# THE LUNAR OBSERVER

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


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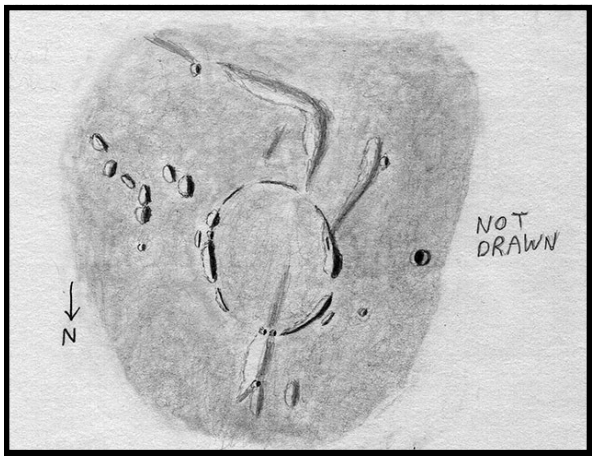
**RECENT BACK ISSUES: http://moon.scopesandscapes.com/tlo_back.html**


# FEATURE OF THE MONTH – JUNE 2019

## WICHMANN ρ and δ




**Sketch and text by Robert H. Hays, Jr. - Worth, Illinois, USA**
**March 17, 2019 03:00-03:26, UT, 15 cm refl, 170x,**
**seeing 8-10, transparency 6/6.**

I drew this area on the evening of March 16/17, 2019. These ridges are part of a ghost ring in southern Oceanus Procellarum east of Letronne. This ring itself has no designation as such on the Lunar Quadrant map, and is obviously an old crater that has been flooded by Oceanus Procellarum. Wichmann rho is the long, fairly narrow ridge on the ring's northwest side. It tapers down at its east end where there are two tiny detached peaks. Another tiny peak is farther to the north, and a low wrinkle extends from north of this peak, then between the two detached peaks and into the ghost ring. No other detail was seen within the ring. Wichmann rho is widest at its southwest end, and a short ridge and tiny peak are nearby outside the ring. Wichmann delta is on the west side of the ring. This ridge is shorter and wider than Wichmann rho. Wichmann delta is widest at its north end where it faces the high point of rho across a gap. Wichmann delta shows terracing inside its south end, then tapers off to some weak shadowing. Letronne D is the small crisp crater to the west. This is the only intact crater on this sketch. The nearby area appeared quite smooth despite its proximity to the terminator. A low wide ridge extends southwestward from Wichmann delta, ending near an isolated peak. This peak stood out because of its relatively dark shadowing. Another such feature is farther south, angles to the southeast, and continues on after a gap. Another isolated peak is in this gap, and also stands out due to darker shadowing. Euclides epsilon is the largest of four segments along the ring's east side. A short ridge is just outside the ring nearby. Two curved strips of weak shading are south, then west of the Euclides epsilon area. Wichmann rho and delta, Euclides epsilon, and assorted peaks and shadow strips would have made a nice symmetric ring before being flooded. An irregular group of conspicuous peaks is southeast of the ring. The one nearest to the ring is probably Herigonius omega. The area south of Herigonius omega appeared very smooth,

# LUNAR CALENDAR

| 2019 | U.T. | EVENT |
|---|---|---|
| Jun 01 | 18:15 | Moon-Venus: 3.4° N |
| 03 | 10:02 | New Moon |
| 05 | 12:58 | Moon North Dec.: 22.4° N |
| 05 | 15:05 | Moon-Mars: 1.6° N |
| 05 | 22:46 | Moon Ascending Node |
| 07 | 23:21 | Moon Perigee: 368500 km |
| 10 | 05:59 | First Quarter |
| 16 | 18:50 | Moon-Jupiter: 2.1° S |
| 17 | 08:31 | Full Moon |
| 19 | 15:33 | Moon South Dec.: 22.4° S |
| 18 | 05:49 | Moon Descending Node |
| 19 | 03:58 | Moon-Saturn: 0.5° N |
| 24 | 07:50 | Moon Apogee: 404500 km |
| 25 | 09:46 | Last Quarter |

| 2019 | U.T. | EVENT |
|---|---|---|
| Jul 02 | 19:16 | New Moon |
| 02 | 19:23 | Total Solar Eclipse |
| 02 | 22:02 | Moon North Dec.: 22.4° N |
| 03 | 06:53 | Moon Ascending Node |
| 04 | 10:34 | Moon-Mercury: 3.3° S |
| 05 | 04:54 | Moon Perigee: 363700 km |
| 09 | 10:55 | First Quarter |
| 13 | 19:43 | Moon-Jupiter: 2.5° S |
| 15 | 22:49 | Moon South Dec.: 22.4° S |
| 16 | 07:27 | Moon-Saturn: 0.2° N |
| 16 | 09:05 | Moon Descending Node |
| 16 | 21:31 | Partial Lunar Eclipse |
| 16 | 21:38 | Full Moon |
| 21 | 00:01 | Moon Apogee: 405500 km |
| 25 | 01:18 | Last Quarter |
| 30 | 09:10 | Moon North Dec.: 22.4° N |
| 30 | 17:02 | Moon Ascending Node |

# 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.

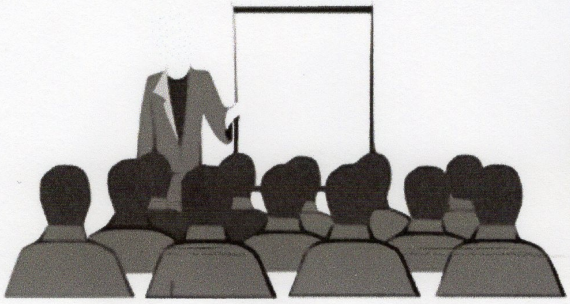
Our quarterly journal, **The Journal of the Association of Lunar and Planetary Observers-The Strolling Astronomer**, contains the results of the many observing programs which we sponsor including the drawings and images produced by individual amateurs. Additional information about the A.L.P.O. and its 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.

# *ALPO '19*

# July 12-13, 2019

*A joint conference of the*
*Assn of Lunar & Planetary Observers and the*
*Southeast Region of the Astronomical League*



Venue: Gordon State College, in picturesque
Barnesville, Georgia (near Atlanta)
**Look for conference details via regular and e-mail soon!**

# 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 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 11 Region – Sea of Tranquility

***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 **July 2019** edition will be the Apollo 11 Region – Sea of Tranquilty**. This is the 50th Anniversary of the Apollo 11 flight.** 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 11 Region – Sea of Tranquility article is June. 20, 2019**

## 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.

| Subject | TLO Issue | Deadline |
|---|---|---|
| Alphonsus & Aristarchus | September 2019 | August 20, 2019 |
| Atlas & Copernicus | November 2019 | October 20 ,2019 |
| Plato & Theophilus | January 2020 | December 20, 2019 |

# HESIODUS B & X

## Alberto Anunziato

We are in the Mare Nubium, north of Hesiodus and Pitatus craters. Hesioudus B is the crater to the west. It measures 10 kilometers in diameter. You can't see many details, only its very dark interior and its walls that seem higher towards the west, according to the shade they project and the area that receives most sunlight. Hesiodus X is more complex and interesting. Only the west wall seems almost complete, although its northern segment appears much brighter than the rest, so we presume that it is higher than the rest. The north wall has almost completely disappeared. The south wall, the best preserved, is abruptly interrupted, which is deduced from the shadows that separate it from the east wall (with a scope as small as mine it is not easy to observe

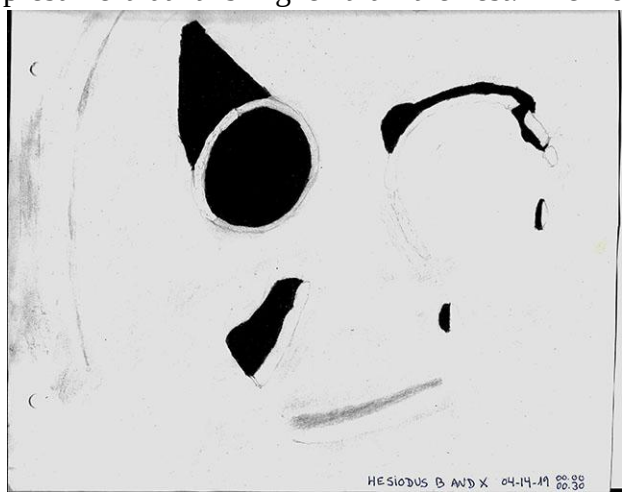



***FIGURE 1.*** ***HESIODUS B & X*** *– Alberto Anunziato, Paraná, Argentina. April 14, 2019 00:00-00:30 UT. Colongitude 97.3º. Meade EX-105 Mak-Cass, 154x.*

shadows that separate fragments of fractured walls). There are 3 fragments, two are contiguous and the third more separated towards the north. On the right there is an isolated peak and on the left a kind of very high mountain range, judging by the deep shadows that project towards the west. Further to the south I observed something similar to a dorsum, a ripple with a slight grayish shadow that helped by contrast to perceive its slight brightness. The 3 southern accidents, of which I could not find the name: Will they belong to craters that have disappeared? Nor have I found what could correspond to the very slight shadow that extends in a semicircle at the western end of the image. A truly fascinating area.

