



The Lunar Observer

A publication of the Lunar Section of ALPO

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Recent back issues: http://moon.scopesandscapes.com/tlo_back.html



January 2020

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In the January 2020 issue of The Lunar Observer, you will find an extensive Focus-On article about craters Plato and Theophilus by Jerry Hubbell. Rik Hill covers some complicated regions of the lunar highlands with his four articles and stunning images. Howard Eskildsen continues his research and imaging of lunar domes near Vitruvius and Cauchy, Kies, Gambart, Capuanus and Lansberg D. David Teske delves into the area near Billy and Flamsteed with a whimsical character. Tony Cook presents another thorough article about lunar change. As always, several observers contributed many sharp images for our recent topographic studies.

Lunar Calendar January 2020

| 2020 | U.T. | EVENT |
|-----------|------|---|
| January 2 | 0200 | Moon at apogee, 404,580 km |
| 3 | 0445 | First Quarter Moon |
| 9 | 1300 | Moon 1.5° south of M35 |
| 10 | 1921 | Full Moon. Penumbral eclipse visible in Australia, Asia, Africa, Europe, eastern South America, northern North America, the Atlantic Ocean, the Indian Ocean and the Pacific Ocean. |
| 12 | 0000 | Moon 1.0° north of M44 |
| 13 | 2000 | Moon at perigee, 365,958 km. |
| 17 | 1258 | Last Quarter Moon |
| 20 | 1900 | Mars 2° south of the Moon |
| 23 | 0300 | Jupiter 0.4° north of the Moon, occultation visible from Madagascar to southwest Polynesia. |
| 24 | 2142 | New Moon, lunation 1201 |
| 29 | 2100 | Moon at apogee (405,393 km) |

Lunar Librations January 2020

Libration in longitude: East limb most exposed on the 21st, +5.4°, west limb most exposed on the 8th -5.7°.

Libration in latitude: North limb most exposed on the 3rd, +6.9° and the 30th, +6.8°, south limb most exposed on the 16th, -6.8°.

The Lunar Observer welcomes all lunar related images, drawings, articles, reviews of equipment and reviews of books. You do not have to be a member of ALPO to submit material, though membership is highly encouraged. Please see below for membership and near the end of *The Lunar Observer* for submission guidelines.

Comments and suggestions? Please send to David Teske, contact information page 1. Need a hard copy, please contact David Teske.

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.

LUNAR TOPOGRAPHICAL STUDIES

Acting Coordinator – David Teske - david.teske@alpo-astronomy.org

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

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

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

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

OBSERVATIONS RECEIVED

Alberto Anunziato, Oro Verde, Argentina. Images and write up of Plato in *Focus-On Plato and Theophilus*.

Sergio Babino, Montevideo, Uruguay. Images of Aristillus, Aristoteles, Ptolemaeus and Deslandres.

Aylen Borgatello, AEA - Oro Verde, Entre Rios, Argentina. Images of Gassendi and Proclus.

Francisco Alsina Cardinali, Oro Verde, Argentina. Images and write up of Plato in *Focus-On Plato and Theophilus*.

Walter Ricardo Elias, AEA - Oro Verde, Entre Rios, Argentina. Images of Cleomedes, Langrenus and Theophilus.

Howard Eskildsen, Ocala, Florida, USA. Articles and images of *Lacus Mortis*, *Vitruvius* and *Cauchy Domes*, *Kies Domes* and *Marth*, *Gambart Domes*, *Capuanus Domes* 2019.12.06, *Lansberg D Domes*, images of Promontorium Laplace Domes, Hortensius and Milichius Domes, (2) and Luther 1 Dome.

Victoria Gomez, AEA - Oro Verde, Entre Rios, Argentina. Image of Aristarchus.

Facundo Gramer, AEA - Oro Verde, Entre Rios, Argentina. Images of Alphonsus, Aristoteles and Jansen.

Richard Hill, Tucson Arizona, USA. Articles and images of *A Gemma of a Region (Gemma Frisius)*, *Down Under (Licetus to Boussingault)*, *Meet the Catena (Catena Abulfeda)* and *Lost in the Glory (Hipparchus region)*.

Jerry Hubbell, Wilderness, Virginia, USA. Article and images *Focus-On Plato and Theophilus*.

David Teske, Louisville, Mississippi, USA. Article and image of *Oh No! Mr. Bill and Billy*.

Alan Trumper, AEA - Oro Verde, Entre Rios, Argentina. Image of Byrgius,

Many thanks for all these observations, images, and drawings.

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 :

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 “-”. Spaces within a feature name should be replaced by “-”.)

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

Sinus-Iridum_2018-04-25-0916.jpg

(Feature Sinus Iridum, Year 2018, Month April, Day 25, UT Time 09 hr16 min)

Additional information requested for lunar images (next page) should, if possible, 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 changes prior to uploading the image(s). However, use of the recommended format, reduces the effort to post the images significantly. 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:

David Teske – david.teske@alpo-astronomy.org

Jerry Hubbell – jerry.hubbell@alpo-astronomy.org

Wayne Bailey—wayne.bailey@alpo-astronomy.org

Hard copy submissions should be mailed to David Teske at the address on page one.

CALL FOR OBSERVATIONS: FOCUS ON: Tycho and Herodotus

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 2020** edition will be the Tycho and Herodotus regions. 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

David Teske – david.teske@alpo-astronomy.org

Deadline for inclusion in the Tycho and Herodotus region article is February. 20, 2020

FUTURE FOCUS ON ARTICLES:

In order to provide more lead time for contributors the following future targets have been selected: The next series of three will concentrate on subjects of the Selected Areas Program.

| <u>Subject</u> | <u>TLO Issue</u> | <u>Deadline</u> |
|-------------------|------------------|-------------------|
| Tycho & Herodotus | March 2020 | February 20, 2020 |

Focus On: Plato & Theophilus

Jerry Hubbell

Assistant Coordinator, Lunar Topographical Studies

This is the third article of four in our series on the craters in the Lunar Topographical Studies [Selected Areas Program](#) (SAP). This is a visual observing program that most beginners can easily start out using a small refractor or Newtonian reflector. This observing program is designed to focus attention on areas of the moon that have shown unusual albedo changes during the lunation period. The SAP is a great way to get familiar with some of the main features of the Moon and enjoy visually roaming over the landscape to see every tiny detail. You will find all the information needed to start this observing program in the [SAP Handbook](#).

As in the previous articles, we will continue to use the [Lunar Terminator Visualization Tool \(LTVT\)](#) to do various measurements of these craters. The goal is to start using this tool to help monitor and detect the “regular and cyclical long-term variations” that may occur in these areas. To learn more about LTVT please visit the [LTVT Wiki](#). The LTVT allows you to not only measure the size of features, but also systematically measure the size of the various peaks and hills on the moon through shadow measurements. Some of the changes in these areas involve the shifting shadows and by measuring specific locations over the long-term, the apparent shift in the measured heights over time will give us information about the precision of our measurements and detect other shadow anomalies that may occur. Using the [SAP crater drawing templates](#) and the Lunar Aeronautical Charts for each crater, I will be identifying specific shadows to measure. I welcome any suggestions you may have in this regard.

This month I will cover the craters Plato – 63 miles (101 km) & Theophilus – 63 miles (101 km). By mere coincidence, these two craters are about the same size. Figures 1 and 3 show the crater drawing outlines used in the SAP for Plato & Theophilus, and Figures 2 and 4 show the Lunar Aeronautical Chart view of these craters. Note that the SAP drawings are depicted rotated 180° (north up, east right) as compared to the [crater drawing outline chart](#) (SAP form) available on the website to more easily compare to the LAC charts.

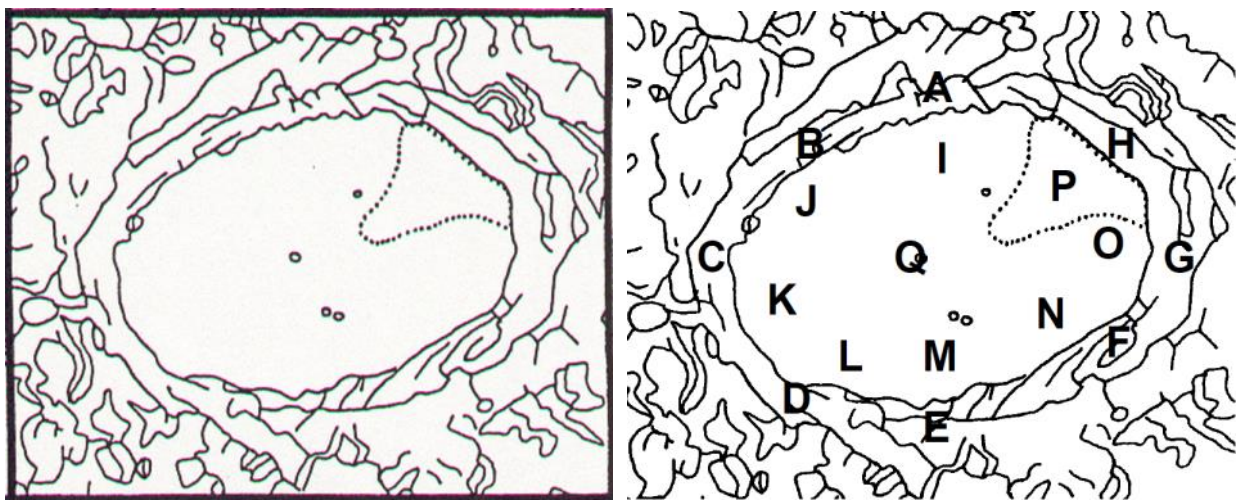


Figure 1. Outline drawing of Plato (left) and Albedo Points for Plato (right) (north-down, east-left)

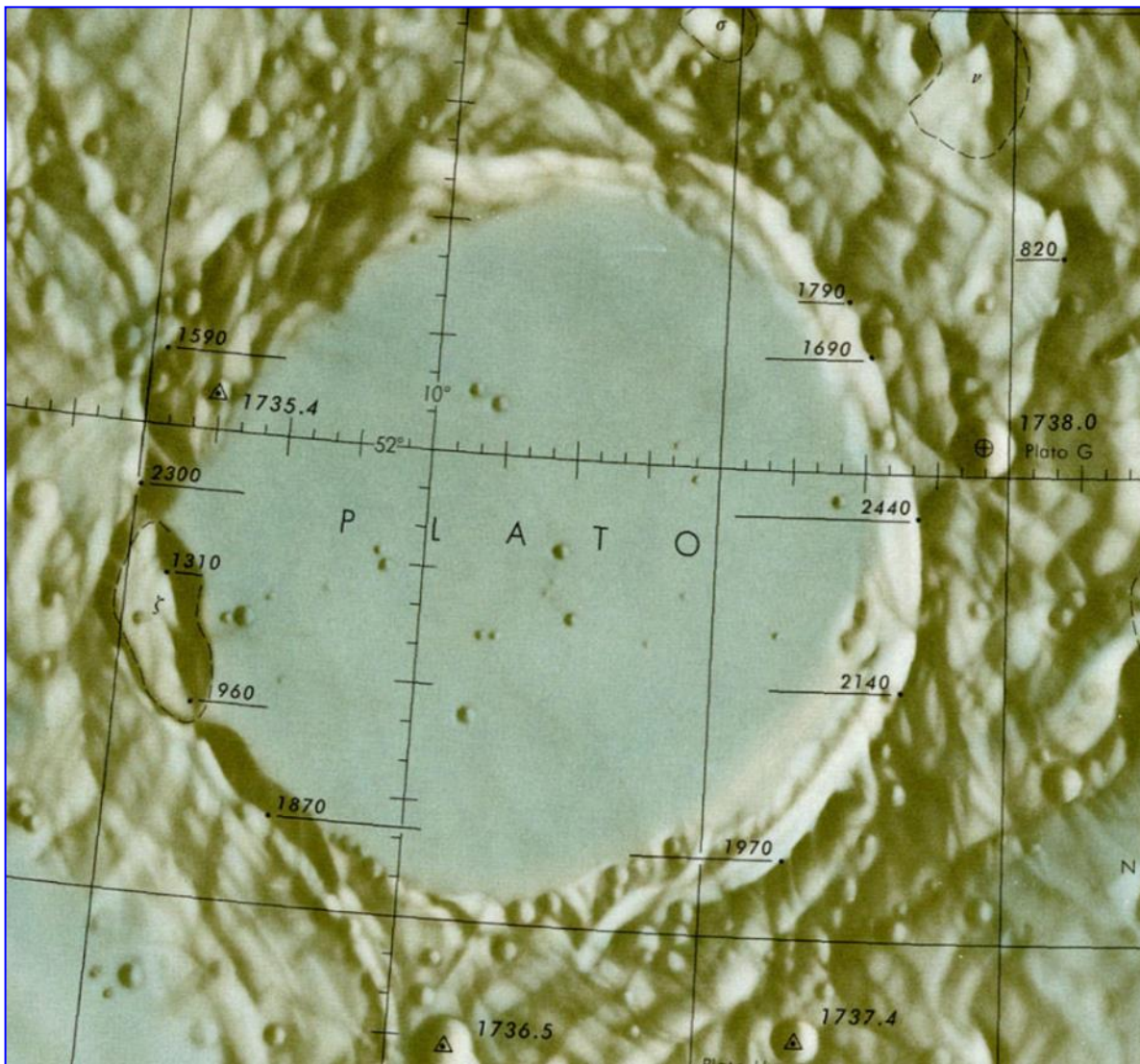


Figure 2. LAC12 chart of Plato. (north-up, east-right)

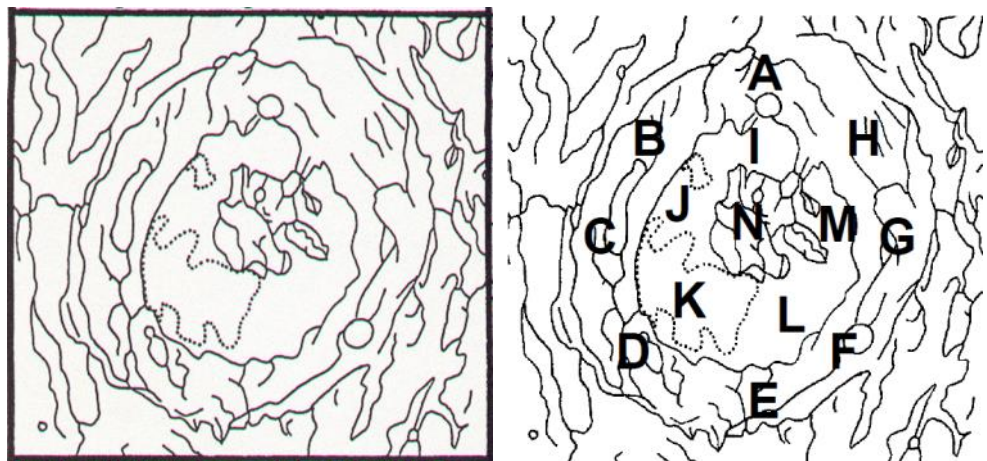


Figure 3. Outline drawing of Theophilus (left) and Albedo points for Theophilus (north-down, east-left).

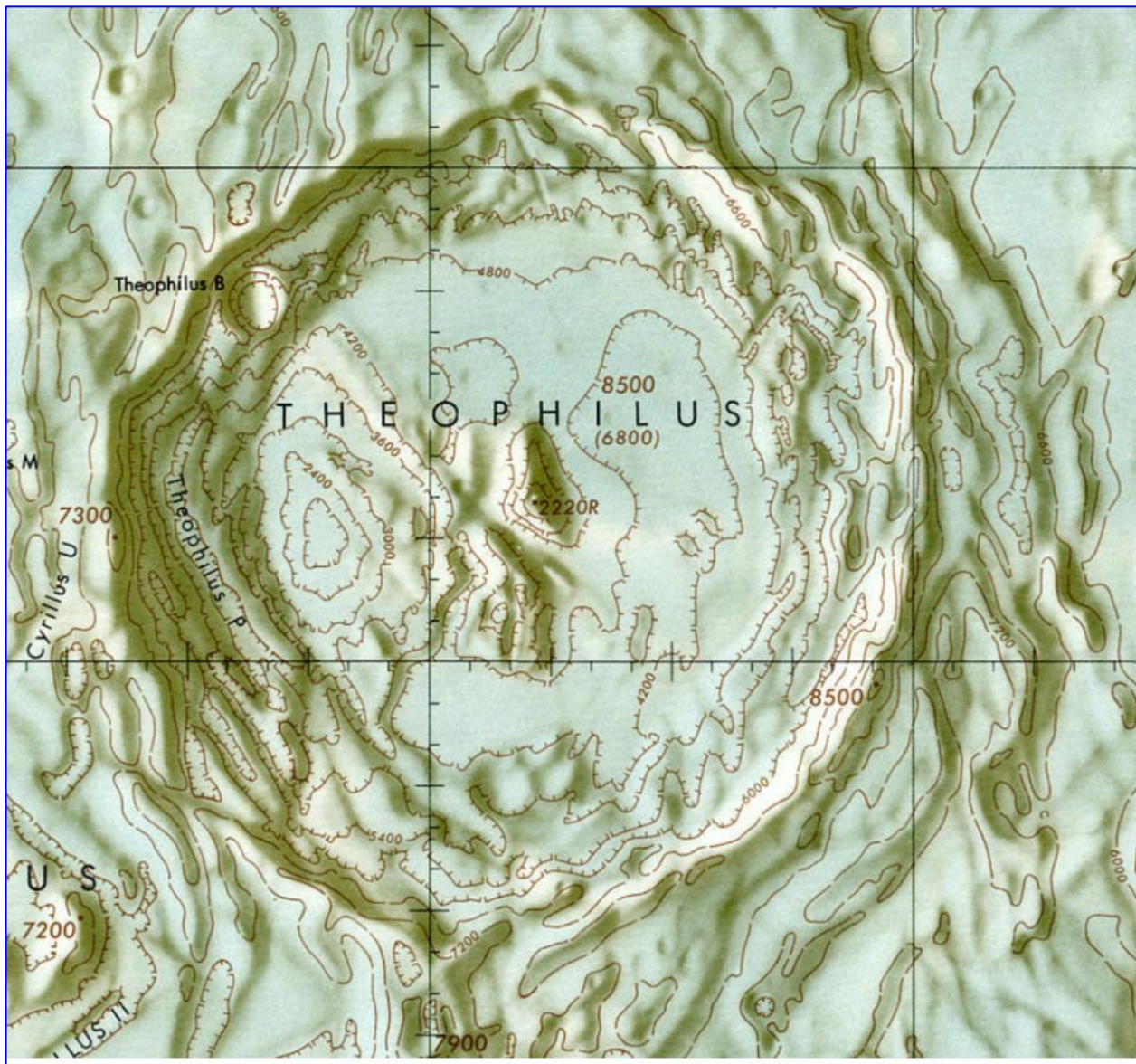


Figure 4. LAC78 chart excerpt of crater Theophilus.

