



# THE LUNAR OBSERVER

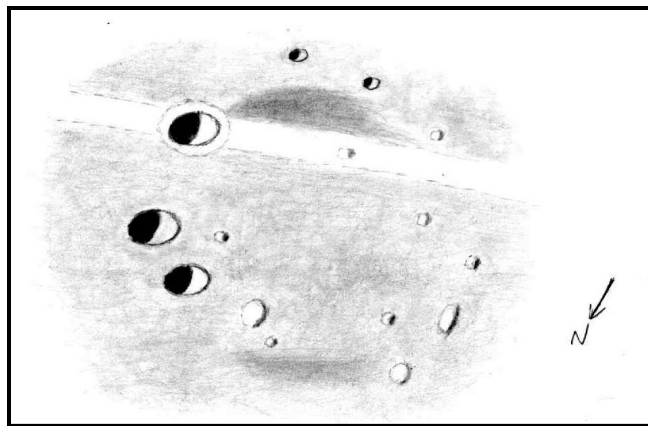
A PUBLICATION OF THE LUNAR SECTION OF THE A.L.P.O.

EDITED BY: Wayne Bailey [wayne.bailey@alpo-astronomy.org](mailto:wayne.bailey@alpo-astronomy.org)

17 Autumn Lane, Sewell, NJ 08080

RECENT BACK ISSUES: [http://moon.scopesandscapes.com/tlo\\_back.html](http://moon.scopesandscapes.com/tlo_back.html)

## FEATURE OF THE MONTH – APRIL 2018 HARPALUS E, G, H



**Sketch and text by Robert H. Hays, Jr. - Worth, Illinois, USA**

**Dec. 1, 2017 05:34-05:48, 06:02-06:12 UT, 15 cm refl, 170x,**

**seeing 8-9/10, transparency 5/6.**

I drew these craters and vicinity on the night of Nov. 30/ Dec. 1, 2017. This area is in Sinus Roris west of Harpalus itself. These three craters are very similar in size, but not appearance. Harpalus E is the southernmost one and has the brightest interior. This crater also has a halo. Harpalus H, the northernmost one, also has a bright interior, but not as bright as that of E. Harpalus G in the middle is dull by comparison. Harpalus S is a smaller crater south of E, and a similar pit is west of S. This pit is shown but not labeled on the Lunar Quadrant map. A straight east-west ray passes through Harpalus E and goes north of Harpalus S and its neighbor. A darker area with a fairly sharp boundary is between this ray and Harpalus S. Markov lambda is the large round peak west of Harpalus H, and two small peaks are nearby. The largest of a group of peaks well west of Harpalus H is Markov theta. The peak between Markov theta and lambda is Markov mu, and Markov tau is south of theta. All three of these peaks had dark shadowing at this time. A low mound is to their north, and three small peaks are between Markov tau and Harpalus S. These features all had much lighter shadowing than Markov theta and its neighbors.

I checked this area the next evening, and Harpalus E and H stood out more from their surroundings.

# LUNAR CALENDAR

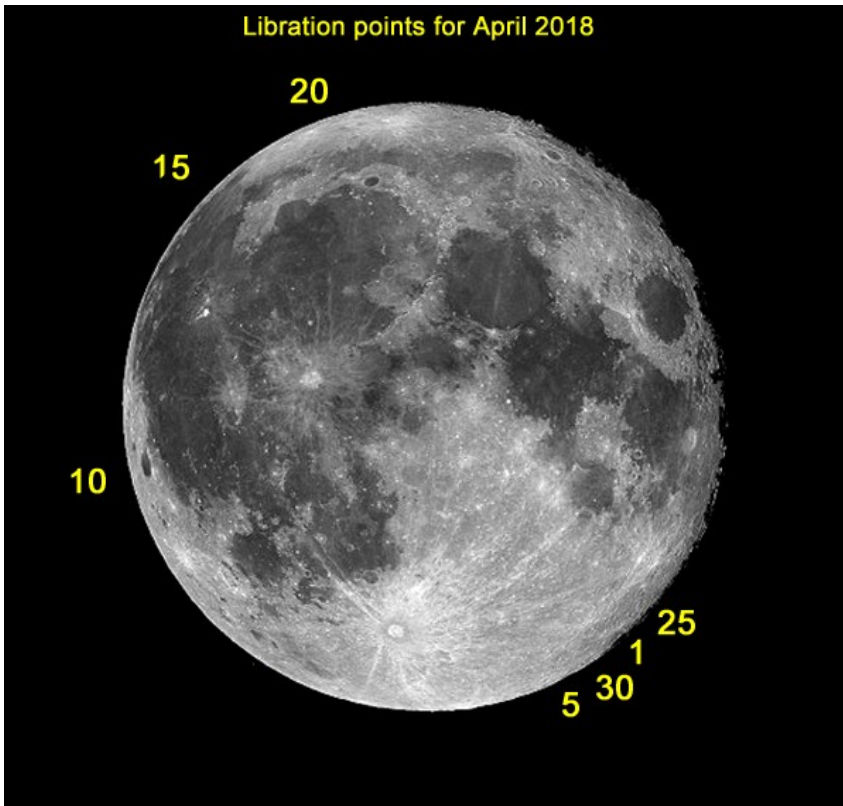
2018	U.T.	EVENT
Apr 03	14:14	Moon-Jupiter: 4.2° S
07	12:50	Moon-Saturn: 2.1° S
07	14:37	Moon Extreme South Dec.: 20.3° S
07	18:15	Moon-Mars: 3.5° S
08	05:32	Moon Apogee: 404100 km
08	07:18	Last Quarter
10	08:09	Moon Descending Node
16	01:57	New Moon
17	19:29	Moon-Venus: 5.5° N
20	14:44	Moon Perigee: 368700 km
21	07:38	Moon Extreme North Dec.: 20.4° N
22	21:46	First Quarter
23	12:19	Moon Ascending Node
30	00:58	Full Moon
30	17:16	Moon-Jupiter: 4.1° S

2018	U.T.	EVENT
May 04	20:31	Moon-Saturn: 1.9° S
04	23:00	Moon Extreme South Dec.: 20.6° S
06	00:35	Moon Apogee: 404500 km
06	07:24	Moon-Mars: 3° S
07	10:24	Moon Descending Node
08	02:09	Last Quarter
13	17:21	Moon-Mercury: 2.5° N
15	11:48	New Moon
17	18:11	Moon-Venus: 4.8° N
17	21:06	Moon Perigee: 363800 km
18	15:02	Moon Extreme North Dec.: 20.7° N
20	13:13	Moon Ascending Node
22	03:49	First Quarter
27	17:39	Moon-Jupiter: 4.3° S
29	14:20	Full Moon

# LUNAR LIBRATION

APRIL-MAY 2018

Libration points for April 2018



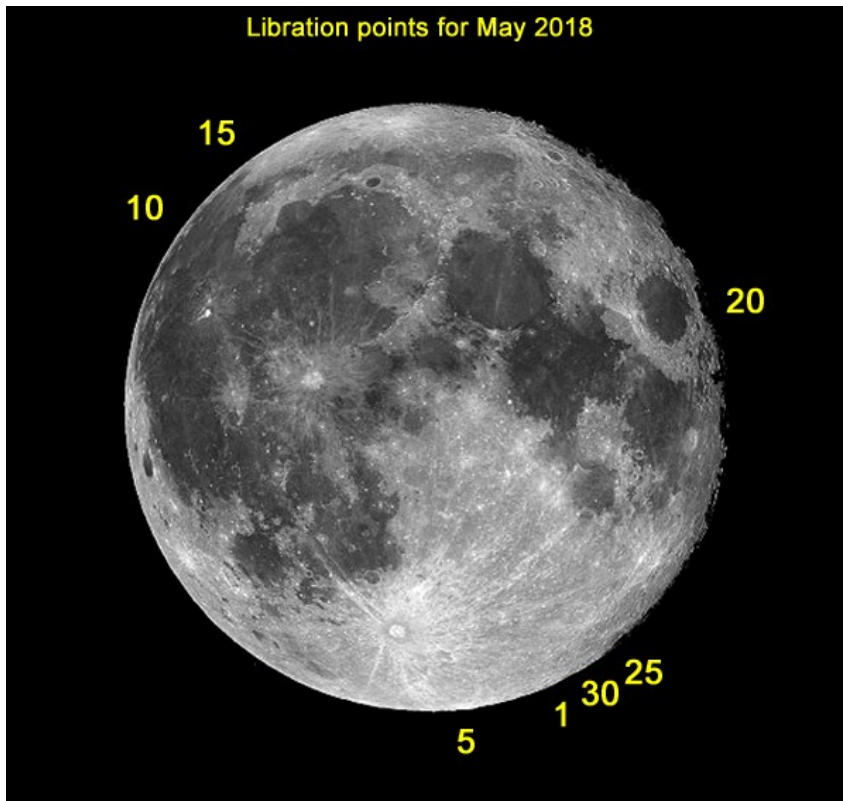
Size of Libration

04/01	Lat -05°58'	Long +04°27'
04/05	Lat -05°57'	Long +03°30'
04/10	Lat -00°27'	Long -02°45'
04/15	Lat +05°39'	Long -05°51'
04/20	Lat +05°02'	Long -01°32'
04/25	Lat -02°20'	Long +02°58'
04/30	Lat -06°33'	Long +04°20'

**NOTE:**

Librations are based on a geocentric position at 0 hr. Universal Time.

Libration points for May 2018



Size of Libration

05/01	Lat -06°25'	Long +04°00'
05/05	Lat -03°12'	Long +00°17'
05/10	Lat +03°23'	Long -05°59'
05/15	Lat +06°30'	Long -04°53'
05/20	Lat +00°57'	Long +02°12'
05/25	Lat -05°47'	Long +05°14'
05/30	Lat -05°25'	Long +03°06'

**NOTE:**

Librations are based on a geocentric position at 0 hr. Universal Time.

## **AN INVITATION TO JOIN THE A.L.P.O.**

**The Lunar Observer** is a publication of the Association of Lunar and Planetary Observers that is available for access and participation by non-members free of charge, but there is more to the A.L.P.O. than a monthly lunar newsletter. If you are a nonmember you are invited to join our organization for its many other advantages.

We have sections devoted to the observation of all types of bodies found in our solar system. Section coordinators collect and study members' observations, correspond with observers, encourage beginners, and contribute reports to our Journal at appropriate intervals.