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# A LITTLE MOUNTAIN CLIMBING

## Rik Hill

I think Montes Apenninus (fig. 1) is one of the most dramatic mountain ranges on the moon. My favorite range is still Montes Caucasus but these are so well placed that their grand ramparts cast dramatic shadows in the sunrise light, that can be enjoyed in any telescope. In the lower left corner of this image

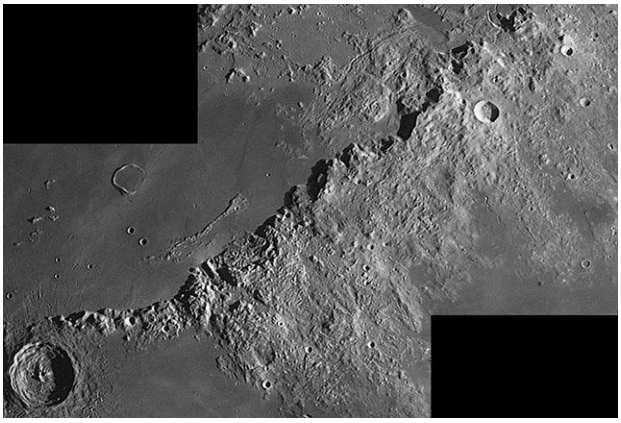

***FIGURE 1.*** ***MONTES APENNINUS*** *– Richard Hill – Tucson, Arizona, USA April 14, 2019 02:40 UT. Colongitude 21.1°. Seeing 8/10. TEC 8" f/20 Mak-Cass, SKYRIS 445M, 6100 nm filter.*

we see Eratosthenes (60km diameter) anchoring the southern end of the range. Moving up the range we see a prominent gap. The mountain on the southern side of this gap is Mons Wolff (3.5km height). Just north and west (left) of this is a low thin range of unnamed mountains with a small crater off the north end out in the mare. This is Huxley (3km) and will be a guidepost for another peak. Due south of Huxley is Mons Ampere (3km) tucked back into the range. To the northeast of this is the much taller Mons Huygens (5.4km), the tallest peak in the range. You can see the peak displayed in the shadow it projects. What a sight this must be from Huxley!

Moving further northeast we come to the crater Conon (22km) and just west of that is Mons Bradley (4.2km). West of Mons Bradley is the graben-like Rima Bradley. Mons Bradley appears to be a tall ridge rather than an individual peak. Due north of Conon is Bela, the gash that is the southern end of Rima Hadley the northern end of which was the Apollo 15 base.

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# CATENA REDUX

## Rik Hill

Last year I posted an image of this region that was pretty good but a few nights ago I had 9/10 quality seeing and got an image of Catena Davy (fig. 1) just about at the resolution limit of my 8" f/20 Mak-Cass telescope (1 km). The great walled plain taking up the upper right quarter of this image is, of course, Ptolemaeus (158km dia.) with the more recent crater Ammonias' (9km) prominent on its northern floor. Above this crater is the smaller crater Herschel (43 km) with it's slumped walls and complex infilling. Below Ptolemaeus is Alphonsus (121km) with its dark haloed craters. The crater Davy is the flooded 21km diameter crater near the inset image with Davy A on its southeastern (lower right) wall. The Catena can be seen as a string of craterlets just left of center to the northeast of the crater. The inset (spacecraft) image shows some of the craterlets in the chain that were named in 1974 during mapping of this area. Their sizes are:

| | |
|---|---|
| Susan | 1.0km |
| Osman | 2.0km |
| Priscilla | 1.8km |
| Alan | 2.0km |
| Delia | 2.0km |
| Harold | 2.0km |

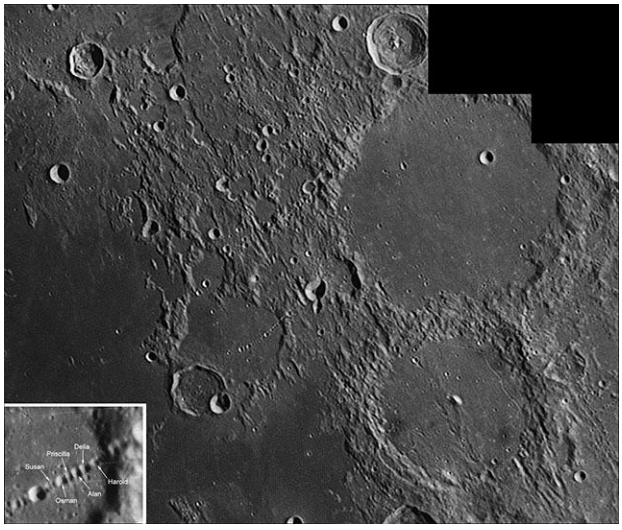


***FIGURE 1.*** ***CATENA DAVY*** *– Richard Hill – Tucson, Arizona, USA May 14, 2019 02:33 UT. Colongitude 27.0°. Seeing 9/10. TEC 8" f/20 Mak-Cass, SKYRIS 445M, 610 nm filter.*

All of them can be easily identified in this image. This catena is cited as an example of an impact of a tidally disrupted body, similar to the SL9 impact on Jupiter, but because of the much slower rotation of the moon they occurred much closer to each other.

# MORE MORETUS

## Rik Hill

I had clear skies and good seeing on the night of May 13/14 with a maximum libration at the lunar south pole. Now that's irresistable! I was off. A little orientation first. The large crater dominating the center of this image (fig. 1) is Moretus (117km diameter). To the upper right of that is the most polite crater on the Moon, Curtius (99km). Above this crater is Zach (73km) and forming a triangle to the east (right) with these two is Pentland (58km). Below and right of Curtius is Simpelius (71km) with a strong shadow lingering on its east side and below this is a smaller version of Moretus, Schomberger (88km).

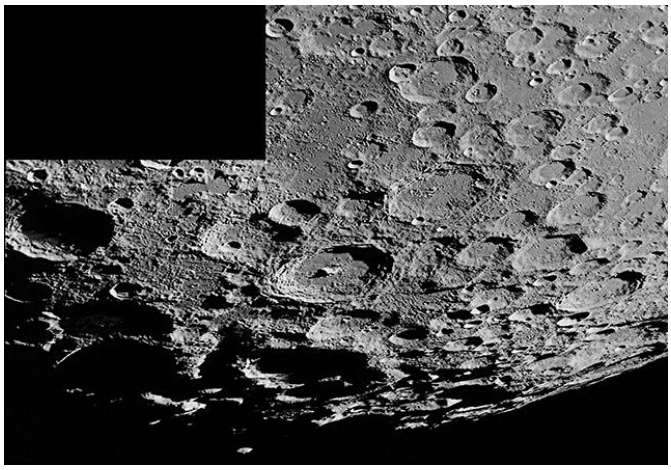

***FIGURE 1.*** ***MORETUS*** *– Richard Hill – Tucson, Arizona, USA May 14, 2019 02:12 UT. colongitude 27.0°. Seeing 9/10. TEC 8" f/20 Mak-Cass, SKYRIS 445M, 610 nm filter.*

Going back to Moretus, just to the south of this crater is another, Short (51km), with a smaller crater on its floor. Above Moretus is the mosly ruined Gruemberger (97km) and to its right the smaller Cysatus (51km), the same diameter as Short but it sure looks smaller to me! From Short we begin our trek to the polar regions. Below Short are three craters deep in shadow. In order from Short they are: Newton (82km), Newton G (67km) and Newton A (64km). Further on is one edge of a crater very deep in shadow. This is Cabeus (100km), the site where, in 2009, the LCROSS spacecraft looked for water in the lunar regolith when it passed through the plume created by the impact of its upper stage moments before. LCROSS then also impacted the Moon very close by in Cabeus.

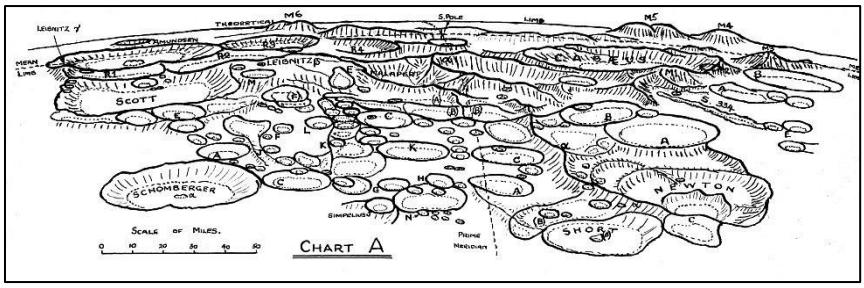


***FIGURE 2.*** ***SOUTH POLAR CHART*** *– Ewne Whitaker. .*

So what, I wondered, is the lone peak illuminated at the bottom of this image? After spending a good bit of time with the 1:1 Million-Scale Maps of the Moon online (which all lunar observers should bookmark), I've come to the conclusion that it's an unnamed peak near Cabeus B at long.-70, lat.-84 designated as M4 on the South Pole Chart A by Ewen Whitaker (fig. 2), almost exactly between Cabeus and Drygalski which is still in darkness here.