PLATO

Plato 63 miles (101 km), was named after ancient Greek philosopher Plato, an Athenian philosopher during the Classical period in Ancient Greece and founder of the Platonist school of thought. He also founded the Academy, the first institution of higher learning in the Western world. The crater is located on the northeastern shore of Mare Imbrium, at the western edge of Montes Alpes. To the south are several hills collectively named Montes Tenerife. To the north lies the wide stretch of the Mare Frigoris. East of the crater, among the Montes Alpes, are several rilles collectively named the Rimae Plato.

Plato is about 3.8 billion years and is younger than the Mare Imbrium to the south. The irregular rim with 2-km-tall jagged peaks project prominent shadows across the crater floor when the Sun is at a low angle (Figure 6.) Sections of the inner wall display signs of past slumping, most notably a large triangular slide along the western side. Plato, being far north shows a fair amount of foreshortening and looks like an oval flat plate. Figure 5 shows an aerial view of Plato from David Teske's image from May 14, 2019 showing it is really a circle.

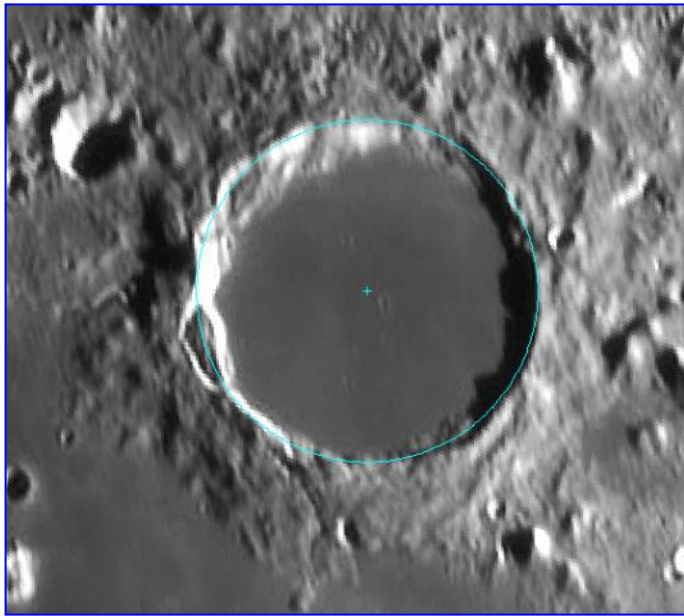


Figure 5, Crater Plato, David Teske, Louisville, Mississippi, USA. 14 May 2019 0321 UT, Colongitude 27.2°. 180 mm Takahashi Mewlon telescope, ZWO ASI 120 mms camera, 500 frames, Firecapture, Registax, Photoshop. Seeing 7/10. North/Up, East/Right. Note: Processed in LTVT and cropped by Jerry Hubbell.

The floor of Plato has a relatively low albedo, making it appear darker than the surrounding terrain. The floor is free of medium size impact craters and lacks a central peak due to the crater being filled with lava during its formation. There are a few small craterlets scattered across the floor which provide are challenging to observe and image. There are reports of transient lunar phenomena (TLP) occurring in Plato, including flashes of light, unusual color patterns, and areas of haze. These anomalies are likely a result of seeing conditions, combined with the effects of different illumination angles of the Sun.

Alberto Anunziato sent in a very nice image of Plato obtained by Francisco Alsina Cardinalli. This image (Figure 6.) shows good detail and provides some good shadows on the eastern rim that can be used to measure the height of the rim above the very flat floor of the crater. Alberto and Francisco provide the following description:

“Probably Plato is the most peculiar crater on the Moon. We are amazed by its almost completely flat and dark floor. Sunk two kilometers beneath the level of the Alps where it is located, interrupted only by a few small craters (very difficult to discern), a dark and huge mass of basaltic lava fills an oval of more than 100 kilometers in diameter. A romantic landscape that is dramatically accentuated when the shadows of the eastern rim cast sharp shadows that look like claws that extend to the western rim, revealing irregularities in the western rim that cannot be observed directly. Another unknown is how so much lava came into Plato's interior if no openings are observed at the rim, lava that flooded a hypothetical central peak that would have to rise 1.5 kilometers above the surface according to the models that explain the impact craters. Among these fascinating features of Plato, we choose the two bright sides triangles that we can observe on the western rim. They are two huge blocks disconnected from the steep rim and that have had to slide down in gigantic landslides of which we don't know their causes... the terminator moves away from Plato and only parts of its west rim are illuminated: the most prominent triangle, a thin line to the south and to the north a very bright spot and some high areas. Image 2 (Figure 6) was obtained with the same instruments just over an hour later and the edges of the famous Plato triangle are clearly determined and inside it we can see a shaded area to the west and a lighter one to the east. The second triangle to the north appears sharper than in image 1...”



Figure 6, Crater Plato (image 2), Francisco Alsina Cardinalli, Oro Verde, Argentina. 20 December 2015 0206 UT, Colongitude 20.4°. 10-inch Meade LX200 SCT, Canon EOS Digital Rebel XS camera, 500 frames, Firecapture, Registax, Photoshop, Seeing 7/10, north/up, east/right.



Figure 7. Craters Plato (top) and Archimedes (bottom), David Teske, Louisville, Mississippi, USA. 17 December 19, 2019 1156 UT, Colongitude 183.5°. 180 mm Takahashi Mewlon telescope, ZWO ASI 120 mms camera, 500 frames, Firecapture, Registax, Photoshop. Seeing 9/10.

The portion of Plato's western rim that slipped down in a triangular shape is very noticeable in Figure 7. This region of the crater rim is a good candidate to determine how much that section of the rim slipped down as compared to the section north of the slippage. Figure 8 shows the LTVT analysis of the crater rim in this area and from the various measurements we can estimate how much the section slipped. Table 1 shows the measurements.

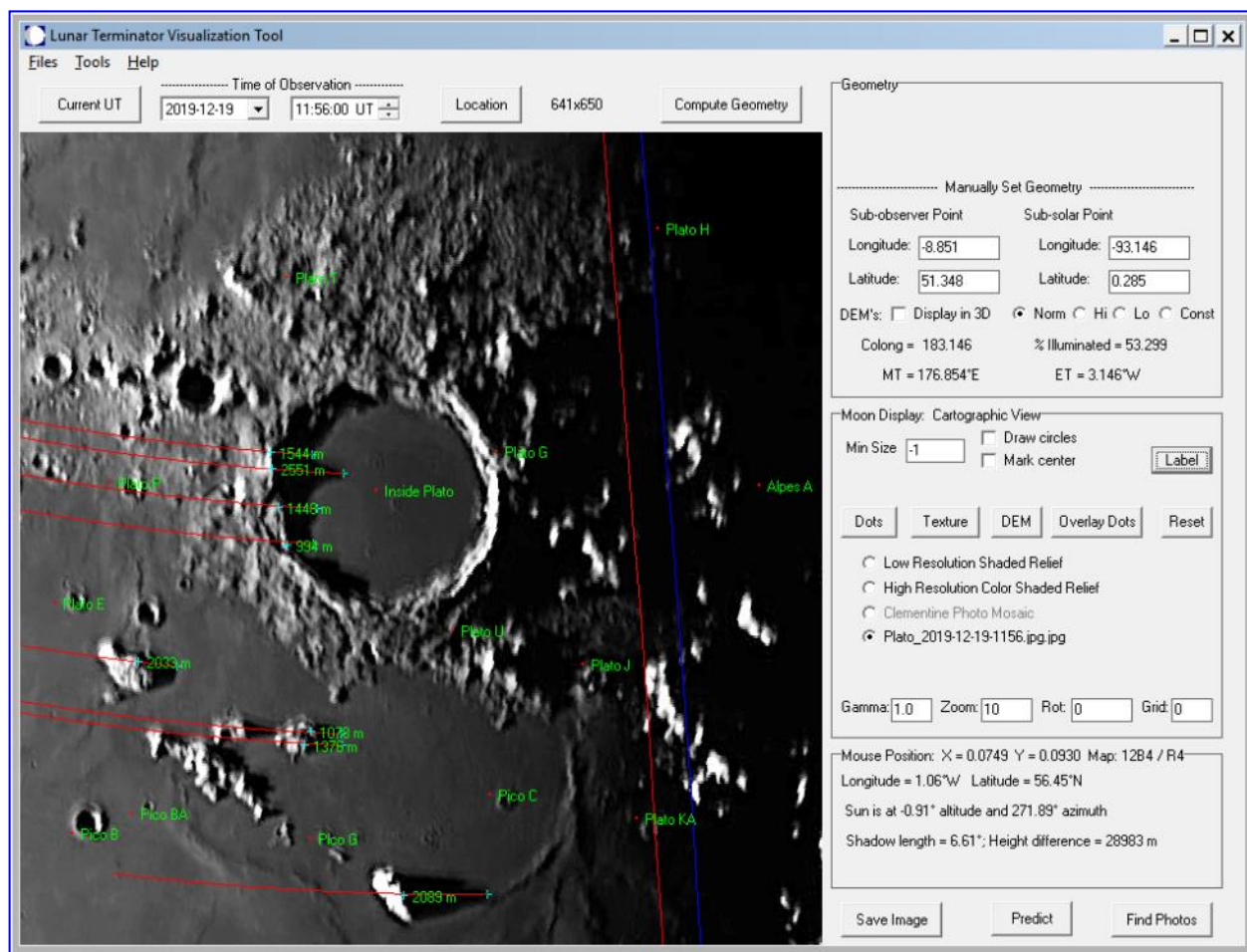


Figure 8. LTVT Measurement of Crater Plato, David Teske, Louisville, Mississippi, USA. 17 December 19, 2019 1156 UT, Colongitude 183.5°. 180 mm Takahashi Mewlon telescope, ZWO ASI 120 mms camera, 500 frames, Firecapture, Registax, Photoshop. Seeing 9/10. Processed in LTVT by Jerry Hubbell

| Parameter* | Measured Value | LAC12 Value |
|--|-------------------|-------------------|
| Crater Rim Shadow Point 1 | 1544 m (5,066 ft) | |
| Crater Rim Shadow Point 2 | 2551 m (8,369 ft) | |
| Crater Rim Shadow Point 3 (Slipped Region) | 1448 m (4,751 ft) | 1310 m (4,298 ft) |
| Crater Rim Shadow Point 3 (Slipped Region) | 994 m (3,261 ft) | 960 m (3,150 ft) |
| Isolated Peak Shadow Point 1 (west Mons Teneriffe) | 1078 m (3,537 ft) | |

*As shown from North to South on Figure 8. These measurements are at a Colongitude of 183.5°.

Table 1. Plato LTVT Measurements.

The amount of slippage based on the difference between shadow point 2 and adjacent shadow point 3 is »1100 m or »3,600 ft.

THEOPHILUS

The crater Theophilus 63 miles (101 km), was named after Pope Theophilus of Alexandria (d. 412 A.D.) according to Wikipedia but is listed as “Greek astronomer (unkn-A.D. 412)” in the IAU Gazetteer of Planetary Names Origins field and does not mention that it is Pope Theophilus. The date A.D. 412 though in the Origins field seems to confirm it as Pope Theophilus. The crater Theophilus on the lunar surface is near two other large craters nearly identical in size, Cyrillus 59 miles (98 km), and Catharina 61 miles (101 km), which form a trio of craters which are all worth extended study.

The crater has a terraced inner surface and is »4300 m deep from the southwestern portion of its rim to the floor and encroaches into the crater Cyrillus. It was formed during the Eratosthene period (1.1 to 3.2 Gy). The central mountain peak is a very interesting formation of four summits the tallest of which rises »2200 m above the floor.

Theophilus is a good candidate for analysis with LTVT due to its numerous peaks and rim features that are easy to see and measure on photographs taken at low sun angles.

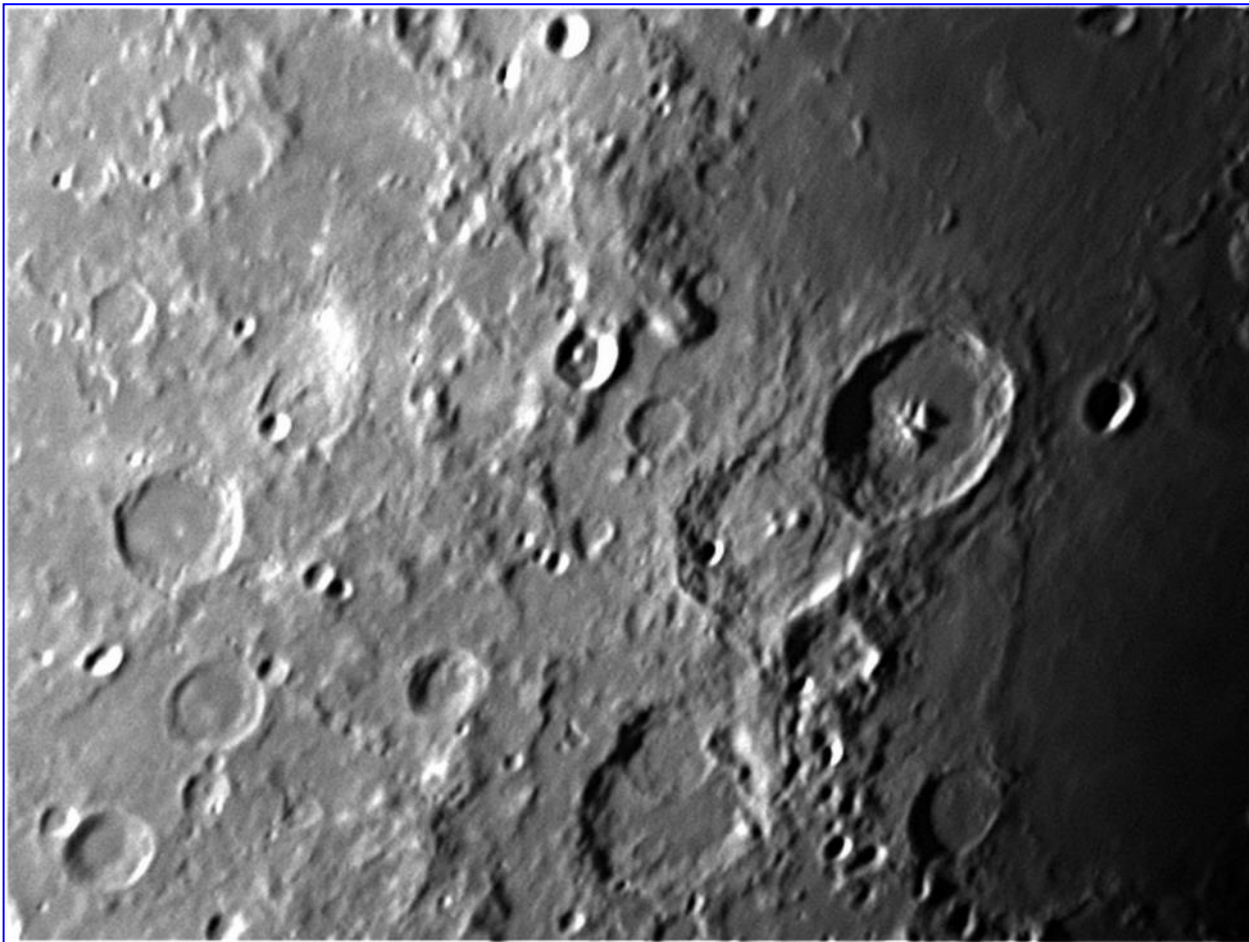


Figure 9, Craters Theophilus, Cyrillus, and Catharina, Jerry Hubbell, MSRO Wilderness, VA. USA. 10 September 2017 0248 UT, Colongitude 28.2°. 0.15-m APO Refractor, 4x Powermate tele-extender, Red Filter, FLIR Systems Flea3 GigE CCD Camera, east/up, north/left, Seeing 7/10, Transparency 5/6.

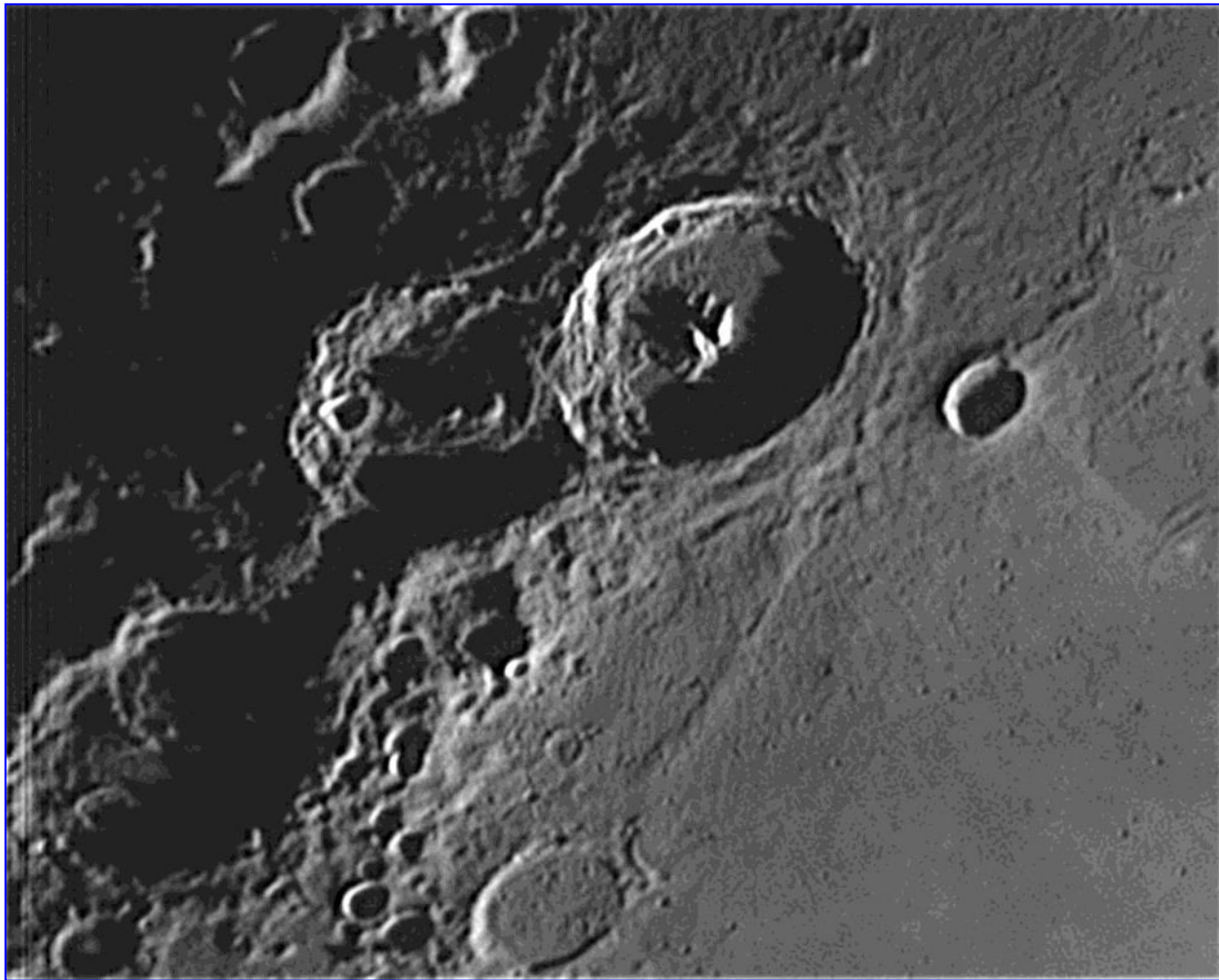


Figure 10, Craters Theophilus, Cyrillus, and Catharina, Jerry Hubbell, MSRO Wilderness, VA. USA. January 11, 2019 2244 UT, Colongitude 339.3°. 12-inch Meade LX200 SCT, 2x Barlow, Red Filter, FLIR Systems Flea3 GigE CCD Camera, north/up, east/right, Seeing 8/10, Transparency 5/6.