Our quarterly journal, **The Journal of the Association of Lunar and Planetary Observers-The Strolling Astronomer**, contains the results of the many observing programs which we sponsor including the drawings and images produced by individual amateurs. Additional information about the A.L.P.O. and its Journal is on-line at: <http://www.alpo-astronomy.org>. I invite you to spend a few minutes browsing the Section Pages to learn more about the fine work being done by your fellow amateur astronomers.

To learn more about membership in the A.L.P.O. go to: <http://www.alpo-astronomy.org/main/member.html> which now also provides links so that you can enroll and pay your membership dues online.

## When submitting observations to the A.L.P.O. Lunar Section

In addition to information specifically related to the observing program being addressed, the following data should be included:

**Name and location of observer**

**Name of feature**

**Date and time (UT) of observation (use month name or specify mm/dd/yyyy, dd/mm/yyyy)**

**Size and type of telescope used Magnification (for sketches)**

**Filter (if used)**

Medium employed (for photos and electronic images)

Orientation of image: (North/South - East/West)

Seeing: 0 to 10 (0-Worst 10-Best)

Transparency: 1 to 6

Full resolution images are preferred-it is not necessary to compress, or reduce the size of images. *Additional commentary accompanying images is always welcome.* **Items in bold are required. Submissions lacking this basic information will be discarded.**

Digitally submitted images should be sent to both

Wayne Bailey – [wayne.bailey@alpo-astronomy.org](mailto:wayne.bailey@alpo-astronomy.org)

and Jerry Hubbell – [jerry.hubbell@alpo-astronomy.org](mailto:jerry.hubbell@alpo-astronomy.org)

Hard copy submissions should be mailed to Wayne Bailey at the address on page one.

## CALL FOR OBSERVATIONS:

### FOCUS ON: Craters-Latest and Greatest

**Focus on** is a bi-monthly series of articles, which includes observations received for a specific feature or class of features. The subject for the **May 2018** edition will be **Craters-Latest and Greatest**. Observations at all phases and of all kinds (electronic or film based images, drawings, etc.) are welcomed and invited. Keep in mind that observations do not have to be recent ones, so search your files and/or add these features to your observing list and send your favorites to (both):

**Jerry Hubbell** – [jerry.hubbell@alpo-astronomy.org](mailto:jerry.hubbell@alpo-astronomy.org)

**Wayne Bailey** - [wayne.bailey@alpo-astronomy.org](mailto:wayne.bailey@alpo-astronomy.org)

**Deadline for inclusion in the Craters article is April 20, 2018**

## FUTURE FOCUS ON ARTICLES:

In order to provide more lead time for potential contributors the following targets have been selected:

**Subject**

**TLO Issue**

**Deadline**





## Invitation to the Society for Astronomical Sciences 2018 Symposium and ALPO 2018 Conference

The SAS Program Committee invites you to participate in the Society for Astronomical Sciences' 37<sup>th</sup> Annual Symposium. The Symposium is the premier annual conference devoted to small-telescope astronomical research. This year will be a joint meeting with the Association of Lunar and Planetary Observers (ALPO).

The Symposium brings together amateur astronomers who are engaged in scientific research, professional astronomers, educators and students, for in-depth discussions of topics related to small-telescope research. It is an excellent venue for presenting recent results, discussing targets of observational campaigns, describing instrumentation and data reduction/analysis methods, developing collaborations, and bringing together the community of practice to share expertise and experience. Almost any topic related to astronomical research using modest telescopes is of interest to SAS. You need not be an expert to benefit from participating in the Symposium: one goal of SAS is to provide a mentoring environment where you will learn how you can contribute to astronomical science.

**Date & Location:** The 2018 SAS Symposium will be held on Thursday-Friday-Saturday, June 14-15-16, 2018 at the Ontario Airport Hotel, Ontario CA.

**Workshops:** Educational workshops are being planned for Thursday (June 14). Details will be on the SAS website soon ([www.SocAstroSci.org](http://www.SocAstroSci.org)).

**Technical Presentations:** Friday and Saturday (June 15-16) will be the Technical Sessions, including both presentations and poster papers. Presentations and Posters will span the wide range of topics of interest to the small-telescope research community: solar-system objects, variable-stars, and binary stars; instrumentation for photometry, astrometry and spectroscopy; and related subjects.

You can read the Proceedings from recent SAS Symposia, and view videos of many recent Presentations, on the SAS website ([www.SocAstroSci.org](http://www.SocAstroSci.org)).

**Sponsors:** SAS Sponsors – developers, suppliers, and retailers of astronomical equipment – will be on hand with displays of their featured products.

**Registration information for SAS 2018** will be on the SAS website ([www.SocAstroSci.org](http://www.SocAstroSci.org)) beginning February 20, 2018.

# RECORDING BRIGHT LUNAR RAYS

William Dembowski

ALPO Assistant Coordinator, Lunar Topographical Studies

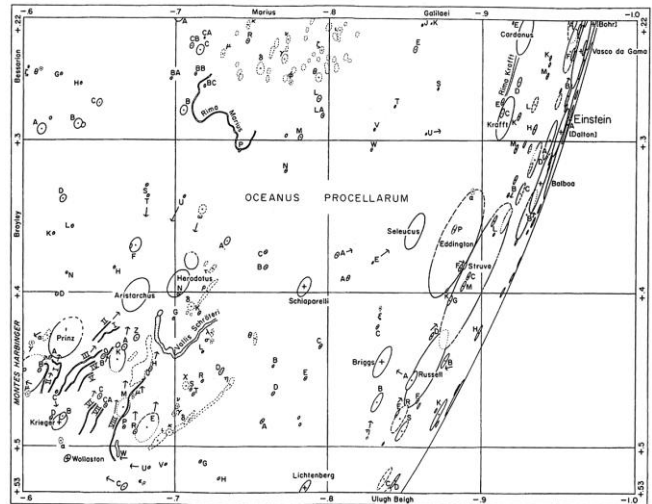
It is well known that the best time to observe bright lunar rays is at, or around, full moon. Studying the rays, however, is another matter. They do not suddenly pop into view at the moment of full moon and then disappear immediately thereafter. And all rays do not brighten and darken in unison. If one is to make a serious study of bright lunar rays, they must be observed under all lighting conditions. One of the objectives of ray-study is to determine when each ray system is first visible and then when it becomes no longer visible. These limits are not based on the time of day but on selenographic colongitude (the longitude of the morning terminator on the moon).

Another important property of a ray system is its size and extent at any given time. These properties may appear to change throughout a lunation as the angle of the sunlight changes. One way to record the position and extent of the rays is to draw them onto a map of the moon. One of the best maps to use are the Lunar Quadrant Maps (Fig. 1) published by the Lunar & Planetary Laboratory which can be downloaded for free from their website at = <https://www.lpl.arizona.edu/>

Search for - THE SYSTEM OF LUNAR CRATERS, QUADRANT I - and so forth through QUADRANT IV. Each quadrant consists of 11 small maps for a total of 44. The beauty of these maps is not just their uncluttered portrayal of the craters, but they do not show any of the rays associated with them.

*Figure 1 - Map for area near crater Aristarchus*

Not all rays present the same general appearance. Those of Tycho are rather narrow, straight and solid (See Fig. 2) while those of Copernicus are more wispy and often do not form a solid path away from their parent crater (See Fig. 3).



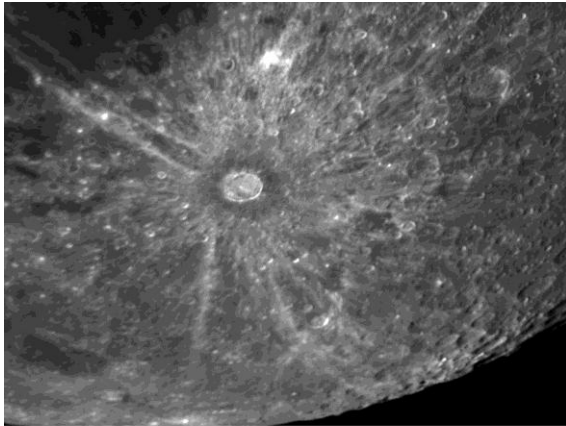
Other differences in the appearance of the rays which should be noted include:

- \* How does the brightness and/or color of a ray change during the lunation?
- \* Are there brightness and/or color differences between one ray system and another?
- \* Do the brightness and/or color of a ray change over its length?
- \* Does the appearance of the ray change with the use of color or polarizing filters?

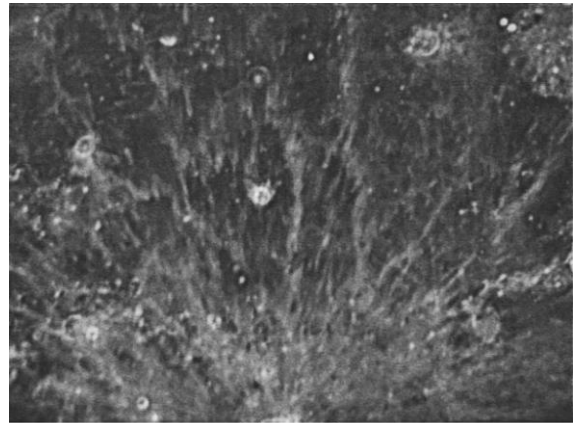
There are, in addition to the large ray patterns, hundreds of bright spots across the surface of the moon (see Figure 4). Since they are undoubtedly of impact origin, they may be classified as rays of limited extent. Once again, using a lunar map to record them is an ideal method. Simply fill in the appropriate craters with a red pencil and you have a handy record of all that you have observed.

For those wishing to pursue the study of bright lunar rays and participate in the Bright Lunar Rays Program of the A.L.P.O. Lunar Section --- below (Figure 5) is a list of the more prominent ray systems on the near side of the moon. Any and all observations of lunar rays, be they photographic, drawings, or written will be welcomed and incorporated into the data base of information already accumulated in this most fascinating field of lunar study.