# TYCHO NW

## Rik Hill

Many of the glamorous features on the moon overshadow the interesting regions they occupy. Tycho is just such a feature. Here (fig. 1) you see the great 88km diameter crater in the lower right corner in all its majesty with a rubble strewn floor and well terraced walls. Notice how the surrounding area is splattered with secondary craters down to the limits of resolution, about 1.2 km in this image. Most particularly I would point out an enjoyable line of craters at 10 o'clock from Tycho stretching for over 100 km out across the surrounding terrain. The line points to Wurzelbauer D (38km) with a very straight edged shadow bisecting the crater. Wurzelbauer (90km) itself is the very ruined and ancient (pre-Nectarian age) crater above this crater aforementioned crater. Above Tycho is another large ruined crater, Sasserides (94km) covered with secondary craters and ejecta from Tycho. Above this near the top of the image is a crater of the same age with a central peak. This is Ball (43km) with muted terraced walls from the covering layer ejecta.

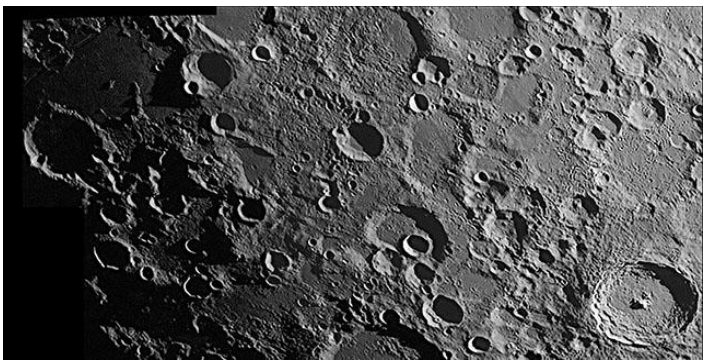

***FIGURE 1.*** ***TYCHO NW*** *– Richard Hill – Tucson, Arizona, USA May 14, 2019 02:25 UT. colongitude 27.0°. Seeing 8-9/10. TEC 8" f/20 Mak-Cass, SKYRIS 445M, 610 nm filter.*

Just below the middle of this image is what looks to be half a crater with another inside on its floor. This is Heinsius (66km), another ancient crater of pre-Imbrian age, very similar to Wurzelbauer. Left of this latter crater (due west) is a smaller deep crater Cichus (43km) casting nice shadows to the west into Palus Epidemiarum. Further west is the large shadow filled Capuanus (61km) on the south shore of the Palus. Notice the interesting triangular region east of Capuanus and south of Cichus. It's unnamed but has a very interesting rather sharp boundary of mountains on the north side.

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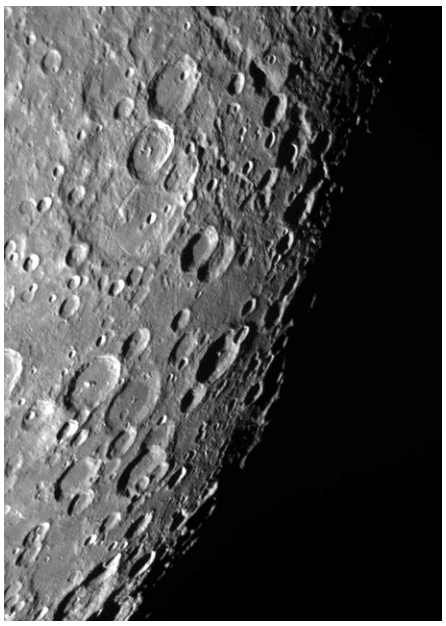
# JANSSEN AND FABRICIUS

## David Teske

The accompanying image is the first light of a new lunar telescope. It had been a most frustrating few months in the South with rain, clouds, and finally pollen. But finally, a good view of Luna. My attention turned to the southern highlands and the heavily cratered region around Janssen. Named after the French astronomer Pierre J. C. Janssen, who lived from 1824 to 1907, the giant complex crater of his namesake likely formed over 4 billion years ago by an asteroid impact 10 km in diameter. The resulting crater was about 200 km in diameter. Over the long course of time, Janssen's surface was impacted by secondary impacts that almost obliterated the crater, leaving only hints of its original wall. As such, it is difficult to recognize the crater except at sunrise and sunset. This wall is broken in many places and has indefinite boundaries in other regions, especially in the west. Its overall shape is hexagonal. Perhaps Janssen's unusual shape is due to the fact that Janssen sits upon an unnamed even more ancient ring of about the same size.

Probably the most striking about Janssen is Rima Janssen, an arcuate rille about 120 km long and 3 km wide. This rille appears to be a tension cracks it follows the track of the crater wall, but its actual origin is uncertain. This rille appears to be a graben that curves from the southwest wall of Janssen and attaches to the south wall of Fabricius. It is unusual in that it is a highland rille. The rille cuts through Fabricius ejecta and smooth plains on the floor of Janssen. Another rille extends from the base of the inner southern wall, curving slightly along its path, to meet the main rille.



The north floor of Janssen is cut by a 9 km wide eroded valley which appears to be a secondary impact structure, radial to the Nectaris Basin. The large and irregular mountainous plateau near the center of Janssen might be a giant slump block dislodged from Janssen's rim by the much later impact of Fabricius. The northern part of the rim is lower and rougher than the southern part of the rim.

**FIGURE 1. JANSSEN & FABRICIUS** - *David Teske, Louisville, Mississippi, USA, 22 April 2019 0456 UT. Colongitude 119.5°, Seeing 6/10, 180 mm Takahashi Mewlon, ZWOASI120mms.*

Janssen's walls are broken in the south by the bright-walled crater Lockyer with a light floor with much detail. The northern walls of Janssen are broken by Fabricius, a fresh looking, 78 km diameter crater with elongated central peak and a massive ridge on its floor. Its inner walls is horseshoe shaped, consisting of mountain ridges and landslides.

## 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 Hesiodus B & X.

SERGIO BABINO - MONTEVIDEO, URUGUAY. Digital image of Grimaldi.

FRANCISCO CARDINALLI - ORO VERDE, ARGENTINA. Digital images of Aristarchus(2).

JAIRO CHEVEZ - POPAYÁN,COLUMBIA. Digital images of full Moon(2).

MAURICE COLLINS - PALMERSTON NORTH, NEW ZEALAND. Digital images of 8, & 14(2) day Moon, Alphonsus(2), Clavius, Copernicus, Eratosthenes(2), Langrenus, Mare Humorum, Plato-Eratosthenes, southwest Moon,(2) & Tycho.

HOWARD ESKILDSEN - OCALA, FLORIDA, USA. Digital image of Vitruvius-Maskelyne.

MARCELO GUNDLACH – COCHABAMBA, BOLIVIA. Digital images of Alphonsus, Aristillus, Clavius, Copernicus(3), Doppelmayer, Grimaldi, Langrenus, Plato(2), Schiller, Sinus Iridum.

RICHARD HILL – TUCSON, ARIZONA, USA. Digital images of Apollo 11 site(4), Catena Davy, Moretus, Montes Apenninus, & Tycho.

DAVID JACKSON - REYNOLDSBURG, OHIO, USA. Digital image of waxing crescent Moon.

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

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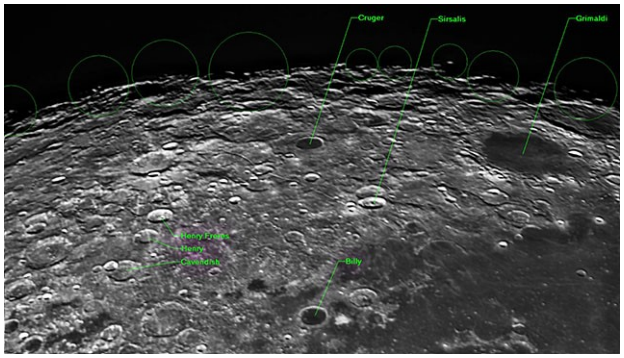
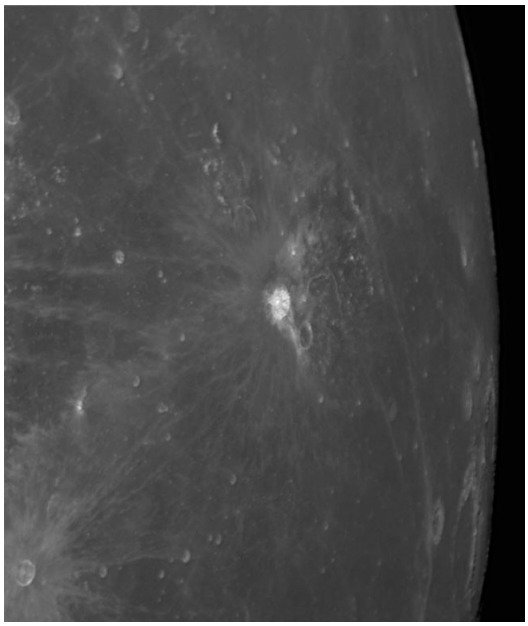
## RECENT TOPOGRAPHICAL OBSERVATIONS




**GRIMALDI** - Sergio Babino,- Montevideo, Uruguay. January 20, 2019 04:15 UT. 8" Astrotech RC. ZWO 174 MM.

# RECENT TOPOGRAPHICAL OBSERVATIONS



**ARISTARCHUS -** Luis Francisco Alsina Cardinalli, Oro Verde, Argentina, April 19, 2019, 02:10 UT, 105 mm Meade ETX-105 Mak-Cass, QHY5-II..