Figure 10 is an excellent candidate for analysis with LTVT providing many shadow peaks and crater rim profiles. (Figure 11.)

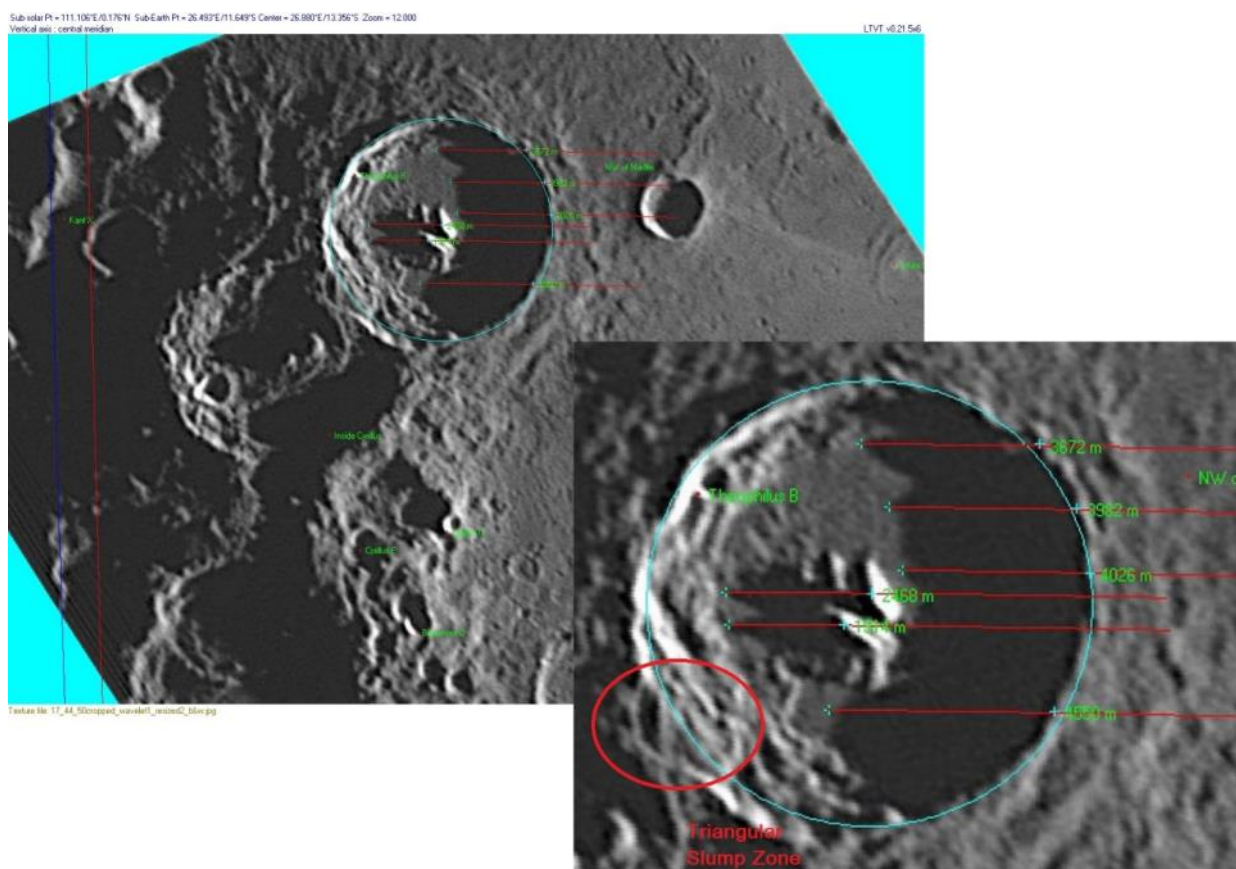


Figure 11, Crater Theophilus Peak Measurements, Jerry Hubbell, MSRO Wilderness, VA. USA. January 11, 2019 2244 UT, Colongitude 339.3°. 12-inch Meade LX200 SCT, 2x Barlow, Red Filter, FLIR Systems Flea3 GigE CCD Camera, north/up, east/right, Seeing 8/10, Transparency 5/6. Processed in LTVT by Jerry Hubbell.

| Parameter* | Measured Value | LAC Value |
|-----------------------------|--------------------|---------------------|
| Crater Rim Shadow Point 1 | 3672 m (12,047 ft) | |
| Crater Rim Shadow Point 2 | 3982 m (13,064 ft) | |
| Crater Rim Shadow Point 3 | 4026 m (13,209 ft) | ~4300 m (14,107 ft) |
| Central Peak Shadow point 1 | 2468 m (8,097 ft) | |
| Central Peak Shadow Point 2 | 1914 m (6,280 ft) | |

*As shown from North to South on Figure 11 inset. These measurements are at a Colongitude of 339.3°.

Table 2. Theophilus LTVT Measurements

The measured values for the crater rim at the two points that bracket the estimated rim height of »4300 m (14,107 ft) are 4026 m and 4550 m. The average of these is very close to this estimate and is 4288 m (14,068 ft). I estimate the precision to be about » ±130 m (» ±430 ft). I think this demonstrates the power of using LTVT in doing these measurements.

Note the triangular slip formation on the southwestern rim of Theophilus (Figure 10, red oval) that is very similar to the larger slip formation in Plato. I had not noticed this before and it apparently is something that happens on these larger craters. Finally, I measured the diameter of Theophilus and came up with a value of 60 miles (96 km) versus 63 miles (101 km). I would be interested in what your measurements would be.

When repeating the shadow measurements at different Colongitude values, it is important to make sure you are measuring from the same point on the rim of the crater. This will allow you to trend the measured value for that specific point on the rim over time. Several measurements made at the same Colongitude can be averaged and the scatter of the data can be used to estimate the precision of the measurement. You can use the program Virtual Moon Atlas (VMA) to calculate the time and date at your location for a given Colongitude value so that you can image at those times every month to gather your data. Over time, a record of the measurements will show you how your imaging technique has improved the resolution of your images.

In the next few months, I will be establishing the optimum Colongitude for each of the craters in the SAP and the selenographic longitudes and latitudes of the crater rim locations for shadow measurements. That way we all can make repeatable measurements every month and start to understand if we have any odd occurrences going on in these craters with this additional data.

COMPUTER PROGRAMS

Virtual Moon Atlas

<https://sourceforge.net/projects/virtualmoon/>

Lunar Terminator Visualization Tool (LTVT) http://www.alpoastronomy.org/lunarupload/LTVT/lvtv_20180429-HTML.zip

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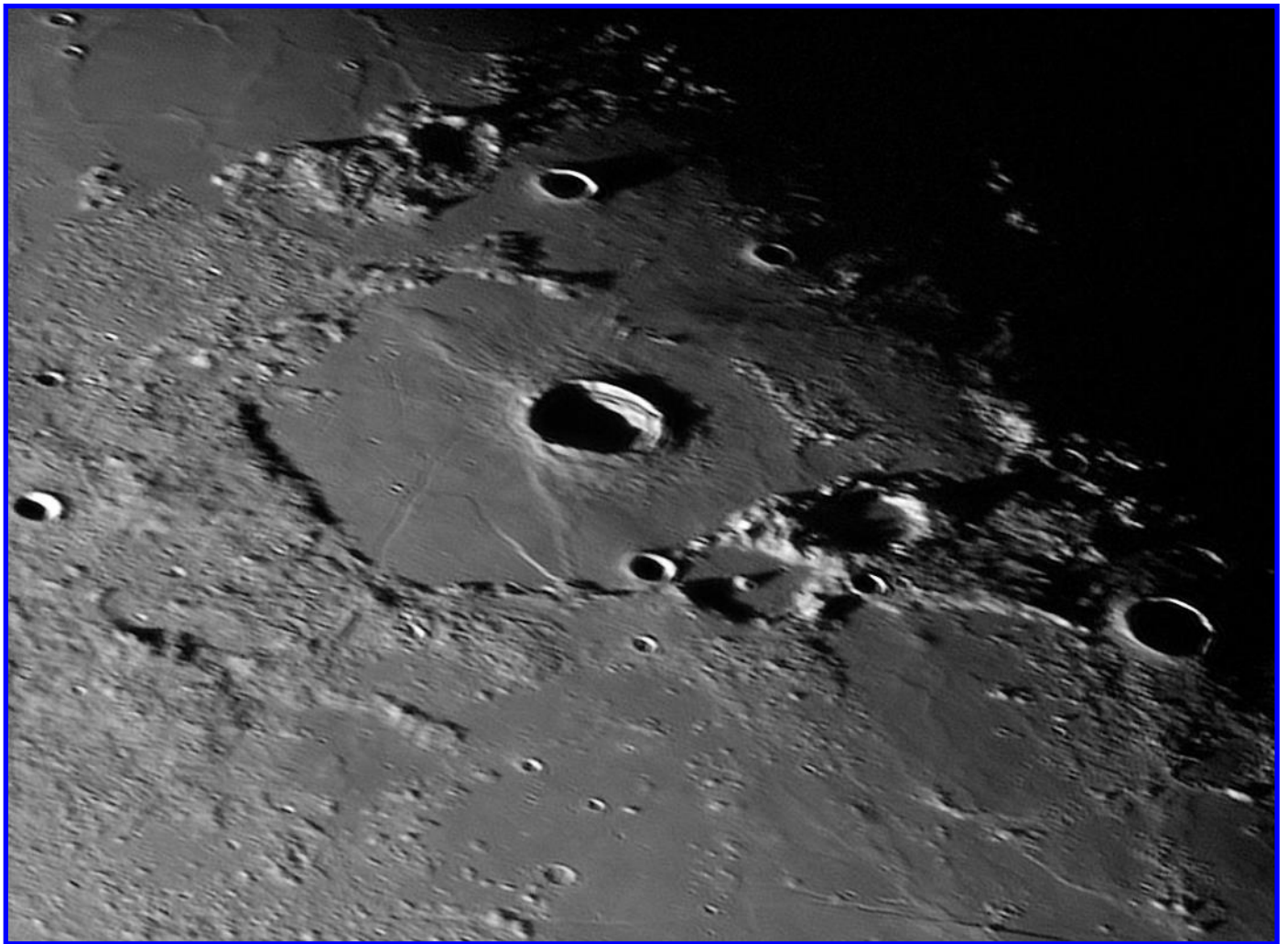
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Lacus Mortis

Howard Eskildsen

Crater Bürg casts its shadows just to the right of the center of the basalt-filled Lacus Mortis. Rimae Bürg crease the western half of the lacus while winkle ridges extend from the northern and southern lacus margins to the western wall of Bürg. The two tired, old craters, Plana and Mason, indent the lower right rim of the ancient crater bounding the lacus. Plana's central peak casts a shadow in the direction of Mason, which has a shadowy interior. At the bottom right and center of the image, the Rimae Daniell cross the field of view horizontally.



Lacus Mortis, Howard Eskildsen, Ocala, Florida, USA. 16 December 2019 1046 UT, colongitude 146.1°. 9.25 inch Schmidt-Cassegrain, f/10, fl 2395 mm, 2 x barlow, W-25 red filter, DMK 41AU02.AS camera. Seeing 6/10, transparency 5/6.

Oh No! Mr. Bill and Billy

David Teske

The southwest Moon near sunrise provides many treats for the lunar observer. Along with the stunning Gassendi in Mare Humorum is the flooded crater Letronne just to the north of Gassendi in Oceanus Procellarum. Looking similar to both Gassendi and Fracastorius in Mare Nectaris, Letronne, named after the French archeologist Jean Antoine Letronne who lived from 1787 to 1848, is a semicircular relief feature 116 km across. Like the aforementioned craters, Letronne is an example of subsidence with its northern, seaward limb completely covered by lava. On the floor of Letronne are three small mountain peaks, all that remains of the central mountain. Northwest of these peaks lies a craterlet surrounded by a bright halo. Letronne B with a diameter of 5 km also sports a bright halo near the inner eastern wall of Letronne. On the western wall of the flooded crater Letronne is an even more flooded crater, Winthrop, with a diameter of 17 km. This was named after John Winthrop, the American astronomer who lived from 1714 to 1779.

Perhaps most eye catching in this area is the crater duo of Hansteen and Billy. Billy is the really easy one to see, at 45 km diameter and a smooth, dark floor. Named after Jacques de Billy, the French Jesuit mathematician and astronomer who lived from 1602 to 1679, it has a small bright impact on its southwest floor that contrasts well with its dark floor. Northwest of Billy lies Hansteen, a 44 km wide crater with a rough floor, concentric ridges and cracks that signify this is a floor fractured crater. Just west of Hansteen lies Rima Hansteen with a length of 25 km and is up to 3 km wide. Hansteen was named after Christopher Hansteen, a Norwegian geophysicist who lived from 1784 to 1873. Both Hansteen and Billy are around the same age, formed in the Upper Imbrian 3.75 to 3.2 billion years ago. Both show features related to volcanic activity. Billy's lava deposits likely welled up from beneath its interior while the fractured appearance of Hansteen is due to the same structural occurrence that did not quite reach the surface. Hansteen may well have been another Billy but its impact was on slightly higher ground, leaving a 200 m difference in height between each of the floors. Besides the floor fractured surface of Hansteen there is also a lava deposit on its northeast floor and an odd cleft on its north end. Maybe this was a gap that allowed some lava flows from Oceanus Procellarum to enter Hansteen.

Lying between Hansteen and Billy to the east is Mons Hansteen, an isolated mountain that is triangular in shape, roughly 30 by 30 km. This mountain is a bright volcanic mass that contains more silica than in surrounding mare lavas. As such, its origin is unknown.

Named after John Flamsteed, the first Astronomer Royal who lived from 1646 to 1719, the name-sake crater is 20 km across. In Oceanus Procellarum to the northeast of Billy, Flamsteed is Eratosthenian in age, 3.15 to 1.1 billion years old. It lies in an area of high titanium basaltic lava flows that flooded the region, but did not spill into the crater's interior. Most notable, Flamsteed lies near the southern section of the much larger ghost crater Flamsteed P, a partially breached ring 110 km across. It is an old impact crater that was long ago submerged by lavas when Oceanus Procellarum was flooded. Back on 02 June 1966, Surveyor I landed near the inner northeast crater wall, ultimately sending back more than 11,000 images of the lunar surface. Nowhere do the walls of Flamsteed P rise more than 350 m above the Procellarum plains, and in some places, it rises only 50 m. It is easiest to see with full illumination. Also, inside Flamsteed P are the craters Flamsteed D (6 km) and K (4 km). Altogether, it looks like a big shocked face looking at us. I believe it was Rik Hill who said it reminded him of the Saturday Night Live character Mr. Bill. Ever since I read that some time ago, that is what I see. While you ponder whether or not Flamsteed P resembles a shocked face, it is worth considering the ages that are seen here. According to crater counts done by Schultz and Spudis, there are three areas of the southern Oceanus Procellarum that have mare patches of lava that are as young as the ray-covering lavas near Lichtenberg. These young patches are on the western floor of Letronne, inside the ring of Flamsteed P and just northeast of the Flamsteed ring. These lavas flowed about 1 billion years ago.

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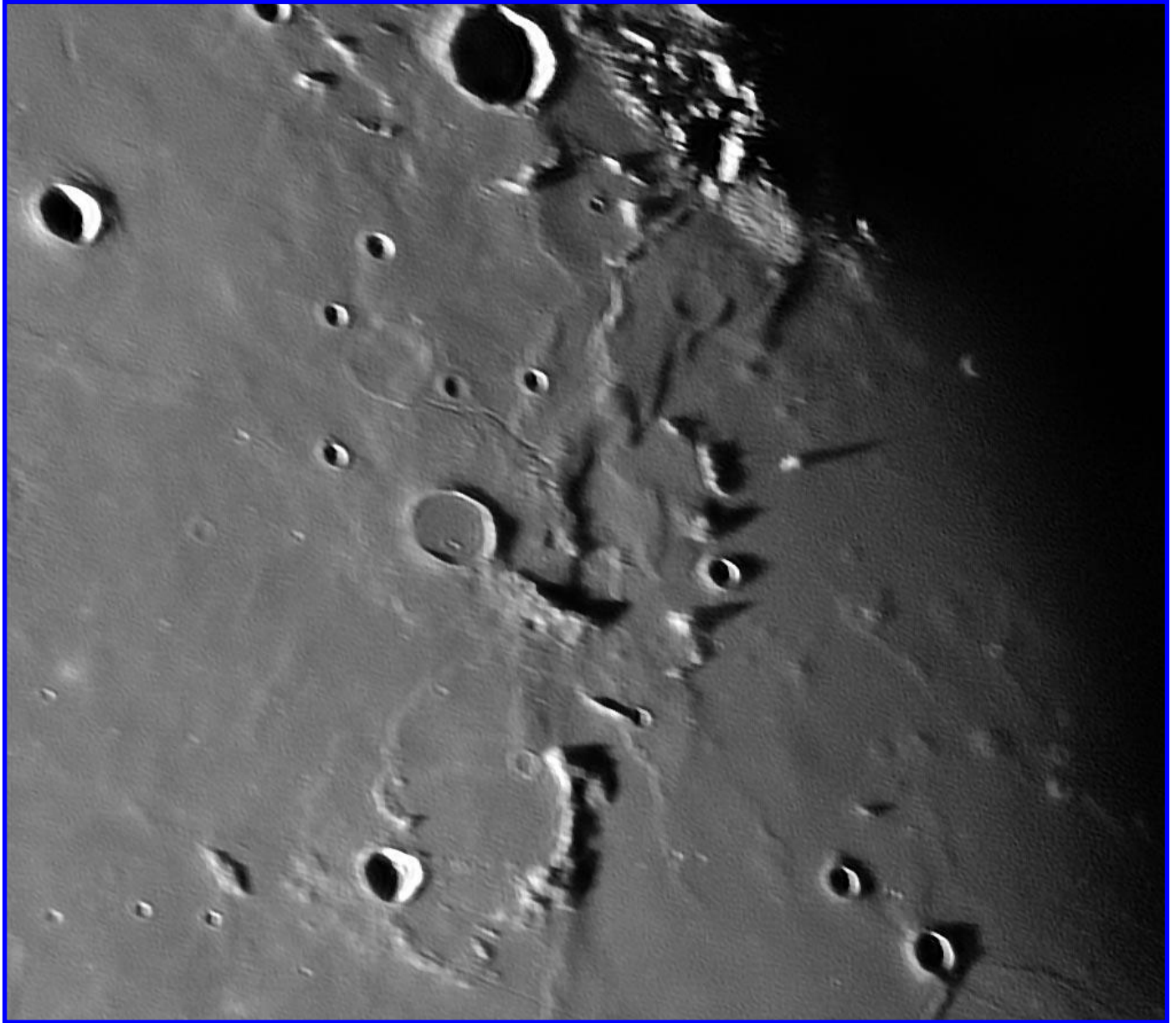
Hansteen and Billy, David Teske, Louisville, Mississippi, USA, 10 November 2019 at 0200 UT, co-longitude 61.1° . Seeing 7/10, 180 mm Takahashi Mewlon, ZWOASI120mms, 500 frames, Firecapture, Registax, Photoshop. Seeing 7/10.



