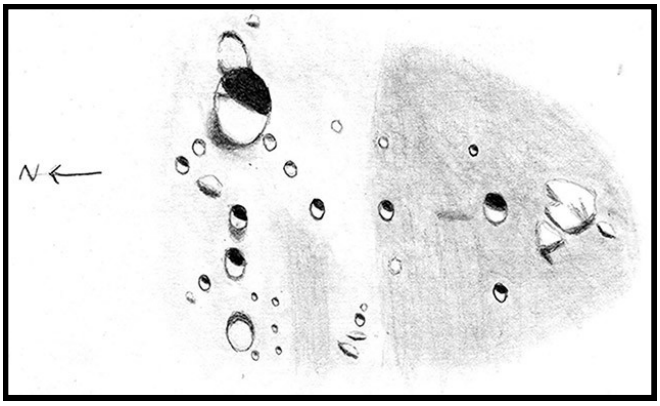
# THE LUNAR OBSERVER

**A PUBLICATION OF THE LUNAR SECTION OF THE A.L.P.O.**
**EDITED BY: Wayne Bailey wayne.bailey@alpo-astronomy.org**
**17 Autumn Lane, Sewell, NJ 08080**
**RECENT BACK ISSUES: http://moon.scopesandscapes.com/tlo_back.html**


# FEATURE OF THE MONTH – FEBRUARY 2019
# PLATO A TO B




**Sketch and text by Robert H. Hays, Jr. - Worth, Illinois, USA**
**December 18, 2018 02:04-02:42, 02:58-03:10 UT, 15 cm refl, 170x, seeing 7-9/10, transparence 6/6.**

I observed the group of craters just west of Plato on the evening of Dec. 17/18, 2018. Plato A is the largest crater in this sketch. Three other craters form nearly a straight line to the west. From east to west, these are Plato M, Y and B. These four craters probably do not make a related chain since they differ considerably in appearance. Plato A has an irregular east rim (shadowed here) that appears to merge into an old ring. A small peak is near this old ring. Plato A also had a detached strip of internal shadow and substantial exterior shadow at this time. Plato M and Y look similar, but M seems deeper than Y. Plato M also had much exterior shadow. Plato B is the second largest crater depicted here, but it is shallower than its neighbors. Plato BA is the small crater northwest of Plato Y, and a small peak is farther to the northwest. A short ridge is just north of Plato Y. A large peak is northeast of Plato M, and Plato S is the crater farther northeast. A shallow pit is between Plato S and A. A group of five tiny pits are near and south of Plato Y and B. Plato O is due south of M and Plato P is the similar crater south of O. Plato F is the small crater west of O and P, and is tucked among two small peaks and perhaps a tiny pit. Plato D farther south is nearly as large as Plato B, but is much deeper. Plato D is flanked by Plato E to the west and the small crater Plato X to the east. All of the Platos BA, S, O, P, F, E, D and X are very similar in general appearance, differing only in size. Plato epsilon is the large peak south of Plato D and Plato omega is the small peak just to its southwest. On closer inspection, Plato epsilon is split along a seam that detaches a triangular segment to the northwest. An odd bit of shadow protrudes from the west tip of this segment. Two tiny bright spots are east and west of Plato P, and another such spot is south of Plato A. Two shallow saucers are between Plato O and A. The north edge of Mare Imbrium is fairly well defined just north of Plato P and south of the Plato F area, A dusky strip is between Plato B and F.

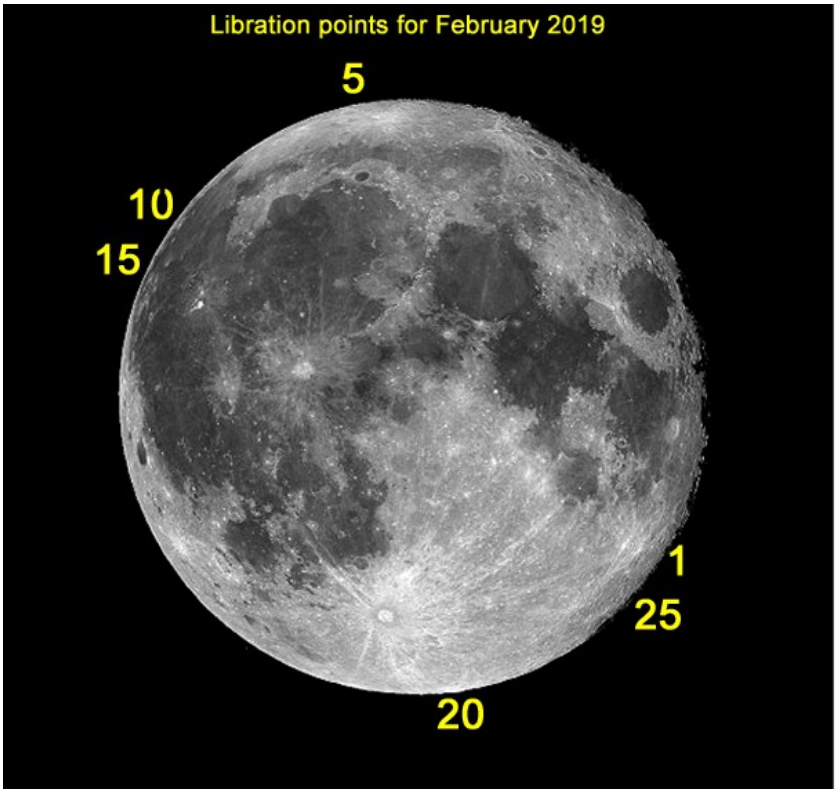
# LUNAR CALENDAR

| | | | |
|---|---|---|---|
| Feb | 01 | 19:48 | Moon South Dec.: 21.5° S |
| | 02 | 02:18 | Moon-Saturn: 0.7° S |
| | 03 | 01:35 | Moon Descending Node |
| | 04 | 16:04 | New Moon |
| | 05 | 04:26 | Moon Apogee: 406600 km |
| | 12 | 17:26 | First Quarter |
| | 16 | 04:56 | Moon North Dec.: 21.6° N |
| | 17 | 04:42 | Moon Ascending Node |
| | 19 | 04:06 | Moon Perigee: 356800 km |
| | 19 | 10:53 | Full Moon |
| | 26 | 06:28 | Last Quarter |
| | 27 | 09:17 | Moon-Jupiter: 2.5° S |

| | | | |
|---|---|---|---|
| Mar | 01 | 01:23 | Moon South Dec.: 21.6° S |
| | 01 | 13:40 | Moon-Saturn: 0.3° S |
| | 02 | 06:03 | Moon Descending Node |
| | 02 | 16:28 | Moon-Venus: 1.3° N |
| | 04 | 06:25 | Moon Apogee: 406400 km |
| | 06 | 11:04 | New Moon |
| | 14 | 06:27 | First Quarter |
| | 15 | 13:59 | Moon North Dec.: 21.8° N |
| | 16 | 12:22 | Moon Ascending Node |
| | 19 | 15:47 | Moon Perigee: 359400 km |
| | 20 | 21:43 | Full Moon |
| | 26 | 22:28 | Moon-Jupiter: 2° S |
| | 28 | 00:10 | Last Quarter |
| | 28 | 09:02 | Moon South Dec.: 21.9° S |
| | 29 | 01:11 | Moon-Saturn: 0.1° N |
| | 29 | 09:08 | Moon Descending Node |
| | 31 | 20:14 | Moon Apogee: 405600 km |

# LUNAR LIBRATION

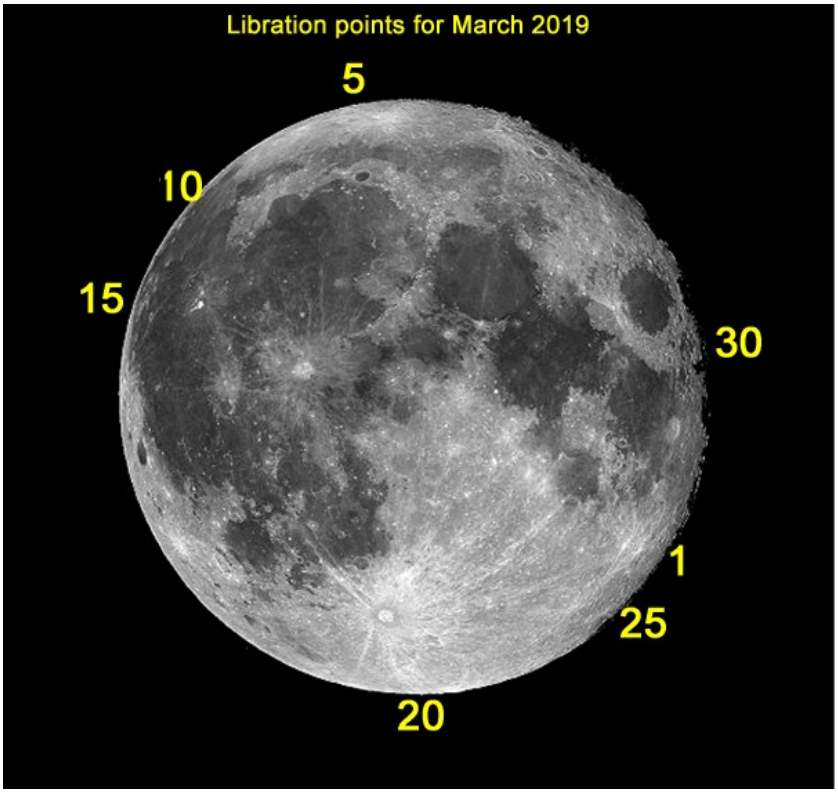
## EEBRUARY – MARCH 2019




**Size of Libration**

| | | | | |
|---|---|---|---|---|
| 02/01 | Lat | -03°07' | Long | +05°01' |
| 02/05 | Lat | +02°24' | Long | -00°13' |
| 02/10 | Lat | +06°41' | Long | -06°23' |
| 02/15 | Lat | +03°51' | Long | -07°17' |
| 02/20 | Lat | -04°19' | Long | +00°46' |
| 02/25 | Lat | -06°13' | Long | +07°28' |