**FULL MOON** – Jairo Chavez,- Popayán Columbia. April 20, 2019 02:51 UT. 10" Dobsonian, Sony DSC-WX50.

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**ERATOSTHENES** - Maurice Collins,- Palmerston North, New Zealand. May 13, 2019 05:58 UT. FLT-110, f/14, ASI 120MC.

# RECENT TOPOGRAPHICAL OBSERVATIONS

**ALPHONSUS** - Maurice Collins,- Palmerston North, New Zealand. May 13, 2019 06:01 UT. FLT-110. ASI 120MC.

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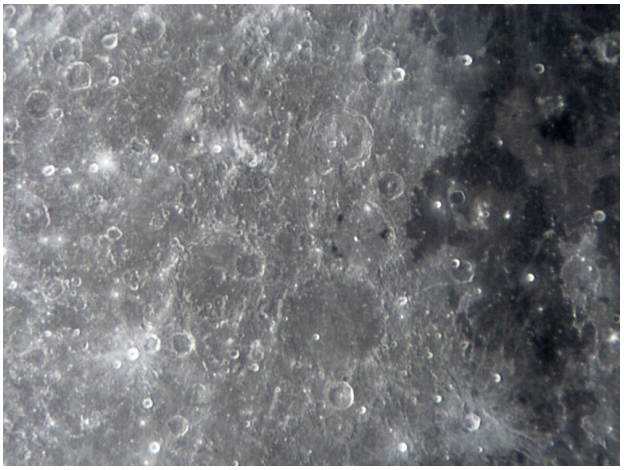
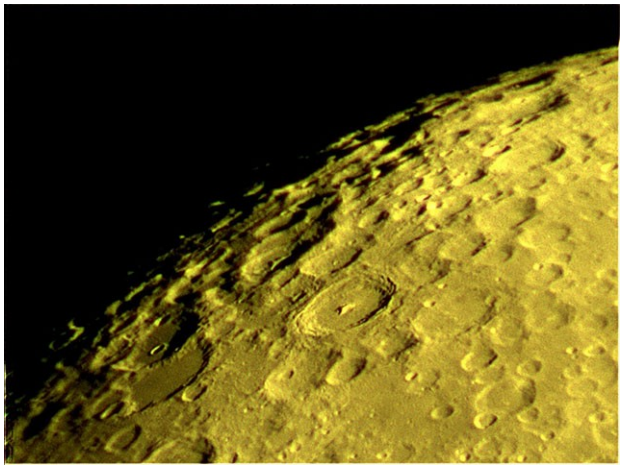


**ALPHONSUS** - Maurice Collins,- Palmerston North, New Zealand. April 17, 2019 10:01 UT. FLT-110. ASI 120MC.

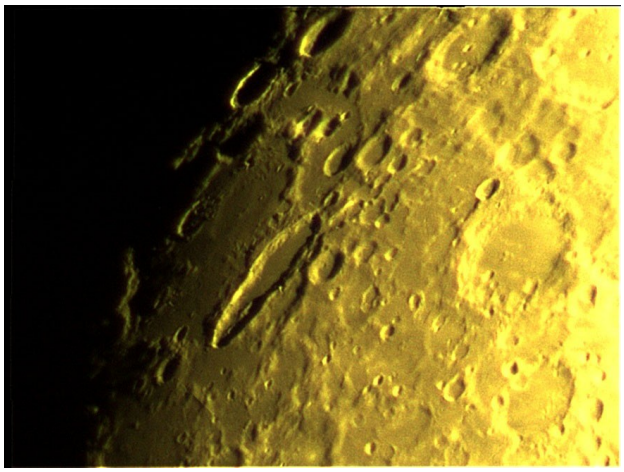
**VITRUVIUS-MASKELYNE**- Howard Eskildsen, Ocala, Florida, USA. April 24, 2019 09:45 UT. Seeing 6/10, transparency 4/6. 6" f/8 refractor, 2x barlow, W-8 yellow filter, DMK 41AU02.AS.

# RECENT TOPOGRAPHICAL OBSERVATIONS

**CLAVIUS** – Marcelo Gundlach, Cochabamba, Bolivia. May 14, 2019 05:02 UT. 150mm, refractor, ZWO 120..



**LANGRENUS** – Marcelo Gundlach, Cochabamba, Bolivia. May 16, 2019 02:54 UT. 150mm refractor, Orion V-block filter, ZWO 120..



**SCHILLER** – Marcelo Gundlach, Cochabamba, Bolivia. May 16, 2019 02:52 UT. 150mm refractor, Orion V-block filter, ZWO 120..

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**16% waxing CRESCENT MOON. -** David Jackson. Reynoldsburg, Ohio USA. May 9, 2019 21:14 UT. Orion XT-10, 30mm eyepiece, Google Pixel 2XL smartphone.

# BRIGHT LUNAR RAYS PROJECT

**Coordinator – Wayne Bailey – wayne.bailey@alpo-astronomy.org**
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**Bright Lunar Rays Website: http://moon.scopesandscapes.com/alpo-rays.html**

## RECENT RAY OBSERVATIONS

**COPERNICUS** - Maurice Collins,- Palmerston North, New Zealand. April 17, 2019 09:02-10:02 UT. FLT-110 f/14. ASI120MC North down.

**LANGRENUS** - Maurice Collins,- Palmerston North, New Zealand. MAy 19, 2019 10:39 UT. FLT-110 f/14. ASI120MC North down.

# LUNAR GEOLOGICAL CHANGE DETECTION PROGRAM

**Coordinator – Dr. Anthony Cook – atc@aber.ac.uk**

**Assistant Coordinator – David O. Darling - DOD121252@aol.com**

Reports have been received from the following observers for March: Jay Albert (Lake Worth, FL, USA - ALPO) observed: Aristarchus, Daniell, Kepler, Mons Piton, Plato, and imaged part of the western hemisphere of the Moon. Alberto Anunziato (Argentina – SLA) observed: Alphonsus, Aristarchus, Plato, Proclus and Ross D. Bruno Cantarella (Italy - UAI) imaged the Full Moon. Francisco Alsina Cardinali (Argentina – SLA) imaged Aristarchus. Jairo Andres Chavez (Columbia – LIADA) imaged: several features. Maurice Collins (New Zealand – ALPO/BAA/RASNZ) imaged: Alphonsus, Aristarchus, Bailly, Mare Humorum, Schickard, Tycho and several features. Marie Cook (Mundesley, UK – BAA) observed: Archimedes, Moltke and Plato. Tony Cook (Newtown, UK & Torrevija, Spain – ALPO/BAA) videoed earthshine, Mare Serenitatis and several features. Walter Ricardo Elias (Argentina - AEA) imaged: Alphonsus, Aristarchus, Montes Carpatus, Moretus, Plato, Proclus, Ross D, Torricelli B, Tycho and several features. Valerio Fontani (Italy – UAI) imaged the Full Moon. Rik Hill (Tucson, AZ, USA – ALPO/BAA) imaged Copernicus, Montes Alpes, Montes Apenninus, and Rima Hadley. Leonardo Mazzei (Italy – UAI) imaged the Full Moon. Jorgelina Rodriguez (Argentina – AEA) imaged Censorinus. Robert Stuart (Rhayader, UK – BAA) imaged: Agrippa, Aristarchus, Aristotles, Atlas, Barocius, Boscovich, Catherina, Cyrillus, Endymion, Eudoxus, Gemma Frisius, Hercules, Jacobi, Lade, Macrobius, Mare Nectaris, Mare Serenitatis, Maurolycus, Messier, Meton, Montes Caucasus, Piccolomini, Posidonius, Rupes Altai, Sacrobosco, Santbech, Theophilus, and several features. Aldo Tonon (Italy – UAI) imaged the Full Moon. Luigi Zanatta (Italy – UAI) imaged the Full Moon. Marcelo Zurita (Brazil - APA/BRAMON/SAB) videoed earthshine.

**LTP reports:** No LTP were observed in April.

**News:** NASA's LROC web site has revealed the location of Israel's crsashed Beresheet 1 lander: http://www.lroc.asu.edu/posts/1101 . It is still uncertain when the replacement Beresheet 2 will be made and launched – but perhaps in the next couple of years? I will be checking my videos (see last month's newsletter) again very carefully with the contrast turned up to see if I detected anything at this location (19.35°E, 32.60°N) which was different to the planned landing site.