Vitruvius and Cauchy Domes

Howard Eskildsen

Even with marginal seeing and soft focus, the image still seems to be a useful observation. To the left of center of the image, Jansen (not to be confused with Janssen on the southeastern Moon) is filled to the brim with basalt, like a little brother to well-known Wargentín. Just above it an over-filled crater. Jansen Y, sets like a balloon tied to a string tied to the rille, Rima Jansen. Wrinkle ridges cross the central image north to south and multiple domes associated with Vitruvius and Cauchy can be seen between the area between the ridges and the terminator.



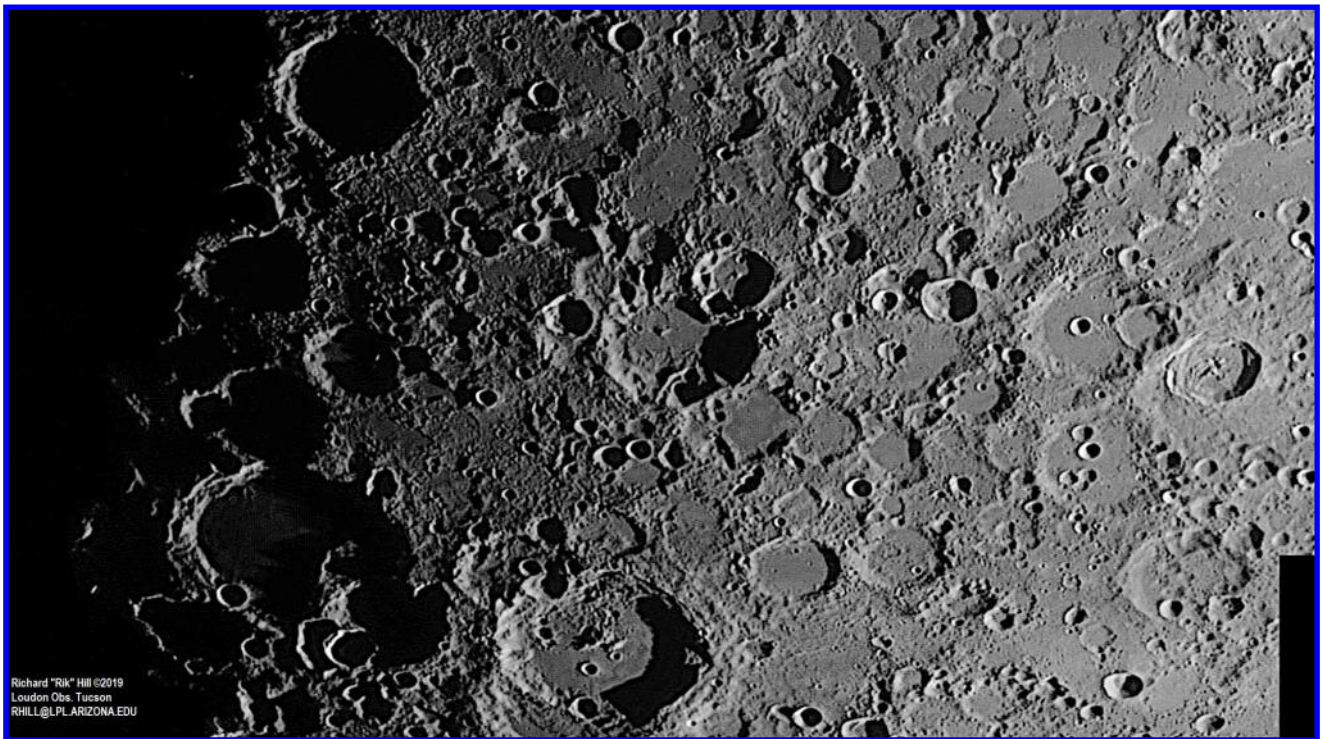
***Vitruvius and Cauchy Domes**, Howard Eskildsen, Ocala, Florida, USA. 16 December 2019 1041 UT, colongitude 146.1°. 9.25 inch Schmidt-Cassegrain, f/10, fl 2395 mm, 2 x barlow, W-25 red filter, DMK 41AU02.AS camera. Seeing 6/10, transparency 5/6.*

A Gemma of a Region

Rik Hill

So much to see here. The big crater in the lower left, with the fantastic shadows on its floor, is Stöfler (129 km). The other big one to the right of Stöfler is Maurolycus (117 km). Above Stöfler are three shadow filled craters that form a triangle. The lowest one is Fernelius (66 km) above and right of it is Kaiser (54 km) and straight north is Nonius (77 km). These are all capped off by the big black circle at top which is Aliacensis (82 km) making for a dramatic terminator.

In the center of the image, with a large amount of shadow on its floor, is the crater Gemma Frisius (90 km). It is an ancient crater, possibly over 4 billion years old, overlain on its north wall by the younger Goodacre (48 km). Notice the remarkable feature on the southern floor of Gemma. It appears to be a double walled crater that was further deformed by a later impact on its northern wall. North and a little to the right of Gemma is the curious low relief crater of Pontanus (60 km) with several less eroded satellite craters below it. There is much interesting detail here for the lunar prowler. Then east (right) and a little south from Gemma we see a low relief crater with several pairs of satellite craters on its floor. This is Rabbi Levi (83 km) and above it is Zagut (87 km) with one prominent satellite crater on its floor. East of both of these is the prominent but smaller crater Lindenau (54 km) with unusual flows on its floor. All these will all serve as landmarks in an area of endless features for exploration!



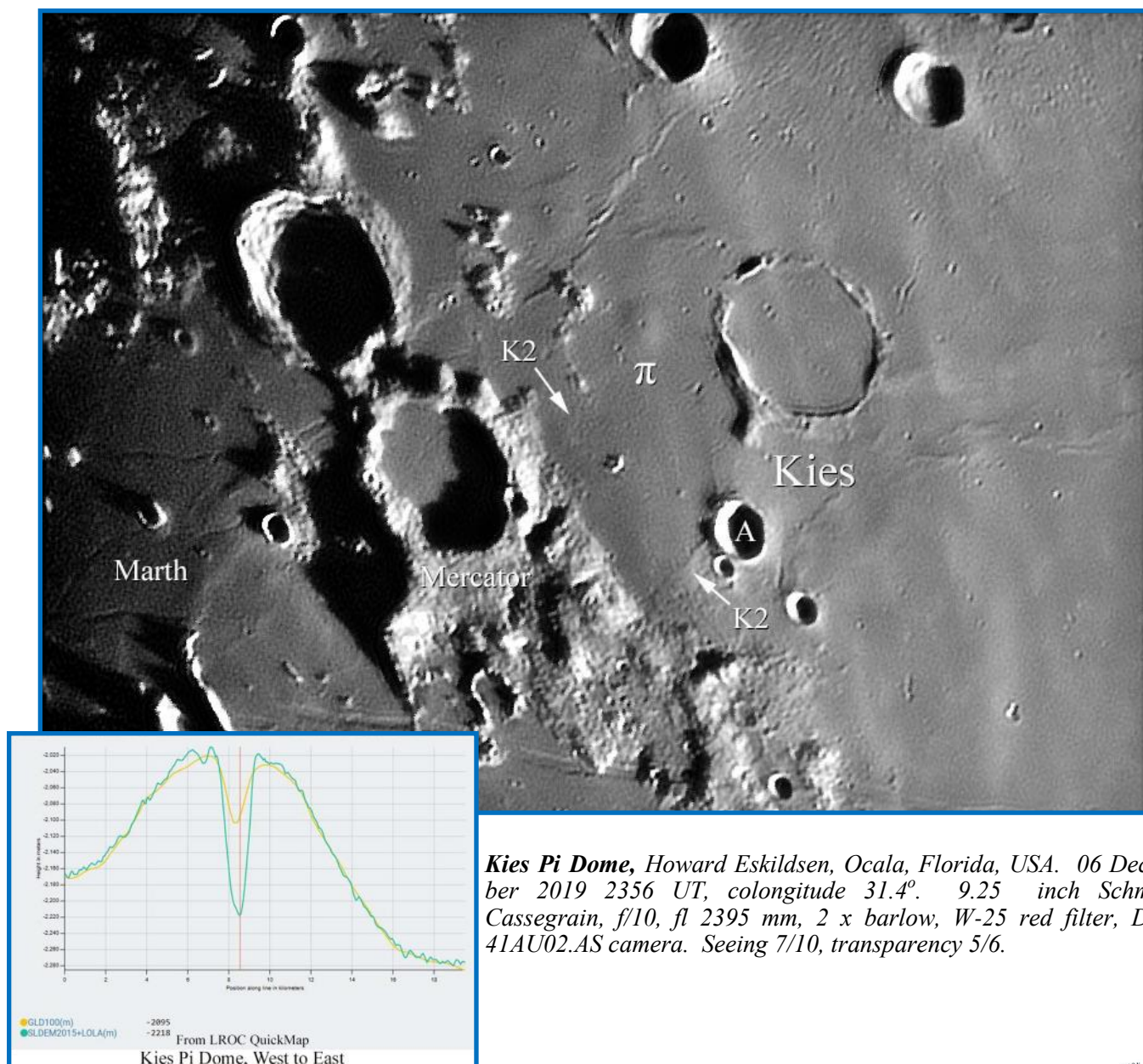
***Gemma Frisius**, Richard Hill, Tucson, Arizona, USA. 06 October 2019 0223 UT, colongitude 358.1°. TEC 8" f/20 Mak-Cas, Skyris 445M camera, 665 nm filter. Seeing 8/10.*

Kies Domes and Marth Howard Eskildsen

The dome, Kies π , is visible just to the right and slightly above center of this image. Per <http://kiesdomes.blogspot.com/>, Kies π is 13.6 km in diameter and 160 meters high with a slope of 1.3° and is considered an effusive dome. A crater pit is visible at its summit, and the west-to-east LROC Quickmap LOLA elevation chart shows that the crater pit is approximately as deep as the dome is high.

Just below Kies π lies a smooth, low-relief region which is the location of Keis2 dome, denoted by two arrows marked "K2". It is likely an intrusive dome and is 51 km by 34 km in size. It extends from Kies A almost to Mercator, and from just below Kies π to the hills directly to the south of π . There are hints of faults or rilles coursing roughly south to north on the dome, and one rille crossing the SE boundary of the dome. Per <http://kiesdomes.blogspot.com/>, it is 55 meters in height with a slope of only 0.15°.

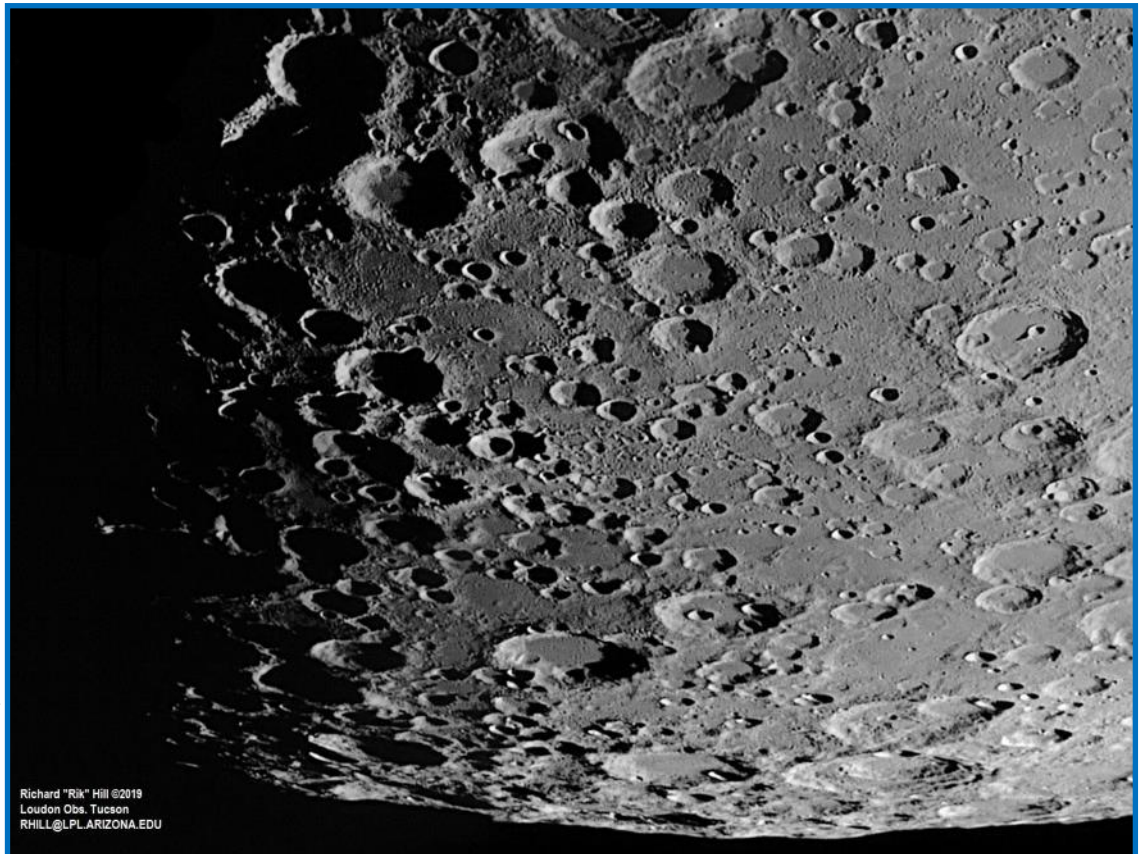
On the left lower part of the image, a small, horseshoe-appearing, crater is visible. This is the concentric crater Marth, which is located on the summit of a small dome. On the image some of the dome uplift is just visible on the lower and the right margins of Marth.



Down Under Rik Hill

It was not a particularly favorable view of the south end of the moon in terms of libration or distance but still it was dramatic down under. Starting with the shadow filled crater in the upper left we see Licetus (77 km) that looks to be wearing a necktie. This necktie is the western or left wall of the odd crater Heraclitus (94 km) catching the morning light before the lower eastern portions. Below and right (east) of Licetus is the same sized Cuvier (77 km) and further east is Clairaut (also 77 km) with the trio of smaller craters on the floor. Northeast of this is Barocius (85 km) with the "D" satellite crater taking a bite out of the eastern wall. Two craters to the south Breislak (51 km) and finally Baco (71 km) form an equilateral triangle with Barocius and Clairaut. Three smaller craters lead from Barocius to the upper right corner of this image. They are Ideler (41 km) overlapping another older crater of the same size, then further northeast is the almost polygonal Spallanzani (32 km) and another one of the same general morphology in the corner of the image, Nicolai (43 km).

*Licetus to Bous-
singault, Richard
Hill, Tucson, Arizo-
na, USA. 06 Octo-
ber 2019 0123 UT,
colongitude 355.5°.
TEC 8" f/20 Mak-
Cas, Skyris 445M
camera, 665 nm fil-
ter. Seeing 8/10.*



The big
crater due south of
Nicolai is Pitiscus
(85 km) with the
odd central crater
that appears to be
casting a shadow

in the wrong direction. This is because the shadow is being cast by the remnant of the former central peak that was impacted on the east side when Pitiscus A (10 km) was formed. South of this is a large, very old crater Hommel (129 km) overlain by half a dozen smaller crater. This one may be over 4 billion years old! That's approximately 16 rotations of our galaxy!! Down at the bottom near the limb is an eye-catching double crater. This is Boussingault (134 km) with the large inner satellite "A" crater (72 km) nearly perfectly concentric inside. West of this is the crater Buguslawsky (100 km) with the flat bottomed Manzinus (also 100 km) north of it with a floor littered with 2-4 km secondary craters. To the east (right) is the crater, Mutus (80 km), with three smaller craters (16-24 km) within its walls. There are a few other shadow filled craters along the terminator but details are lost in the shadows. Take a moment before moving on to enjoy the limb with the mountains near the south pole. I have always enjoyed seeing limb profiles like this.

Richard "Rik" Hill ©2019
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Gambart Domes

Howard Eskildsen

Domes near Gambart and Gambart C are visible on this image. Ga1 lies south of the 25 km, basalt-floored crater, Gambart, and per <http://gambartdomes.blogspot.com/> is 30 km in diameter, with a height of 140 meters and a slope of 0.57 degrees and is likely an intrusive dome. Ga2 and Ga3 are near the 12.2 km crater Gambart C. Ga2 is 19.5 km diameter, 190 meters high and a slope of 1.11 degrees. Ga3 is 9 km diameter, 50 meters high and has a slope of 0.63 degrees. Ga2 and Ga3 are classified as effusive domes, but have different morphologic and rheologic properties suggesting different eruptive conditions even though they lie in close proximity. For further discussion see website listed above.



Gambart Domes, Howard Eskildsen, Ocala, Florida, USA. 05 December 2019 2339 UT, colongitude 19.1°. 9.25 inch Schmidt-Cassegrain, f/10, fl 2395 mm, 2 x barlow, W-25 red filter, DMK 41AU02.AS camera. Seeing 7/10, transparency 5/6.

Lost in the Glory

Rik Hill

There are two craters near the center of the visible disk of the moon would, in many other places, be highlights on their own but because of the proximity of spectacular craters they are lost in their glory. In this case half of the great crater Ptolemaeus can be seen on the left edge of this image and below it is, of course, Alphonsus and Arzachel all stealing the show. This overshadowing is just the case for Albategnius (82 km diameter) and Hipparchus (155 km). The former can be seen below and left of center in this image and the latter above center with the crisp, relatively recent Horrocks (31 km) in the upper right, or northeast floor. Northeast of Horrocks is an even more recent crater, Pickering (15 km) and due east of Horrocks is the remnants of a very ancient and hexagonal crater, Saucer (46 km) possibly as old as 4.5 billion years!

Between the two main craters of this article is an interesting arc of four craters of decreasing diameter to the east. The first is Halley (37 km) directly south of the center of Hipparchus followed to the east by Hind (31 km) then Hipparchus-C (17 km) and finally Hipparchus-L (12 km). There is no significance to this configuration other than it makes a nice little eye-catching grouping.

On the west wall of Albategnius is the crater Klein (46 km) with a tiny central peak (most of it buried during the lava flooding event, and due east is the oddly shaped crater Ritchey (26 km), its form the result of several merged impacts. Below Albategnius is an interesting group of features. The first are two craters with what look to be a canyon cutting north-south through them. That canyon is actually a couple of small deformed craters on either end with your eye forming the rest of the canyon! This is easy to see in the LROC images. Below these is another nice crater, Argelander (36 km) with a tiny central peak. Note the two sharply

define tiny craters just above that central peak. These are very fresh, recent craters of 4 km and 2.5 km diameters. Before leaving, you should pay attention to the huge parallel scars all over this region. Just one of them was created by a city sized 'rock' that was ejected as a secondary event during the Imbrium basin impact, in just a few seconds. Now imagine a whole fleet of them raking across the landscape plowing up phenomenal amount of soil and rock all in a few seconds! It must have been a terrible wonder to behold!!