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




**Size of Libration**

| | | | | |
|---|---|---|---|---|
| 03/01 | Lat | -01°59' | Long | +05°06' |
| 03/05 | Lat | +03°23' | Long | -00°24' |
| 03/10 | Lat | +06°38' | Long | -05°53' |
| 03/15 | Lat | +02°39' | Long | -06°46' |
| 03/20 | Lat | -05°02' | Long | -00°02' |
| 03/25 | Lat | -05°33' | Long | +06°49' |
| 03/30 | Lat | +00°38' | Long | +03°24' |

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

# 2019 ALPO MEETING

The 2019 Annual Meeting of the Association of Lunar and Planetary Observers will be held, combined with the South East Region Astronomical League, at Gordon College in Barnesville, GA the weekend of July 12-14.

Additional information will be available in the JALPO and included here as it becomes available.

# 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 nonmembers 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.

# SUBMISSION THROUGH THE ALPO IMAGE ARCHIVE

ALPO's archives go back many years and preserve the many observations and reports made by amateur astronomers. ALPO's galleries allow you to see on-line the thumbnail images of the submitted pictures/observations, as well as full size versions. It now is as simple as sending an email to include your images in the archives. Simply attach the image to an email addressed to

lunar@alpo-astronomy.org (lunar images).

It is helpful if the filenames follow the naming convention which, for the lunar gallery is:

FEATURE-NAME_YYYY-MM-DD-HHMM.ext

YYYY {0..9} Year
MM {0..9} Month
DD {0..9} Day
HH {0..9} Hour (UT)
MM {0..9} Minute (UT)
.ext (file type extension)
(NO spaces or special characters other than "_" or "-")

As an example the following file name would be a valid filename:

Copernicus_2018-04-25-0916.jpg
(Feature Copernicus, Year 2018, Month April, Day 25, UT Time 0916)

Additional information requested for lunar images (next page) should be included on the image. Alternatively, include the information in the submittal e-mail, and/or in the file name (in which case, the coordinator will superimpose it on the image before archiving). As always, additional commentary is always welcome and should be included in the submittal email, or attached as a separate file.

If the filename does not conform to the standard, the staff member who uploads the image into the data base will make the correction prior to uploading the image(s). However, if they come in the recommended format, it would reduce the effort to post the images a lot.

Observers who submit digital versions of drawings should scan their images at a resolution of 72 dpi and save the file as a 8 1/2' x 11? or A4 sized picture.

Finally a word to the type and size of the submitted images. It is recommended that the image type of the file submitted be jpg. Other file types (such as png, bmp or tif) may be submitted, but may be converted to jpg at the discretion of the coordinator. Use the minimum file size that retains image detail (use jpg quality settings. Most single frame images are adequately represented at 200-300 kB). However, images intended for photometric analysis should be submitted as tif or bmp files to avoid lossy compression.

**Images may still be submitted directly to the coordinators (as described on the next page). However, since all images submitted through the on-line gallery will be automatically forwarded to the coordinators, it has the advantage of not changing if coordinators change.**

## 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-hhmm or yyyy-mm-dd-hhmm)**
**Filter (if used)**
Size and type of telescope used Magnification (for sketches)
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

Resolution appropriate to the image detail is preferred-it is not necessary to 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
and Jerry Hubbell –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: Apollo 14 Region – Fra Mauro

***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 **March 2019** edition will be the **Apollo 14 Region – Fra Mauro.** 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
**Wayne Bailey** - wayne.bailey@alpo-astronomy.org

**Deadline for inclusion in the Apollo 14 Region – Fra Mauro article is Feb. 20, 2019**

## FUTURE FOCUS ON ARTICLES:

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

| Subject | TLO Issue | Deadline |
|---|---|---|
| Apollo 12 Region – Ocean of Storms | May 2019 | April 20, 2019 |
| Apollo 11 Region – 50th Anniversary – Sea of Tranquility | July 2019 | June 20, 2019 |

# ANSGARIUS P & C IN THE TERMINATOR

## Alberto Anunziato

The isolated lights in the vicinity of the terminator are strangely fascinating. Already Hevelius in his Selenographia (1647) pointed out that they were the light of the Sun illuminating first the highest points of the zone, but each time I see them they continue to exercise a certain charm on me. And when the lights seem to float between the limb and the vicinity of the Moon, the scene is delicious. So it happened on December 23, 2018, when the Moon was illuminated at 99.8% (fig. 1). Elongated lights seemed to float over the limb. With the Moon shining so much it was not easy to distinguish the accident to which those illuminated zones belonged, reason why we resorted to the most notorious accident of the zone (Langrenus) to go approaching us to the crater looked for. The bright northern stripe corresponds to the Ansgarius west wall, evidently the highest, as can be seen in the Lunar Reconnaissance Orbiter image corresponding to Ansgarius and La Pérouse of the LRO-WAC global moon mosaic, in which only this wall project shadow The following bright areas in the dark correspond to the mountainous foothills that extend up to Behaim, in the last one even the shadow of the interior of a small unnamed crater is perceived. To the west we find the two most defined craters in the image, Ansgarius P to the north, 10 kilometers in diameter, and Ansgarius C, 14 kilometers in diameter, to the south. The east walls of both shine, while the west side is in shadow. With such luminosity in the highlands of the east limb it was not easy to distinguish details in the small elevations that during the observation were insinuated between Ansgarius P and C, with modest shadows on the west slopes, elevations that can be confirmed in the LRO image before mentioned.

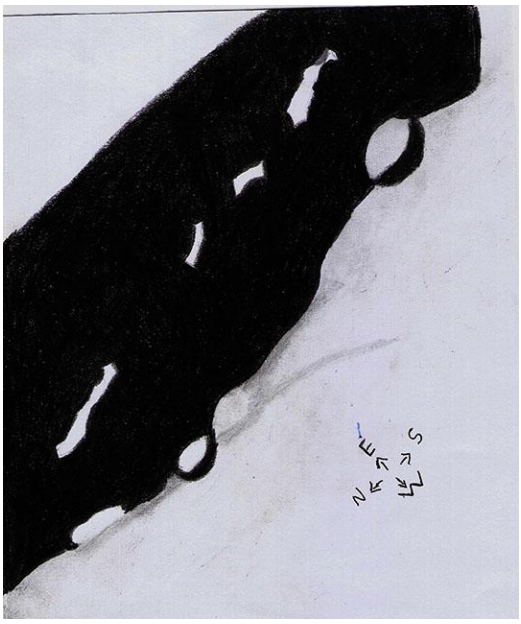



***FIGURE 1.*** ***ANSGARIUS P & C*** *– Alberto Anunziato, Paraná, Argentina. December 23, 2018 05:15-05:30 UT. Colongitude 97.3º. Meade EX-105 Mak-Cass, 154x.*

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# BEWITCHING SELENE

## Rik Hill

There are not many detailed images of the bewitching crater Endymion (fig. 1, 129km diameter) seen here right of center (see mythology for the "bewitching"!). It is generally not well seen in the waxing crescent phase early in a lunation due to the low altitude in the early evening twilight . Then, two weeks later, many have gotten out of the habit of observing the blinding full moon phase and by the time the go back to observing the moon Endymion is already in shadow! You have to catch it within 2 or 3 days of full depending on the libration for the best view. Here you can see the terraced walls but even more interesting the unnamed small lacus (?) above and right of Endymion. It seems like such nice little feature should have a name of its own.

Below and left of Endymion are the two craters Atlas (90km) with the complex system of rimae on its floor, and Hercules with the 13km crater Hercules G on is floor. Use some magnification to enjoy all these two have to offer.