Tim Haymes (BAA) forwarded me a copy of an old BAA Lunar Section Circular, which he had come across, from 1967 which had a report by Terence Moseley, Armagh, Northern Ireland. The report describes seeing a very bright flash in earthshine on the Moon at 04:20 UT on 1967 Sep 2, lasting about 3 seconds, approximately near to the crater Parrot. Terence was using a 10" refractor at x80 magnification. Could this have been a lunar impact flash Tim wonders? Unfortunately, we have no confirmation by a 2$^{nd}$ observer to verify this.

In May I attended European Lunar Symposium, held in Manchester, UK. Three items seemed to be of interest to us. You may have seen images of Atlas and Hercules in these newsletters quite a lot, what you may not know is that Hercules at least lies in a cold spot on the Moon. Not significantly cold, but slightly colder than what we would expect from the

surroundings. Cold spots are usually associated with young fresh craters, but this is not the case with Hercules. However, it does have a slightly higher radar reflectivity at 70 cm, perhaps related to layers of regolith 1-7m deep? Another talk was on transient lunar atmospheres – yes the Moon could have had these everytime it had episodes of volcanism – even so this would have been pretty tenuous at approximately one millionth of the Earth's. The average separation between these outgassing events, from past times when the Moon was more active, was approximately every 20-60 thousand years. Of course, even larger transient atmosphere events could have happened during major impact basin formations. The LROC team are examining some of the LROC wide Angle Camera images, looking for changes. Apparently one crater that formed during the duration of the mission (70m diameter), emitted ejecta that was spread radially over a distance of upto 100 km. However you need to use special phase difference image processing, or 415nm/643nm color ratio images to be able to detect this.

Lastly a paper has been published in Nature Geoscience on the 13th of May which has relocalised the epicenters of the 28 shallow moonquakes detected by the Apollo seismometers and have found that 8 of these lie within 30 km of known fault scarps. For this to happen by chance would have a probability of be less than one in twenty. NASA's LROC has found over 3500 of these fault scarps, and the fact that some of these show landslides or boulders and are relatively bright, infers that that a few may still be geologically active. How this relates to LTP activity is not discussed in the paper, but rocks grinding together can release gas such as Argon from within the minerals, and also Radon from the rocks deeper under the surface. Here on Earth quakes sometimes produce high voltages which hypothetically could lead to substantially increased charging of dust particles which then repel and levitate. Also quakes here on Earth have sometimes been associated with quake lights – however this may be a bit far fetched on the Moon as all current theories suggest an atmosphere is needed, which is clearly not present on the Moon now.

**Routine Reports:** Below are a selection of reports received for April 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.

**Censorinus:** On 2019 Apr 11 UT 22:47-00:02 Jorgelina Rodriguez (AEA) imaged this crater during two repeat illumination events (to within: ±0.5°) of the following:

> *On 1983 Apr 19 at 21:45UT M.C. Cook (Frimley, UK) reported that Censorinus' exterior white patch was grayish at this time and there was a "momentary glow outside the crater to the North West. The Crater Extinction Device brightness measurement for Censorinus was 4.0 whereas Proclus was 4.4. Cook was expecting a lower CED brightness measurement. Foley notes that Censorinus is usually brighter than Proclus. On 1983 Jan 29 Chapman obtained a very high brightness measurement for this spot. The Cameron 2006 catalog extension ID=212 and the weight=3. The ALPO/BAA weight=2.*
>
> *On 1987 Nov 27 at 20:56-21:12 UT M.C. Cook (Frimley, UK, seeing IV-V) saw spurious color on the Proclus floor and also on the rim. At 20:56UT Censorinus was quite dull and diffuse, spurious color but no blink. Cameron 1978 catalog ID=314 and weight=5. The ALPO/BAA weight, in view of the poor observing conditions is 2.*

As you can see from Jorgelina's image in Fig 1, there is no sign of a glow to the north west. But the crater cannot really be described as "dull", as in Marie's 1987 report. Instead it looks quite bright, though as Proclus is not in the same field of view it cannot be compared. Another image (not shown here) taken at 23:59-00:02UT is slightly less exposed, so Censorinus

is not saturated, and this shows that the crater is at least as bright as sunward facing slopes of craters out of the field of view in Fig 1. So we shall leave both these 1980's reports at a weight of 2 for now.

**Figure 1.** Censorinus as imaged by Jorgelina Rodriguez (AEA) on 2019 Apr 11 UT 22:47, using a Celestron CPC 1100, and orientated with north towards the top.

**Messier:** On 2019 Apr 11 UT 19:02-19:03 Robert Stuart imaged this crater under similar illumination (±0.5°) to the following Victorian era report:

> *Messier 1878 Nov 01 UT 20:00? Observed by Klein (Cologne, Germany, 6" refractor?) "Shaped like a half moon with E. edge missing. Appeared diffuse. Messier A was sharp & completely defined. Was sure there was fog there. Next day same appear. Shadow was diffused before noon, Mess. A is more yellow after noon, greener near Mess. A noon, both are same color." NASA catalog weight=4. NASA catalog ID #206. ALPO/BAA weight=2.*

We have covered this event before in the Jul 2018 newsletter (see p24) and determined that the description of the crescent shape is accurate and normal. But Bob's image, in Fig 2, is even sharper this time, showing part of the chevron pattern one gets with shallow approach impacts. A comment was made about this in the July 2018 BAA LSC editorial However we kept this on the LTP database because of the mention of color, but I think it would be appropriate to lower the weight to 1 and change the description accordingly to:

> *Messier 1878 Nov 01 UT 20:00? Observed by Klein (Cologne, Germany, 6" refractor?) " Mess. A is more yellow after noon, greener near Mess. At noon, both are same color." NASA catalog weight=4. Please observe this pair of craters in color and compare with noon and non-noon views. NASA catalog ID #206. ALPO/BAA weight=1.*

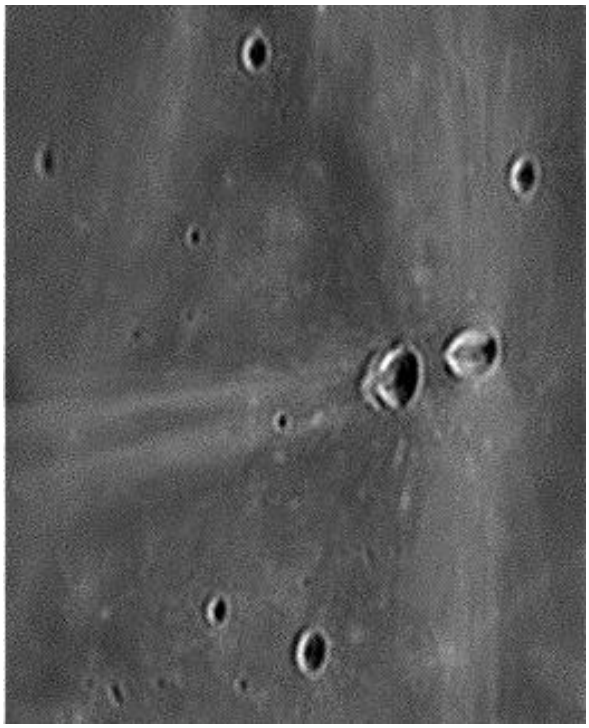

**Figure 2**. Messier and Messier A as imaged by Bob Stuart (BAA) on 2019 Apr UT 1958, orientated with north towards the top.

**Archimedes:** On 2019 Apr 12 UT 19:45-19:50 Marie Cook (BAA) observed this crater under similar illumination and topocentric libration (to within ±0.5°) to the following report:

> *Archimedes 1967 Jan 18/19 UT 23:00?-01:00? Observed by Delano (New Bedford?. Massachusetts, USA, 12.5" ? reflector) and by Corralitos Observatory (Organ Pass, NM, USA, 24" reflector + Moon Blink) "Saw an obscuration or unusual appearance on floor. Not confirmed by Corralitos MB., but their rep't says Aristarchus)" NASA catalog weight=4. NASA catalog ID #1009. ALPO/BAA weight=1.*

We have made a repeat illumination attempt on this 1967 report before in the 2012 Oct newsletter (see p14) and the image described in that newsletter is illustrated in Fig 3. Marie used a 90 mm Questar telescope at x80 & x130, under Antoniadi III seeing, but poor transparency. She notes that the floor was in shadow (full darkness), but the rim was sharp and clear, with no sign of an obscuration or an unusual appearance on the floor – everything was perfectly normal. A more detailed description of the supposed LTP observation by the Rev. Delano has been located in the BAA Lunar Section circular, Vol. 2, No. 5, p4 and I quote it here: *"On January 18 at 23.00 U.T. at col. 05.24, when the entire floor was in black shadow, there was no trace of fluorescent bands on Archimedes' floor. At this time the upper west (IAU sense) rim was entirely visible with my 12½" reflector at 300X under poor seeing conditions but with a very clear sky. Then next observed at 01.15 U.T. (Jan 19) at col. 06.38, I did detect three practically parallel light streaks on Archimedes' floor running from the base of the western wall to a little east of the middle of the crater. These faint bands of illuminosity though nearly parallel sided, seemed to taper to a point in the direction of the sun, which led me to believe that the bands were the results of the enfeebled light of the partially-obscured sun, which from the floor of Archimedes would be only partially visible between peaks on the east rim. This opinion was confirmed by*

*continued observations lasting until 1.45 U.T. during which time the luminous bands grew brighter and became clearly delineated as shafts of sunlight shining between peaks on the east rim onto the floor of Archimedes."*. So I think with Marie's visual report, and Rik's image, confirming the appearance at the start of the Delano description, and the statement that Delano did not see any signs of fluorescent bands, shows that that this should never have been in the Cameron LTP catalog in the first place, and we can safely remove this LTP from the ALPO/BAA LTP database by assigning a weight of 0.