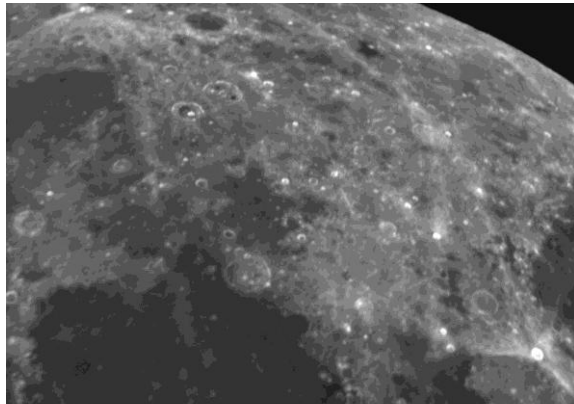
Any contributions or inquiries concerning this project should be directed to William Dembowski at [dembowski@zone-vx.com](mailto:dembowski@zone-vx.com). Your observation will be acknowledged, recorded, and become a permanent part of the A.L.P.O. Lunar Section's study of Bright Lunar Rays.



**Figure 2**  
Ray System of Tycho  
William Dembowski - Dembowski Moonshine Observatory  
9 July 2009 - 03:45 UT - Colong. 111.1 - Seeing 4/10  
8 inch f/10 SCT - Imaging Source DMK41 Camera



**Figure 3**  
Rays North of Copernicus  
William Dembowski - Dembowski Moonshine Observatory  
31 July 2007 - 03:39 UT - Colong. 108.2 - Seeing 4/10  
8 inch f/10 SCT - Celestron Neximage Camera



**Figure 4**  
Albedo Features - Northeast Quadrant  
William M. Dembowski, FRAS - Elton Moonshine Observatory  
06 July 2009 - 02:37 UT - Colong: 73.6 - Seeing 3/10  
Celestron 8 inch f/10 SCT - ImagingSource DMK41 - UV/IR Cutoff

## **REFERENCES:**

- Antonin Rukl, "Atlas of the Moon", Paul Hamlyn Publishing, London, 1991
- Jack Kramer, "Observing the Moon: Lunar Rays", [www.lcas-astronomy.org](http://www.lcas-astronomy.org)
- Jim Bell, Astronomy Magazine, May 1999

	CRATER	LAT.	LONG.
1	ANAXAGORAS	73.4N	10.1W
2	ARISTARCHUS	23.7N	47.4W
3	ARISTILLUS	33.9N	01.2E
4	AUTOLYCUS	30.7N	01.5E
5	BESSEL	21.8N	17.9E
6	BIRT	22.4S	08.5W
7	BYRGIUS_A	27.7S	63.6W
8	COPERNICUS	09.7N	20.0W
9	EUCLIDES	07.4S	29.5W
10	FURNERIUS_A	33.5S	57.2E
11	GEMINUS_C	33.9N	56.8E
12	GODIN	01.8N	10.2E
13	HIND	07.9S	07.4E
14	KEPLER	08.1N	38.0W
15	LALANDE	04.4S	08.6W
16	LANGRANUS	08.9S	60.9E
17	MANILIUS	14.5N	09.1E
18	MENELAUS	16.3N	16.0E
19	MESSALA_B	37.1N	57.6E
20	MESSIER_A	02.0S	46.9E
21	OLBERS	07.4N	75.9W
22	OLBERS_A	08.3N	77.5W
23	PETAVIUS_B	27.9S	58.6E
24	PROCLUS	16.1N	46.8E
25	REINER GAMMA	08.0N	58.0W
26	SIRSALIS	12.5S	60.4W
27	SNELIUS	29.3S	55.7E
28	STEVINUS_A	32.1S	51.9E
29	STRABO	61.9N	54.3E
30	TARUNTIUS	05.6N	46.5E
31	THALES	61.8N	50.3E
32	THEOPHILUS	11.4S	26.4E
33	TIMOCHARIS	26.7N	13.1W
34	TYCHO	43.3S	11.2W
35	ZUCCHIUS	61.4S	50.3W

**Figure 5**



# DETECTION OF THE TENUOUS LUNAR ATMOSPHERE WITH A SMALL TELESCOPE

Francis Graham

Contrary to popular thought, the “airless” Moon does have an *extremely tenuous* atmosphere.

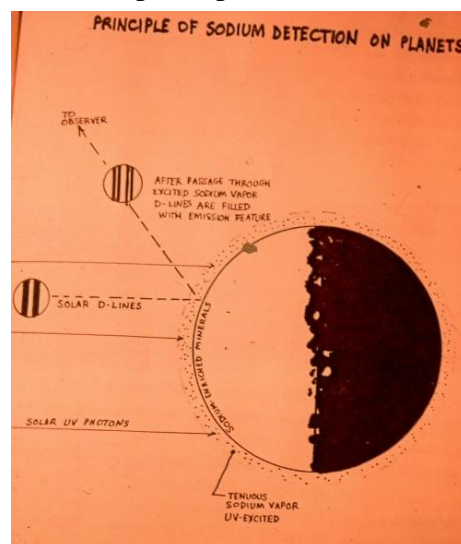
It is hardly any atmosphere at all. Where the Earth’s atmosphere at sea level consists of about  $10^{19}$  molecules per cubic centimeter, in frenzied rapid collision, the Moon’s atmosphere is about  $10^6$  atoms per cubic centimeter that almost never collide at all, passing each other like distant strangers in the night. Where the Earth’s atmosphere has a surface pressure at sea level averaging 101,300 pascals, the Moon’s atmosphere is 0.3 *nanopascals*. The entire atmosphere of the Moon likely is less than 10 tons. This is only slightly more than the exhaust gases of all the spacecraft that landed upon the Moon.

Most of the atoms in the lunar atmosphere, according to the Apollo LACE experiment, are argon and helium atoms. But about 17 atoms per cubic centimeter are sodium atoms. Sodium as a vapor is extremely sensitive to spectroscopic detection. The characteristic double “D” emission lines can be detected at less than a few micrograms per cubic meter.

The Sun also has sodium vapor in its outer layers and so the “D” lines are seen as darker *absorption* lines in the solar spectrum. These dark lines are present in the spectrum of the Moon as sunlight is reflected off the lunar surface. However, since sodium vapor is present in the lunar atmosphere, inside the solar “D” lines, are bright emission lines of sodium vapor energized by the sunlight (fig. 1). The low pressure of the lunar atmosphere, compared to the pressure on the Sun where the “D” absorption lines are formed, ensure that the sodium emission D lines are entirely within the reflected solar “D” absorption lines.

**FIGURE 1.** *Formation of sodium emission line.*

This is how the lunar atmosphere was first detected from Earth by Potter and Morgan in 1988. The emission lines are not very bright, however. When viewed at the subsolar point on the limb of the quarter Moon, when one is looking through the longest column of it at the point of maximum sunlight, it emits about  $1.4 \times 10^{13}$  photons per square centimeter of column. That is not much. To observe it with a small refractor, as one might find in a small college observatory or an amateur observatory, I constructed a multi-prism spectroscope. This spread the spectrum out with three prisms. The continuous component of the reflected solar spectrum is thus spread out and reduced in brightness. The emission “D” lines thus show up and are visible. They are very delicate and crepuscular in appearance. It is not surprising that the 19<sup>th</sup> century visual spectroscopists failed to notice them, perhaps also convinced that the Moon has “no” atmosphere. See Figure 2 for my multi-prism spectroscope, without the cover, on the 13-inch Fitz Refractor at Allegheny Observatory in 1987 ( I began to look for the D line





emissions before Potter and Morgan discovered them, but I erroneously started with the full moon phase).

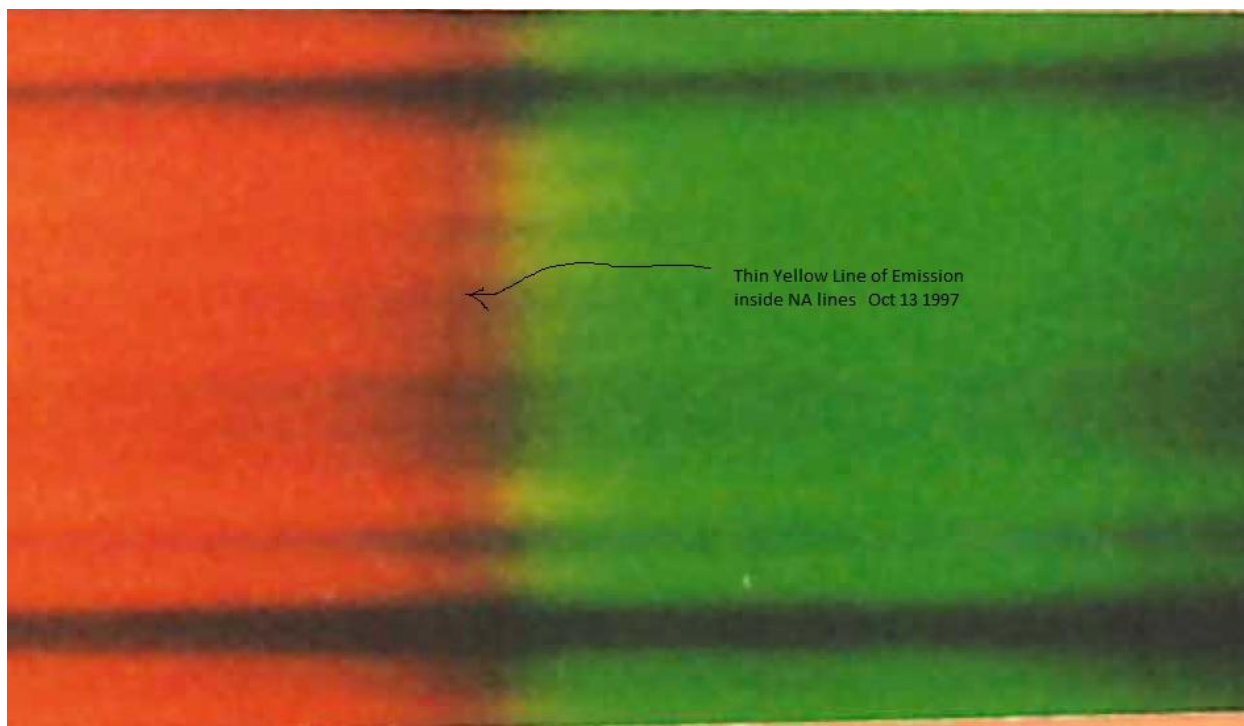
**FIGURE 2.** *Spectrograph on the telescope.*

Photographing them proved to be a daunting challenge. I tried unsuccessfully on many occasions. On October 13, 1997 I finally was successful (fig 3). A very delicate yellow line shows up in one of the D lines. Part of it is just up from center and another portion near the top. I used 3M Imation 400 film

processed commercially. The telescope was a 16 cm f/15 refractor made by Wayne Gondella. The exposure time was a lunar-driven, guided, 18 minutes at the lunar limb.

