The Lunar Observer

A Publication of the Lunar Section of ALPO
David Teske, editor
Coordinator, Lunar Topographic Studies Section Program

September 2023

In This Issue

Mare Humorum and Gassendi, *Larry Todd, Dunedin, New Zealand. 2023 July 30 07:18 UT. 8 inch OMC Maksutov-Cassegrain telescope.*

Online readers, click on images for hyperlinks

ATTENTION ALL CONTRIBUTORS

First, it is a great honor to put together The Lunar Observer. I have been a member of the ALPO since 1994, and have always wished to do a project like this. But we are now overwhelmed by our success. This issue is 200 plus pages. That is not a newsletter, it is a book!

So, dear contributors, remember putting this together with your fine articles, drawings and images is a one person operation; mine. It takes me an hour for 8 images to download, process, place in TLO and in the ALPO Lunar Image Gallery, write-up and thank the contributor. This issue has 250 images. Lots of hours. I am greedy, I would like a little time off! So lets make it faster. Here is how:

1. **Make the image the way that you want it showing. Many images received are quite dark and need to be brightened in Photoshop or other photo processing programs. I think that the contributor could do this.**
2. **Please crop your images so that the edges are not jagged. This sharpens the look up much.**
3. **Please orient the image so it makes the most sense. I like north at the top and Mare Crisium on the upper right. It just makes more sense! To our many wonderful southern hemisphere contributors, please orient as you wish (south at top).**
4. **Please try to be very limited on end of the month submissions.**
5. **VERY IMPORTANT: THE DATE. Make sure I know the date and UT of observation, not local time. Please submit in the following format so I am not confused (October 3 or March 10, big difference and have to look it up n the Virtual Moon Atlas). IT THE RESPONSIBILITY OF THE CONTRIBUTOR TO HAVE THE CORRECT DATE AND UNIVERSAL TIME. FAILURE TO HAVE THIS GREATLY REDUCES THE SCIENTIFIC VALUE OF THE IMAGE.**
6. **Images should be submitted object name (spelled correctly)_year-month-day-hour-minutes-Your Name or initials-anything else you may want to include (telescope, filters, camera…(not necessary)). So for my image of Copernicus, it should have a file name of:**

Copernicus_2023-08-31-2134-DTe
means
Copernicus, 2023 August 31, 21:34 UT by David Teske

If we all do this going forward, it should make putting this all together faster and easier. Many of you already do this. Thank you for your contributions and your help. We have a premier lunar resource for the planet.

Lunar Reflections

Hoping all of out readers have had a positive month. Here is the Deep South of the USA, it has been another very hot and muggy month. Too muggy for lunar observing here! On the other hand, it has been very good for lunar observing in other parts of the world. Indeed, I present to you the very largest The Lunar Observer, ever! Coming in at xxx pages, it has been a monster to put together! But in its many pages, you will find many interesting articles, images and drawings of our nearest neighbor in the universe. Articles include by lunar expert John Moore about two newly named lunar craters. Raffaello Lena, our lunar dome coordinator and expert discusses whether domes in Lacus Veris are visible in telescopic images. Howard Eskildsen covers fascinating lunar topography with the concentric crater Crozier H and contrasting craters Atlas and Hercules. Rik Hill, our lunar guru, brings us on many guided tours of the Moon, including Albategnius, Langrenus and many floor-fractured craters. Jeff Grainger documents his studies of the floor-fractured craters Posidonius, Petavius and Gassendi. All of this leads us to this month's Focus-On topic, Floor-Fractured Craters, with an amazing article by Alberto Anunziato. Many thanks to all who contributed to this study with your articles, images, and drawings. As always, Tony Cook leads un on Lunar Geologic Change and Buried Basins and Crater. Plus, we had a spectacular turnout for images and drawings in the Recent Topographic Studies. Much thank you for all who contributed!

I encourage you if you haven't to contribute your lunar work here. You might want to give writing about your lunar forays a shot! There is so much to learn!

Many congratulations to the Indian Space Agency for their successful landing with Chandrayaan-3. We look forward to its discoveries near the lunar south pole. At the same time, condolences are in order for the Russian Space Agency with the failure of Luna-25. The Moon is still a most challenging target to visit.

Please remember to follow the future Focus-On topics and gather observations of these features. Next up is the very interesting Dorsa Smirnov. Observations are due to Alberto and myself by October 20, 2023.

Clear skies,

-**David Teske**

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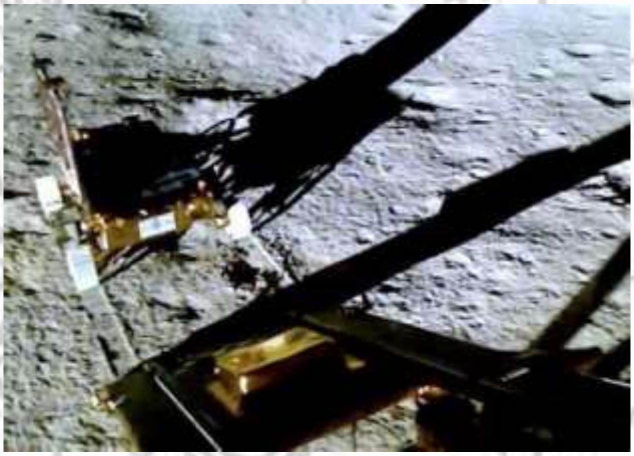

Lunar Topographic Studies

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Website: http://www.alpo-astronomy.org/

Observations Received

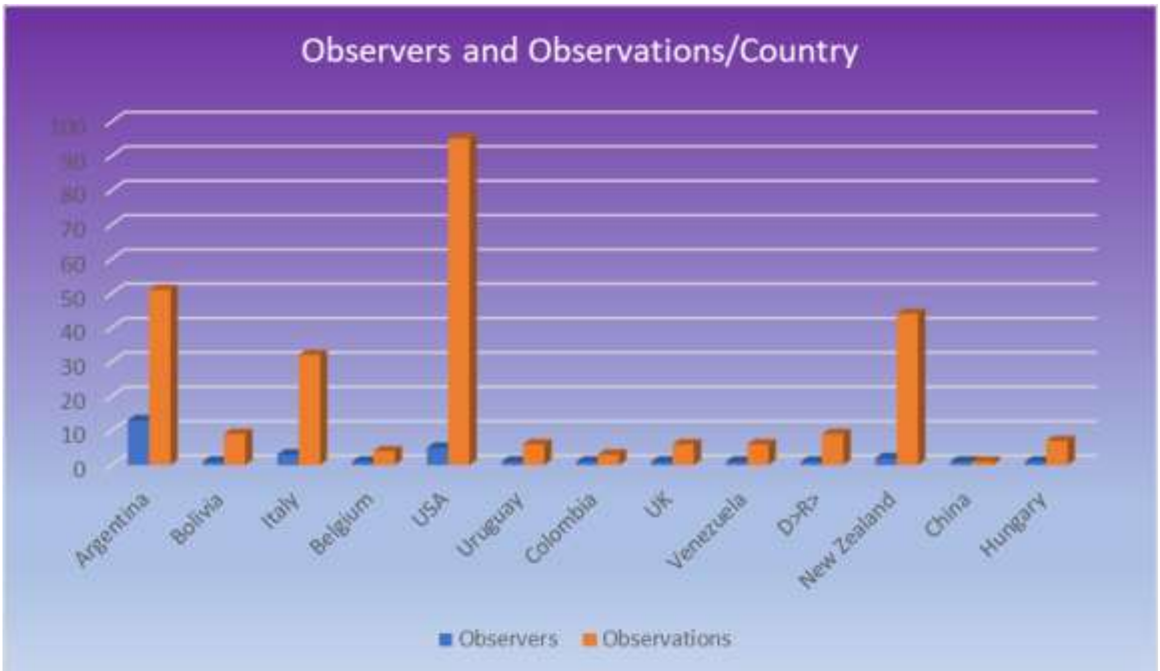
Name	Location and Organization	Image/Article
Alberto Anunziato	Paraná, Argentina, SLA	Article *Focus-On: Floor Fractured Craters*, images of Atlas (2), Petavius and Gassendi.
Sergio Babino	Montevideo, Uruguay	Images of Hercules, Posidonius, Goclenius, Bohnenberger, Fabricius and Langrenus.
Inez Beck	unknown	Drawing of Reiner Gamma.
Don Capone	Waxahachie, Texas, USA	Images of Hadley Rille, Eratosthenes, Straight Wall, Fracastorius, Theophilus, Janssen, Tycho and Posidonius.
Francisco Alsina Cardinalli	Oro Verde, Argentina, SLA	Images of Posidonius (2), Gassendi (3), Taruntius, Cassini, Colombo, la Condamine, Alphonsus, Thebit, Metius, Fracastorius, Campanus and Grimaldi.
Ariel Cappelletti	Córdoba, Argentina, SLA	Images of Cassini (2).
Jairo Chavez	Popayán, Colombia	Images of Cassini, Gutenberg and Fracastorius.
Marice Collins	Palmerston North, New Zealand	Images of Aristarchus (4), 14.5-day old Moon, 12.5-day old Moon, 12.6-day old Moon, Sinus Iridum, Schickard, 16.7-day old Moon (2), Rupes Recta, 8.9-day old Moon (2), Clavius, Copernicus, Mare Imbrium, Plato, Vallis Alpes, 12-day old Moon, 12.9-day old Moon, Mons Rümker and 14-day old Moon.
Leonardo Alberto Colombo	Córdoba, Argentina	Image of Gassendi.
Jef de Wit	Hove, Belgium	Drawings of Posidonius, Taruntius, de Gasparis and Gassendi.
Massimo Dionisi	Sassari, Italy	Images of Mare Undarum (4), Jansen, Lacus Mortis, Carrel, Posidonius, Aristoteles (2), Sinus Asperitatis, Ross, Arago, Aristillus (2), Manilius, Rima Hyginus and Archimedes.
Avril Elias	Oro Verde, Argentina, AEA	Images of Mons Piton and Mons Pico.
Walter Ricardo Elias	Oro Verde, Argentina, AEA	Images of Aristarchus (2), Moltke, Darwin, Gassendi, Mare Crisium, Mare Fecunditatis, Mare Frigoris, Mare Humorum, Mare Imbrium, Mare Nectaris, Mare Serenitatis, Mare Tranquillitatis, Proclus, Theophilus (2), Langrenus (2) and Jansen.
Howard Eskildsen	Ocala, Florida, USA	Article and image *Concentric Crater Crozier H, Atlas and Hercules* and images of Endymion, Yerkes dome,
István Zoltán Földvári	Budapest, Hungary	Drawings of Harlan, Banachiewicz, Kästner, la

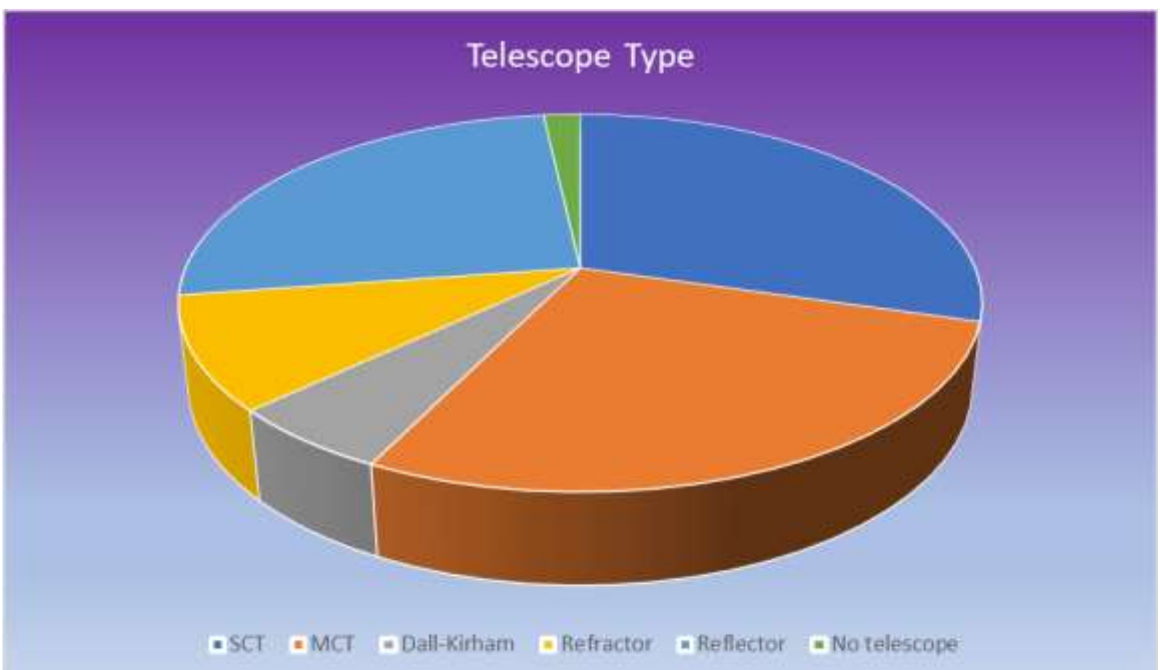
Many thanks for all these observations, images, and drawings.

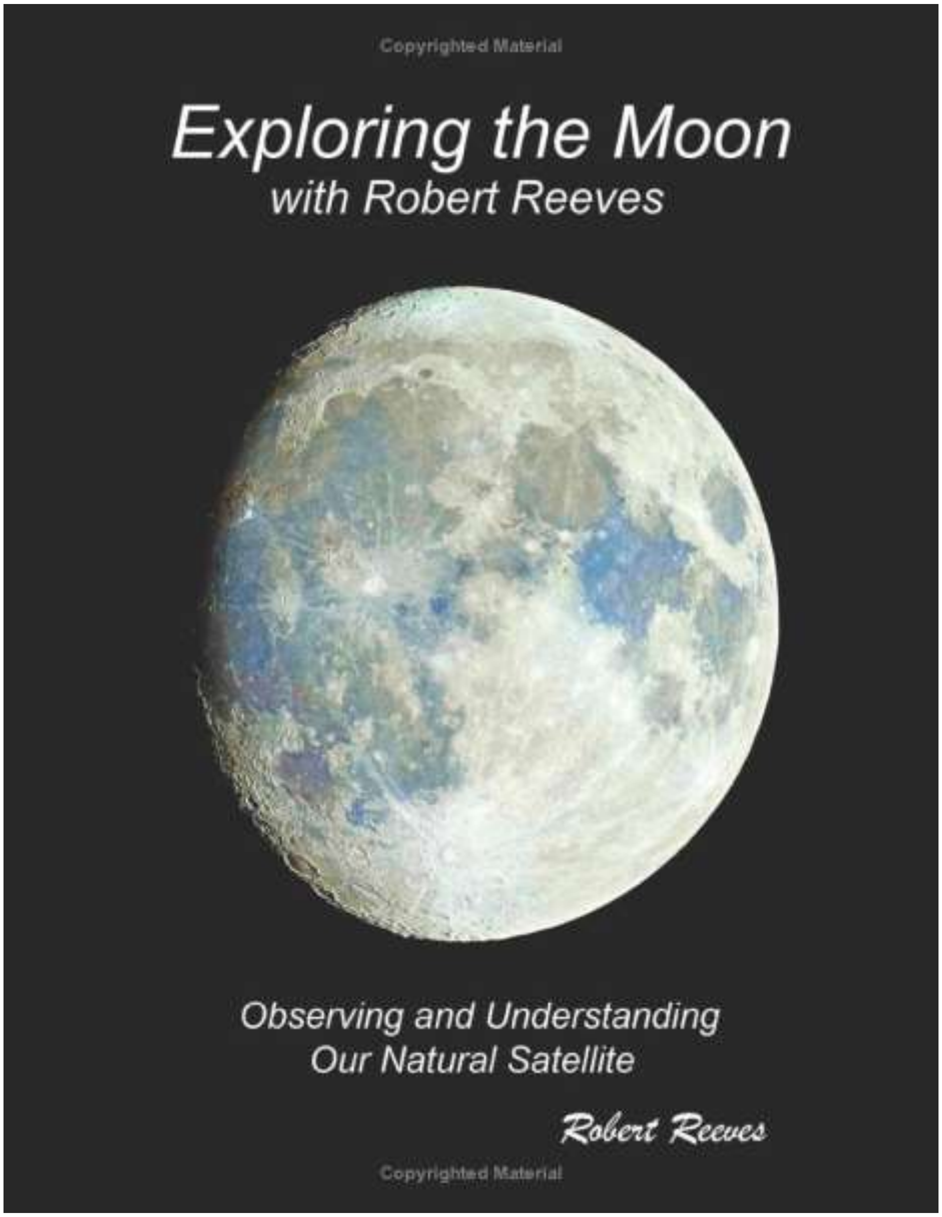
Name	Location and Organization	Image/Article
César Fornari	Oro Verde, Argentina	Image of Atlas.
Desiré Godoy	Oro Verde, Argentina, SLA	Images of Taruntius and Alphonsus.
Jeff Grainger	Cumbria, UK	Articles: *A Tour of Gassendi, A Tour of Petavius* and *A Tour of Posidonius*.
Marcelo Mojica Gundlach	Cochabamba, Bolivia	Images of Gassendi, Cassini (2), Alphonsus, Manilius, Janssen, Pitatus, Schiller and Bullialdus.
Anthony Harding	Northeast Indiana, USA	Images of Posidonius (2) and Ptolemaeus (3).
Rik Hill	Loudon Observatory, Tucson, Arizona, USA	Article and image *Breathtaking Terminator, North Crisium, Albategnius, Petavius, Posidonius,* images of Posidonius (12), Taruntius (2), Gassendi (8), Alphonsus (2), Atlas (9), Cassini (4), Mare Humorum (3), Janssen (3), Furnerius, Manilius, Petavius (11), Vitello and Pitatus.
Raffaello Lena	Rome, Italy	Article *Are the Domes in Lacus Veris Detectable in Telescopic Images?*
Felix León	Santo Domingo, República Dominicana	Images of Petavius, Gassendi, Messala, Reiner Gamma, Cleomedes, Fracastorius and Pitatus.
Ron May	El Dorado Hills	Images of the very old Moon (4).
John Moore	Ireland	Article *Two new crater names in Lunar Nomenclature– August 2023.*
KC Pau	Hong Kong, China	Image of Sinus Iridum.
Jesús Piñeiro	San Antonio de los Altos, Venezuela	Images of Atlas, Alphonsus (2), Mare Crisium, and Theophilus.
Erica Reisenauer	Oro Verde, Argentina	Image of Alphonsus.
Pedro Romano	San Juan, Argentina	Image of Posidonius.
Germán Savor	Oro Verde, Argentina	Image of Cassini.
Greg Shanos	Sarasota, Florida, USA	Images of Posidonius, Taruntius, Mare Crisium and the Super Moon.
Fernando Sura	San Nicolás de los Arroyos, Argentina	Image of Posidonius.
David Teske	Louisville, Mississippi, USA	Images of Hercules, Petavius, Mare Tranquillitatis (3), Gassendi (2) Mare Crisium (3), Mare Nectaris and Schickard.
Larry Todd	Dunedin, New Zealand	Images of Messier, Taruntius, Langrenus, Petavius, Atlas, Messala, Plato, Rümker (3), Schiller (2), Marius, Clavius (2), Mare Frigoris, Aristarchus (3), Mare Humorum (2), Wargentin and Pythagoras.
Fabio Verza	Milan, Italy, SNdR	Images of Atlas, Posidonius (3), Albategnius, Montes Caucasus, Mare Crisium, Maurolycus, Mare Nectaris, Scoresby, Proclus, Theophilus and Vallis Alpes
Ignacio Villarraza	San Nicolás de los Arroyos, Argentina	Image of Atlas.

September 2023 *The Lunar Observer*
By the Numbers

This month there were 273 observations by 34 contributors in 13 countries.







David, the long-anticipated resource by Robert Reeves, titled Exploring the Moon with Robert Reeves has just been released on Amazon.

It is available in Kindle format, soft cover and hard cover.

I bought both Kindle and Hard Cover.

I must say the images and prose are next to none in quality and information.

It's a must have for any of us in ALPO and especially in the Lunar Section.

Can you share this, post it or tell me how I might do so?

Of course, I am not Robert Reeves, nor being paid or otherwise compensated for saying so. I asked this question in last year's ALPO Virtual Conference looking for resources...

Thanks!

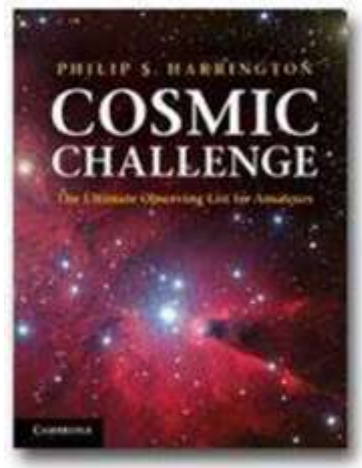
John Sillasen ALPO member

Lunar X and V Visibility 2023

Submitted by Greg Shanos

Table 4.3 Lunar X and Lunar V Visibility Timetable

	2023
Jan	29; 00:37
Feb	27; 15:02
Mar	29; 04:59
Apr	27; 18:10
May	27; 06:28
Jun	25; 18:02
Jul	25; 05:07
Aug	23; 16:07
Sep	22; 03:26
Oct	21; 15:27
Nov	20; 04:23
Dec	19; 18:16



Note: The dates and times listed are based on calculations made with the Lunar Terminator Visualization Tool (LTVT) by Jim Mosher and Henrik Bonda. This useful freeware program may be downloaded from https://github.com/fermigas/ltvt/wiki.

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Breathtaking Terminator

Rik Hill

It's a magnificent sight when these three craters are on the terminator: Petavius (182 km dia.) with its grand rimae at bottom, Vendelinus (151 km) still deep in shadow above and at top the great Langrenus (136 km) with its central peak's sunset shadow climbing the wonderful terraces of the eastern wall. To the west of these last two craters, we see the plain of Mare Fecunditatis.

Above Petavius is the crater Wrottesley (60 km) a little younger than the former, then on either side of Wrottesley you can see ejecta splashed out from the great Petavius impact. Below and left of Petavius are two craters, first Snellius (85 km) of Nectarian age and below it the younger Stevinus (77 km) with its crescent shaped central peak. But notice the thin winding vallis that ends in a small crater below both of these near the edge of this image. This is Vallis Snellius as long as 600 km (depending on the source) and as wide as 15 km at its widest. It is said to be the longest vallis on the moon but certainly not the most visible!

Petavius to Langrenus, *Richard Hill, Loudon Observatory, Tucson, Arizona, USA. 2023 January 09 00:12 UT, colongitude 117.2º. TEC 8 inch f/20 Maksutov-Cassegrain telescope, 610 nm filter, SKYRIS 132M camera. Seeing 8/10.*

Lunar Topographic Studies
Breathtaking Terminator

Two New Crater Names into the Lunar Nomenclature August 2023

John Moore

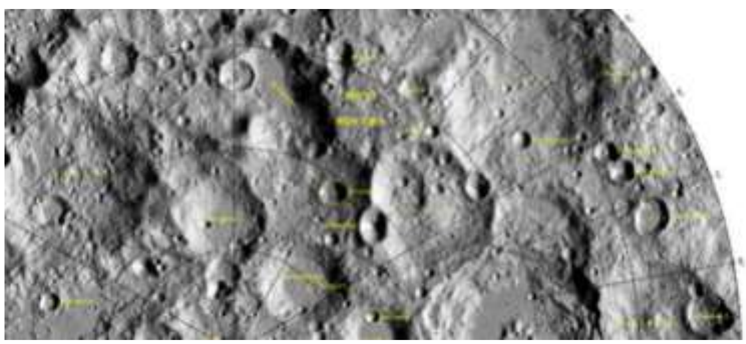
We have two new crater names added into the official lunar nomenclature: crater **Burbidge** (Lat -86.35S Long 48.60E, Diameter 21.00km) and crater **Floss** (Lat -84.28S Long 42.27E, Diameter 9.0km).

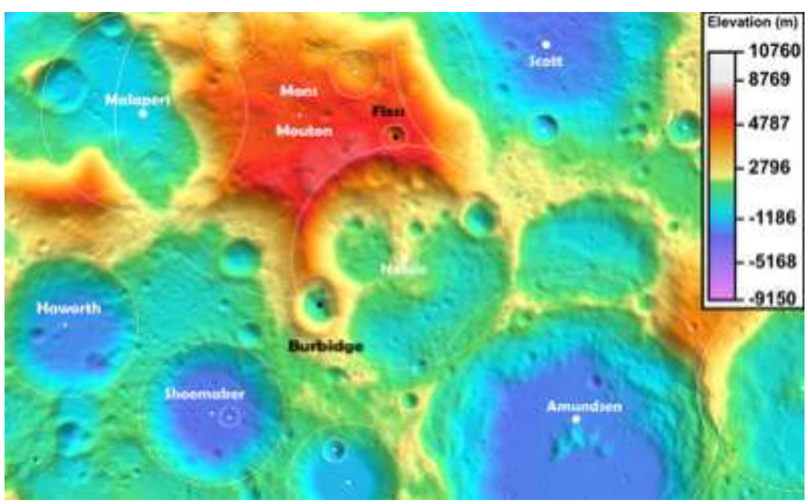
Burbidge is, as you mention, in honor of *Eleanor Margaret Burbidge* (1919-2020), but also of Geoffrey Burbidge (1925-2010), second author (after E. Margaret) of the landmark scientific paper *"Synthesis of the Elements in Stars*." (a free PDF file).

Floss is in honor of *Christine Floss* (1961-2018) an American cosmochemist.

Both are located at the South Pole region of the Moon, and so will prove a challenge to see; as with most craters that lie near the limb. Good luck in trying to capture decent views, as I suspect you will need some favorable North-South librations.

Below, a view from the *LAC 144*, and a color-photographic view (created using LTVT).





Lunar Topographic Studies

Are the Domes in Lacus Veris Detectable in Telescopic Images?

Raffaello Lena

In a previous note (Lena, 2023) I have described Lacus Veris, Lacus Autumni and Schlüter crater. Following my request, some images of these regions have been submitted by Robert Cazilhac. These interesting images are shown in Figures 1 and 2 but, unfortunately, the times in UT are not available.

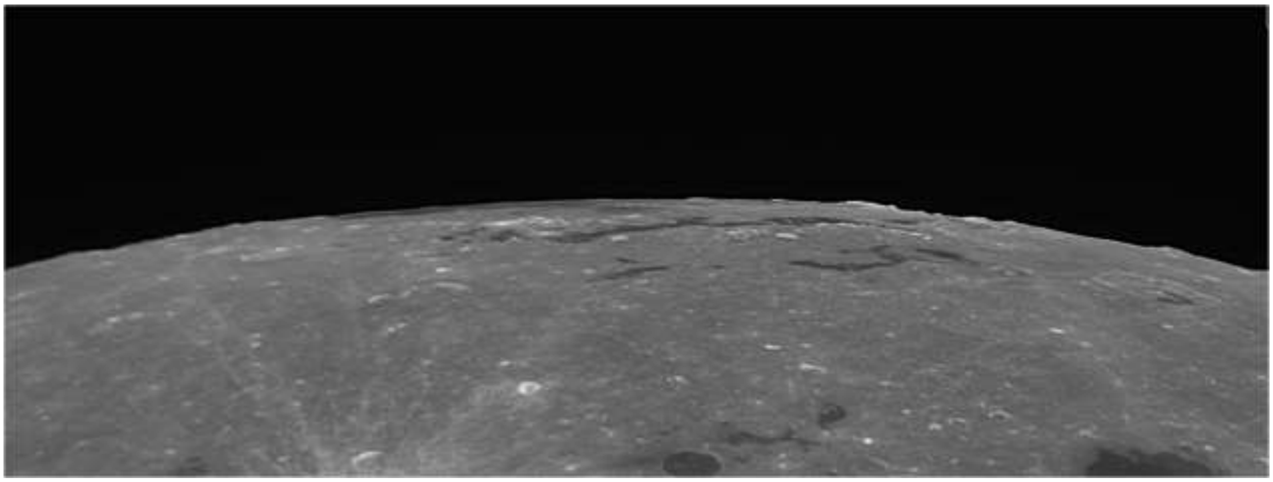


Figure 1: Image taken by Cazilhac on February 28, 2021. Telescope Schmidt Cassegrain 30 cm.

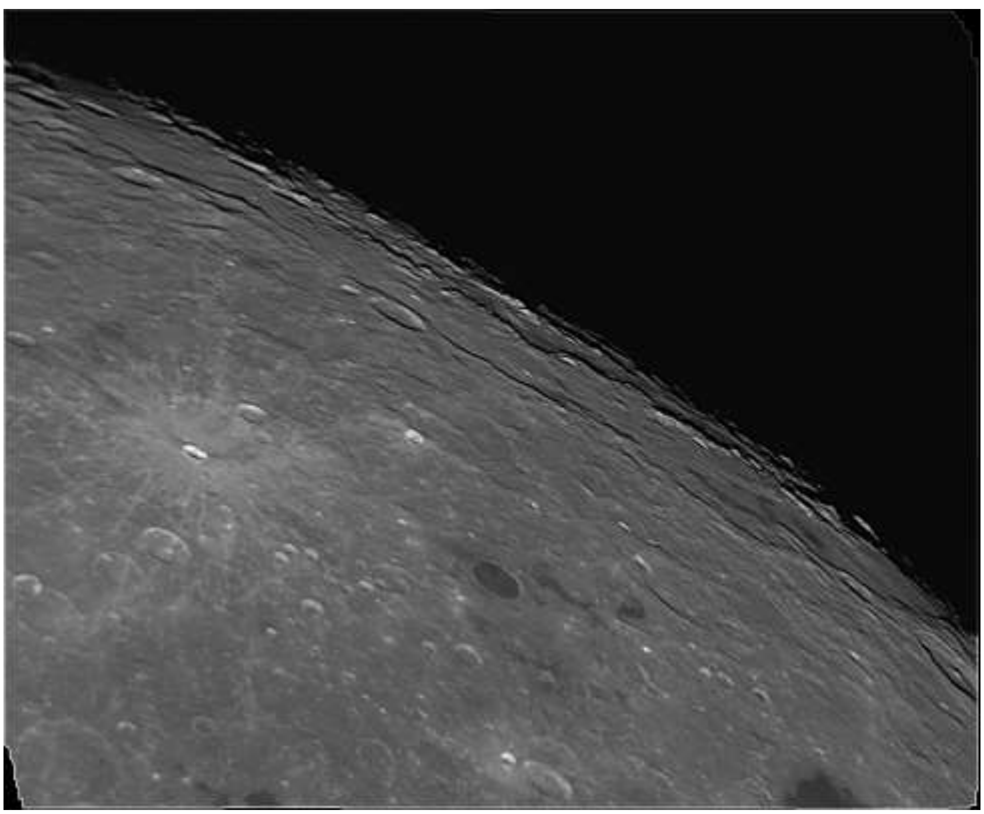


Figure 2: Image taken by Cazilhac on February 27, 2021. Telescope Schmidt Cassegrain 30 cm.

The dome Kopff 1 (Ko1) lies in Lacus Veris to the north of a plateau or two features like domes (identified with x). Fig. 3 displays the mentioned domes.

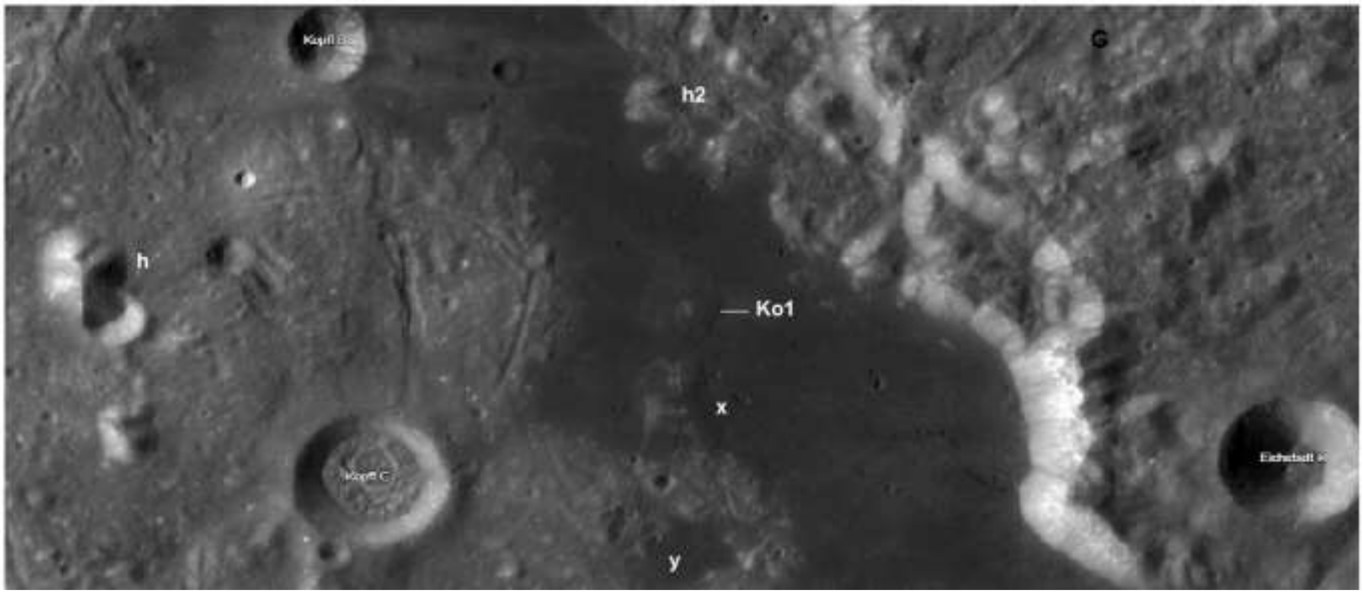


Figure 3: WAC imagery of the region of interest. The dome termed Kopff1 (Ko1) is located to the north (up) of an elongated swell (marked with the symbol x). In the image are marked some topographic points (h, h2 and y).

The images reported in Figures 1 and 2 have been studied using several lunar atlases, LRO WAC /NAC imagery, cylindrical projections and topographic benchmark (Fig. 3).

Results for the lower resolution image of February 28, 2021

Fig. 4 displays the transformed image which was corrected in various ways with a zenithal view (4C and 4D).

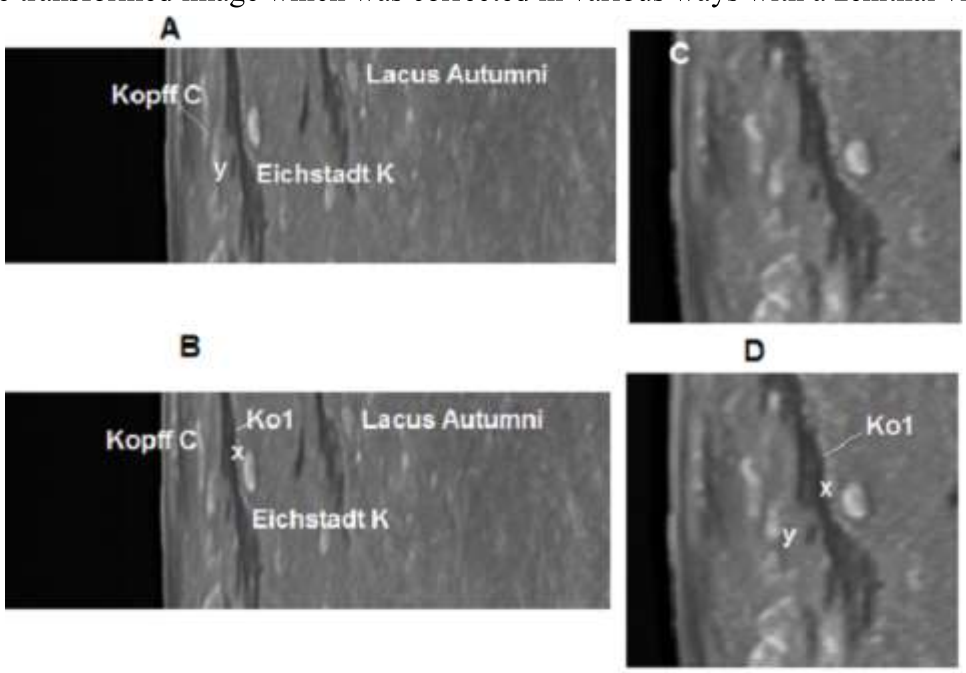


Figure 4: Results based on the image taken on February 28, 2021.The swell (x) and Ko1 are marked.

The dome Ko1 and the swell x are detectable like two bright spots. Superimposition and analysis carried out using WAC imagery confirm their position.

Results for the image of February 27, 2021

Fig. 5 displays the transformed image taken on February 27, 2021 which was corrected in various ways with a zenithal view (5E and 5F).

Based on this higher resolution image, and some topographic benchmark, Ko1 most likely was imaged but new images are recommended in Hires and with precise time (date and time in UT) to try other measurements and comparison.

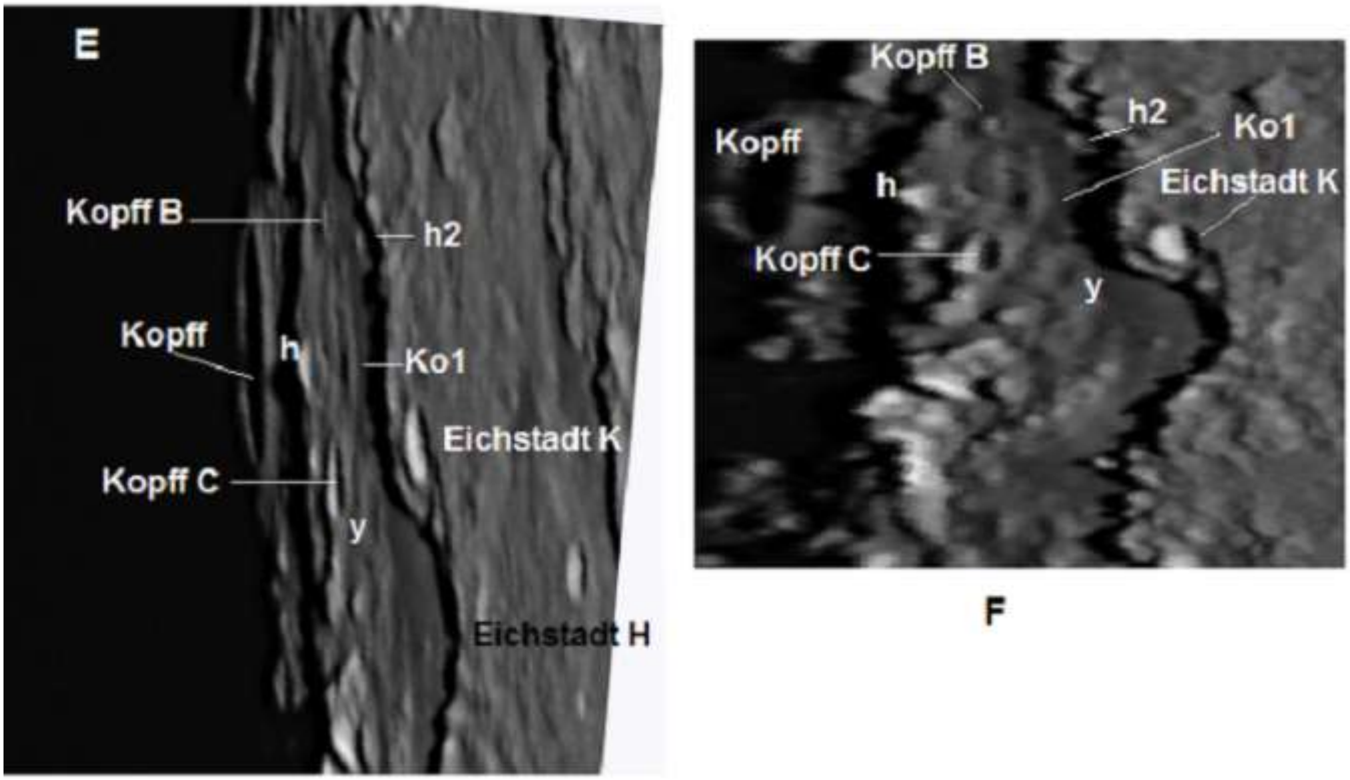


Figure 5: Results based on the image taken on February 27, 2021.The probable position of Ko1 is marked, perhaps unresolved with the swell x.

Lacus Veris lies between the ring-shaped inner and outer Rook Mountains that form part of the Orientale impact basin. Mare Orientale was created by an impact of a huge meteorite that lifted the mountains bordering the basin. The Mare Orientale is surrounded by two mountain ranges, one internal, more than 700 kilometers in diameter, the Montes Rook and the other external, more than 900 kilometers, the Montes Cordillera (Greeley, 1976).

Volcanism in Lacus Veris and identified domes

Volcanic phenomena have occurred in these regions with the formation of lava plain and also lunar domes (in Lacus Veris near the crater Kopff). During a recent survey I have identified four domes under investigation (Fig. 6). This study, including spectral data, is ongoing.

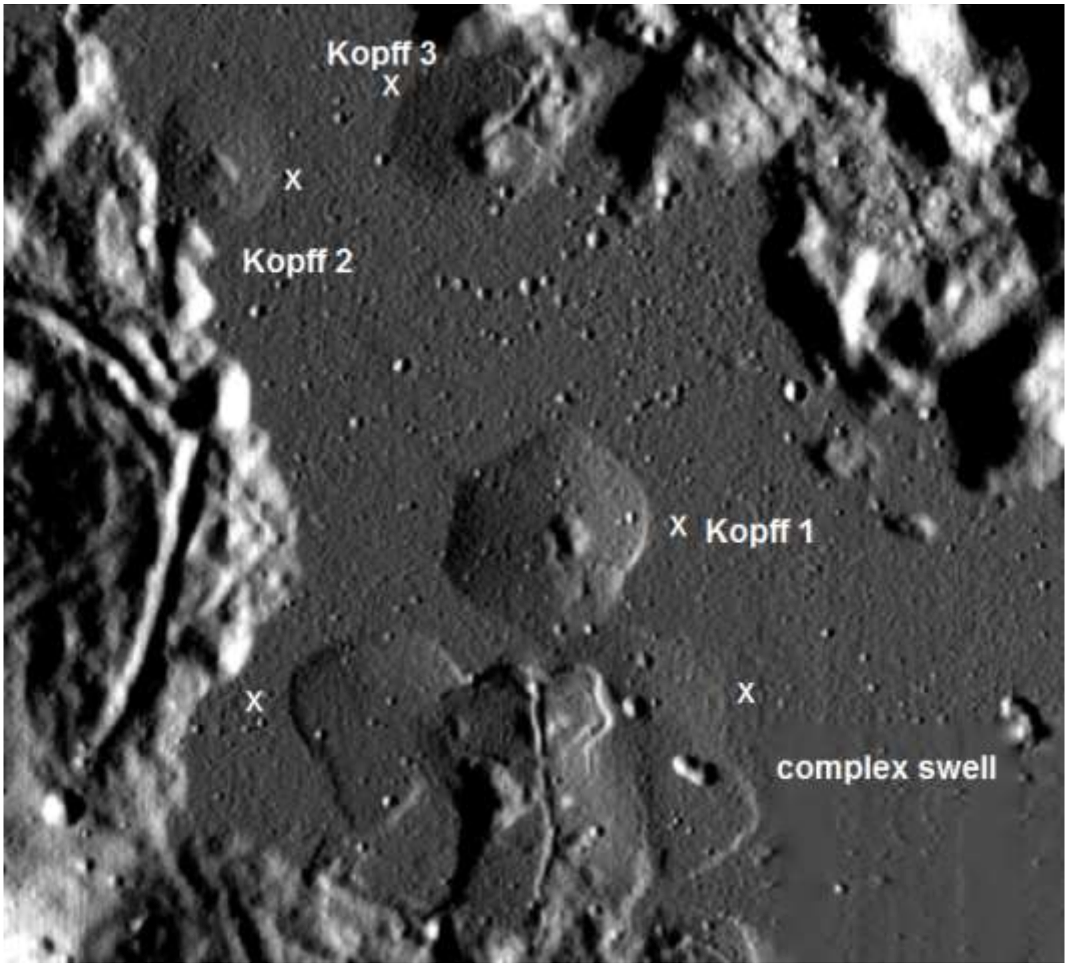


Figure 6: Lacus Veris, WAC imagery. Identified domes are marked with the symbol x.

Kopff 1: The first examined dome termed Kopff 1 lies at coordinates 17.76° S and 85.25° W, with a diameter of 7.3 km. Kopff 1 is 165 m high with an average flank slope of 2.6°. In the summit is embayed a non volcanic hill, rising for 60 m. Thus, Ko1 is 220m higher than the mare (Fig. 7). The edifice volume, computed assuming a parabolic shape, is determined to 3.4 km^3. The rheologic model applied to Ko1 dome yields a low effusion rate of 54 m^3 s^{-1} and a high lava viscosity of 3.1 x 10^6 Pa s, computed based on a lava density of 2800 kg m^{-3}. It formed over a period of time of about 2.0 years.

The 3D reconstruction of Ko1 is shown in Fig. 8.

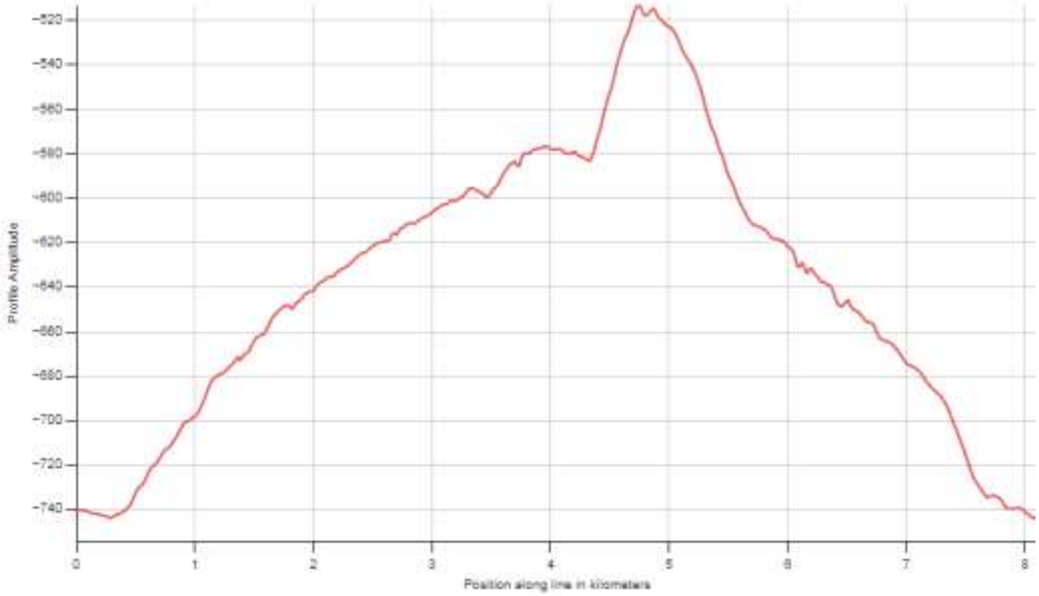


Figure 7: LRO WAC-derived surface elevation plot of an east to west cross-section of the dome Kopff 1.

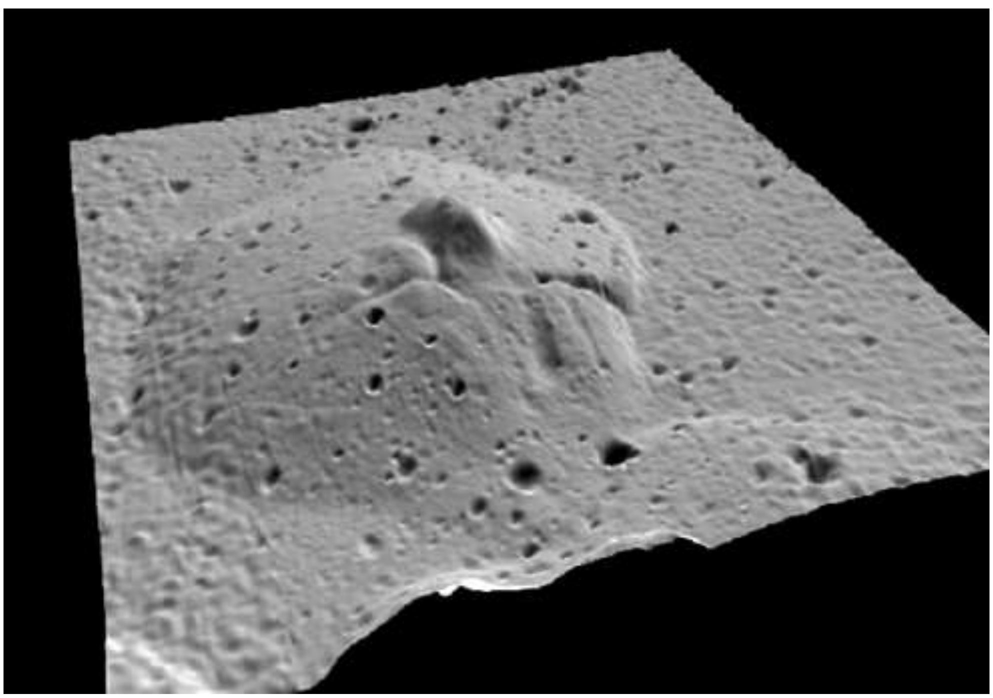


Figure 8: 3D reconstruction of Kopff 1. The vertical axis is 7 times exaggerated. Some rilles are located on its summit.

Kopff 2: The dome termed Kopff 2 lies at coordinates 17.29° S and 85.70° W, with a diameter of 5.6 x 5.2km. Kopff 2 is 45 m high with an average flank slope of 0.9°.

In the summit is embayed a non volcanic hill, rising for 50 m (Fig. 9). The edifice volume, computed assuming a parabolic shape, is determined to 0.5 km^3. The rheologic model (Lena et al., 2013) applied to Ko1 dome yields a low effusion rate of 112 m^3 s^{-1} and a lava viscosity of 1.2 x 10^4 Pa s, computed based on a lava density of 2800kg m^{-3}. It formed over a period of time of about 0.15 years.

Lunar Topographic Studies
Are the Domes in Lacus Veris Detectable in Telescopic Images? R. Lena

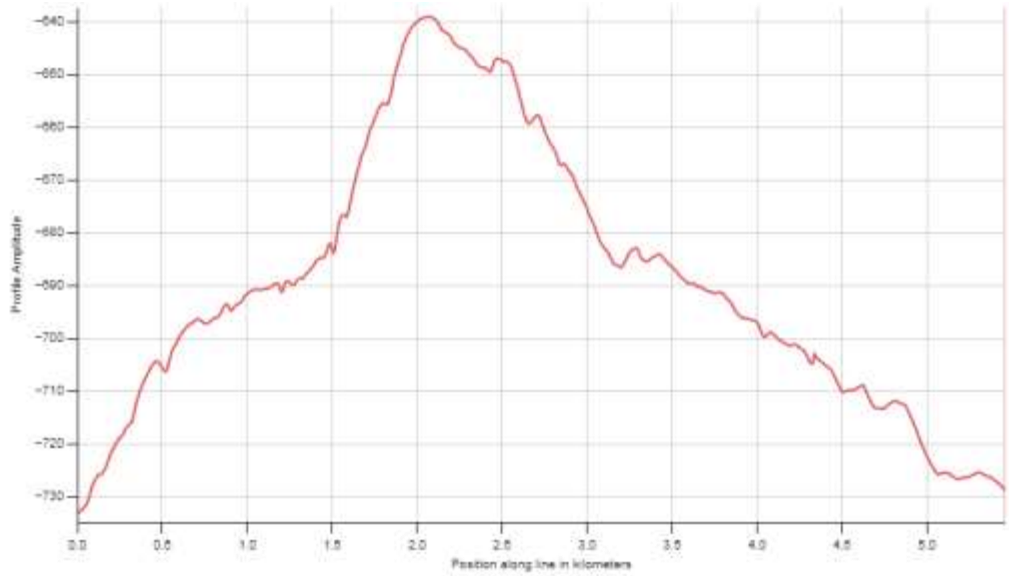


Figure 9: LRO WAC-derived surface elevation plot of an east to west cross-section of the dome Kopff 2.

The 3D reconstruction of Ko1 is shown in Fig. 10.

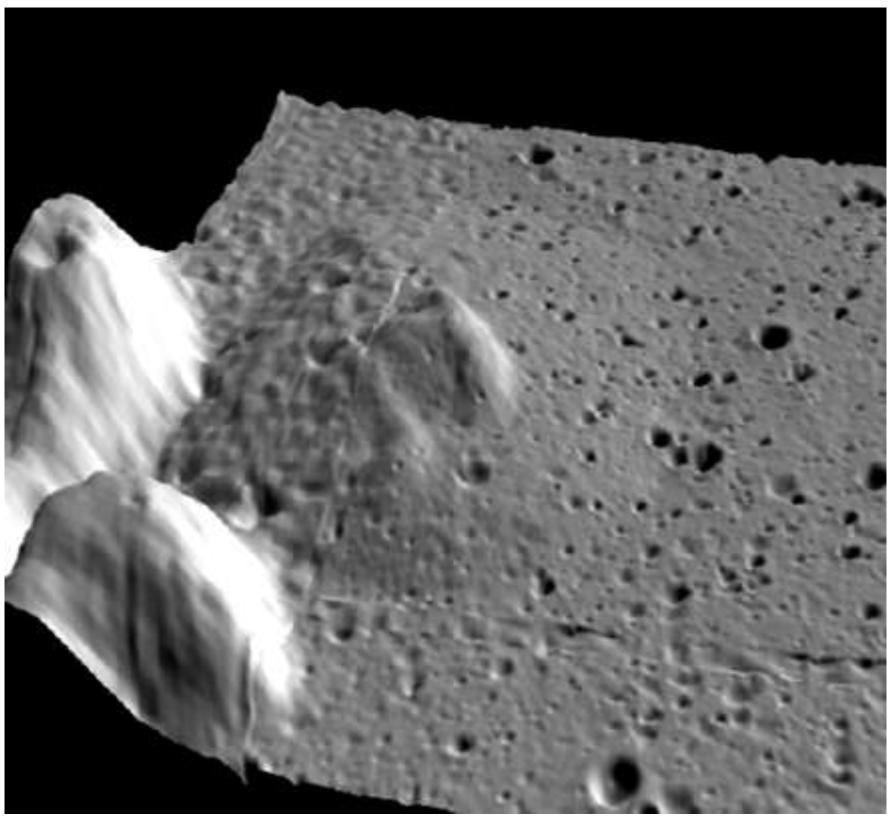


Figure 10: 3D reconstruction of Kopff 2. The vertical axis is 7 times exaggerated.

Kopff 3: The dome termed Kopff 3 lies at coordinates of 17.25° S 85.35° W, with a diameter of 6.6 x 7.2 km. Kopff 3 is 130m high with an average flank slope of 2.2° (Fig. 11).

The edifice volume, computed assuming a parabolic shape, is determined to 2.6km^3. The rheologic model applied to Ko1 dome yields a low effusion rate of 62 m^3 s^{-1} and a lava viscosity of 1.1 x 10^6 Pa s, computed based on a lava density of 2800 kg m^{-3}. It formed over a period of time of about 1.3 years.

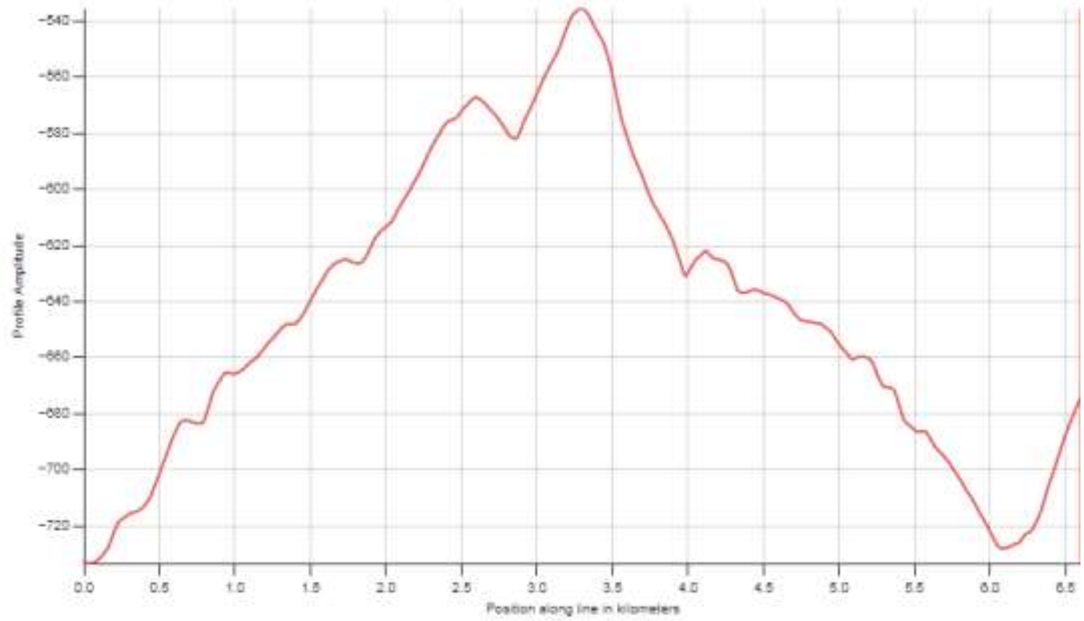


Figure 11: LRO WAC-derived surface elevation plot of an east to west cross-section of the dome Kopff 3.

The 3D reconstruction of Ko3 is shown in Fig. 12.

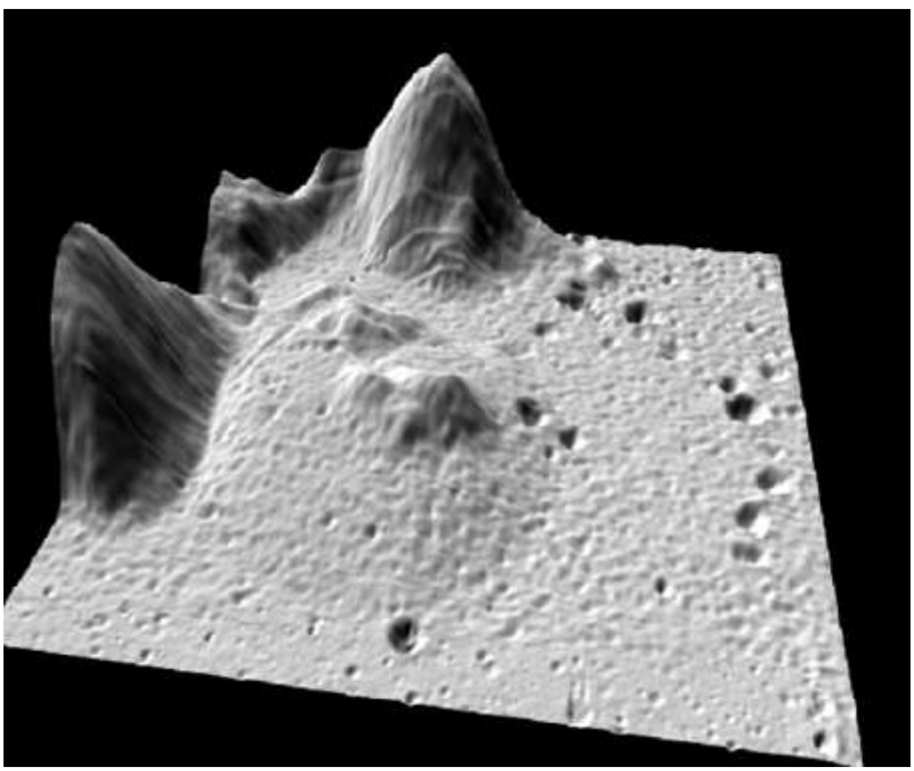


Figure 12: 3D reconstruction of Kopff 3. The vertical axis is 7 times exaggerated.