Hipparchus, Richard Hill, Tucson, Arizona, USA. 07 October 2019 0153 UT, colongitude 9°. TEC 8" f/20 Mak-Cas, Skyris 445M camera, 665 nm filter. Seeing 8/10.

Richard "Rik" Hill ©2019
Loudon Obs. Tucson
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Capuanus Domes 2019.12.06

Howard Eskildsen

The 60 km diameter crater Capuanus lies in the southern margin of Palus Epidemiarum and contains three domes on its interior. Per the Lunar Domes Atlas GLR Group (see <http://capuanusdomes.blogspot.com/>) Ca1 is 7 km in diameter and 100 meters high with a slope of 1.63°. Ca2 is 9 km in diameter and also 100 meters high with a slope of 1.27°. Ca3 is 5 km in diameter, 80 meters high and has a slope of 1.04°.

Since they are constrained within a small area of the Moon, it might seem that the domes should be of similar properties and composition, however, their varying slopes hint that there are differences in their composition and viscosities. Clementine data suggest differences as well; Ca2 and Ca3 have low [TiO₂-content](#) basalt, while Ca1 has basalt with higher TiO₂ content and lower aluminum content. (Source: *Lunar Domes Properties and Formation Processes*, by R. Lena, C. Wöhler, J. Phillips, and M. T. Chiocchetta.)

Other features on the imager include Rima Hesiodus, which angles across the left central image. Mercator (47 km) and Campanus (48 km), with its floor in shadows, are visible on the upper central image. On the upper right of the image the ring of Kies (44 km) lies nearly completely flooded by the lava flows of Mare Nubium, accompanied by the dome Kies π to the left of Kies. Another image of the Kies area will follow in the near future.

The crater diameter data source was *Atlas of the Moon* by Antonín Růkl

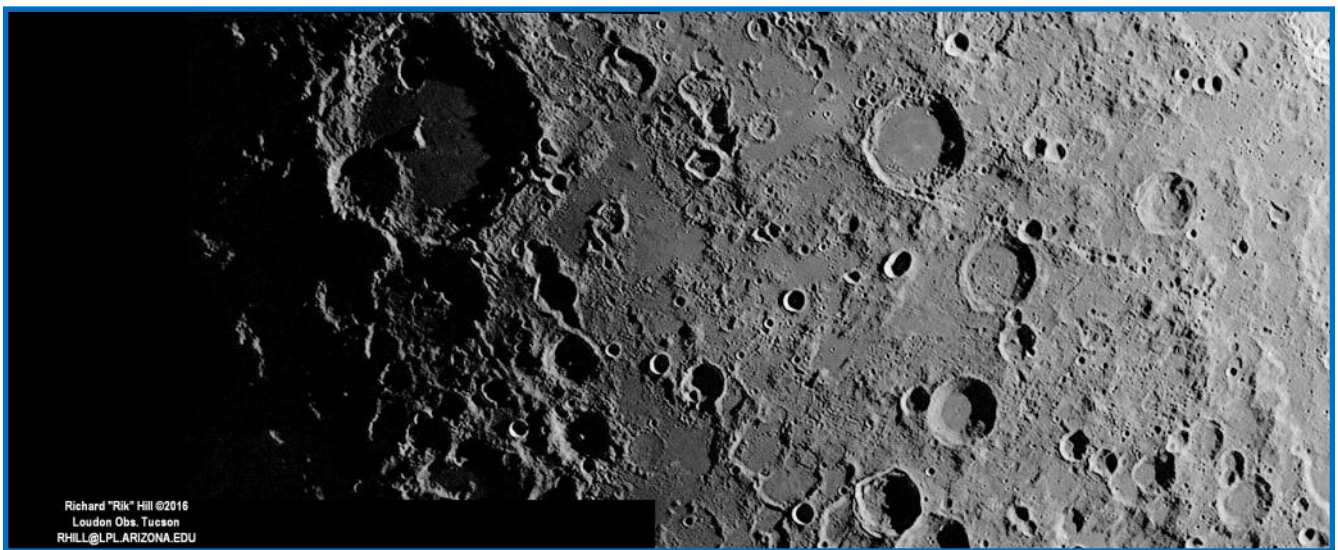
Capuanus Domes,
Howard Eskildsen,
Ocala, Florida, USA.
06 December 2019
2357 UT, colongitude
31.4°. 9.25 inch
Schmidt-Cassegrain,
f/10, fl 2395 mm, 2 x
barlow, W-25 red fil-
ter, DMK 41AU02.AS
camera. Seeing 7/10,
transparency 5/6.



Meet at the Catena Rik Hill

Because of the Ptolemaeus-Alphonsus-Arzachel trio on the west side and the Theophilus-Cyrillus-Catharina trio on the east side, this whole area gets overlooked by many observers. Besides being the just south of the Apollo 16 landing (one of the most difficult sites to locate) it contains a profusion of interesting craters and features. The large craggy crater on the left is Albategnius (139 km) with Klein (46 km) sitting on its southwest wall. Due south of this is the large ruined crater Parrot (121 km). Then east of this crater is a curious looking double crater with a valley cutting through the pair. The lower crater is Vogel (27 km) and the upper one is the satellite crater Vogel B and the valley is an illusion created by two smaller craters that were formed from separate impacts on the northern wall of the "B" crater and the southern wall of Vogel that just happened to be aligned with the centers of the other craters! Moving further south of these we see two craters Argelander (36 km) and Airy (37 km).

There are four large craters forming an eye catching north-south arc in the center of this image. The top one is Abulfeda (65 km), below it is Almanon (51 km), then Geber (46 km) and lastly the doublet Abenezra (43 km) and Azophi (49 km). If you are going to this area find these first and use them as your guide to the rest of the area. Due east of Almanon is the crater Tacitus (41 km). Notice the line of small craters between these last two running from the bottom of Abulfeda out past Tacitus. This is a catena a controversial Latin name for what we used to just call "crater chains". In this case this is officially Catena Abulfeda. There are several hypothesized origins of these. One is that they are just chance alignments of ejecta from a larger impact that laid down secondary craters in a row. There are a few candidate craters for the origin of such material here. Second would be the volcanic hypothesis that these would be a line of vents along a fault. Third is that a series of impacts from a fragmented asteroid or comet pieces, similar in nature to what we saw with SL9 on Jupiter, but with the moons much lower rotational velocity they are much closer together. In this case a look at the LROC QuickMap image of this crater chain makes the first hypothesis more likely. Go to QuickMap and take a look. What do you think?



Catena Abulfeda, Richard Hill, Tucson, Arizona, USA. 12 July 2016 0252 UT. TEC 8" f/20 Mak-Cas, Skyris 445M camera, 656.3 nm filter. Seeing 8/10.

Lansberg D Domes

Howard Eskildsen

Three notable domes are visible on this image near the crater Lansberg D, the small crater adjacent to the "L2" on the labeled image. Per <http://lansbergdomes.blogspot.com/>, Their properties are as follows:

L1--20x16 km diameter, 120m high, 0.68° slope

L2--25x19 km diameter, 80m high, 0.4° slope

L3--19x15 km diameter, 120m high, 0.77° slope

With such low slopes, these are likely intrusive domes.

Finally, a minor apology for the last image. The three domes together look like a bird to me with L1 as the head, L2 the body, and L3 the feet. Hope no one is too chirped off by my aberrant sense of humor

or



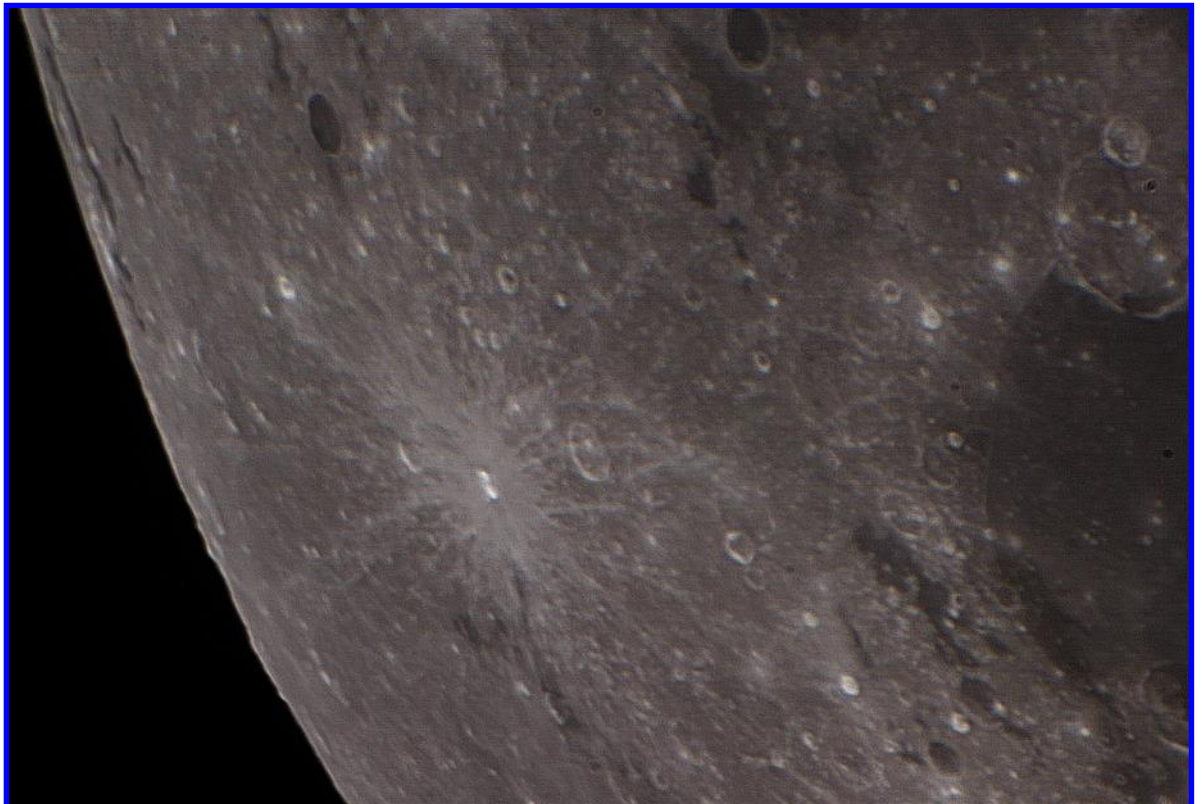
Lansberg D Domes, Howard Eskildsen, Ocala, Florida, USA. 06 December 2019 23564 UT, colongitude 31.4°. 9.25 inch Schmidt-Cassegrain, f/10, fl 2395 mm, 2 x barlow, W-25 red filter, DMK 41AU02.AS camera. Seeing 7/10, transparency 5/6.

Recent Topographic Studies



Promontorium Laplace Domes,
Howard Eskildsen,
Ocala, Florida,
USA. 06 December 2019 2348 UT,
colongitude 31.4° .
9.25 inch Schmidt-
Cassegrain, f/10, fl
2395 mm, 2 x bar-
low, W-25 red fil-
ter, DMK
41AU02.AS cam-
era. Seeing 7/10,
transparency 5/6.

Byrgius, Alan
Trumper, AEA -
Oro Verde, Entre
Rios, Argentina.
14 November
2019 0445 UT.
CPC 11 inch
Schmidt-
Cassegrain tele-
scope, f/10, fl
2800 mm, Can-
on Rebel T7i.



Recent Topographic Studies

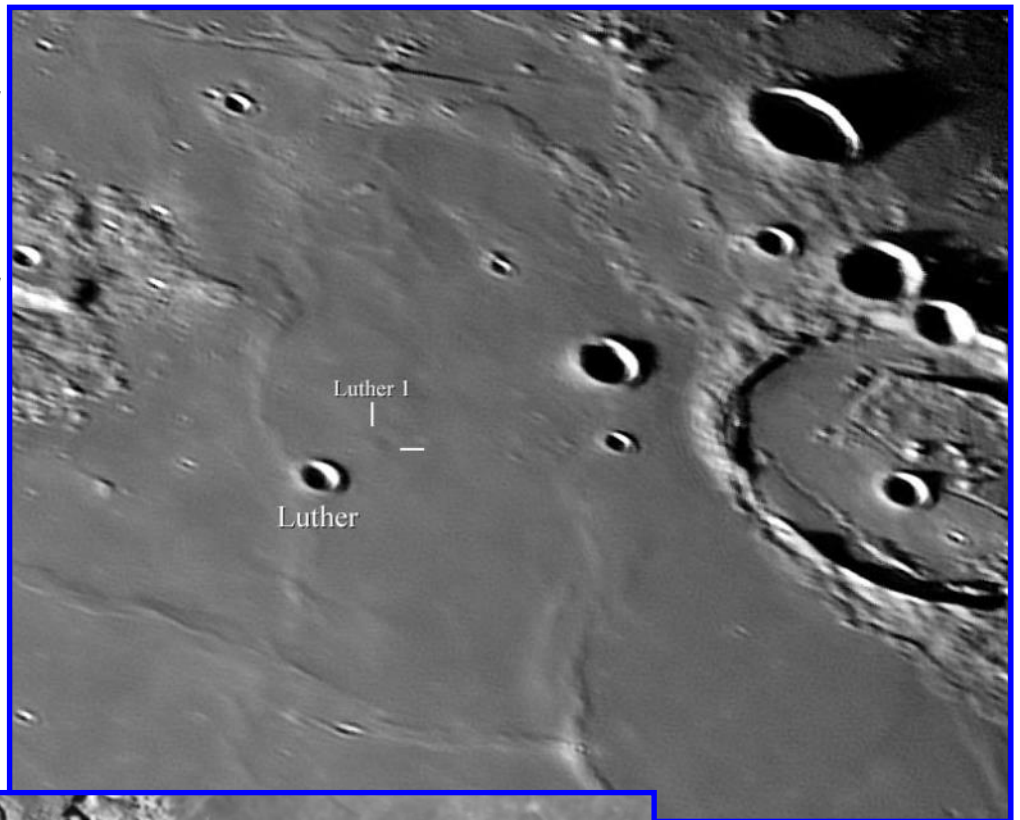
Hortensius and Milichius Domes, Howard Eskildsen, Ocala, Florida, USA. 06 December 2019 2352 UT, colongitude 31.4°. 9.25 inch Schmidt-Cassegrain, f/10, fl 2395 mm, 2 x barlow, W-25 red filter, DMK 41AU02.AS camera. Seeing 7/10, transparency 5/6.



Hortensius and Milichius Domes, Howard Eskildsen, Ocala, Florida, USA. 06 December 2019 2351 UT, colongitude 31.4°. 9.25 inch Schmidt-Cassegrain, f/10, fl 2395 mm, 2 x barlow, W-25 red filter, DMK 41AU02.AS camera. Seeing 7/10, transparency 5/6.

Recent Topographic Studies

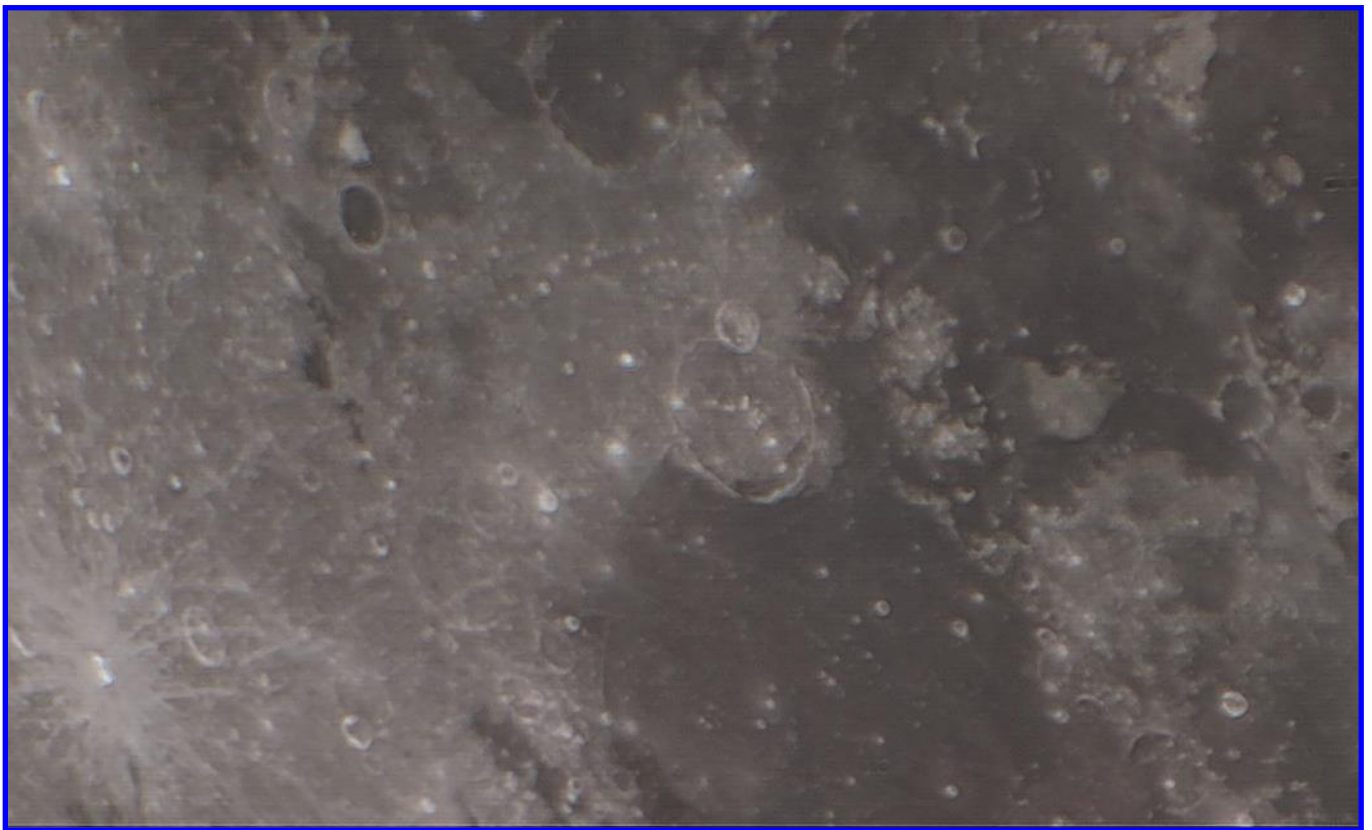
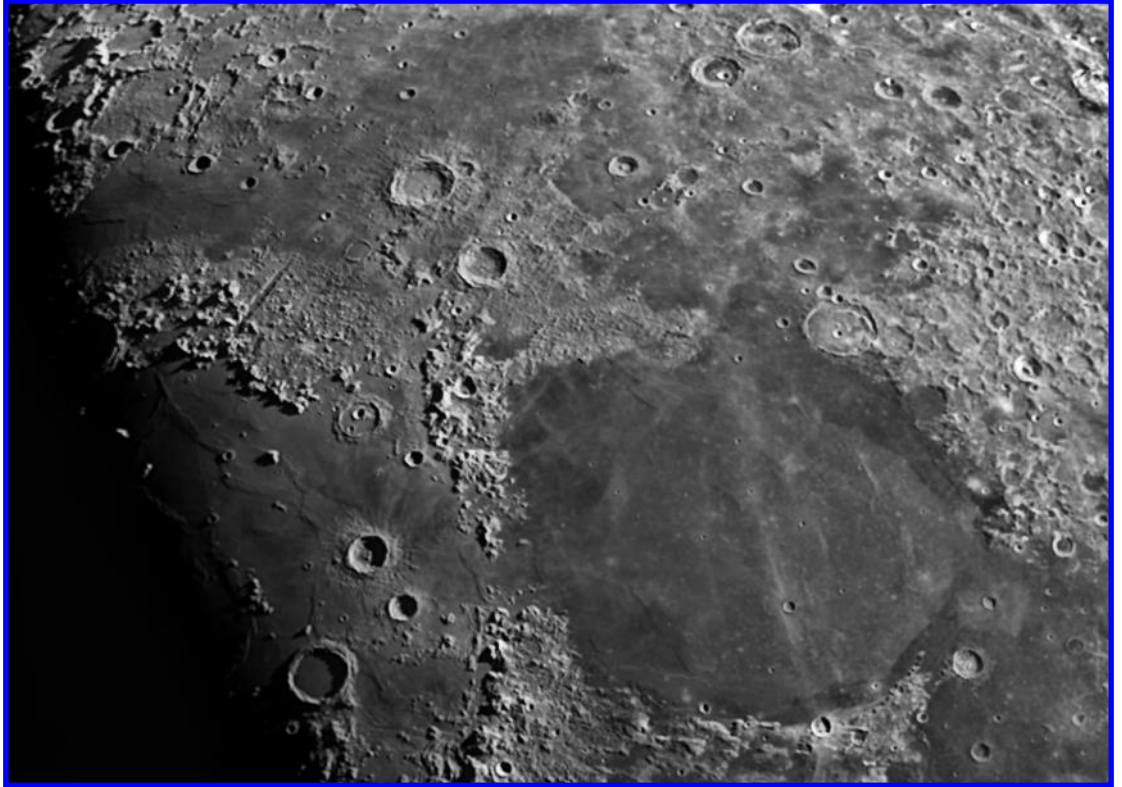
Luther 1 Dome, Howard Eskildsen, Ocala, Florida, USA. 16 December 2019 1044 UT, colongitude 146.1°. 9.25 inch Schmidt-Cassegrain, f/10, fl 2395 mm, 2 x barlow, W-25 red filter, DMK 41AU02.AS camera. Seeing 6/10, transparency 5/6.