There are high pressure sodium lights in my city, but that did not have an effect since the high pressure lamps self-absorb at the D wavelengths. Also twilight was over so I did not think dayglow—which has D line emission—was a factor.

I would be extremely interested to know if others have done this with smaller telescopes, and can do better than I have. It should be possible in the October third quarter with the Moon high in the northern hemisphere and the twilight gone, and with larger aperture telescopes than the ones I used. The detection of the lunar atmosphere is a challenge indeed. Please let me know of results.

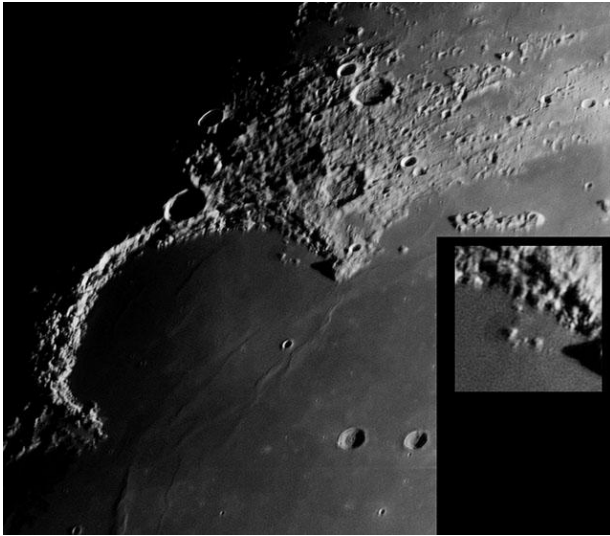


**FIGURE 3.** *Spectrum of Sodium line showing the core lunar emission line.*

# RAINBOW BAY

## Rik Hill

The Bay of Rainbows (fig.1) is a glorious sight as the Montes Jura catch the first of the morning light. At the south end of the mountains is Promontorium Heraclides and the north point is Promontorium Laplace casting a nice triangular shadow to the west. The shadow filled crater near the middle of the Montes Jura is Bianchini (39km dia.). Near the mouth of the Bay are two similar sized craters acting as sentinels, Helicon (26km) on the left and Le Verrier (20km) on the right. Above the inset is a curious set of mountains, the Montes Recti, the very tips of a once magnificent range buried in the Mare Imbrium lava.



**FIGURE 1. Sinus Iridum.** Richard Hill – Tucson, Arizona, USA February 26, 2018 01:56 UT. Colongitude 38.3°. Seeing 7/10. TEC 8" f/20 Mak-Cass, 610 nm filter, SKYRIS 445M.

The shadow of Prom. La Place points to a couple small peaks that are next to a couple charted domes. You can see them on the magnified inset of that region where the one dome is north of the left peak and the other dome is more of a darker apron to the left of

that peak. Amazing what you can see when you look a little closer.

\*\*\*\*\*

# LONE OUTPOST

## Rik Hill

Rising 1.8 km off the floor of Mare Imbrium is the neglected and overlooked Mons La Hire (fig.1) a little above and right of center in this image. It is north of Copernicus forming an isosceles triangle with Copernicus and Aristarchus to the west. In fact, this little peak is completely overshadowed by these two features plus Sinus Iridum to its north but it sparkles in the first rays of sunlight in the lunar morning. On the eastern flank of the main mass is a 3.5 km crater. There are clusters of 1-3km secondary craters from the Copernicus impact that are all around it that can be seen in good seeing with some magnification, belying the smooth appearance of Imbrium!

**FIGURE 1. Mons La Hire.** Richard Hill – Tucson, Arizona, USA February 26, 2018 01:47 UT. Colongitude 38.1°. Seeing 8/10. TEC 8" f/20 Mak-Cass, 610 nm filter, SKYRIS 445M.

To the southeast (lower right) of this mountain is the nicely terraced crater Lambert (31km dia.) sitting on Dorsum Zirkel which is best seen here just north of La Hire. Further out to the southwest is the shadow filled Euler (29km) and beyond it Mons



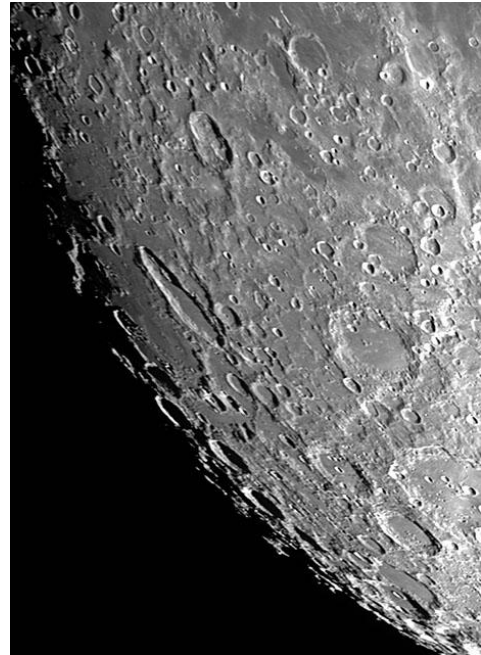
Vinogradov (formerly Mons Euler) a 25km diameter cluster of peaks rising 1.0-1.4 km above the mare floor. Due west is the crater Diophantus (19km) and above it the larger Delisle (26km) with Mons Delisle just coming into the light at the edge of this image. This is a region worth a few minutes of your time!

# **SCHILLER**

**David Teske**

Schiller (fig. 1) is the giant elongated crater near the Moon's southwest limb. This weird crater was named after Julius Schiller, a German monk who was the author of a Christian atlas of the sky around 1627. With measurements of 179 by 70 km, the southern portion of the crater is smooth and level whereas the northern portion is rough and furrowed and has two mountain peaks. Schiller appears to be composed of three or four overlapping craters. By using crater counting, the age has been determined to be 3.7 billion years old for the smooth area on Schiller's floor. Impact craters are round because they are essentially point source explosions that throw out

**FIGURE 1.** *Schiller, David Teske, Louisville, Mississippi, USA, 27 February 2018 at 0243 UT. Colongitude 48.1 degrees, Seeing 5/10, 4 inch APO refractor, 2.5 x Powermate.*



material in all directions. So what went wrong with Schiller? There is no process that could create one crater with such an elongated axis. The floor of Schiller has no indication of separate impacts. Schiller may have been created when a flight of three or four impactors landed at virtually the same moment. The liquefied target zones then blended together to leave no trace of separate impacts. This impact would have come from a very shallow angle, much like the much smaller craters Messier and Messier A. Observations supporting this very low angle include that the elongated ridge in the northern part of Schiller suggest a formation similar to that of Messier. The overall shape of Schiller also gives us clues as to its formation. The southern rim has a smaller radius than that of the adjoining main section of the crater. The northern section is narrower and constricts sharply where it ends in an arc of smaller radius. Moreover, the northern section has two central peaks, both of which are highly elongated into ridges running along the long axis of the southern part of Schiller. The northern part of Schiller doesn't quite follow the same axis as that of the south; it bends slightly to the east. So, Schiller appears to be made of three or more overlapping circular craters whose shared walls are missing. Perhaps a small asteroid or comet was once captured in lunar orbit. While slowly spiraling inward, gravity tore this projectile into multiple pieces with the final near-grazing simultaneous impacts creating overlapping craters.

## **References**

- Chu, A., Paech, W., Weigand, M., and Dunlop, S.: The Cambridge Photographic Moon Atlas, Cambridge University Press, 2012.
- Kitt, Michael T.: The Moon: An Observing Guide for Backyard Telescopes, Kalmbach Books, 1992.
- Legault, Thierry and Brunier, Serge: New Atlas of the Moon, Firefly Books, 2006.
- North, Gerald: Observing the Moon, the Modern Astronomer's Guide, Cambridge, 2000.
- Planck, Andrew: What's Hot on the Moon Tonight?, Moonscape Publishing LLC, 2015.
- Shirao, Motomaro and Wood, Charles A.: The Kaguya Lunar Atlas, Springer, 2010.
- Wilkinson, John.: The Moon in Close-up, Springer, 2010.
- Wood, Charles A.: The Modern Moon, Sky Publishing Corp., 2003
- Wood, Charles A. and Collins, Maurice J. S.: 21<sup>st</sup> Century Atlas of the Moon, Lunar Publishing UIAI Inc., 2012.



# LUNAR TOPOGRAPHICAL STUDIES

Coordinator – Wayne Bailey - [wayne.bailey@alpo-astronomy.org](mailto:wayne.bailey@alpo-astronomy.org)

Assistant Coordinator – William Dembowski - [dembowski@zone-vx.com](mailto:dembowski@zone-vx.com)

Assistant Coordinator – Jerry Hubbell – [jerry.hubbell@alpo-astronomy.org](mailto:jerry.hubbell@alpo-astronomy.org)

Website: <http://moon.scopesandscapes.com/>

## OBSERVATIONS RECEIVED

ALBERTO ANUNZIATO - ORO VERDE, ARGENTINA. Digital images of Gassendi, Holmheltz, Kepler, Lalande, Langrenus, Petavius & Plato

JAIRO CHEVEZ - POPAYÁN, COLUMBIA. Digital images of Moon, Plato & Tycho.

ABEL CIAN - PARANÁ, ARGENTINA. Digital image of Plato.

WALTER ELIAS - ORO VERDE, ARGENTINA. Digital images of Alphonsus(2), Aristarchus(2), Censorinus, Eratosthenes(2), Funerius, Gassendi(2), Geminus, Plato(2), Riccoli(2), Rupes Recta, Schickard(2), Torricelli, Tycho & Vallis Schroteri.

RICHARD HILL – TUCSON, ARIZONA, USA. Digital images of Kepler, Mons La Hire & Sinus Iridum.

DAVID TESKE - LOUISVILLE, MISSISSIPPI, USA. Digital image of Schiller.