Lunar Topographic Studies
Are the Domes in Lacus Veris Detectable in Telescopic Images? R. Lena

Summary and request of images

I have described some domes in Lacus Veris. These results are preliminary and under investigation.

It would be interesting to receive any images of Mare Orientale, including also Lacus Veris, made with terrestrial telescopes for further studies investigating if the described domes in Lacus Veris can be imaged using telescopic images and deleting, with some software, the foreshortening effect.

Preliminary analysis carried out on two images taken by Cazilhac would indicate that some of these domes are detectable. Of course, we need of more images in Hires for a complete investigation about this specific project.

The recognized domes, reported in this note, are under spectral and mineralogical investigation.
Please check also your past imagery and send them to us for the ongoing study (email: lunar-domes@alpo-astronomy.org).

References

Greeley, R. (March 15–19, 1976). "Modes of emplacement of basalt terrains and an analysis of mare volcanism in the Orientale Basin". Proceedings, 7th Lunar Science Conference. Houston, Texas: Pergamon Press, Inc. pp. 2747–2759.

Greeley, R. (March 1976). "Mare Emplacement in the Orientale Basin". Proceedings, Lunar and Planetary Science Conference 7. pp. 334–335.

Lena, R., Wöhler, C., Phillips, J., Chiocchetta, M.T., 2013. Lunar domes: Properties and Formation Processes, Springer Praxis Books.

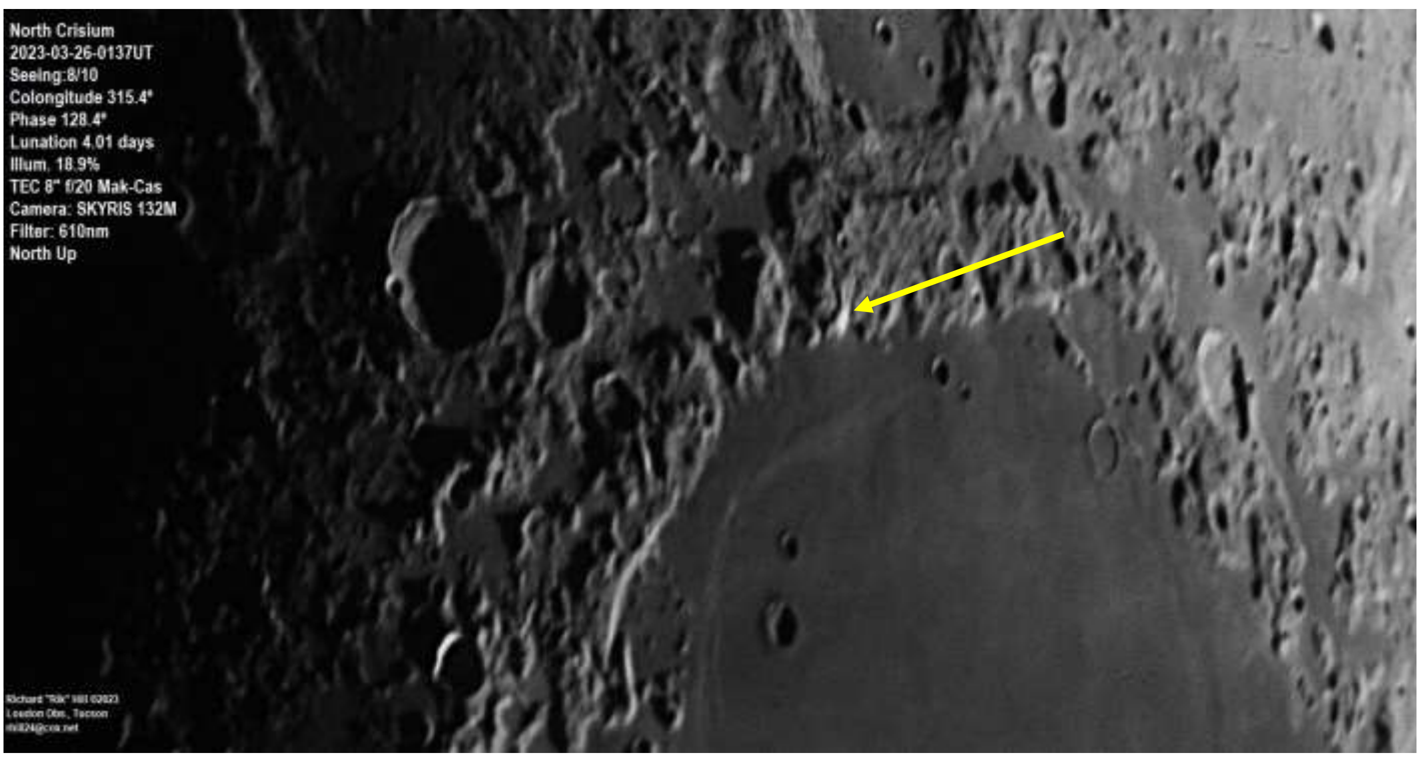
Lena, R. Lunar domes (part LXVII): Lacus Veris, Lacus Autumni and Schlüter crater. BAA LS Circular, July 2023.

North Crisium

Rik Hill

Mare Crisium (638 km dia.) is a fascinating mare but too often we see the whole sea portrayed in images and many of the most fascinating parts are missed because of that. Here we have the northern third of the polygonal mare. This image spans the region from Macrobius (66 km) on the left, to the flat floored crater Eimmart (48 km) near the right edge. In Crisium itself we see the wrinkle ridge, Dorsum Oppel that parallels the north shore of the mare for over 300 km. with the two craters Peirce (19 km) and Swift (10) at the mid-point. At the upper end is a similar sized crater Cleomedes F (12 km). On the outside of the northeast (upper right) edge of the mare is the long winding Mare Anguis or the Sea of Snake with Eimmart in its middle. This strange mare stretches on north to the crater Delmotte (34 km). Note how the mountains that make the northern wall of Crisium have been eroded with the outpouring of the lavas from the mare. This forms interesting passes through these mountains.

At the north interior of Crisium, not far from Cleomedes F, you can see a brilliant white spot (yellow arrow). This had been reported as a "transient phenomenon" by observers over the years but a look at LROC QuickMap shows it to be a very fresh small kilometer sized crater at the top of a mountain that has an ejecta blanket spread over the mountains and the mare floor to the south. It has a very sharp and crisp rim indicating a young age. The interior appears bright as well. I have taken many images of this feature and have found it shows up very bright at a wide range of colongitudes. One might suspect this of being the caldera on a volcano, but the crater does not have the morphology of a caldera and the rays on the floor of Crisium indicate an impact. Look for it the next time you are in the area!



North Crisium, *Richard Hill, Loudon Observatory, Tucson, Arizona, USA. 2023 March 26 01:37 UT, colongitude 315.4^o. TEC 8 inch f/20 Maksutov-Cassegrain telescope, 610 nm filter, SKYRIS 132M camera. Seeing 8/10.*

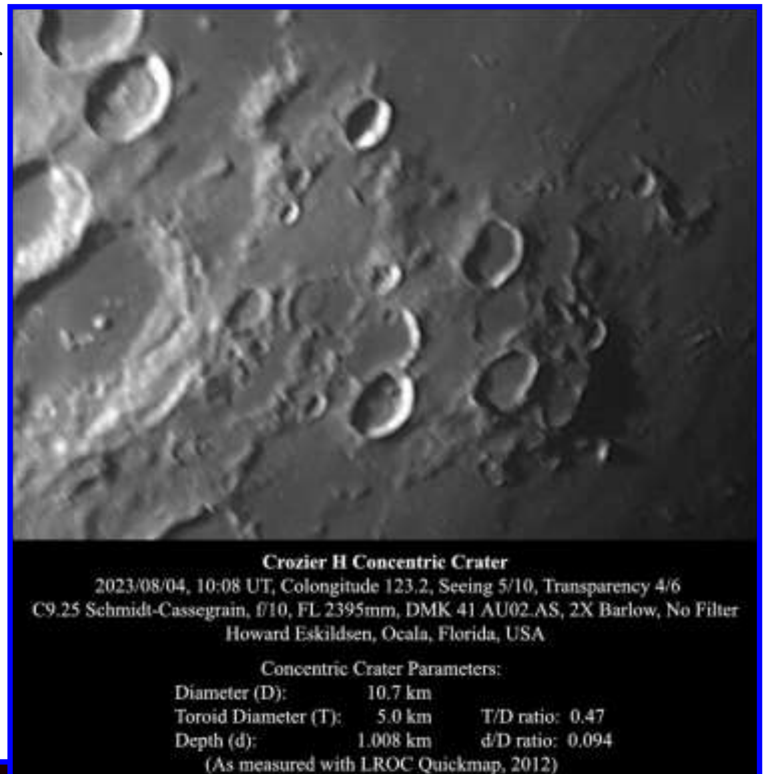
Lunar Topographic Studies
North Crisium

Concentric Crater Crozier H

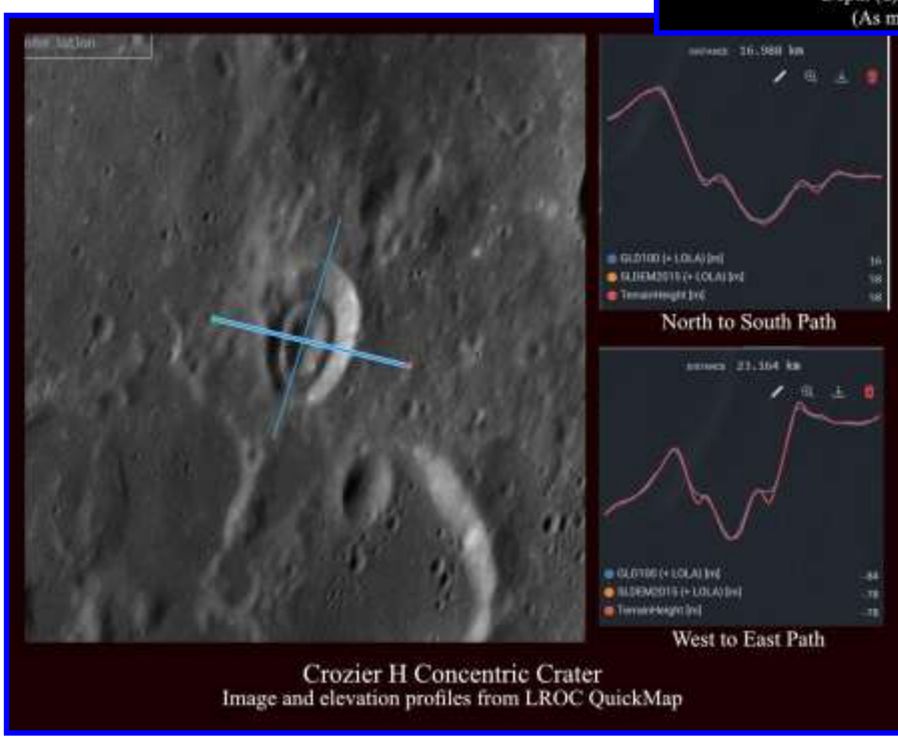
Howard Eskildsen

The telescopic image of Crozier H (center of image) was obtained on August 4, 2023, and the other is a composite from the LROC QuickMap showing close up of the crater as well as elevation profiles. They show the outer rim as well as the inner rim or "toroid" of the concentric crater. Per measurements I did in 2012 using the QuickMap, the outer rim diameter (D) is 10.7 km and the toroid (inner ring) diameter (T) is 5.0 km for a T/D ratio of 0.47. The mean depth (d) of the crater is 1.008 km for a d/D ratio of 0.094. For comparison, the LROC QuickMap Feature Inspector lists the diameter of Crozier H as 10.5 km.

The LROC composite image gives a visual perspective to the shape of the crater and its inner toroid. It appears from the profiles that the crater is superimposed over sloping terrain.



Crozier H Concentric Crater*, Howard Eskildsen, Ocala, Florida, USA. 2023 August 04 10:08 UT, colongitude 123.2º. 9.25 inch Celestron Schmidt-Cassegrain telescope, 2x barlow, DMK 41 AU02.AS camera. Seeing 5/10, transparency 4/6*



Crozier H Concentric Crater, *LROC.*

Lunar Topographic Studies
Concentric Crater Crozier H

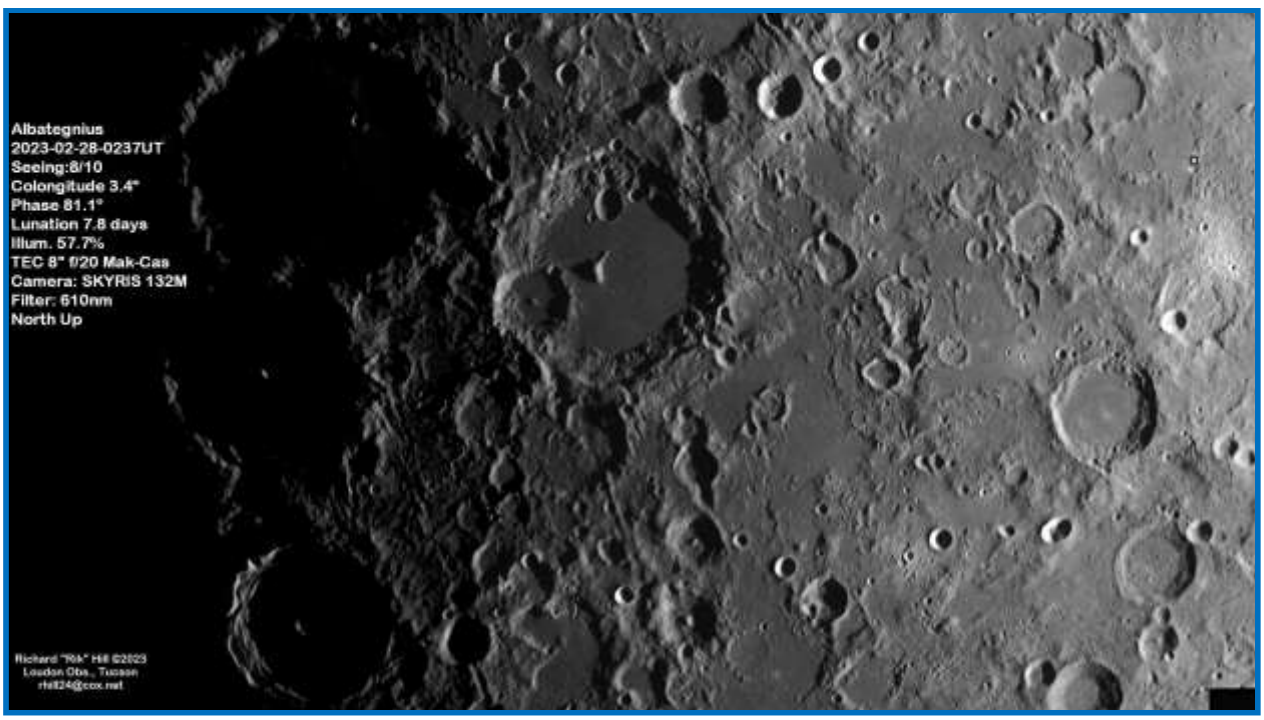
Albategnius

Rik Hill

The large flat floored crater just above center is Albategnius (dia. 139 km) with the crater Klein (46km) on its west (left) wall. In the upper left of this image is the great walled plain Ptolemaeus (158 km) with Alphonsus (121 km) below its central peak catching the first rays of the morning sunlight. Below that is Arzachel (100 km) with its central peak likewise just seeing sunrise. South of Albategnius is a curious feature that looks like two craters with a north-south trough running through them. Actually, it is the merged alignment of four craters. The largest crater is Vogel (26 km) with Vogel B (21 km) just above and Vogel A (9 km) above that. Below Vogel B is the last member of this alignment, an unnamed and badly eroded crater some 10-12 km in diameter. These separate features can only be seen clearly during higher illuminations.

Note the large scratch marks that run diagonally from upper left to lower right in this image. These are "scratches" carved by city sized ejecta boulders from the Imbrium impact to the north. In the upper right corner, you can see a small "x" that marks the Apollo 16 landing site and below it a whitish area that is one of the enigmatic magnetic 'lunar swirls' on the north edge of the ruined crater Descartes. Just below the 'x' is a tiny white spot. This is "South Ray" a very small bright rayed crater only 0.6 km in diameter. The crater is hard to see but you should be able to pick out the bright spot and find the landing site. There are sites on the web that have close up images of all the Apollo landing sites so you can use these images at your telescope to find these features.

Further south is a fair sized flat floored crater Abulfeda (62 km) with a long string of craterlets tangent to the south wall. This kind of feature is called a "catena" and this one is Catena Abulfeda that runs over 200 km across these lunar highlands. There is so much more to talk about in just this single image but I'm not writing a book here!



Albategnius, *Richard Hill, Loudon Observatory, Tucson, Arizona, USA. 2023 February 28 02:37 UT, colongitude 3.4°. TEC 8 inch f/20 Maksutov-Cassegrain telescope, 610 nm filter, SKYRIS 132M camera. Seeing 8/10.*

Lunar Topographic Studies
Albategnius

Focus-On: Floor Fractured Craters
Alberto Anunziato

In this extensive Focus On we are going to have a guide not to get lost: "Luna Cognita" by Robert Garfinkle, in which we find a catalog of Floor-Fractured Craters (FFC), in its chapter 24 and defines them as follows: "They typically are anomalously shallow, mare-flooded (breached) craters with plate-like floors with concentric and/or radial rilles and/or polygonal fractures. They may have moats, "v"-profile valleys, dark halo craters, patches of mare materials, and are located near a mare. Floor-fractured craters have had their floors distorted by endogenic processes, such as tectonism and/or volcanism. In fractured-floor craters cracks have developed on the crater's floor caused by the cooling of emplaced lava".

The term was coined in 1976 by Peter Schultz coined the term "floor-fractured craters" and "He divided his classification system into 6 subclasses. Class 4 was further subdivided into classes 4a, 4b, and 4c about 40 years after Schultz published his original classification system" (Garfinkle). Although most of the FFCs are of either Copernican or Eratosthenian ages, many of the most known are of earlier. ages to be found.

There are two theories about the formation mechanisms for the creation of FFCs, the first one being the most accepted:

"In the more widely held theory, during the creation impact, deep cracks were created in the crust material under the impact. Magma then flowed upward (magmatic intrusion) and ponded under the crater's floor. As more magma filled the pond it caused the floor to lift. This accounts for the general shallowness of FFCs. Once the magma cooled, it shrunk allowing the floor to subside and fracture".

"When high thermal gradients occur within a given area, such as inside and/or under a crater, viscous relaxation takes place. For this theory to work, the crater must rest on a cold shallow crust on top of a warmer, less viscous layer. This causes a strain that leads to upward flexure of the bottom of the crater, which in turn causes bending stresses on the floor that can create floor fractures" (Garfinkle).

One of the characteristics of the FFCs is their location on the shores of the maria, as illustrated by Rik Hill's images 1 and 2. In the first one we mark the FFCs around the Mare Humorum: 1) Gassendi, 2) Doppelmayer, 3) Vitello, 4) Hippalus, 5) Campanus.

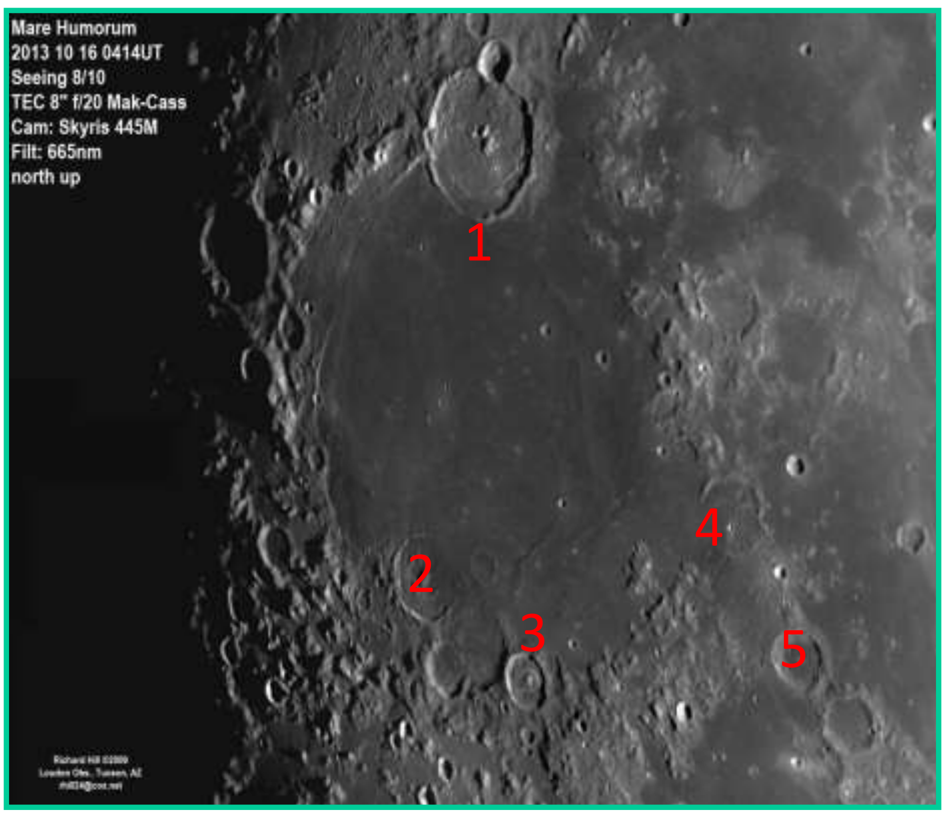


Image 1, Mare Humorum, *Richard Hill, Loudon Observatory, Tucson, Arizona, USA. 2013 October 16 04:14 UT. TEC 8 inch f/20 Maksutov-Cassegrain telescope, 665 nm filter, SKYRIS 445M camera. Seeing 8/10.*

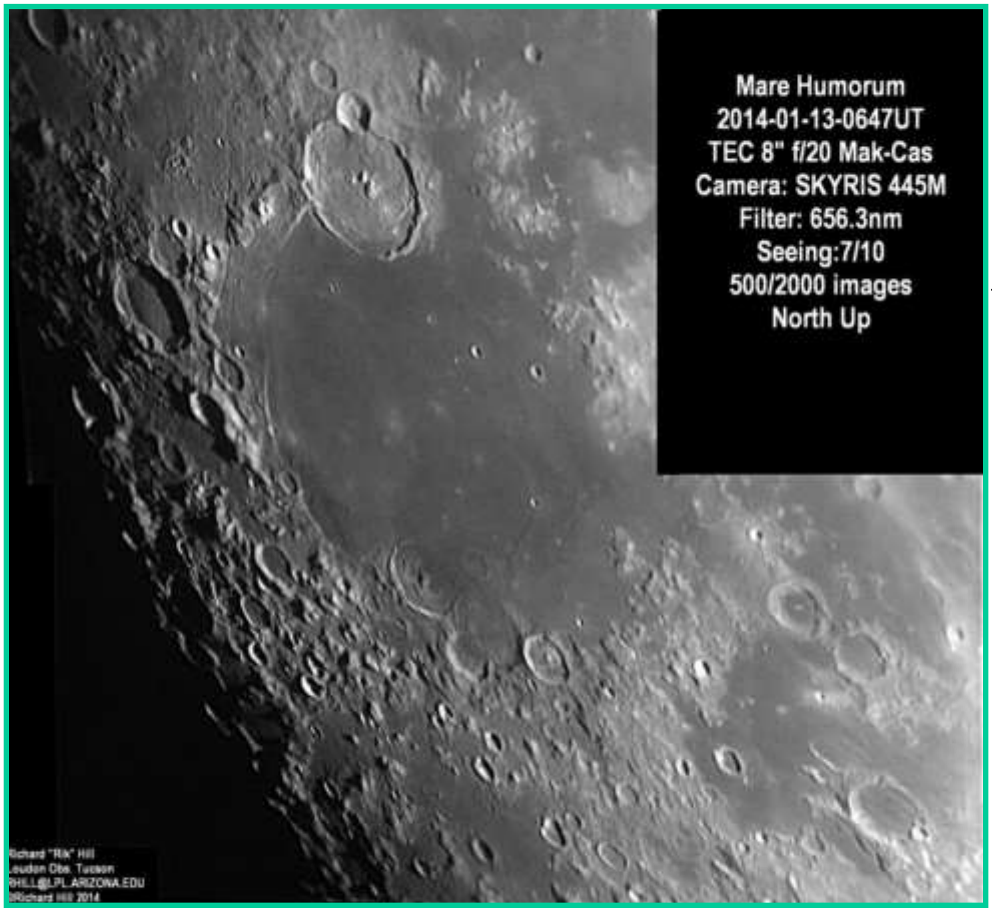


Image 2, Mare Humorum, *Richard Hill, Loudon Observatory, Tucson, Arizona, USA. 2014 January 13 06:47 UT. TEC 8 inch f/20 Maksutov-Cassegrain telescope, 656.3 nm filter, SKYRIS 445M camera. Seeing 7/10.*

There is a pattern in the location of the FFCs and the morphology of each crater: within the maria and in the shore of the maria we can see flat floored large FFC of the Class 1 and 3, produced by "Large scale (thick) intrusions, or ones that intrude very shallowly below the overlying crater floor produce enough force to cause a piston-like uplift in the crater floor" (…), "but as the intrusions become smaller (thinner), or deeper below the overlying crater, they cause varying amounts of flexure in the overlying crust, with the resulting floor fractures being predominantly concentric. This manifestation can be observed in the morphology of Classes 2 and 4, with their often-convex floors, and well-developed concentric fractures" (Jozwiak et al.), which are located near or in the highlands.

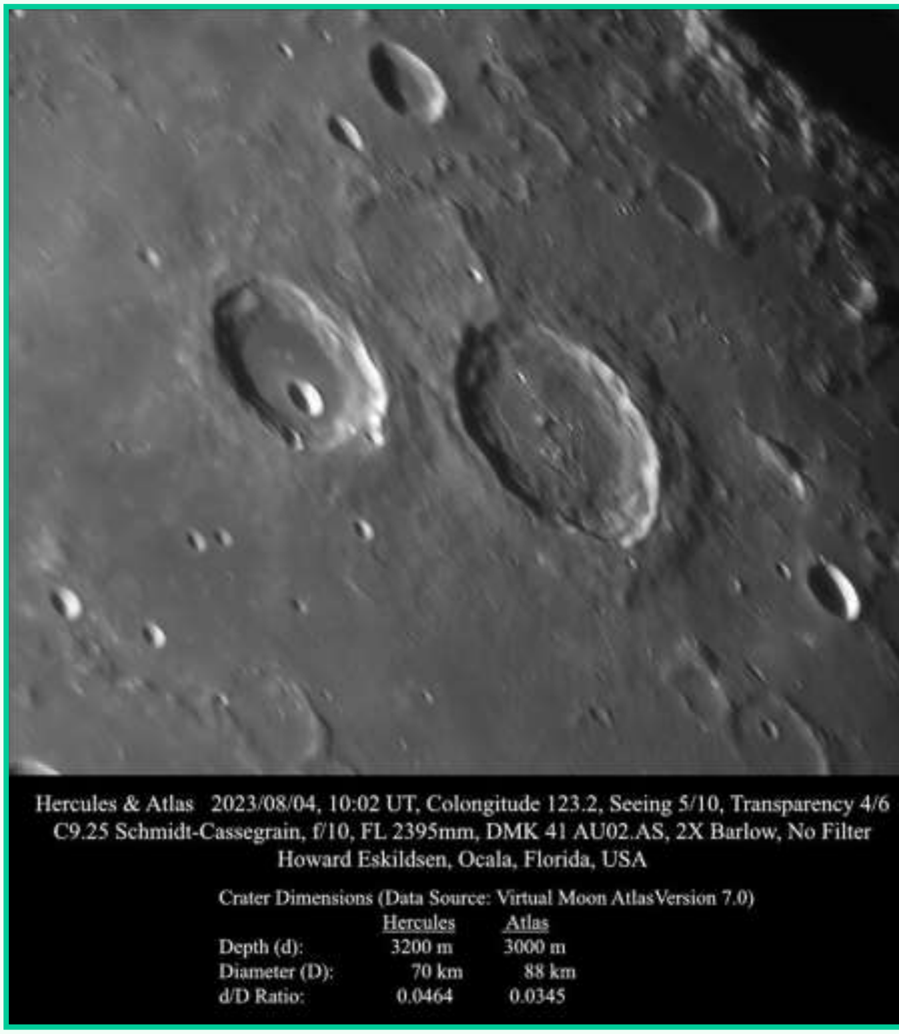
CLASS 1

Atlas and Hercules, the famous pair of craters with the names of strongmen, allow, by comparison, to understand the difference between a crater that has been affected by the mechanisms that form an FFC and another that has not been affected. First, let's look at Howard Eskildsen's images (IMAGES 3 and 4) and the accompanying text. Atlas (88 kilometers in diameter) is much shallower and has also been affected by volcanism, says Charles Wood: "The real differences between these craters are their floors. Hercules has a flat floor with two bumps that might be the tops of the central peeks protruding through dark hued lava. The floor of Atlas is much more interesting. Atlas is a so-called floor fractured crater, with central peaks surrounded by a network of rilles. And like Alphonsus, two dark spots centered on tiny pits occur along the rilles. Telescopic spectral data by Hawke and his University of Hawaii colleagues demonstrate that these dark spots result from volcanic eruptions of volcanic glass and lava fragments. Why, I wonder, does Atlas have a volcanic manifestation of rilles and explosions craters, whereas nearby Hercules simply has a lava-covered floor? We see this frequently on the Moon: small-scale volcanic features occur in one place and not in similar nearby areas. The circumstances that gave rise to explosive volcanism on the Moon must have been very special (The Modern Moon, pages 72/73). According to Garfinkle "The current shallowness of FFCs varies from 20 to 85 percent of the predicted unmodified crater floor-depth to rim-crest height ratio".

Hercules and Atlas

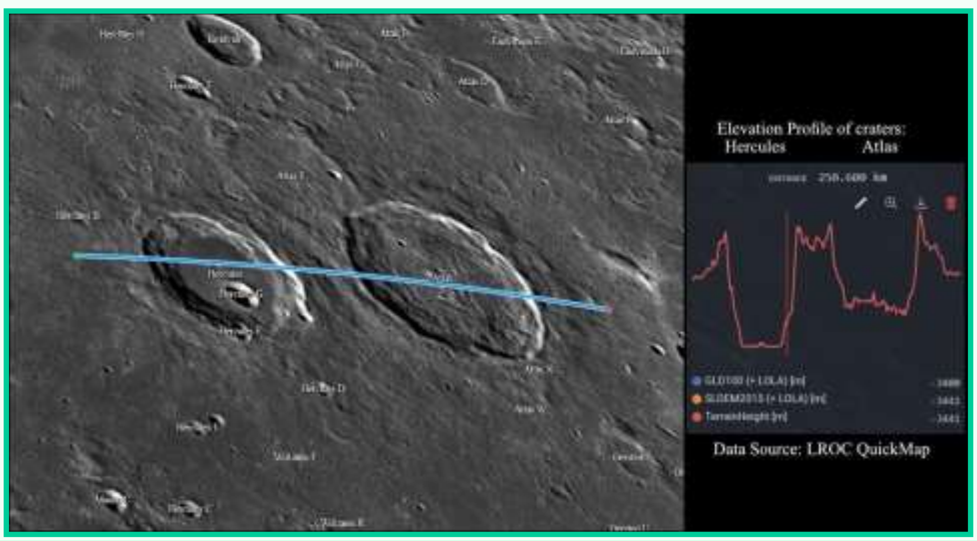
Howard Eskildsen

Images 3 and 4, Hercules and Atlas*, Howard Eskildsen, Ocala, Florida, USA. 2023 August 04 10:02 UT, colongitude 123.2º. 9.25 inch Celestron Schmidt-Cassegrain telescope, 2x barlow, DMK 41 AU02.AS camera. Seeing 5/10, transparency 4/6.*



Howard adds: "I took this image of Atlas to show Rimae Atlas, the rilles across the floor of the crater. Obviously there has been some volcanic intrusion below the surface that elevated the floor and caused the fractures in the surface. Barely detectable on this image, there are some small pyroclastic deposits in the northern and the southern regions of the crater. Hercules, on the other hand has a smooth, very flat and level floor with only the tip of its central peaks rising above the fill. It shows no rilles or wrinkles, only pockmarks from subsequent cratering. It would appear that we have two adjacent craters modified by different types volcanic activity; Hercules with extrusion of lava into a flat, solidified lake (dare I call it "Crater Lake?"), and Atlas with the floor deformed by subterranean intrusion, with only a couple of extrusive, pyroclastic flows.

It is interesting to note that per dimensions on the first image, Hercules is about 200 meters deeper than Atlas and hence has a larger d/D ratio. The bottom image is a composite taken from the LROC QuickMap showing the profiles of the craters along the blue line of the sampling path. The flatness of the floor of Hercules is obvious, while the floor of Atlas is tilted, fractured and slightly domed. The contrasting features of these two craters makes for an interesting juxtaposition."



FOCUS ON: Floor Fractured Craters: Hercules and Atlas

Atlas belongs to Class 1 of FFC, in which there are only 8 craters, but 3 are spectacular: Atlas, Posidonius and Petavius, characterized by having a "Concentric, polygonal, radial fracture pattern" and more precisely, quoting Garfinkle: “Craters have most characteristics found in fresh (Copernican-age) large impact craters. They have central peaks, ejecta blanket, deep floor to rim crest elevation difference; interior wall terraces; extensive wall slumps; fractured floor with rilles that are generally concentric with crater walls; rilles fracture patterns may also be radial or polygonal. May have dark halo craters and mare-like patches near or on floor–wall boundary. Generally located on or near maria and predate last stages of local mare emplacement; large craters [50 to 300 km (31 to 186.4 miles)] in diameter; average diameter of about 140 km (87 miles)”. In IMAGE 5 (detail of IMAGE 6) we see the characteristics of the Class 1’s FFC in Atlas: 1.- central peaks, 2.- ejecta blanket, 3.- deep floor to rim crest elevation difference; 4.- interior wall terraces; 5.- fractured floor with rilles, 6.-extensive wall slumps.

Image 5, Atlas and Hercules, *Jesús Piñeiro, San Antonio de los Altos, Venezuela. 2021 December 10 22:50 UT. Meade 10 inch Schmidt-Cassegrain telescope, Astronomik L2 UV-IR 2 inch filter, ZWO ASI462MC camera.* ***Image 6 (right)*** *is a close-up of image 5.*

Peter Schultz designated an archetype crater for each class, no surprise that the archetype for Class 1 is Atlas: "The crater's floor is laced with several deep and wide radial and concentric fractures and terraced walls along with dark mantling materials in two large areas. Annular valleys are at the base of the interior walls. Class 1 consists of large craters with generally wide radial and concentric fractures. They have patches of mare-like materials near the base of their walls. There are eight such Class 1 formations with all but one being located away from the margins of the basins" (Garfinkle).

Atlas and Hercules are a spectacular pair, so it's not surprising that we have a lot of images of this popular FFC. In IMAGES 7 to 13 we clearly see the irregular system of Atlas floor rilles, which Elger accurately described more than 100 years ago in The Moon (pages 46/47): "Several clefts may be seen on the floor under suitable illumination, among them a forked cleft on the N.W. quarter, and two others, originating at a dusky pit of irregular form situated near the foot of the S.W. wall, one of which runs E. of the central hills, and the other on the opposite side. A ridge, at times resembling a light marking, extends from the central mountain to the N. border".

Image 7, Atlas, *Richard Hill, Loudon Observatory, Tucson, Arizona, USA. 2019 July 08 02:27 UT, colongitude 329.0°. TEC 8 inch f/20 Maksutov-Cassegrain telescope, 610 nm filter, SKYRIS 445M camera. Seeing 8/10.*

Image 8, Atlas & Hercules, *Richard Hill, Loudon Observatory, Tucson, Arizona, USA. 2018 May 20 02:07 UT, colongitude 329.3°. TEC 8 inch f/20 Maksutov-Cassegrain telescope, UV filter, SKYRIS 445M camera. Seeing 8/10.*

Image 9, Atlas, *Richard Hill, Loudon Observatory, Tucson, Arizona, USA. 2015 July 21 02:58 UT. TEC 8 inch f/20 Maksutov-Cassegrain telescope, 656.3 nm filter, SKYRIS 445M camera. Seeing 7-8/10.*

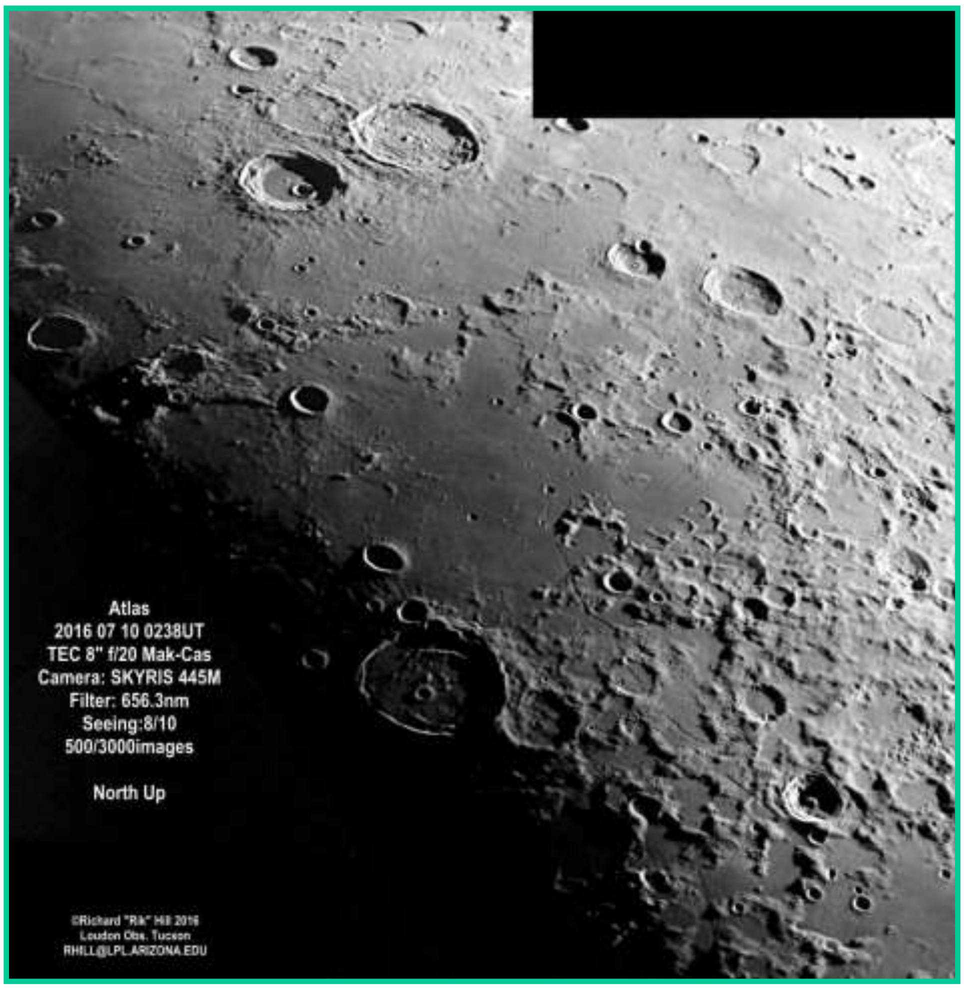


Image 10, Atlas, *Richard Hill, Loudon Observatory, Tucson, Arizona, USA. 2016 July 10 02:38 UT. TEC 8 inch f/20 Maksutov-Cassegrain telescope, 656.3 filter, SKYRIS 445M camera. Seeing 8/10.*

FOCUS ON: Floor Fractured Craters

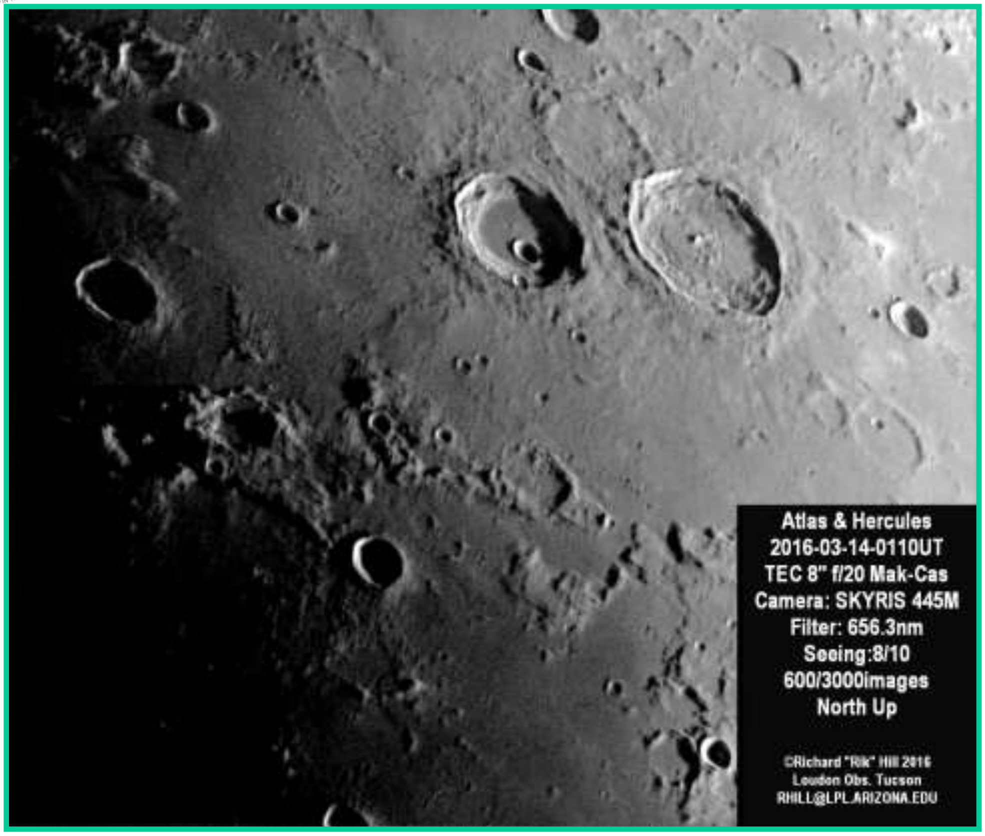


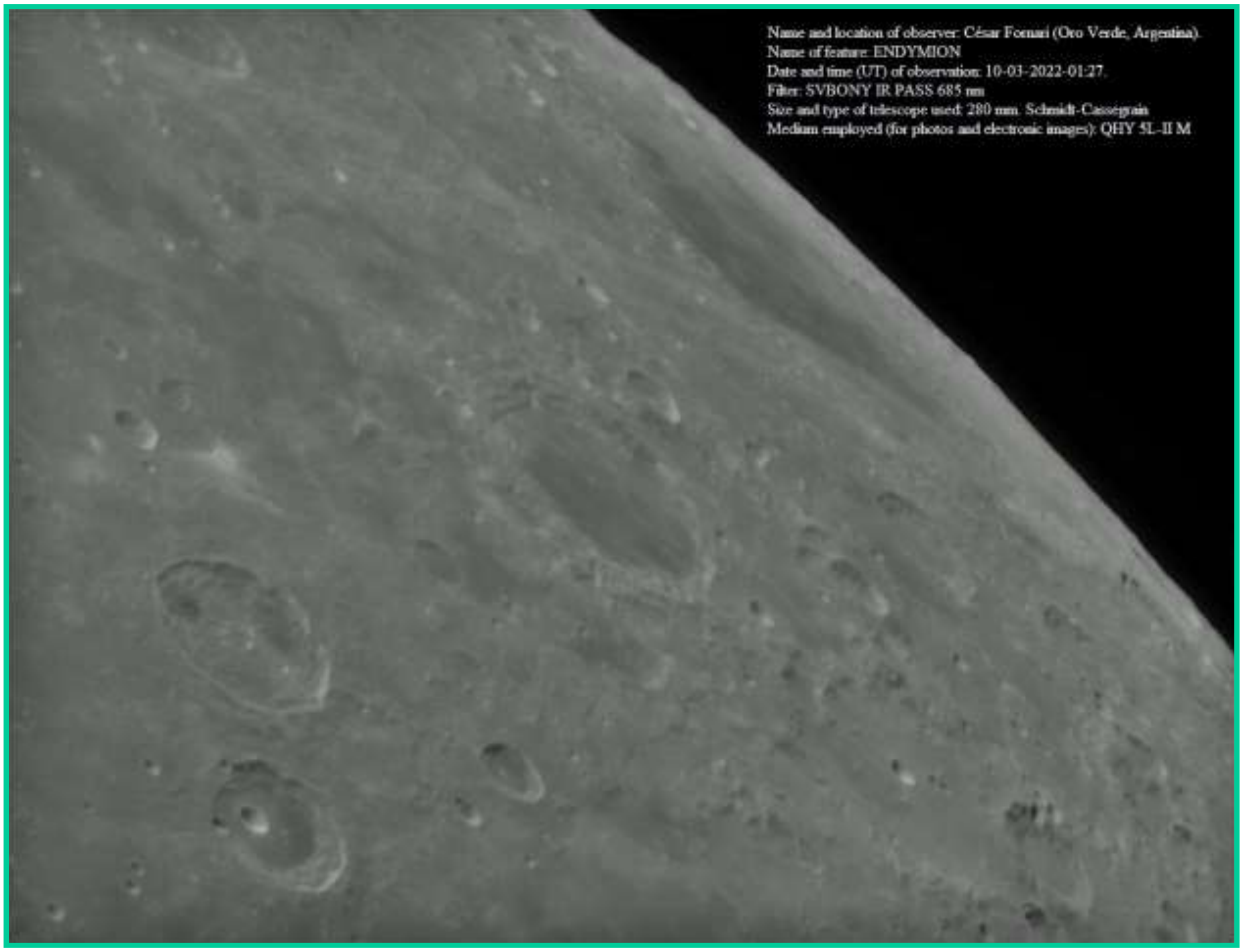
Image 11, Atlas & Hercules, *Richard Hill, Loudon Observatory, Tucson, Arizona, USA. 2016 March 14 01:10 UT. TEC 8 inch f/20 Maksutov-Cassegrain telescope, 656.3 nm filter, SKYRIS 445M camera. Seeing 8/10.*

Image 12, Atlas and Hercules, *Alberto Anunziato, Oro Verde, Argentina. 2016 August 21 05:22 UT. Meade LX 200 10 inch Schmidt-Cassegrain telescope, Astronomik Pro-Planet 742 IR-pass filter, QHY5-II camera*

FOCUS ON: Floor Fractured Craters

Image 13, Lacus Temporis, *Richard Hill, Loudon Observatory, Tucson, Arizona, USA. 2016 April 12 03:26 UT. 3.5 inch Questar Maksutov-Cassegrain telescope, 656.3 filter, SKYRIS 445M camera. Seeing 8/10.*

Image 14, Endymion, *César Fornari, Oro Verde, Argentina. 2022 October 03 01:27 UT. 280 mm Schmidt-Cassegrain telescope, SVBONY IR pass 685 nm filter, QHY5L-IIM camera.*



FOCUS ON: Floor Fractured Craters

IMAGES 14 to 21, on the other hand, show another aspect of the changing Atlas floor, the dark spots to the north and east, which caught the attention of the imaginative William Pickering: "During the years 1870 and 1871 I bestowed some attention on the dusky pit, and was led to suspect that both it and the surrounding area vary considerably in tone from time to time. Professor W.H. Pickering, observing the formation in 1891 with a 13-inch telescope under the favorable atmospheric conditions which prevail at Arequipa, Perú, confirmed this supposition, and has discovered some very interesting and suggestive facts relating to these variations, which, it is hoped, will soon be made public" (The Moon, page 47). We say goodbye to Atlas with IMAGE 22, a perfect illustration of what Garfinkle called "deep and wide concentric fractures".

Image 15, Atlas & Hercules, *Richard Hill, Loudon Observatory, Tucson, Arizona, USA. 2012 October 03 06:50 UT. TEC 8 inch f/20 Maksutov-Cassegrain telescope, 656.3 nm filter, DMK21AU04 camera. Seeing 6/10.*

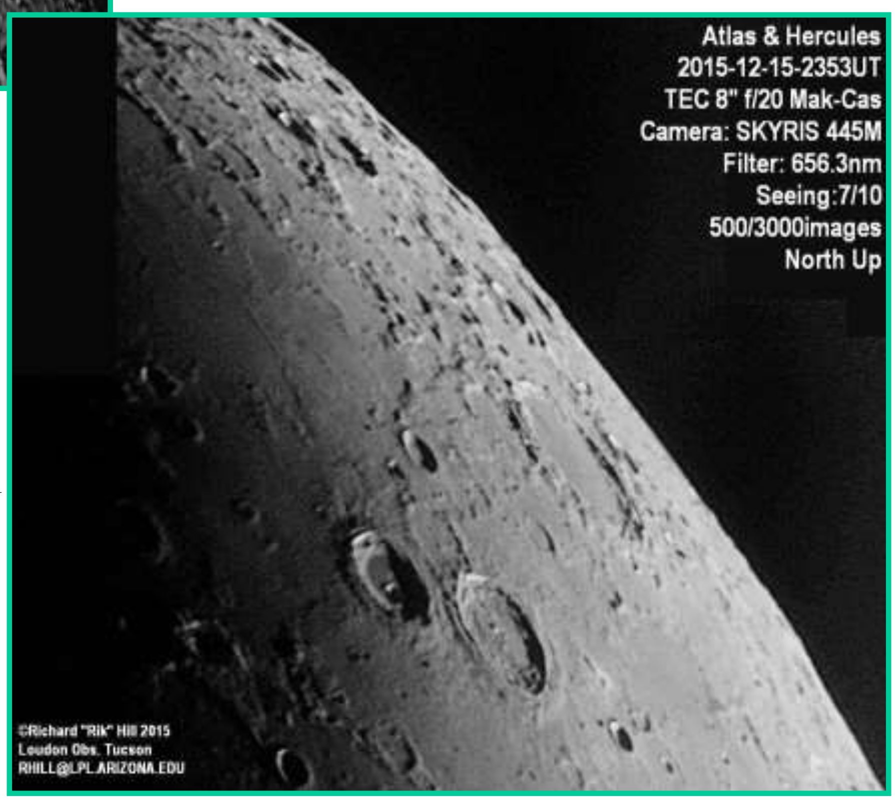


Image 16, Atlas & Hercules, *Richard Hill, Loudon Observatory, Tucson, Arizona, USA. 2015 December 15 23:53 UT. TEC 8 inch f/20 Maksutov-Cassegrain telescope, 656.3 nm filter, SKYRIS 445M camera. Seeing 7/10.*

FOCUS ON: Floor Fractured Craters

Image 17, Atlas and Hercules, *Richard Hill, Loudon Observatory, Tucson, Arizona, USA. 2008 August 19 06:25 UT. Celestron 14 inch Schmidt-Cassegrain telescope, 2x barlow, UV/IR blocking filter, SPC900NC camera. Seeing 5/10.*

Image 18, Atlas and Hercules, *Alberto Anunziato, Oro Verde, Argentina. 2015 November 29 04:13 UT. Meade LX 200 10 inch Schmidt-Cassegrain telescope, telextender, Canon EOS digital rebel XS camera*

FOCUS ON: Floor Fractured Craters

Image 19, Atlas, *Sergio Babino, Montevideo, Uruguay. 2018 October 14 23:32 UT. 81 mm refractor telescope, ZWO ASI174 mm camera.*

Image 20 Atlas, *Ignacio Villarraza, San Nicolás de los Arroyos, Argentina. 2020 December 29 00:00 UT 127 mm Maksutov-Cassegrain telescope, Xiaomi mi 8 Lite cell phone camera.*

FOCUS ON: Floor Fractured Craters

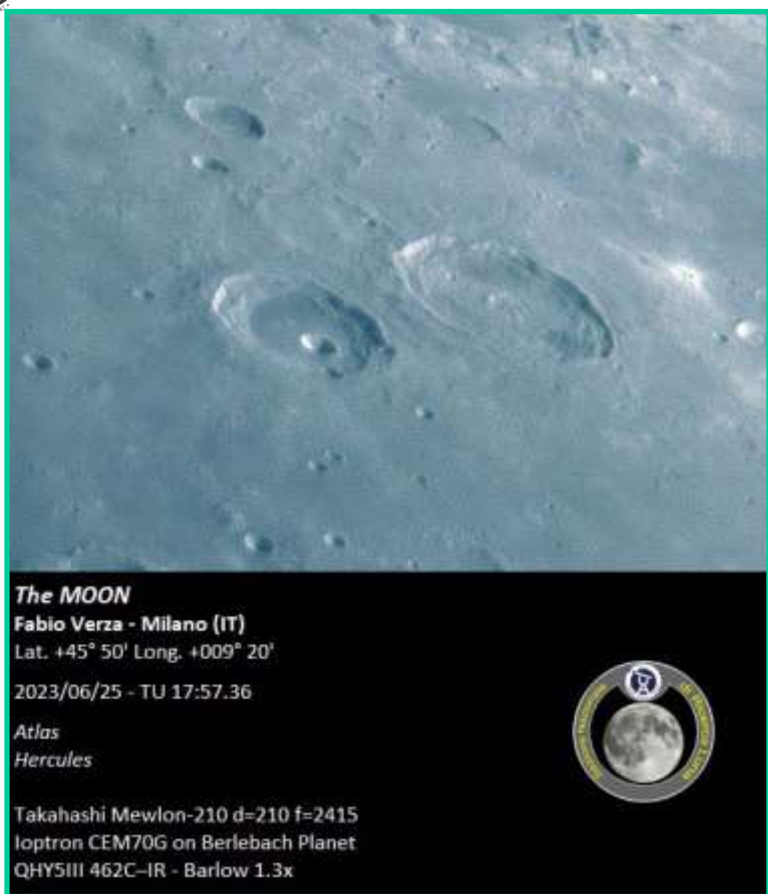


Image 21, Atlas, *Fabio Verza, SNdR, Milan, Italy. 2023 June 25 17:57 UT. Takahashi Mewlon 210 mm Dall-Kirkham telescope, 1.3x barlow, QHY-III462C camera, -IR filter.*

Image 22, Atlas, Hercules and Endymion, *Larry Todd, Dunedin, New Zealand. 2023 August 03 10:49 UT. 8 inch OMC Maksutov-Cassegrain telescope.*

FOCUS ON: Floor Fractured Craters

With IMAGE 23 and 24 we leave the edge of Mare Frigoris to go to the edge of Mare Serenitatis to meet the second star FFC of the first category: Posidonius (96 kilometers in diameter). We have little left to say about Posidonius, we refer to the texts by Rik Hill, Anthony Harding and Jeff Grainger that make up this edition of The Lunar Observer. IMAGE 25 and especially IMAGE 26 illustrate very well the description of Posidonius complexity that we read in "The Moon and How to Observe It": "Posidonius lies at the northeastern border of Mare Serenitatis at the entrance to Lacus Somniorum (Lake of Dreams). A 100mm telescope will reveal the complex nature of Posidonius's floor. A prominent clear cut bowl-shaped crater Posidonius A (12 km) sits slightly west of center. To its east there are a number of linear rilles, the Rimae Posidonius, the most prominent of which cuts 50 km across the center of the floor, and it is cut across itself at a right-angles by a smaller rille. Another, longer, rille makes its way along the floor near the inner western wall. The best views of the Rimae Posidonius are to be obtained through a 150mm telescope at high magnification. The eastern part of Posidonius' floor is crossed by a prominent curving ridge – a huge block of crust that has slipped away from the main wall. Posidonius's northern rim is dented by a chain of smaller craters, Posidonius J, B and D. Under a high Sun, Posidonius remains clearly visible, with a bright rim and a light-colored floor" (Grego, page 127).