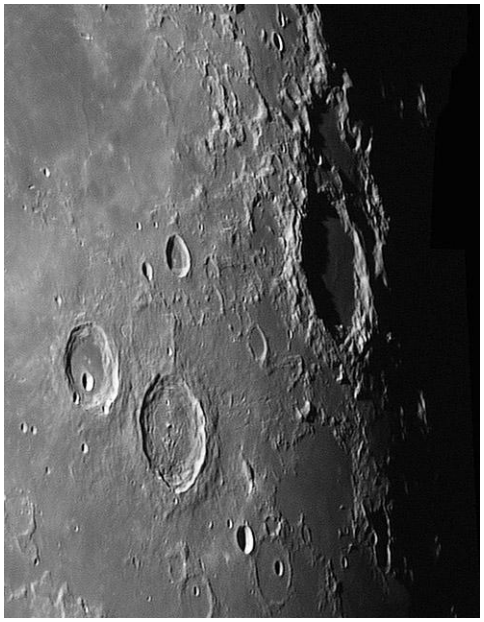

***FIGURE 1.*** ***ENDYMION*** *– Richard Hill – Tucson, Arizona, USA September 27, 2018 05:32 UT. Colongitude 116.7°. Seeing 8/10. TEC 8" f/20 Mak-Cass, SKYRIS 445M, 610 nm filter.*

Between Endymion and Hercules is the crater Reldysh (34km). Below Endymion is a flat area that is Lacus Temporis, the Lake of Time. It consists of two roundish areas that are 3.85-4.5 billion years old, that may have been very ancient craters that were later flooded. South of this is another mostly flooded crater with a younger one on its floor. This is Chevallier and the smaller one is Chevallier B. Enjoy this region just after the full moon passes!

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# MONTES CAUCASUS TRIANGLE

## Rik Hill

My favorite mountains on the moon are the Montes Caucasus (fig. 1). Seen here as a triangular shaped patch of mountains dominating the right half of this image. The curious large crater at the top middle of the range is Calippus (34km) showing much post impact slumping and infilling. In the upper right corner is most of the large lacus-like crater Alexander (85km) partly cut off by the right edge of the image. Below

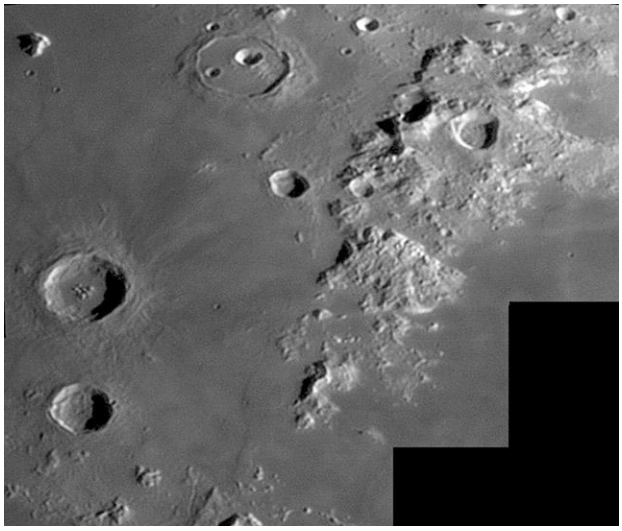

***FIGURE 1.*** ***MONTES CAUCASUS*** *– Richard Hill – Tucson, Arizona, USA August 20, 2018 02:29 UT. colongitude 14.7°. Seeing 7-8/10. TEC 8" f/20 Mak-Cass, SKYRIS 445M, 610 nm filter.*

Alexander on the mare you can just see the dark thread that is Rima Calippus. In the middle of the mountain range is a large flooded east-west pass that may delineate a fault. This pass opens to the west towards the very non-round, some call polygonal, crater Theaetetus (26km). Further south the peaks are more flooded with only their tips showing until at the southern point of the range is the beautiful unnamed "S" shaped ridge.

Just to the west of the mountains is the crater Cassini (60km dia.) seen at the top middle of this image sitting in the unofficial Palus Nebularum portion of Mare Imbrium. Inside Cassini are two distinctive craters, the larger being Cassini A (17km) and Cassini B (9km), There is also an

interesting pair of rimae on the floor of Cassini roughly concentric with Cassini A making this crater very identifiable. Going farther to the west we see the isolated grand peak Mons Piton rising 2250 m above the Imbrium plain. South of this is the large crater Aristillus (56km) and then Autolycus (41km). In the middle bottom part of the Rima Fresnel system can just be seen.

Fig. 2 is an Apollo 15 image of Montes Caucasus. It's a little better resolution than my image. You will note the "S" shaped ridge mentioned above in the lower center. I've labeled some key points. The thing I found surprising is the profile of Cassini! It took some work for me to be convinced that was Cassini, but it is. Our view from Earth often gives us a distorted impression!

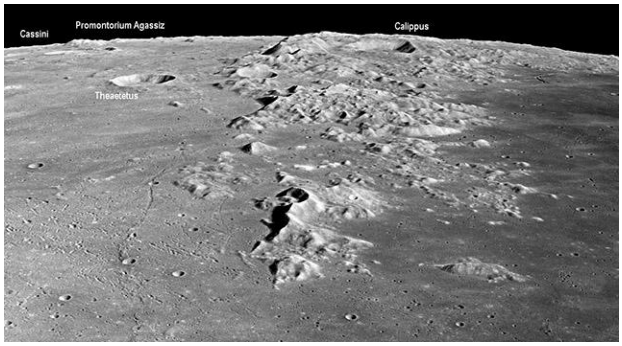


***FIGURE 2.*** ***MONTES CAUCASUS*** *as viewed from Apollo 15.*

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# THE BIGGEST HEXAGON

## Rik Hill

It's often hard to get a good image of sunrise on Mare Crisium (fig. 1). It happens to be best placed when the waxing crescent moon is low in the western sky where seeing is not the best and use of a monochromatic filters a necessity. On the image shown here you can clearly see the hexagonal shape to this roughly 555 km diameter basin that formed during the Pre-Imbrium period from 3.85-4.55 billion years ago. So for the whole span of biological evolution on the earth, that dark spot on the moon has remained largely unchanged!

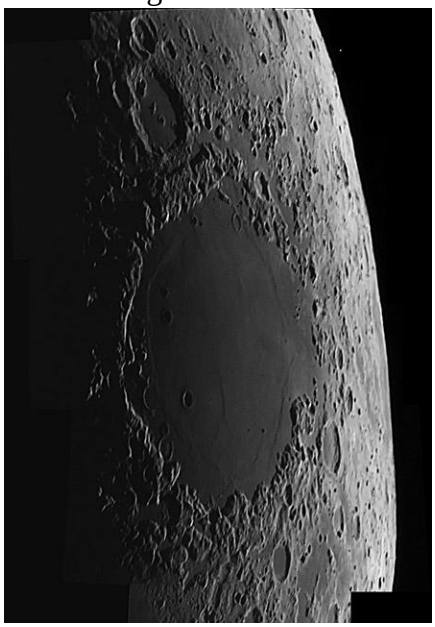

***FIGURE 1.*** ***MARE CRISIUM*** *– Richard Hill – Tucson, Arizona, USA April 19, 2018 02:09 UT. colongitude 311.8°. Seeing 7/10. TEC 8" f/20 Mak-Cass, SKYRIS 445M, 610 nm filter.*

At the top of Crisium you can see the large crater Cleomedes (129km dia.) and above that Burckhardt (60km). Near the lower right (east) show is the flat bottomed (but convex) Condorcet (77km) and due south of Crisium is Firmicus (58km). Note the large river-like feature that meanders from Condorcet to just north of Firmicus and beyond off the bottom edge of this image. This does not seem to be a feature with one common origin or name though it always seems to stand out. Below Firmicus is a small flat area that is Mare Undarum (or what we have jokingly called Mare Underarm). This mare is the third smallest on the Moon with only Mare Spumans and Mare Anguis being smaller. This was not a favorable libration so little can be seen well between Crisium and the limb. But of all the hexagonal formations on the moon, this one is the largest.

# ARISTOTELES AND EUDOXUS

**David Teske**

To the west of Lacus Mortis and north of Mare Serenitatis are the spectacular craters Eudoxus and Aristoteles (fig. 1). The more northerly and larger of these two is Aristoteles, a very prominent, young, large crater with a diameter of 87 km. Named after the Greek philosopher who lived from 384 to 322 BC, Aristoteles is likely of Eratosthenian age due to its lack of rays, or if there are rays, they are weak. Aristoteles has broad inner walls that display some of the most extensive terracing of any crater on the Moon. Its rim is sharp and displays a scalloped effect caused by large units of rock that have broken away from the wall and slid down the wall to some extent. These pronounced terraces extend down to the floor, 3.3 km below the crater rim. Beneath the western wall, a landslide is visible. The floor of Aristoteles is relatively smooth, divided by a north-south ridge. In place of a central mountain it has a couple of off center peaks that are poking through the lava plain on its floor south of center. These center summits are no more than 500 m tall. Though similar in size to Tycho, Aristoteles is 1.2 km less deep than Tycho, implying that the floor has been made shallower by something, perhaps a thick deposit of impact melt and a splattering of lava, rocks, and dust from when nearby Eudoxus was formed. The strongly textured ejecta blanket to the north of Aristoteles clearly shows a radial structure as it is full of radial hills and valleys that spread across Mare Frigoris. Aristoteles is unusual, in that it overlaps the smaller crater Mitchell. The ejecta of Aristoteles cover the older crater Mitchell. Mitchell itself is 30 km in diameter with a floor that is slightly convex. Its walls rise 1,200 m above its floor.