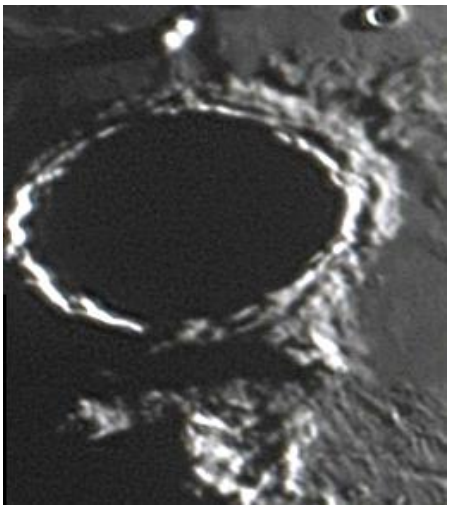

**Figure 3.** An archive image of Archimedes, cut from a larger regional image mosaic of "Archimedes to Cassini", taken by Rik Hill (ALPO.BAA) on 2012 Aug 25 UT 02:34 and orientated with north towards the top,

**Plato:** On 2019 Apr 13 UT 22:04 Walter Ricardo Elias (Argentina - AEA) imaged this crater under similar illumination to a Sky and Telescope report from 1952:

> *In 1952 Nov 26 at UT 01:00? Carle (USA, 8" reflector, x700, seeing = poor) observed the following in Plato: "Sketch shows 8 spots -- 5 craters showed interior shad., 1 completely filled, but no others seen despite several hrs. of study. Spots that should have been seen were missing. poor seeing converts floor into shimmering shapeless blob. Has observed it under good seeing & seen nothing on fl. as others have noted". The Cameron 1978 catalog ID=555 and weight=3. The ALPO/BAA weight=2.*

Upon consulting the text referring to Carle observation in the April 1955 edition of Sky and telescope, it contradicts the Cameron catalog account as it says that the seeing was actually really excellent! Anyway, the point is that Carle found it unusual that they did not see more craterlets on the floor of Plato (Fig 4 – Right). However, as you can see from Walter's image (Fig 4 – Left) you can barely see about three light spots (craterlets) on the floor – though the shadows inside the eastern rim agree very well between sketch and image. Variable numbers of craterlets on Plato's floor, although a common excuse for people to say that some sort of obscuration is taking place, can probably be explained by a combination of lack of image contrast by having too high magnification, atmospheric transparency issues, solar altitude, and seeing conditions – though the latter does not seem to be the case with Carle's report. Anyway, for now I will reduce the weight of this LTP to 1, as Walter's image shows that it can be difficult to see craterlets here at this colongitude.

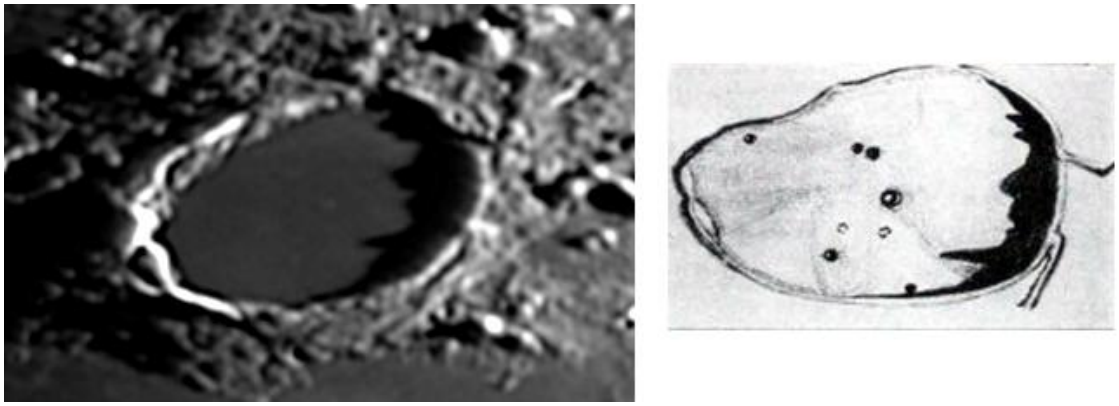

**Figure 4** Plato orientated with north towards the top. **(Left)** An image by Walter Ricardo Elias (AEA) taken on 2018 Apr 13 UT 22:04. **(Right)** A sketch by Jackson T. Carle made on 1952 Nov 26 UT under powers up to x700 under excellent seeing conditions – from Sky and Telescope April 1955, p222.

**Plato:** On 2019 Apr 13 UT 23:40-23:50 Alberto Anunziato (SLA) visually observed the crater under similar illumination to the following report:

> *On 1983 Apr 21 at UT 21:55-22:05 N. King (Winersh, Berkshire, UK, using a 150cm f/8 reflector, with seeing I and transparency good, little spurious color, just a little in Plato). Although observing since 21:25UT the observer noticed a just detectable very faint green color just after the dark shade around the inner eastern crater rim. The effect faded and by 22:05UT had completely gone. This report is not in the Cameron 2006 catalog. It is a BAA report. The ALPO/BAA weight=2.*

Alberto was using a 105 mm Maksutov-Cassegrain (Meade ETX 105 scope at a magnification of x154 – he reported "no color seen". We have covered this repeat illumination event before on p26 of the July 2018 newsletter. The weight shall remain at 2.

**Plato:** On 2019 Apr 14 UT 02:48 Rik Hill (ALPO/BAA) took an image of the Montes Alpes area, which included Plato just 22 minutes after the ±0.5° repeat illumination observing window for the following report:

> *Plato 1970 Nov 8 UT 01:31-01:47 Observed by Bartlett (Baltimore, MD, USA, 3" refractor x59-300) "Only crater A seen, all others obscured. Floor =3deg albedo, very smooth. A had a minute shadow & no obscur. On Nov. 22 1966 at nearly same colong. 5 spots incl. A were vis." NASA catalog weight=4. NASA catalog ID #1278. ALPO/BAA weight=2.*

Rik's image (Fig 5) certainly confirms that the floor looks pretty bland and smooth at this stage in the illumination. But what is slightly odd is that we cannot even see the central craterlet "A" on the floor of Plato, despite using an 8" reflector (2.7x the resolving power of Bartlett's refractor), having an image scale of 0.25"/pixel, and the seeing being pretty good at 8/10 on the Pickering scale. It was visible (just) in Walter's image (Fig 4) from over 4.6 hours earlier. I think I will reduce the weight of Bartlett's LTP from 2 to 1.

**Plato:** On 2019 Apr 16 UT 02:52 Jairo Andes Chavez (LIADA) took a whole Moon image which covered the repeat illumination and topocentric libration (to within ±1°) the following event:

> *Plato 1980 May 25 UT 21:33-22:54 Observed by North (Seaford, UK, seeing III-IV, 460mm Newtonian) Definite strong reddish glow along NNW border, definitely much stronger than spurious coloration and always visible when telescope moved in RA and Dec*

*to eliminate possible chromatic aberration effects in the eyepiece. Effect ended by 21:54 UT. BAA Lunar Section Report. ALPO/BAA weight=2.*

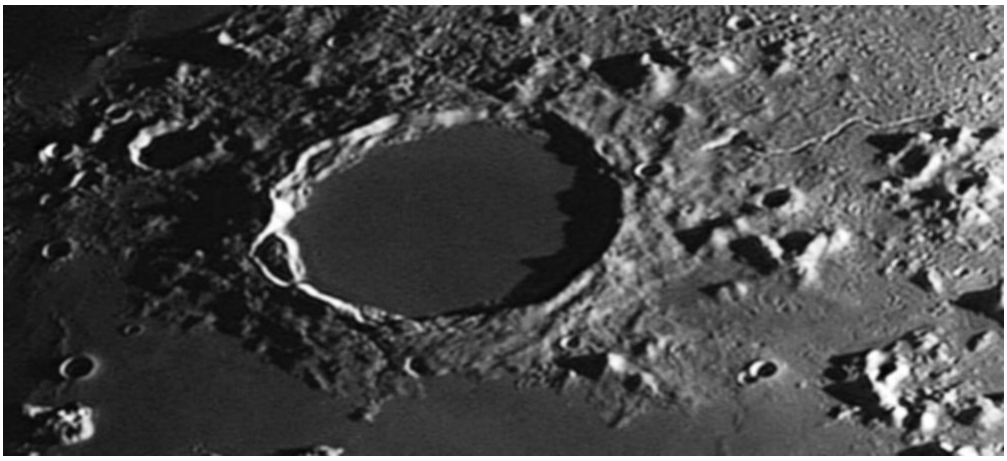

**Figure 5.** Plato from a much larger image of Montes Alpes, taken by Rik Hill (ALPO/BAA) on 2019 Apr 14 UT 02:48, with an 8" f/20 Mak-Cass, using a SKYRIS 445M camera with a 610nm filter. Image has undergone 1-pixel wide Gaussian smoothing. North is towards the top,

Jairo was using a 10" Dobsonian, but clearly no strong reddish glow is visible along the NNW border (Fig 6), so we should leave Gerald's LTP at a weight of 2, as reading though the archive copy of the original report, Gerald also noted that the effect had almost completely faded (indicates it was transient in nature) on the 25th by 22:24 – though atmospheric transparency had worsened.