Image 23, Hercules, *David Teske, Louisville, Mississippi, USA. 2023 January 23 01:36 UT, colongitude 346.8°. 3.5 inch Questar telescope, IR block filter, ZWO ASI120mm/s camera. Seeing 9/10.*

Image 24, Posidonius, *Fabio Verza, SNdR, Milan, Italy. 2023 June 25 19:25 UT. Takahashi Mewlon 210 mm Dall-Kirkham telescope, 1.3x barlow, QHYIII462C camera, -IR filter.*

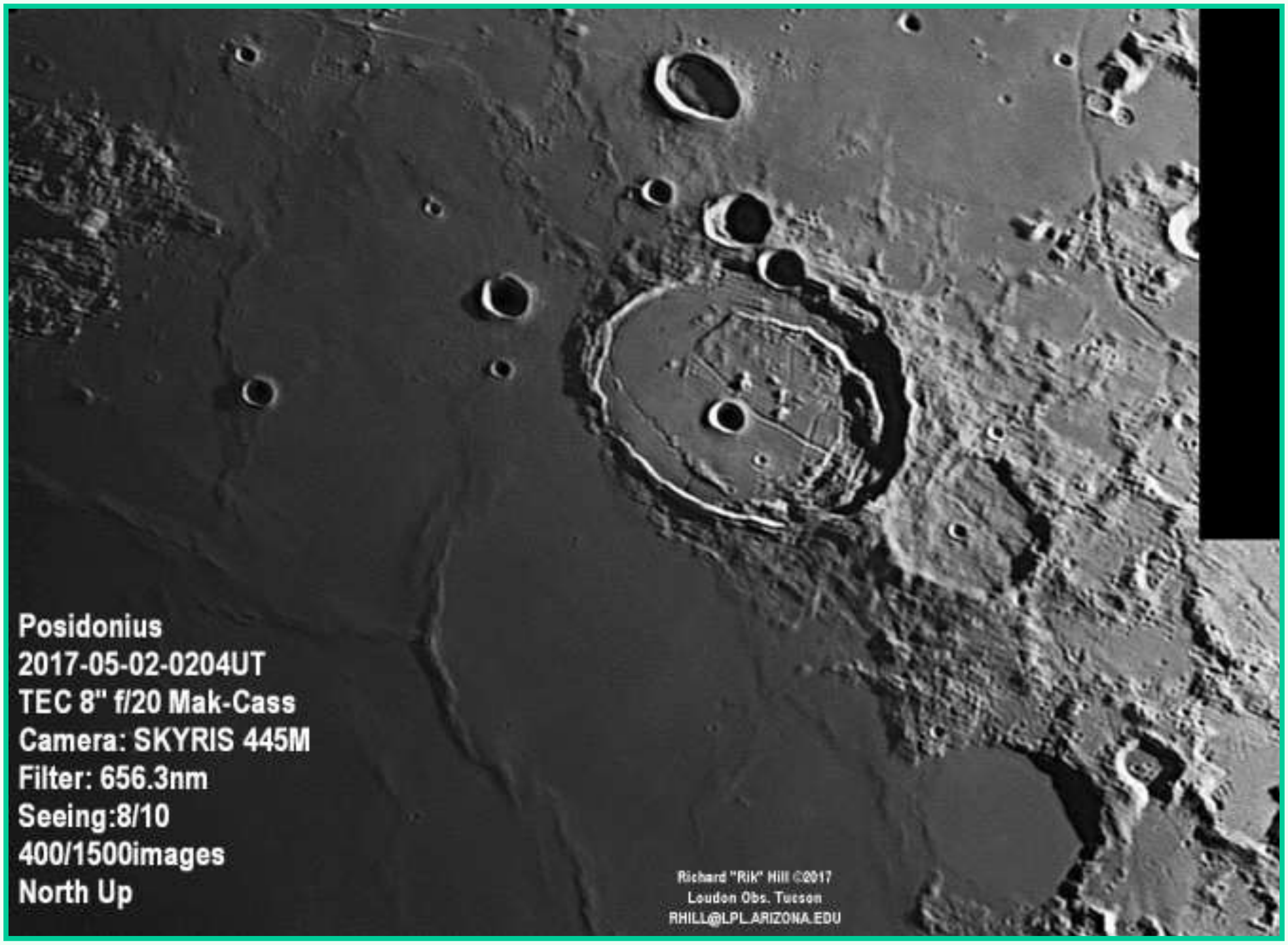
FOCUS ON: Floor Fractured Craters

Posidonius

Rik Hill

Dominating the center of this image is the great 99 km diameter crater Posidonius. Between 3.2 and 3.8 billion years old, it was flooded almost to the top of the crater walls. The remnants of the central peaks can be seen as a broken ring of small mountaintops in the center. On the right side can be seen the remnant wall from a smaller enclosed crater that was completely flooded. The floor of Posidonius is covered with system of rilles called Rimae Posidonius that have several different origins with some being obvious faults and the one on the left side of the crater looking as if it were channel formed by a running fluid.

To the lower right of Posidonius is the ancient crater Chacornac (53 km), about a billion years older than Posidonius. On its floor is the vertical system of Rimae Chacornac that you can trace all the way to the lower right corner of this image. Below Chacornac is the flooded cirque Le Monnier (63 km) opening onto Mare Serenitatis. In the upper right corner of the image, you can see most of Rima G. Bond. Above Posidonius is non-round crater Daniell (31 km) which also has a system of rimae on its floor but hidden in shadow here.



Posidonius, *Richard Hill, Loudon Observatory, Tucson, Arizona, USA. 2017 May 02 02:04 UT. TEC 8 inch f/20 Maksutov-Cassegrain telescope, 656.3 nm filter, SKYRIS 445M camera. Seeing 8/10.*

FOCUS ON: Floor Fractured Craters
Posidonius

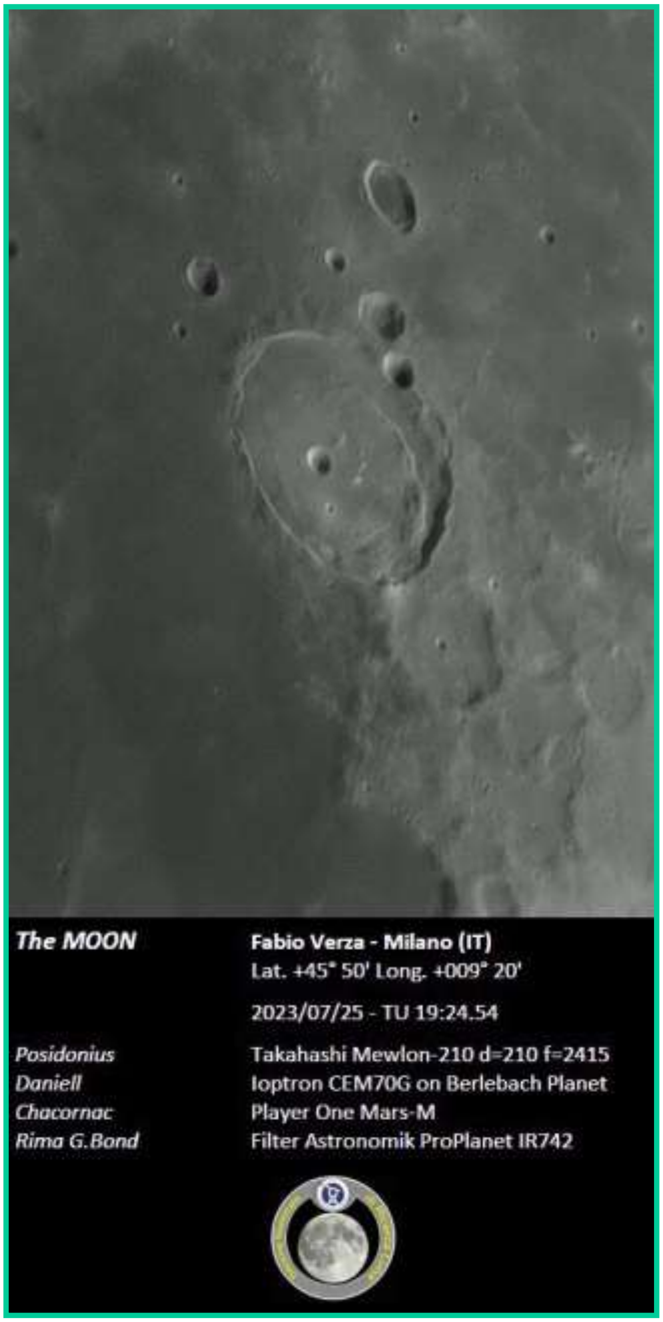


Image 25, Posidonius, *Fabio Verza, SNdR, Milan, Italy. 2023 July 25 19:24 UT. Takahashi Mewlon 210 mm Dall-Kirkham telescope, , Astronomik ProPlanet IR742 nm filter, Player-One Mars M camera.*

Image 26, Posidonius, *Fabio Verza, SNdR, Milan, Italy. 2023 June 25 19:25 UT. Takahashi Mewlon 210 mm Dall-Kirkham telescope, 1.3x barlow, QHYIII462C camera, -IR filter.*

FOCUS ON: Floor Fractured Craters

Garfinkle characterizes Posidonius for his “shallow fractured floor; multiple crossing rilles systems”, which can be seen very well in IMAGES 27 and 28. Of the Posidonius rilles, the one that is concentric with its eastern edge is especially deep, which can be seen in IMAGES 29 to 32, especially in IMAGE 31.

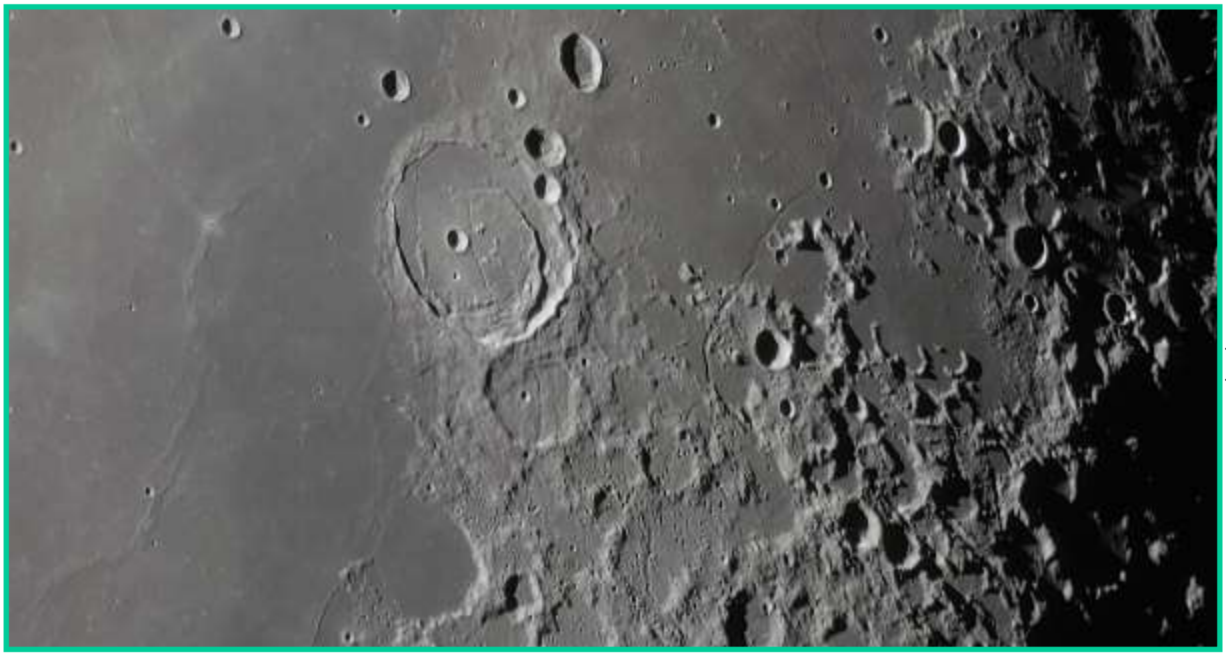


***Image 27, Posidonius,** Don Capone, Waxahachie, Texas, USA. 2023 August 05 10:08 UT. Orion xx16g at f/11, UV/IR cut filter, 2 x barlow, ADC, ASI678MC camera.*

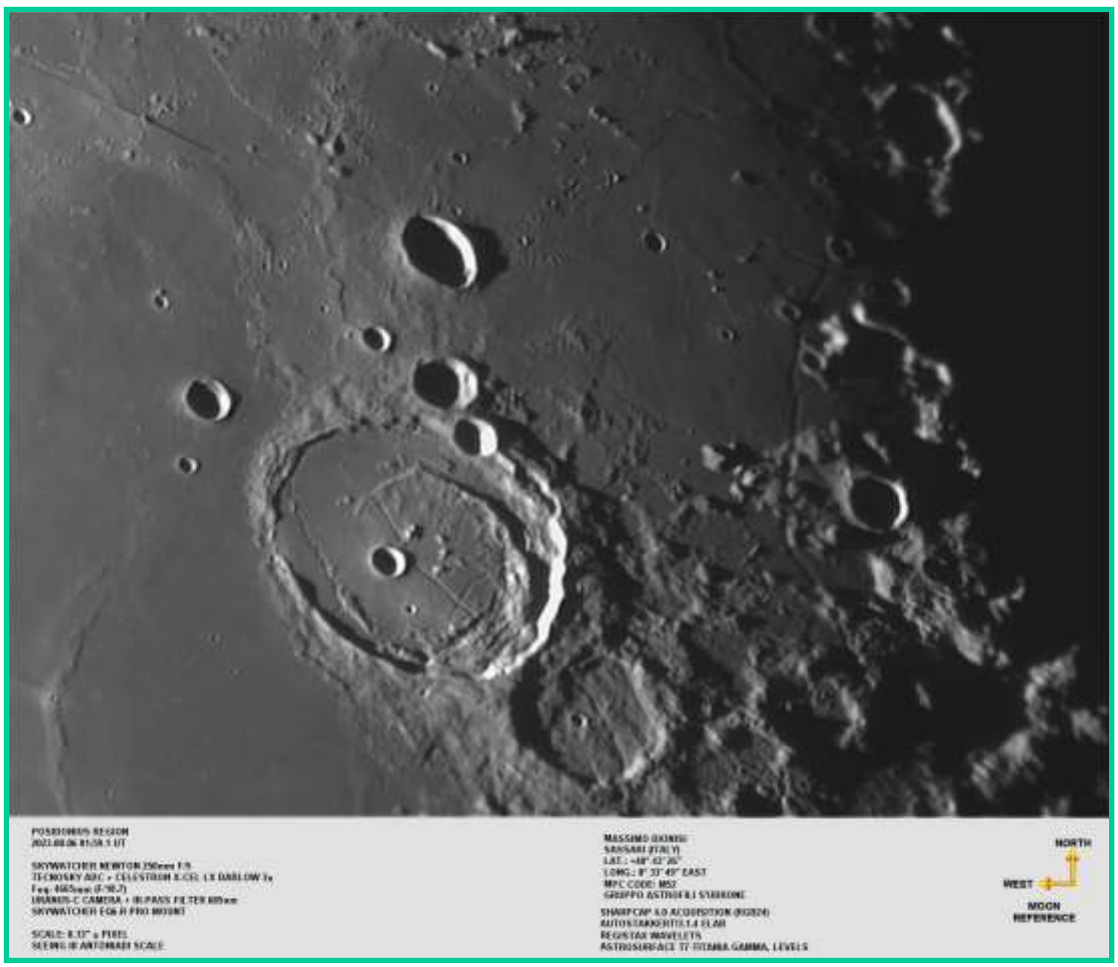


***Image 28, Posidonius,** Massimo Dionisi, Sassari, Italy. 2023 August 06 01:59 UT. Sky Watcher 250 mm f/5 Newtonian reflector telescope, Technosky ADC, Celestron X-cel LX Barlow, 3x, fl 4,665 mm, IR pass filter 685 nm, Uranus-C camera. Seeing III Antoniadi Scale.*

FOCUS ON: Floor Fractured Craters

__Image 29, Posidonius,__ Francisco Alsina Cardinalli, Oro Verde, Argentina, SLA. 2016 March 27 04:45 UT. Celestron Edge HD 11 inch Schmidt-Cassegrain telescope, Canon EOS Digital Rebel XS camera.

__Image 30, Posidonius,__ Francisco Alsina Cardinalli, Oro Verde, Argentina, SLA. 2016 March 28 04:45 UT. Celestron Edge HD 11 inch Schmidt-Cassegrain telescope, Canon EOS Digital Rebel XS camera.

FOCUS ON: Floor Fractured Craters:

Image 31, Posidonius, *Sergio Babino, Montevideo, Uruguay. 2020 March 14 04:58 UT. 203 mm catadrioptic telescope, ZWO ASI174 mm camera.*

Image 32, Posidonius, Fernando Sura, San Nicolás de los Arroyos, Argentina. 2020 June 27 23:27 UT. 127 Maksutov-Cassegrain telescope, Celestron NexImage 5 camera.

FOCUS ON: Floor Fractured Craters:

Image 33, Posidonius, *Pedro Romano, San Juan, Argentina. 2018 June 19 23:30 UT. 500 mm reflector telescope, ZWO ASI120 camera.*

Once again, Elger describes Posidonius with beautiful precision: "On the floor, which shines with a glittering luster, are the well-marked remains of a second ring, nearly concentric with the principal rampart, and separated from it by an interval of nine or ten thousands. The most prominent object, however, is the bright crater a little W. of the center. This is partially surrounded on the E. by three or four small bright mountains, through which runs in a meridional direction a rill-valley, not easily traced as a whole, except under a low sun. There is another cleft on the N.W. side of the interior, which is an apparent extension of part of the inner ring, a transverse rill-valley on the N., a fourth quasi rille on the N.E., and a fifth short cleft on the S. part of the floor" (page 52). The reader can follow this description in the series of images by Rik Hill (IMAGES 33 to 46) and Anthony Harding (IMAGES 47 and 48) and Jeff de Wit (IMAGE 49).

Image 34, Posidonius, *Richard Hill, Loudon Observatory, Tucson, Arizona, USA. 2008 June 09 03:00 UT. Celestron 14 inch Schmidt-Cassegrain telescope, 2x barlow, UV/IR blocking filter, SPC900NC camera. Seeing 8/10.*

FOCUS ON: Floor Fractured Craters:

Image 35, Posidonius, *Richard Hill, Loudon Observatory, Tucson, Arizona, USA. 2019 July 09 02:48 UT, colongitude 351.3°. TEC 8 inch f/20 Maksutov-Cassegrain telescope, 610 nm filter, SKYRIS 445M camera. Seeing 9/10.*

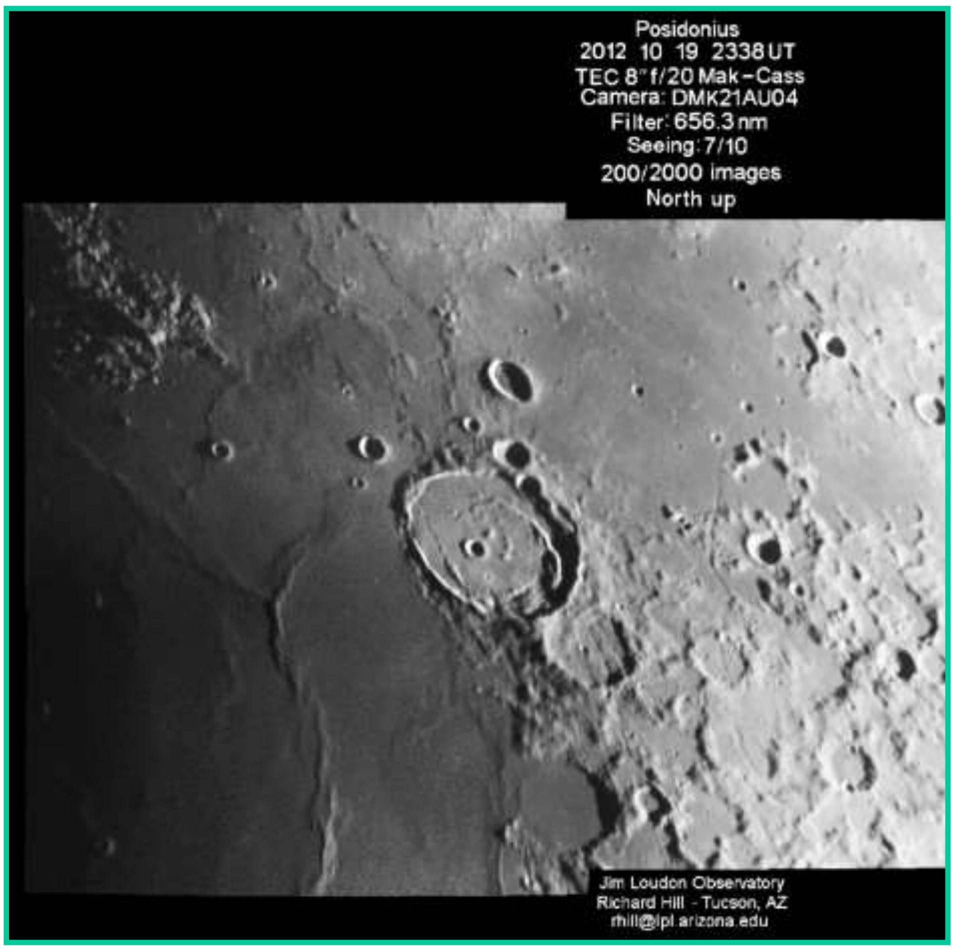


Image 36, Posidonius, *Richard Hill, Loudon Observatory, Tucson, Arizona, USA. 2012 October 19 23:38 UT. TEC 8 inch f/20 Maksutov-Cassegrain telescope, 656.3 nm filter, DMK21AU04 camera. Seeing 7/10.*

FOCUS ON: Floor Fractured Craters:

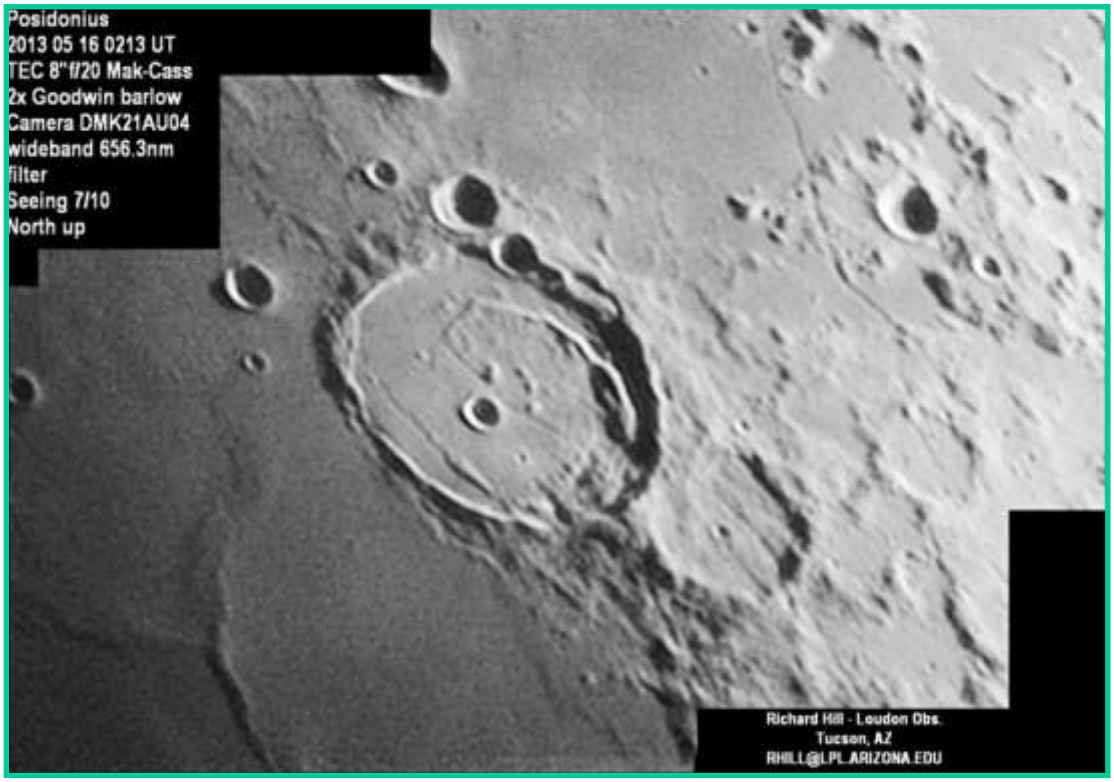


Image 37, Posidonius, *Richard Hill, Loudon Observatory, Tucson, Arizona, USA. 2013 May 16 02:13 UT. TEC 8 inch f/20 Maksutov-Cassegrain telescope, 2x barlow, 656.3 nm filter, DMK21AU04 camera. Seeing 7/10.*

Image 38, Posidonius, *Richard Hill, Loudon Observatory, Tucson, Arizona, USA. 2016 March 14 01:19 UT. TEC 8 inch f/20 Maksutov-Cassegrain telescope, 656.3 nm filter, SKYRIS 445M camera. Seeing 8/10.*

FOCUS ON: Floor Fractured Craters:

Image 39, ***Posidonius,*** *Richard Hill, Loudon Observatory, Tucson, Arizona, USA. 2016 April 13 02:29 UT. TEC 8 inch f/20 Maksutov-Cassegrain telescope, 656.3 nm filter, SKYRIS 445M camera. Seeing 7/10.*

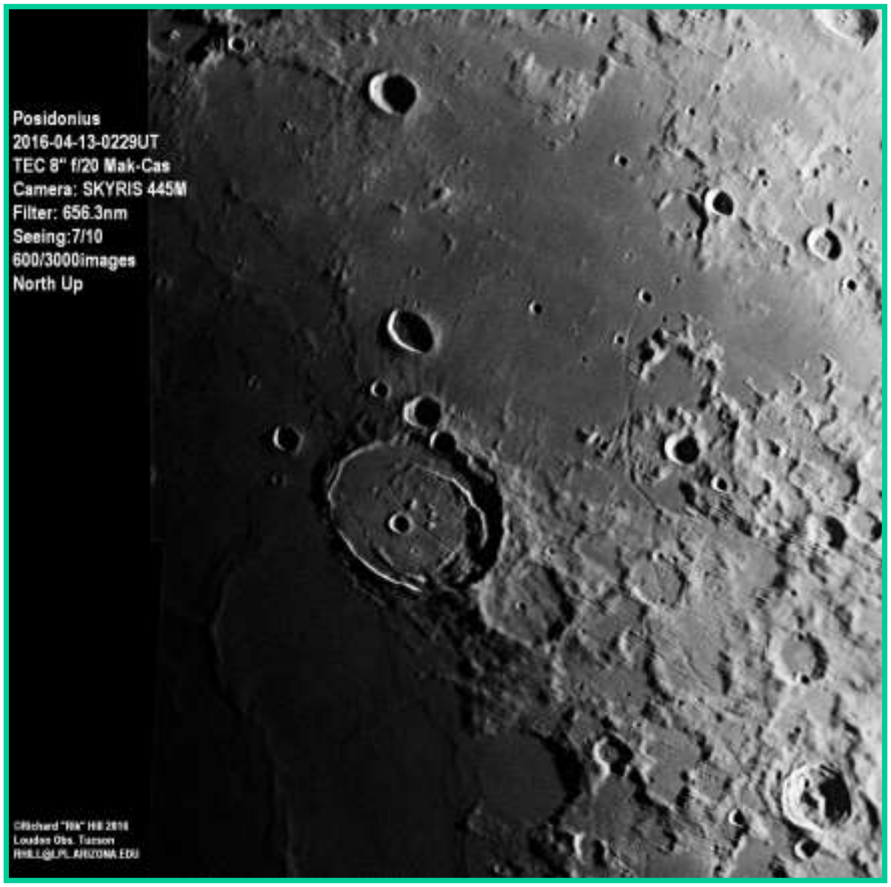
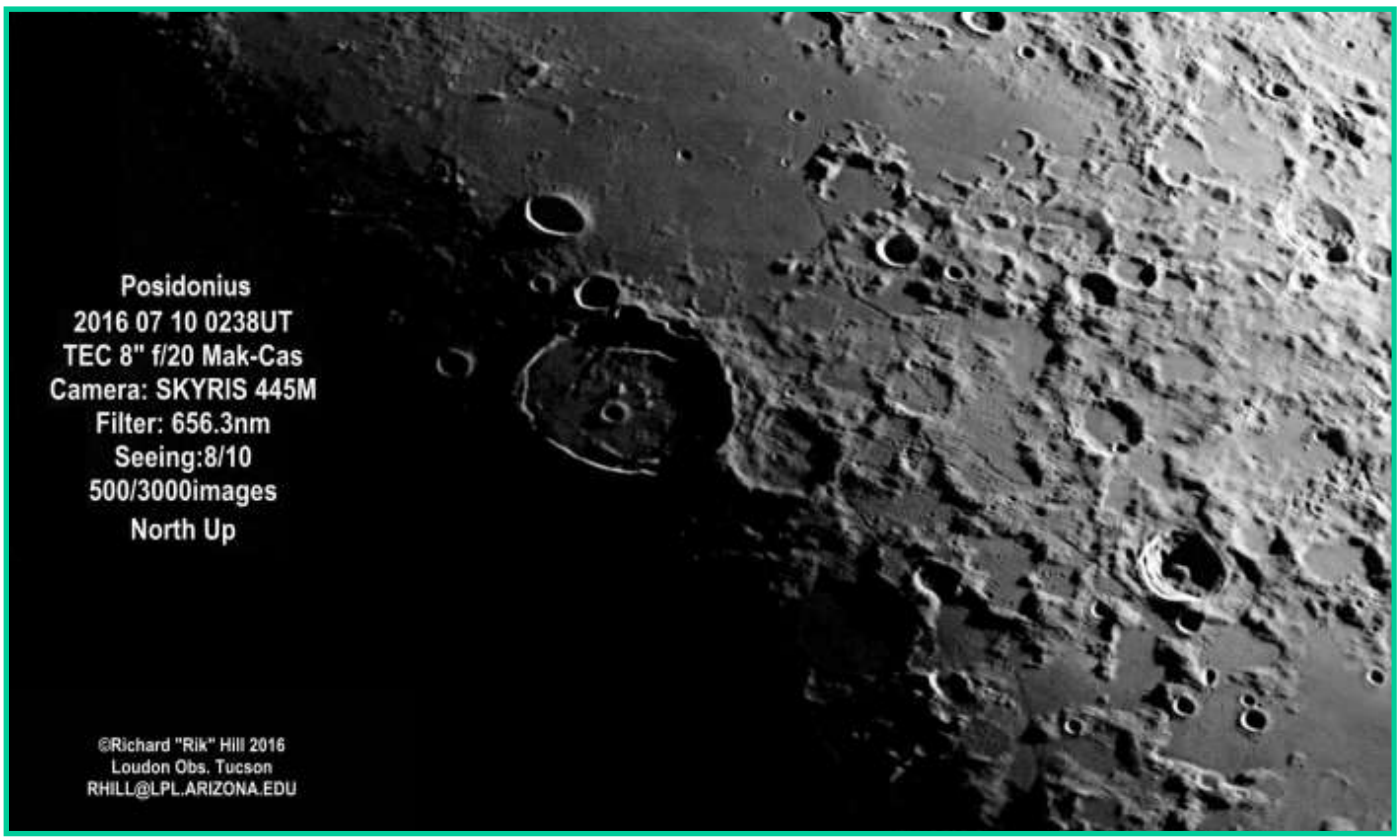


Image 40, Posidonius, *Richard Hill, Loudon Observatory, Tucson, Arizona, USA. 2016 July 10 02:38 UT. TEC 8 inch f/20 Maksutov-Cassegrain telescope, 656.3 nm filter, SKYRIS 445M camera. Seeing*



FOCUS ON: Floor Fractured Craters:

Image 41, Posidonius to Plinius, *Richard Hill, Loudon Observatory, Tucson, Arizona, USA. 2017 May 02 02:07 UT, colongitude 149.8º. TEC 8 inch f/20 Maksutov-Cassegrain telescope, 665 nm filter, SKYRIS 445M camera. Seeing 8/10.*

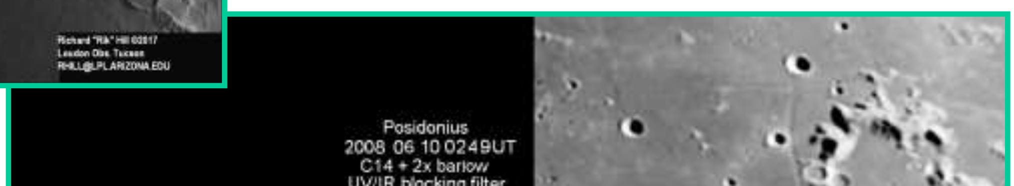
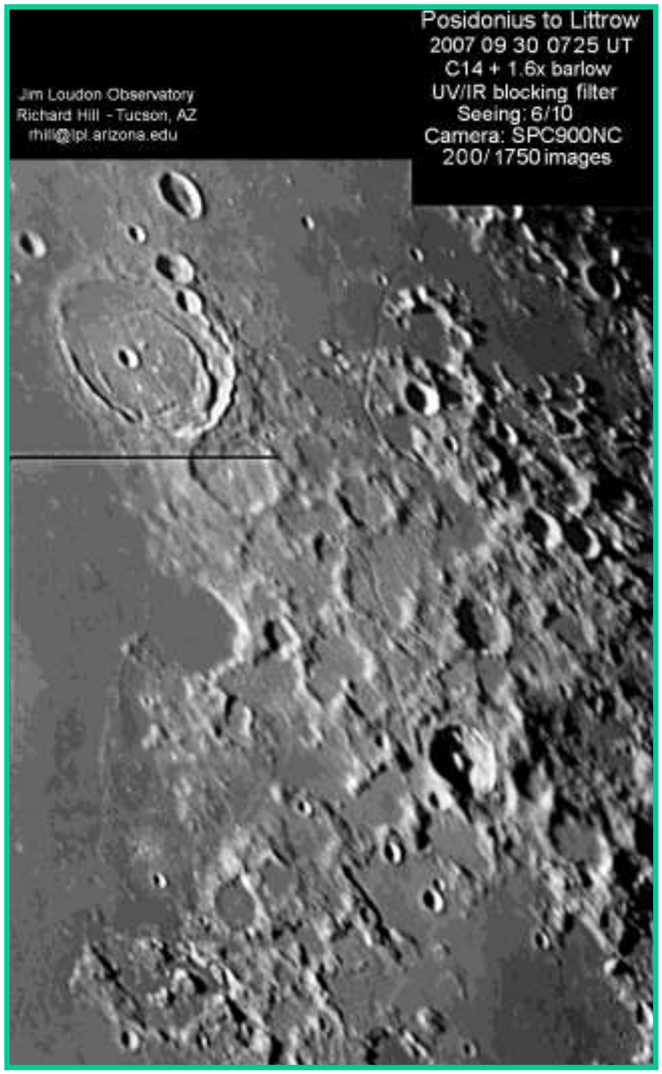


Image 42, Posidonius, *Richard Hill, Loudon Observatory, Tucson, Arizona, USA. 2008 June 10 02:49 UT. Celestron 14 inch Schmidt-Cassegrain telescope, 2x barlow, UV/IR blocking filter, SPC900NC camera. Seeing 8/10.*

FOCUS ON: Floor Fractured Craters:

Image 43, Posidonius to Littrow, *Richard Hill, Loudon Observatory, Tucson, Arizona, USA. 2007 September 30 07:25 UT. Celestron 14 inch Schmidt-Cassegrain telescope, 1.6x barlow, UV/IR blocking filter, SPC900NC camera. Seeing 6/10.*



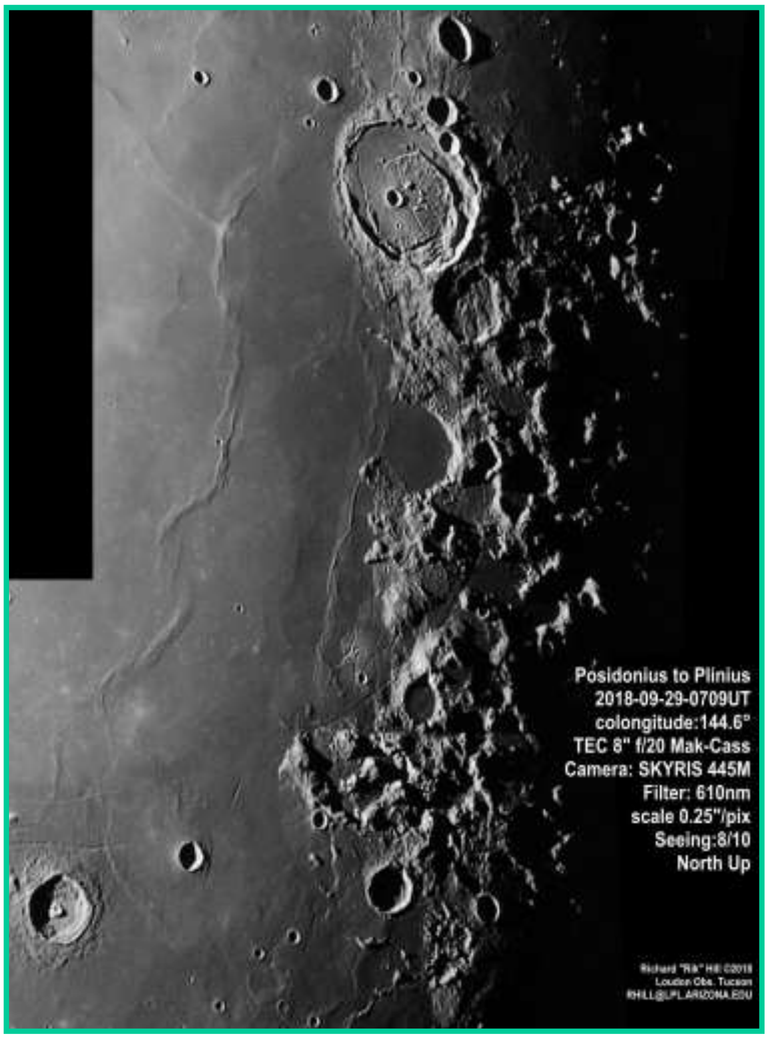


Image 44, Posidonius to Plinius, *Richard Hill, Loudon Observatory, Tucson, Arizona, USA. 2018 September 29 07:09 UT, colongitude 144.6°. TEC 8 inch f/20 Maksutov-Cassegrain telescope, 610 nm filter, SKYRIS 445M camera. Seeing 8/10.*

FOCUS ON: Floor Fractured Craters:

Image 45, Posidonius, *Richard Hill, Loudon Observatory, Tucson, Arizona, USA. 2017 May 02 02:07 UT. TEC 8 inch f/20 Maksutov-Cassegrain telescope, 665 nm filter, SKYRIS 445M camera. Seeing 8/10.*

Image 46, Posidonius, *Richard Hill, Loudon Observatory, Tucson, Arizona, USA. 2019 October 18 07:16 UT, colongitude 149.8°. TEC 8 inch f/20 Maksutov-Cassegrain telescope, 610 nm filter, SKYRIS 445M camera. Seeing 7/10.*

FOCUS ON: Floor Fractured Craters:

Image 47, Posidonius, *Anthony Harding, northeast Indiana, USA. 2023 July 23 03:01 UT, colongitude 333.188°. Orion 90 mm achromat refractor telescope, ZWO ASI290mm/s camera. Seeing 7/10, transparency 5/6. Anthony adds:* "The main goal of this image was to capture a sunrise shot of Posidonius (near the terminator), but the craters Atlas and Hercules were also in the frame. The internal crater Posidonius-A can be seen here, as well as some other floor features. Posidonius-B can also be seen interrupting the larger crater's northeastern rim, and Chacornac sits adjacent to its southeastern rim. Unfortunately, the smaller scope used was not able to resolve Rimae Posidonius."

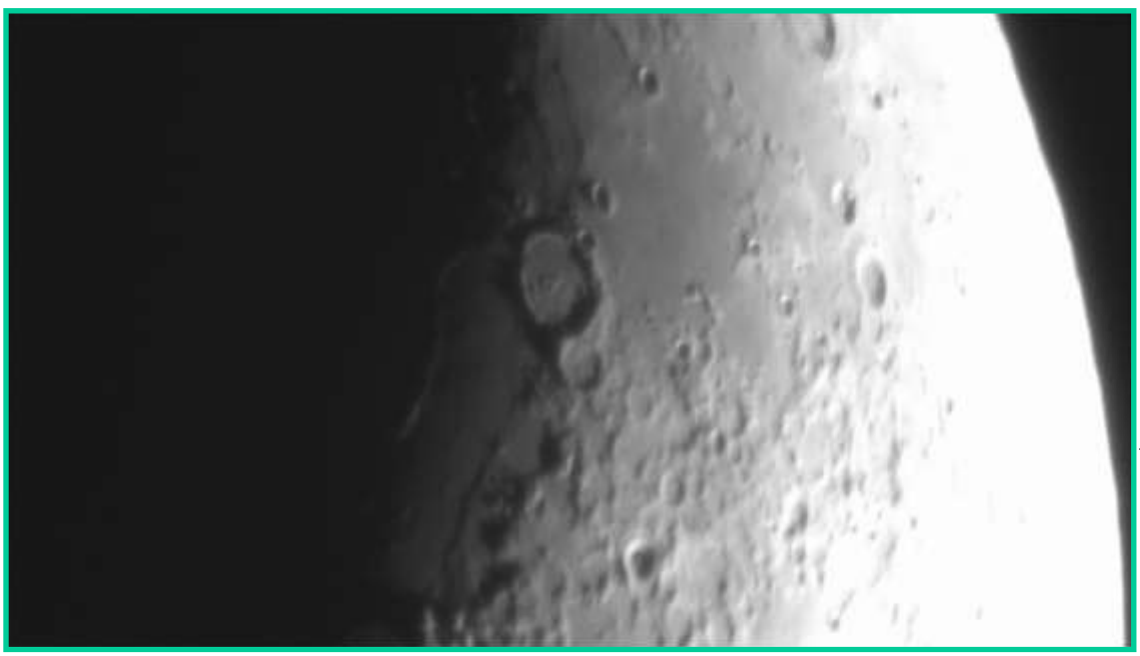


Image 48, Posidonius, *Anthony Harding, northeast Indiana, USA. 2023 July 23 03:09 UT, colongitude 333.256°. Orion 90 mm achromat refractor telescope, 2.5x Tele Vue PowerMate, ZWO ASI290mm/s camera. Seeing 5/10, transparency 5/6. Anthony adds:* "For this follow-up image of Posidonius, the 2.5x PowerMate was used to boost the magnification. The target was falling rapidly into the horizon, so the seeing was deteriorating. Nevertheless, some of the internal features are slightly easier to make out, such as Posidonius-A and the nearby mountains. Again, the smaller scope was unable to resolve Rimae Posidonius."

FOCUS ON: Floor Fractured Craters:

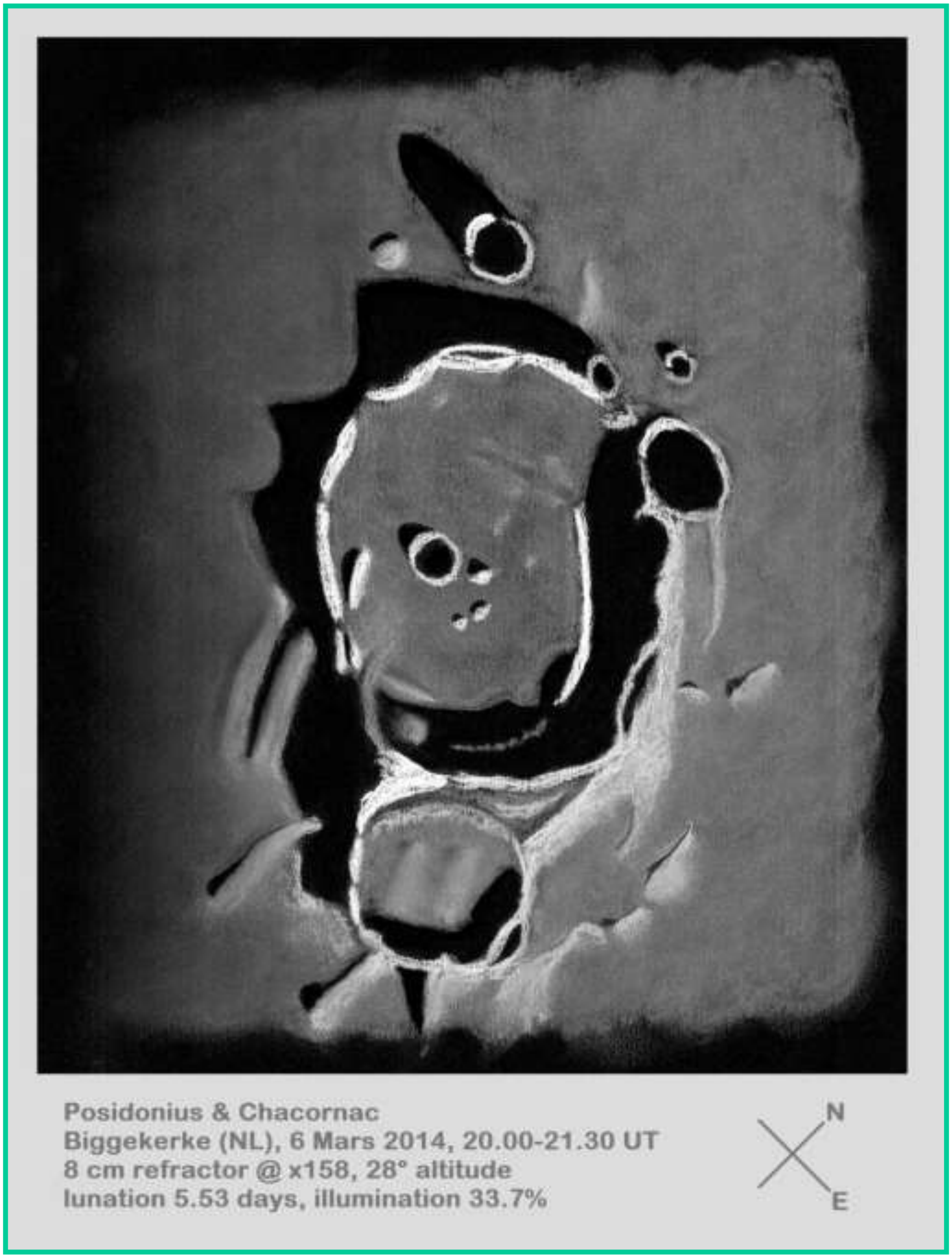
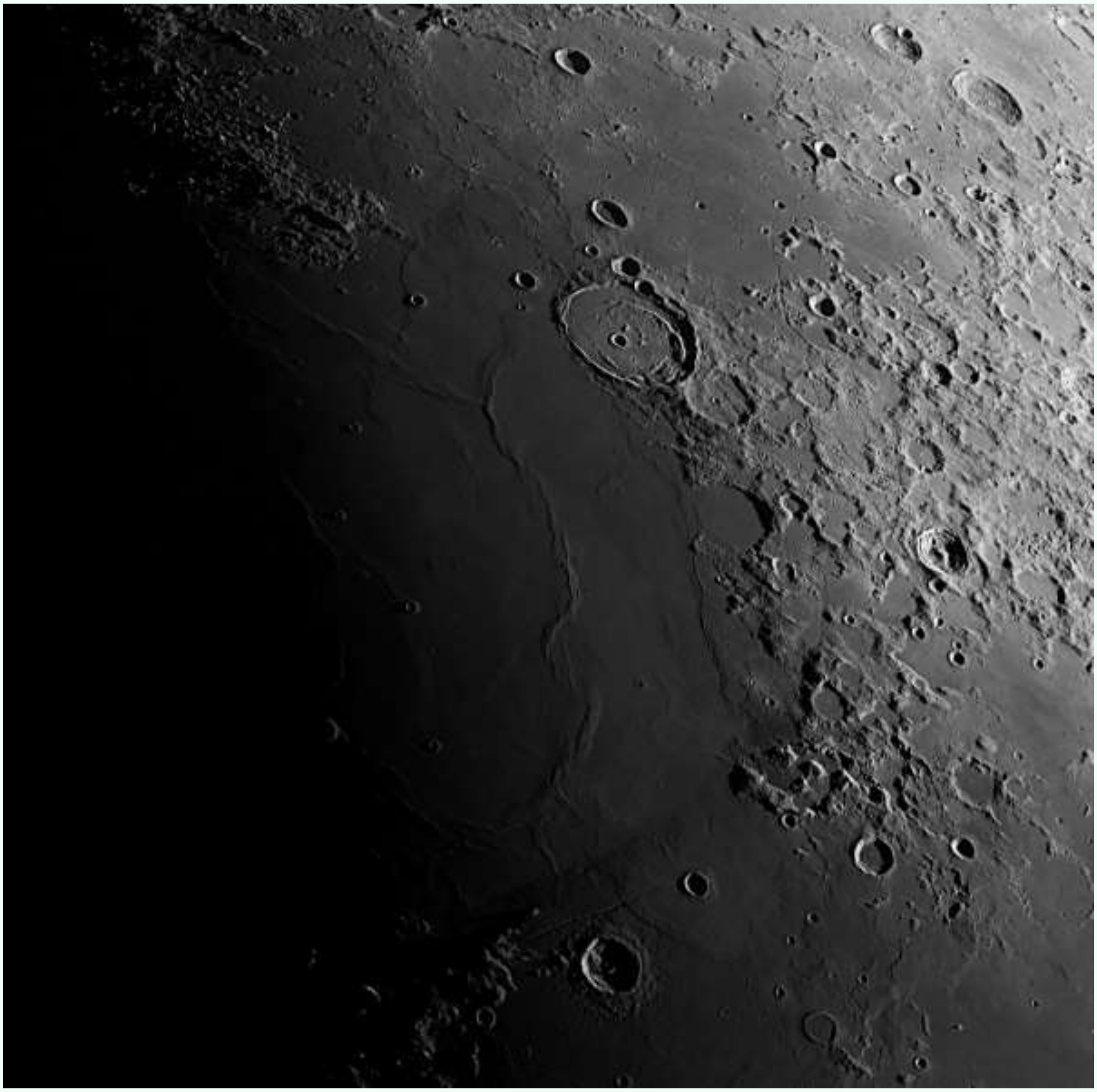


Image 49, Posidonius, *Jef de Wit, Hove, Belgium. 2014 March 06 20:00-21:30 UT. 8 cm refractor telescope, 158 x.*

FOCUS ON: Floor Fractured Craters

A Tour of Posidonius

Jeff Grainger



Posidonius, Dorsa Smirnov and Plinius: 6.19 days 20.31 UT May 25 2023 [183]

[Altitude: 40*09' Azimuth: 247*50' Libration: 6.0* @ PA 186*]

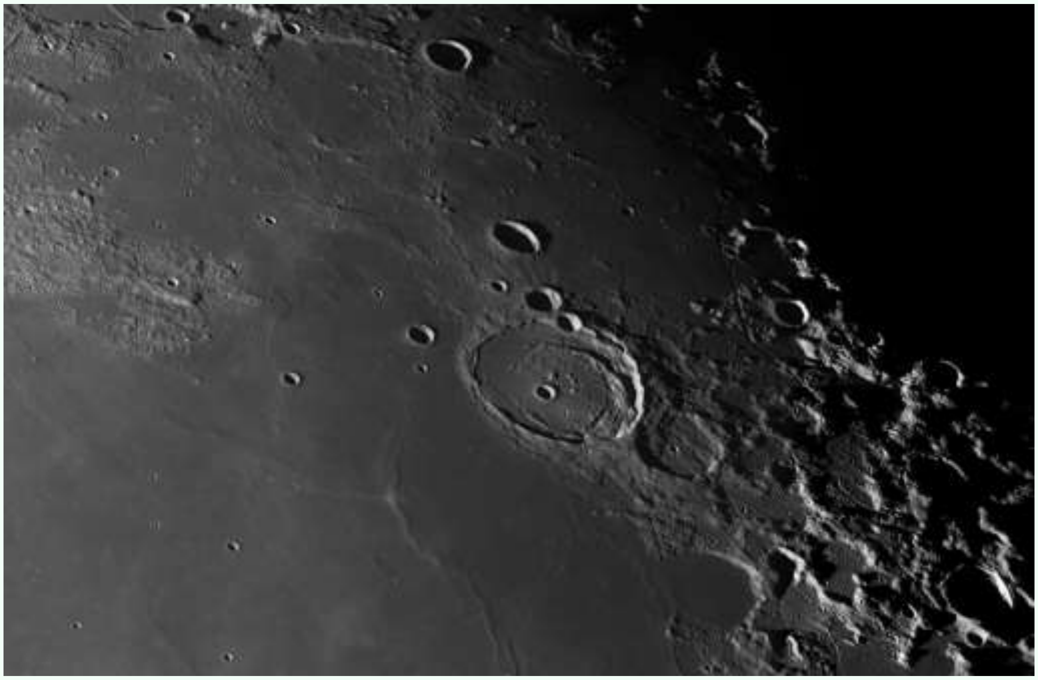
<u>Posidonius Data [see Moore, 514 CoM]:</u>

Diameter: ~ 95 km

Age: ~ Upper Imbrium 3.75-3.3 bn y old

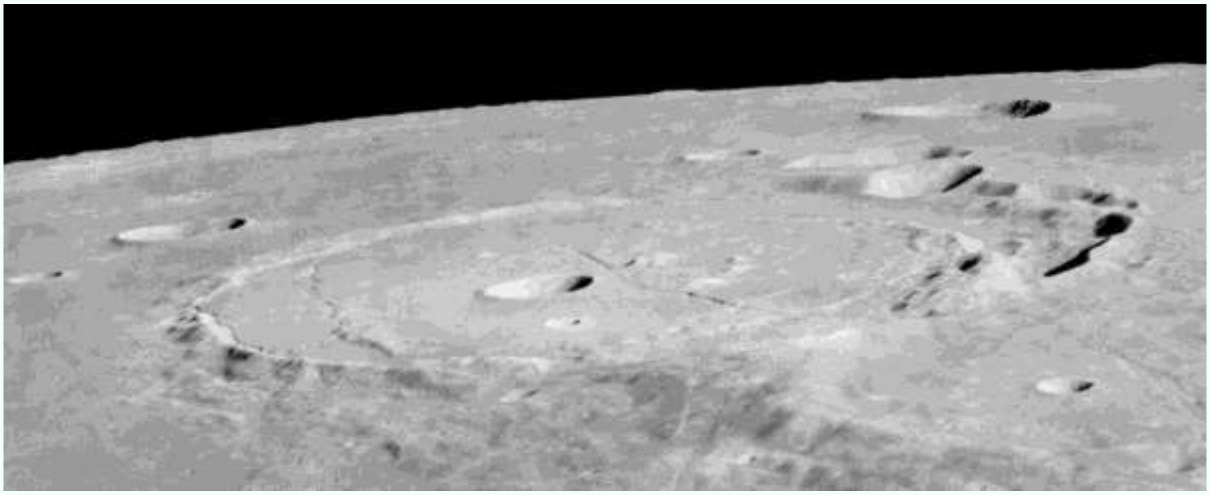
Depth: ~ 1.4km (see LRO profile data)

FOCUS ON: Floor Fractured Craters: A Tour of Posidonius



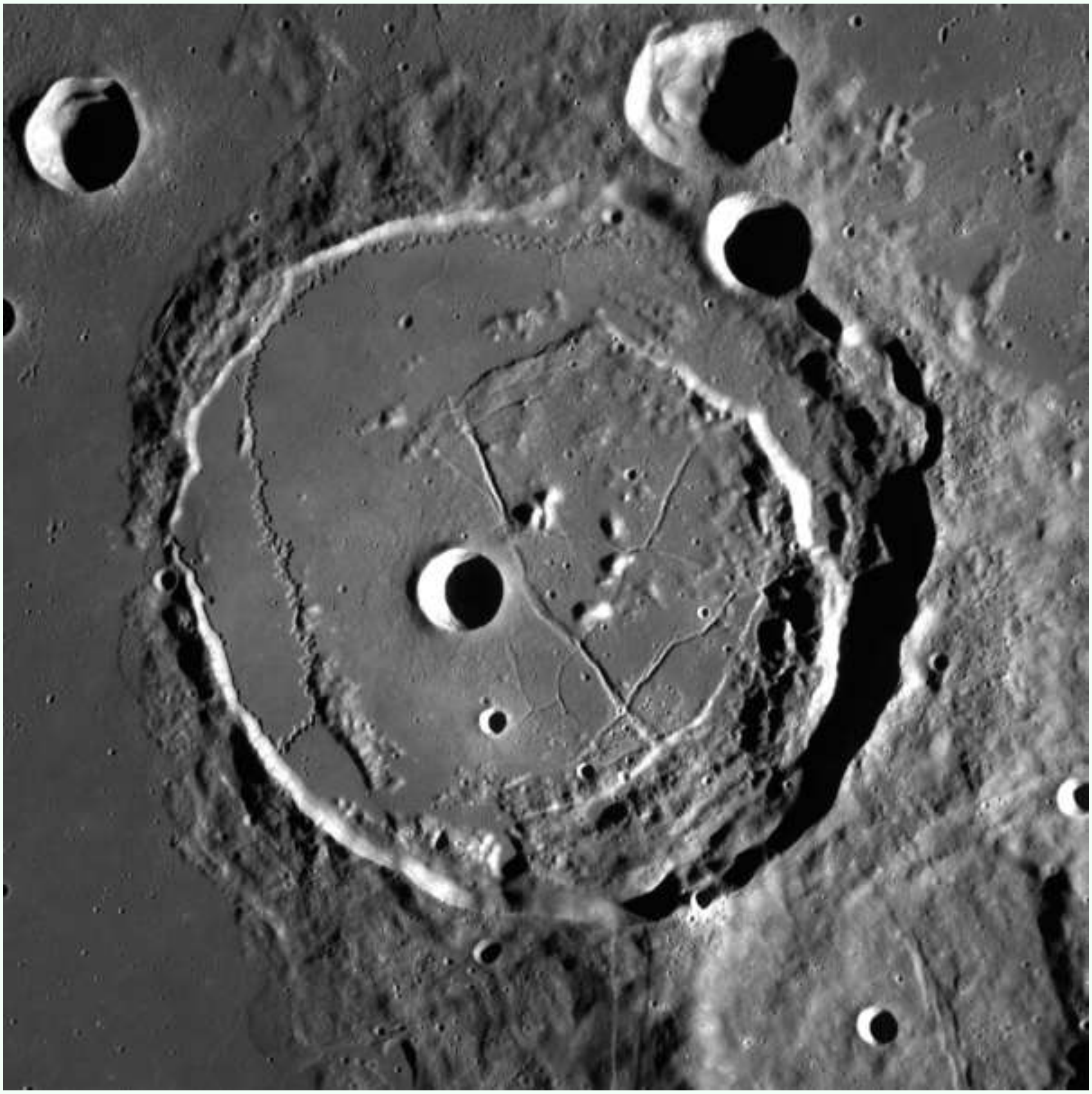
NE Serenitatis: 18.68 days 03.01 UT November 13 2022

[Altitude: 61*39'   Azimuth: 159*23'   Libration: 5.5* @ PA 173*]   [71/73A]



Oblique view of Posidonius looking in a generally north direction. Taken by Apollo 17 in 1972, AS17-M-0938.

FOCUS ON: Floor Fractured Craters: A Tour of Posidonius

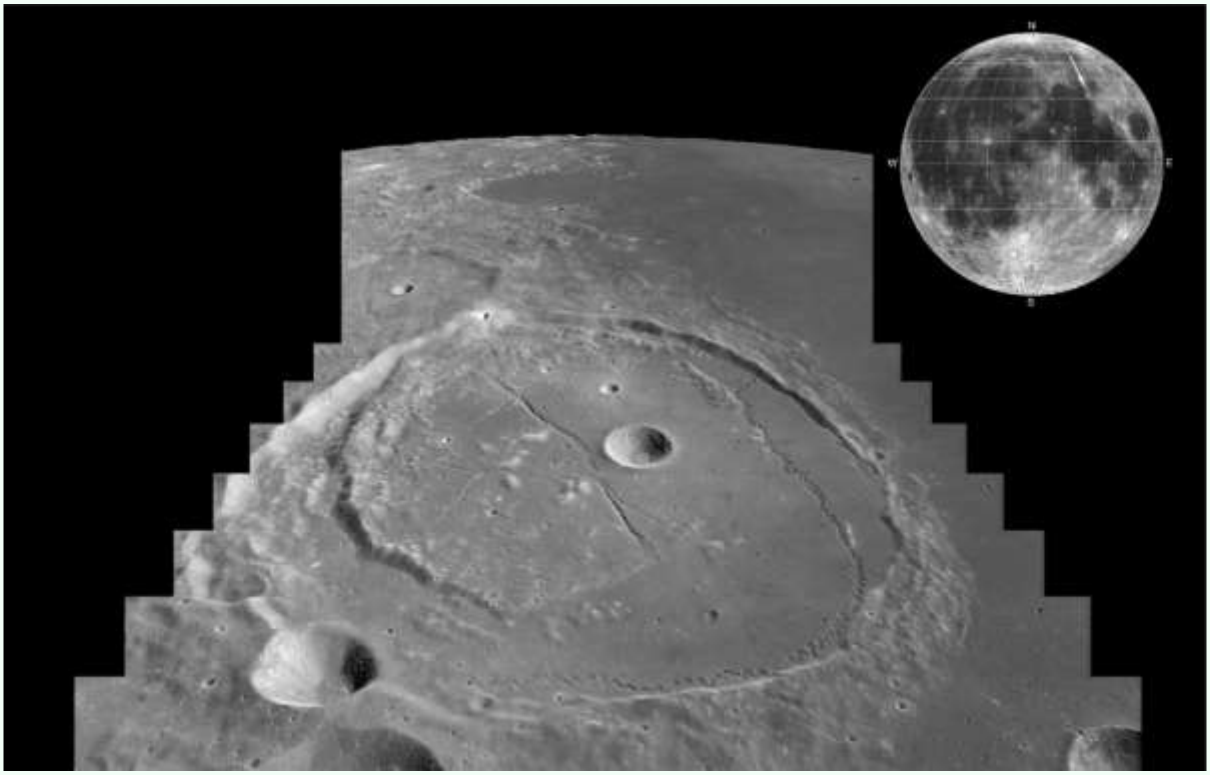


This magnificent image is from the LRO. North at the top.