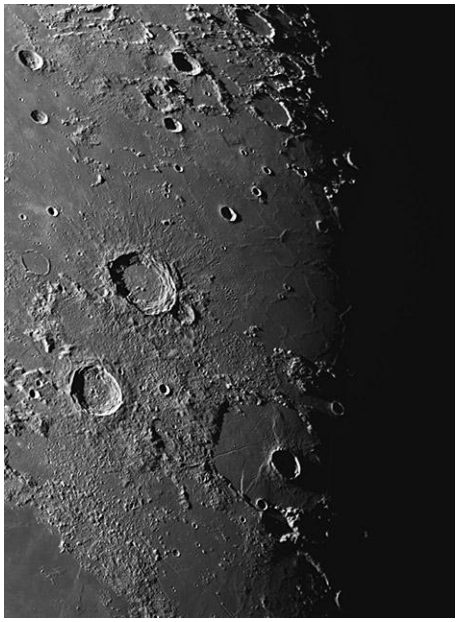

***FIGURE 1.*** ***ARISTOTELES & EUDOXUS*** – *David Teske, Louisville, Mississippi, USA, September 21, 2016 0940: UT. Colongitude 149.7°, seeing 5/10,* Celestron 9.25 inch Edge telescope, Mallincam GMTm camera

Named after the Greek astronomer who lived from 400 to 347 BC, Eudoxus is a prominent crater with terraced crater walls. It has a diameter of 67 km and a depth of 3.4 km. Eudoxus is large enough to be a Tycho-type crater, but it has an unusual rim and central peak similar to that of Aristoteles. Its floor is rougher and blockier than that of Aristoteles. Eudoxus, of Copernican age, is younger than Aristoteles, as that when Eudoxus formed by asteroid impact, a mass of material was ejected towards Aristoteles and piled up against its southern wall, covering a 30 km wide portion of it. The western wall of Eudoxus is separated from its crest by a deep valley, which gives the wall the appearance of being double. Slumping along the western rim has produced a very straight edge for 35 km in its inner section. The terraced walls are a bit less extensive and lower than those of Aristoteles. There is a small crater just outside the north wall.

## References

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# LUNAR TOPOGRAPHICAL STUDIES

**Coordinator – Wayne Bailey - wayne.bailey@alpo-astronomy.org**

**Assistant Coordinator – William Dembowski - dembowski@zone-vx.com**

**Assistant Coordinator – Jerry Hubbell – jerry.hubbell@alpo-astronomy.org**

**Website: http://moon.scopesandscapes.com/**

## OBSERVATIONS RECEIVED

ALBERTO ANUNZIATO - ORO VERDE, ARGENTINA. Drawing of Ansgarius.

SERGIO BAMBINO - MONTEVIDEO, URUGUAY. Digital images of Mare Serenitatis & Mare Tranquilitatis.

JAIRO CHEVEZ - POPAYÁN,COLUMBIA. Digital images of Aristarchus, Mare Crisium, Maurolycus, Montes Apenninus, Plato, Tycho & Walther.

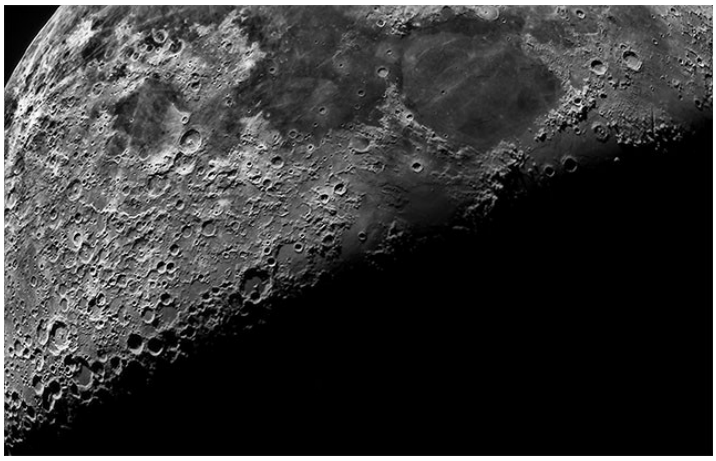
HOWARD ESKILDSEN - OCALA, FLORIDA, USA. Digital images of eclipsed Moon (28).

ROBERT HAYS - WORTH, ILLINOIS, USA. Drawings of Eutecmon & Plato.

RICHARD HILL – TUCSON, ARIZONA, USA. Digital images of Apollo 14 area, Eudymion, Fra Mauro (2), Mare Crisium & Montes Caucasus.

DAVID TESKE - LOUISVILLE, MISSISSIPPI, USA. Digital images of full Moon & Lacus Mortis.

# RECENT TOPOGRAPHICAL OBSERVATIONS



**MARE SERENITATIS** - Sergio Babino,- Montevideo, Uruguay. December 15, 2018 00:55 UT. 8" Astrotech RC. ZWO 174 MM.

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**MARE TRANQUILITATIS**- Sergio Babino,- Montevideo, Uruguay. December 15, 2018 00:58 UT. 8" Astrotech RC. ZWO 174 MM.

**MAUROLYCUS** – Jairo Chavez,- Popayán Columbia. December 15, 2018 23:26 UT. 10" Dobsonian, Sony DSC-WX50.

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# RECENT TOPOGRAPHICAL OBSERVATIONS

**MONTES APENNINUS** – Jairo Chavez,- Popayán Columbia. December 15, 2018 23:29 UT. 10" Dobsonian, Sony DSC-WX50.

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**WALTHER** – Jairo Chavez,- Popayán Columbia. December 15, 2018 23:21 UT. 10" Dobsonian, Sony DSC-WX50.

**LUNAR ECLIPSE**- Howard Eskildsen, Ocala, Florida, USA. January 1, 2019 03:06-07:06, UT. Seeing 7/10, transparency 5/6. 6" f/8 refractor, Canon EOS 60D.

*During egress I did adjust exposures to improve appearance. The ingress images were not changed so the relative brightness of the ingress images are comparable. The camera exposure settings were not changed during totality to show the relative brightness during totality. Other than rotating, cropping, and labeling, none of the images were digitally enhanced.*

***Editor's note:*** *The image link connects to the original composite image which contains links to the original individual images.*

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# LUNAR GEOLOGICAL CHANGE DETECTION PROGRAM

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Reports have been received from the following observers for December: Jay Albert (Lake Worth, FL, USA - ALPO) observed: Aristarchus, Copernicus, Fracastorius and Plato. Simon Bell (Mid Wales, UK - NAS/Slooh) imaged several features. Valerio Fontani (Italy – UAI) imaged the Mare Imbrium and Montes Teneriffe. Les Fry (UK - NAS) imaged several features. Robert Stuart (Rhayader, UK – BAA) imaged: earthshine and the Moon's disk. Aldo Tonon (Italy-UAI) imaged Sinus Iridum. Gary Varney (Pembroke Pines, FL, USA – ALPO) imaged: Littrow, Mare Nectaris and Mare Serenitatis.

**News:** The Chinese landed Chang'e 4 (with rover) on the lunar far side successfully on January 3rd in Von Karman crater, which is inside the South Pole Aitken Basin (SPA). This is the first time anything has landed safely on the far side, and the first time direct measurements will be made of the SPA basin. Let us wait and see if they attempt any imagery of the horizon before sunrise to try to replicate the Surveyor horizon glow images. Meanwhile Israel will have a lunar lander, called "Beresheet", launched around about 2019 Feb 18. It will be equipped with a magnetometer, a laser reflector, and probably a camera. The journey to the Moon will take at around 2-3 weeks, and once it has landed it will operate for approximately 2 days, doing a 50m hop across the surface, before the temperatures of the lunar day overwhelm its thermal protection. Let us hope that they send it somewhere interesting – back in 2016 they were talking about Reiner Gamma, though now I think it is destined for NNW Mare Serenitatis?

**LTP reports:** No LTP were observed in December, though according to Brian Cudnik's ALPO lunar impact flash web site (an excellent place to learn about impact flash observing), Brazilian observers (ROCG): Tiago Augusto, Torres Moreira and Carlos Henrique Barreto, have captured video of suspected Geminid impacts on the Moon at these dates and times: 2018 Dec 12 UT 23:40:22, 2018 Dec 15 UT 00:13:36, 00:22:27, 00:59:30 and 01:05:06. Can you please check any video you may have taken of lunar earthshine around these times to see if you also have detected any flashes here, and email Brian Cudnik if you can confirm them to: b m c u d n i k @ g m a i l . c o m.