Aristillus, Sergio Babino, Montevideo, Uruguay. 05 December 2019 0056 UT. 250 mm Catadioptric telescope, ZWO 174 camera.

Recent Topographic Studies

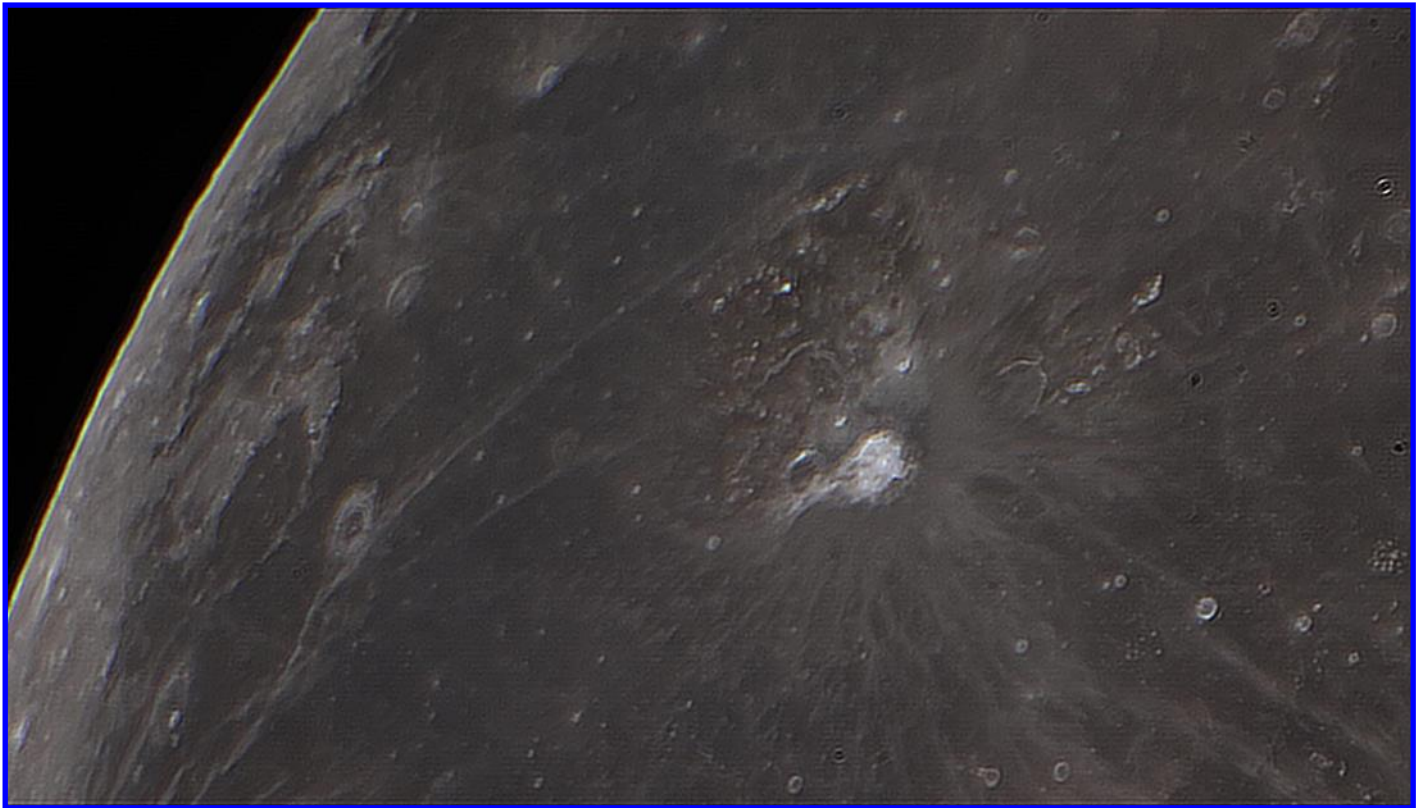
Aristoteles, Sergio Babin, Montevideo, Uruguay. 05 December 2019 0056 UT. 250 mm Catadioptric telescope, ZWO 174 camera.



Gassendi, Aylen Borgatello, AEA - Oro Verde, Entre Rios, Argentina. 14 November 2019 0258 UT. CPC 1100 f/10 fl 2,800 mm telescope, Canon Rebel T7i camera.

Recent Topographic Studies

Cleomedes, Walter Ricardo Elias, AEA - Oro Verde, Entre Rios, Argentina. 14 November 2019 0438 UT. CPC 1100 f/10 fl 2,800 mm telescope, Canon Rebel T7i camera.



Aristarchus, Victoria Gomez, AEA - Oro Verde, Entre Rios, Argentina. 14 November 2019 0254 UT. CPC 1100 f/10 fl 2,800 mm telescope, Canon Rebel T7i camera.

Recent Topographic Studies

***Ptolemaeus,**
Sergio Babino,
Montevideo,
Uruguay. 05
December 2019
0110 UT. 250
mm Catadiop-
tric telescope,
ZWO 174 cam-
era.*



***Alphonsus,** Fac-
undo Gramer,
AEA - Oro Verde,
Entre Rios, Ar-
gentina. 06 No-
vember 2019
0212 UT. CPC
1100 f/10 fl 2,800
mm telescope,
ZWO ASI 120
mms camera.*



Recent Topographic Studies

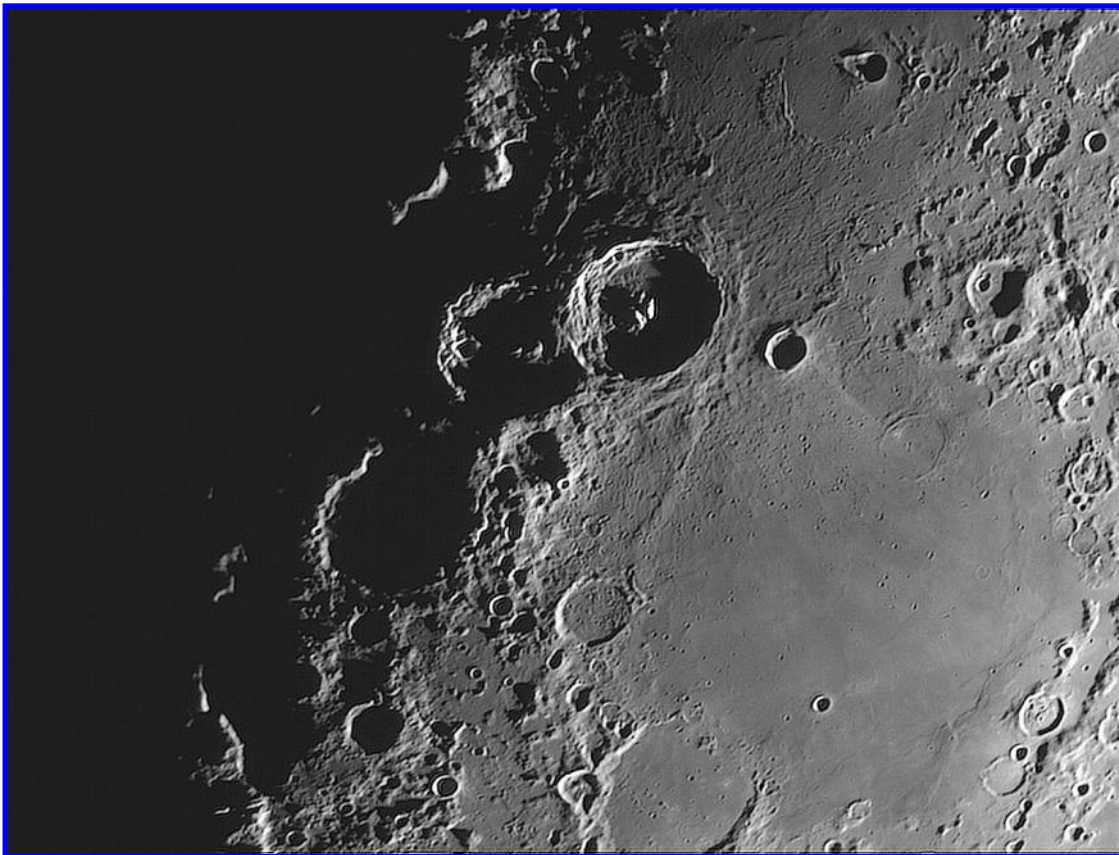
Langrenus, Walter
Ricardo Elias, AEA -
Oro Verde, Entre
Rios, Argentina. 02
November 2019 2335
UT. CPC 1100 f/10 fl
2,800 mm telescope,
ZWO ASI 120mms
camera.



Aristoteles, Facundo Gramer, AEA - Oro Verde, Entre Rios, Argentina. 14 November 2019 0423 UT. CPC 1100 f/10 fl 2,800 mm telescope, Canon Rebel T7i camera.

Recent Topographic Studies

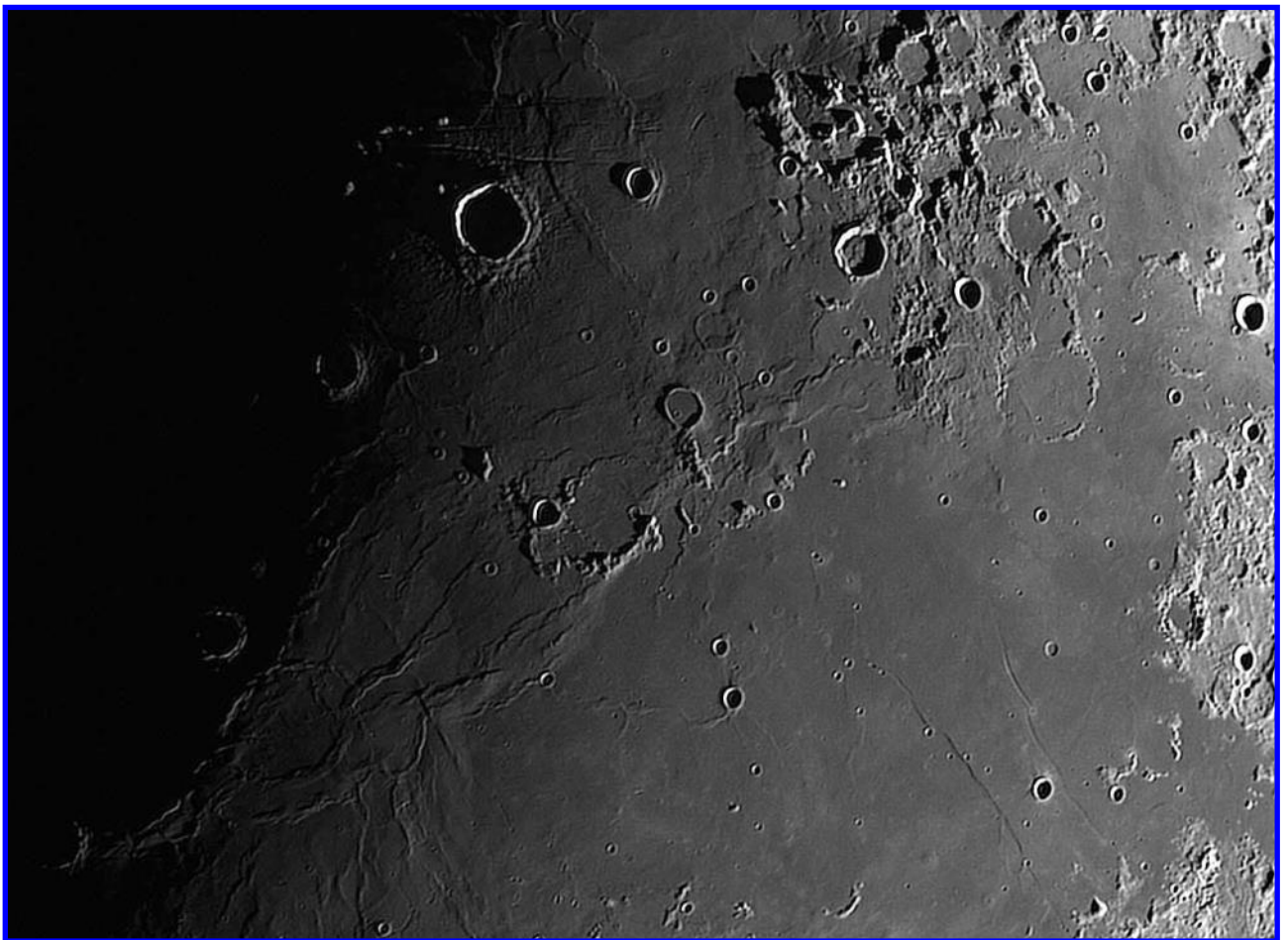
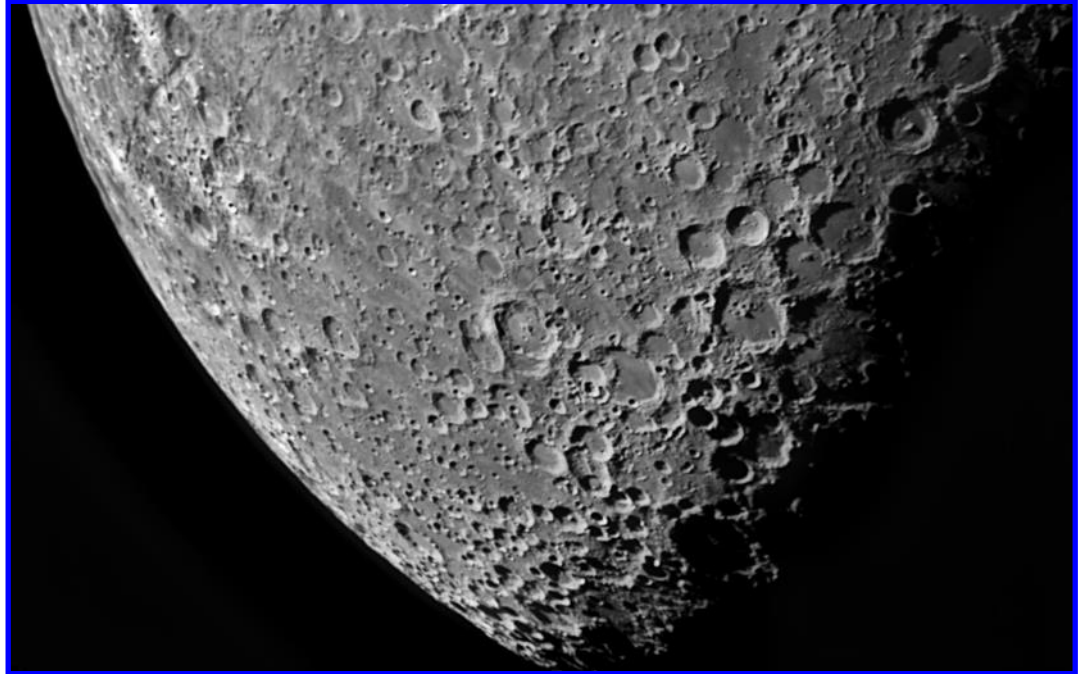
Proclus, Aylen
Borgatello, AEA -
Oro Verde,
Entre Rios, Ar-
gentina. 02 No-
vember 2019
2347 UT. CPC
1100 f/10 fl
2,800 mm tele-
scope, ZWO ASI
120mms camera.



Theophilus, Walter
Ricardo Elias, AEA -
Oro Verde, Entre
Rios, Argentina. 02
November 2019 2356
UT. CPC 1100 f/10 fl
2,800 mm telescope,
ZWO ASI 120mms
camera.

Recent Topographic Studies

Deslandres, Sergio Babin, Montevideo, Uruguay. 05 December 2019 0105 UT. 250 mm Catadioptric telescope, ZWO 174 camera.



Jansen, Facundo Gramer, AEA - Oro Verde, Entre Rios, Argentina. 02 November 2019 2331 UT. CPC 1100 f/10 fl 2,800 mm telescope, ZWO ASI120mms camera.