Rilles, uplifted floors, internal craters… very reminiscent of Gassendi, and also – coincidentally – conspicuously placed at the edge of one of the lunar maria.

The image on the following page was taken by the Kaguya satellite. Looking south, with crater Le Monnier towards the top, with Mare Serenitatis at right.

FOCUS ON: Floor Fractured Craters: A Tour of Posidonius

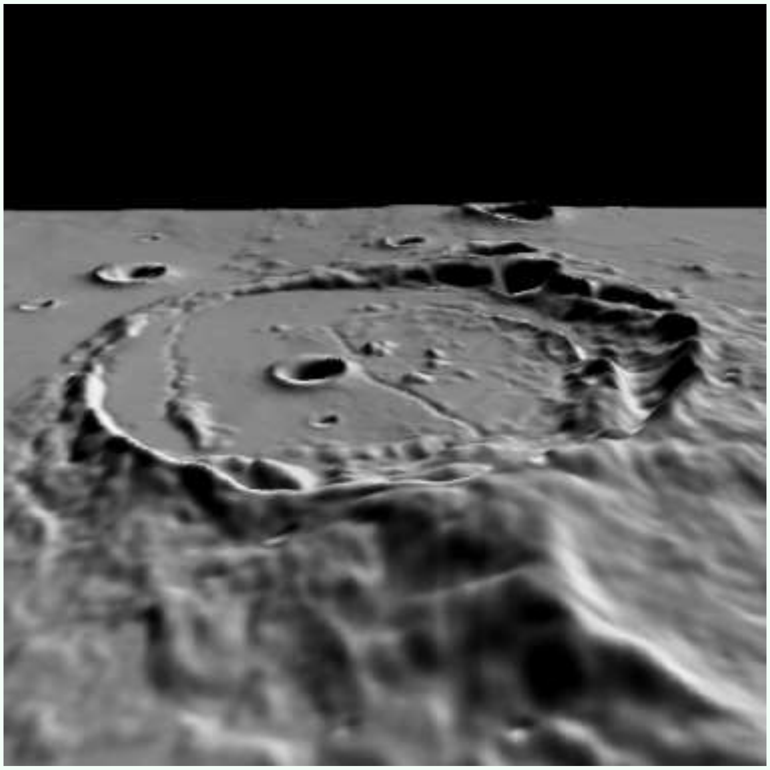


High-resolution Apollo 15 image, looking north.

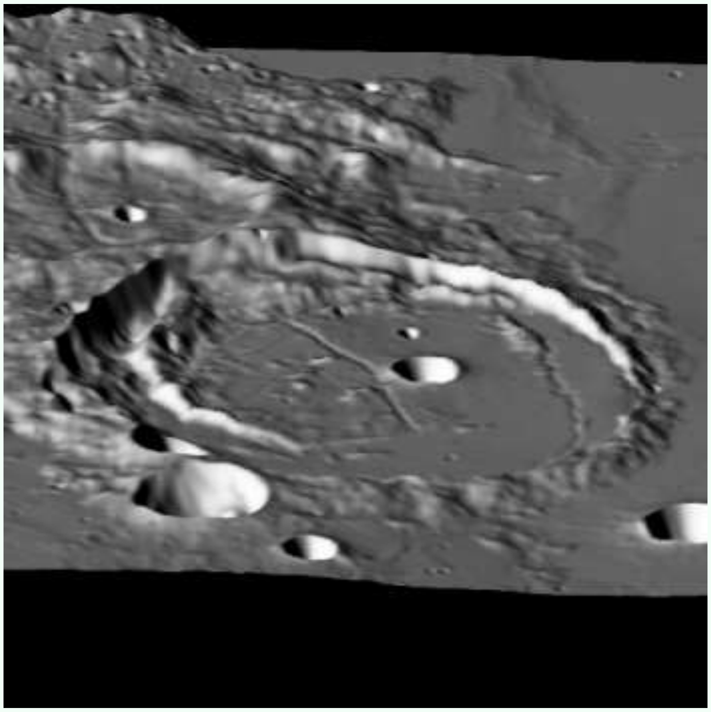
FOCUS ON: Floor Fractured Craters: A Tour of Posidonius

Image Rendering:

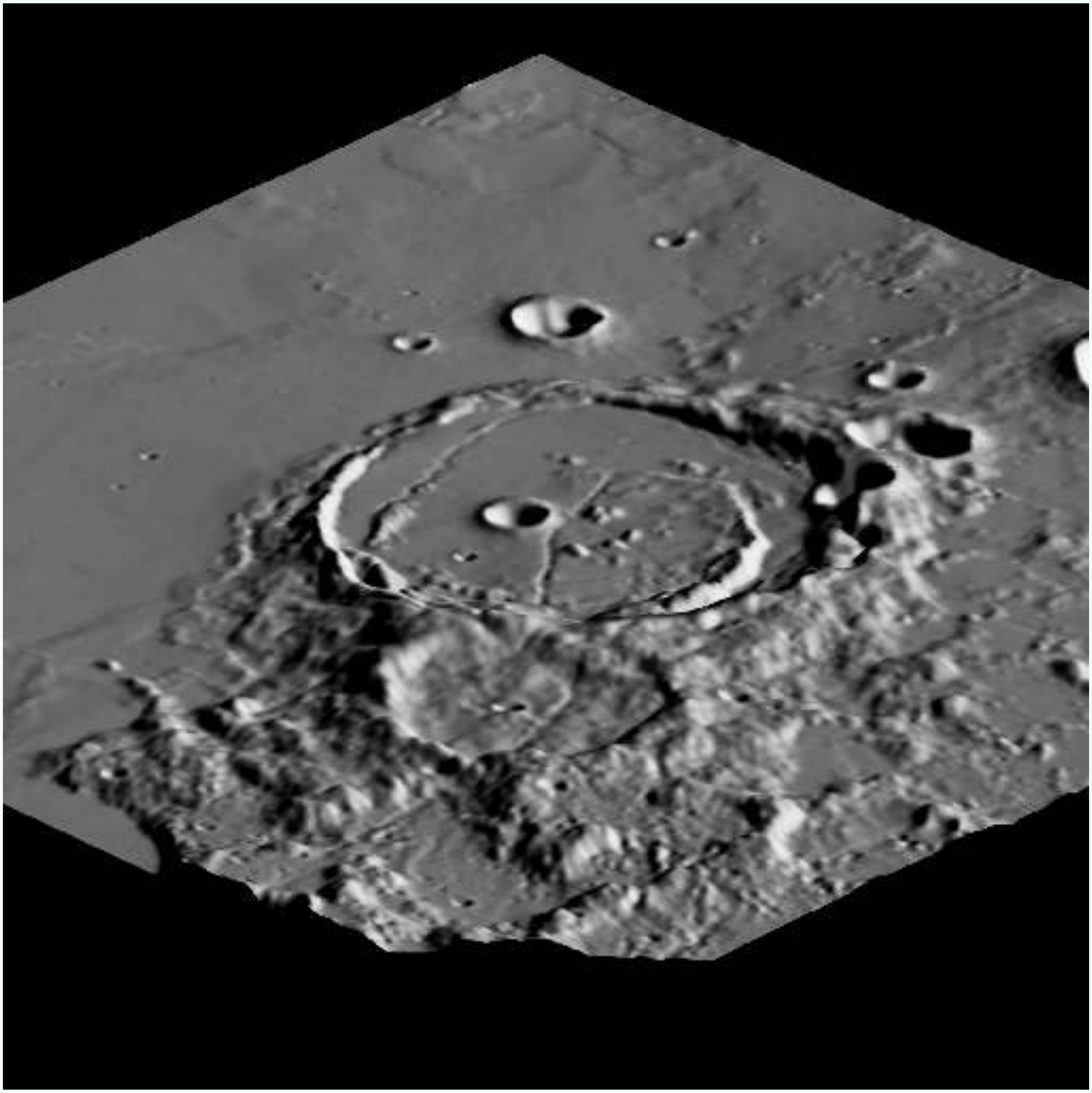
The array of features, changes in floor-depth and adjacent highlands to the south make views of this crater both varied and spectacular!



Looking North from higher terrain. Vertical exaggeration x 3, Perspective view.

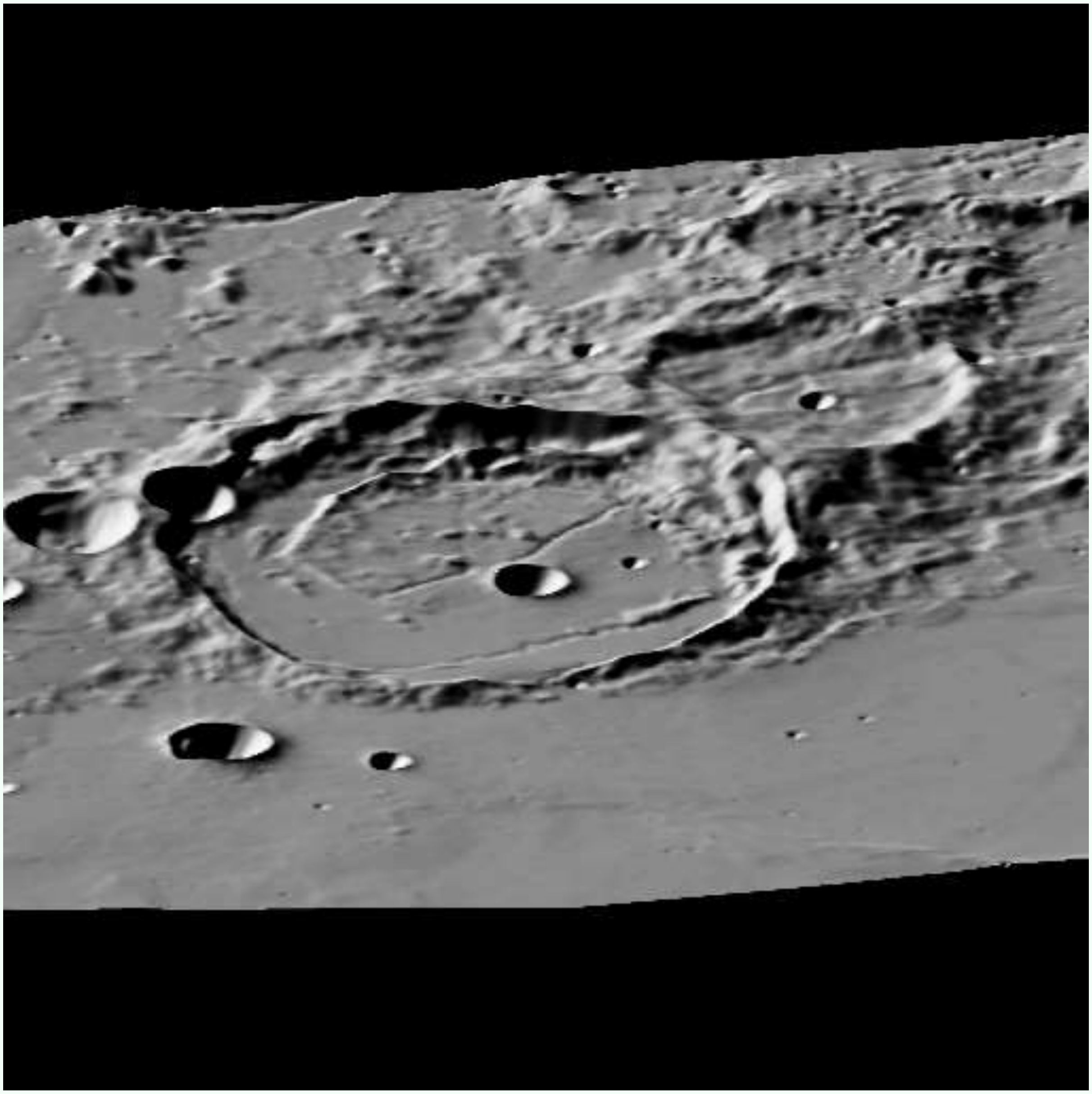


Looking South towards the highland background. Exaggeration x3, zoomed.



View to the NW in the direction of Serenitatis.

Zoomed and vertical enhancement x3.



An easterly view, vertical enhancement x2.

The difference in the floor heights of Posidonius and the adjacent Chacornac to its south (right) are very apparent.

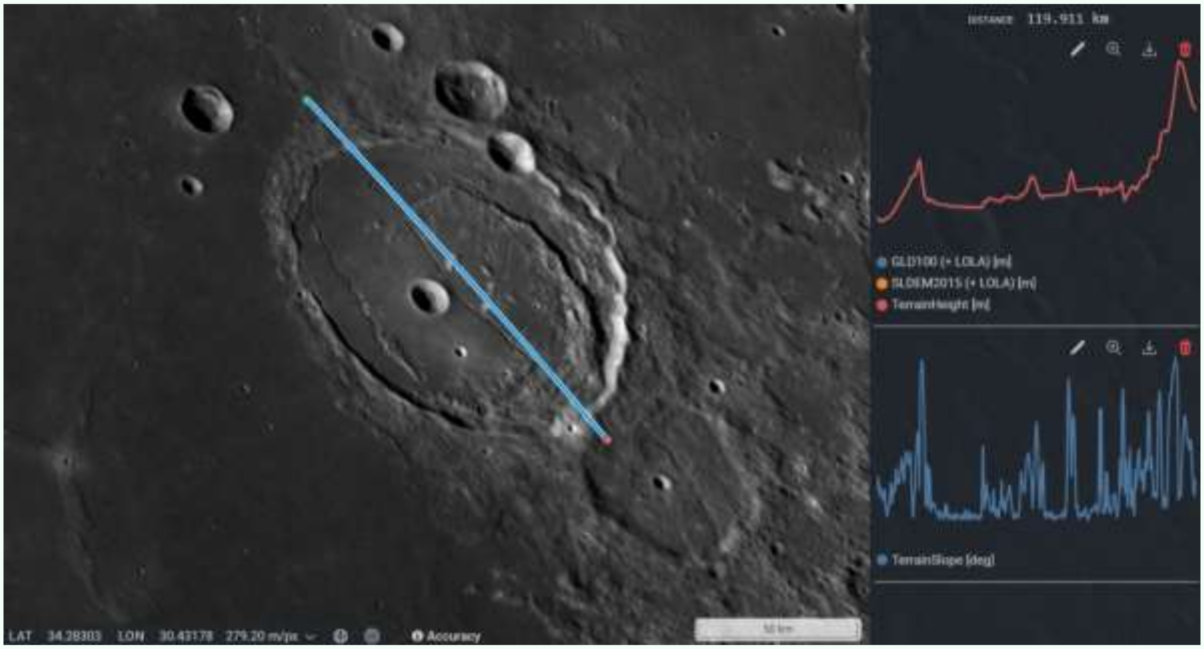
Favourite Craters:

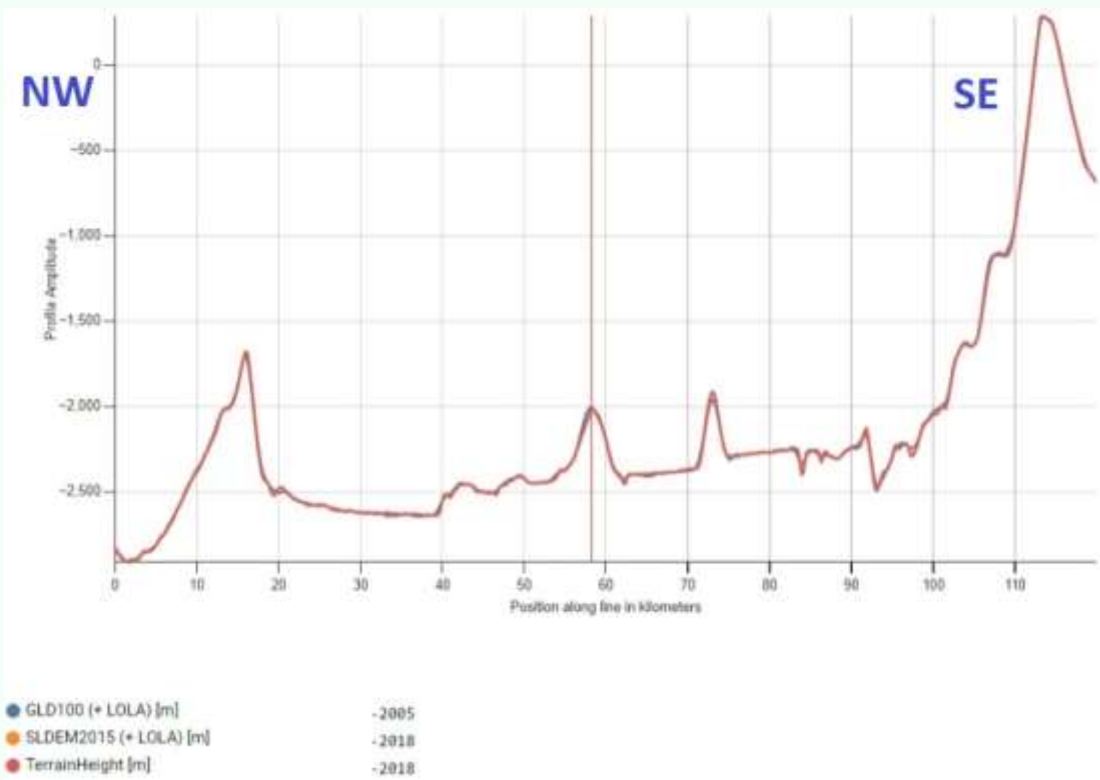
Posidonius is conspicuous when near the terminator and full of features and "character". Alongside its "twin", Gassendi, it ranks among my ten favourite lunar craters.

For reference, Theophilus, Plato, Clavius, Archimedes and Copernicus also make that list!

Crater Profiles:

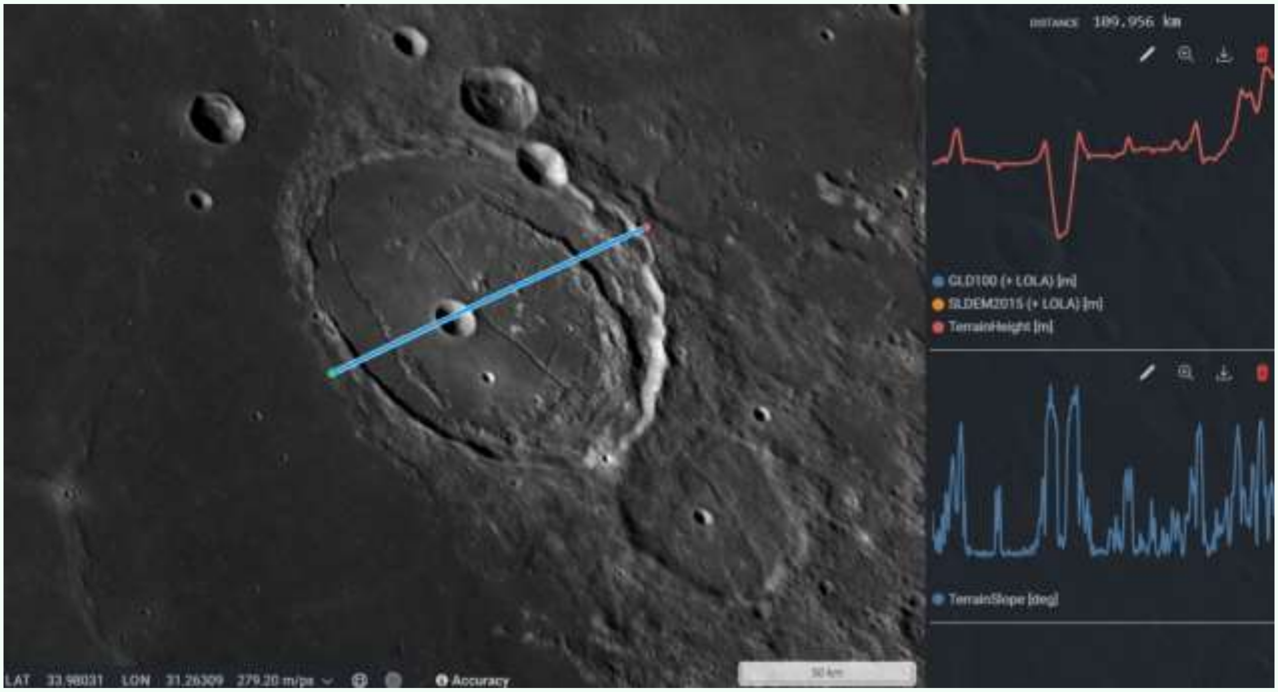
From NW to SE:

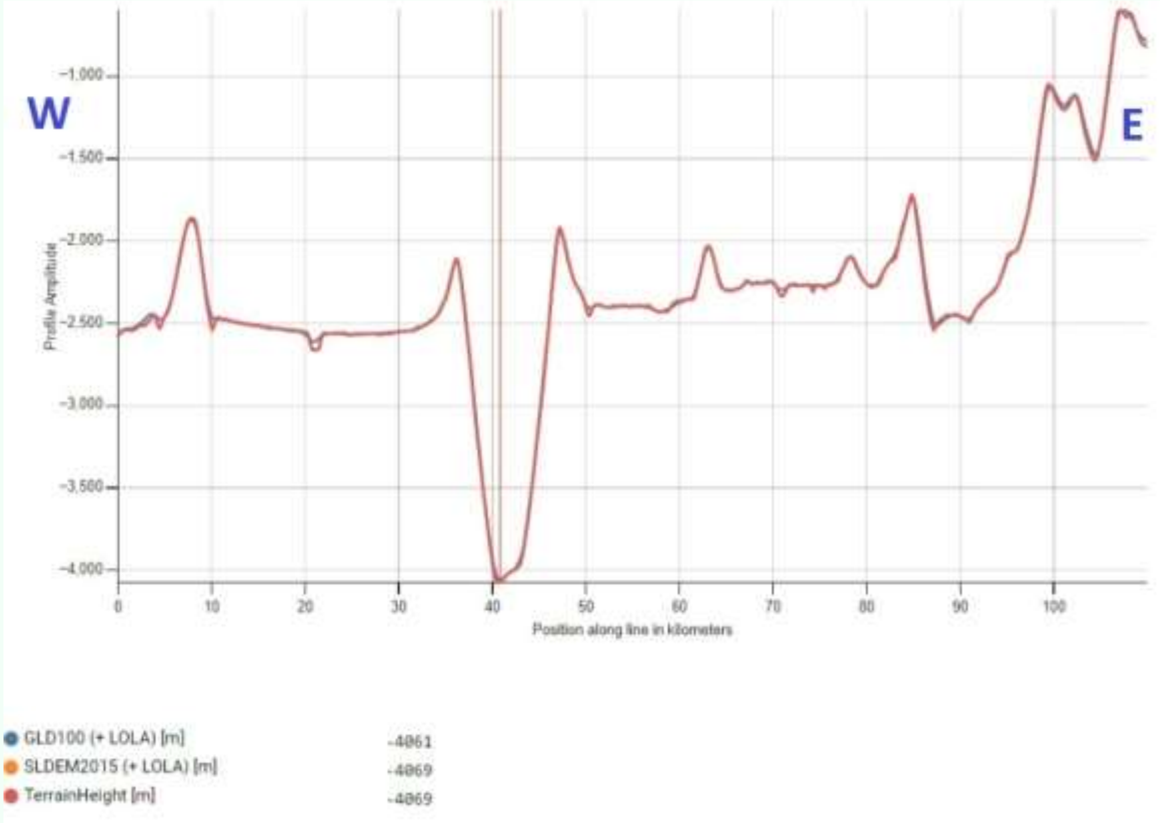




Note the rising ground as we head SE – apparent in the rendered images.

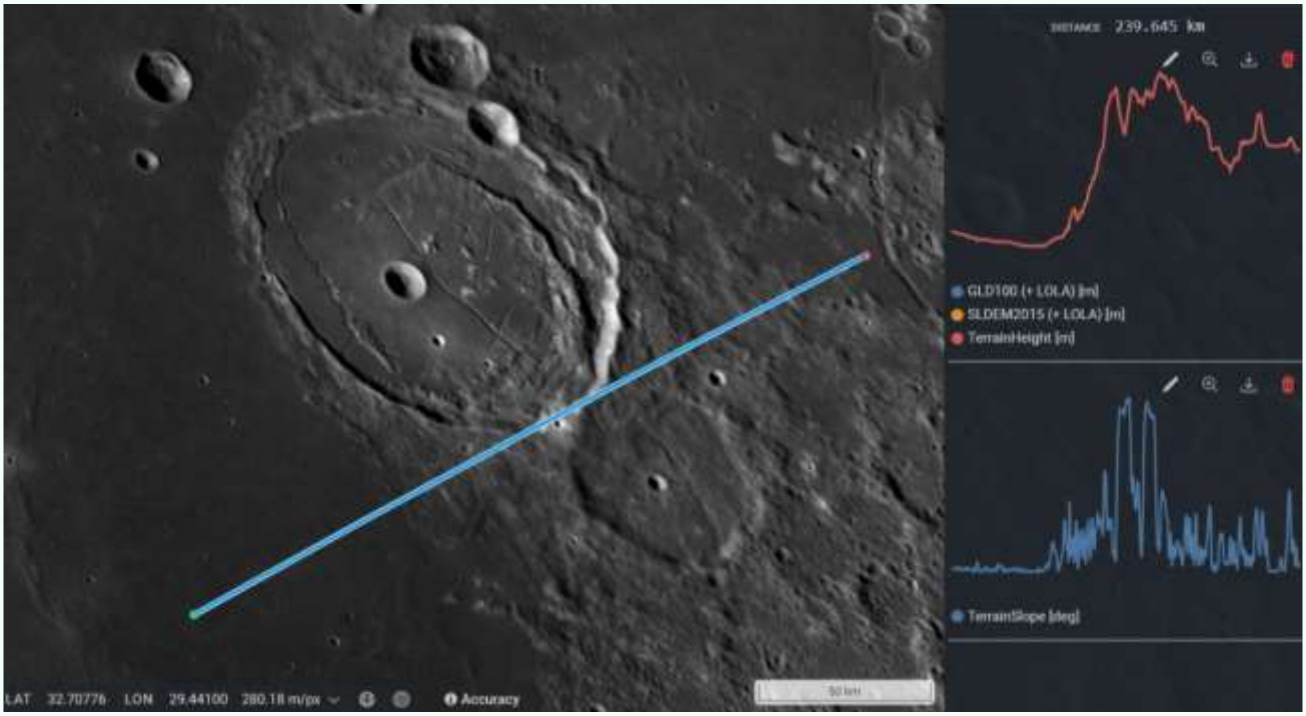
Approx. W to E:





West rim of crater (Mare-side) almost non-existent in places!

Mare to the Highlands:



The profile chart (in red, upper right) confirms the abrupt rise in ground elevation moving eastwards from Serenitatis towards Chacornac and beyond.

FOCUS ON: Floor Fractured Craters: A Tour of Posidonius

The third big one of the Category 1 of the FFC is an old acquaintance of our readers, Petavius (177 kilometers in diameter) was the objective of the Focus On Section of the January 2023 edition. We also refer to the texts of Rik Hill and Jeff Grainger who are part of this edition of our magazine. Although Petavius belongs to the same class as Atlas and Posidonius, it is very different from them. Its fracture system is not concentric like Posidonius nor as complex as Atlas, but rather (in Garfinkle's words) its main feature is "radial fractures in addition to major graben rille Rimae Petavius". They are radial rilles, although Rima Petavius is straight, very straight, the rest are shallower and more tortuous, as we see in IMAGES 50 to 64.

Image 50, Petavius, *Larry Todd, Dunedin, New Zealand. 2023 August 03 10:30 UT. 8 inch OMC Maksutov-Cassegrain telescope.*

Image 51, Petavius, *Felix León, Santo Domingo, República Dominicana. 2022 October 12 05:25 UT. 8 inch Schmidt-Cassegrain telescope, DMK21618AU camera.*

FOCUS ON: Floor Fractured Craters

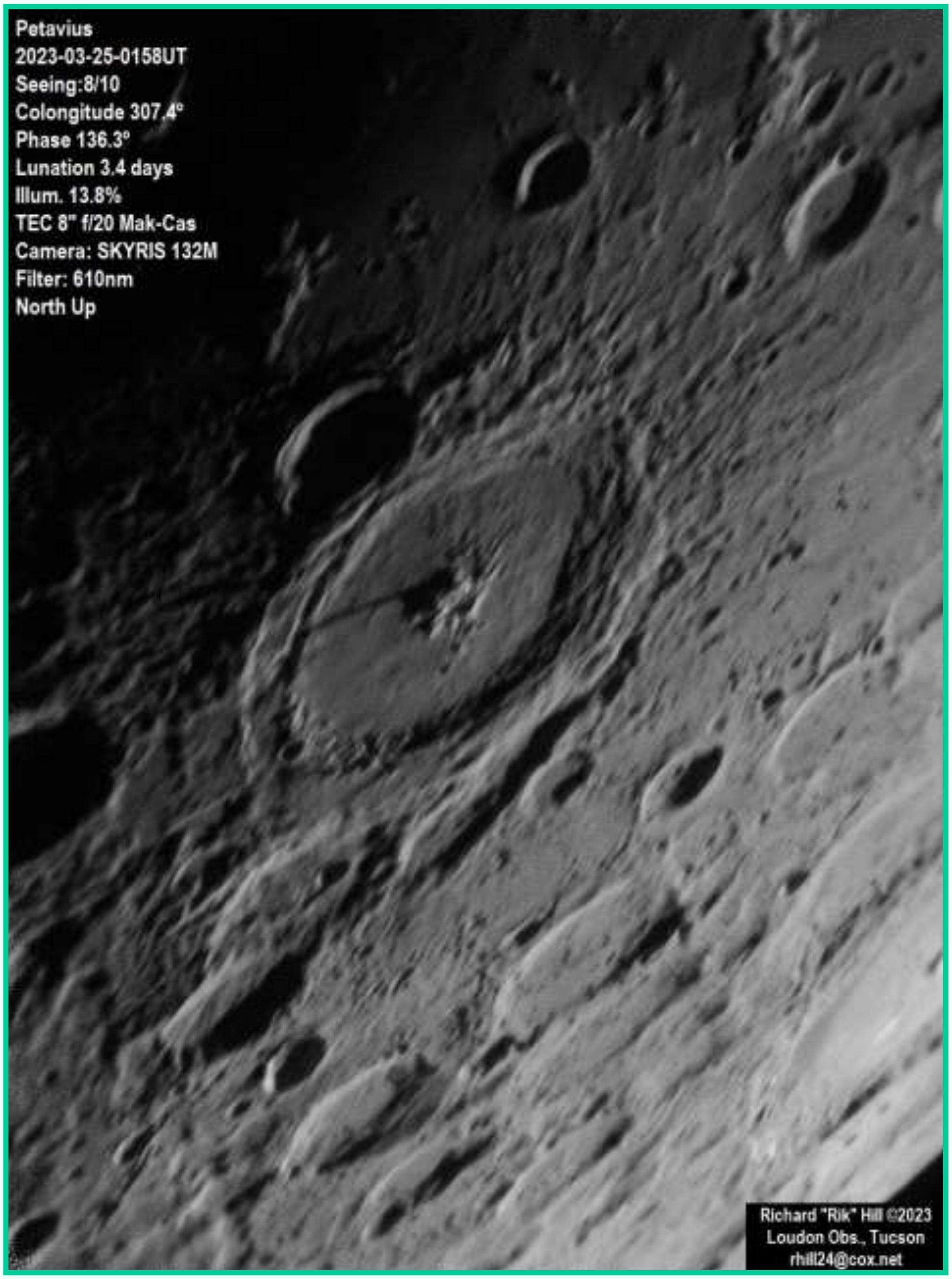
Petavius

Rik Hill

Located just east of the southern lobe of Mare Fecunditatis, is this beautiful 182 km diameter crater Petavius a favorite for all us amateurs as the crescent Moon climbs into our twilight skies at the beginning of each lunation. The beautiful terraced walls and the grand rille (or rima) going from the central peak to the southern wall catches the eye right away. The walls of this crater are rather wide for the diameter and beautifully terraced. Another rima, part of the Rimae Petavius system, is on north side of the central peaks to the upper right in this image. Ejecta splash can be seen to the north and south of this crater indicating the violence of the impact. I always enjoyed seeing all these features in my 2.4" Tasco refractor in the early 1960s. I first read about this crater in Patrick Moore's book Survey of The Moon the second printing of which came out in 1963 (this was well before he was "Sir Patrick"). A few years later this was the first identifiable lunar formation I ever photographed, holding a camera to the eyepiece of my RV-6 reflector telescope (6" f/9).

Notice on the east wall of Petavius (below in this image) the elongated walled plain, Palitzsch an often overlooked "extraordinary formation" as stated by Elger. He described it as "a great trough or a deep elongated gorge" visible in smaller telescopes. Its width is 20 km at the widest and length over 100km as measured on LROC QuickMap and is likely the merger of two or more craters modified by the later impacts.

Three days after full moon you can get another spectacular view of this crater and several more near it when the colongitude is near 117°. No matter when, Petavius never disappoints.



Petavius, *Richard Hill, Loudon Observatory, Tucson, Arizona, USA. 2023 March 25 01:58 UT, colongitude 307.4°. TEC 8 inch f/20 Maksutov-Cassegrain telescope, 610 nm filter, SKYRIS 132M camera. Seeing 8/10.*

FOCUS ON: Floor Fractured Craters: Petavius

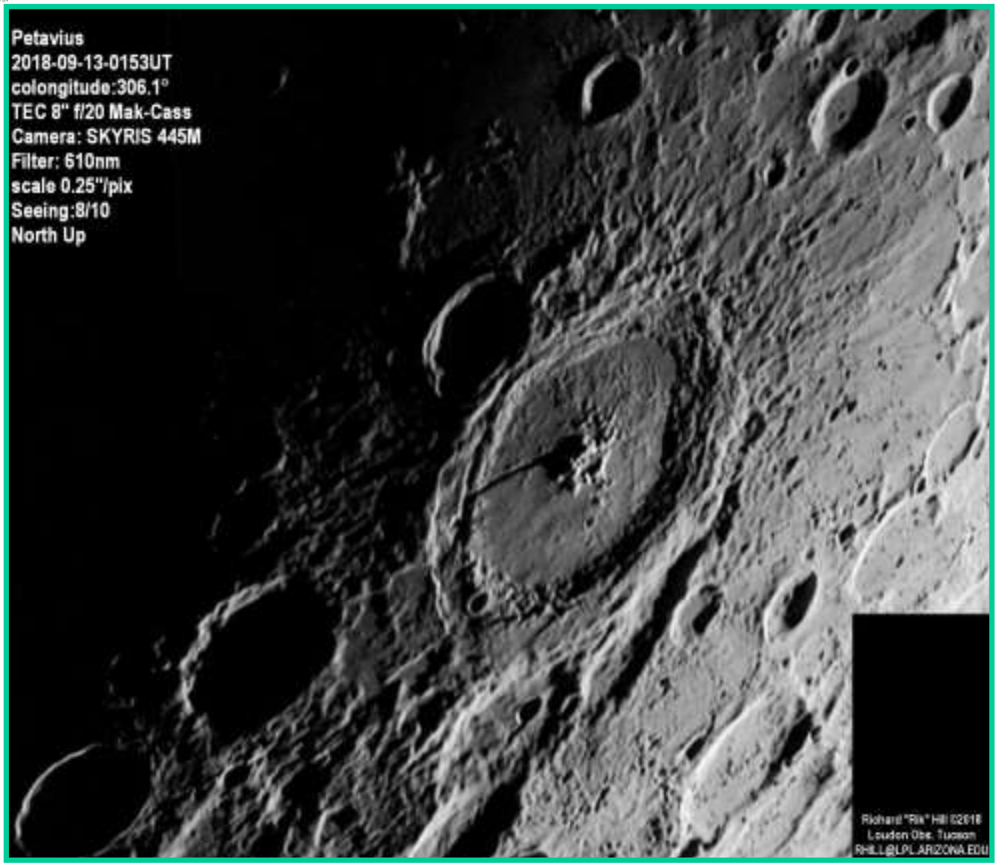


Image 52, Petavius, *Richard Hill, Loudon Observatory, Tucson, Arizona, USA. 2018 September 13 01:53 UT, colongitude 306.1º. TEC 8 inch f/20 Maksutov-Cassegrain telescope, 610 nm filter, SKYRIS 445M camera. Seeing 8/10.*

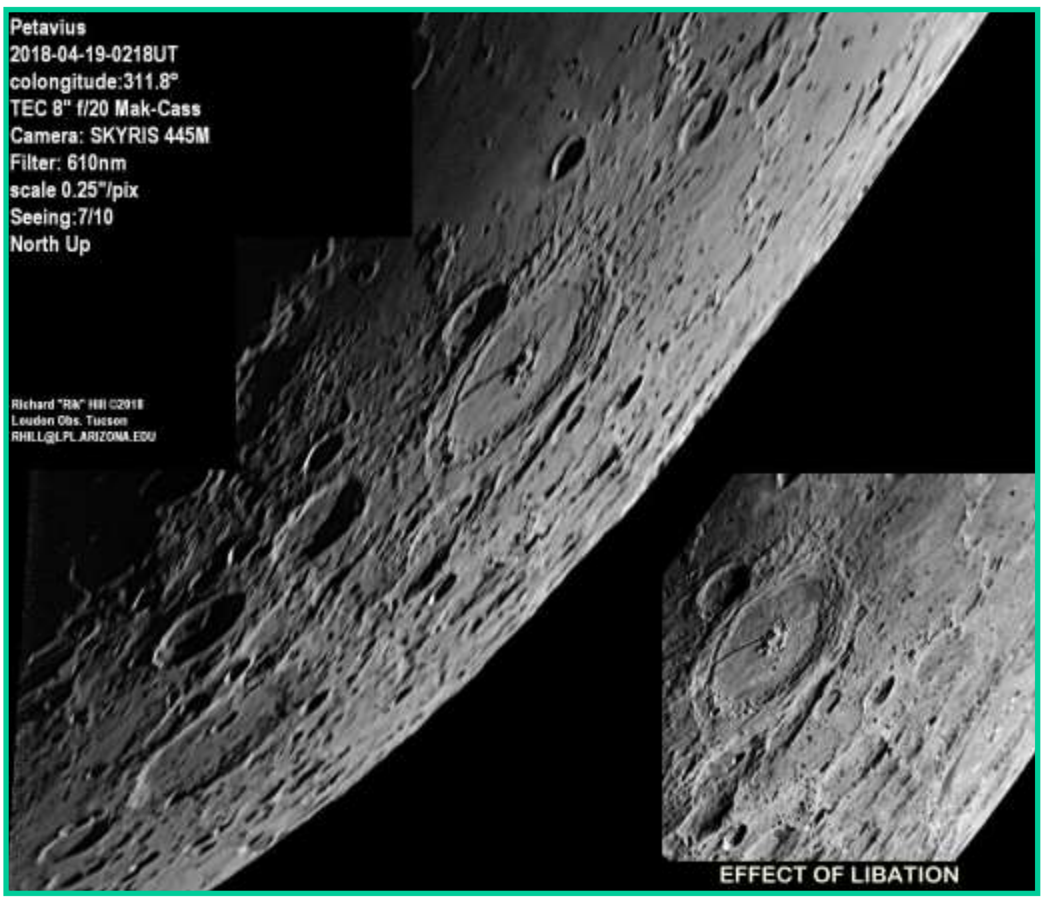


Image 53, Petavius, *Richard Hill, Loudon Observatory, Tucson, Arizona, USA. 2018 April 19 02:18 UT, colongitude 311.8º. TEC 8 inch f/20 Maksutov-Cassegrain telescope, 610 nm filter, SKYRIS 445M camera. Seeing 7/10.*

FOCUS ON: Floor Fractured Craters

Image 54, Petavius to Langrenus, Richard Hill, Loudon Observatory, Tucson, Arizona, USA. 2007 March 06 07:08 UT. Celestron 14 inch Schmidt-Cassegrain telescope, Wratten 21 filter, SPC900NC camera. Seeing 7/10.

Image 55, Petavius, Richard Hill, Loudon Observatory, Tucson, Arizona, USA. 2007 June 19 03:50 UT. Celestron 14 inch Schmidt-Cassegrain telescope, 1.6x barlow, UV/IR blocking filter, SPC900NC camera. Seeing 6/10.

FOCUS ON: Floor Fractured Craters

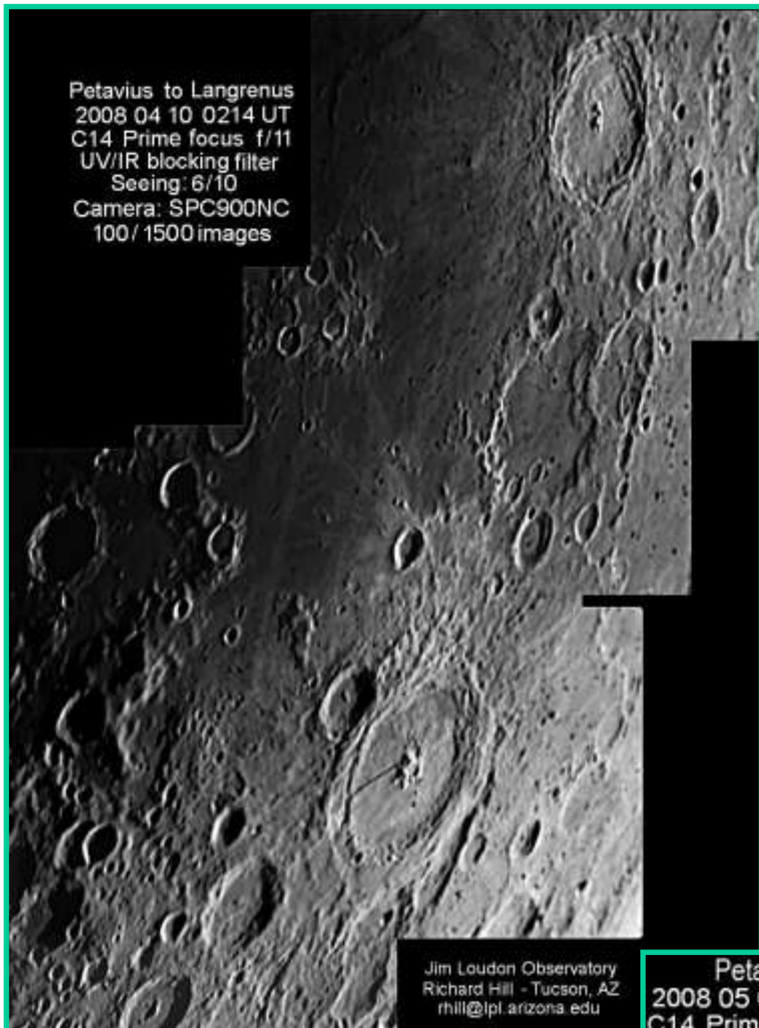


Image 56, Petavius to Langrenus, *Richard Hill, Loudon Observatory, Tucson, Arizona, USA. 2008 April 10 02:14 UT. Celestron 14 inch Schmidt-Cassegrain telescope, UV/IR blocking filter, SPC900NC camera. Seeing 6/10.*

Image 57, Petavius, *Richard Hill, Loudon Observatory, Tucson, Arizona, USA. 2008 May 08 22:02 UT. Celestron 14 inch Schmidt-Cassegrain telescope, 665 nm, SPC900NC camera. Seeing 6/10.*

FOCUS ON: Floor Fractured Craters

Image 58, Petavius, *Richard Hill, Loudon Observatory, Tucson, Arizona, USA. 2008 August 18 06:54 UT. Celestron 14 inch Schmidt-Cassegrain telescope, 2x barlow, UV/IR blocking filter, SPC900NC camera. Seeing 7/10.*

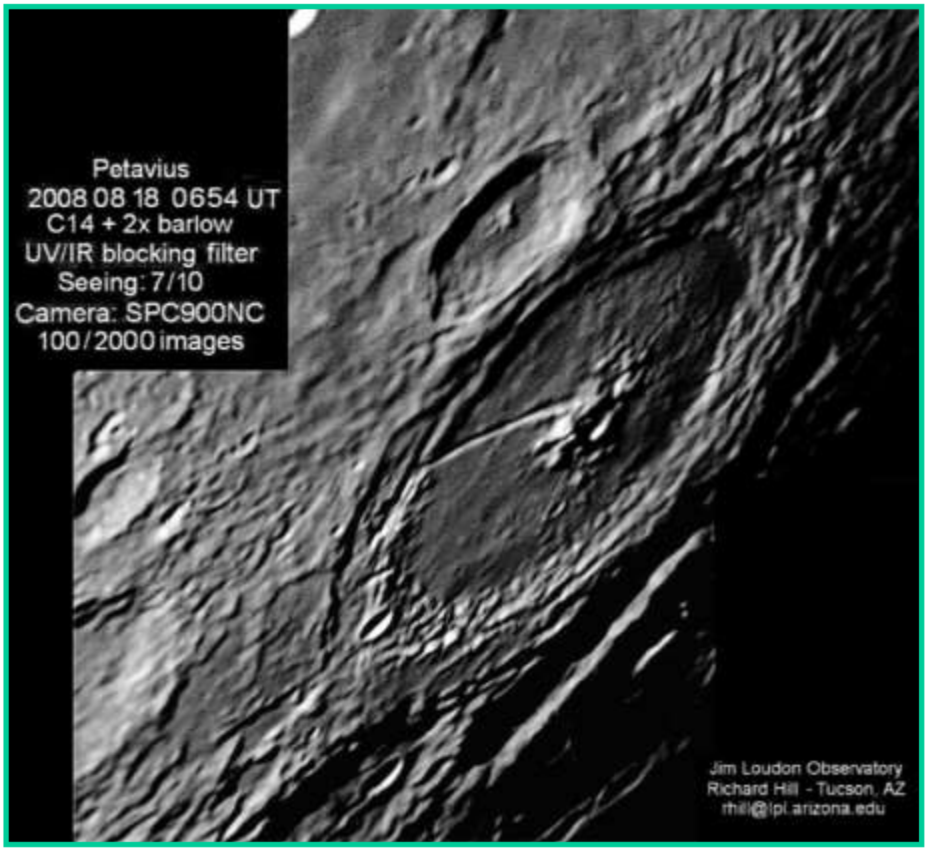


Image 59, Petavius, *Richard Hill, Loudon Observatory, Tucson, Arizona, USA. 2013 April 14 01:45 UT. TEC 8 inch f/20 Maksutov-Cassegrain telescope, 665 nm filter, DMK21AU04 camera. Seeing 6/10.*

FOCUS ON: Floor Fractured Craters

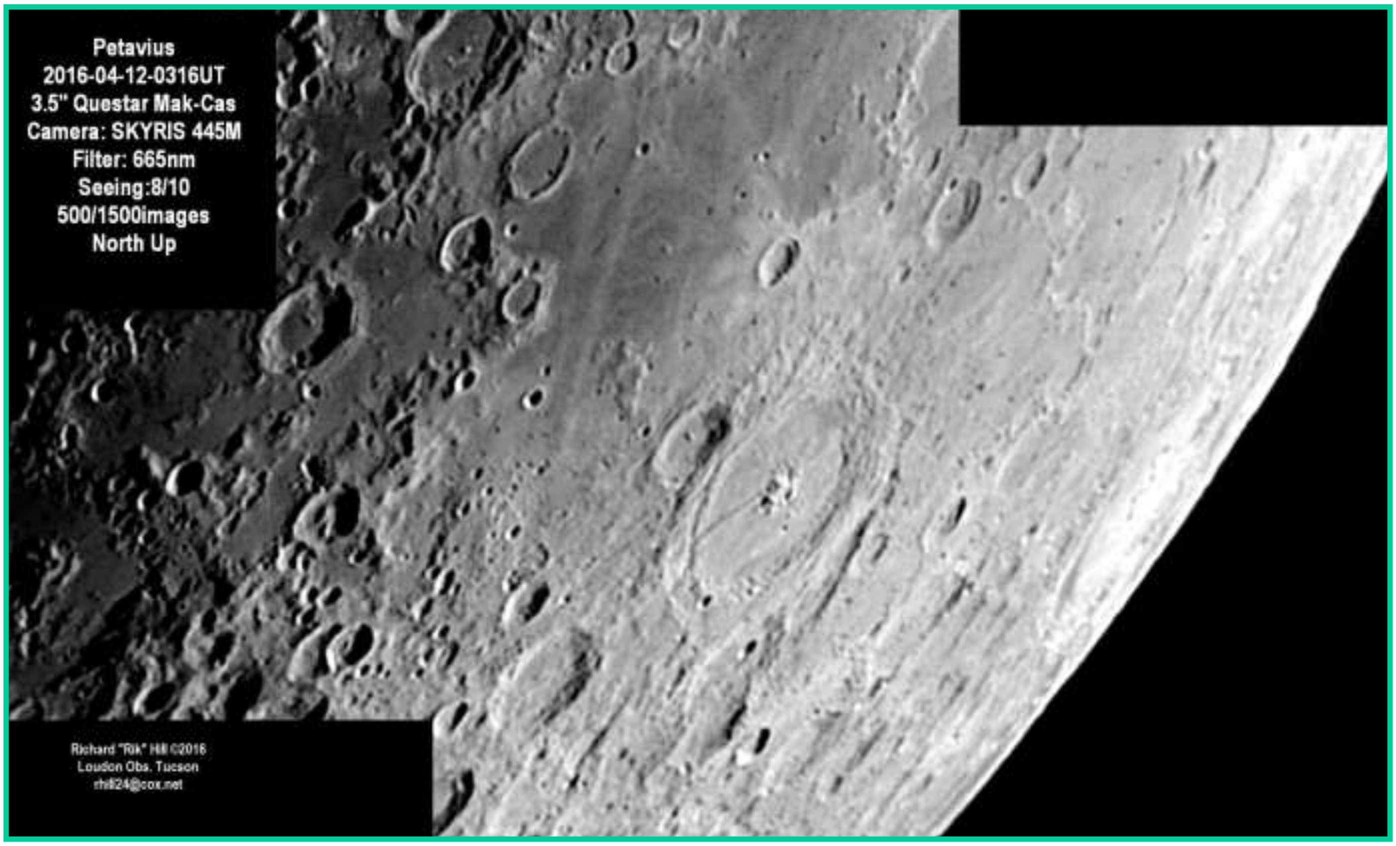


Image 60, Petavius, *Richard Hill, Loudon Observatory, Tucson, Arizona, USA. 2016 April 12 03:16 UT. Questar 3.5 inch Maksutov-Cassegrain telescope, 665 nm filter, SKYRIS 445M camera. Seeing 8/10.*

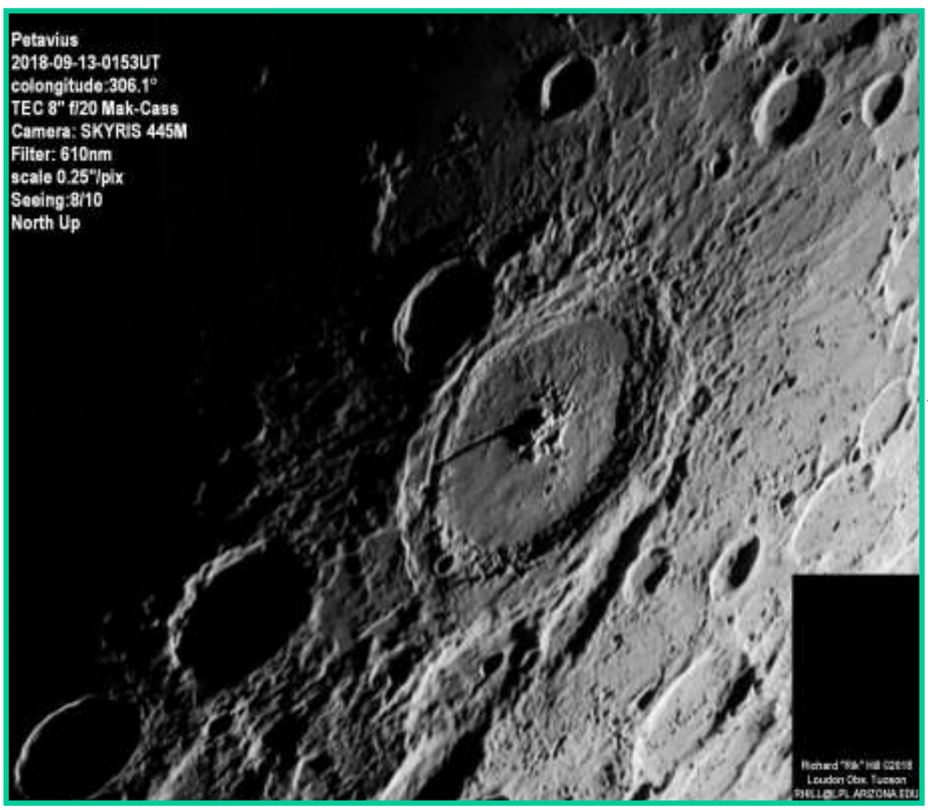


Image 61, Petavius, *Richard Hill, Loudon Observatory, Tucson, Arizona, USA. 2018 September 13 01:53 UT, colongitude 306.1°. TEC 8 inch f/20 Maksutov-Cassegrain telescope, 610 nm filter, SKYRIS 445M camera. Seeing 8/10.*

FOCUS ON: Floor Fractured Craters

*Image 62, **Petavius,** David Teske, Louisville, Mississippi, USA. 2023 January 27 01:57 UT, colongitude 330.6o. 3.5 inch Questar Maksutov-Cassegrain telescope, IR block filter, ZWO ASI120mm/s camera. Seeing 7/10.*

*Image 63, **Petavius to Langrenus,** Richard Hill, Loudon Observatory, Tucson, Arizona, USA. 2023 January 09 00:12 UT, colongitude 334.7°. TEC 8 inch f/20 Maksutov -Cassegrain telescope, 610 nm filter, SKYRIS 132M camera. Seeing 8/10.*

FOCUS ON: Floor Fractured Craters

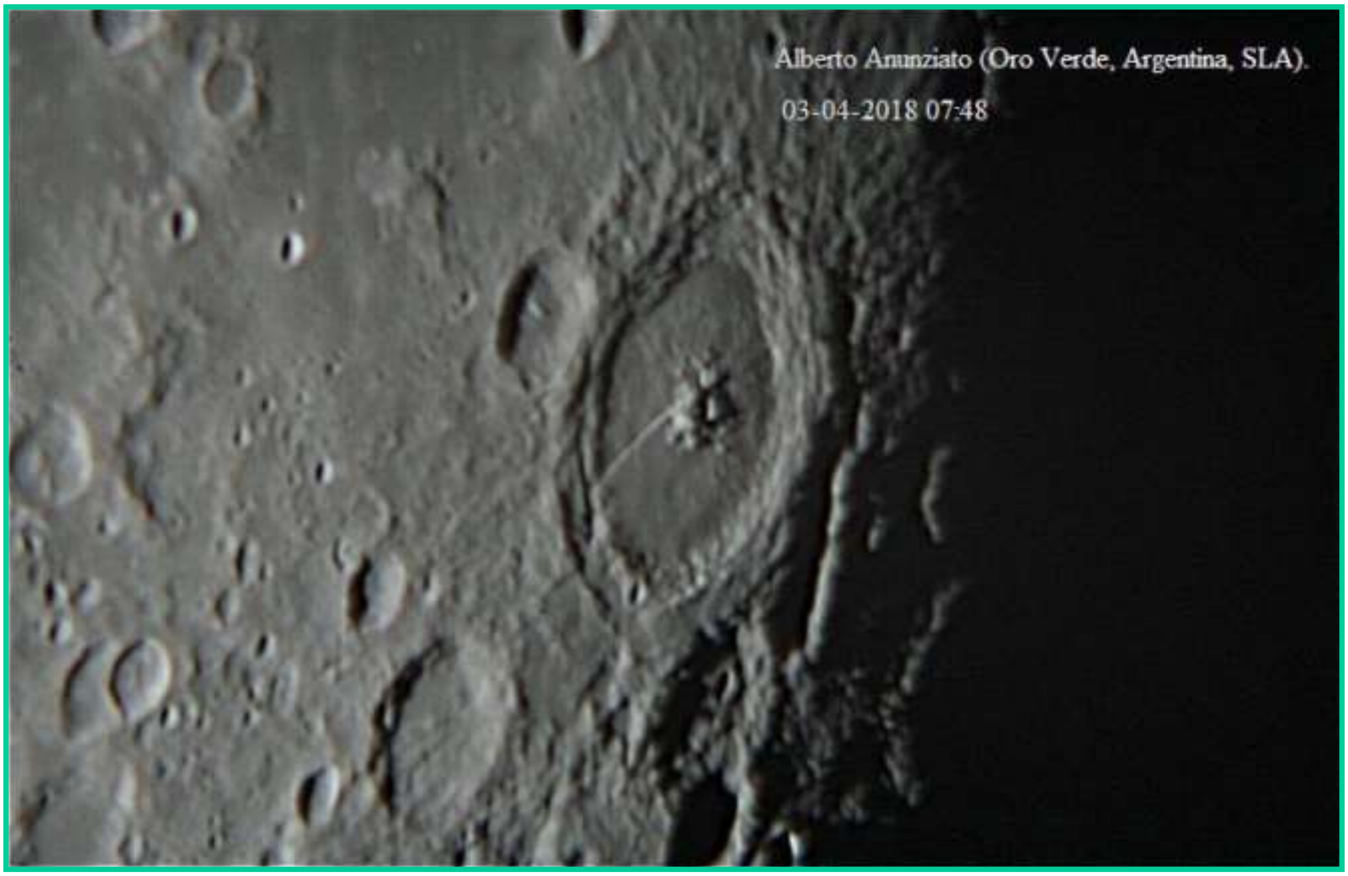


***Image 64, Petavius,** Alberto Anunziato, Oro Verde, Argentina. 2018 March 04 07:48 UT. Celestron 11 inch CPC 1100 Schmidt-Cassegrain telescope, Canon EOS digital rebel XS camera*

***Image 65, Posidonius,** Gregory Shanos, Sarasota, Florida, USA. 2023 January 28 01:49 UT. Meade LX200 GPS 10 inch Schmidt-Cassegrain telescope, Optec f/6.2 reducer, IR cut filter, ZWO ASI178mm camera.*

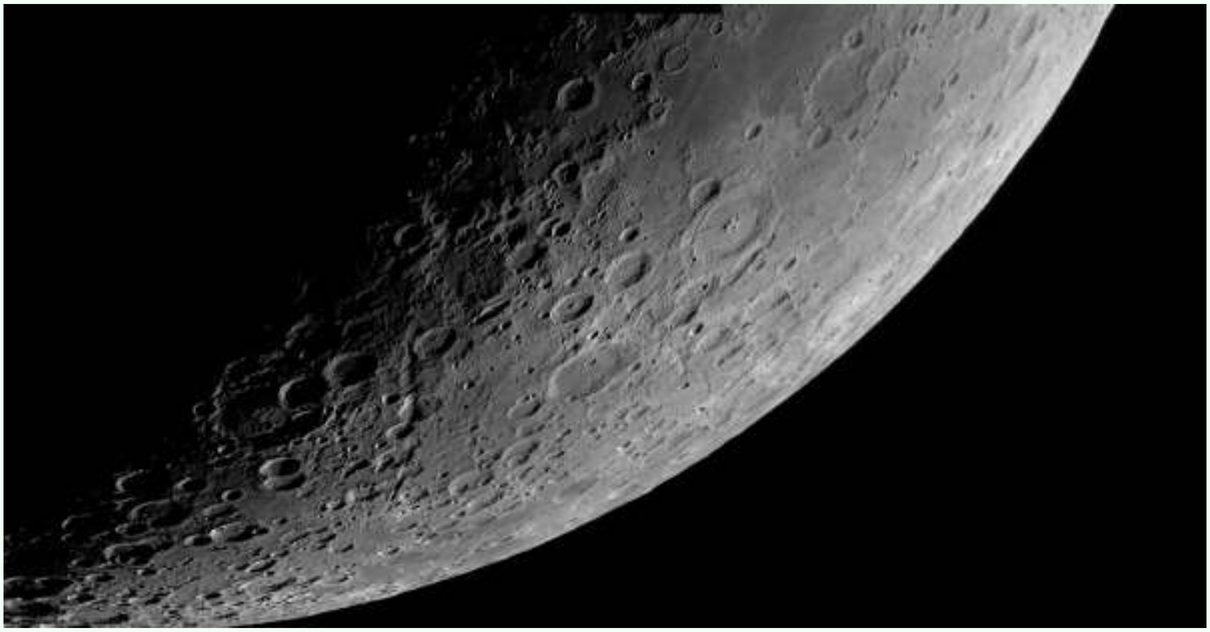
FOCUS ON: Floor Fractured Craters

Image 66, Posidonius, *Gregory Shanos, Sarasota, Florida, USA. 2023 January 28 01:49 UT. Meade LX200 GPS 10 inch Schmidt-Cassegrain telescope, Optec f/6.2 reducer, IR cut filter, ZWO ASI178mm camera. Greg adds:* "Floor fractured crater Posidonius on January 28, 2023 at 1h 49.5m UT. Image taken by ALPO member Gregory T. Shanos with a Meade LX200GPS 10-inch with a ZWO ASI 178MM monochrome camera, IR cut filter and an Optec f/6.2 focal reducer. The moon was at 45% phase. Seeing was good with a clear sky."