I also received an email from Gene Cross concerning the appearance of Ross D on 2018 Jun 19 UT 04:00, where he found the normal ghost crater was not visible, and wondered if there was an obscuration, as the wrinkle ridge intersecting the crater was visible? He was using the Mt Wilson 60" f/16 Cassegrain (Strehl > 0.9) under descent seeing conditions. So again, if you were observing then, please get in touch.

**Lunar Eclipse 2019 Jan 21:** The eclipse was well observed with a flood of pretty, and colorful, images appearing all over the Internet - though it's a shame that so many of these did not include the UT. I decided to have a go at observing myself, though the forecast said it would be totally cloudy. I got up anyway looked through the window and found it was totally clear. I had my 8" Dobsonian scope and an equatorial tracking platform outside and operational between 04:35-06:37UT after which some cloud and mist started to roll in. Now lunar eclipses are not as ideal for looking for impact flashes as one might think. Although dark to our eyes, to a camera such as the Watec 902H, which is near-IR sensitive, the umbra shadow lets through quite a bit of refracted near-IR light from our atmosphere, and because impact flashes are bright in the near-IR anyway, this could potentially make detection problematic for the fainter flashes. On the plus side at least, visible light is effectively cut out. Two candidate impact flashes had previously been recorded during total eclipse, by George Varros, on 2008 Feb 20 – but these have never been confirmed.

After the eclipse I ran my AVI videos through the Automated Lunar Flash Investigation (ALFI) software and when the analysis had been completed, found that I had detected 61 flashes, or about one every two minutes

approximately. However careful examination of these suggested that they were either cosmic ray events (Fig 1 – Left), or point like craters which cause false triggers when the telescope was moved. So, it seemed that I had nothing to show for approximately two hours of observing, though it is important to consider that I was imaging only a quarter of the lunar surface (Fig 1 – Right). A colleague at work, Dr Heather McCreadie emailed at 10:41AM on the 21st to say that she had seen a couple of naked eye flashes on the Moon during the eclipse at around 5AM GMT but didn't note the exact times. I was a little skeptical about this as cosmic ray air showers can produce flashes of light in the eye, just like they do with CCD cameras, and to get two naked eye impact flashes seemed incredibly unlikely. The odd thing was that on the morning of 22nd January I started to receive a flurry of emails about impact flashes during the eclipse. Firstly, from Marcello Zurita (APA/BRAMAON/SAB) and then from the New Scientist over reports appearing via Will Gator's Twitter Site. As some of the images showed a flash which resembled a sharp point, I thought initially that it was a cosmic ray, but because so many images showed the point of light at same time (there were some differences of a few seconds because of Internet time issues) and the same location, and the images were coming in from all over the world, it had to be a lunar impact flash. I got Heather to do a sketch of the first flash (Fig 2 – Left) and the position close to the limb agrees well with Marcello's image from Brazil (Fig 2 – Right). Please do bear in mind that drawing sketches from memory, a few hours after the event can have some uncertainty to them. Assuming the events that Heather saw were not meteors in our atmosphere (see later) the flash had to have been at least 5th magnitude, and to be seen against the red shadow, possibly magnitude 4.

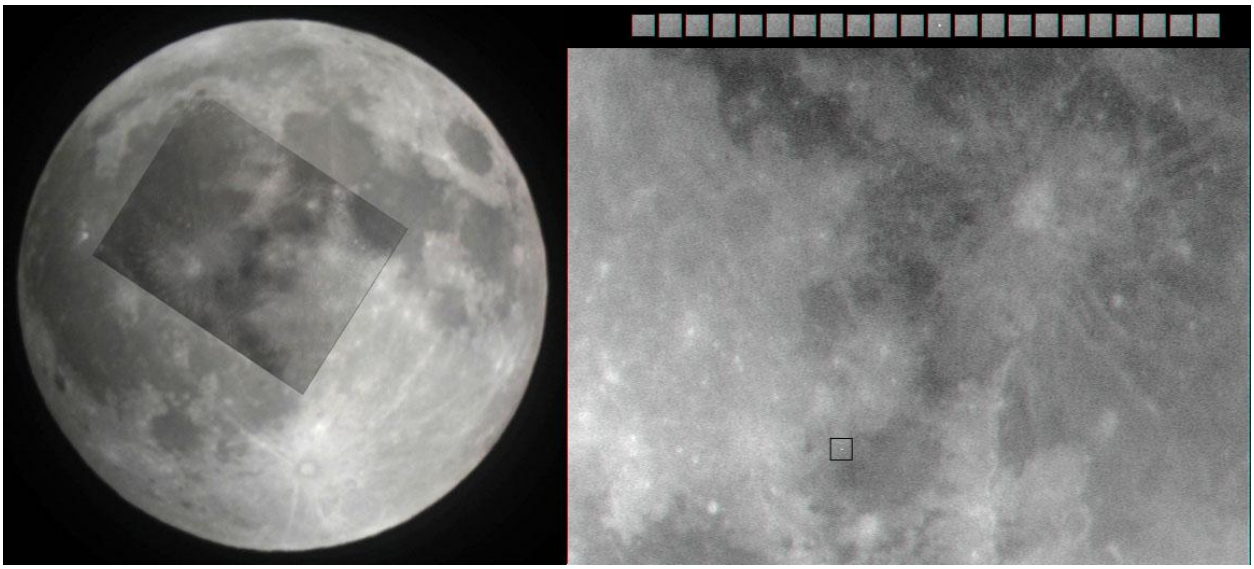

***Figure 1.*** *The Moon on 2019 Jan 21.* ***(Left)*** *Field of view of Tony Cook's Watec 902H camera, at 04:41:43 UT, overlaid on a reference image taken by Franco Taccogna (UAI) at 03:06 UT.* ***(Right)*** *A typical cosmic ray event detected by the ALFI software in Tony Cook's video – at 04:42:20 UT, with north to the bottom right.*

After trawling through social media, I have now found over forty independent accounts/images/videos of the 04:41:38 UT impact flash. In terms of visual sightings, these were reported by: Dr Heather McCredie (See Fig 2 - Left) and she describes the event as *"Color - white steak in - then a blob of white for both, not very large. Quite close in time."*, Jenny Graves (Replying to @willgater @AwesomeAstroPod) – who says *"I think I saw it when it happened. Didn't know what I was seeing at the time. I saw something bright instantly disappear"* and John O'Neal & colleague (Statesville, NC, USA) who saw *"a very short, very fast meteor skimming near the southeast corner of the moon"*. Although these were about the right time, there is a possibility that the first and the last descriptions maybe related to meteors in our atmosphere and perhaps the second to an occultation? It can be difficult to judge and describe events that last a fraction of a second and you are not expecting to see. Of the many images/videos I have seen, the flash looks mostly point-like, but may have some distortion – a curious image by Libor Haspl (Velky Osek, Czech Republic), Observatorio San Vincente, and another by Brett Ashton, seem to show some rays coming off the flash, though whether these are telescope diffraction spikes, astigmatism, reflections inside the optics, refractive/seeing effects in our atmosphere, or excessive high pass filtering (study the NE limb on the Haspl image), I do not know? Something else I noticed was that the flash seems to vary in

brightness between different observers' images, but this can probably be explained by the exposure people used and how sensitive their cameras were to the near-IR. All the images on the Internet were taken in color and that too can affect the apparent brightness if a red flash falls on a blue pixel.