\*\*\*\*\*



**PETAVIUS**– Alberto Anunziato, Paraná, Argentina.  
March 4 2018 06:42 UT. CPC-1100, Canon EOS digital rebel XS.

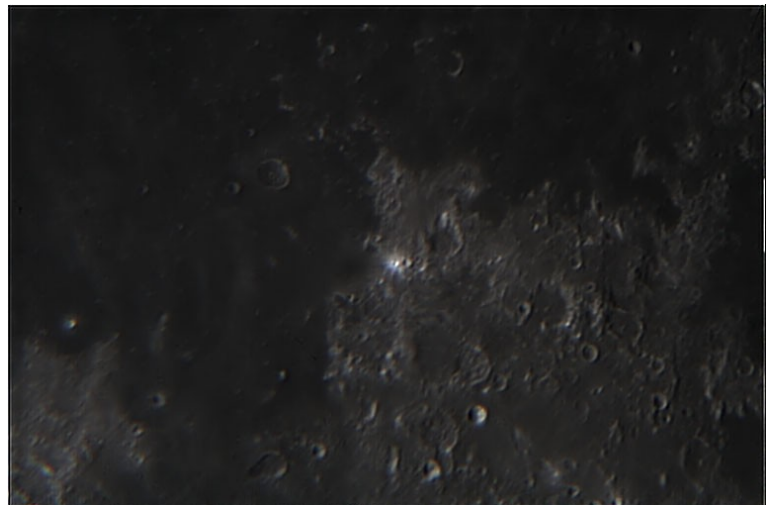
## RECENT TOPOGRAPHICAL OBSERVATIONS

**PLATO** – Jairo Chavez,- Popayán Columbia. February 27 2018 21:04 UT. 10” Dobsonian, Huawei Y360 camera, ISO200.

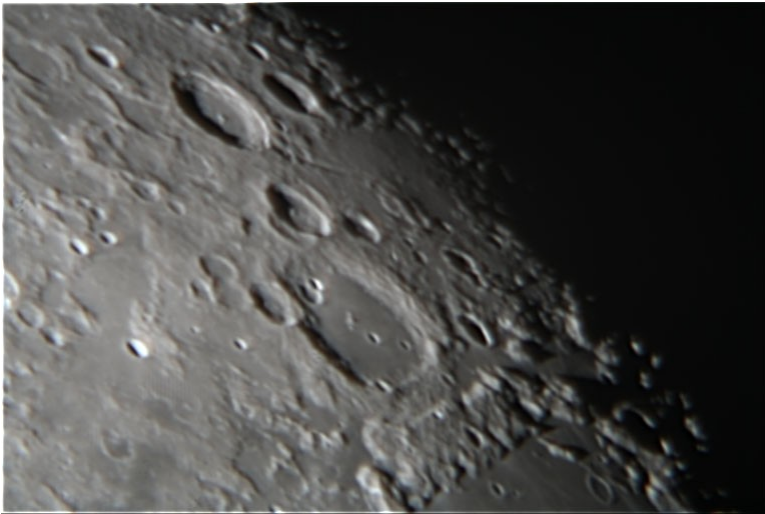


**PLATO**– Abel Gonzalez Cian, Paraná, Argentina. February 28, 2018 00:46 UT. 10” Meade Lightbridge, Nikon D3100.

**CENSORINUS** - Walter Elias, Oro Verde, Argentina. March 4, 2018 05:58 UT. CPC-1100, Canon EOS Digital Rebel XS.



## RECENT TOPOGRAPHICAL OBSERVATIONS

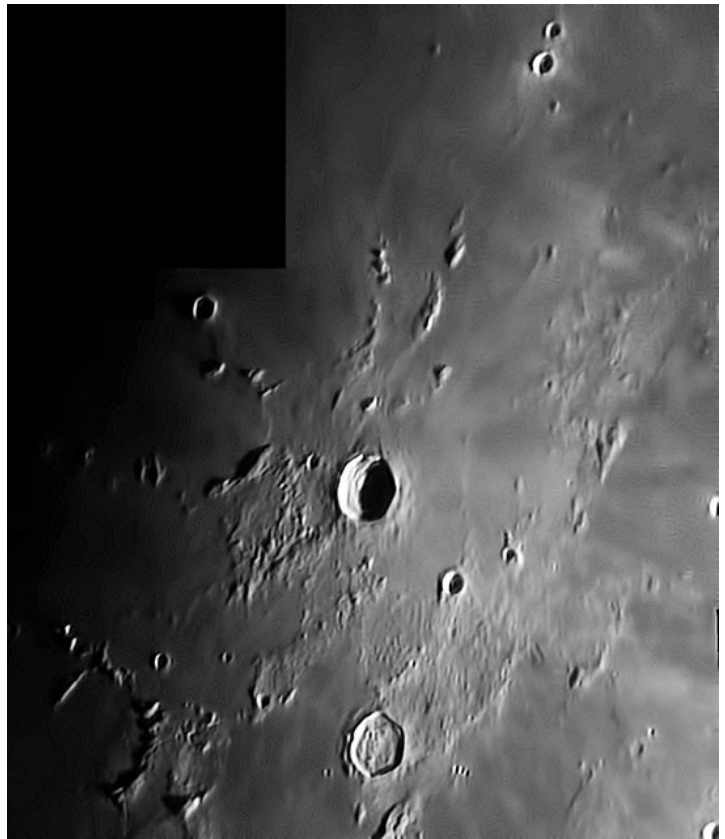


**GEMINUS**- Walter Elias, Oro Verde, Argentina. March 4, 2018  
06:27 UT. CPC-1100, Canon EOS Digital Rebel XS.

**KEPLER** - Richard Hill – Tucson, Arizona, USA January 28, 2018 01:31 UT.  
Colongitude 38.3°. Seeing 7/10. TEC 8"  
f/20 Mak-Cass, 610 nm filter, SKYRIS 445M.

Poor old Kepler, a perfectly respectable 32km diameter, young crater with an extensive ray system but overshadowed by the monster Copernicus to its east and Aristarchus to the north. But when the morning sun is illuminating it there are some very interesting features that can be enjoyed. Here Kepler is in the center of the image with its terraced walls well shown and below it is the remarkably polygonal Encke (31km). To the west of Encke is a small crater Maestlin (7km) and below it is the large upside down "U" which is Maestlin R (60km) much larger than its namesake! At the top of the image are two craters the largest of which is Bessarion (10km).

The pearl in this region for me was capturing the low profile dome Kepler 1. You can see it just to the upper left from Kepler in a pass between the mountain peaks. Using the nearby crater Kepler F (7km) one can estimate a diameter of 12km! If you were driving along in your lunar rover I'm not even sure you'd notice if you were driving over it!



## **BRIGHT LUNAR RAYS PROJECT**

Coordinator – Wayne Bailey – [\\_wayne.bailey@alpo-astronomy.org](mailto:_wayne.bailey@alpo-astronomy.org)

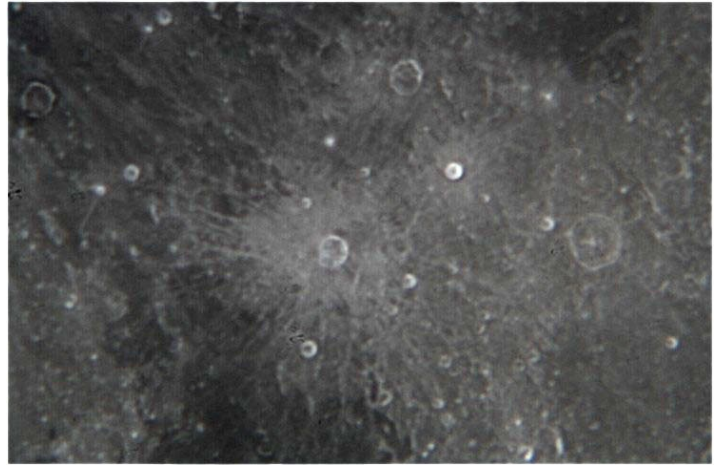
Assistant Coordinator – Jerry Hubbell – [jerry.hubbell@alpo-astronomy.org](mailto:jerry.hubbell@alpo-astronomy.org)

Assistant Coordinator – William Dembowski – [dembowski@zone-vx.com](mailto:dembowski@zone-vx.com)

Bright Lunar Rays Website: <http://moon.scopesandscapes.com/alpo-rays.html>

## **RECENT RAY OBSERVATIONS**

**LALANDE**– Alberto Anunziato, Oro Verde, Argentina. March 4, 2018 04:38 UT. CPC-1100, Canon EOS digital rebel XS.



**TYCHO**– Jairo Chavez,- Popayán Columbia. February 27 2018 21:05 UT. 10” Dobsonian, Huawei Y360 camera, ISO200.



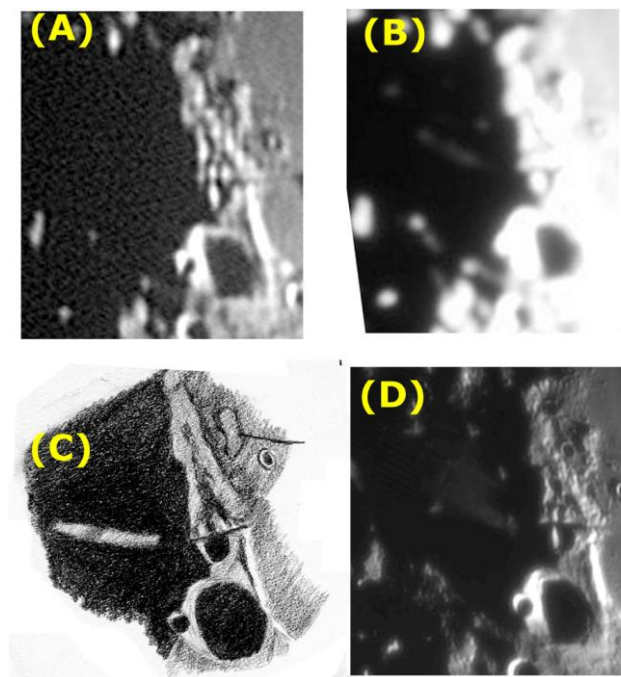
# **LUNAR GEOLOGICAL CHANGE**

## **DETECTION PROGRAM**

**Coordinator – Dr. Anthony Cook – [atc@aber.ac.uk](mailto:atc@aber.ac.uk)**

**Assistant Coordinator – David O. Darling - [DOD121252@aol.com](mailto:DOD121252@aol.com)**

Reports have been received from the following observers: Jay Albert (Lake Worth, FL, USA - ALPO) observed: Aristarchus, Macrobius, Mare Crisium, Picard, and Proclus. Alberto Anunziato (Argentina - AEA) observed: Aristarchus, Atlas, Cleomedes, Gassendi, Macrobius, Mare Crisium, Messier, Mutus, Petavius, Picard, Plato, Proclus, Rima Aridaeus, Rima Furnerius, Rima Jansen, Rimae Goclenius, and Tycho. Jerzy Bohusz (Poland – PTMA) observed several features. Jario Chavez (Columbia - LIADA) imaged Plato, Tycho and the whole lunar disk. Anthony Cook (Newtown, UK – ALPO/BAA) videoed earthshine and imaged several features. Marie Cook (Mundelsey, UK – BAA) observed Alphonsus, Gassendi, Sinus Iridum, and Tycho. Chris Dole (Newbury, UK – BAA) imaged Cichus. Walter Elias (Argentina – AEA) imaged Aristarchus, Censorinus, Gassendi, Linne, Peirce, Ross D and Sharp. Rik Hill (Tucson, AZ, USA – ALPO/BAA) imaged Mons Las Hire, Sinus Iridum, and Torricelli. Walter Latrónico (Argentina – AEA) imaged Littrow. Gary Varney (Pembroke Pines, FL, USA – ALPO) imaged several features.