LUNAR GEOLOGICAL CHANGE DETECTION PROGRAM

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2020 January

Reports have been received from the following observers for Nov: Jay Albert (Lake Worth, FL, USA - ALPO) observed: Alphonsus, Archimedes, Aristarchus, Bullialdus, Gassendi, and the north pole area. Alberto Anunziato (Argentina, SLA) observed: Langrenus, Posidonius and Proclus. Aylen Borgatello (Argentina - AEA) imaged: Proclus and Gassendi. Maurice Collins (New Zealand - ALPO/BAA/RASNZ) imaged: Aristarchus, earthshine, Einstein, Gassendi, Mare Frigoris, an occultation of Saturn, Tycho, and several features. Walter Elias (Argentina - AEA) imaged: Cleomedes, Langrenus, Plato and Theophilus. Desiré Godoy (Argentina - SLA) imaged: Alphonsus, Aristarchus, Bullialdus, and Gassendi. Victoria Gomez (Argentina - AEA) imaged Aristarchus. Facundo Gramer (Argentina - AEA) imaged: Alphonsus, Aristarchus, Jansen and Proclus. Sebastian Moreyra (Argentina - AEA) imaged Aristarchus. Trevor Smith (Codnor, UK - BAA) observed: Alpetragius, Aristarchus, Bullialdus, Gassendi, Herodotus, Kepler, Mare Crisium, Mons Piton, Plato, Promontorium Heraclides, Theophilus, Vallis Schroteri, and several features. Bob Stuart (Rhayader, UK – BAA) imaged: Birmingham, Clavius, Copernicus, Fontenelle, Gassendi, Goldschmidt, Hainzel, Kepler, Prinz, and Sinus Iridum. Sophie Stuart (Rhayader, UK – NAS) imaged: several features. Alan Trumper (Argentina – AEA) imaged Byrgius.

News: Since the last newsletter I have been in contact with ALPO's Darryl Williams about his articles in the [Sep](#) and [Nov](#) 2019 TLO newsletter concerning thermal infrared imaging work and am looking into restarting some thermal IR observing of the Moon. If I can figure out how to improve on the resolution, that I was getting back in 2007, it might be worthwhile conducting some joint IR imaging. Darryl suspects that there may be 3 additional craters visible on the lunar eclipse image from 2007 (see Fig 1) based upon a comparison with other published thermal IR eclipse images made with professional sized scopes.

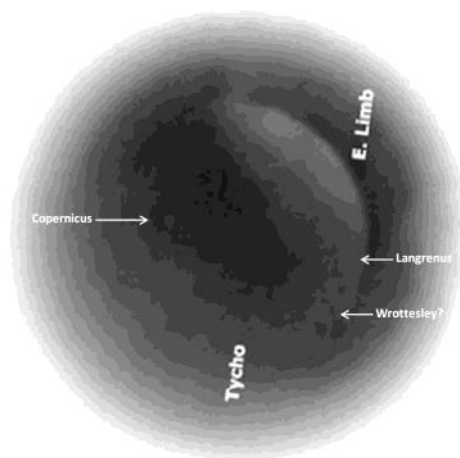


Figure 1. Thermal IR image of the Moon captured by Anthony Cook during the 2007 Mar 03 lunar eclipse at 22:25 UT. White is hot and dark is cool. The locations of some craters have been annotated.

Ivor Walton (BAA) pointed out that the timings for his 2019 Oct 18 observation (mentioned in the Dec newsletter) should have read: 10:48 and not 22:48, as apparently, he was using the “MicroObservatory Robotic Telescope Network” hosted by the Harvard-Smithsonian Center for Astrophysics (OWN – Observing With NASA. Telescope BEN (6-inch reflector) sited at Amado, AZ, USA (110.88°W, 31.68°N. This means that the repeat illumination description for Alphonsus on 2002 Sep 27 was in error. You can therefore ignore the associated repeat illumination description as this no-longer applies. All observers are reminded to let me know if their observing stations differ to where they normally observe from as this can affect how the observational data gets searched for in the ALPO/BAA database.

Lastly, I forgot to apply the correct affiliation to Rik Hill’s observation in the Dec newsletter, this of course should be ALPO/BAA.

LTP reports: No LTP reports were received in November.

Routine Reports: Below are a selection of reports received for Nov 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. Note that some observations sent in have not been used in this newsletter because they do not cover repeat illumination predictions. However, they will be kept in our database and used as reference images should a LTP be reported under similar illumination in the future.

Jansen: On 2019 Nov 02 UT 23:31 Facundo Gramer (AEA) imaged this crater under similar illumination ($\pm 0.5^\circ$) to the following report:

Jansen-Maskelyne 1969 Jul 20 UT 00:53-01:00 Observed by Jean and Collak (Montreal, Canada, 4" refractor and 6" reflector) "Jean and Collack noted obscur. between Jansen and Maskel. from term. No features discernible here whereas Proc. & Theoph. were already vis." NASA catalog weight=2. NASA catalog ID #1169. ALPO/BAA weight=2.

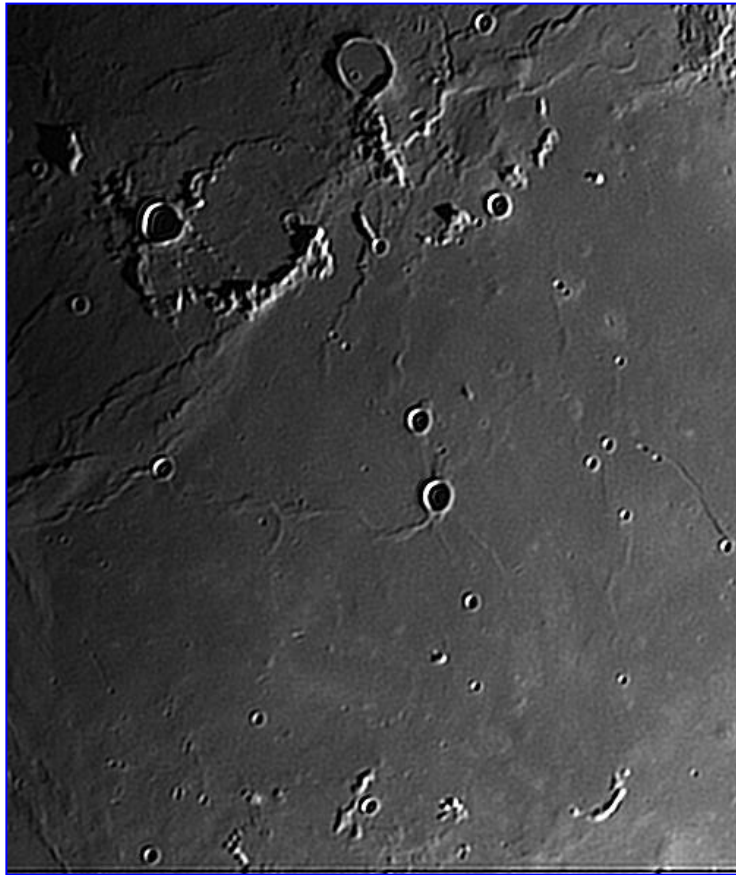


Figure 2. Jansen as imaged by Facundo Gramer (AEA) on 2019 Nov 02 UT 23:31 and orientated with north towards the top. Jansen is located near the center of the top edge.

Facundo's image (Fig 2), although not showing Maskelyne (beyond the bottom edge) clearly shows no obscuration or lack of detail in the region described by Jean and Collack. Therefore, we shall leave the weight at 2 for now.

Proclus: On 2019 Nov 02 UT 23:46 and 23:55-23:59 Aylen Borgatello (AEA) imaged and Alberto Anunziato (SLA) observed visually this crater under similar illumination ($\pm 0.5^\circ$) to the following reports:

near Proclus 1970 Apr 12 UT 00:15, 00:20 Observed by Loochs (Valparaiso, Chile, 12" reflector, x88) "Brilliant in area NW of crater. No change in brightness Contrast to opacity of illuminated fraction of this day. Later saw a flash on the moon. (Apollo 13 watch)." NASA catalog weight=2. NASA catalog ID #1239. ALPO/BAA weight=2.

On 1982 Oct 22 at UT23:45-00:10 K. Marshall (Medellin, Columbia) found the W-NW rim of Proclus was both red and very bright, no similar color effect was seen elsewhere on the Moon. The Cameron 2006 catalog ID=187 and the weight=3. The ALPO/BAA weight=3.

On 2009 Mar 31 at UT 19:26-19:50 Cook M.C. (Mundesley, UK, 90mm Questar reflector, x130, seeing II-III, transparency poor to moderate). The crater had its north-east to west wall illuminated and a central feature on the floor, faintly seen. The crater itself though was much brighter in a red filter, bright in a yellow filter, but dull in a blue filter. Possible variation seen whilst using the red filter, but this may have been due to haze. All other features behaved normally. The ALPO/BAA weight=3.

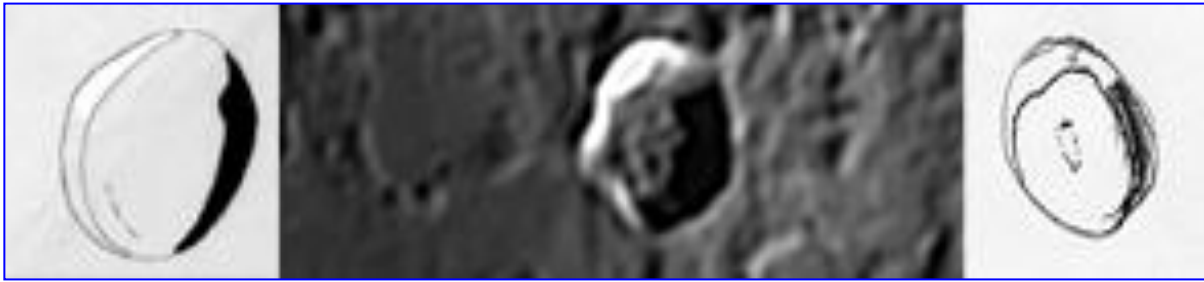


Figure 3. Proclus with north towards the top. **(Left)** A sketch by Kevin Marshall (BAA) made on 1982 Oct 22 UT 23:45 **(Center)** An image by Aylen Borgatello (AEA) made on Nov 02 UT 23:46. **(Right)** a sketch by Marie Cook (BAA) made on 2009 Mar 31 UT 19:26-19:50.

Alberto's visual observation, which is the most similar observing technique to all three LTP listed above, describes how he could distinguish nothing that he regarded as an abnormality in the north west area of the crater. Aylen's image (Fig 3 – Center) backs this description up – although the NW rim looks bright, this is normal for this colongitude. We can therefore say that the Looms report from 1970 is perfectly normal, apart from a flash seen elsewhere on the Moon. I shall therefore remove this from the LTP database by giving it a weight of 0. Incidentally the flash that Looms mentions was in Aristarchus, at magnitude 10, and is still retained in the ALPO/BAA catalog.

With regard to the Marshall (Fig 3 – left) and Cook (Fig 3 – right) reports, we can now exclude their comments about the NW wall being bright from their LTP descriptions as anything abnormal, and instead concentrate on both descriptions noting that some red was visible. In the Marshall report red is on the NW rim (See Fig 1 – left), and no-where else on the Moon. In the Cook report the whole crater is brighter in red than in other filters – furthermore, a faintly visible central feature on the floor is mentioned and drawn (Fig 3 – right) and this is also shown in Aylen's image (Fig 3 – center). Alberto makes no mention of color and Aylen's image is in monochrome, so we are none-the-wiser over the color effects – so will therefore leave the weights of the Marshall and Cook LTPs at 3 – but the descriptions will be amended.

Maskelyne and Menelaus: On 2019 Nov 04 UT 08:01-08:20 Maurice Collins (ALPO/BAA/RASNZ) produced a whole Moon mosaic under similar illumination ($\pm 0.5^\circ$) to two LTP observations made by a past New Zealand Observer - Whelan:

On 1969 Jul 21 at UT09:30 Whelan (Wellington, New Zealand, 10" and 6" reflectors. Other observers involved were: Mackrell (New Zealand, 6" reflector) and Spellman (4" reflector) observed Maskelyne crater undergoing a whitish glowing brightening. Shadowy filling of whole crater. Apollo 11 watch. The Cameron 1978 catalog ID=1179 and the weight=3. The ALPO/BAA weight=2.

On 1970 Apr 13 at UT09:00-09:03 Whelan (Walters, New Zealand, using a 10" reflector) observed Menelaus to have a deep red cloud that seemed to surge upward from outside the southern edge of the crater wall and disperse around the outside edge, spreading out on reaching Mare Serenitatis. All clear again though by 09:03UT, (Apollo 13 watch). Drawing supplied. Cameron 1978 catalog ID=1246 and weight=3. ALPO/BAA weight=3.

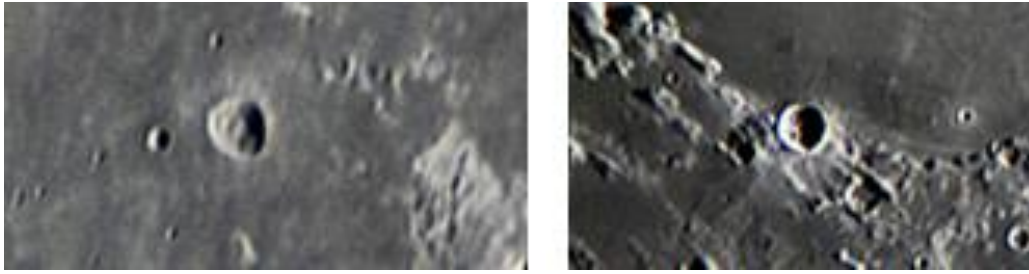


Figure 4. Color images from a larger mosaic of the whole Moon by Maurice Collins (ALPO/BAA/RASNZ) taken on 2019 Nov 04 UT 08:01-08:20 and orientated with north towards the top. **(Left)** Maskelyne crater. **(Right)** Menelaus crater.

There is no sign of Whelan's whitish glowing Maskelyne (Fig 4 – Left), though Whelan's description of a shadowy filling is correct as this is the normal appearance at this colongitude. Neither is there any sign of a deep red in Menelaus or indeed a spreading cloud (Fig4 – Right). Therefore, we shall leave the weights of these two LTP as they were.

Mons Piton: On 2019 Nov 05 UT 20:10 Trevor Smith (BAA) sketched this mountain peak under similar illumination ($\pm 0.5^\circ$) to the following report:

Piton 1960 Nov 27? UT 00:00? Observed by Schneller (Cleveland, OH, USA, 8" Reflector, x53), "Red obscuration concealing peak, @10m2 (if near SR, date is 27th; ancillary data given for 27th -- date not given)." NASA catalog weight=3 (average). NASA catalog ID #731. ALPO/BAA weight=2.

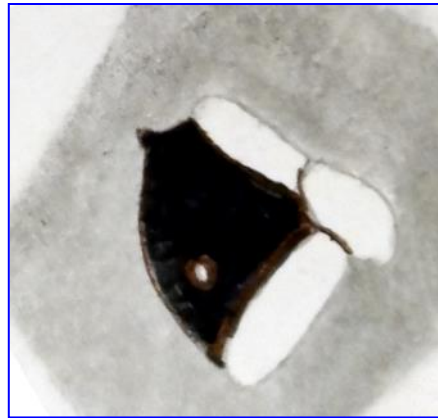


Figure 5. Mons Piton as sketched by Trevor Smith (BAA) on 2019 Nov 05 UT 20:10 and orientated with north towards the top.

Trevor's sketch (Fig 5) and visual descriptive report reveal no sign of any red obscuration concealing the peak – therefore I guess we shall have to leave the weight of the 1960 report at 2 for now, but at least we have a good idea of the mountain appearance based upon Trevor's sketch.

Plato: On 2019 Nov 06 UT 02:42 Walter Elias (AEA) imaged this crater under similar illumination ($\pm 0.5^\circ$) to the following Patrick Moore report:

Plato 1952 Apr 03 UT 20:45-21:30 Observed by Wilkins and Moore Meudon, France, 33" x460) whilst checking up on a 1923 28" refractor sketch by W.H. Stevenson's, that failed to detect a prominent floor craterlet (featured in the 1923 sketch) just inside the W wall. They suspected an obscuration. Interestingly the whole floor was reported to be lacking in detail many hours later as observed by Cragg in the USA. NASA catalog weight=5. NASA catalog LTP ID No. #550. ALPO/BAA weight=2.

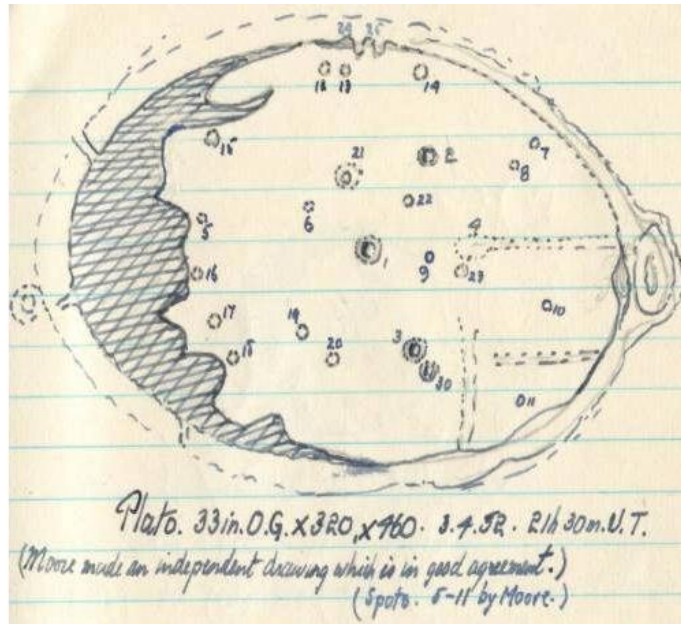
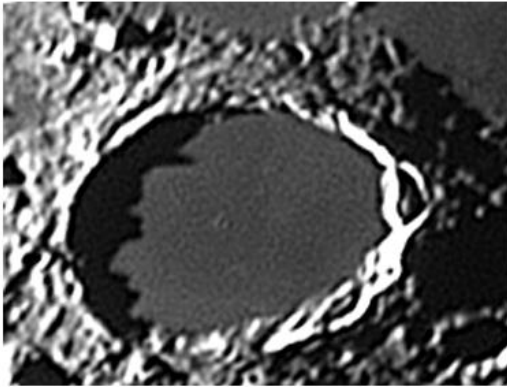


Figure 6. Plato orientated with south towards the top. **(Left)** an image by Walter Elias (AEA) taken on 2019 Nov 06 UT 02:42. **(Right)** A sketch made by Patrick Moore, using the 33" Refractor at Meudon France – on 1952 Apr 03 UT 20:45-21:30 – taken from the BAA Lunar Section Circular 2011 May p11.

Walter, although using a was using a Celestron CPC 1100, had bad seeing on that night, and what with the size difference compared to the Meudon reflector, it is not surprising that only a central craterlet is visible in Walter's image (Fig 6 – Left) compared to the mammoth amount of detail seen in the Patrick Moore sketch (Fig 6 – Right). It just goes to show how atmospheric conditions can have a significant effect on the visibility of floor craterlets in Plato. For now, we shall leave the Moore report with a weight of 2.

Aristarchus: On 2019 Nov 08 UT 01:03 and 01:40-02:00 Desiré Godoy (SLA) and Jay Albert (ALPO) respectively imaged and visually observed the area around where Aristarchus should be under similar illumination ($\pm 0.5^\circ$) to the following report:

Aristarchus 1969 Jul 25 UT 02:15-03:00 Observed by Jose L. da Silva (Rio de Janeiro, Brazil, 13" refractor) "Unusual brightness whole time in center of W. inner slope; rest of crater & Herodotus appeared normal. SW to NW inner slope had pronounced brightness. Aris. still in dark! Apollo 11 watch)." NASA catalog weight=3. NASA catalog ID=1186. ALPO/BAA weight=2.