FOCUS ON: Floor Fractured Craters

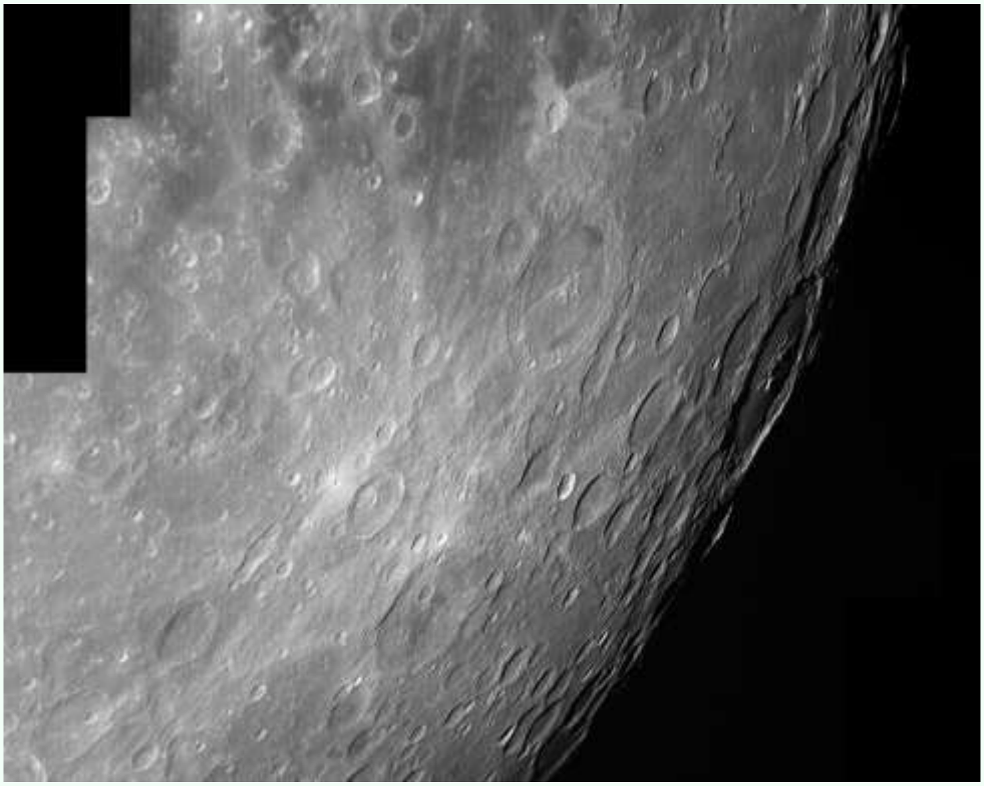
A Tour of Petavius

Jeff Grainger



Petavius Humboldt Janssen: 4.47 days 18.16 UT February 24 2023 [134]

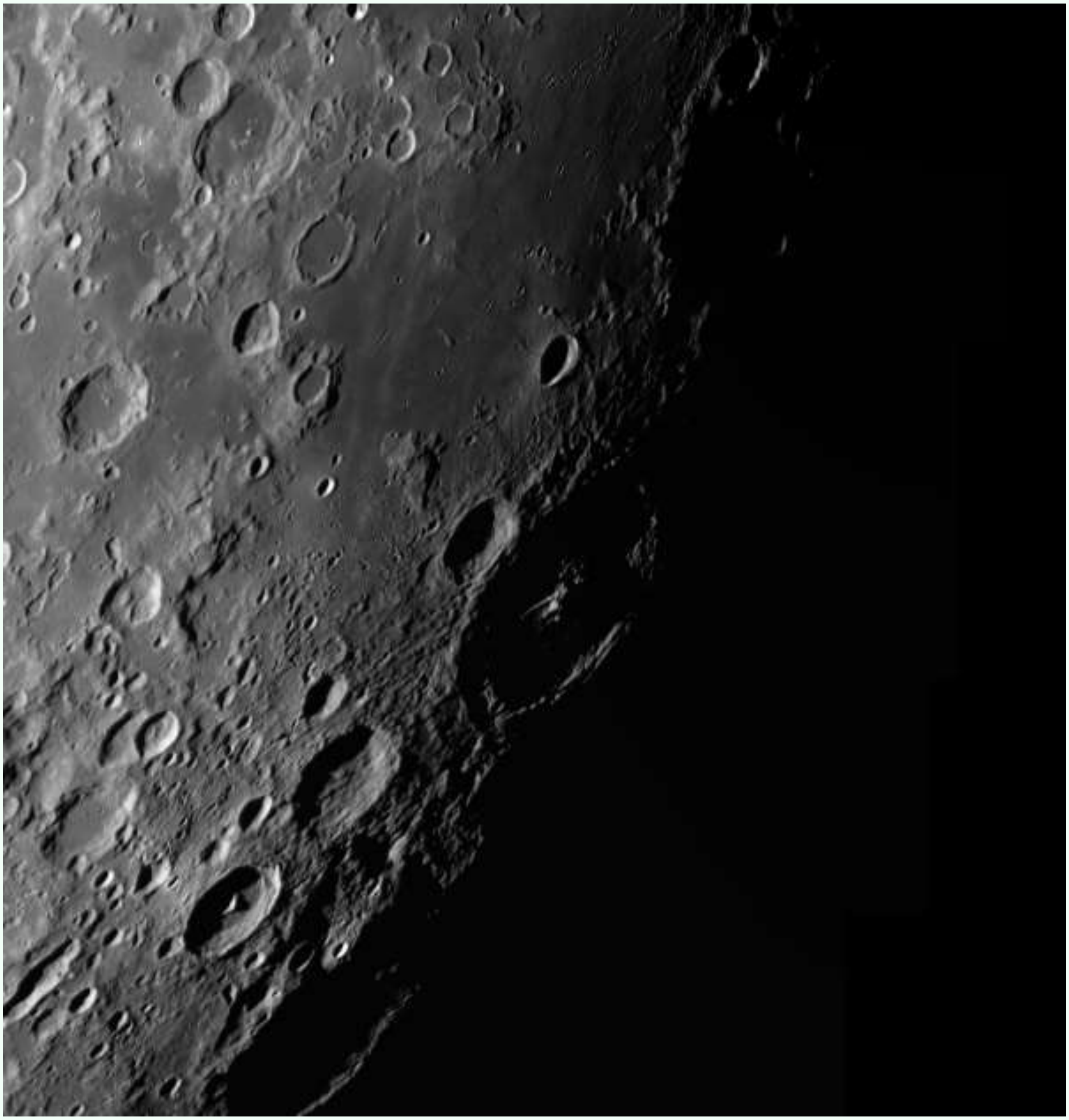
[Altitude: 41*24' Azimuth: 223*58' Libration: 6.8* @ PA 85*]



Petavius and Humboldt: 15.00 days 23.01 UT December 08 2022 [107cr]

[Altitude: 56*30' Azimuth: 135*30' Libration: 4.9* @ PA 147*]

FOCUS ON: Floor Fractured Craters: A Tour of Petavius



Petavius and Furnerius: 16.75 days 02.11 September 13 2022 [13]
[Altitude: 43*08' Azimuth: 177*15' Libration: 6.9* @ PA 64*]

Petavius Data [see Moore, CoM 484]:

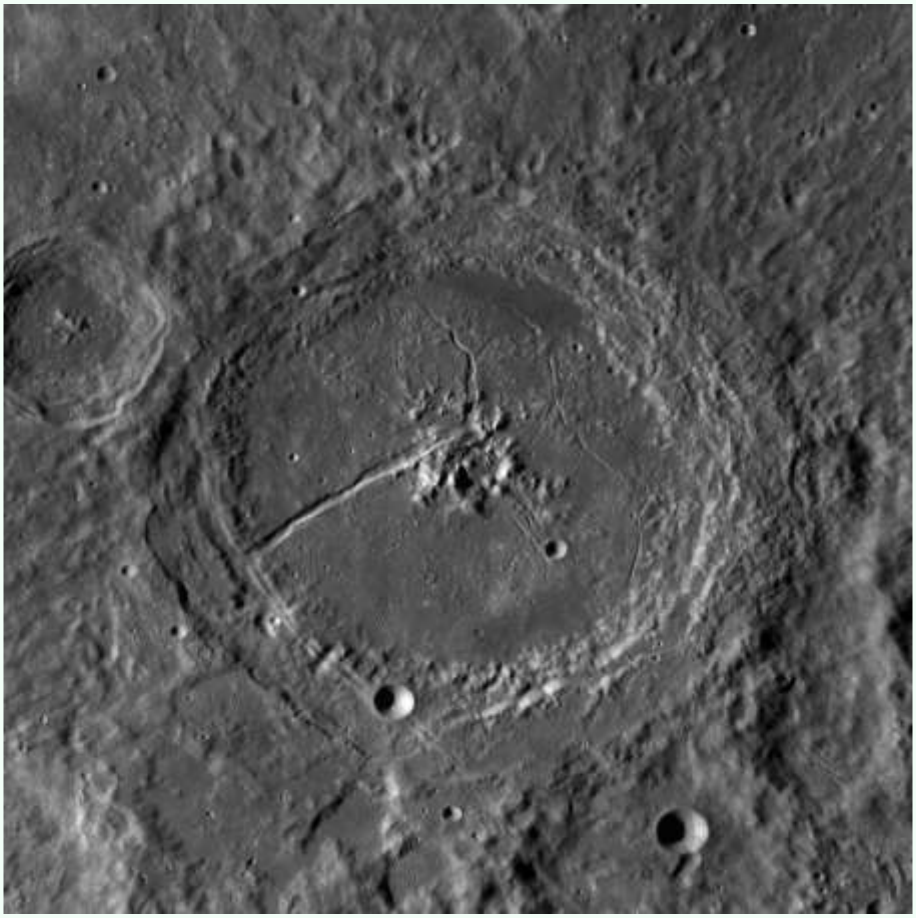
Diameter: ~ 184km

Age: Early Imbrian, ~ 3.9 bn y old

Depth: ~ 3km (see LRO profile data)

FOCUS ON: Floor Fractured Craters: A Tour of Petavius

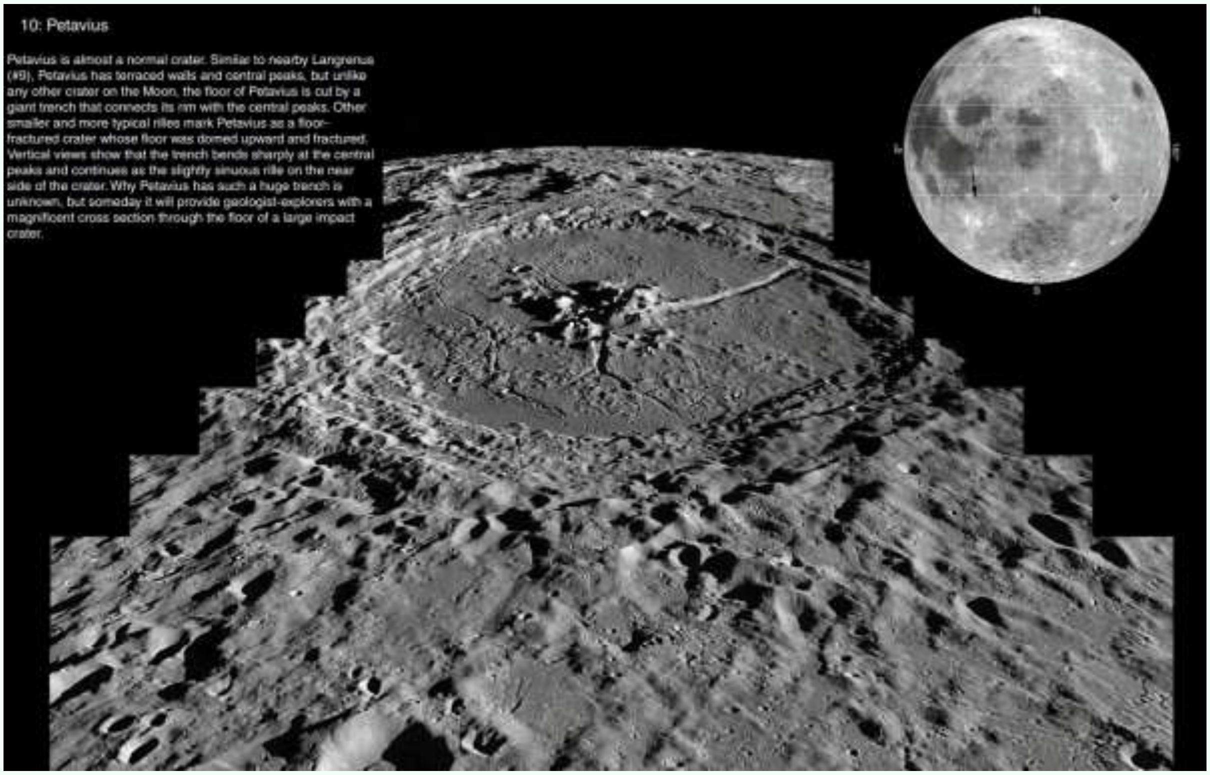
Satellite Images:



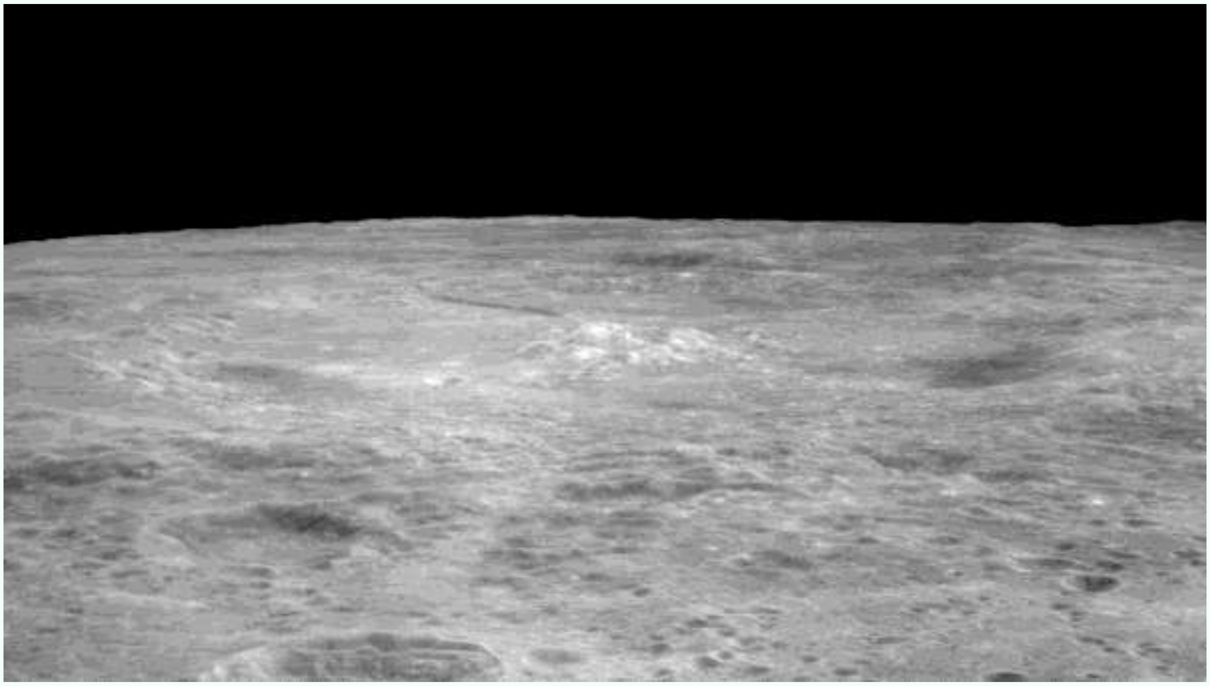
Slightly oblique image of Petavius from LRO (N at top).

A close-up of the central peak system (LRO) is below.

FOCUS ON: Floor Fractured Craters: A Tour of Petavius

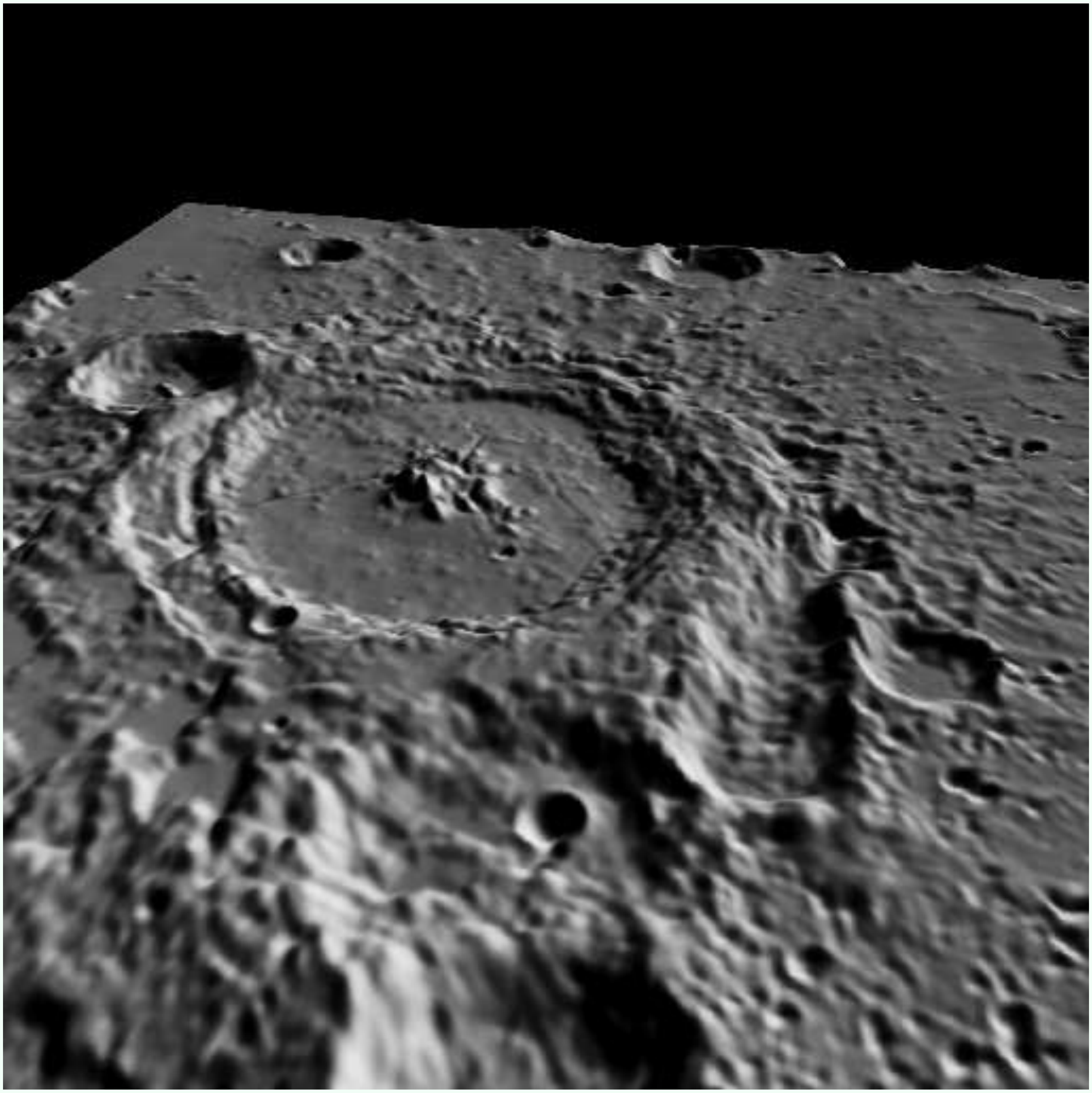


A rather impressive oblique view, looking south, from Kaguya.



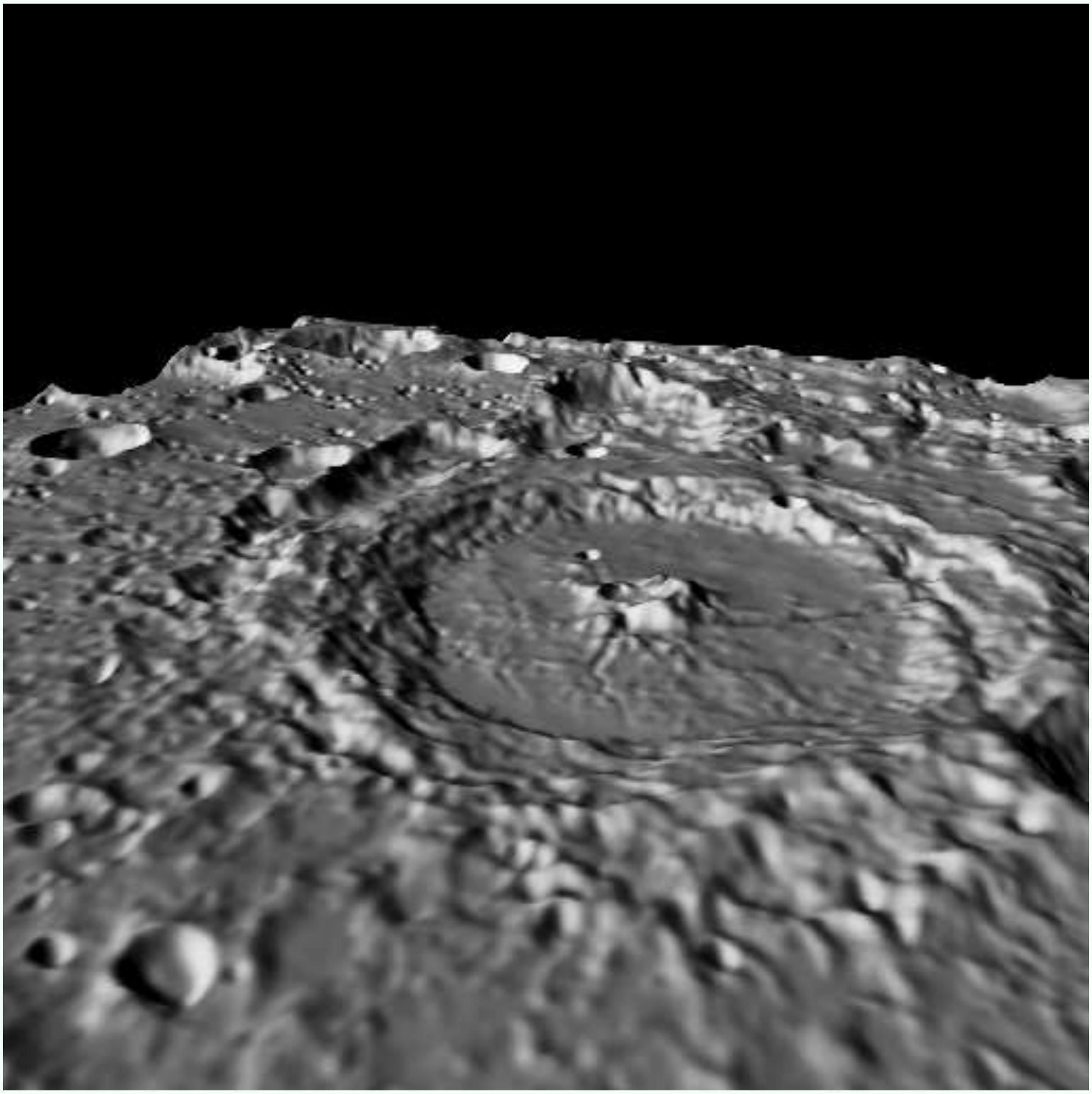
Apollo 17 image, looking west: AS17-P-3152

<u>Image Rendering:</u>

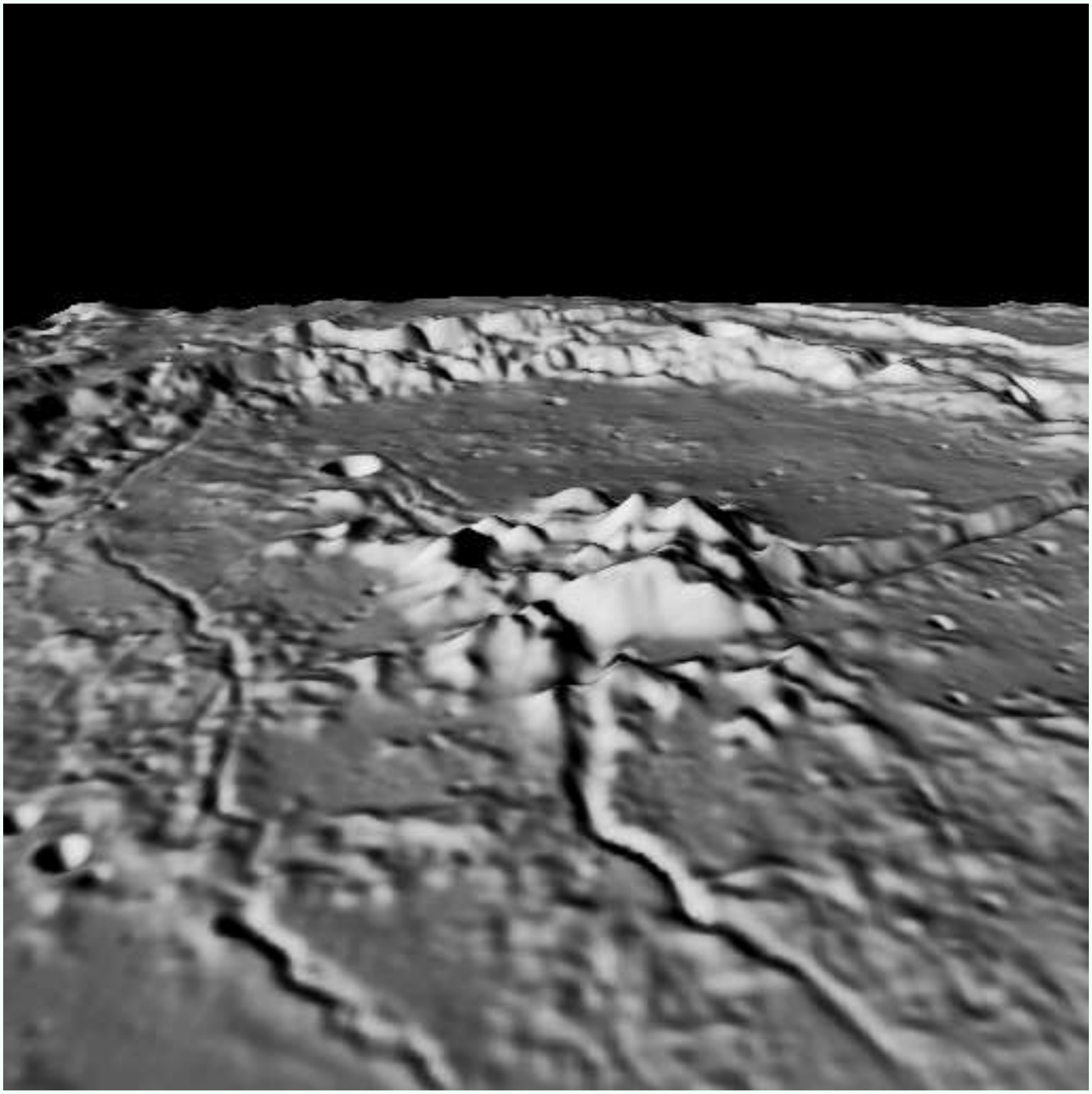


Looking North, Perspective view, 3x vertical exaggeration and zoomed.

Compare this rendering with the LRO view.



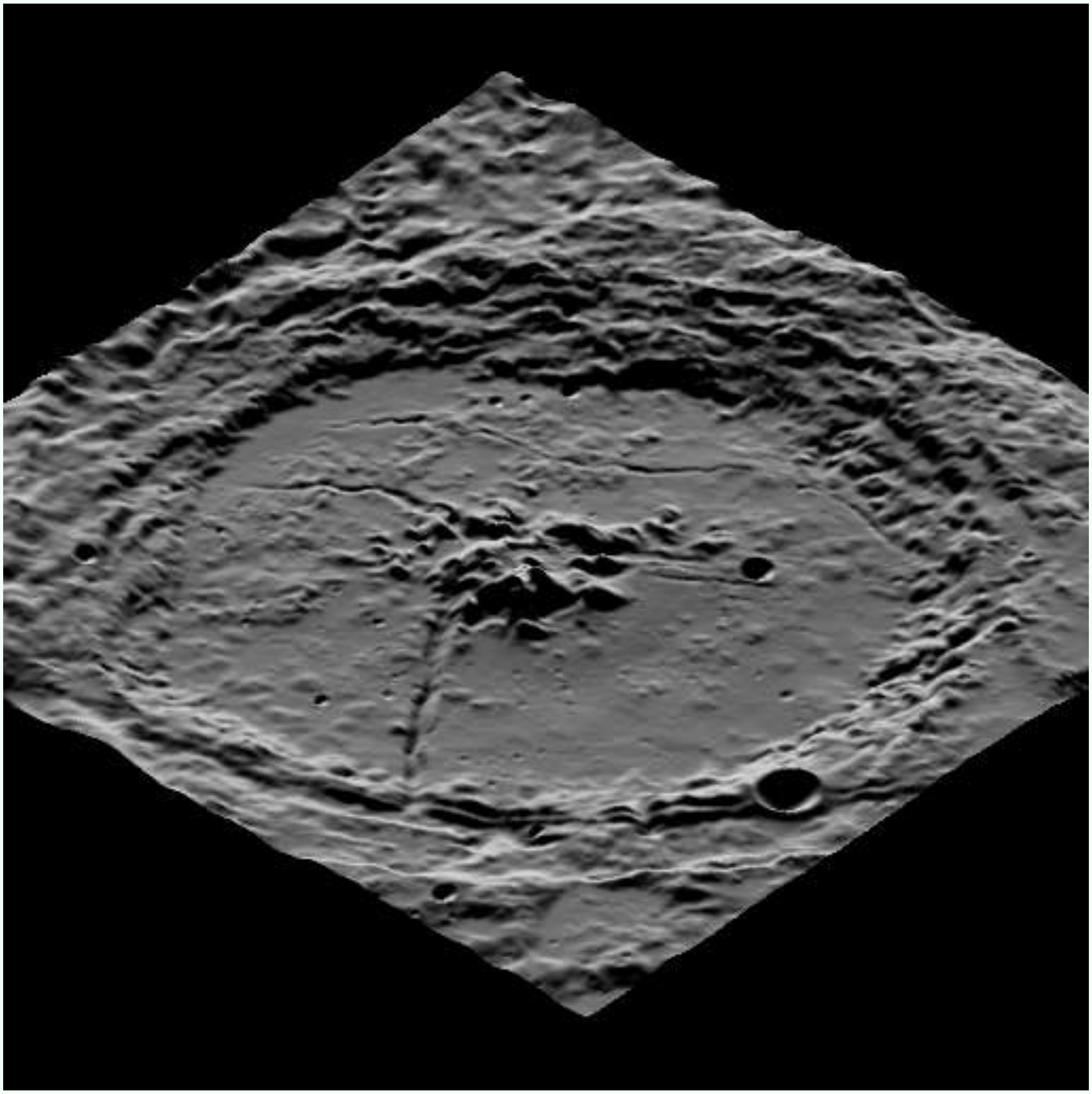
Looking SSW. This can be compared to the Kaguya view, though the vertical exaggeration here (x3) is noticeable compared to a “real” image. Perspective view.



Looking S: again, compare to the Kaguya image.

Perspective view x2, greater zoom.

The multiple rille systems are very evident, especially the large trench to the SW which provides Petavius with the nickname “Clock Crater”.



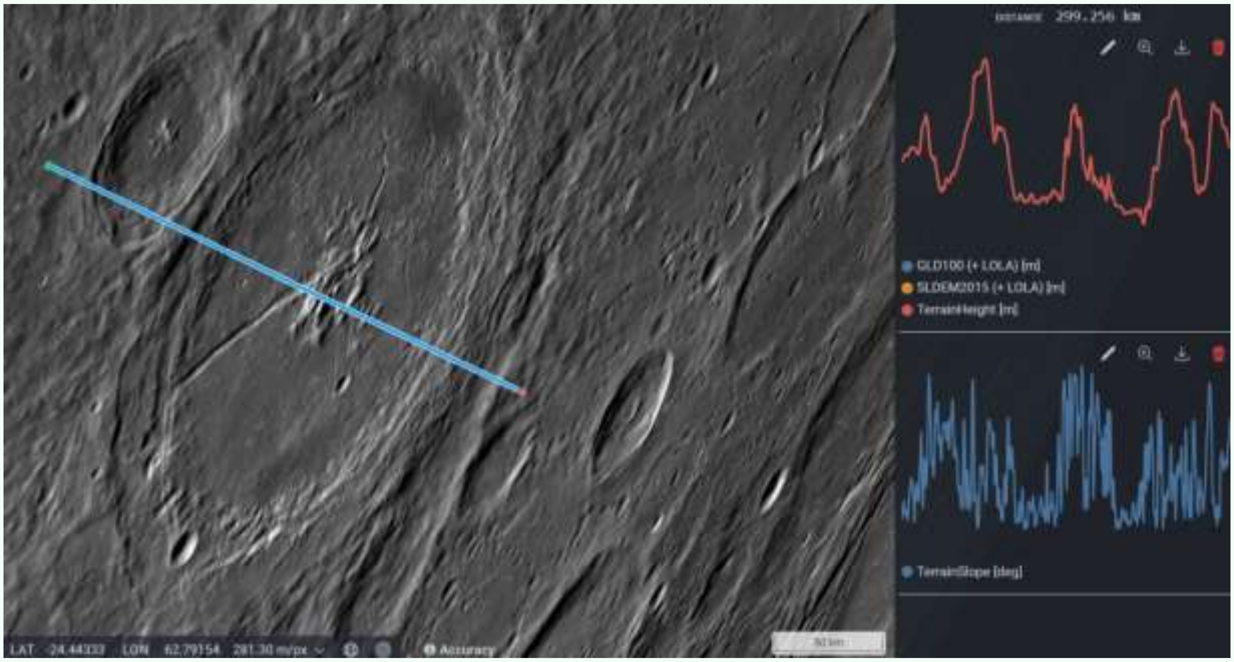
Looking towards the NE, with the main Petavius rille extending towards us.

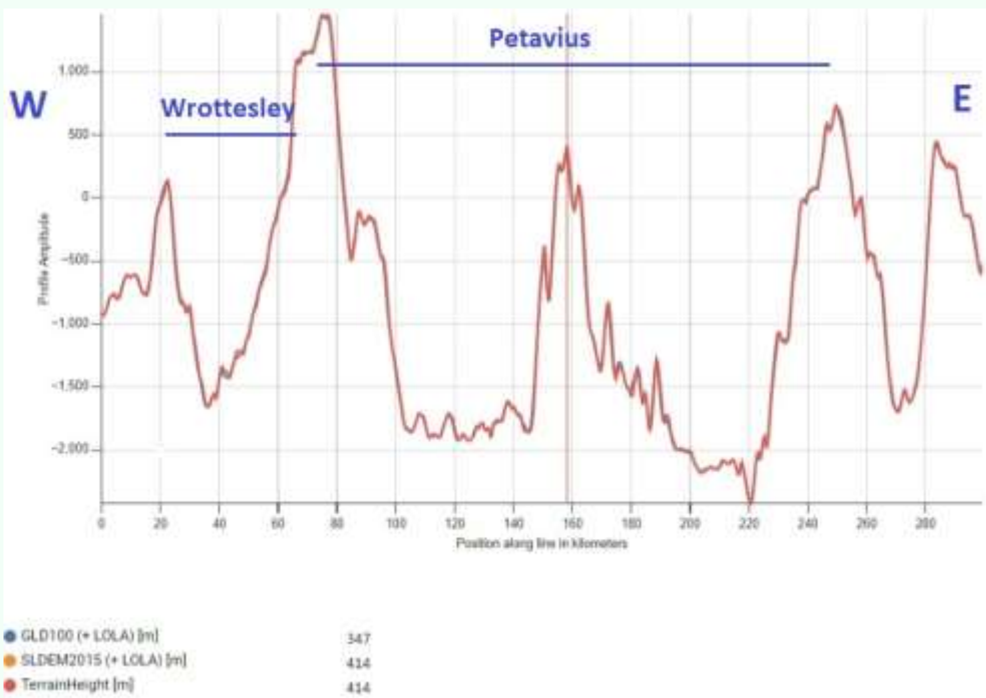
There's less vertical exaggeration in this render (x2) and an Orthographic projection which is flatter than a Perspective one.

Crater Profiles:

There are so many features associated with this crater that I've "gone to town" on the profiles and, hopefully, come up with some interesting analysis!!

Profile from W to E:

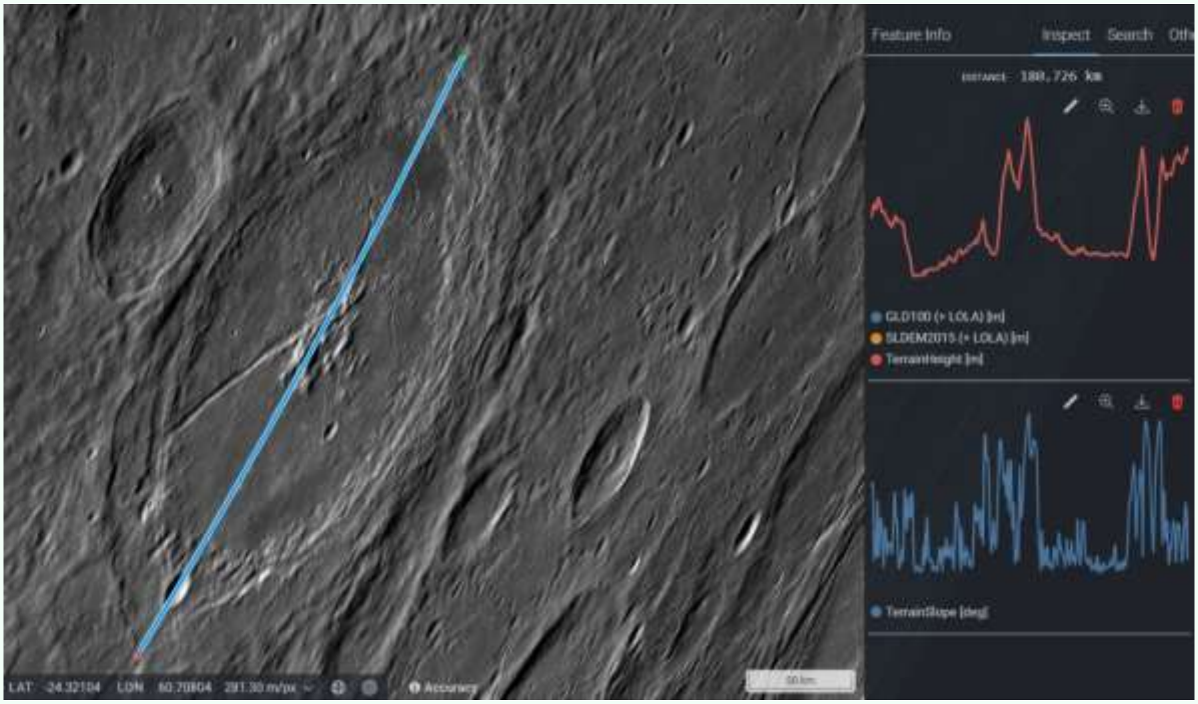


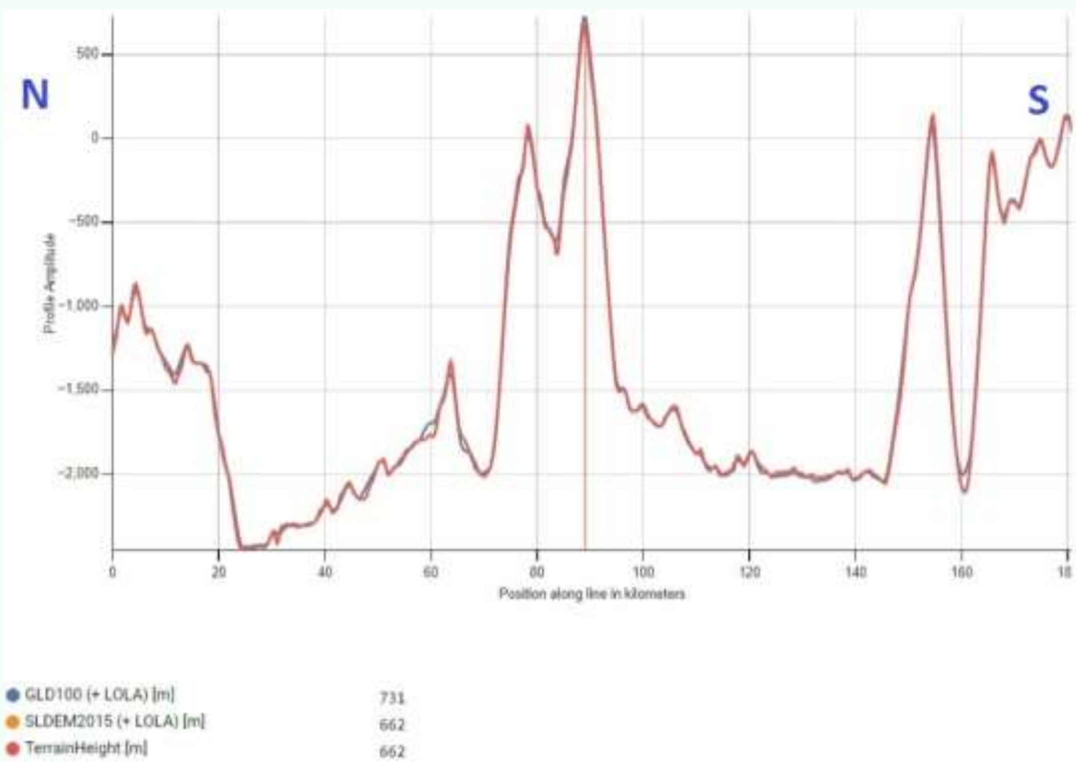


The central peak system rises to around 2500m above the western-side crater floor, BUT notice the drop in floor level as we move east.

FOCUS ON: Floor Fractured Craters: A Tour of Petavius

Profile from N to S:

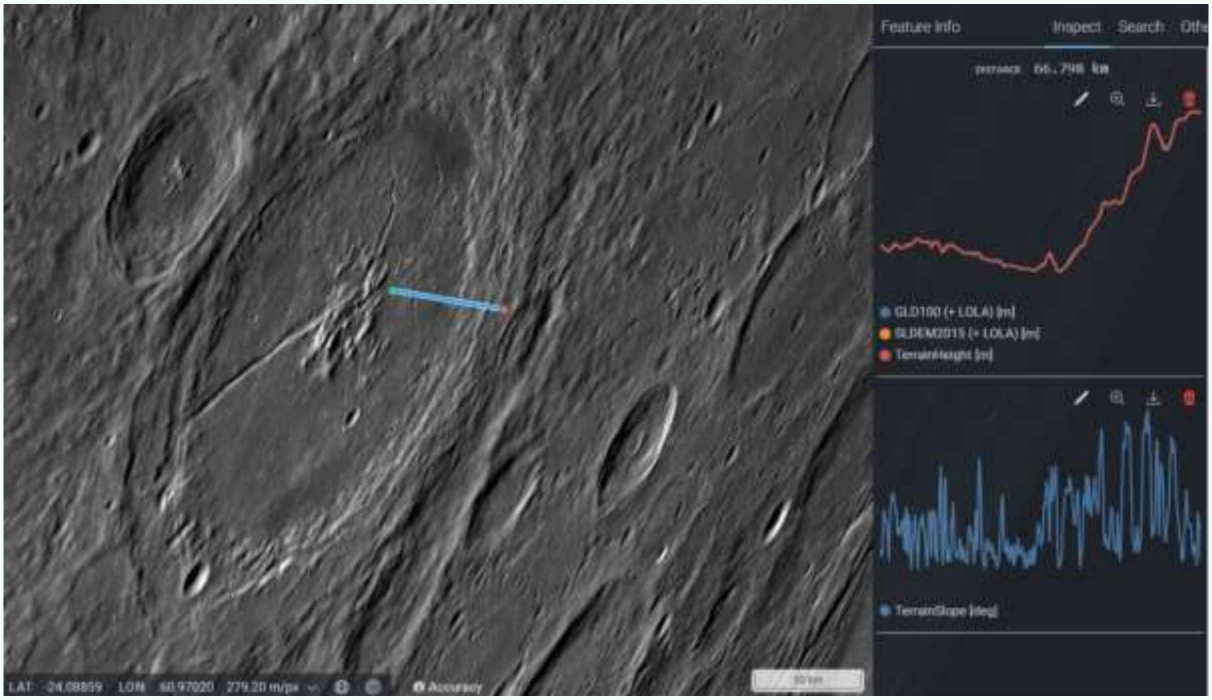




In this case, note the drop in crater floor level to the north of the central peak.

FOCUS ON: Floor Fractured Craters: A Tour of Petavius

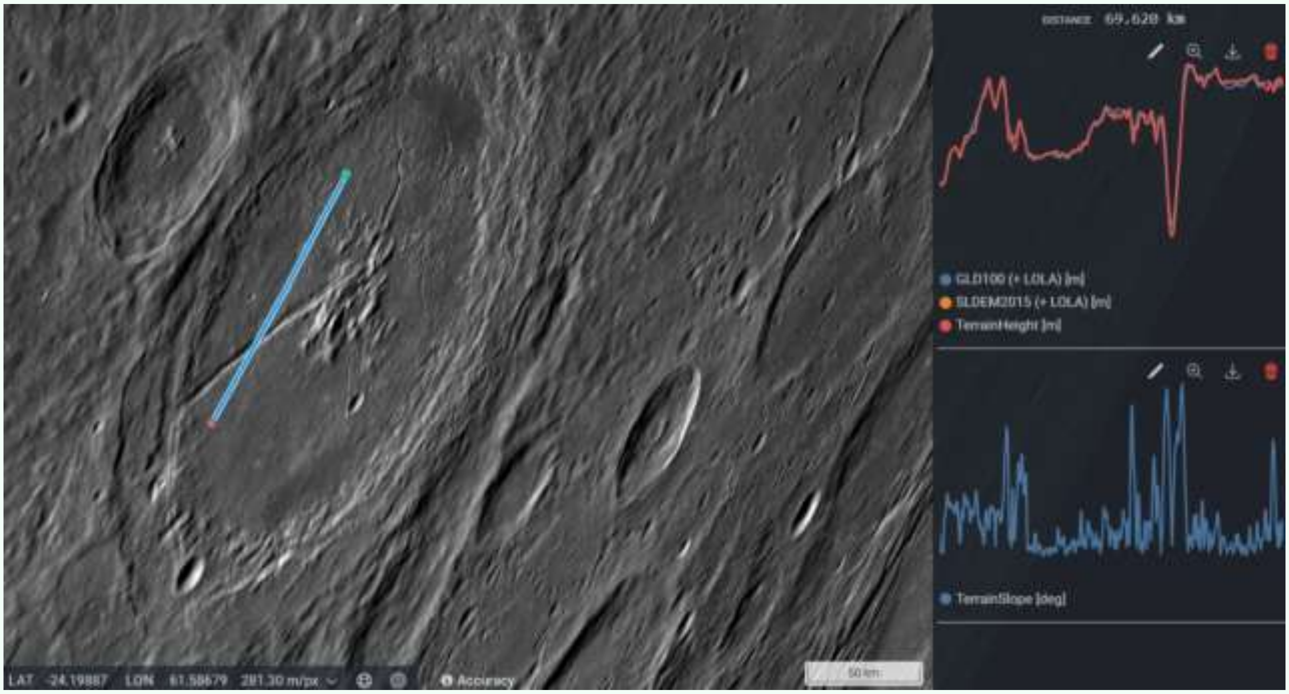
Terrace Profile: East wall

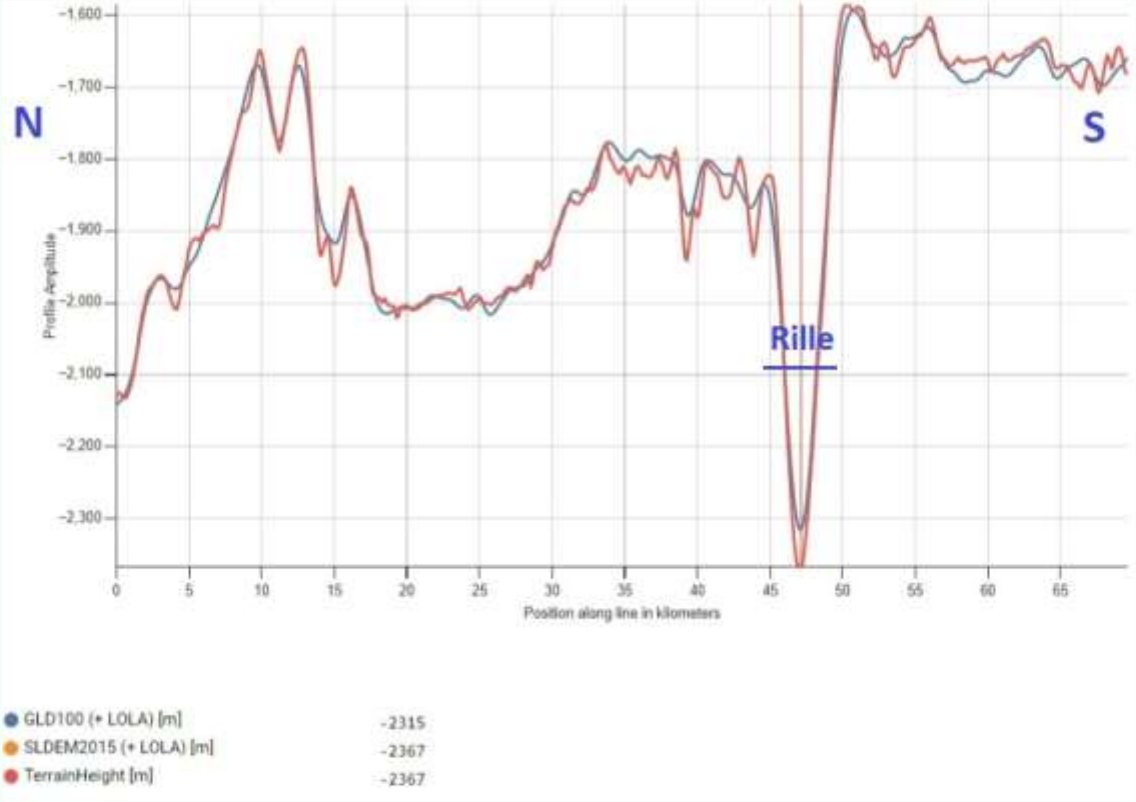


Eastern terrace rises around 2500m over a distance of around 30km. A shallow slope of 1 in 12 or ~ 5 degrees. The overall gentle slope is evident in the satellite images, though there are clearly steeper slopes within the crater terraces.

FOCUS ON: Floor Fractured Craters: A Tour of Petavius

Crater floor profile from N to S:

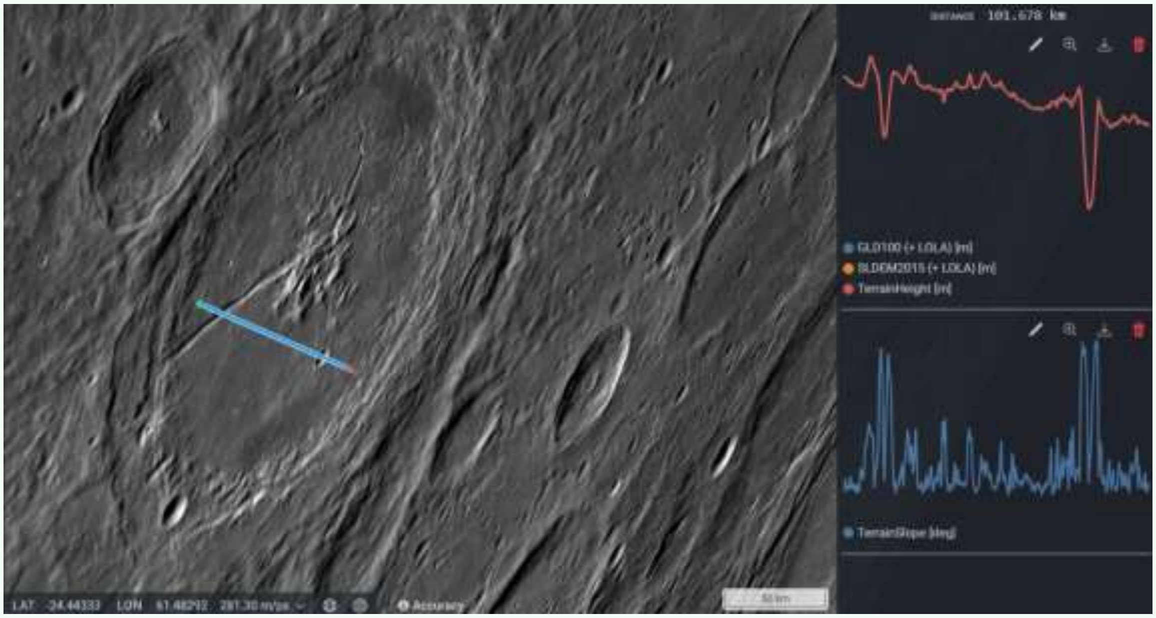


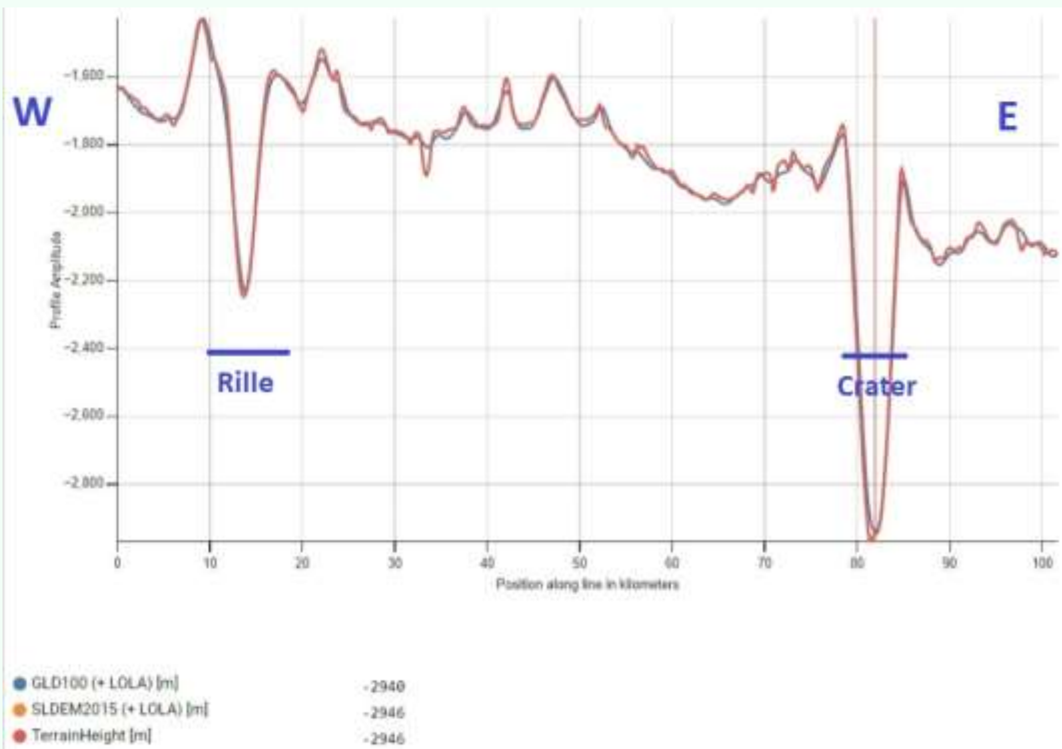


The crater floor is significantly higher on the south side of the main rille than on the north side…..