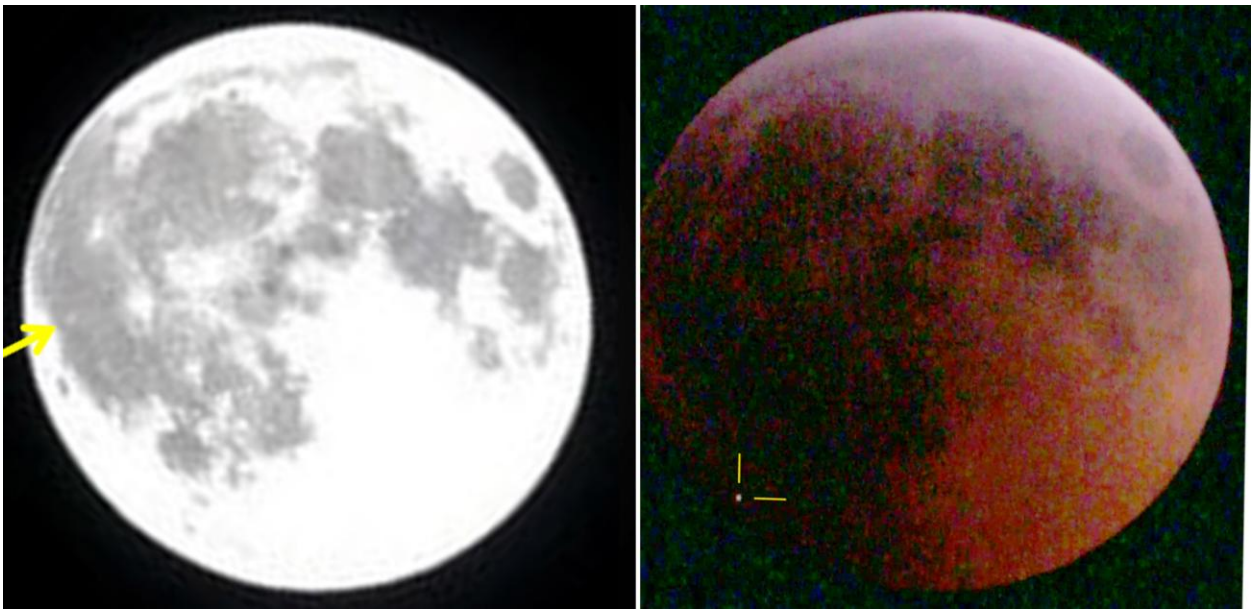

***Figure 2.*** *The Moon on lunar eclipse night 2019 Jan 21, orientated with north towards the top. (Left) A possible visible sighting of a flash on the Moon by Dr Heather McCredie, showing the location of the flash she saw at around 5AM UT with several minutes' uncertainty in time. (Right) An image by Marcello Zurita (APA/BRAMAON/SAB) showing an impact flash between the craters of Byrgius, Lagrange, and Lamarck at 04:41:38 UT.*

A second possible, unconfirmed, impact flash was recorded at the Royal Greenwich Observatory, London, at 04:43:44 UT, NE of Endymion crater. It does not look like a cosmic ray to me, but because it lies in a lighter part of the shadow, many other astronomers have unintentionally over exposed their images/video here, and so may not have noticed it. I showed the video to Dr Heather McCreadie and she thinks this was the part of the Moon where she saw a second flash of light that night. There are also four fainter flashes videoed on eclipse night: 04:06:35UT Montes Cordillera; 04:07:10 UT Flamsteed area; 04:08:02 UT Letronne-Gassendi area; 04:40:56 UT Marius area. The first three were supplied/processed by Eduardo Placido Santiago (EXOSS - Brazil) but taken by their colleague Rafael. The 04:06:35 and 04:07:10 UT ones maybe noise on diagonal line video interference – the 04:08:02 UT one maybe related to a bright ray crater on the surface scintillating in atmospheric seeing? The 04:40:56 UT image was taken by Marcello Zurita (APA/BRAMAON/SAB) and is probably a cosmic ray. However, all of these locations and UTs need to be checked out if you took video or still images during the eclipse – please let me know if you are able to confirm any of these and I shall pass the results onto ALPO's lunar impact flash coordinator Brian Cudnik.

If any readers are interested there is some Europlanet software to which can be used to look for impact flashes on the Moon using recordings of AVI video. This is available from: http://users.aber.ac.uk/atc/alfi.htm. The software is different to the existing Lunar Scan program, but it is intended as a freeware project which will be built upon and improved. It is advisable to try to use both programs to find impact flashes.

**Routine Reports:** Below are a selection of reports received for December 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: But before we start, just a reminder of refinements to weights of LTP mentioned in the Nov and Jan newsletters:

| Ref | Date | Feature | Discoverer | Old Weight | New Weight | TLO |
|---|---|---|---|---|---|---|
| 2 | 2010Apr20 | Descartes | Bryukhanov | 1 | 1 | 2018Nov |
| 3 & 16 | 2006Jan05 | Copernicus | Burt | 3 | 3 | 2018Nov |
| 4 | 1980Oct19 | Promontorium Laplace | Hobdell | 1 | 0 | 2018Nov |
| 5 | 1975Mar22 | Plato | Flynn | 1 | 1 | 2018Nov |
| 6 | 2001Aug30 | Alphonsus | Brook | 2 | 2 | 2018Nov |
| 7 | 1947Aug28 | Langrenus | Baum | 2 | 2 | 2018Nov |
| 8 | 1992Feb16 | Langrenus | Moore | 1 | 1 | 2018Nov |
| 9 | 1976Jan16 | Aristarchus | Foley | 1 | 1 | 2018Nov |
| 10 | 1954Mar23 | Atlas | Delmotte | 3 | 3 | 2018Nov |
| 11 | 1975Mar02 | Plato | Foley | 1 | 1 | 2018Nov |
| 12 | 1995Feb05 | Promontorium Agarum | Moore | 3 | 3 | 2019Jan |
| 13 | 1969May23 | Biela & Maskelyne | Skinner et al. | 5 | 5 | 2019Jan |
| 14 | 1961Oct18 | Agrippa | Bartlett | 2 | 2 | 2019Jan |
| 15 | 1989Jun12 | Torricelli B | North | 3 | 2 | 2019Jan |
| 17 | 1990Apr04 | Copernicus | LeFranc | 2 | 2 | 2019Jan |
| 18 | 1969May26 | Plato | Farrant | 2 | 2 | 2019Jan |
| 19 | 1966Jul29 | Aristarchus | Simmons | 1 | 1 | 2019Jan |
| 20 | 1982Sep29 | Aristarchus **(*)** | Louderbackj | 1 | 0 | 2019Jan |
| 21 | 1965Sep13 | Plato | McCord | 5 | 5 | 2019Jan |
| 22 | 1958Dec02 | Alphonsus | Unknown | 1 | 1 | 2019Jan |
| 23 | 1975Mar04 | Plato | Foley | 1 | 1 | 2019Jan |
| 24 | 2011Dec31 | Torricelli | Braga | 1 | 1 | 2019Jan |
| 25 | 1954May11 | Eratosthenes | Cattermole | 2 | 2 | 2019Jan |
| 26 | 1922Nov28 | Mons La Hire | Wilkins | 3 | 2 | 2019Jan |
| 27 | 1982Aug29 | Pytheas | Robotham | 2 | 1 | 2019Jan |
| 28 | 1969May26 | Plato | Farrant | 2 | 1 | 2019Jan |
| 29 | 1959Feb18 | Alphonsus | Hole | 5 | 5 | 2019Jan |
| 30 | 1959Jan23 | Aristarchus | Alter | 4 | 4 | 2019Jan |
| 31 | 1964Sep20 | Aristarchus-Herodotus | Crowe & Cross | 1 | 1 | 2019Jan |
| 33 | 1964Oct23 | Aristarchus | Bartlett | 2 | 2 | 2019Jan |
| 34 | 1983Oct23 | Aristarchus | Foley | 4 | 4 | 2019Jan |
| 35 | 2002Sep23 | Aristarchus | Brook | 1 | 1 | 2019Jan |

***Table 1.*** *A list of old and new LTP weights. Where changes occur, these are indicated in red font.* ***(*)*** *An email I received from Peter Andersen (BAA) suggested the 1982Sep29UT05:52 LTP was the occultation of a mag 7star SAO164524 which occurred at 05:51:57UT. I checked on the World-Wide Telescope and found that there is a star roughly in the right positions, though the occultation time according to WWT is 06:08UT – but I have found accuracy problems with WWT in the past. Therefore, the weight of this LTP has been reduced to 0.*

**Earthshine:** On 2019 Dec 04 UT 06:07 Bob Roberts (BAA) imaged the lunar earthshine. Bob's image (Fig 3) is just a reminder that like the evening, the early morning is a good time to look for lunar impact flashes, i.e. before local sunrise. Although Bob would have been incredibly lucky to have caught an impact flash in a single exposure image like this, with low sensitivity light video cameras, as was done during the lunar eclipse, and the

right software, like ALVIS or LunarScan, the chances of detection can be significantly improved to one meteorite per 10-20 hours of observing. Though technically speaking, because of the difference in velocity between the Moon in its orbit with typical sporadic meteors, the impact velocity is slightly less in the mornings, so any flashes will be slightly fainter. One bonus of impact flash monitoring is that one can also participate in lunar occultation observing with stars reappearing on the eastern limb, rather than the more normally observed disappearance on the western limb. Please send any observations of these off to the BAA Lunar Section occultation coordinator, Tim Haynes.