Figure 7. Montes Harbinger and Sinus Iridum, taken by Desiré Godoy (SLA) on 2019 Nov 08 UT 01:03, and orientated with north towards the top. The image has been non-linearly contrast stretched to bring out detail near the terminator.

Jay reports that both Aristarchus and Herodotus were beyond the terminator and so could not be seen. He saw that the Sun was rising over Montes Harbinger with its E facing peaks brilliantly lit. He noted that a few of those mountains were large and could easily have been mistaken for crater rims emerging from the darkness. This is confirmed in Desire's image, taken a little earlier in Fig 7. With regards to Jay's theory that da Silva mistook Montes Harbinger for Aristarchus and Herodotus, this is possible, although the da Silva report is very specific about W, SW, NW slopes, which of course are not visible on Montes Harbinger. An alternative explanation is that da Silva got the date wrong and it should have been 1969 Jul 26 – this does sometime happen with observers who live many tens of degrees away from 0° longitude here on Earth. Indeed, for the 1969 Jul 25 UT 02:15-03:00 quoted by da Silva, the Sun would have had an altitude of -7.1° to -5.8° at the crater, and so would have clearly been in darkness. I will change the date from the 25th to 26th and because the original observer may have made either a feature mis-identification or date error, and will also change the ALPO/BAA weight from 2 to 1.

Plato: On 2019 Nov 08 UT 19:34 Sophie Stuart (NAS) imaged the Moon in color and this matched similar illumination ($\pm 0.5^\circ$) to the following report:

On 1938 Mar 13 at UT 04:00-06:00 Barker (Chestnut, England, UK) noted a slight reddish color in Plato. However, Fox (Newark, UK, 6.5" reflector, x240) saw none on the south east wall, but instead saw a yellowish glow on the southern floor at the same time (confirmation?). Apparently, Fox saw the same effect on Apr 10, 11, and May 8-11, then on June 8-10. The Cameron 2006 catalog ID=432 and the weight=5. The ALPO/BAA weight=3.

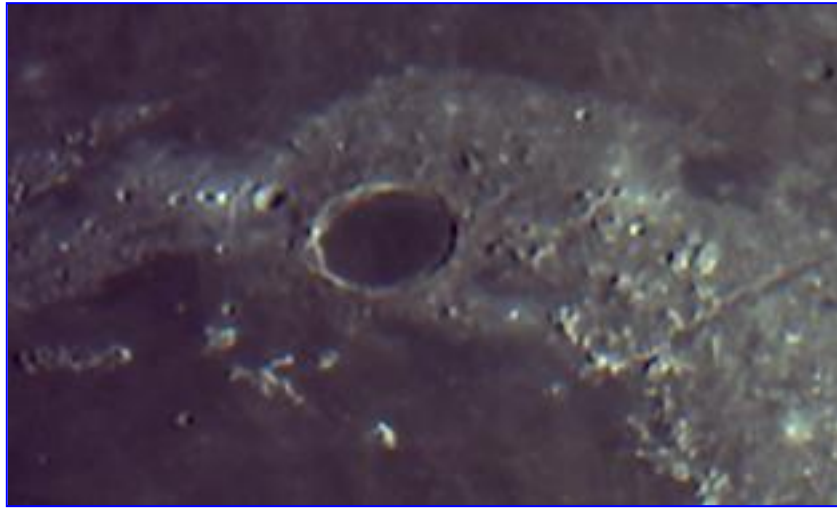


Figure 8. Plato imaged by Sophie Stuart (NAS) on 2019 Nov 08 UT 19:34 and orientated with north towards the top. The image is a subsection from a larger whole Moon mosaic and has been contrast stretched and had color saturation increased by 40%.

Sophie's image (Fig 8) shows no sign of any red on Plato, despite having had the color saturation increased. Neither is there a yellowish glow to the southern floor. There is however a tinge of brown on the edge of the shadow on the NW floor but this is due to atmospheric spectral dispersion as it is visible on other crater shadows too. We shall therefore leave the weight at 3 as what was described back in 1938 was not normal.

Herodotus: On 2019 Nov 08 UT 20:49 Bob Stuart (UAI) imaged this area in monochrome under similar illumination ($\pm 0.5^\circ$) to the following report:

On 1989 May 17 at UT Fabian (Chicago, IL, USA, 4" reflector, x35-x50 and 8" reflector) noted a pale blue coloration in the ridges situated west of Aristarchus and north of Herodotus craters, in the vicinity of the terminator (and on the night side). Aristarchus itself did not have any color. It was only area with such color though there were numerous others of similar elevation and relation to term. The color was seen in a 4" Cassegrain telescope, but when an 8" reflector was used at 02:30UT, even with the same eyepieces. Cameron comments that maybe the larger telescope spread the color out? The sketch that Fabian supplied, suggested to Cameron that the LTP was located at Herodotus, and the ridge was part of Schroter's valley - Cobra Head. The Cameron 2006 catalog ID=364 and the weight=2. The ALPO/BAA weight=2.



Figure 9. Aristarchus as imaged by Bob Stuart (BAA) on 2019 Nov 08 UT 20:49 in monochrome and orientated with north towards the top.

Although Bob's image (Fig 9) is in monochrome, we can at least see the ridges west of Aristarchus and north of Herodotus mentioned in the Fabian report. So, we at least now have a good representation of what the area should have looked like back in 1989. The weight shall remain at 2 for now.

Full Moon: On 2019 Nov 12 UT 21:21 Aldo Tonon (UAI) imaged (Fig 10) the Full Moon, a target on the [Lunar Schedule](#) web site: Aristarchus (205.6), Spot near Hell (181), Proclus (168), Tycho (164), Censorinus (159), Copernicus (140), Kepler (124) Plato (63). From this we are able to measure the relative brightness of several lunar features, some of which it has claimed have varied in brightness. Interestingly on this occasion Aristarchus comes out brightest, whereas in the Nov newsletter, Censorinus was brightest and Aristarchus ranked 4th on the list. Full Moon is thought to be a good time to study the brightness of lunar features as the measured brightness is supposedly directly proportional to albedo. However, Full Moon is also a time when there is an exponential-like increase in the lunar phase function occurs, so phase angle photometric effects may be having a big effect on the relative brightness of features and this is dependent upon the alt/az of the Sun (and observer) as seen from the feature concerned. We are gradually building up a set of imagery of the Full Moon under lots of different topocentric librations and selenographic colongitudes/sub-solar latitudes.



Figure 10. The Full Moon as imaged by Aldo Tonon (UAI) on 2019 Nov 12 UT 21:21 and orientated with north towards the top.

Aristarchus: On 2019 Nov 14 UT 02:54 Victoria Gomez (AEA) imaged the crater in color under similar illumination ($\pm 0.5^\circ$) to the following two reports:

Aristarchus (Bartlett, 1965 Oct 12 UT 02:15-20:25, 5-inch reflector x280) - NASA catalog quotes "Nimbus was only a dark violet hue". NASA catalog weight=4. NASA catalog ID #904. ALPO/BAA weight=1.

Aristarchus 1975 Feb 27/28 UT 22:00-01:00 Observers: Robinson (Teignmouth, England - 10" reflector), Fitton (Lancashire, England - 8" reflector), Amery (Reading, England - 8" reflector), Mills Observatory (Dundee, Scotland, 10" reflector) - NASA catalog states: "Robinson at 2200h got blink on E.wall, strong at 200x till 2225h. (Fitton) at 2200h (moon low) at 200x saw vivid blue to N., vivid yellow & orange to S. in Aris., Proc., Menelaus, & many other bright craters til 2300h. Then Aris. less blue & mare obj. no colors. No blinks in these craters. No obscur. Polariz. normal till 2330h using many rotations. At 2330h Aris. blue in N. but fainter. Only Proc. remained blue till 0020h (28th). Photo-electric scan at 2340h was normal for Aris. (600 microamps) compared with Tycho (900 microamps), total of 10 scans. all neg. with 15km resolution. Blink neg. but blue still vis. in N. in white light till 0030h. At 0100h (S=III at 200x) Proc. clear of blue, Aris. nearly clear, blink neg. (Amery) at 2310h saw blue on N.rim of Aris., no color in other craters at 300x. No blink in Aris. S. part of Aris. indistinct but abnormal. No blink till 2350h. (Mills Observatory) at 0000h checking rep'ts got blink in S.part of Aris. Blue only in N.part. Similar blue in bright craters in E.hemisphere & blue halo on S.limb till 0020h. Concluded due to optical effects. Fitton says due to atm. effects from high press. sys. W. of obs (blue on one rim & red on other due to chrom. aberr.? If spurious, should get no blink & similar crater conditions should exhibit same phenomena all over Moon). NASA catalog weight=5. NASA catalog LTP ID No. 1400. ALPO/BAA weight=3.

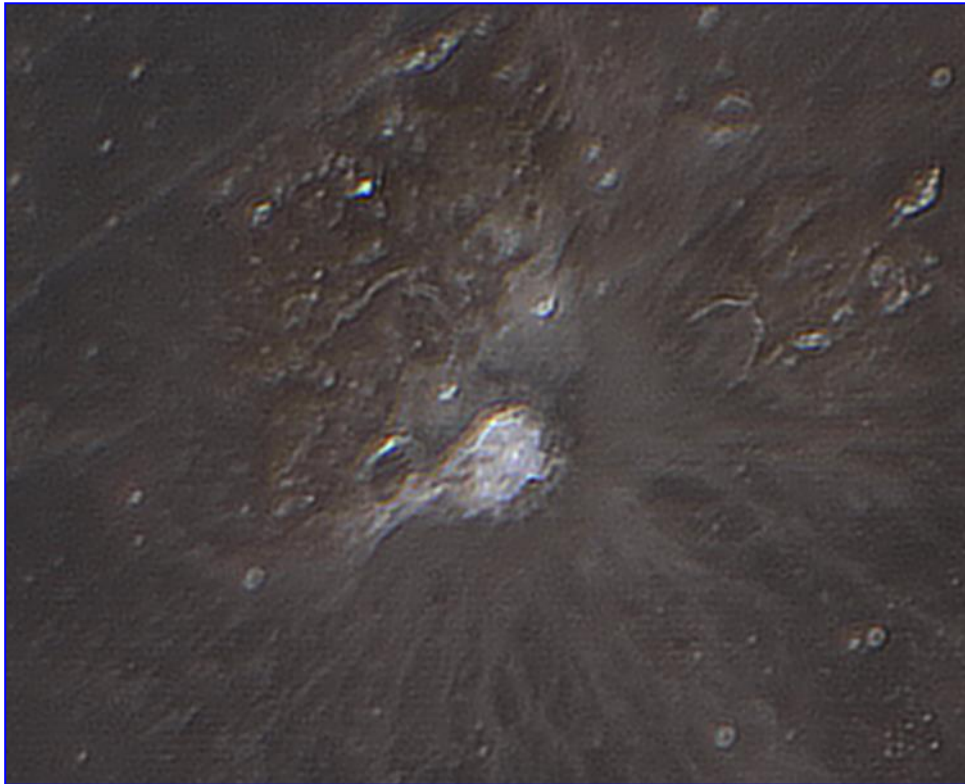


Figure 11. Aristarchus as imaged by Victoria Gomez (AEA) on 2019 Nov 14 UT 02:54, with color saturation increased to 30% and orientated with north towards the top.

Victoria's image (Fig 11) shows up some of the brown Oceanus Procellarum color and a slightly stronger brown for the Aristarchus plateau. Aristarchus itself has a very slight blue cast, but not as much as I have seen in other color images and certainly does not replicate much of what was described in the 1965 and 1975 reports. We shall therefore leave the weights of these LTP as they are for now.

Aristarchus: On 2019 Nov 14 UT 04:19 & 04:21 Sebastian Moreyra (AEA) imaged the crater in color under similar illumination ($\pm 0.5^\circ$) to the following two reports:

On 1981 Oct 15 at UT06:03-05:51 D. Louderback (South Bend, WA, USA, seeing=1-2 and transparency=5) The Cobra Head had a brightness of 8, though normally it should be less than 7. The Cameron 2006 catalog ID=156 and weight=3. ALPO/BAA weight=1.

On 1992 May 19 at UT 01:00-02:05 P. Moore (Selsey, UK, 15" reflector, x260) saw at 01:25UT an unmistakable red-orange glow on the south and south-east rim with the "Spur". Apparently, Chapman (Kent, UK) detected it easily. At 01:33UT the color was barely visible. No LTP alert was issued because the southern edge of Mons Pico also exhibited a hint of color, and anyway the seeing conditions were poor. Despite this no other features revealed color. The Cameron 2006 catalog ID=446 and the weight=0. The ALPO/BAA weight=1.

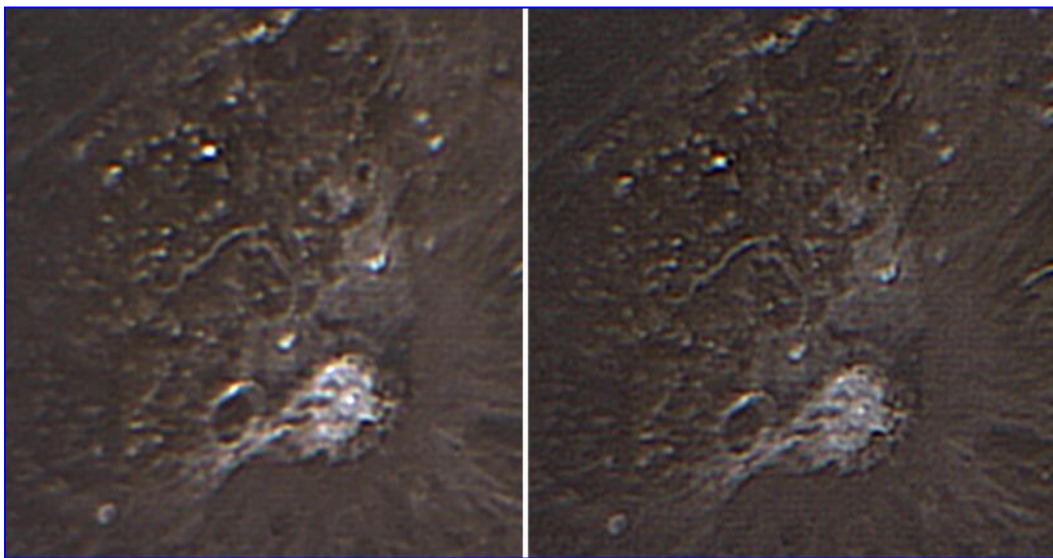


Figure 12. Aristarchus as imaged by Sebastian Moreyra (AEA) on 2019 Nov 14 UT. Orientated with north towards the top and color saturation increased to 30%. **(Left)** 04:19 UT view. **(Right)** 04:21 UT view.

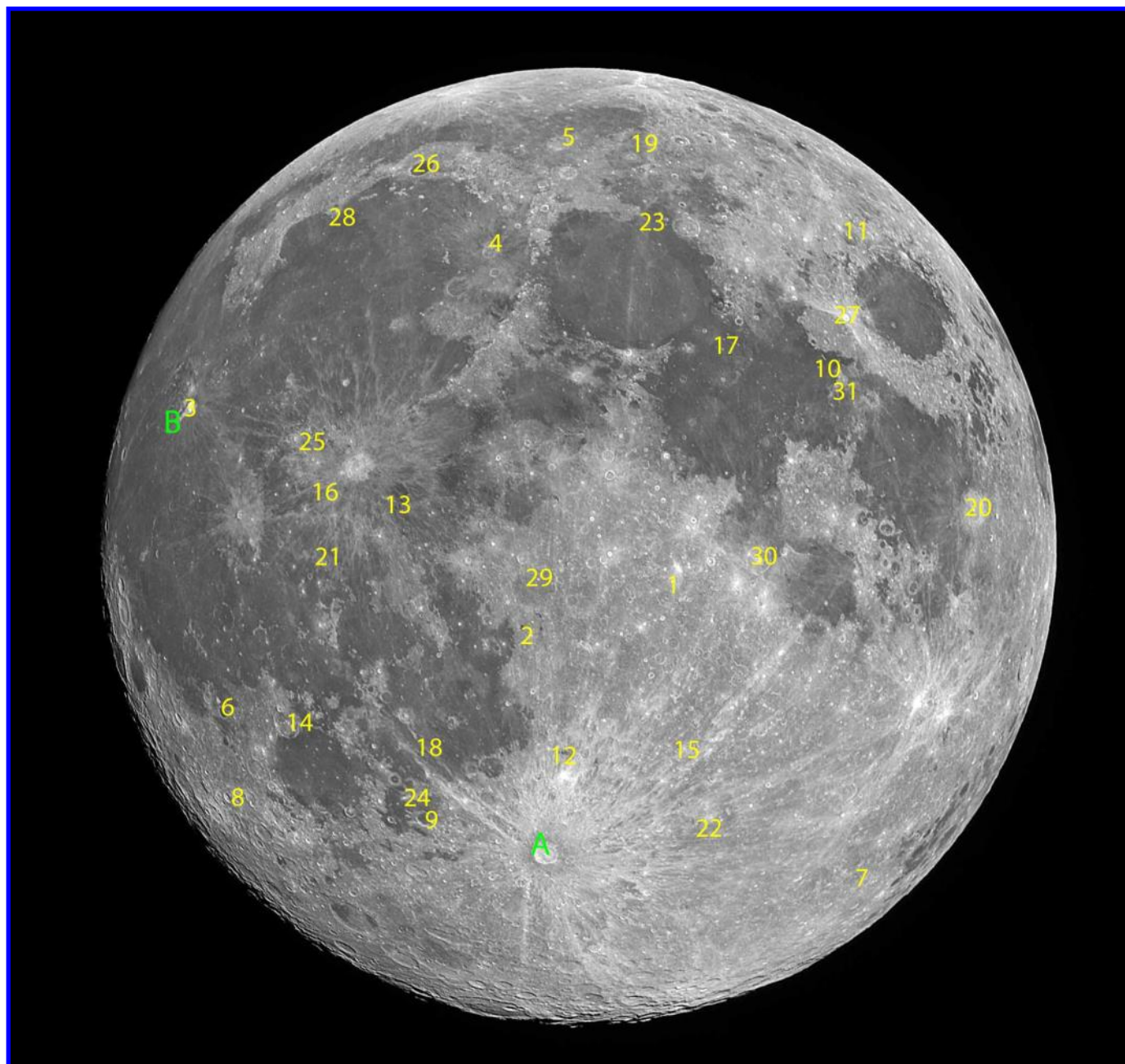
Concerning Louderback's remark that the Cobra's Head had a visual brightness of 8 whereas it is usually 7, as you can see from Sebastian's example images (Fig 12) the Cobra's Head is a bit fainter than the central peak of Aristarchus. However, quibbling over whether it is at a visual intensity of 7 or 8 seems a bit pointless considering the effect that blurring in our atmosphere has on point-like features. I will therefore lower the weight from 1 to 0 and remove it from the ALPO/BAA database.

With regard to the Moore LTP, Fig 12 shows no red on the S and SE rims – if anything perhaps a hint of blue on the SE and red on the NW. For now, we shall leave the weight at 1.

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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| 5. Aristoteles | 20. Langrenus |
| 6. Billy | 21. Lansberg |
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- B. Herodotus