FOCUS ON: Floor Fractured Craters: A Tour of Petavius

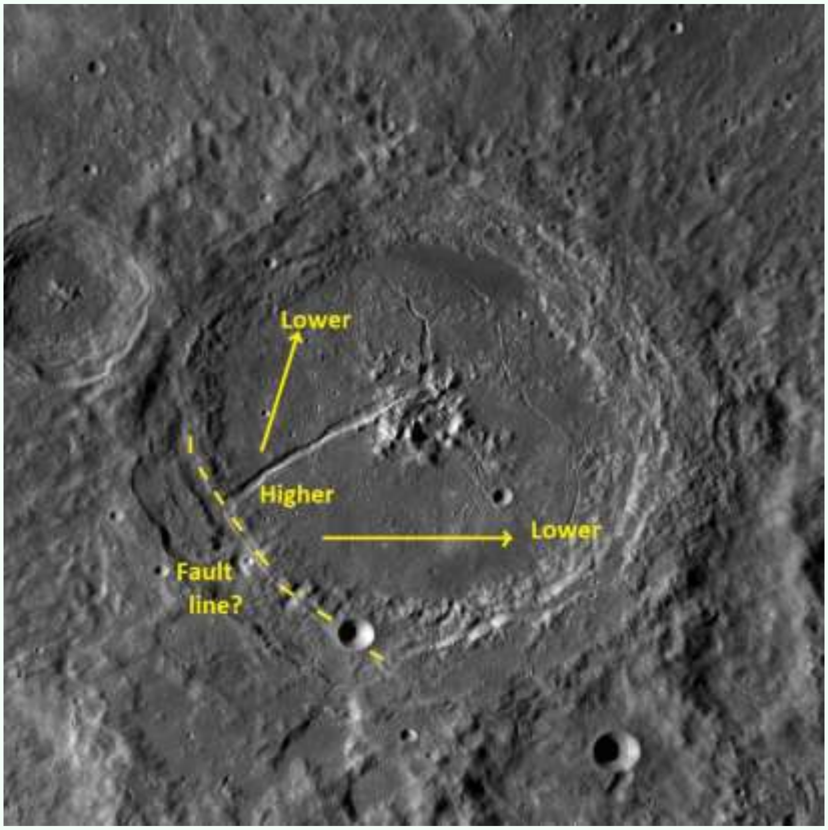
Crater floor profile from W to E:



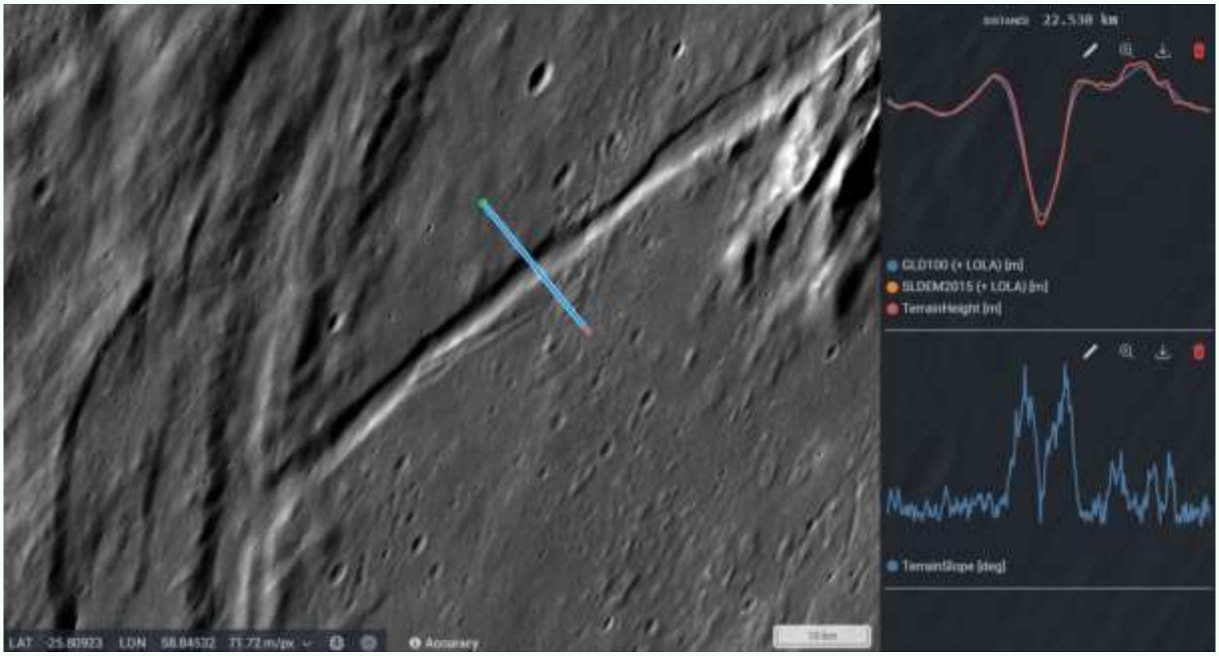


The ground level is clearly falling from W to E.

The ground falling to the north and to the east, and the large fault line around the periphery of the SW quadrant floor (see diagram on next page) suggests that at some time during the past the floor has been uplifted.



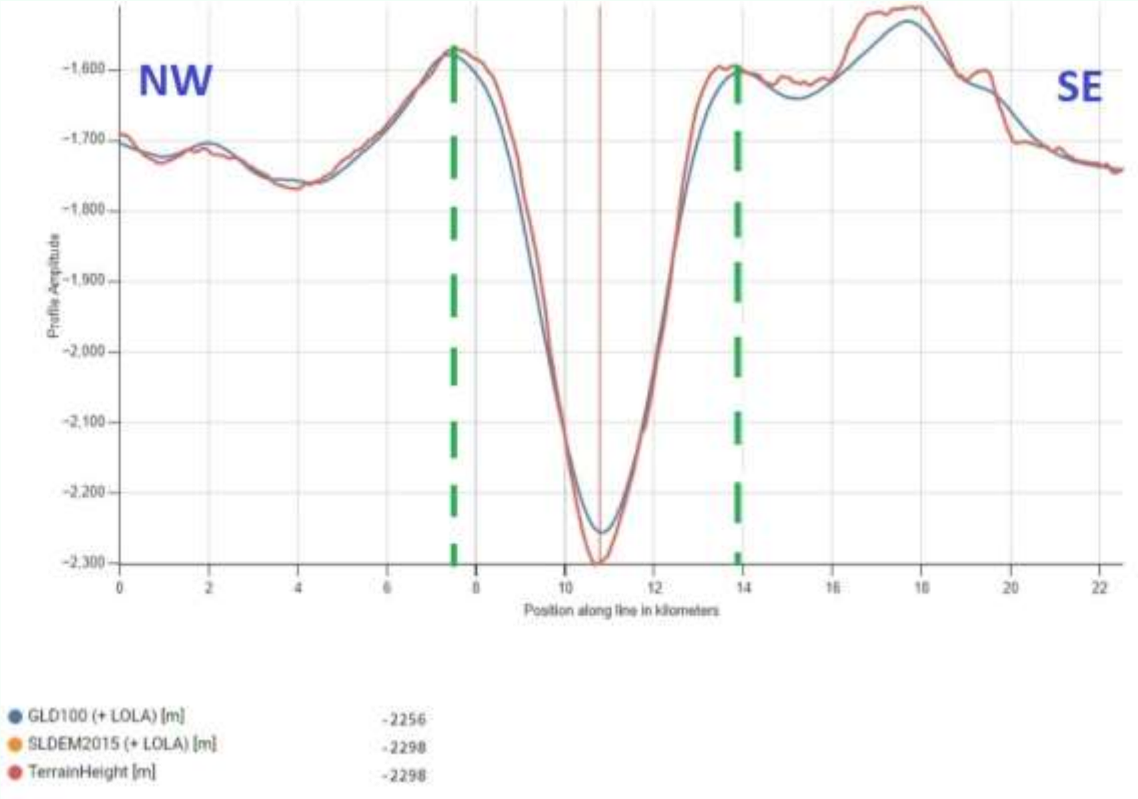
The “8 o’clock” Rille:



A cross-section across the rille, in a NW-SE direction, was taken at a random place along the rille.

FOCUS ON: Floor Fractured Craters: A Tour of Petavius

The profile is shown on.



The rille appears to be around 6-7km across (Moore gives 4.6km)

At the distance of the moon, a 2km wide object subtends ~ 1”.

So, the main Petavius rille is ~ 3”, easily visible in a small telescope.

Also NOTE the higher floor level on the SW side of the rille….

CLASS 2:

FFC's of the Class 2 are characterized by Garfinkle as "shallow, hummocky floor bounded by abrupt wall scarps; concentric rills; may have a central peak; usually does not have dark halo craters or mantling deposits; crater occur immediately adjacent to or within mare plains", craters or mantling deposits; crater occurs immediately adjacent to or within mare plains". Although 17 are cataloged, they are not among the most prominent, except for two famous twins on the shores of Mare Tranquillitatis: Sabine and Ritter, who we see in David Teske's IMAGES 67 to 70, as well as the detail of the last one, IMAGE 68: the one on the left is Ritter and the one on the right is Sabine, which has some curious dark spots that probably indicate the concentric cracks that Garfinkle mentions. Another crater in this category is Vitello, on the southern shore of Mare Humorum, shown in Rik Hill IMAGES 71 to 73. Can you spot Vitello by its shallow and hummocky floor characteristics? It is marked by the red arrow in IMAGE 71. Vitello is the archetype of Class 2: "floor -fractured craters have hummocky convex-up floor profiles that are cut by concentric rilles that are found around the crater's central peak complex. The craters all have steep interior walls. All but 5 Class 2 formations are located along the edges of the maria. These five FFCs are located in the southern highlands" (Garfinkle).

Image 67, Mare Tranquillitatis, *David Teske, Louisville, Mississippi, USA. 2023 June 26 02:20 UT, colongitude 348.2°. 3.5 inch Questar telescope, IR block filter, ZWO ASI120mm/s camera. Seeing 7/10.*

Image 68, Mare Tranquillitatis, *David Teske, Louisville, Mississippi, USA. 2023 February 28 02:37 UT, colongitude 0.7°. 6 inch Celestron Schmidt-Cassegrain telescope, IR block filter, ZWO ASI120mm/s camera. Seeing 6/10.*

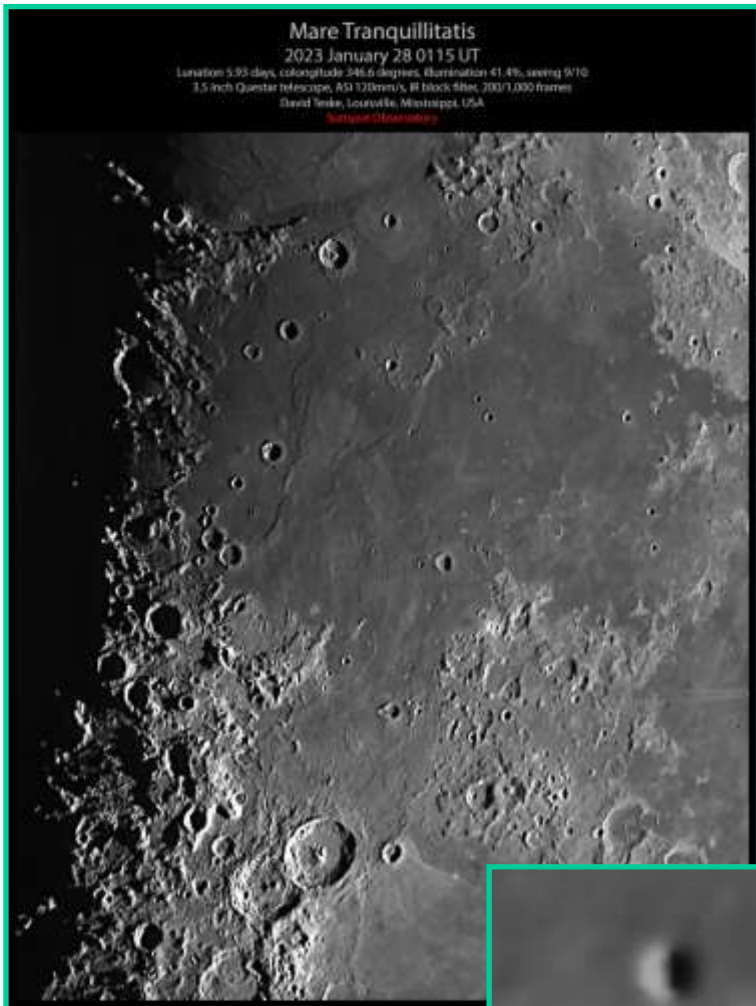


Image 69, Mare Tranquillitatis, *David Teske, Louisville, Mississippi, USA. 2023 January 28 01:15 UT, colongitude 346.6°. 3.5 inch Questar telescope, IR block filter, ZWO ASI120mm/s camera. Seeing 9/10.*

Image 70, Mare Tranquillitatis, *David Teske, Louisville, Mississippi, USA. 2023 January 28 01:15 UT, colongitude 346.6°. 3.5 inch Questar telescope, IR block filter, ZWO ASI120mm/s camera. Seeing 9/10. Close-up of image 69.*

FOCUS ON: Floor Fractured Craters

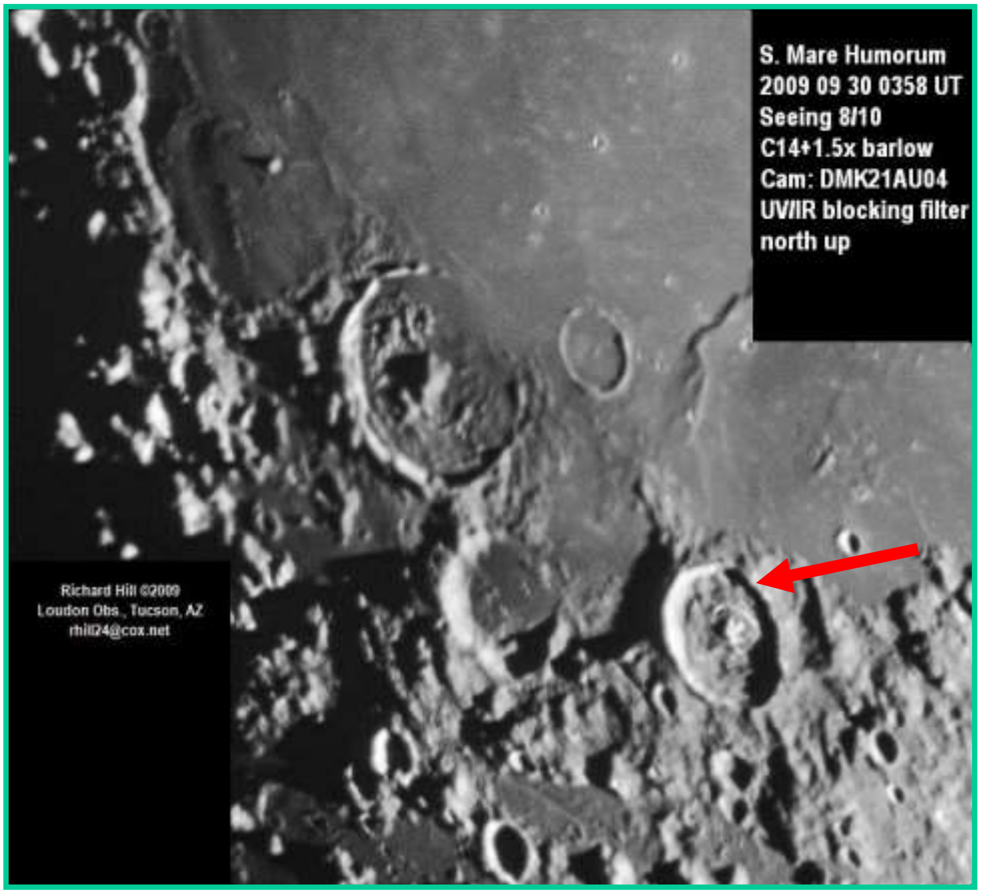


Image 71, South Mare Humorum, *Richard Hill, Loudon Observatory, Tucson, Arizona, USA. 2009 September 30 03:58 UT. Celestron 14 inch Schmidt-Cassegrain telescope, 1.5x barlow, UV/IR blocking filter, DMK21AU04 camera. Seeing 8/10.*

Image 72, Palus Epidemiarum, *Richard Hill, Loudon Observatory, Tucson, Arizona, USA. 2015 October 24 02:51 UT. TEC 8 inch f/20 Maksutov-Cassegrain telescope, 656.3 nm filter, SKYRIS 445M camera. Seeing 7/10.*

FOCUS ON: Floor Fractured Craters

Image 73, Vitello, *Richard Hill, Loudon Observatory, Tucson, Arizona, USA. 2017 March 09 04:29 UT. TEC 8 inch f/20 Maksutov-Cassegrain telescope, 656.3 nm filter, SKYRIS 445M camera. Seeing 8/10.*

CLASS 3

In class 3 are perhaps the most spectacular FFC's, Gassendi being the most obvious, dominating the landscape of Mare Humorum. It is also the largest category, 41 craters. It's not just Gassendi, there's also Taruntius and Cassini, all three could be targets for future Focus On. Garfinkle summarizes the characteristics of these craters: "Wide discontinuous annular depression (moat-like) between a shallow plate-like floor and wall scarp; moat best developed on side nearest to an exterior mare plain; crater filled with mare or light-hues plains; crater diameters range from about 12 to 70 km (7.5 to 44 miles), but majority are between 30 and 60 km (18.6 to 37.2 miles) in diameter".

Let's start with the beauty of Gassendi. First of all, we can take the tour that Jeff Grainger proposes to us, then we can return to the rest of the images.

A Tour of Gassendi

Jeff Grainger

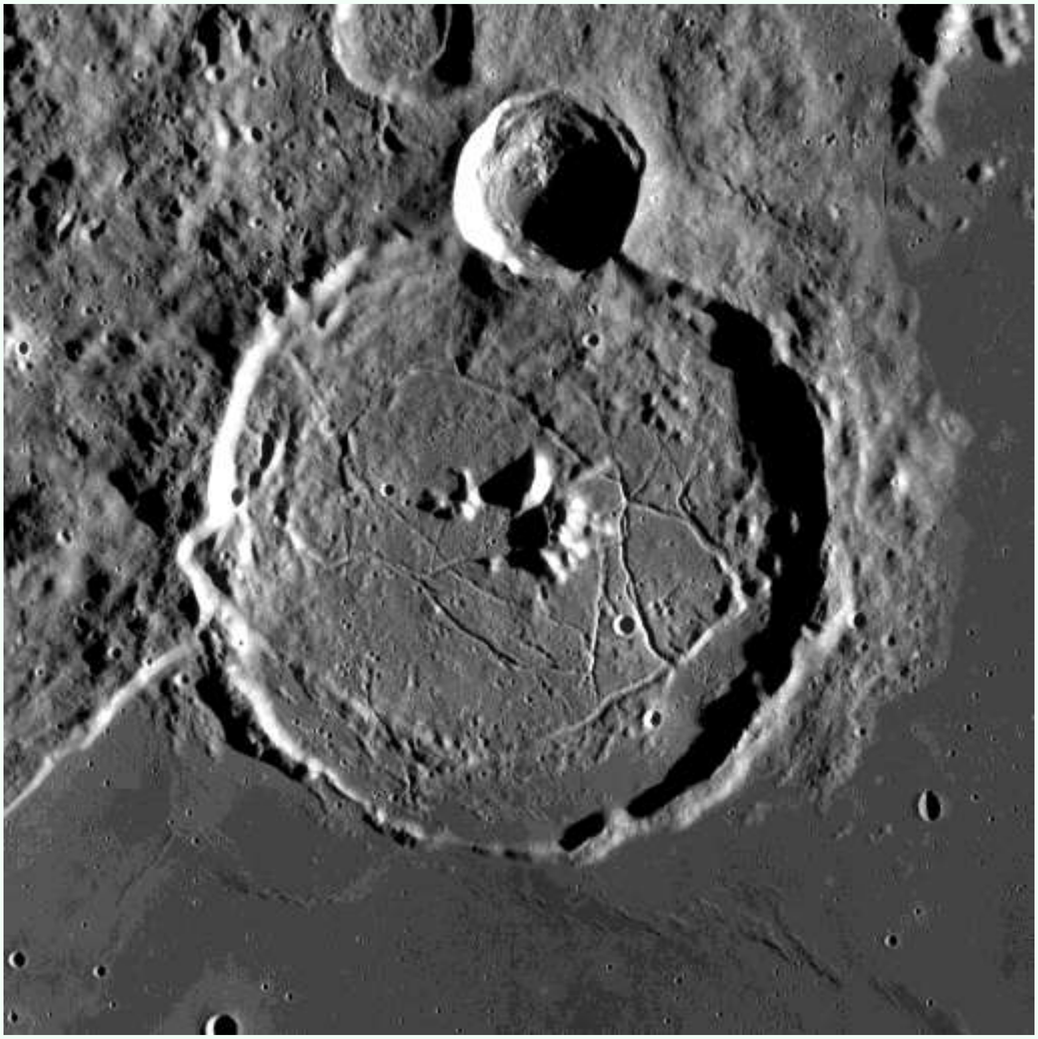
Dominating the northern end of the Mare Humorum, Gassendi features central peaks, rilles and sunken floors – with lava ingress at its southern end.

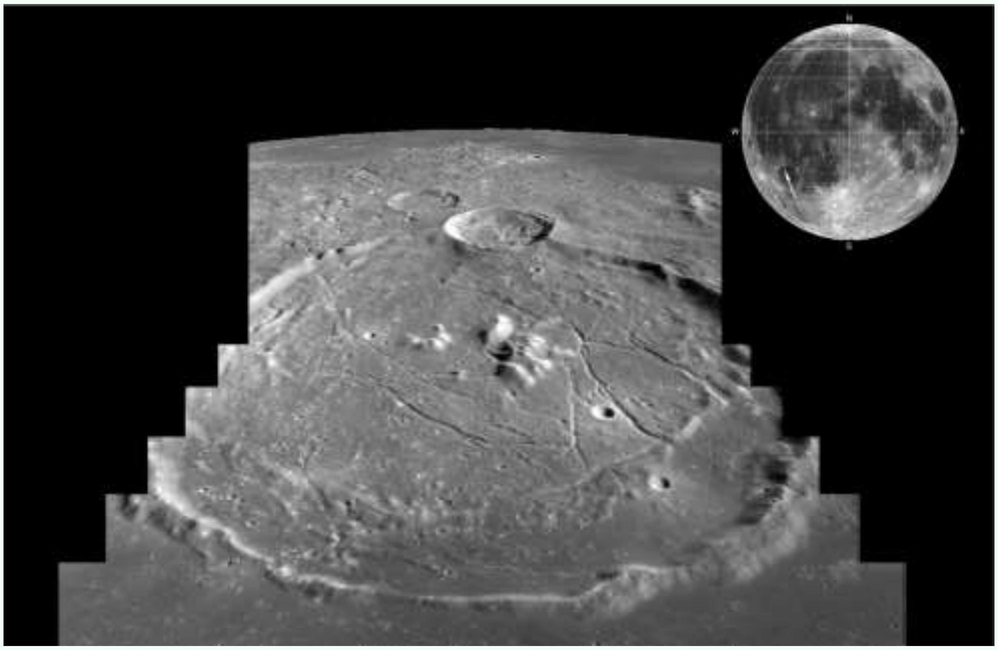
Gassendi and Mare Humorum: 11.40 days 20.21 UT November 05 2022 [61]
[Altitude: 33*23' Azimuth: 149*22' Libration: 6.8* @ PA 50*]

Gassendi Data [see Moore, CoM 235]:
Diameter: ~ 111km
Age: Nectarian period, 3.92-3.85 bn y old
Depth: ~ 1.4km (see LRO profile data)

FOCUS ON: Floor Fractured Craters: A Tour of Gassendi

An enlarged view of Gassendi, taken from the previous image, along with an LRO satellite image:



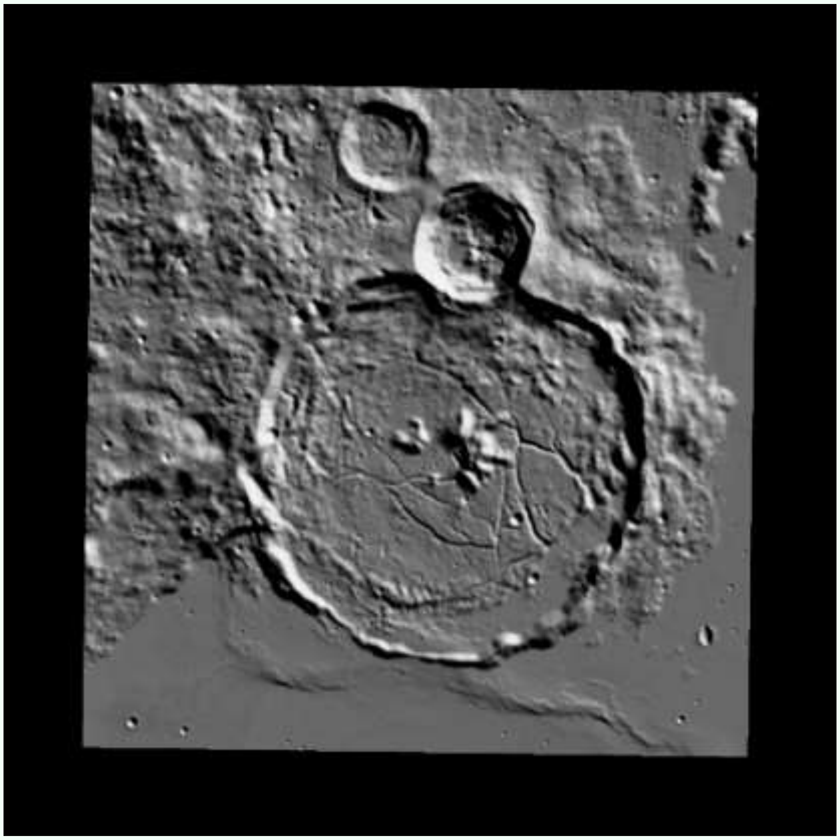


Oblique KAGUYA view of Gassendi, looking North.

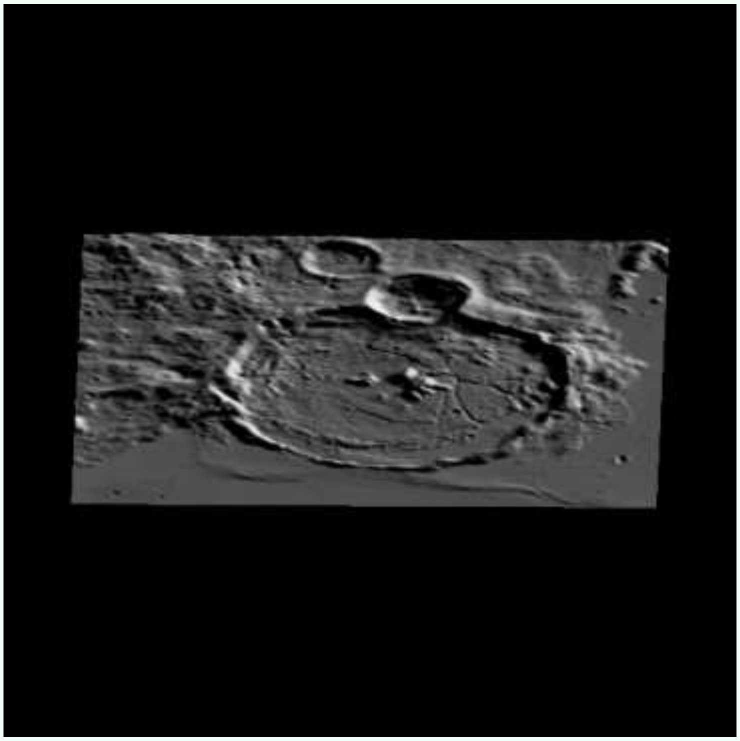
FOCUS ON: Floor Fractured Craters: A Tour of Gassendi

Oblique Apollo 16 view of Gassendi, looking South.

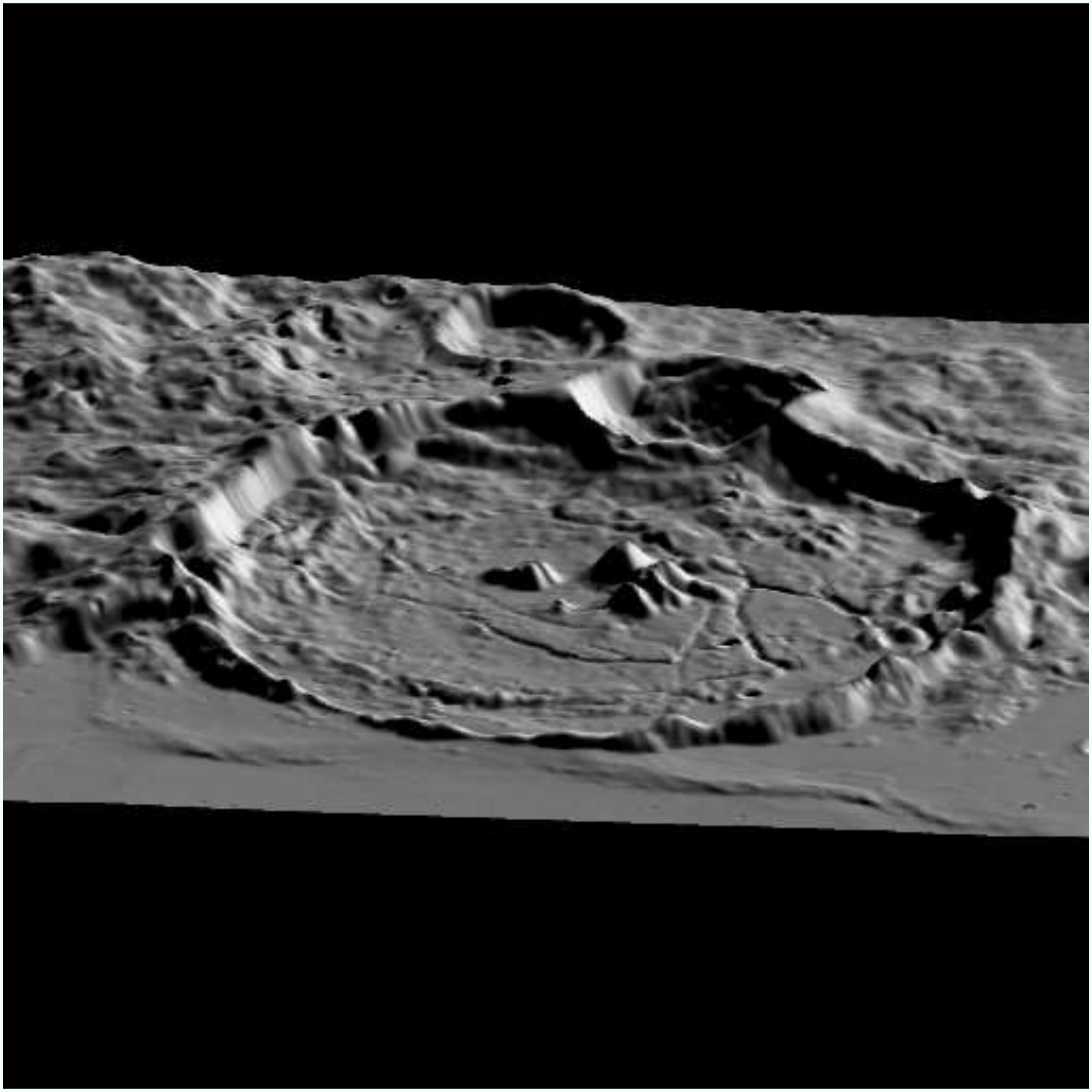
Image Rendering:
Overhead view, no exaggeration.



Looking North



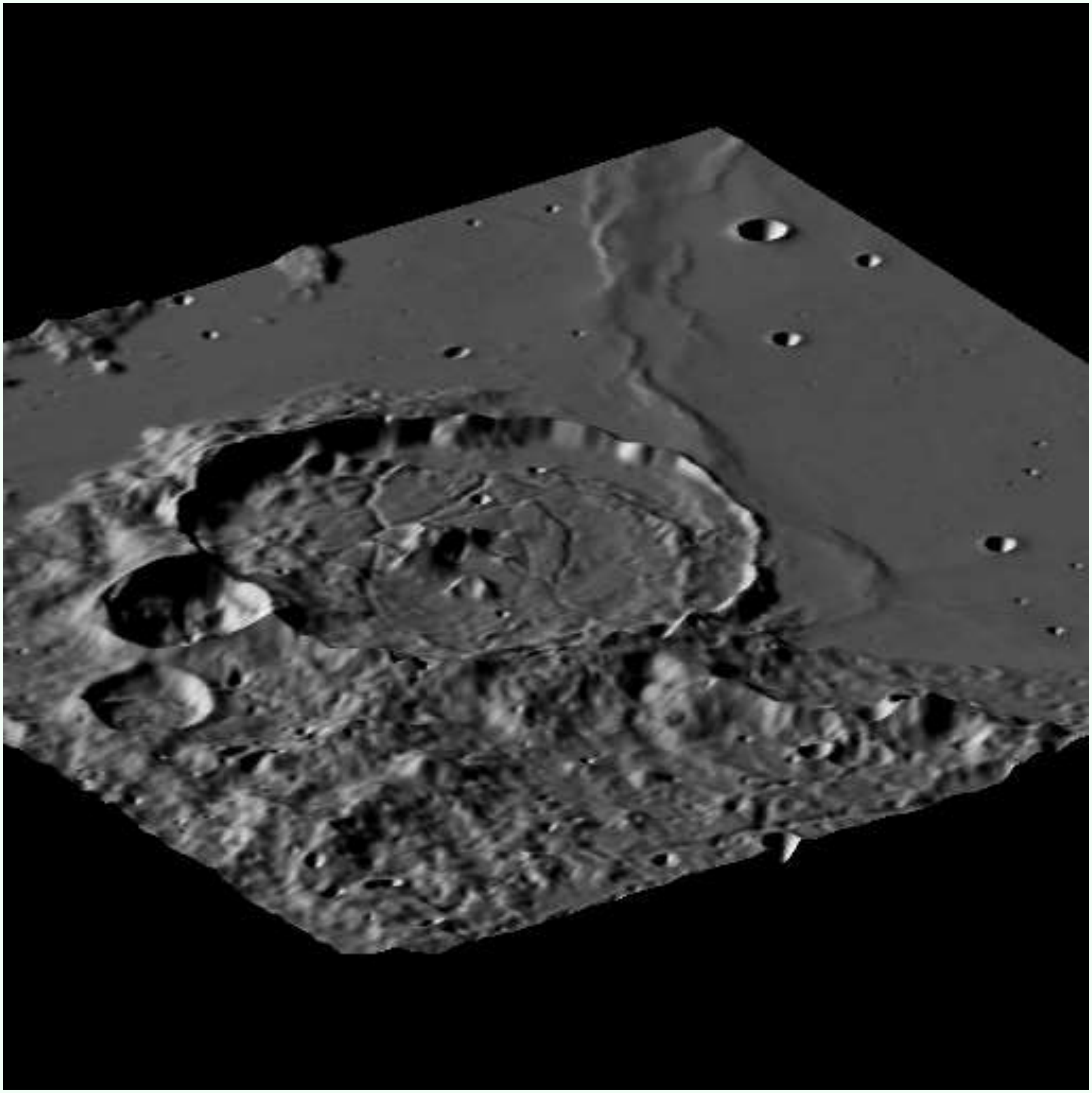
Looking North Exag x3 and Zoom



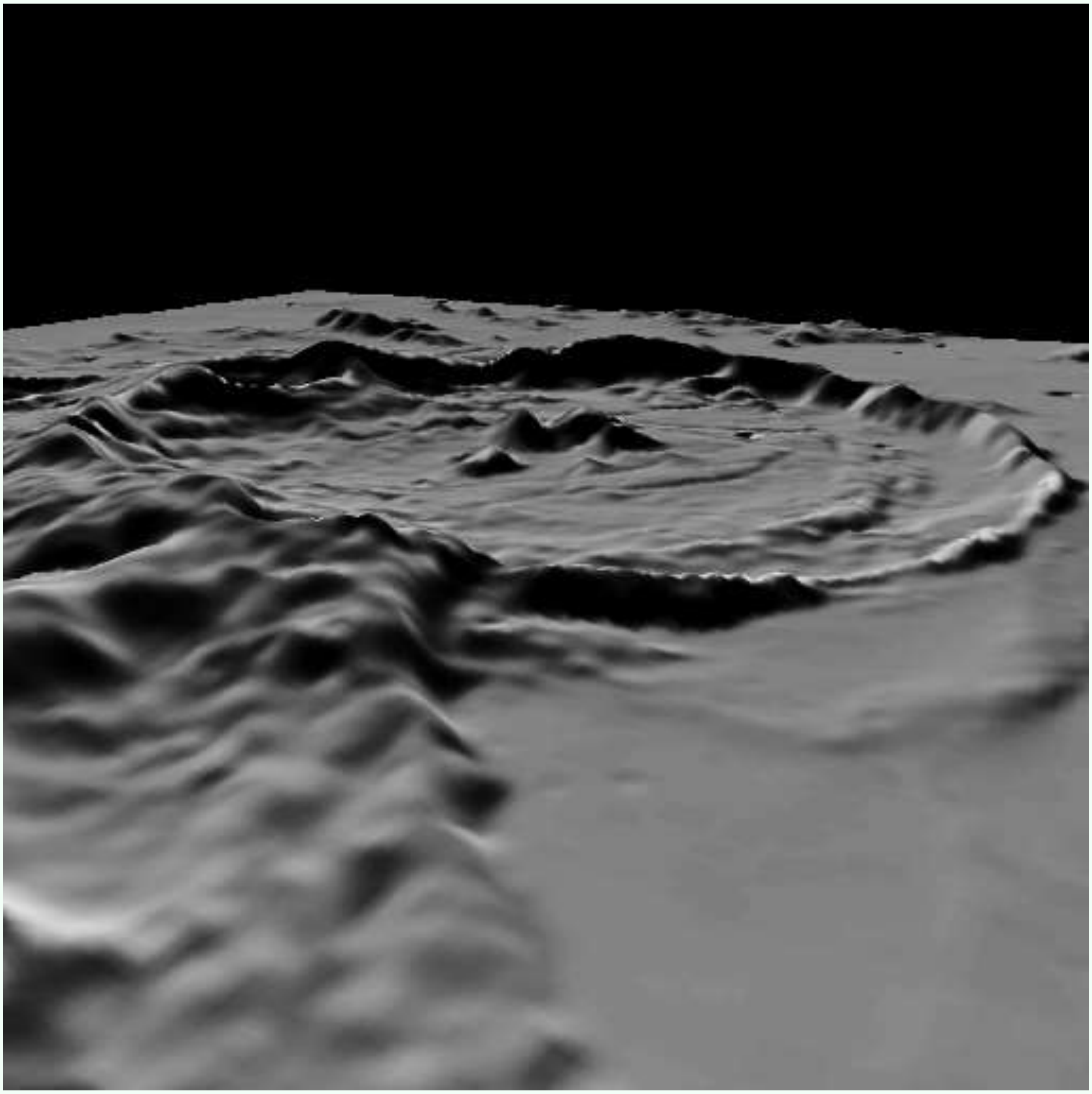
Compare this crater to Posidonius which shares similar characteristics, including tilted floor, lava-ingress and multiple rilles.

Both are comparably spectacular!

So spectacular that I've decided to indulge myself with a couple more full-page renderings. So, here goes….



Looking SE, vertical exaggeration x3 and zoomed….

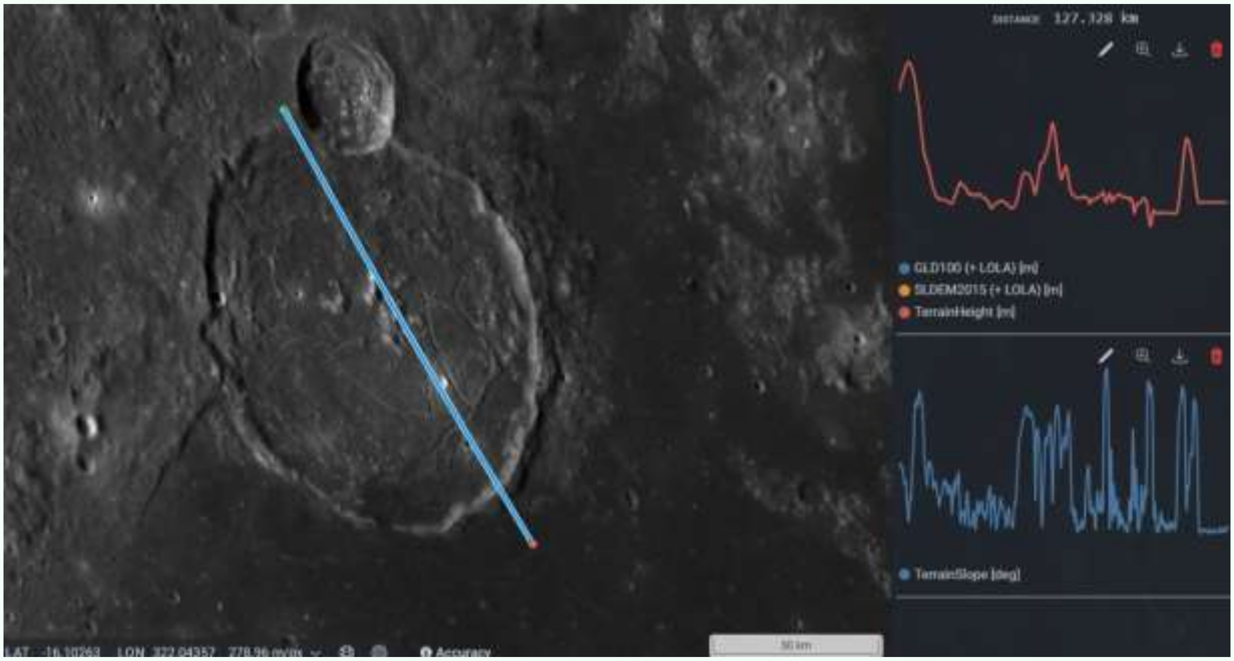


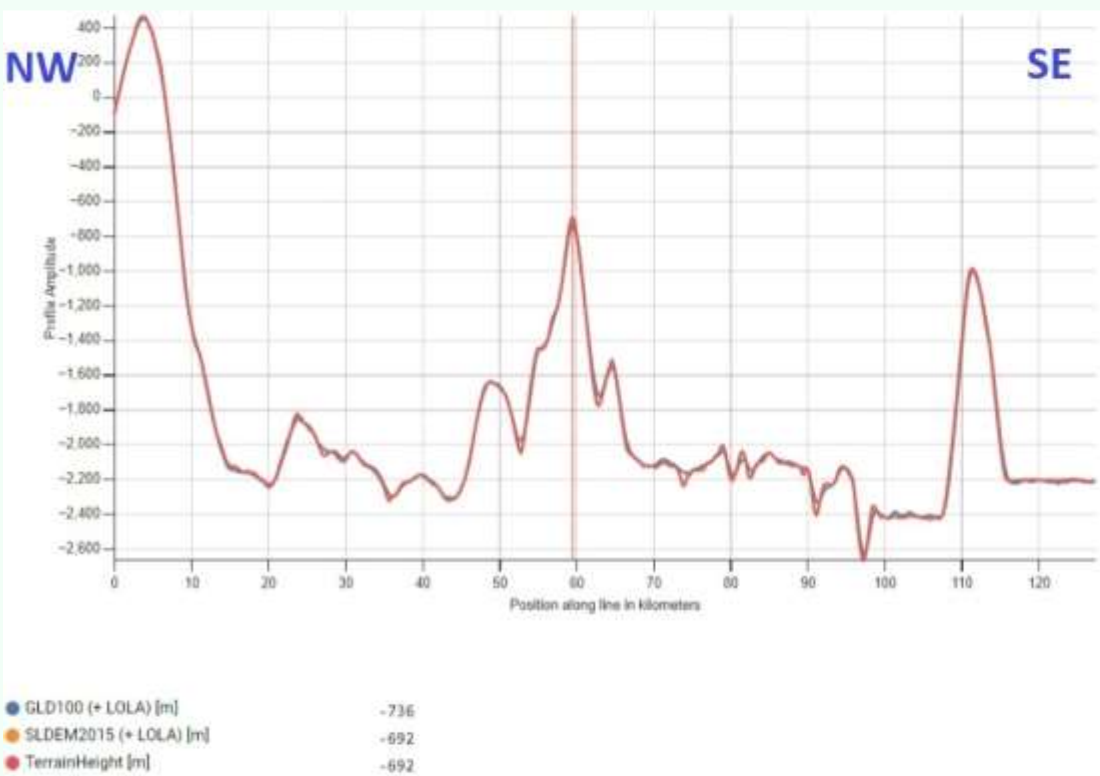
Looking NE, Perspective view, exaggeration x 3 and zoomed.

The rille system isn't apparent in this lower-level view but the tilt of the floor and the central peak complex are conspicuous features.

Crater Profiles:

Approx NW to SE:

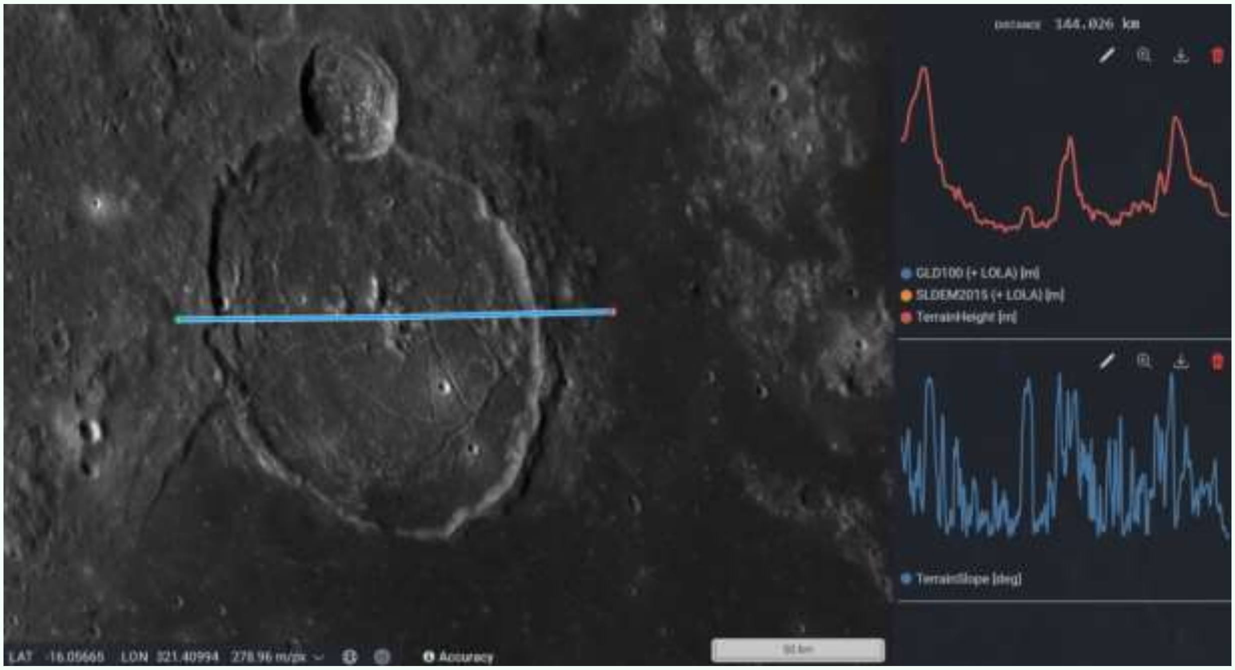


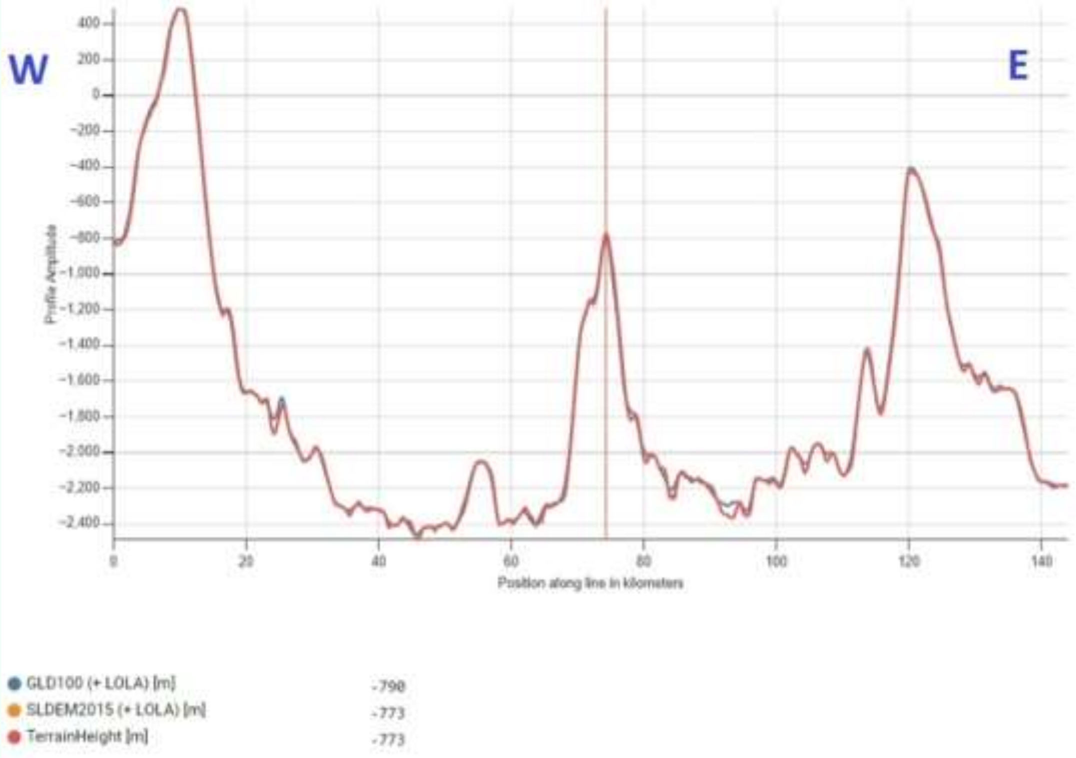


FOCUS ON: Floor Fractured Craters: A Tour of Gassendi

Note the lower height of the southern crater lip caused by tilt/lava ingress.

<u>Approx W to E:</u>





The sequence of Rik Hill's Gassendi images (IMAGES 74 to 81) is also spectacular, let's see if we can locate in these images with different illumination the characteristics of the floor that Peter Grego enunciates (page 193): “Gassendi’s floor is a complex collection of hills, mountains, ridges and linear rilles. A group of three large central mountains is surrounded by Rimae Gassendi, which cut across much of the crater’s floor, mostly to the east of the central peaks. Resolvable thorough a 100 mm telescope, the most prominent rille proceeds east of the largest central peak and curves towards the crater’s eastern wall before heading south, just inside a low, concentric ridge that marks a submerged inner wall of Gassendi’s. The other rilles require a 150mm telescope to resolve adequately. Added together, the largest components of Rimae Gassendi would stretch for more than 300 km.” With frontal illumination it’s more difficult to spot the famous rilles of Gassendi, but we clearly see a zone notoriously darker near the southern wall (“Wide discontinuous annular depression (moat-like) between a shallow plate-like floor and wall scarp”). In IMAGE 75 we already see the dark strip better and now Rimae Gassendi is better outlined, also in the north (in the direction of Gassendi A) the limit of the "shallow plate-like floor" is clearly noticeable, the same in IMAGES 76 to 78. The illumination changes noticeably in 79 and it is the ideal one to differentiate the two sides divided by the three central peaks: the north side full of small elevations and the smoother south side divided by Rimae Gassendi. The differences between the rilles running east of the central peaks and the one running south can be seen in 80 and especially 81 (“Shallow tilted fractured floor; multiple crossing rilles systems”). In Foldvari's sketch IMAGE 82 this is seen also, related to the higher areas of the Rimae, the same can be seen in the precise map of Gassendi floor rilles which is Jeff de Wit's IMAGE 83. We can see in IMAGES 84 to 94 the extraordinarily complicated Gassendi floor, with the characteristics that we have seen and that we can summarize like this, with Garfinkle: “a moat to the south, best developed on side nearest to an exterior mare plain (Mare Humorum), rilles around the central peaks in the center and light-hues plains” (more visible with frontal illumination).

Image 74, Gassendi, *Richard Hill, Loudon Observatory, Tucson, Arizona, USA. 2007 September 26 05:50 UT. Celestron 14 inch Schmidt-Cassegrain telescope, 1.6x barlow, UV/IR blocking filter, SPC900NC camera. Seeing 6/10.*

FOCUS ON: Floor Fractured Craters

Image 75, Gassendi, Richard Hill, Loudon Observatory, Tucson, Arizona, USA. 2008 March 19 05:02 UT. Celestron 14 inch Schmidt-Cassegrain telescope, 1.6x barlow, UV/IR blocking filter, SPC900NC camera. Seeing 6/10.

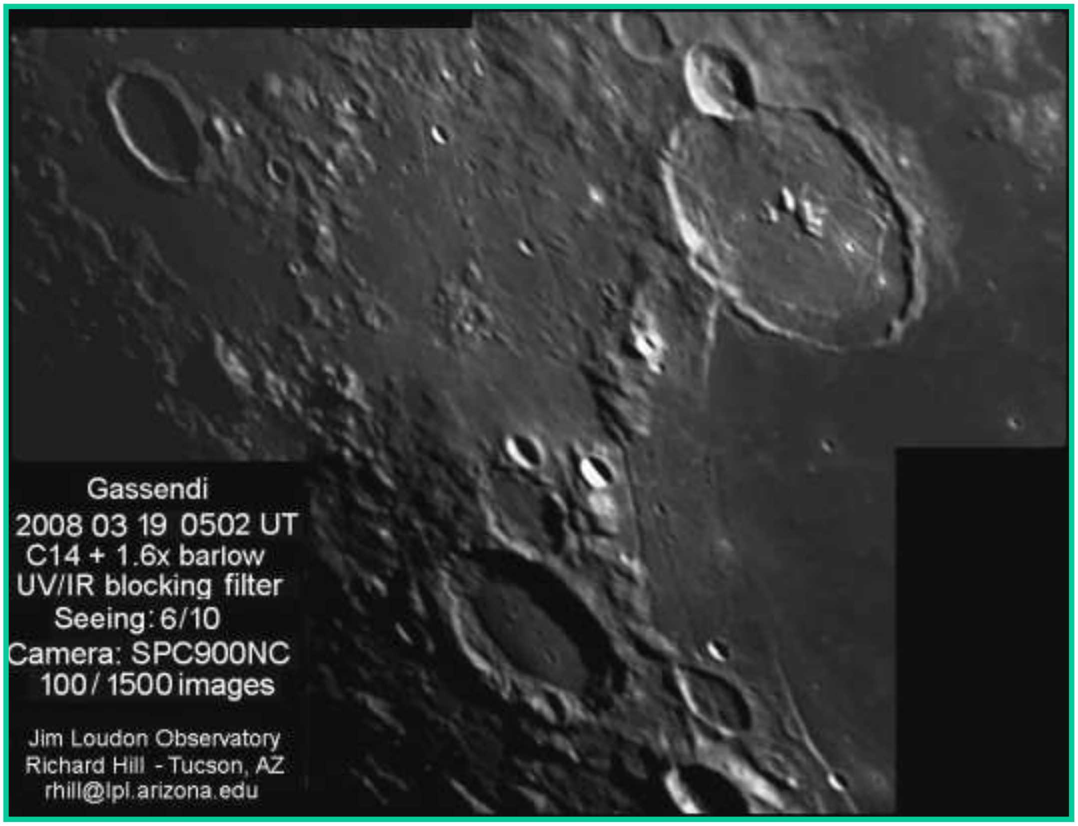


Image 76, Gassendi, Richard Hill, Loudon Observatory, Tucson, Arizona, USA. 2012 October 27 04:09 UT. TEC 8 inch f/20 Maksutov-Cassegrain telescope, 656.3 nm filter, DMK21AU04 camera. Seeing 7/10.