***Figure 3**. Lunar Earthshine on 2018 Dec 04 UT 06:07 and orientated with north towards the top. Taken by Bob Stuart (BAA/NAS).*

**Montes Teneriffe:** On 2018 Dec 15 UT 21:18-21:48 Valerio Fontani imaged this area at selenographic colongitudes: 9.0° to 12.4° which match those of an 1854 observation:

*nr. Plato in Teneriffe Mountains 1854 Dec 27 UT 18:00-23:00 Observed by Hart & others (Glasgow, Scotland, 10" reflector) "2 luminous fiery spots on bright side on either side of a ridge, contrasting color. Seemed to be 2 active volcanoes. Ridge was normal color. Spots were yellow or flame color. Never seen before in 40 yrs. of observing." NASA catalog weight=4. NASA catalog ID #129. ALPO/BAA weight=3.*

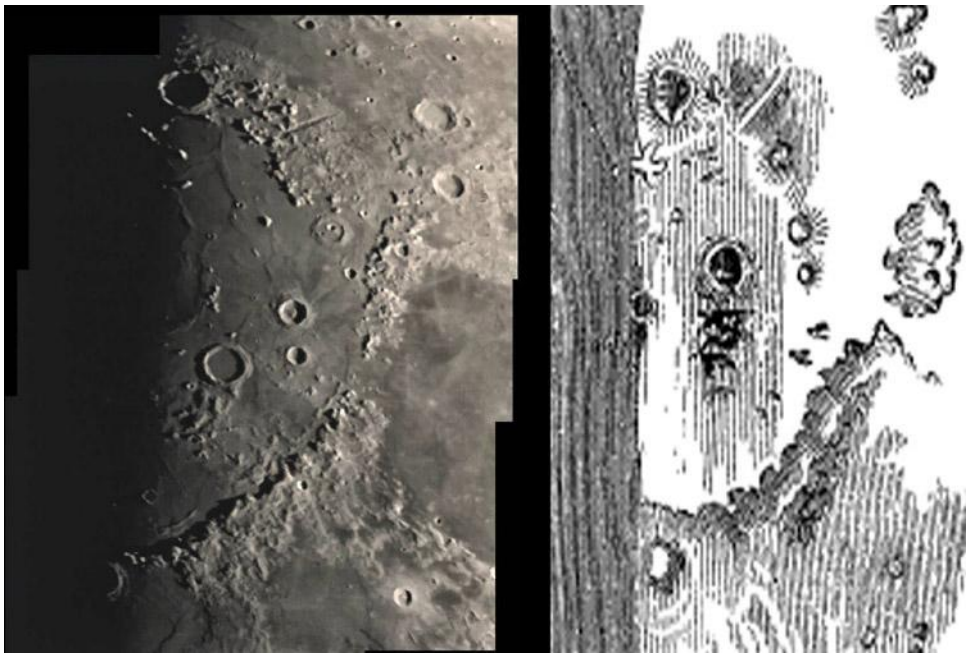

***Figure 4**. The Mare Imbrium area, orientated with north towards the topo. **(Left)** an image mosaic by Valerio Fontani (UAI) from 2019 Dec 15 UT 21:21-21:39. **(Right)** A portion of a sketch from Robert Hart made on 1854 Dec 27/28 UT 19:00-00:00 and published in: Hart, R. (1855) "On a Telescopic Appearance Seen in the Moon", Monthly Notices of the Royal Astronomical Society, Vol 15, p163.*

Valerio's image (Fig 4 – Left) shows pretty much all of the detail that we can see in the Hart sketch (Fig 4 – Right), though I would say that the terminator seems to be a bit further to the west in 1854 as Timocharis is visible. So, we now need to increase our lower limit of selenographic colongitude to say 10.2° for all future repeat illumination observations. As to what the colors were due to, in 1854 – one might think that this could be caused by the Moon being low, but its calculated altitude of 37°-24° is not so low. Chromatic aberration from a poor-quality low magnification eyepiece might be another way of causing color; and coupled with poor seeing conditions could make bright sunward facing slopes sparkle with colored seeing flare. However, we need to check that indeed the Montes Teneriffe do appear bright in the new range of selenographic colongitudes we have assigned. We shall keep the weight at 3 for now.

**Mons La Hire:** On 2018 Dec 17 UT 02:37 UT 02:37 Simon Bell (NAS – Mid Wales, UK), using the Slooh robotic telescope network to image the Moon at the same illumination, to within ±0.5° to the following observation:

*Mons Lahire 1887 Feb 02 UT 20:00? Observed by Klein (Cologne, Germany, 6" refractor) "Intense yellow streak that cast shadows around neighbouring features". NASA catalog weight=4. NASA catalog ID #255. ALPO/BAA weight=3.*

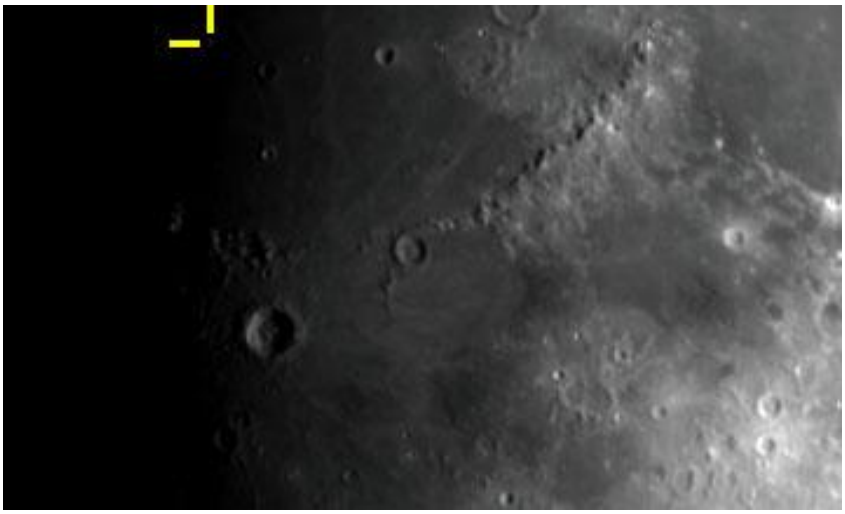

***Figure 5.*** *Copernicus and the Montes Apenninus, from a larger monochrome image of the waxing gibbous Moon, taken by Simon Bell (NAS) on 2019 Dec 17 UT 02:23 using the Slooh Chile 1 Wide Field robotic scope. The yellow markers indicate the position of Mons La Hire. Image re-orientated with north towards the top.*

Although taken with a wide field of view (Fig 5), we can at least see what the scene may have looked like to Klein in 1867, though there is a bit of uncertainty over the 20:00 quoted in the Cameron catalog reference. We shall keep the weight at 3 for now. Certainly, no intense streak is visible in the Slooh telescope image. The Slooh robotic telescope robotic telescope network allows amateur astronomers to observe by subscription at a variety of affordable rates. Something that is useful if you do not own your own scope, or can no longer observe outside easily.

**Promontorium Laplace:** On 2018 Dec 17 UT 20:35 and 20:45 Aldo Tonon (UAI imaged this area under the same illumination and topocentric libration, to within ±1° to the following observation:

*On 1994 Apr 21 at UT 06:00 W, Cameron (Sedona, USA) detected a reddish color on Pronontorium Laplace, This is LTP event No. 9 in the ALPO Clementine LTP program Nov 1994. The ALPO/BAA weight=2.*

Aldo took the images under poor observing conditions, and I have tried to add some atmospheric spectral dispersion the 20:45UT image (Fig 6 Right). It certainly does show some red to Promontorium Laplace, but also rather obvious color fringes elsewhere. From Winnie Cameron's observing location in Sedona, Arizona, the Moon was 44° above the horizon and so atmospheric spectral dispersion does not seem a likely option – also she would not have been fooled by it. Unfortunately, the report I have does not state whether the red color was seen visually, or detected using color filters, so for now I shall keep the weight at 2.

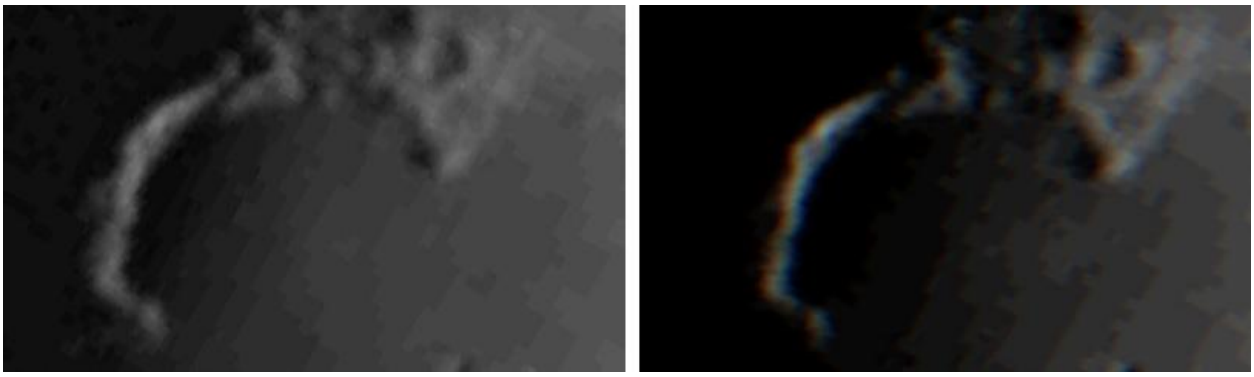

***Figure 6.*** *Promontorium Laplace orientated with north towards the top and taken by Aldo Tonon (UAI). on 2018 Dec 17.* ***(Left)*** *Taken at 20:35UT.* ***(Right)*** *Taken at 20:45UT but with artificial atmospheric spectral dispersion added.*