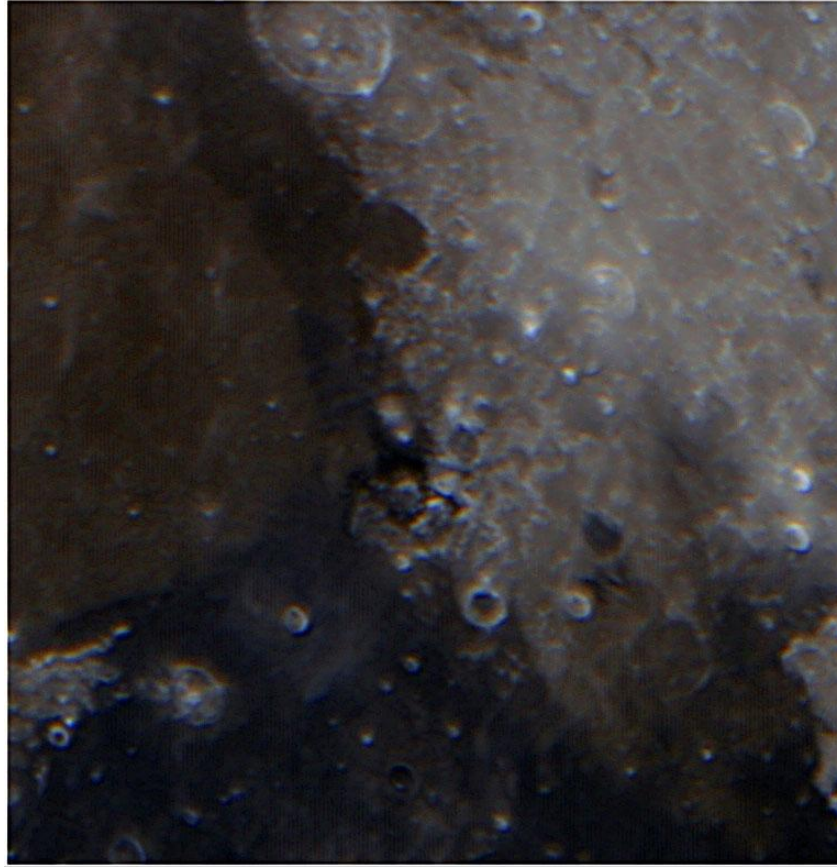


**Figure 1.** The Cichus-Weiss area, as observed on 2018 Feb 24, orientated with north towards the top. N.B. Images have been non-linearly contrast stretched to bring out detail beyond the terminator. (A) An image by Anthony Cook (ALPO/BAA) taken at 20:24 UT. (B) An image by Mick Crook (BAA), taken at 21:28 UT. (C) A sketch by Mick Crook (BAA), made at 21:35 UT. (D) An image by Chris Dole (BAA), taken at 23:05 UT.

**LTP Reports:** On 2018 Feb 24 Mick Crook was observing the Cichus-Weiss area for the thread like floor illumination effect that we regularly see at sunrise, as mentioned in articles by Nigel Longshaw. Suitable times to look for this natural illumination effect are given on the Lunar Schedule [web site](#). The only reason why it has ended up in this LTP section was that at around 21:35 (Fig 1 C) Mick noted that the ray effect went from a silvery to a more golden hue. Now this does not mean that it was a LTP as there are a whole host of possible explanations, such as natural surface color, atmospheric effects etc, but it might be worth looking for again in future. Mick's

seeing was poor at Antoniadi IV, but nevertheless at x120 and x240, he was able to see the thread-like needle effect through his 15 cm reflector. He took an image earlier using a 14cm Maksutov, which also shows the needle-like thread (Fig 1B), however just over an hour earlier it was not visible (Fig 1A) in an image that I took. So what we need from now on are some color images of this area at the dates and times in the Lunar Schedule [web site](#).

**Routine Reports:** Below is a selection of reports received for February that can help us to re-assess unusual past lunar observations – if not eliminate some, then at least establish the normal appearance of the surface features in question.



**Figure 2.** The Littrow area of the Moon as imaged by Walter Latrónico on 2018 Feb 01 UT 02:29, and orientated with north towards the top. The image has been contrast stretched, color normalized and then had its color saturation increased to 70%.

**Littrow:** On 2018 Feb 01 UT 02:29 Walter Latrónico (AEA) imaged this area under similar illumination, to within  $\pm 0.5^\circ$ , to the following post World War One observation:

*nr. Littrow 1919 Dec 07 UT 20:00 Observed by W.J. West (Gosport, UK) "Conspicuous ink-black mark. N. of C. Argaeus of S. of Littrow." NASA catalog weight=1. NASA catalog ID #374. ALPO/BAA weight=1.*

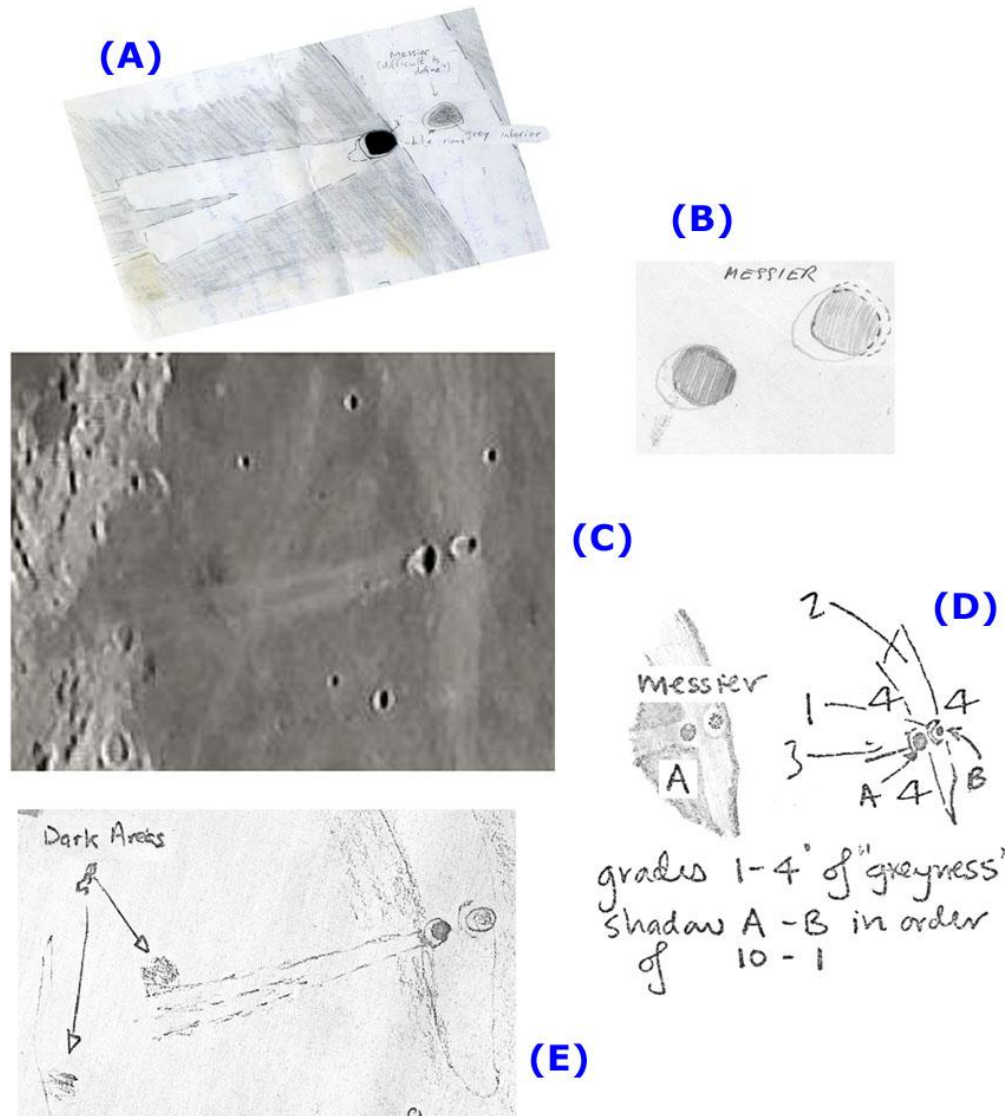
Walter's image has been contrast stretched, and had color saturation increased (Fig 2), however in terms of contrast, alone, this might be what W.J. West would have noticed under a low power eyepiece. So the dark area near Littrow is perfectly normal and a result of dark mantle material in the area, something that the Apollo 17 mission investigated. We shall therefore change the weight from 1 to 0 and remove it from the LTP database.

**Picard:** On 2018 Feb 02 UT03:35-03:50 Jay Albert (ALPO) observed this area within  $\pm 0.5^\circ$  of the following 1960's report:

*East of Picard 1964 Oct 16/17 UTC 23:00-01:00? Observed by Ingall (Camberwell ?, England) "Remarkable bright spot" NASA catalog weight=3. NASA catalog ID #135. ALPO/BAA weight=3.*

Jay definitely saw a bright spot east of Picard, but this was normal, and unlike the LTP description, the spot was not remarkable and certainly less bright than when he had seen the same spot during a waxing lunar phase.