FOCUS ON: Floor Fractured Craters

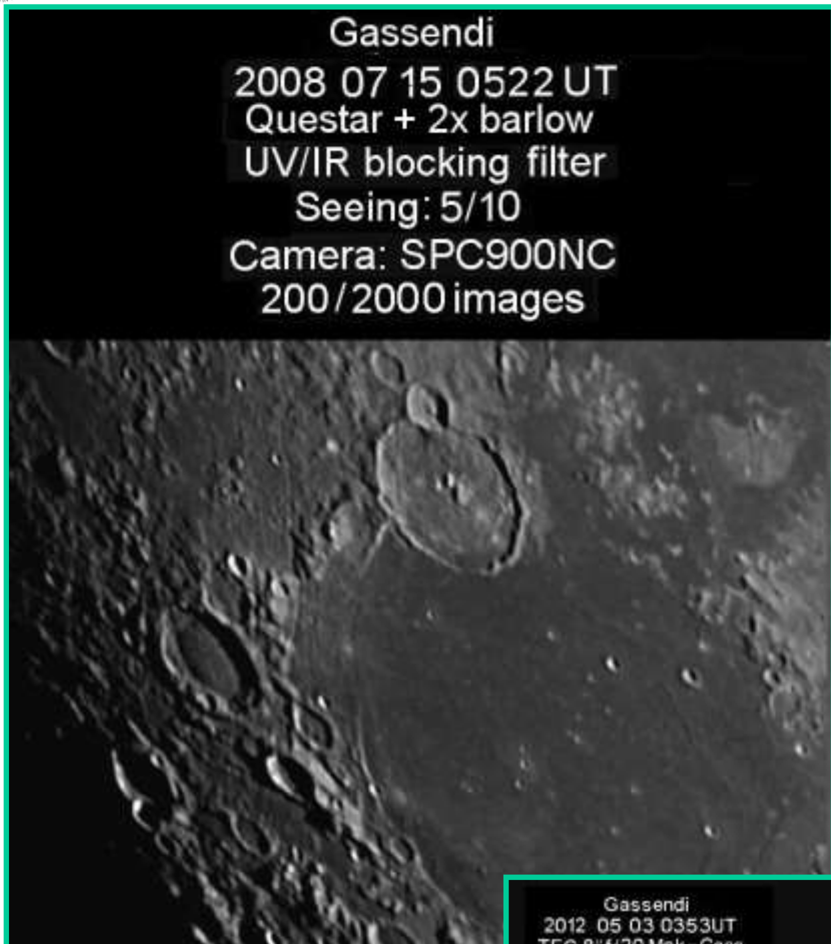


Image 77, Gassendi, *Richard Hill, Loudon Observatory, Tucson, Arizona, USA. 2008 July 15 05:22 UT. 3.5 inch Questar Maksutov-Cassegrain telescope, 2x barlow, UV/IR blocking filter, SPC900NC camera. Seeing 5/10.*

Image 78, Gassendi, *Richard Hill, Loudon Observatory, Tucson, Arizona, USA. 2012 May 03 03:53 UT. TEC 8 inch f/20 Maksutov-Cassegrain telescope, Wratten 23 filter, DMK21AU04 camera. Seeing 7/10.*

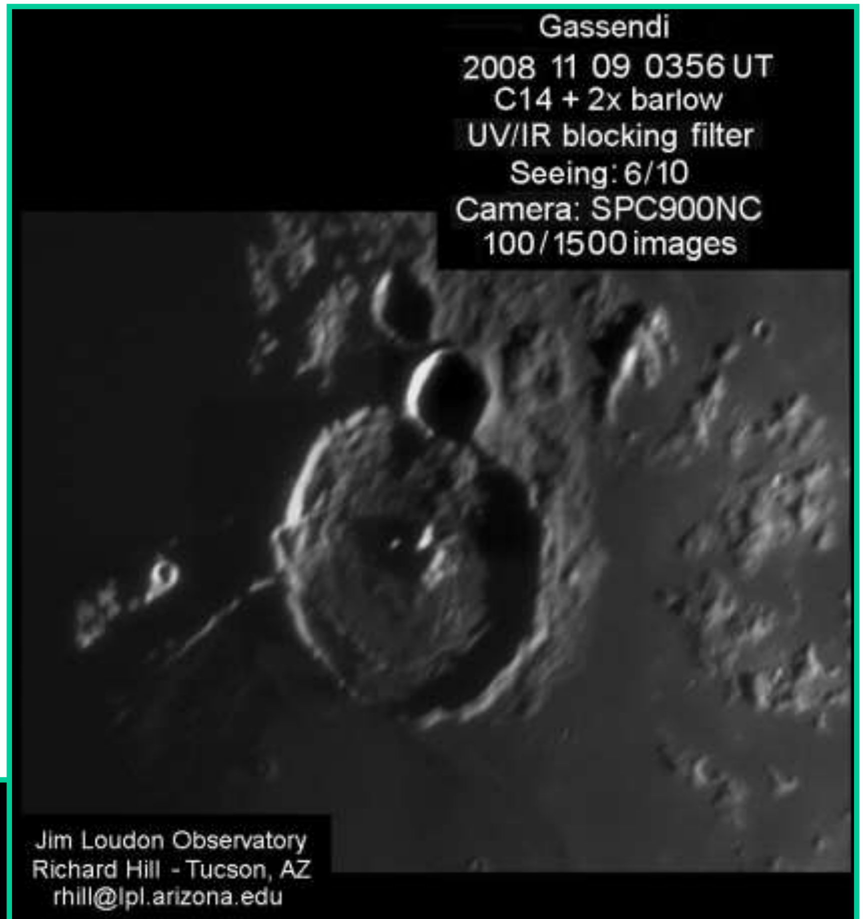
FOCUS ON: Floor Fractured Craters

Image 79, Gassendi, *Richard Hill, Loudon Observatory, Tucson, Arizona, USA. 2009 September 30 03:55 UT. Celestron 14 inch Schmidt-Cassegrain telescope, 1.6x barlow, UV/IR blocking filter, DMK21AU04 camera. Seeing 8/10.*

Image 80, Gassendi, *Richard Hill, Loudon Observatory, Tucson, Arizona, USA. 2012 October 26 03:47 UT. TEC 8 inch f/20 Maksutov-Cassegrain telescope, 656.3 nm filter, DMK21AU04 camera. Seeing 8/10.*

FOCUS ON: Floor Fractured Craters

Image 81, Gassendi, *Richard Hill, Loudon Observatory, Tucson, Arizona, USA. 2008 November 09 03:56 UT. Celestron 14 inch Schmidt-Cassegrain telescope, 2x barlow, UV/IR blocking filter, SPC900NC camera. Seeing 6/10.*



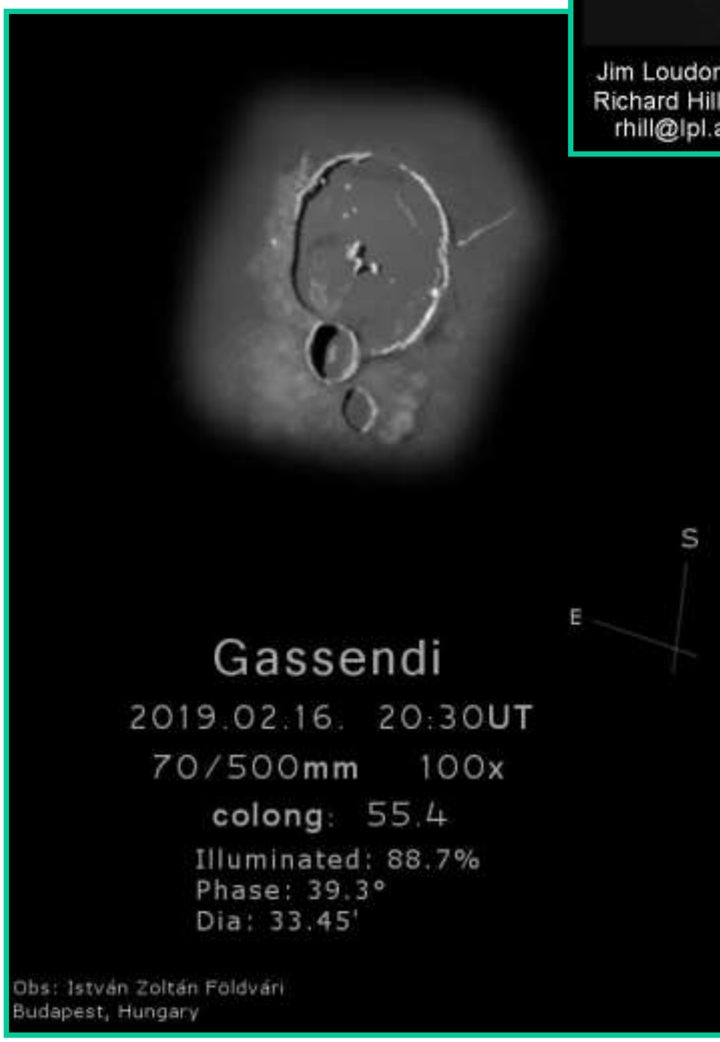


Image 82, Gassendi, *István Zoltán Földvári, Budapest, Hungary. 2019 February 16, 20:13-20:37 UT, colongitude 55.4°. 70 mm refractor telescope, 500 mm focal length, 100x.*

FOCUS ON: Floor Fractured Craters

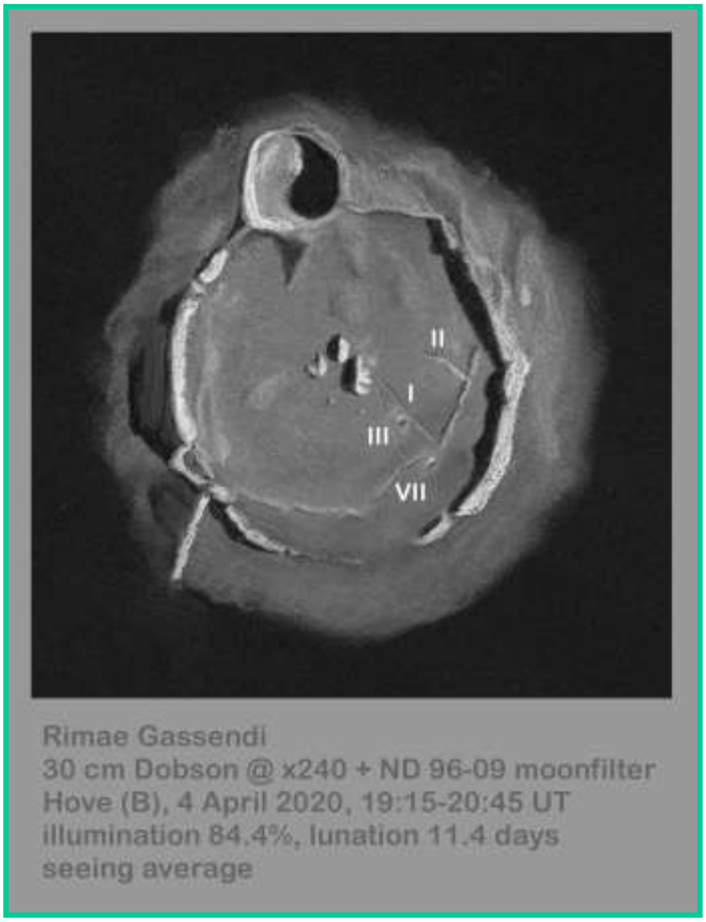
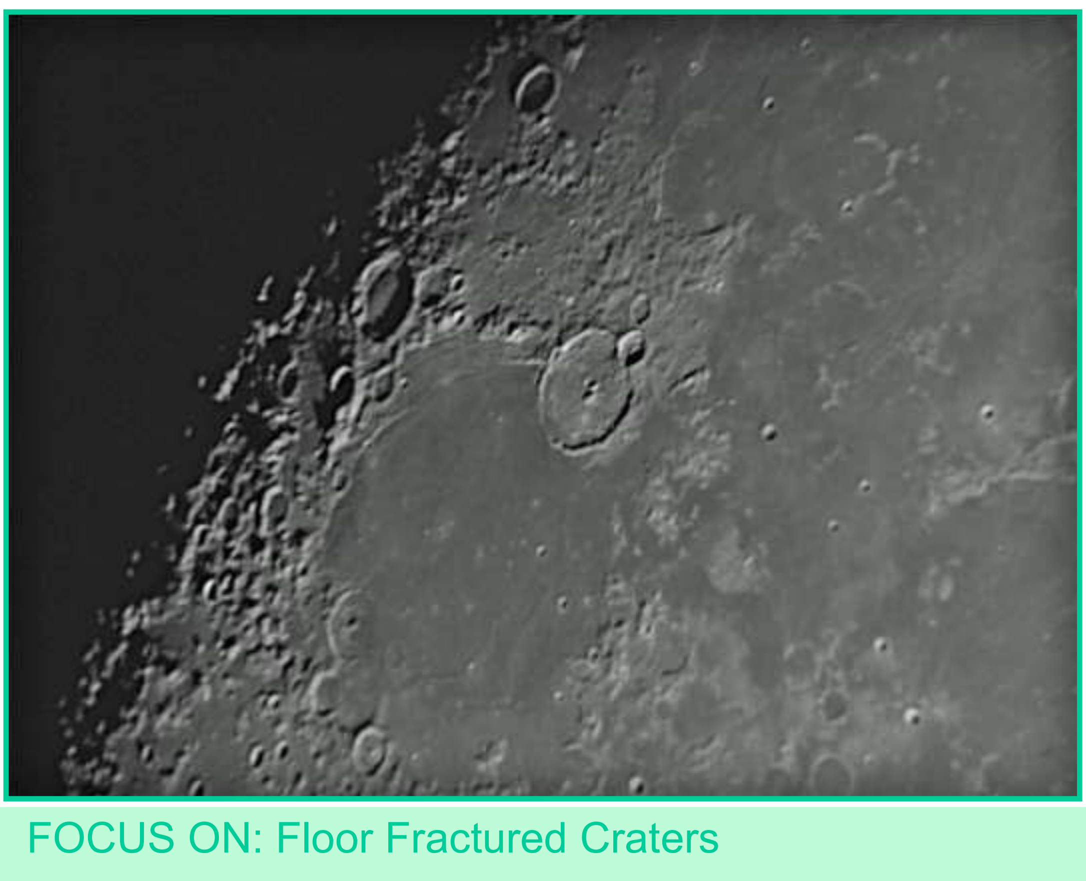


Image 83, Gassendi, *Jef de Wit, Hove, Belgium. 2020 April 04 19:15-20:45 UT. 30 cm Dobsonian reflector telescope, 240 x. Average seeing.*

Image 84, Gassendi, *Francisco Alsina Cardinalli, Oro Verde, Argentina, SLA. 2016 December 11 04:29 UT. Meade LX200 10 inch Schmidt-Cassegrain telescope, Astronomik ProPlanet 742 nm IR Pass filter.*



FOCUS ON: Floor Fractured Craters

Image 85, Gassendi, *Leonardo Alberto Colombo, Córdoba, Argentina. 2022 December 06 03:03 UT. 102 mm Maksutov-Cassegrain telescope, IR pass 685 nm filter, QHY5LII-M camera.*

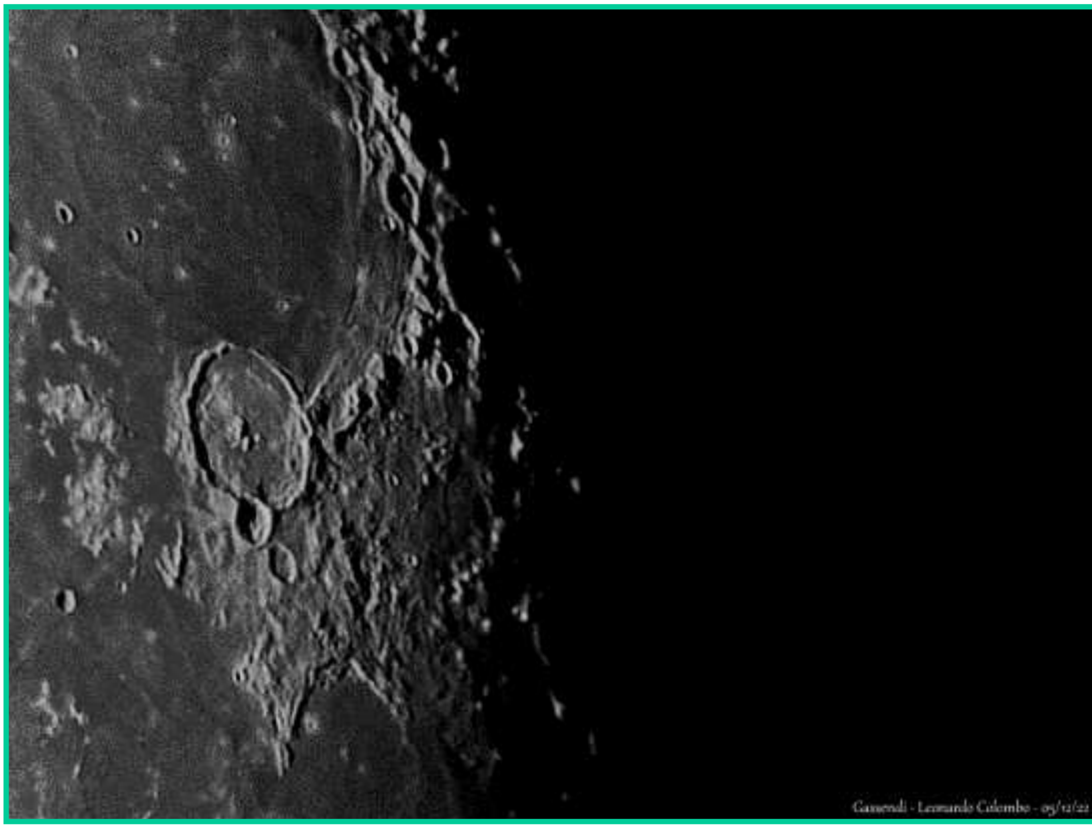


Image 86, Atlas and Hercules, *Alberto Anunziato, Oro Verde, Argentina. 2016 April 30 09:06 UT. Meade LX 200 10 inch Schmidt-Cassegrain telescope, QHY5-II camera*

FOCUS ON: Floor Fractured Craters

Image 87, Gassendi, *Francisco Alsina Cardinalli, Oro Verde, Argentina, SLA. 2016 January 16 23:45 UT. Meade LX200 10 inch Schmidt-Cassegrain telescope, telextender, Canon EOS Digital Rebel XS camera.*

Image 88, Gassendi, *Francisco Alsina Cardinalli, Oro Verde, Argentina, SLA. 2015 December 20 00:45 UT. Meade LX200 10 inch Schmidt-Cassegrain telescope, telextender, Canon EOS Digital Rebel XS camera.*

FOCUS ON: Floor Fractured Craters

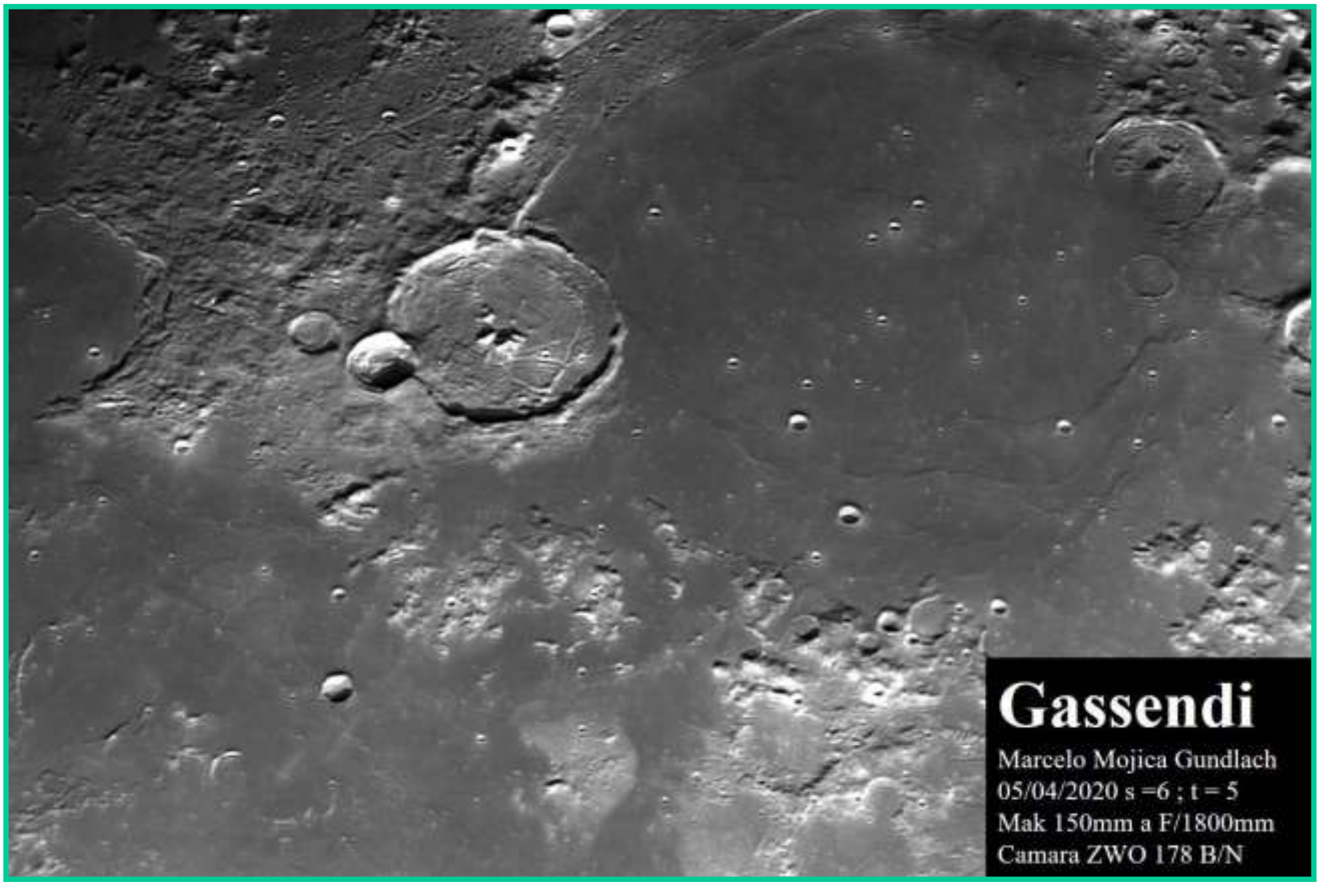


Image 89, Gassendi, *Marcelo Mojica Gundlach, Cochabamba, Bolivia. 2020 April 05 23:21 UT. 6 inch Sky Watcher Maksutov-Cassegrain telescope, fl 1,800 mm, ZWO ASI178 B/N camera.*

Image 90, Gassendi, *Felix León, Santo Domingo, República Dominicana. 2021 March 27 00:05 UT. 127 mm Maksutov-Cassegrain telescope, DMK21618AU camera.*

FOCUS ON: Floor Fractured Craters

Image 91, Grimaldi, *David Teske, Louisville, Mississippi, USA. 2023 February 04 02:43 UT, colongitude 68.5º. 3.5 inch Questar telescope, IR block filter, ZWO ASI120mm/s camera. Seeing 8/10.*

Image 92, Mare Humorum, *David Teske, Louisville, Mississippi, USA. 2023 May 02 02:57 UT, colongitude 48.8º. Takahashi FOA60Q refractor telescope, IR block filter, ZWO ASI120mm/s camera. Seeing 8/10.*

FOCUS ON: Floor Fractured Craters

Image 93, Mare Humorum and Gassendi, *Larry Todd, Dunedin, New Zealand. 2023 June 30 07:03 UT. 8 inch OMC Maksutov-Cassegrain telescope.*

Image 94, Taruntius, *Desiré Godoy, Oro Verde, Argentina, SLA. 2020 August 28 23:53 UT. 200 mm refractor telescope, 742 nm filter, QHY5-II camera.*

FOCUS ON: Floor Fractured Craters

It is not strange that Schultz had choose Gassendi as archetype of the Class 3 FFC's: "Craters in this class have wide annular moats on their floors near the base of their interior walls. The lava-flooded moats separate the walls from the rest of the crater's floor. In Gassendi the moat is where lava flowed into the tilted and breached crater through a low pass in the crater's southern wall. Class 3 crater floors have radial and polygonal fractures. The craters in this class are almost all located around the shores of the maria" (Garfinkle).

Already in IMAGE 95 we see that Taruntius is similar to Gassendi but different. The reason? Gassendi belongs to the Nectarian period and Taruntius is Copernican and that is perhaps why its floor appears more orderly, with a strange resemblance to a concentric crater, especially on the northeast floor, where there is (Garfinkle) a "wide annular stretch along northeastern floor", particularly visible in IMAGES 96 to 100, in which the illumination allows to appreciate the internal height. As Wood says, with Taruntius, "something's wrong. With a diameter of 56 km, Taruntius should be about 2.3 km deep, but its depth is only 0.4 km. And a prominent ring of hills and tiny rilles circles the central peaks. These are all the characteristics signatures of a floor-fractured and uplifted crater. Schultz and Wichman attributed the uplift as to a 1.9-km thick pond of frozen magma (a laccolith) only a few kilometers beneath the crater floor. The intriguing thing is that Taruntius's youthful age implies that magma rose near the surface in Copernican time. Under a high Sun, you can see two dark patches near Taruntius's central peak, so maybe lava or ash did erupt on to the surface a billion years ago. If so, this episode would have been one or the last gasps of volcanism on the Moon, making Taruntius a strong candidate for future exploration" (pages 107, 108).

Image 95, Taruntius, *Richard Hill, Loudon Observatory, Tucson, Arizona, USA. 2007 May 21 03:26 UT. Celestron 14 inch Schmidt-Cassegrain telescope, W21 filter, SPC900NC camera.*

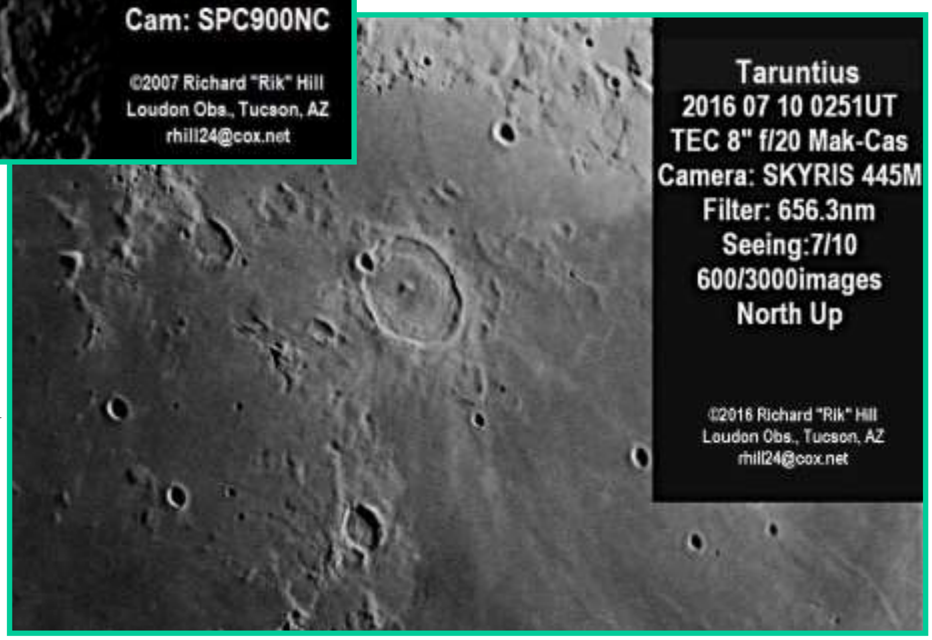


Image 96, Taruntius, *Richard Hill, Loudon Observatory, Tucson, Arizona, USA. 2016 July 10 02:51 UT. TEC 8 inch f/20 Maksutov-Cassegrain telescope, 656.3 nm filter, SKYRIS 445M camera. Seeing 7/10.*

Image 97, Taruntius, *Larry Todd, Dunedin, New Zealand. 2023 August 03 10:24 UT. 8 inch OMC Maksutov-Cassegrain telescope.*

Image 98, Taruntius, *Gregory Shanos, Sarasota, Florida, USA. 2023 January 28 02:26 UT. Meade LX200 GPS 10 inch Schmidt-Cassegrain telescope, 1.5x barlow, IR cut filter, ZWO ASI178mm camera. Greg adds:* "Floor fractured crater Taruntius on January 28, 2023 at 2h 26.2m UT. Image taken by ALPO member Gregory T. Shanos with a Meade LX200GPS 10-inch with a ZWO ASI 178MM monochrome camera, IR cut filter Vernon scope 1.5x Barlow. The moon was at 45% phase. Seeing was good with a clear sky."

FOCUS ON: Floor Fractured Craters

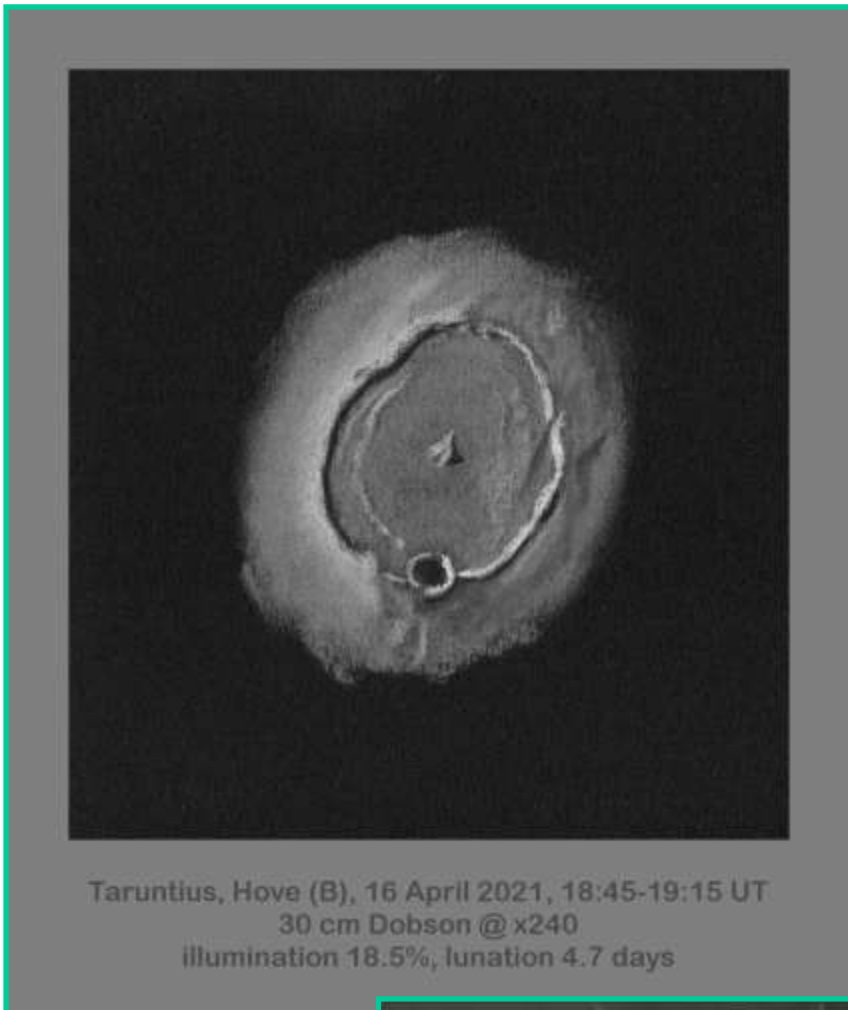


Image 99, Taruntius, *Jef de Wit, Hove, Belgium. 2021 April 16 18:45-19:15 UT. 30 cm Dobsonian reflector telescope, 240 x.*

Image 100, Taruntius, *Francisco Alsina Cardinalli, Oro Verde, Argentina, SLA. 2016 August 21 05:16 UT. Meade LX200 10 inch Schmidt-Cassegrain telescope, Astronomik ProPlanet 742 IR-pass filter, QHY5-II camera.*

FOCUS ON: Floor Fractured Craters

Before we could personally travel to Taruntius, we contented ourselves with The Lunar Observer. And then we travel to Cassini (58 kilometers in diameter), an often ignored crater, to which Wood does justice: "Cassini (57 km wide) is a wonderful crater with a wreathlike outer rim partially covered by Imbrium lavas. It is another Archimedes-style crater, formed in the Interval between the creation of the Imbrium basin and the flood of later mare lavas. Lavas also welled up to nearly fill Cassini, which has only a narrow inner wall that rises a mere 1.2 km above the floor at the high west rim. Two prominent craters (9 and 15 km in diameter) reside on Cassini's floor, along with a striated mound under the larger crater and extending east. The three tiny hills just barely visible between the two craters may be the tops of lava-covered central peaks, but if this were true, the peaks would be unusually tall. Cassini it's in a broad, mare-covered embayment of the hilly terrain behind the Alps and Caucasus mountains. Why does this embayment exist?" (Page 34). If we look at the spectacular panorama of IMAGE 101, it is not easy to distinguish the fractures that Garfinkle mentions when characterizing Cassini as FFC: "parallel fractures on elevated crater floor southeast of Cassini A", IMAGE 102 does clearly show the fractures on the ground raised to the side of the huge inner crater Cassini A, slightly less clearly in IMAGES 103 to 111.

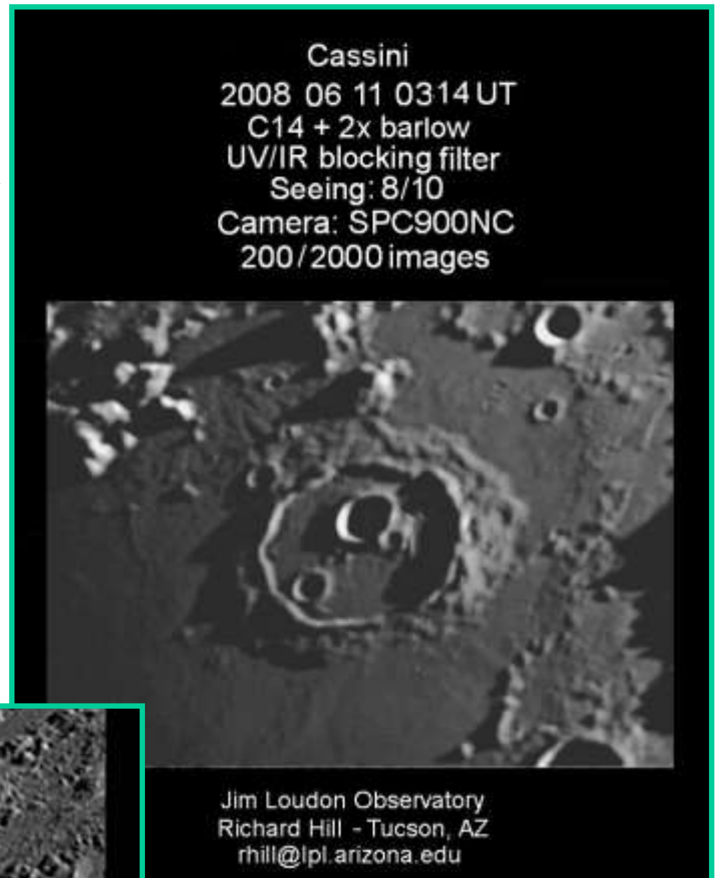


Image 101, Cassini, *Richard Hill, Loudon Observatory, Tucson, Arizona, USA. 2008 June 11 03:14 UT. Celestron 14 inch Schmidt-Cassegrain telescope, 2x barlow, UV/IR blocking filter, SPC900NC camera. Seeing 8/10.*

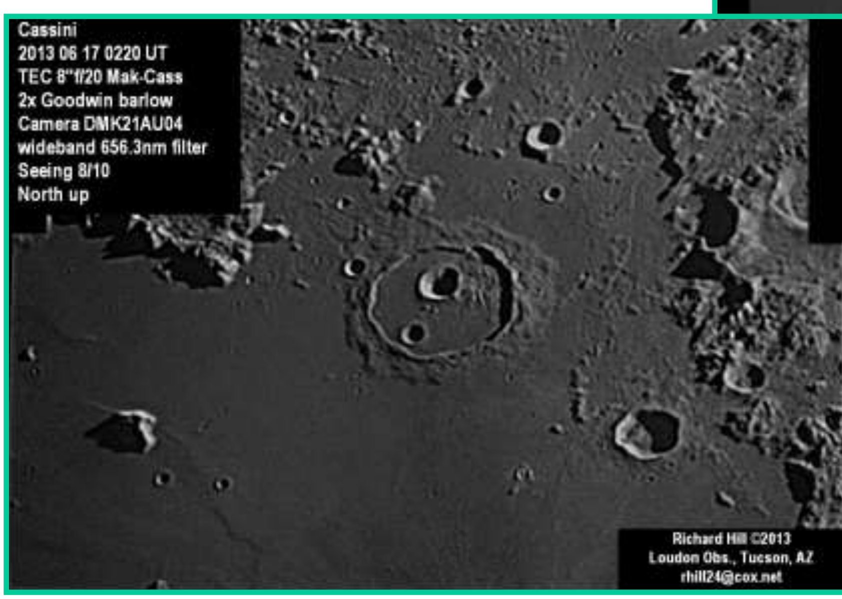


Image 102, Cassini, *Richard Hill, Loudon Observatory, Tucson, Arizona, USA. 2013 June 17 02:20 UT. TEC 8 inch f/20 Maksutov-Cassegrain telescope, 2x Goodwin barlow, 656.3 nm filter, DMK21AU04 camera. Seeing 8/10.*

FOCUS ON: Floor Fractured Craters

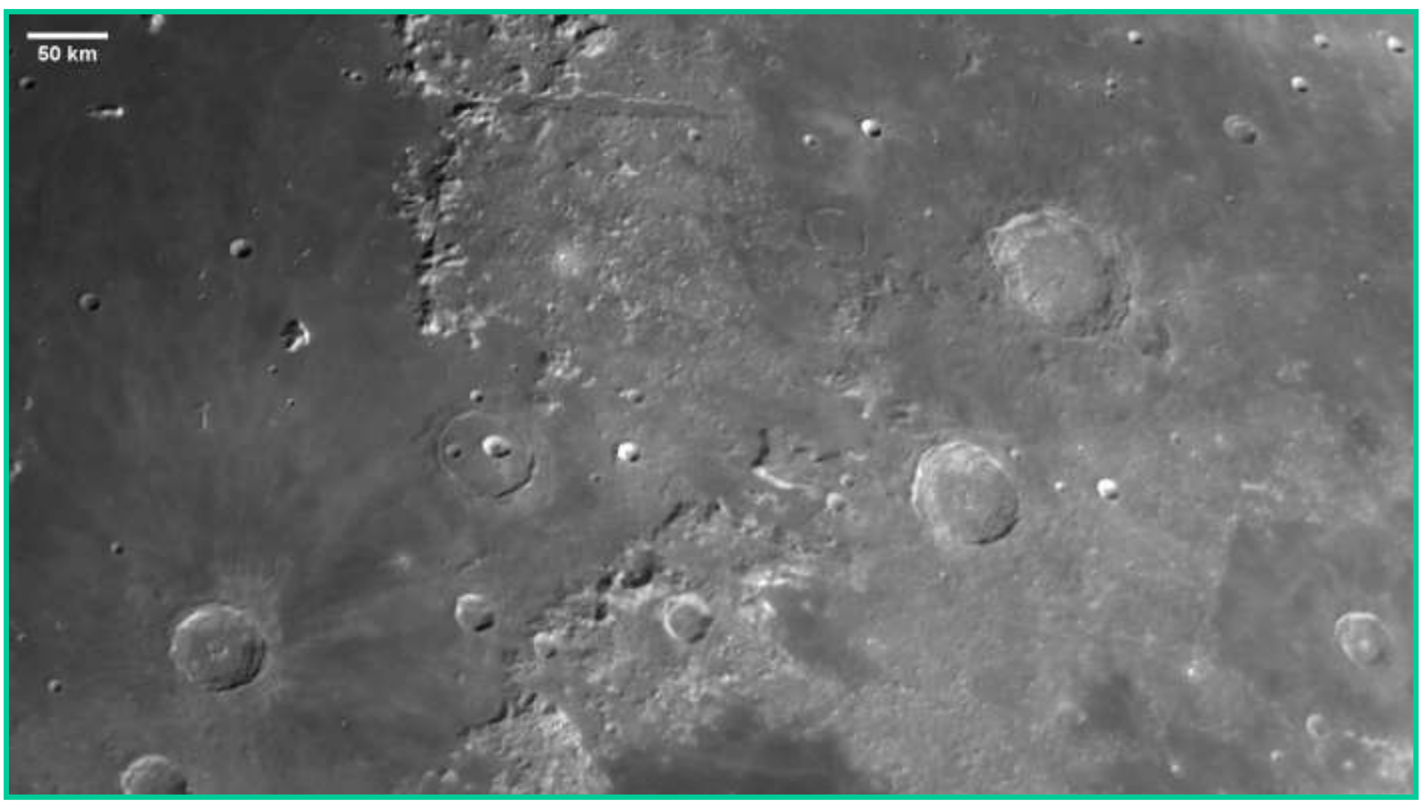
Image 103, Cassini, *Richard Hill, Loudon Observatory, Tucson, Arizona, USA. 2007 December 18 01:58 UT. Celestron 14 inch Schmidt-Cassegrain telescope, 1.6x barlow, UV/IR blocking filter, SPC900NC camera. Seeing 7/10.*

Image 104, Cassini, *Richard Hill, Loudon Observatory, Tucson, Arizona, USA. 2014 April 08 02:46 UT. TEC 8 inch f/20 Maksutov-Cassegrain telescope, 665 nm filter, SKYRIS 445M camera. Seeing 8/10.*

FOCUS ON: Floor Fractured Craters

Image 105, Cassini, *Jairo Chavez, Popayán, Colombia. 2021 November 12 03:30 UT. 311 mm truss Dobsonian reflector telescope, MOTO E5 PLAY camera.*

Image 106, Cassini, *Ariel Cappelletti, Córdoba, Argentina, SLA. 2020 October 26 23:40 UT. 254 mm Newtonian reflector telescope, QHY5III 462 c camera.*



FOCUS ON: Floor Fractured Craters

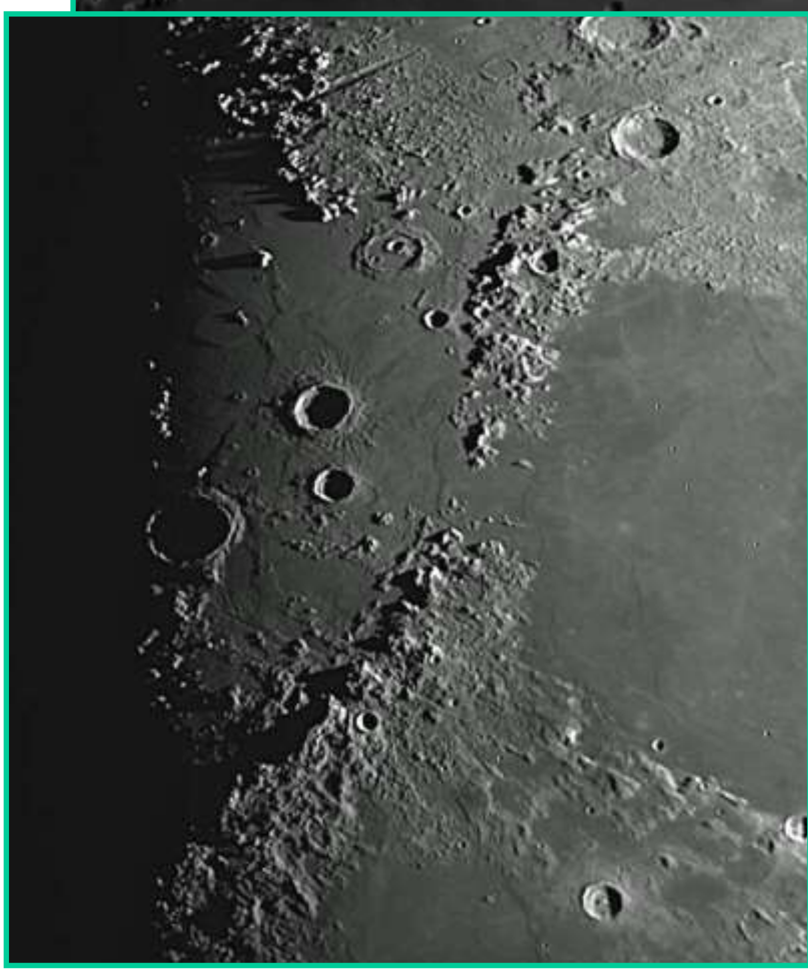


Image 107, Cassini, *Ariel Cappelletti, Córdoba, Argentina, SLA. 2020 June 06 23:10 UT. 254 mm Newtonian reflector telescope, ZWO ASI178mc camera.*

Image 108, Cassini, *Francisco Alsina Cardinalli, Oro Verde, Argentina, SLA. 2017 July 01 00:05 UT. 200 mm refractor telescope, Astronomik Pro-Planet 742 IR-pass filter, QHY5-II camera.*

FOCUS ON: Floor Fractured Craters

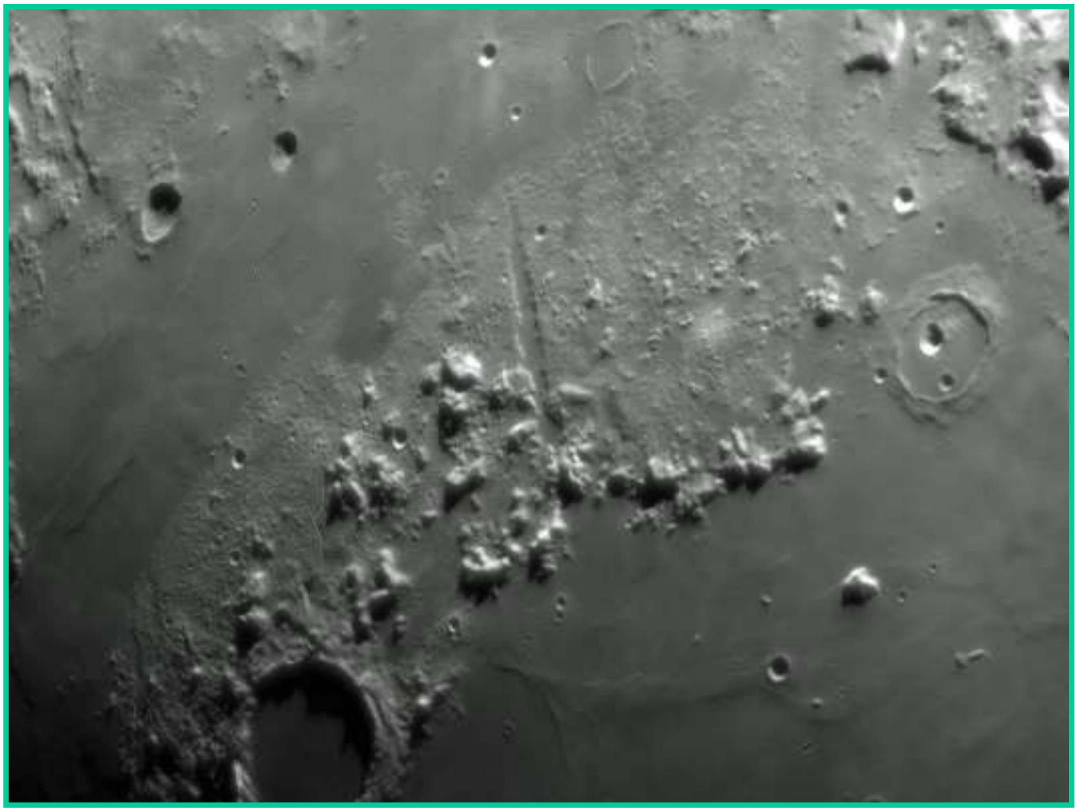
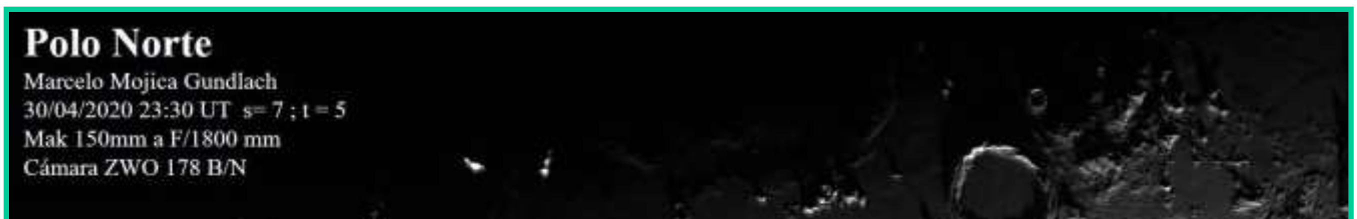


Image 109, Cassini, *Germán Savor, Oro Verde, Argentina. 2022 October 03 01:48 UT. 280 mm Schmidt-Cassegrain telescope, SVBONY IR PASS 685 nm, QHY5L-IIM camera.*

Image 110, Cassini, *Marcelo Mojica Gundlach, Cochabamba, Bolivia. 2020 April 30 23:21 UT. 6 inch Sky Watcher Maksutov-Cassegrain telescope, fl 1,800 mm, ZWO ASI178 B/N camera.*



FOCUS ON: Floor Fractured Craters

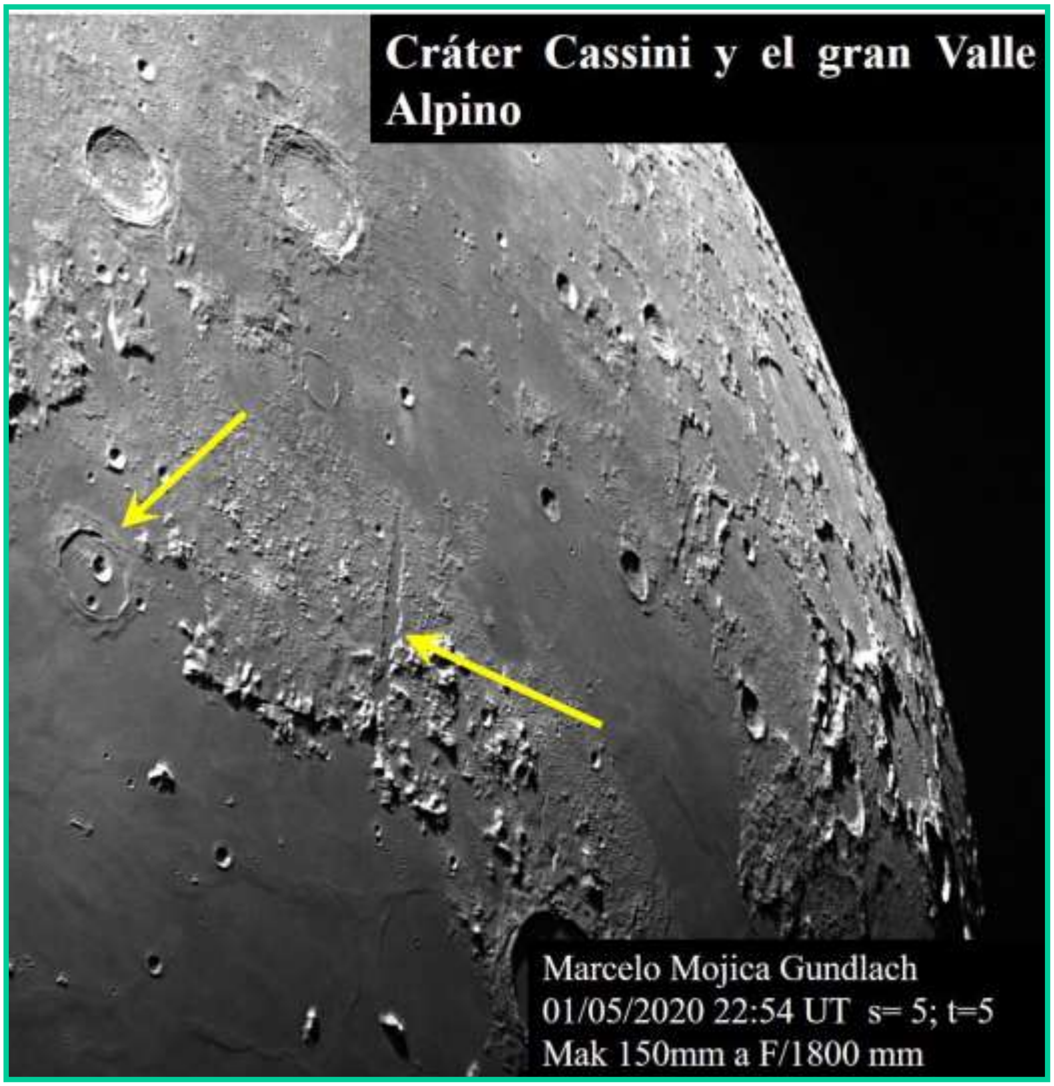


Image 111, Gassendi, *Marcelo Mojica Gundlach, Cochabamba, Bolivia. 2020 May 01 22:54 UT. 6 inch Sky Watcher Maksutov-Cassegrain telescope, fl 1,800 mm, ZWO ASI178 B/N camera.*

Within the 41 category 3 craters there are other less spectacular craters such as the fantastic trio of Gassendi, Taruntius and Cassini. On the west bank of Mare Fecunditatis there are two very close FFCs, which we see in the bottom center area of IMAGE 112: Goclenius (51 x 62 km) is crossed by a single linear rille, and, as with Gutenberg to its northwest, this rille intersects but does not cut through the crater's central mountain, nor does it appear to slice into the crater's walls. An extension of this rille, one of components of the Rimae Goclenius system (Grego, page 217) and Gutenberg ("Rimae Gutenberg, a group of parallel linear rilles, cuts through the highlands from Censorinus C across the floor of Gutenberg (74 km) , 350 km to the southeast", Grego page 216). In IMAGE 113 its floors are seen bisected by graben rilles, the zone (dense in FFC) is seen in IMAGE 114.

La Condamine (in Mare Frigoris) is small (36 km in diameter) and therefore it is difficult to see its "annular fracturing deep crack are western side of floor" (Garfinkle), you have to zoom in on IMAGE 115.

Finally, we return to IMAGE 71 of Rik Hill, the crater in the center belongs to class 3, it is Doppelmayer (65 km in diameter), which presents, according to Garfinkle: "concentric fractures; northern fractures buried by mare flooding".

Image 112, Gutenberg, *Jairo Chavez, Popayán, Colombia. 2019 September 04 00:05 UT. 10 inch truss Dobsonian reflector telescope, DSC-WX50 camera.*

Image 113, Goclenius, *Sergio Babino, Montevideo, Uruguay. 2018 October 13 00:24 UT. 203 mm catadrioptic telescope.*

FOCUS ON: Floor Fractured Craters

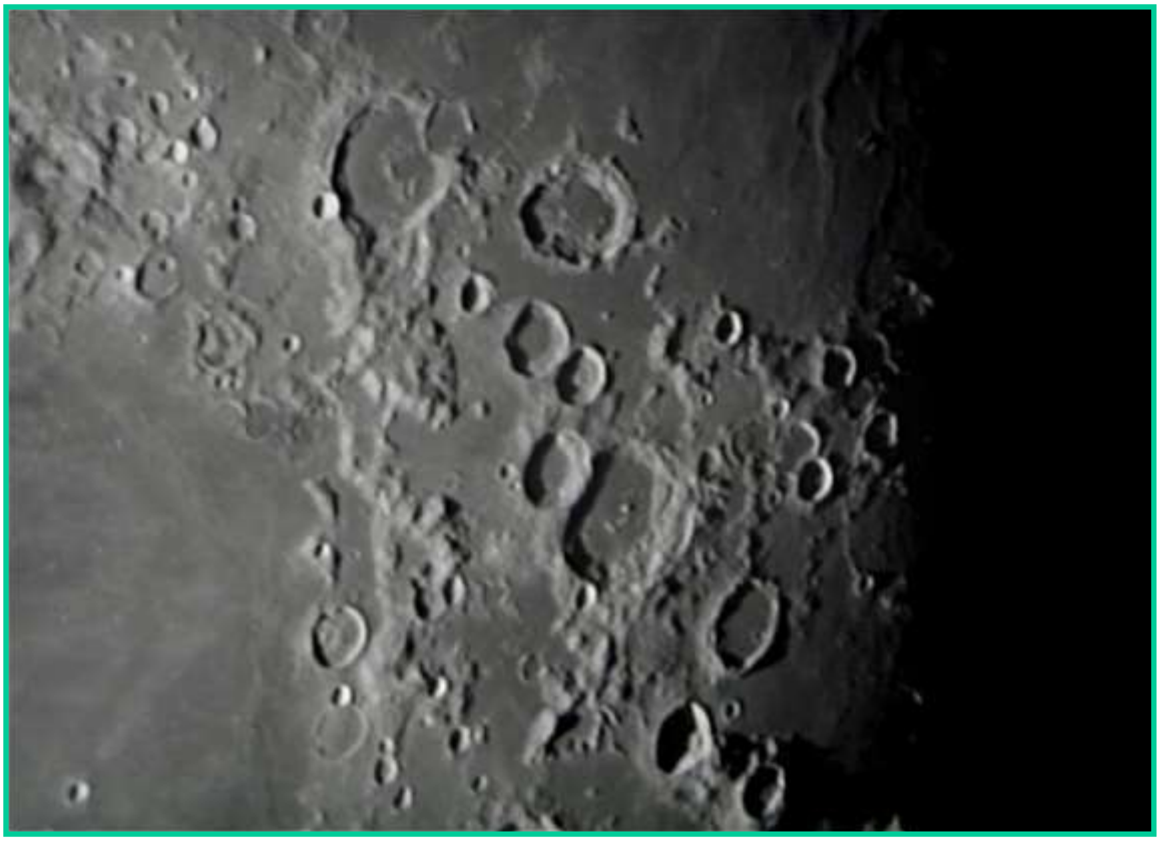


Image 114, Colombo, *Francisco Alsina Cardinalli, Oro Verde, Argentina, SLA. 2015 November 29 05:37 UT. Meade LX200 10 inch Schmidt-Cassegrain telescope, teleextender, Canon EOS Digital Rebel XS camera.*

Image 115, la Condamine, *Francisco Alsina Cardinalli, Oro Verde, Argentina, SLA. 2019 February 17 03:40 UT. 200 mm refractor telescope, Astronomik ProPlanet 742 IR-pass filter, QHY5-II camera.*

FOCUS ON: Floor Fractured Craters

CLASS 4:

This class is characterized by a "narrow V-shaped moat-like feature adjacent to crater's wall, interior border of moat is ridge-like" (Garfinkle). The craters that seem more characteristic are Bohnenberger (33 km diameter) and Bohenberger A (30 km diameter), in the eastern shore of Mare Nectaris, which we see in the IMAGE 116. From this image we extracted two details: 117, in which we see Bohnenberger, and 118, in which we see Bohnenberger A (which belongs to category 4 a). Both are similar, the floor is concave with radial fractures and no central peaks. Another type of category 4 crater (actually 4b) is Manilius (840 km in diameter), which we see in IMAGE 119 and its detail 120: "annular valleys along base of interior walls; central region of floor appears to have subsidized". If we go back to IMAGE 114, in that landscape full of FFC's, we find one that belongs to this class 4, we mark Gaudibert with an arrow (33 km diameter), whose characteristics according to Garfinkle are: "fractures at bottom of valleys; V-shaped profile moat with pronounced inner ridge".