**Gassendi:** On 2018 Dec 18 UT 20:11 Les Fry (NAS) imaged this crater under the same illumination and topocentric libration, to within ±1° to the following observation:

*On 1976 Apr 10 at 21:15-21:49UT S. Spencer (60mm refractor x60, seeing quite good) noticed a faint red glow at the south west wall of Gassendi covering a span of about 35 deg arc. The observer had some doubts about this because they were using a small telescope, but thought that they ought to report it, just in case. A BAA Lunar Section report. ALPO/BAA weight=1.*

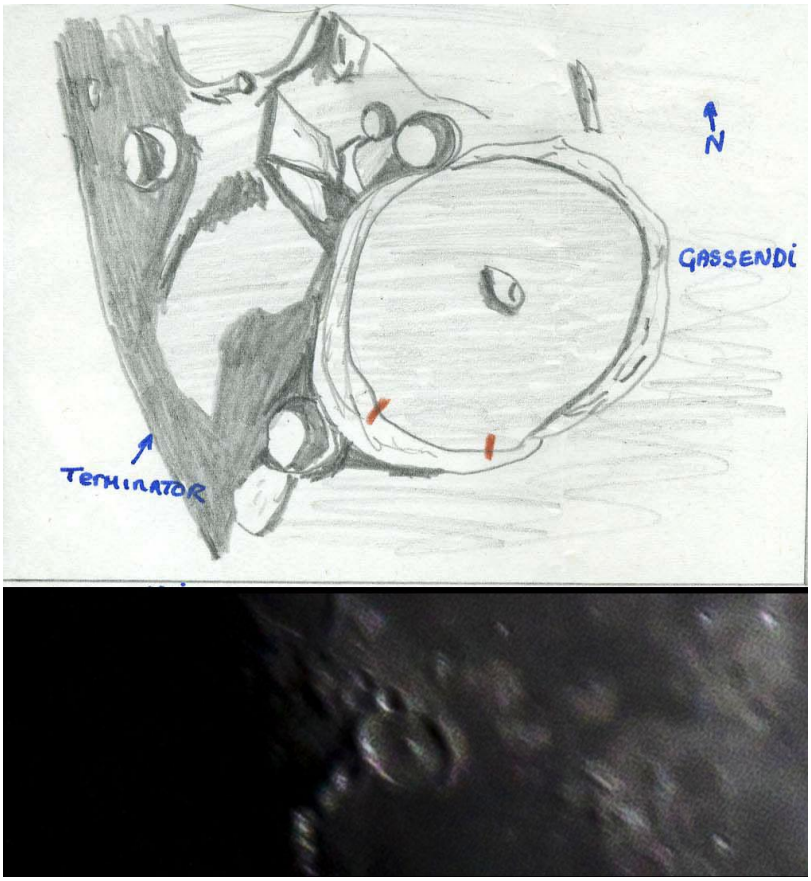


***Figure 7.*** *Gassendi orientated with north towards the top.* ***(Top)*** *as drawn by Steven Spencer (BAA) on 1976 Apr 10 UT 21:15-21:49.* ***(Bottom)*** *A subsection of an image by Les Fry (NAS), taken on 2018 Dec 18 UT 20:11, with color saturation increased to 40%.*

Despite increasing the color saturation of Les' image (Fig 7b) there is no sign of a faint glow between the parallel lines shown in Steven Spencer's sketch. The weight of 1 seems appropriate at the moment though it may have an origin in chromatic aberration in the small 2" refractor being used.

**Fracastorius:** On 2018 Dec 22 UT 01:40-02:03 Jay Albert observed this crater under similar illumination (within ±0.5°) to the following late 1970's report:

*On 1977 Mar 04 at UT 20:55-21:18 JH Robinson (Teignmouth, Devon, UK, 26cm reflector, x200, Wratten 25 and 44a filters, seeing steady, transparency varies from fair to very poor and cloud eventually halted observations). The floor of Fracastorius is significantly brighter in a red filter than in a blue filter. This is a BAA Lunar Section observation. ALPO/BAA weight=2.*

Jay was using a Celestron NexStar Evolution 8" SCT under a hazy, mostly clear sky. Transparency was 2nd magnitude. Seeing was a poor 3-4/10. He found the 1977 description pretty accurate, namely that the floor was brighter in the red Wratten 25 filter than in the blue Wratten 44A filter. He commented that the north part of the floor was especially dark in the blue. We shall therefore lower the ALPO/BAA weight from 2 to 1, as I would like to check that this appearance repeats. The floor of Fracastorius is known as a "Permanent Blink" area by old time LTP observers, namely they always suspect color here when they used Moon Blink devices on this crater. However, I seem to recall that earlier repeat illumination observations of the crater do not always show a color filter effect, hence why we will knot go lower than a weight of 1 just yet.

**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 . 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 . 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 https://twitter.com/lunarnaut .

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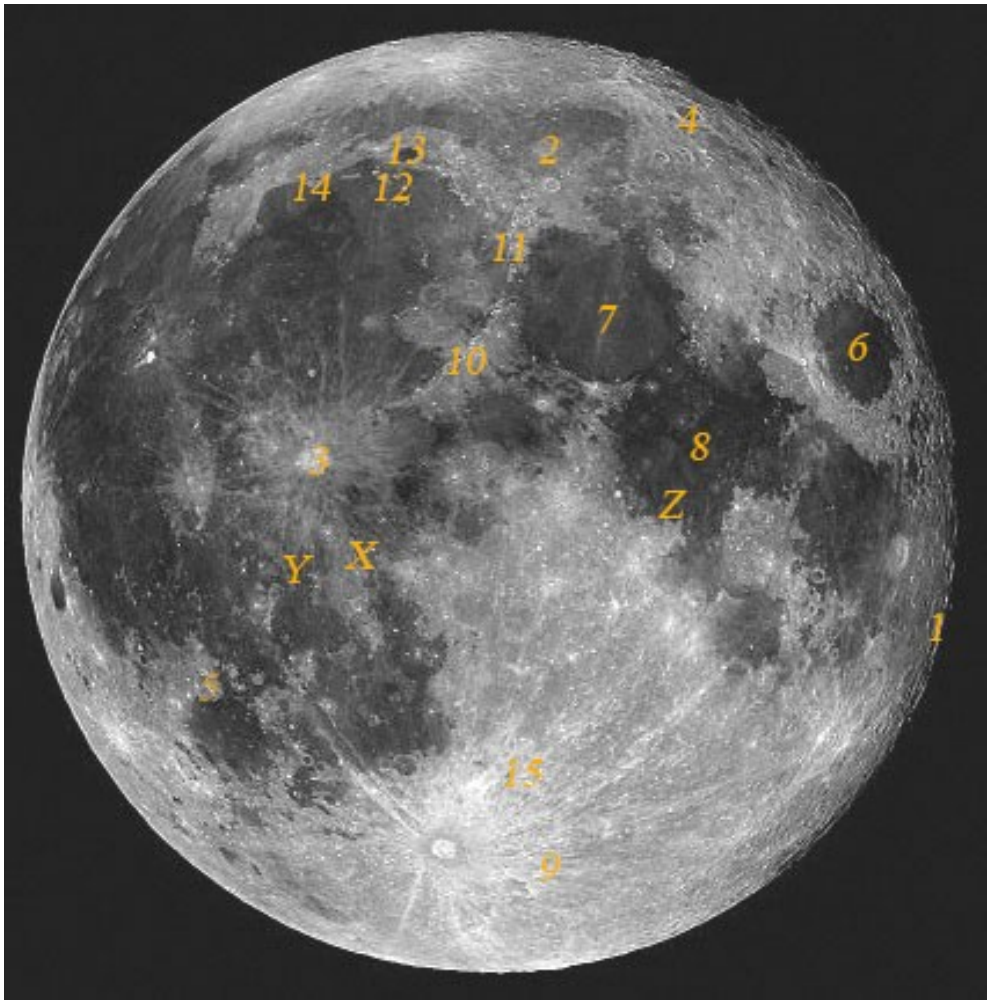
# KEY TO IMAGES IN THIS ISSUE

1. **Ansgarius**
2. **Aristoteles**
3. **Copernicus**
4. **Endymion**
5. **Gassendi**
6. **Mare Crisium**
7. **Mare Serenitatis**
8. **Mare Tranquilitatis**
9. **Maurolycus**
10. **Montes Apenninus**
11. **Montes Caucasus**
12. **Motes Teneriffe**
13. **Plato**
14. **Promontorium Laplace**
15. **Walther**




## FOCUS ON targets

**X = Apollo 14 Fra Mauro**
**Y = Apollo 12 Ocean of Storms**
**Z = Apollo 11 Sea of Tranquility**