Under the best moments of seeing, he could see this spot as a tiny craterlet. We shall therefore keep the weight as it is, as the 1964 report is difficult to explain.



**Figure 3.** Messier orientated with north towards the top – N.B. the sketches above have been rotated and re-annotated so that the text is at the correct orientation for viewing. (A) A sketch by Marcus Price (BAA) from 1981 Feb 10 UT 20:44-20:55. (B) A sketch by John Pedler (BAA) from 1981 Feb 10 UT 21:38-22:03. (C) An image by Ed Crandall from 2006 Nov 26 UT 22:56 – reproduced from p11 of the Jul 2007 BAA Lunar Section Circular. (D) A sketch by M.D. Taylor (BAA) from 1981 Feb 10 UT 21:45-21:48 illustrating the appearance and relative intensities. (E) A sketch by Jeremy Cook (BAA) from 1981 Feb 10 UT 20:50.

**Messier:** On 2018 Feb 21 UT 18:20-20:20 Jerzy Bohusz (PTMA) observed visually the Moon with a 18cm Maksutov (x96, x123, x208 & x338) telescope, under excellent 9-10 seeing conditions, and under good (only slightly hazy sky) transparency conditions. During this time (he also observed Proclus) he recorded the appearance of Messier under similar illumination conditions, to within  $\pm 0.5^\circ$ , to a 1981 report:

*Messier 1981 Feb 10 UT 19:20-20:10 LTP discovered by Hedley Robinson (Devon, England) "Messier was brighter than Aristarchus in both red and blue filters and also appeared indistinct, later becoming invisible - lost in a bright streak. In comparison Aristarchus was clear. Another observer, Amery confirmed that Aristarchus was sharp in appearance but Messier certainly was not. Cook likewise found Messier not to be as sharp as Messier A due to a big shadow in Messier A. Pedler found that the sun facing wall of Messier was OK but that the shadow was changing from black to grey periodically at intervals of 2-3 minutes to a few seconds. By contrast he found that Messier A remained quite well defined. He tried red and blue filters but found no blink effect. At 20:23UT Pedler found that the shadow had stabilized to a shade of "mid grey" although remaining ill-defined. North also found that Messier A was distinct but Messier itself was ill-defined. Moore*

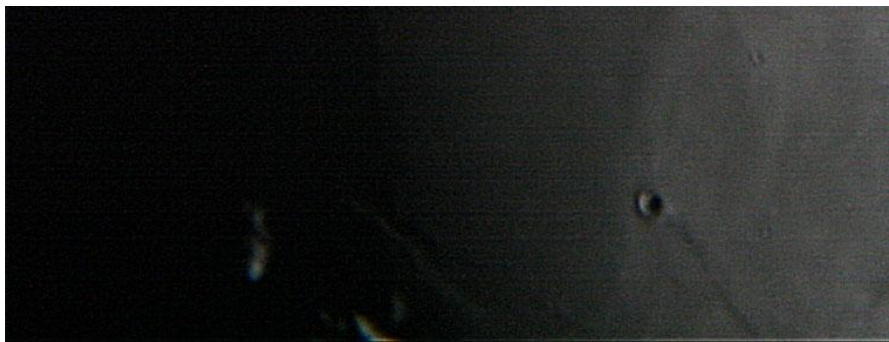


*found the same thing but thinks that this is normal for Messier under this illumination to appear indistinct. Moore also saw the grey interior shadow. Price saw similar appearance to Moore and suspected that this was normal for this stage in illumination. Ratcliffe suspected everything normal - just commenting that Messier was smaller and no detail in comparison to Messier A. Madej and Taylor provided a sketch that showed again a grey interior and merging with the east wall/mare. Foley found Messier's pale grey interior to be unfocusable but in comparison Messier A was sharp. He says that he would expect a grey interior and the east wall to merge with the mare. However the complete loss of detail and variability were not normal. Cameron comments that the Kuiper atlas confirms the fuzzy indistinct appearance of Messier and that a Lunar Orbiter picture shows a grey shadow. The Cameron extended catalog weight=5. The ALPO/BAA weight=2.*

Jerzy commented that nothing unusual was seen, and that Messier, was less visible than Messier A. We have covered the 1981 observation before back in the 2014 Nov [newsletter](#), so this time I thought that I would include some of the original sketches made (See Fig 3). Although none of these cover the brightness aspect of J-Headley Robinson's observation, they do indicate well the contrast and relative visibility between Messier and Messier A, and this is confirmed by a repeat illumination image (Fig 3C), from Ed Crandall, that I found in our ALPO/BAA observations database. Therefore most of the 1981 report descriptions seem perfectly normal. However I will keep the ALPO/BAA weight at 2 because Headley Robinson's description of Messier being brighter than Aristarchus seems odd?

**Linne:** On 2018 Feb 22 UT 00:13 Walter Elias (AEA) imaged this crater under similar illumination to the following Victorian era report:

*Linne 1867 Aug 06 UT 21:00? Observed by Buckingham (England?) "Crater in darkness, he saw a "rising oval spot". Other obs. saw it as a triang. Bold black spot pointing to earth, slowly diffused white & drift of white on slope of pyramid. (indep. confirmation?)" NASA catalog weight=5 and catalog ID #155. ALPO/BAA weight=3.*



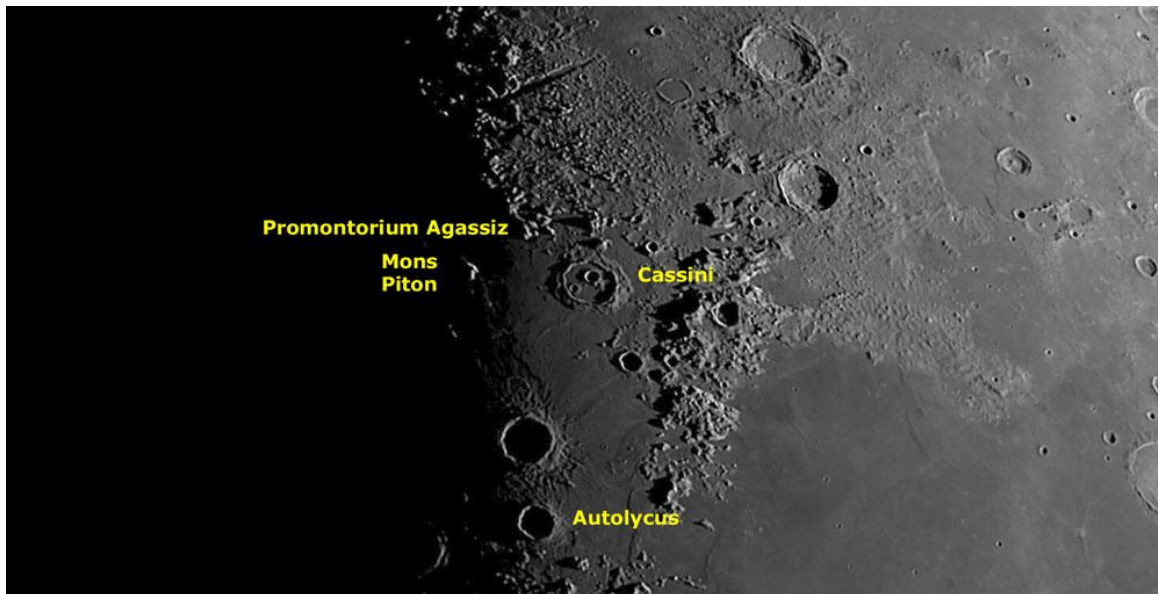
**Figure 4.** Linne as imaged by Walter Elias (AEA) on 2018 Feb 22 UT 00:13. North is towards the top left.

This was covered before in another repeat illumination observation as described in the 2014 Jul [newsletter](#), by Jay Albert: "*Linne appeared as a bright, white spot in a clearing surrounded by wrinkle ridges at the edge of the terminator. I did not see a "rising oval spot" or a "bold black spot pointing to Earth". I did see a somewhat triangular shadow, possibly a depression, just 5 to 10 kilometers S of Linne' which may relate to one of the features described in the LTP.*" So we can now compare this directly to Walter's image in Fig 4 – there certainly is a nice dark interior shadow to Linne, but nothing resembling what Buckingham or the other observer saw. Linne does appear however to be at the northern end of a wrinkle ridge. Whilst clearly a lot of the fuss about Linne changing in appearance, in the past, was caused by errors on maps, I still think it is a useful exercise to do repeat illumination observations to explain some of the reported appearances from a historical point of view. In the case of the Buckingham observation, I suspect that we have a timing issue as the 20:00 in the Cameron catalog is an estimated time. I shall lower the weight from 2 to 1 in order to keep it present in the database for future observations so that we can solve this riddle.

**Montes Alpes:** On 2018 Feb 23 UT 00:53-01:23 Gary Varney (ALPO) produced an image mosaic of the Moon that matched similar illumination, to within  $\pm 0.5^\circ$ , to a Victorian era LTP:

*South of Alps 1843 Jul 04 UT 21:15-22:00 Observed by Gerling (Germany?) "Bright pt. glowing like a star on the S. extension of the Alps. On the following eve. found a small mt. which he did not see before." NASA catalog weight=1. NASA catalog ID=122. ALPO/BAA weight=1.*





**Figure 5.** The Montes Alpes, as imaged by Gary Varney (ALPO) from an image mosaic from 2018 Feb 23 UT 00:53-01:23. The image is orientated with north towards the top.

We have covered this event before in the 2013 Jan [Newsletter](#), and I shall quote from this here: “*One wonders if Gerling got confused by Mons Piton? As you can see from Figure 2 it can appear quite bright, and if he had seen it early surrounded by shadow it might well have looked star-like. He then goes on to say that it appeared as a mountain on the next night, but that he had not seen this before. However he also says that it was on a south extension of the Alpes, whereas Mons Piton is offset quite far to the south west. Maybe something in the description was lost in translation? Unfortunately I do not have any additional information about this LTP other than what is in the NASA catalog. Therefore it shall remain at an already low weight of 1*”.