**Figure 6**. Subsection of a larger image, showing the region around Plato, orientated with north towards the top with color saturation increased to 60%.

**Aristarchus:** On 2019 Apr 17 UT 02:05-02:30 Jay albert observed visually, and at 02:59 imaged the crater under similar illumination (to within ±0.5°) to the following report:

*Aristarchus 1972 Oct 19 UT 17:55-18:05 Observed by Gabriel (Wettern, Belg. 4" refractor, x166, S=E), Hitchens (Stamine Locks, Eng., 8.5" reflector, S=F), Peters (Kent, Eng., 10" reflector), Amery (Reading, Emg. 10?" reflector), Flynn (England, 12" reflector) "At 17:55h noted bluish-purple color area just N. of Aris. & it reached just over N. wall, lasted 2 min. At 1800h color noted again, but not as brilliant & gone at 1801h. Seen again at 1804h & now was on E. (ast. ?) wall, lasting M 1min. Sure of its reality but not of lunar origin. All gone at 1805h. Hitchens noted a very bright spot on W. (IAU?) wall between 2 prominent bands. Blue darkening in W#38 filter, neg. in W#8,25,58 & integrated light. Other areas gave similar but lesser effects. May be due to damp geletin. (Moore thinks not LTP but many obs. have rep't blue in Aris.) Others obs. later (2100, 2215-2300, 2305h) & noted nothing unusual." NASA catalog weight=2. NASA catalog ID #1346. ALPO/BAA weight=2.*

**Figure 7**. Aristarchus as captured with Jay Albert's (ALPO) iPhone held up to the eyepiece on 2019 Apr 17 UT 02:59. Color saturation has been increased to 60% and the image is orientated with north towards the top,

Jay's observation overlapped the first 5 minutes of this repeat illumination window, but the image in Fig 7 (from a larger regional image) was closer to the center of the observing window. Jay comments that *"Improved seeing of 5/10 showed Aristarchus to be sharply detailed with its central peak at the edge of the E wall shadow. Terracing on the W wall was clearly seen with the white patch mentioned in the LTP description visible on the middle of the W wall between two of the dark, vertical bands. There was no "bluish-purple" or other color seen just N of the crater, over the crater's N wall or anyplace else on or near the Aristarchus Plateau. The improved seeing permitted observation at 226x and 290x for the first time in this session. I observed Aristarchus from 02:05 to 02:30UT."* – Jay was using a Celestron NexStar Evolution 8" SCT under a haze-free, but partly cloudy sky. Transparency was 2nd magnitude and seeing was initially 3/10 gradually improving to 5/10 late in the session There is no purple blue color north of Aristarchus in Jay's image, despite having its saturation enhanced. It looks like the bright spot on the west wall is normal, although strangely we cannot see it during a repeat illumination occurrence that was described on p27 of the May 2018 newsletter. We shall leave the weight at 2.

**Herodotus and Aristarchus:** On 2019 Apr 17 UT 09:02-10:02 and 10:45 Maurice Collins imaged the lunar surface at similar illumination (to within ±0.5°) for these two events:

> *On 2016 Jul 17 UT 03:49 P. Zeller (ALPO, Indianapolis, IN, USA) imaged a pseudo-peak with shadow on the floor of Herodotus, however the image scale and quality of this color image were not great and the observer suspects that it might be an imaging artefact. ALPO/BAA weight=1.*
>
> *On 1978 May 19 P. Foley of Kent, UK, using a 12" reflector, seeing=III-II, noticed that initially that the crater was pretty dull and that the floor was a slate blue-gray in color at 22:45UT. A noticeable green spot inside the crater on the south east appeared at 22:25UT and vanished at 00:50UT. Cameron notes that one doesn't get green with spurious color. Crater Extinction brightness measurements were made at 22:00 UT (reading=2.8) and at 23:45UT (reading=3.7). The crater dropped in brightness from 3.7 to 2.8 at 23:50UT and remained lower until 3.0 at 23:50-03:15 UT. A graph was produced and showed Proclus and Censorinus at similar brightness's, but Aristarchus variable. The Earthshine was 0.3. Cameron 2006 Extension catalog ID=31 and weight=5. ALPO/BAA weight=3.*

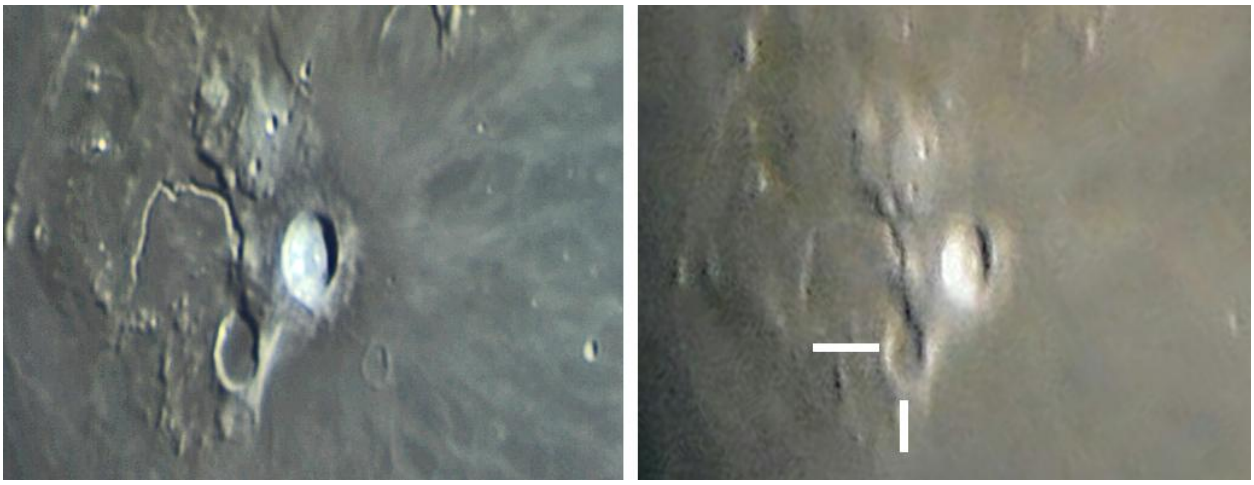

**Figure 8.** Aristarchus orientated with north towards the top. **(Left)** An image by Maurice Collins taken on 2019 Apr 17 UT 03:49 with color saturation increased to 50%. **(Right)** An image by Paul Zeller from 2016 Jul 17 UT 03:49, with white ticks indicating the location of a suspect pseudo peak shadow.

As you can see by comparing Maurice Collin's image (Fig 8 – Left) with the image of the suspected pseudo peak (Fig 8 – Right), no central peak exists on the floor of Herodotus. The most likely explanation for what we see in Paul's image is that it is just a bit of image noise, or perhaps even a speck of dirt on the CCD. However, we live in hope that one of these days a higher quality image of a pseudo-peak effect will be obtained as there are numerous visual accounts of one being seen here in the archives. We shall leave the weight of the Zeller LTP at 1 for now just in case there is the remotest chance that it is not image noise/dirt speck.

For the Foley LTP account – Maurice's image sort of shows a slate-blue color on the floor of Aristarchus – so this seems to be normal. The appearance of a green spot is not visible and for that reason, as it is quite difficult to replicate with atmospheric spectral dispersion, we shall leave the weight of the 1978 report at 3.

**Aristarchus:** On 2019 Apr 19 UT 02:08 and 02:10 Francisco Alsina Cardinali (SLA) imaged this crater under similar illumination (to within ±0.5°) to the following report:

> *Aristarchus, Cobra Head, 1969 Dec 23 UT 05:19-05:34 Observed by A.R. Taylor (Buckinghamshire, UK, 8.5" reflector, 240x, Wratten 25 and 80B) Strong blink in crater at 0519. All traces gone by 0534. Could only see in filters, Plato, Copernicus, Gassendi all normal. Obscur. also in Cob. Head." NASA catalog weight=4. NASA catalog ID #1230. ALPO/BAA weight=3.*

We cannot comment on the color seen by Taylor in 1969 as Francisco's image (Fig 9) is monochrome, however it could be used in future to investigate whether atmospheric spectral dispersion could be to blame. The image is also interesting because it is around Full Moon time, that the central peak of Aristarchus seems to really stand out in brilliance amongst all the other spots inside and exterior to the crater. For now we shall leave the weight at 3.

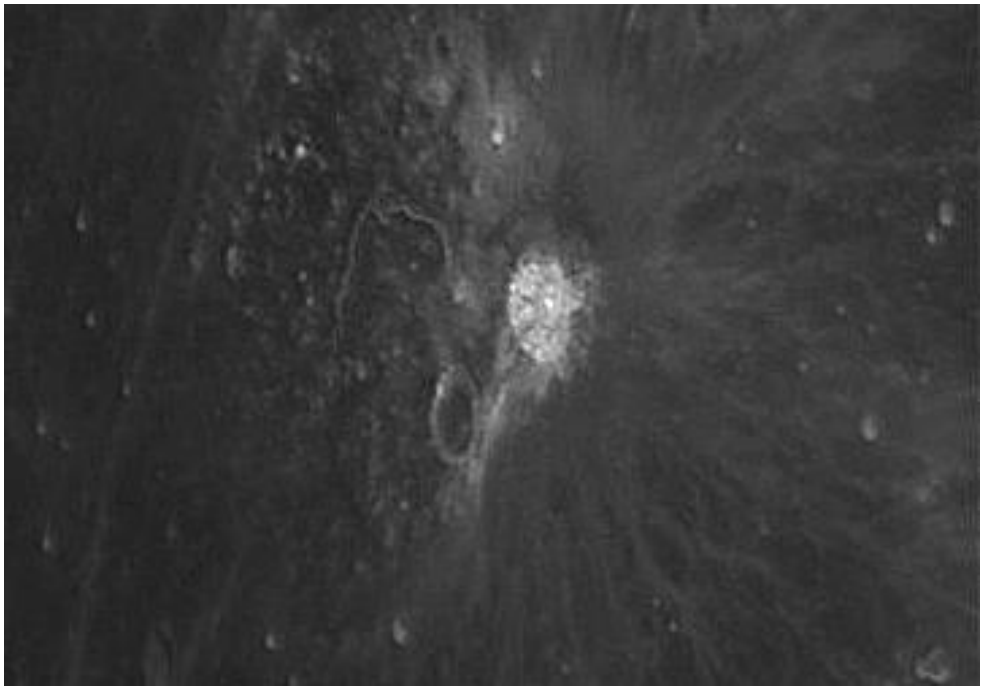

**Figure 9.** Aristarchus as imaged by Francisco Alsina Cardinali (SLA) on 2019 Apr 19 UT 02:08 and orientated with north towards the top.

**Full Moon:** On 2019 Apr 19 several observers carried out my request on the lunar schedule web site for images of the Full Moon, so that we could continue to get an idea of the relative apparent brightness of various bright ray craters. The reason why we do this is that there are numerous LTP reports from the past where an observer says that a particular crater was "brighter" or "duller" than normal. Indeed a visual device to help measure the brightness of craters was devised by (now professional astronomer) David Jewitt and was called a Crater Extinction Device (CED). CEDs worked by using a couple of disks of stepped neutral density filters. The idea was that observers used combinations of filters, one in front of the other, to eventually extinguish the crater from view. So, the brighter the crater, the higher density combination of filters were needed to extinguish from visibility. There was also an earlier visual brightness scale being used from 0 (darkest lunar shadow) to 10 (the bright central peak of Aristarchus), but this relies upon memory if a crater like Aristarchus is not visible at a particular phase. Anyway, the reason why we ask observers to image the Moon at close to Full Moon is that it is at this time the brightness reflects albedo (surface reflectivity) with no shadow, and the only other controlling factor will be viewing angle or topocentric libration. So it's a good way to check up on CED related LTP reports, at least during Full Moon. UAI observers: Bruno Cantarella, Valerio Fontani, Leonardo Mazzei, Aldo Tonon, and Luigi Zanatta took several images from which the relative brightness of several ray craters (Aristarchus, Censorinus, Copernicus, Hell (bright nearby patch), Kepler, Plato, Proclus, and Tycho) were measured. Their Digital Number (DN) brightness measurements from the images have been normalized, and then the craters ranked according to albedo. Where color images were provided, the green channel was always used.

The results, shown in table 1 show that the bright patch near Hell out reflects all the other craters in the list, though the standard deviation error bars do overlap between Hell, Proclus, Censorinus and Aristarchus. The crater with the largest brightness uncertainty was Censorinus –

no doubt because it is point like and the brightness changes with the image resolution used. This data is part of a longer term study we are doing into the relative brightness of craters near to Full Moon and how this varies with topocentric libration (viewing angle), or order top see if this can explain some past LTP reports where observers have claimed certain craters were brighter than normal.

| Feature | DN Value |
|---|---|
| Hell | 190 ± 8 |
| Proclus | 187 ± 16 |
| Censorinus | 177 ± 25 |
| Aristarchus | 175 ± 13 |
| Tycho | 167 ± 6 |
| Copernicus | 145 ± 5 |
| Kepler | 128 ± 9 |
| Plato | 73 ± 5 |

**Table 1** Relative brightness (Digital Number) rankings of several lunar craters using white light images or the green channel of color images. These measurements were taken from images supplied for 2019 Apr 19 UT20:50-21:56 by UAI astronomers: Bruno Cantarella, Valerio Fontani, Leonardo Mazzei, Aldo Tonon, and Luigi Zanatta.

**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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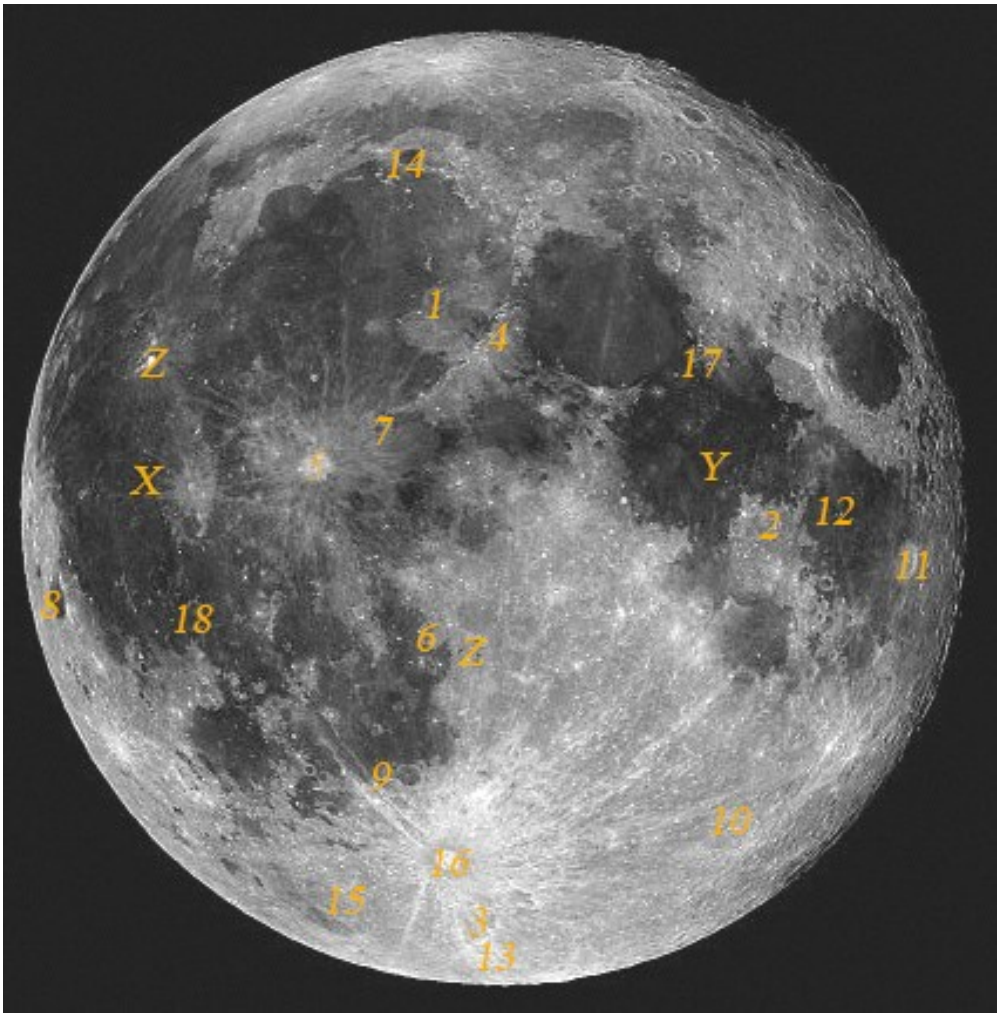
# KEY TO IMAGES IN THIS ISSUE

1. **Archimedes**
2. **Censorinus**
3. **Clavius**
4. **Conon**
5. **Copernicus**
6. **Davy**
7. **Eratosthenes**
8. **Grimaldi**
9. **Hesiodus**
10. **Janssen**
11. **Langrenus**
12. **Messier**
13. **Moretus**
14. **Plato**
15. **Schiller**
16. **Tycho**
17. **Vitruvius**
18. **Wichmann**




## FOCUS ON targets

**X = Apollo 12 Ocean of Storms**
**Y = Apollo 11 Sea of Tranquility**
**Z = Alphonsus & Aristarchus**