I have since come across an article by Edward S. Holden, of the Lick Observatory, published in the Royal Astronomical Society’s “[The Observatory](#)”, from 1888, Vol 11, p334-335. In this Edward Holden says that he saw an illumination of a crest of a high peak that was extraordinarily and incredibly bright, at the southern extremity of the Montes Alpes. In the dark portion of the disk, not far from the terminator. He gives the dimensions as 40”-50” in length and 5” wide (80-100km x 10km). He implies that what he saw in 1888 was what Gerling saw in 1843, and quotes Gerling as saying that the location of that bright point was the same distance from Autolycus, as Cassini was, namely 300 km. Which could imply Mons Piton, indeed one day later Gerling describes the peak as conical, which might fit a description of a less shadowed view of Piton? However the dimensions that Holden gives for his 1888 sighting is a factor of two too big, and Cameron links Holden’s event to Promontorium Agassiz.?

Although we have not positively identified the location of either of the events, looking at Fig 5, I would reckon that Mons Piton is the most likely feature that Gerling saw, and I will give the benefit of the doubt to Cameron (originally from the Middlehurst catalog) over Holden’s mountain, namely Promontorium Agassiz as its boundary outline would better represent the description that Holden gives. Either way both LTP’s will remain at weights of 1 as the brilliance does not come across in Gary Varney’s image, though lower magnification could make either look more star-like and brilliant to the eye?

**Copernicus:** On 2018 Feb 24 UT 18:06-18:07 Anthony Cook (ALPO/BAA) imaged this crater under similar illumination and topocentric libration ( $\pm 1^\circ$ ) to the following report:

*On 1990 Aug 30 at UT02:11-02:36 D. Darling (Sun Prairie, WI, USA, 3" refractor, x90, seeing conditions: "at, boiling") noted a colored area on the west wall of Copernicus that was unusual in appearance - however other craters along the terminator had a similar effect. There was also a "dazzling bright spot on the E. rim and he witnessed 6 flashes from the lighted part of Copernicus over a very short time interval. Cameron comments that the color may well have been due to chromatic aberration because a refractor was used. The Cameron 2006 catalog ID=408 and the weight=0. The ALPO/BAA weight=1.*



**Figure 6.** Copernicus orientated with north towards the top. Captured by Anthony Cook on 2018 Feb 24 UT 18:06-18:07.

The image in Figure 6 is in monochrome, but at least shows that there is a bright spot on the east rim, even though it is not as bright as David suggested, but that may depend upon colongitude. We shall keep the weight at 1.

**Alphonsus:** On 2018 Feb 24 UT 18:50-19:09 Marie Cook, using a Questar 90mm scope, at x80, under Antoniadi III seeing, and moderate transparency, observed this crater under similar illumination (to within  $\pm 0.5^\circ$ ) to the following:

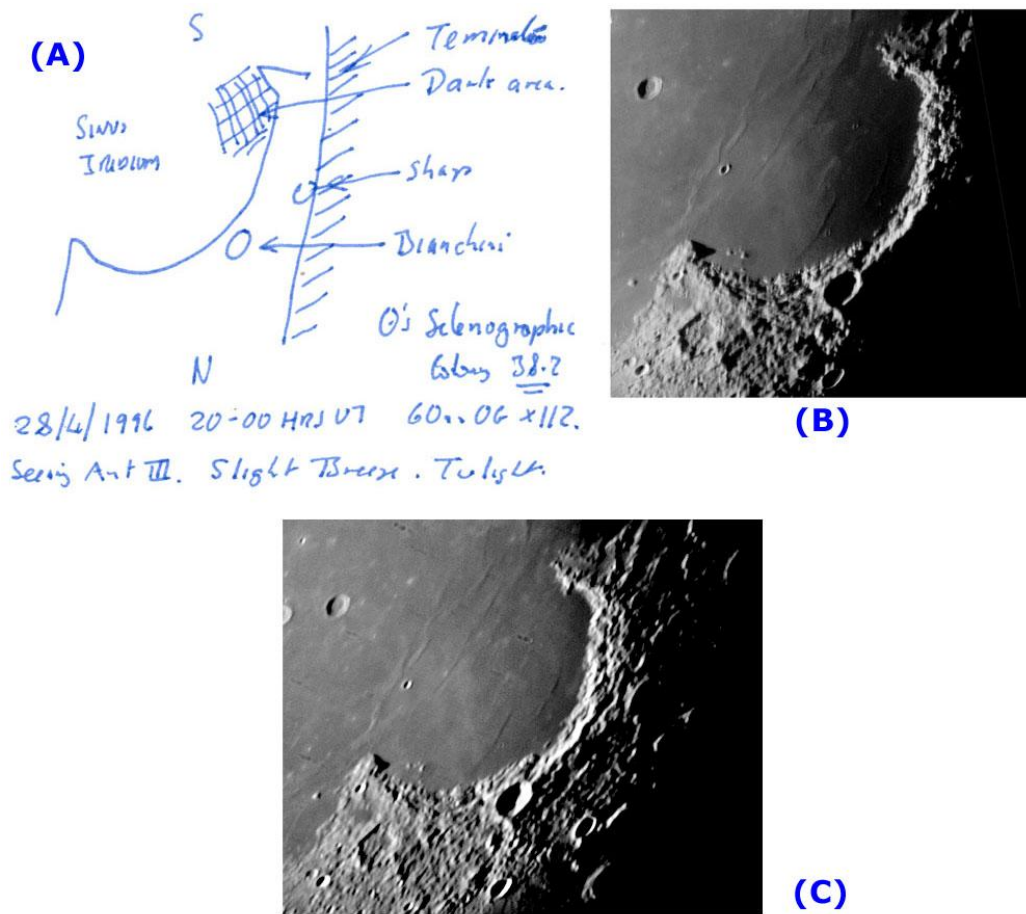
*Alphonsus 1966 Nov 22 UT 03:17-03:40 Observed by Kelsey (Riverside, CA, USA, 8" reflector x300) "Seen first with (Eng.) moon blink, red filter but not in the green. Not seen at 03:42h" NASA catalog weight=4. NASA catalog ID #998. ALPO/BAA weight=3.*

Marie used Cinemoid color filters (Green 24, Blue 61, Red 35, and Yellow 46). She found that the crater was slightly brighter in the green than red, then yellow, and darkest of all in the blue. However the same applied to Ptolemaeus and Arzachel, and at 19:10 she caught a glimpse of a color blink effect in Tycho, with the illuminated rim (in red and green filters). Such a color effects over several craters, and the fact that there were intervening clouds, implied an atmospheric origin. We shall keep the weight at 3.

**Sinus Iridum:** On 2018 Feb 26 UT 01:56 Rik Hill (ALPO/BAA) imaged this area under the same illumination, to within  $\pm 0.5^\circ$ , the following report:

*Sinus Iridum 1996 Apr 28 UT 22:00 Observed by Brook (Plymouth, UK, 60mm refractor, x112, seeing III, slight breeze, twilight) "dark shaded area on floor ~1/4 diameter of Sinus Iridum on western interior by rim" BAA Lunar Section Observation. ALPO/BAA weight=1.*

We have covered repeat illumination observations of this 1996 LTP, several times before, e.g. the [2016 Oct](#) and [2017 May](#) newsletters. As you can see by comparing from Fig 7A the problem is that the location of the terminator in Clive's sketch is too far west from where it should be in Rik's image (Fig 7B) for this particular colongitude. Indeed in the 2016 and 2017 newsletters we have repeatedly adjusted Clive's UT to compensate for this, in case there was a typographical error when he wrote down the time. However this has all been to no avail. In order to get the terminator in the right place, we need to shift the colongitude further along to match an image by Maurice Collins (Fig 7C). This now has the terminator near Sharp crater, but the shading on the floor of Sinus Iridum is still parallel to the western shoreline, as in Rik's image.



**Figure 7.** Sinus Iridum, orientated with north towards the bottom. (A) A sketch by Clive Brook (BAA) from 1996 Apr 28 UT 20:00. (B) An image by Rik Hill (ALPO/BAA) from 2018 Feb 26 UT 01:56 – the image has been non-linearly contrast stretched to bring out some detail in the dark area of the floor. (C) An image by Maurice Collins (ALO/BAA/RASNZ) from 2015 Mar 31 UT 09:29 – the image has been non-linearly contrast stretched to bring out some detail in the dark area of the floor.

Looking at Clive's sketch and letter (the latter is not shown here) I note that he compares the shaded area that he saw on the SW shoreline of Sinus Iridum, to a plate in the [Hatfield Lunar Atlas](#). The only plate I can think of is Plate 6C. This does have the terminator in the right place. Perhaps Clive noted visually the shading and its location, and only later, drew the sketch, utilizing the plate in the Hatfield atlas as an outline? This would explain why the colongitude looks wrong. If that was the case, then the only mystery is why he drew a shaded area on the SW interior margin of Sinus Iridum, and not along the interior western edge? As the 1996 observation was made with a very small 60mm refractor, then resolution was obviously poor. I will revert the UT of Clive's original observation back to 20:00UT, but keep the weight at 1 due to the shading not being where we expect it to be.

**General Information:** For repeat illumination (and a few repeat libration) observations for the coming month - these can be found on the following web site: [http://users.aber.ac.uk/atc/lunar\\_schedule.htm](http://users.aber.ac.uk/atc/lunar_schedule.htm) . By re-observing and submitting your observations, only this way can we fully resolve past observational puzzles. To keep yourself busy on cloudy nights, why not try "Spot the Difference" between spacecraft imagery taken on different dates? This can be found on: [http://users.aber.ac.uk/atc/tlp/spot\\_the\\_difference.htm](http://users.aber.ac.uk/atc/tlp/spot_the_difference.htm) . If in the unlikely event you do ever see a LTP, firstly read the LTP checklist on <http://users.aber.ac.uk/atc/alpo/ltp.htm> , and if this does not explain what you are seeing, please give me a call on my cell phone: +44 (0)798 505 5681 and I will alert other observers. Note when telephoning from outside the UK you must not use the (0). When phoning from within the UK please do not use the +44! Twitter LTP alerts can be accessed on

Dr Anthony Cook, Department of Physics, Aberystwyth University, Penglais, Aberystwyth, Ceredigion, SY23 3BZ, WALES, UNITED KINGDOM. Email: atc @ aber.ac.uk .

## KEY TO IMAGES IN THIS ISSUE

1. Censorinus
2. Cichus
3. Copernicus
4. Geminus
5. Harpalus
6. Kepler
7. Lalande
8. Linne
9. Littrow
10. Messier
11. Mons La Hire
12. Montes Alpes
13. Petavius
14. Plato
15. Schiller
16. Sinus Iridum
17. Tycho