Image 116, Bohnenberger, *Sergio Babino, Montevideo, Uruguay. 2018 October 13 22:24 UT. 81 mm refractor telescope., ZWO174 mm camera.*

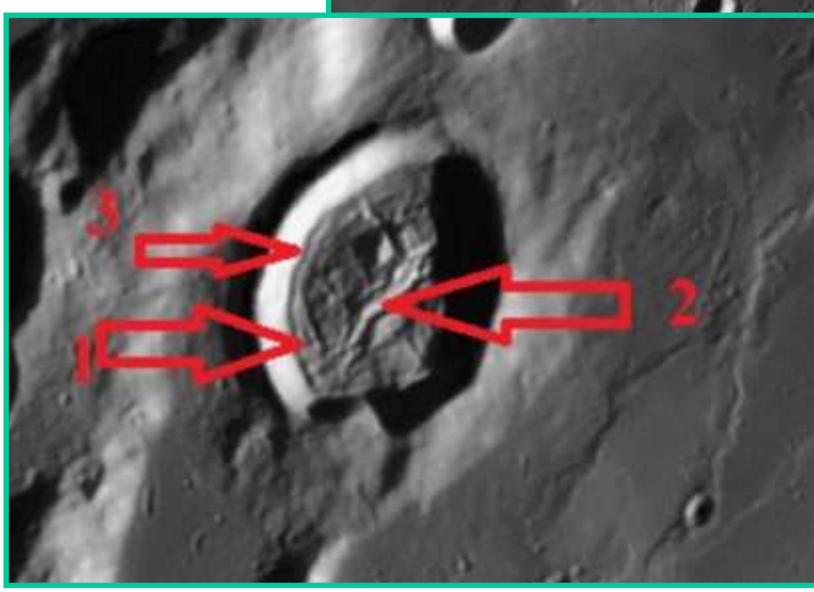


Image 117-118, Bohnenberger, *Sergio Babino, Montevideo, Uruguay. 2018 October 13 22:24 UT. 81 mm refractor telescope., ZWO174 mm camera. Close up of image 116.*

The craters that we were able to portray with the images that our observers sent from this class of difficult-to-see craters are those that Schultz had chosen as archetypes of this category: “Class 4 is divided into 3 subclasses (4a, 4b, and 4c) with the crater Bohnenberger serving as the archetype for Class 4^{a}. The craters in this subclass are smaller formations and have a “v”-profile moat, with concentric or radial fractures, on a convex-up floor. Class 4a are the largest subclass of Class 4. The craters in Class 4a are scattered all over the Moon with many of them in the in the highlands just south of the maria, but not located on the edges of the maria. The small craters in Class 4b also have a “v”-profile moat, but with a pronounced inner ridge that can be higher in elevation than the crater’s rim. These Class 4b craters also have hummocky convex-up central floor regions. Relative to Class 4a formations, Class 4b craters are located farther away from the maria basins. The crater Gaudibert is the archetype for Class 4b. The archetype for Class 4c is an unnamed breached, flooded, and floor-fractured crater, with the satellite cone crater Capella B on its northeastern floor” (Garfinkle).

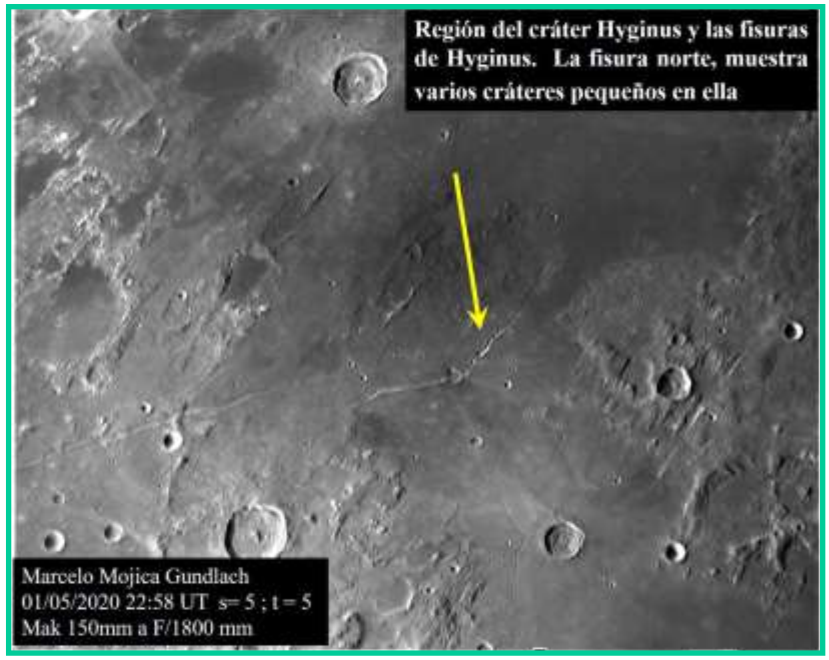


Image 119, Manilius, *Marcelo Mojica Gundlach, Cochabamba, Bolivia. 2020 May 01 22:58 UT. 6 inch Sky Watcher Maksutov-Cassegrain telescope, fl 1,800 mm, ZWO ASI178 B/N camera.*

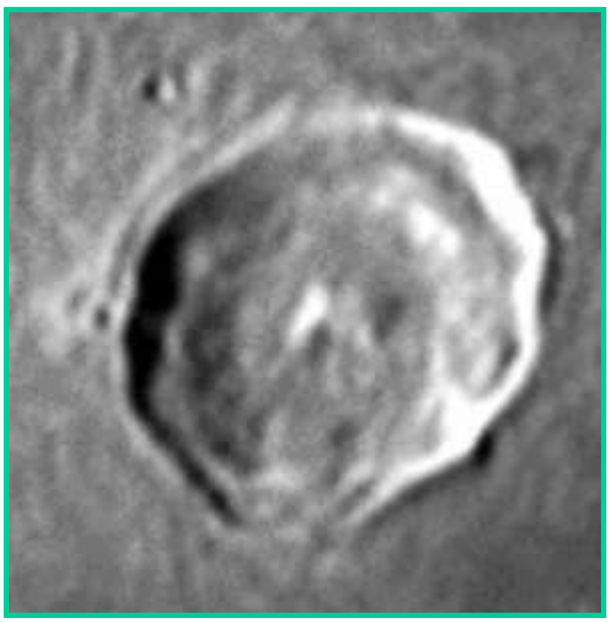
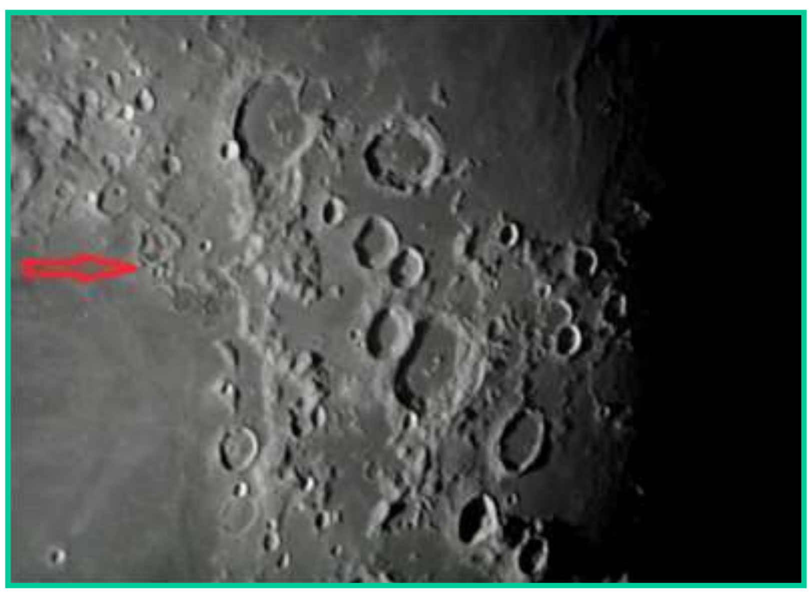


Image 114, Colombo, *Francisco Alsina Cardinalli, Oro Verde, Argentina, SLA. 2015 November 29 05:37 UT. Meade LX200 10 inch Schmidt-Cassegrain telescope, teleextender, Canon EOS Digital Rebel XS camera.*

Image 120, Manilius, *Marcelo Mojica Gundlach, Cochabamba, Bolivia. 2020 May 01 22:58 UT. 6 inch Sky Watcher Maksutov-Cassegrain telescope, fl 1,800 mm, ZWO ASI178 B/N camera. Close-up of image 119.*



FOCUS ON: Floor Fractured Craters

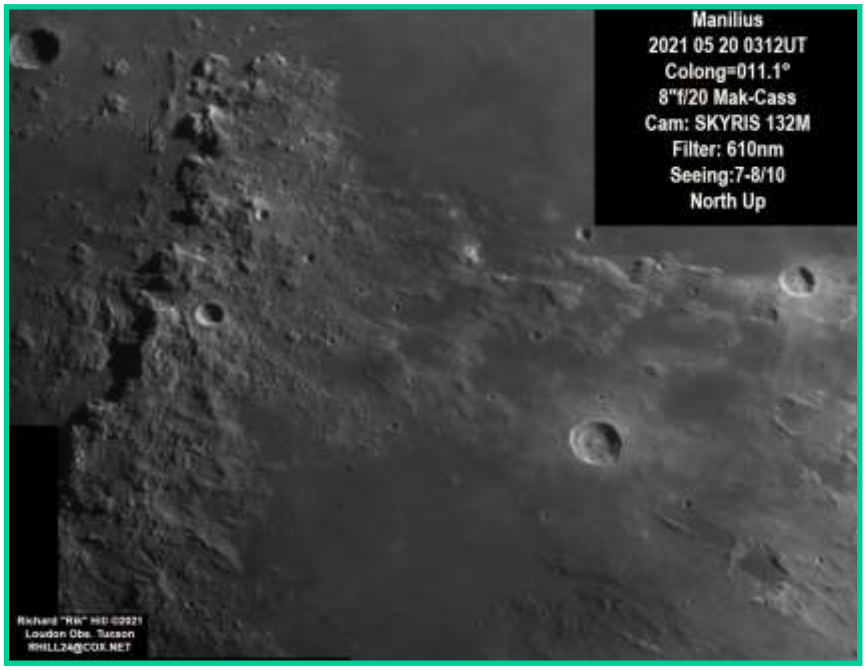
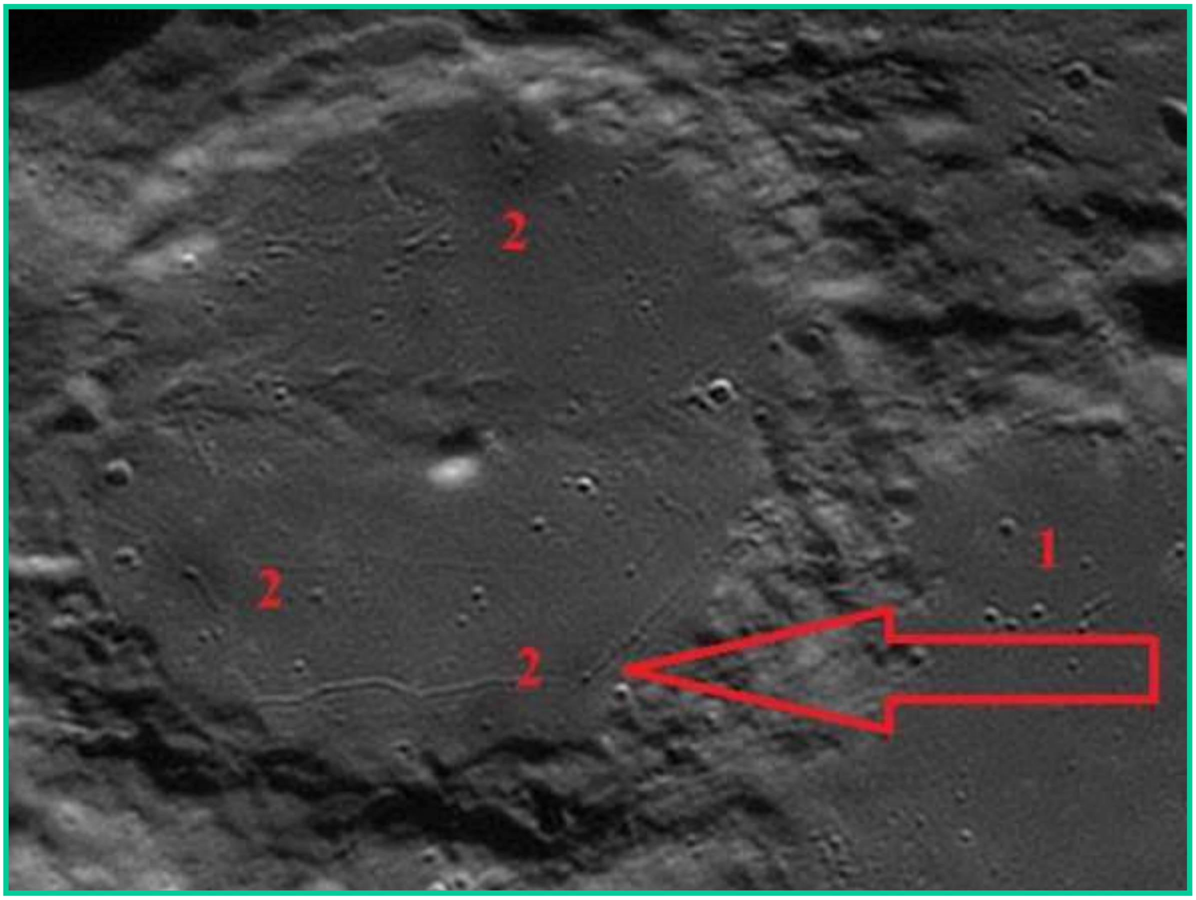


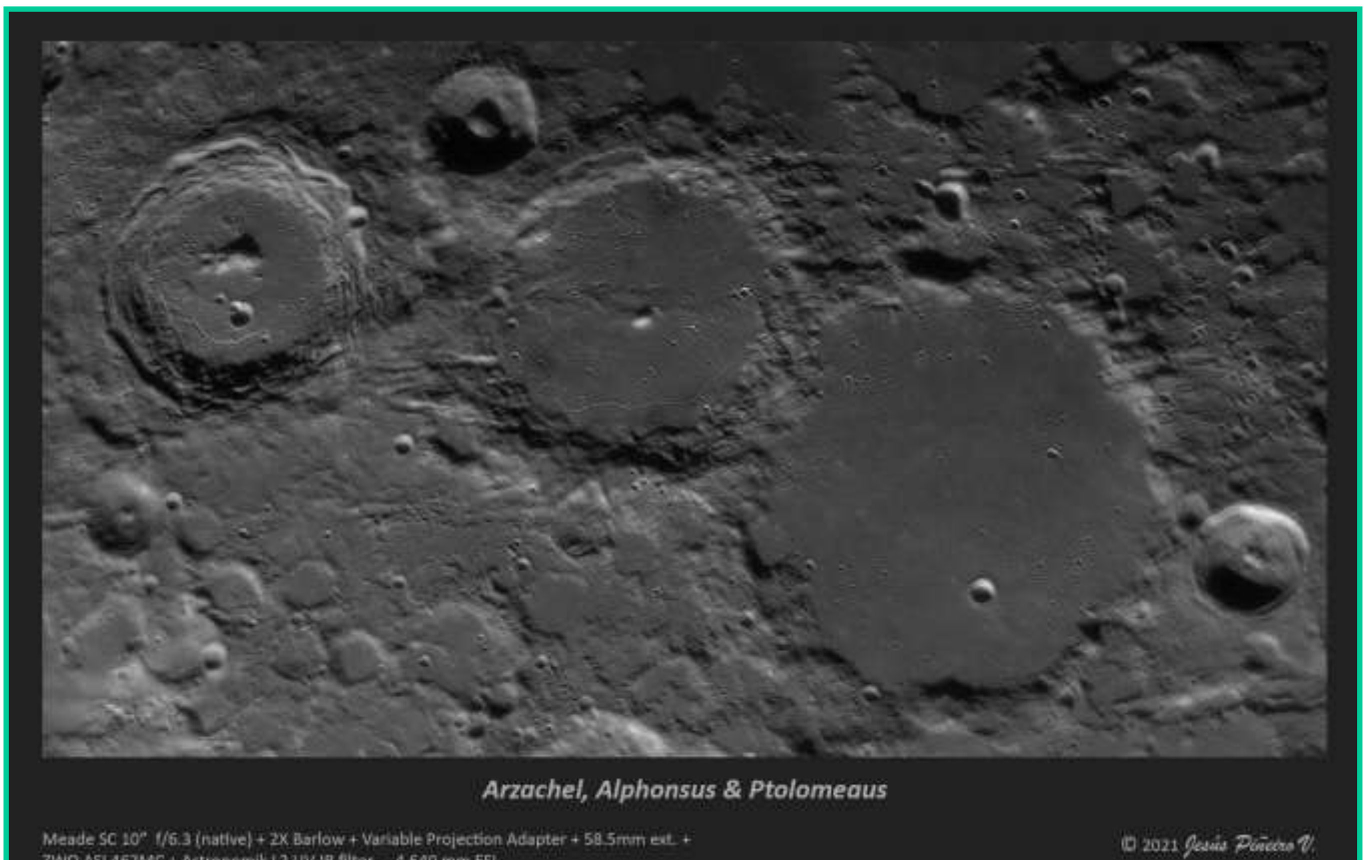
Image 121, Manilius, *Richard Hill, Loudon Observatory, Tucson, Arizona, USA. 2021 May 20 03:12 UT, colongitude 11.1°. TEC 8 inch f/20 Maksutov-Cassegrain telescope, 610 nm filter, SKYRIS 132M camera. Seeing 7-8/10.*

CLASS 5

This class of craters, ancient and large, has 3 magnificent specimens on the eastern shore of Mare Nubium: Alphonsus, Arzachel and Thebit. Let's start with the most famous of all, Alphonsus (118 km in diameter). IMAGE 122 shows its characteristics: 1) linear rilles and 2 dark halo craters, of volcanic origin, which is seen in the spectacular source image, 123 (by Jesús Piñeiro), as well as in 124 by Rik Hill. In IMAGE 125 we see Alphonsus next to Arzachel (98 km in diameter), which has a more wavy crack, which we can see in IMAGE 126 and its detail 127. Arzachel is younger than Alphonsus (which can be easily noticed by comparing their peaks central), so it does not have traces of volcanism like the well-known dark spots of Alphonsus, residues of the volcanic eruptions that arose from the craters that we marked with number 2 in IMAGE 122. These volcanic areas are best appreciated with frontal illumination, as in IMAGES 128, 129, 130 and 131, which shows the third FFC in the area, Thebit (58 km in diameter). In IMAGE 132 Thebit appears in a beautiful panorama with the Rupes Recta. The main fracture of the central zone of the soil is more similar to that of Arzachel than that of Alphonsus, as we see in IMAGE 133.

Image 122, Alphonsus, *Jesús Piñeiro, San Antonio de los Altos, Venezuela. 2021 December 12 23:52 UT. Meade 10 inch Schmidt-Cassegrain telescope, Astronomik L2 UV-IR 2 inch filter, ZWO ASI462MC camera.* ***Image 123 (below)*** *is a wider view of image 122.*





FOCUS ON: Floor Fractured Craters

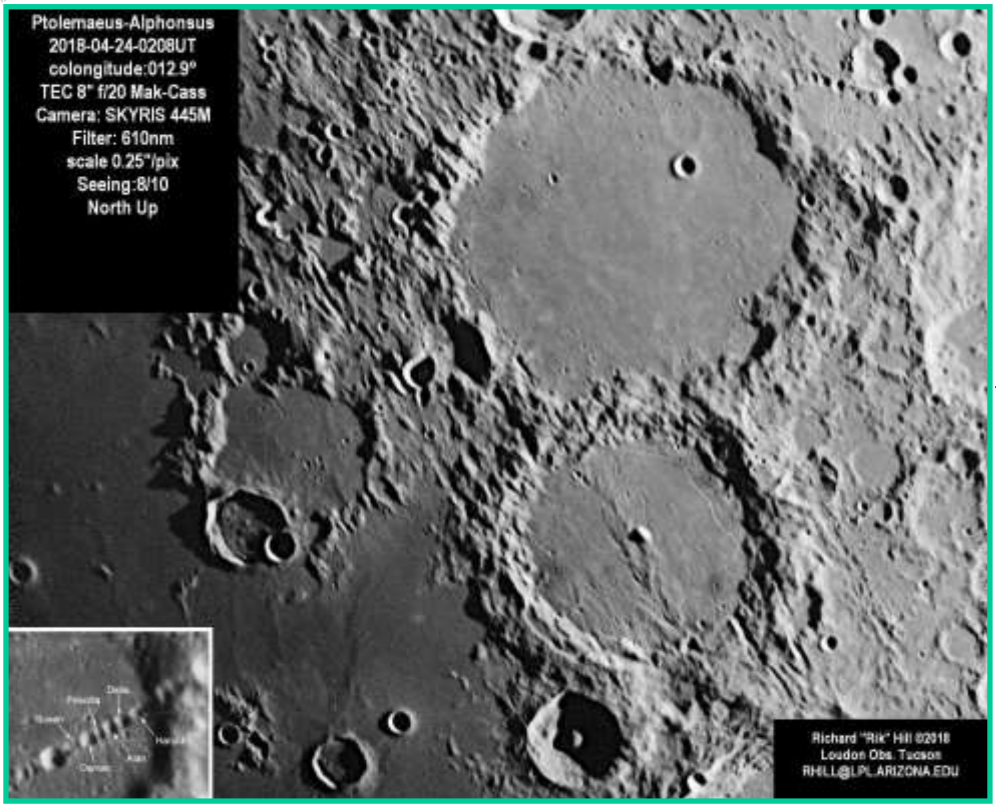
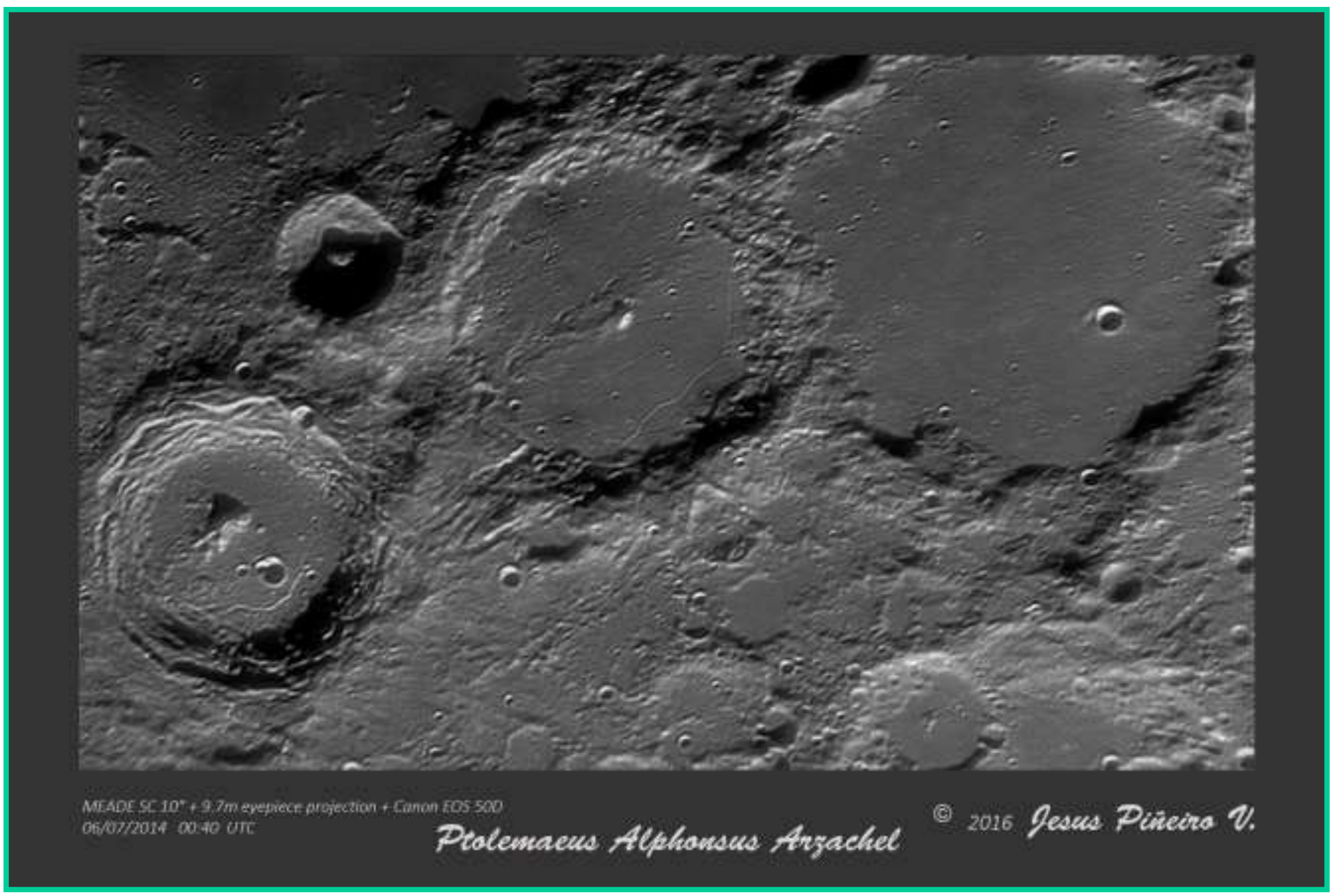


Image 124, Ptolemaeus-Alphonsus, *Richard Hill, Loudon Observatory, Tucson, Arizona, USA. 2018 April 24 02:08 UT, colongitude 12.9º. TEC 8 inch f/20 Maksutov-Cassegrain telescope, 610 nm filter, SKYRIS 445M camera. Seeing 8/10.*

Image 125, Alphonsus, *Jesús Piñeiro, San Antonio de los Altos, Venezuela. 2014 July 06 00:40 UT. Meade 10 inch Schmidt-Cassegrain telescope, Canon EOS 50D camera.*



FOCUS ON: Floor Fractured Craters

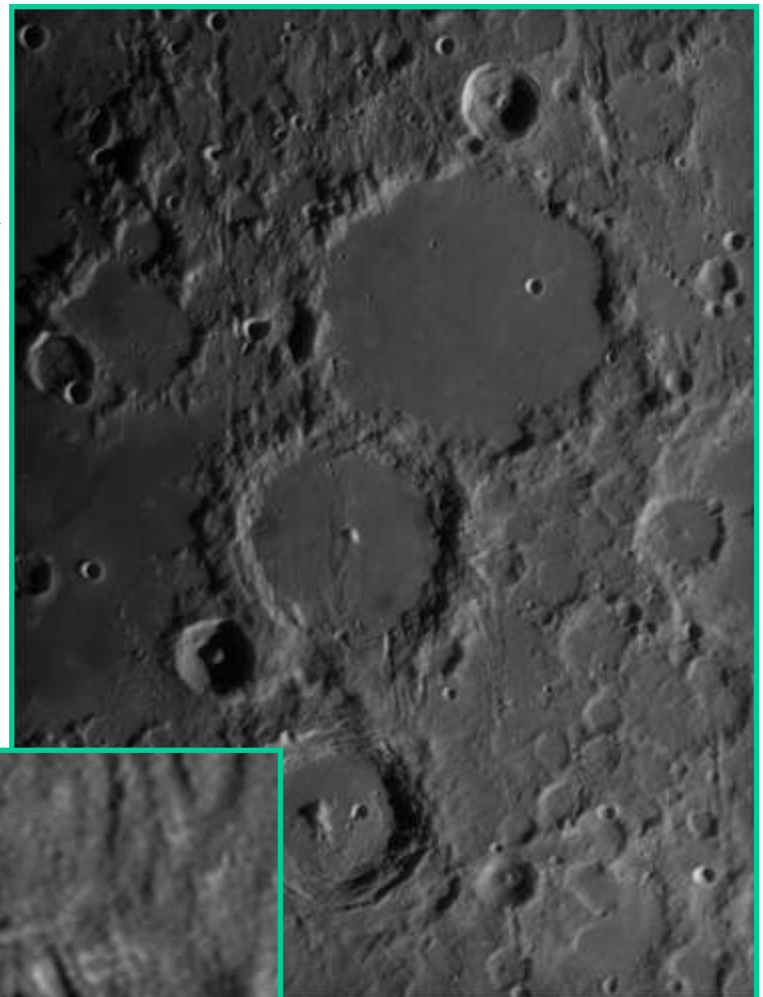


***Image 126, Alphonsus**, Erica Reisenauer, Oro Verde, Argentina. 2022 October 03 01:33 UT. 280 mm Schmidt-Cassegrain telescope, SVBONY IR PASS 685 nm filter, QHY5L-IIM camera.*

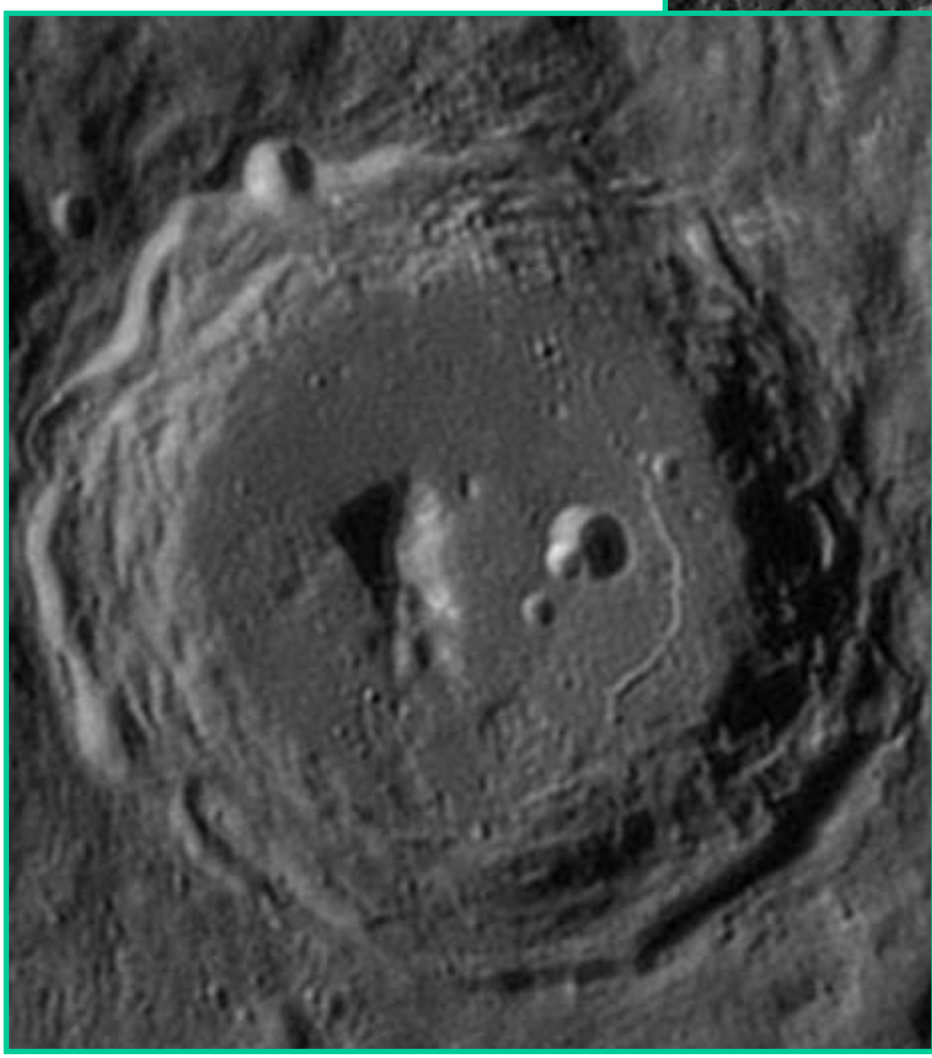


***Image 127, Alphonsus**, Erica Reisenauer, Oro Verde, Argentina. 2022 October 03 01:33 UT. 280 mm Schmidt-Cassegrain telescope, SVBONY IR PASS 685 nm filter, QHY5L-IIM camera. This is a close-up of image 126.*

FOCUS ON: Floor Fractured Craters

***Image 128, Taruntius,** Desiré Godoy, Oro Verde, Argentina, SLA. 2016 December 10 01:59 UT. Meade LX200 Schmidt-Cassegrain telescope, 742 nm filter.*

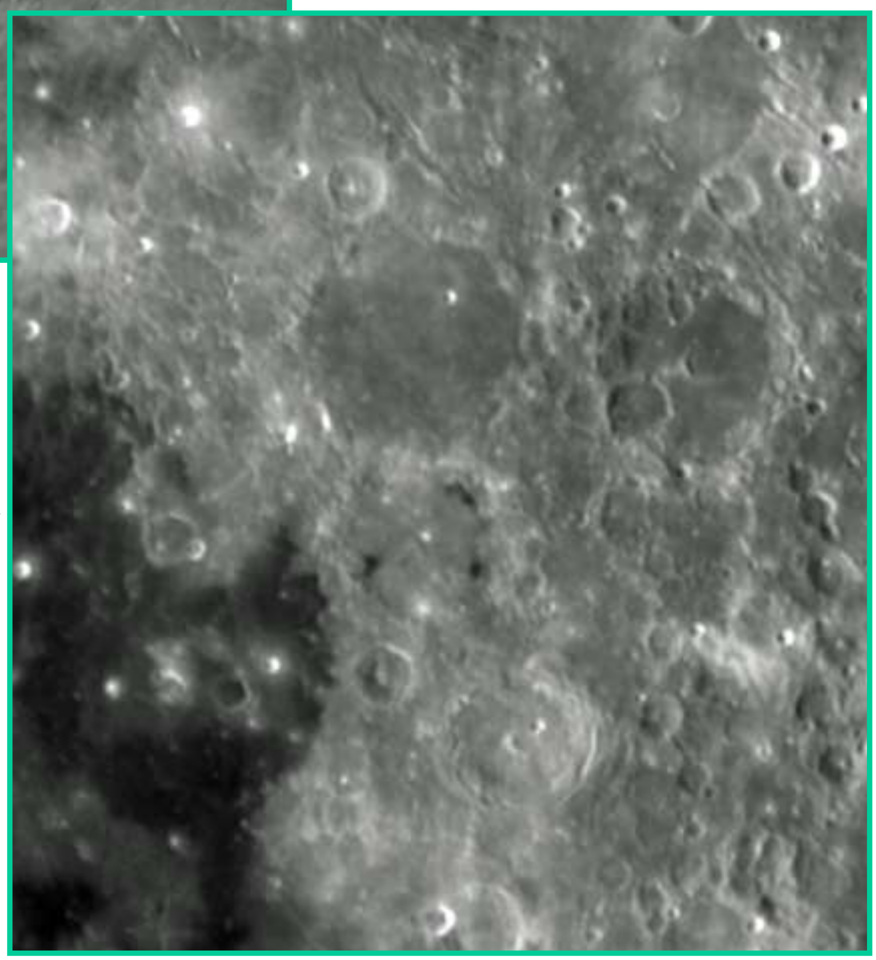


***Image 129, Alphonsus,** Francisco Alsina Cardinalli, Oro Verde, Argentina, SLA. 2016 March 27 04:20 UT. Celestron Edge HD 11 inch Schmidt-Cassegrain telescope, Canon EOS Digital Rebel XS camera.*

FOCUS ON: Floor Fractured Craters

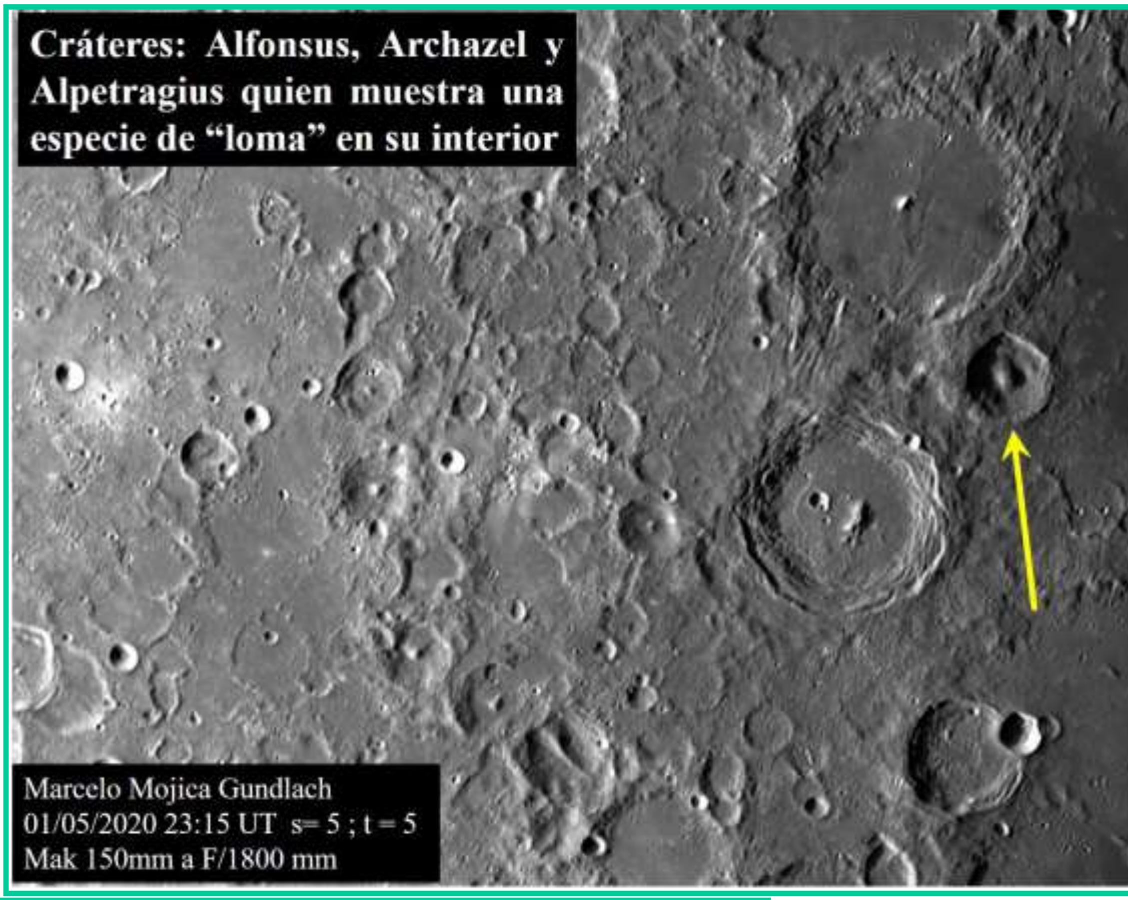


Image 130, Alphonsus, *Marcelo Mojica Gundlach, Cochabamba, Bolivia. 2020 May 01 23:15 UT. 6 inch Sky Watcher Maksutov-Cassegrain telescope, fl 1,800 mm, ZWO ASI178 B/N camera.*

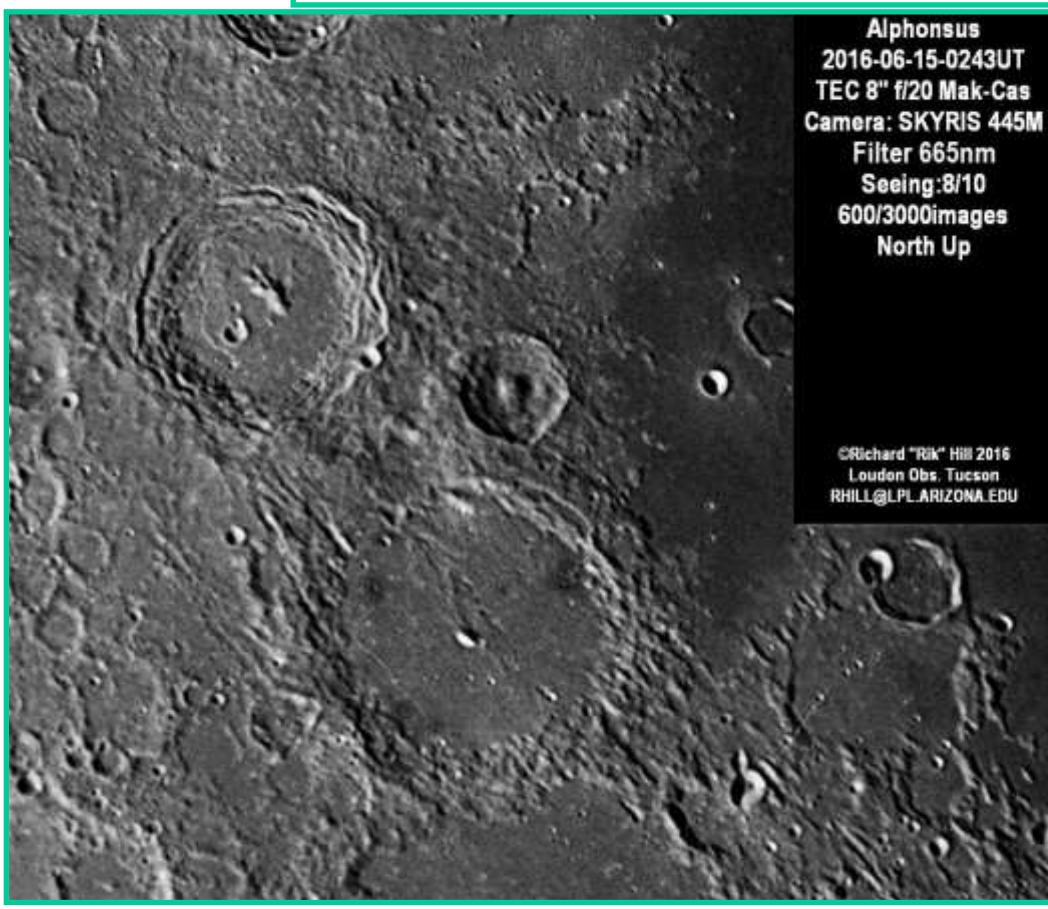


Image 131, Alphonsus, *Richard Hill, Loudon Observatory, Tucson, Arizona, USA. 2016 June 15 02:43 UT. TEC 8 inch f/20 Maksutov-Cassegrain telescope, 665 nm filter, SKYRIS 445M camera. Seeing 8/10.*

FOCUS ON: Floor Fractured Craters

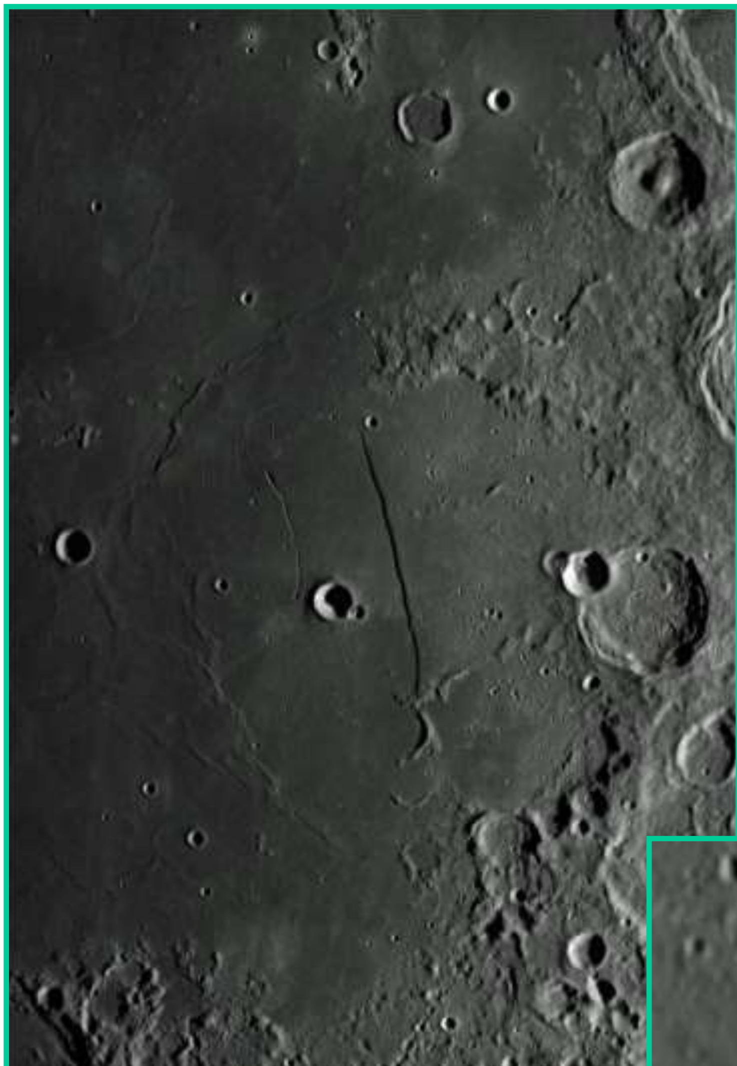


Image 132, Thebit, *Francisco Alsina Cardinalli, Oro Verde, Argentina, SLA. 2016 September 10 22:51 UT. Celestron Edge HD 11 inch Schmidt-Cassegrain telescope, QHY5-II camera.*

Image 133, Thebit, *Francisco Alsina Cardinalli, Oro Verde, Argentina, SLA. 2016 September 10 22:51 UT. Celestron Edge HD 11 inch Schmidt-Cassegrain telescope, QHY5-II camera. Close-up of image 132.*

FOCUS ON: Floor Fractured

IMAGE 134 shows the fourth FFC that we have selected from the class 5, Janssen, crossed by Rima Janssen. Janssen is “a large (190 km) and unusual crater. Janssen doesn’t look right-it bulges outward on its north-west rim. The key to understanding its shape. Is to notice that Janssen sits on top of the unnamed ancient ring that is about its same size” (Wood, page 105).

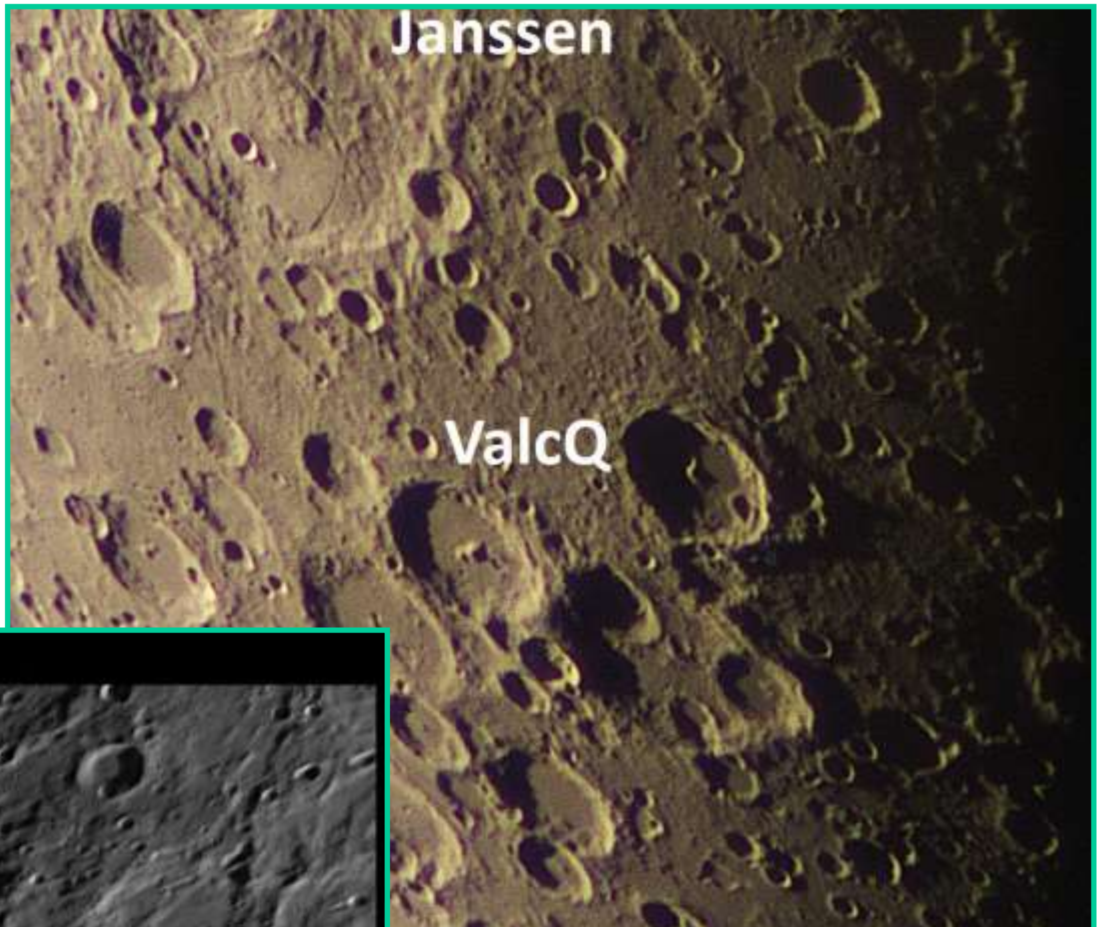


Image 134, Janssen, *Marcelo Mojica Gundlach, Cochabamba, Bolivia. 2019 July 11 22:30 UT. 6 inch Sky Watcher Maksutov-Cassegrain telescope, fl 1,800 mm, ZWO ASI178 B/N camera.*

Image 135, Janssen, *Richard Hill, Loudon Observatory, Tucson, Arizona, USA. 2014 January 07 01:18 UT. TEC 8 inch f/20 Maksutov-Cassegrain telescope, 665 nm filter, SKYRIS 445M camera. Seeing 7/10.*

FOCUS ON: Floor Fractured Craters

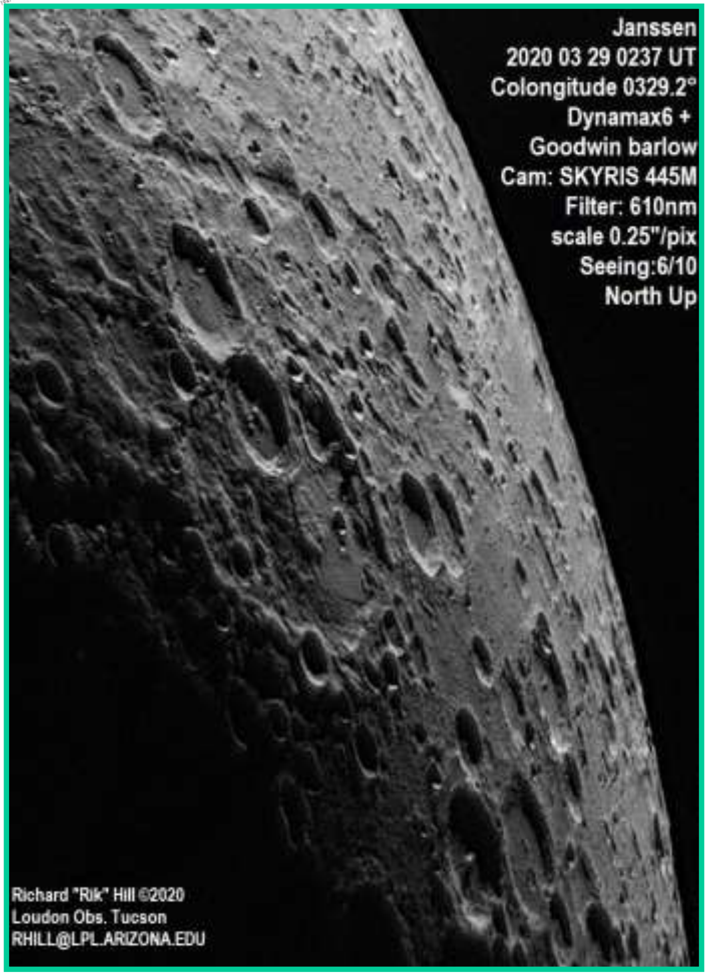


Image 136, Janssen, *Richard Hill, Loudon Observatory, Tucson, Arizona, USA. 2020 March 29 02:37 UT, colongitude 329.2°. Dynamax 6 inch Schmidt-Cassegrain telescope, Goodwin barlow, 610 nm filter, SKYRIS 445M camera. Seeing 6/10.*

Image 137, Janssen, *Richard Hill, Loudon Observatory, Tucson, Arizona, USA. 2017 February 02 01:49 UT. TEC 8 inch f/20 Maksutov-Cassegrain telescope, 665 nm filter, SKYRIS 445M camera. Seeing 7/10.*

FOCUS ON: Floor Fractured Craters

Very different is Messala, which we see together with Geminus and Cleomedes in IMAGE 138 and in detail in IMAGE 139, which is characterized by Garfinkle as "a large crater with scattered deep and shallow fractures on its generally smooth floor". The fractures are also separated in the central zone of the Fabricius floor, a crater located to the north of the aforementioned Janssen (we also see both in IMAGE 140 and 141). Finally, in the western area of Oceanus Procellarum there is a series of class 5 FFCs, too small to be seen inside, but one is quite prominent, Hevelius, with its Rimae Hevelius in center of its floor.

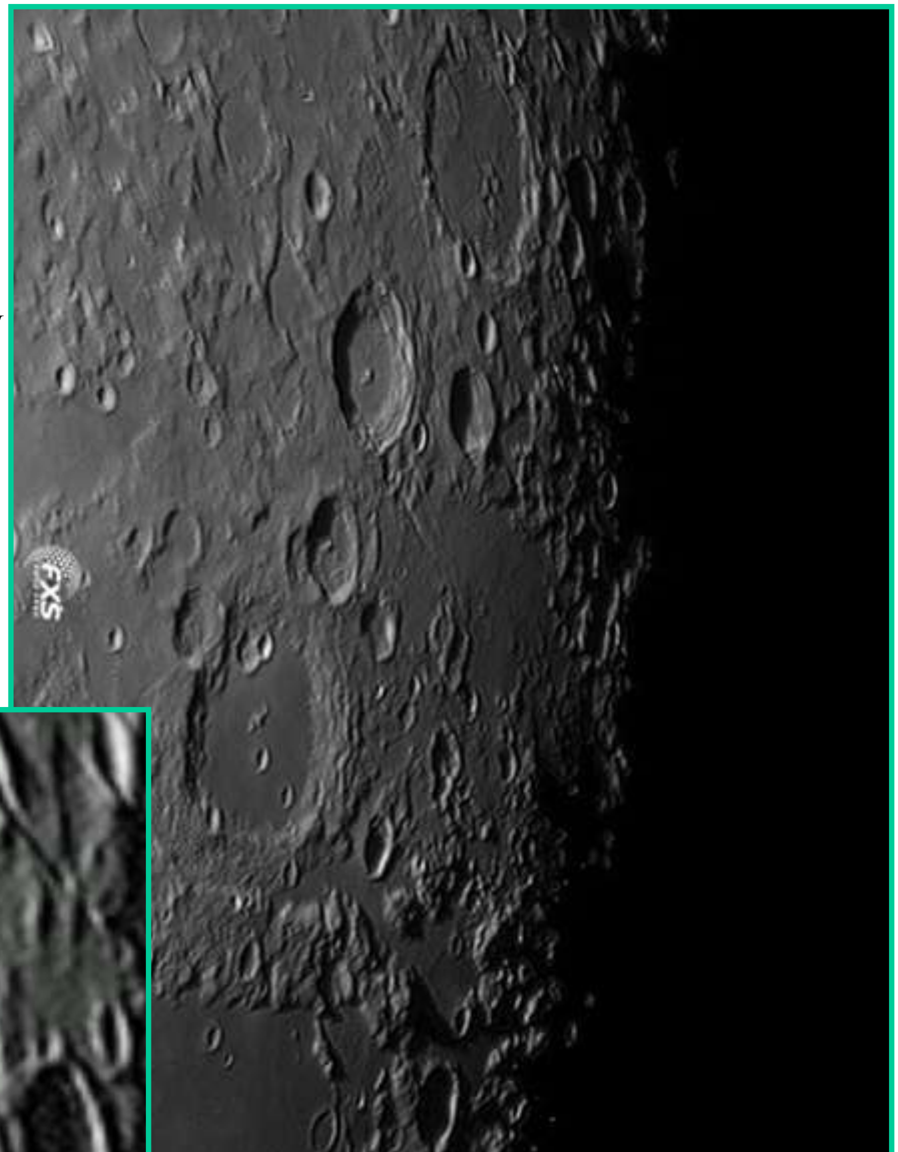


Image 138, Messala, *Felix León, Santo Domingo, República Dominicana. 2022 October 12 04:03 UT. 8 inch Schmidt-Cassegrain telescope, DMK21618AU camera.*

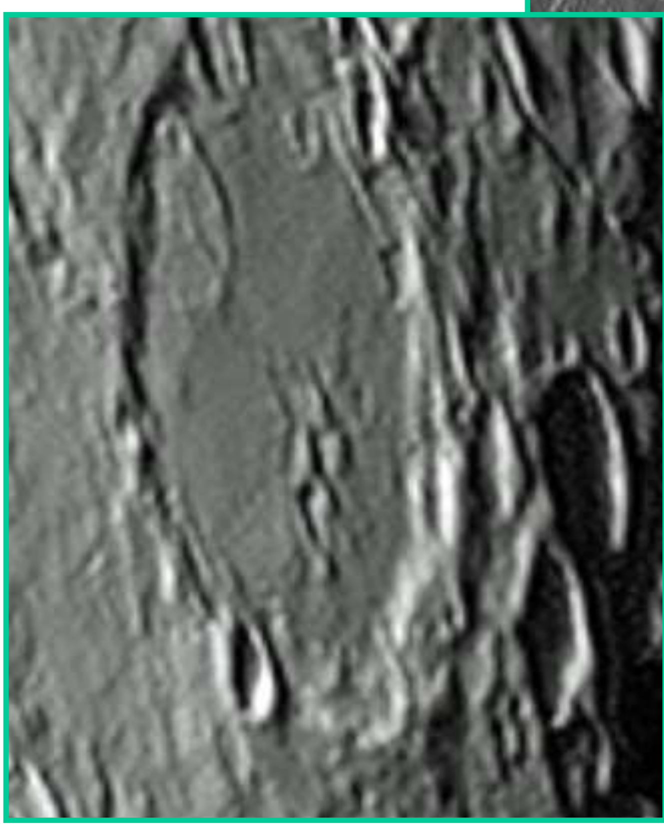


Image 139, Geminus, *Felix León, Santo Domingo, República Dominicana. 2022 October 12 04:03 UT. 8 inch Schmidt-Cassegrain telescope, DMK21618AU camera. This is a close-up of image 138.*

Image 140, Fabricius, *Sergio Babino, Montevideo, Uruguay. 2018 October 14 23:24 UT. 81 mm refractor telescope., ZWO174 mm camera.*

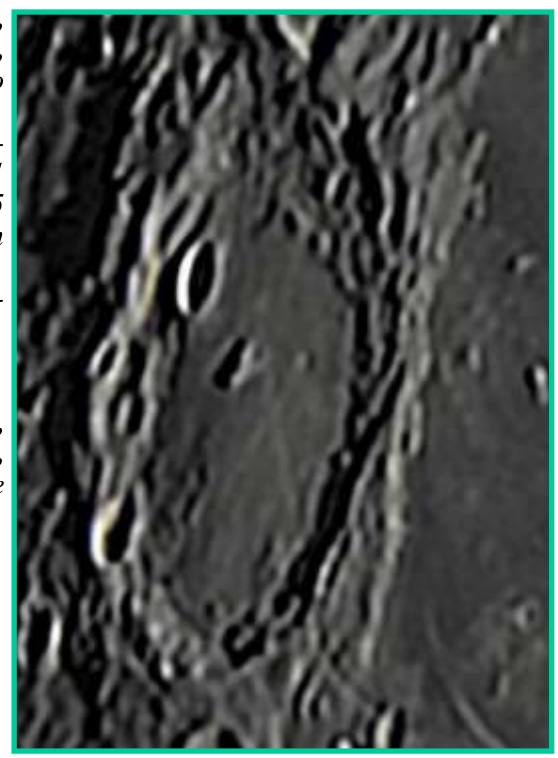
Image 141, Metius and Fabricius, *Francisco Alsina Cardinalli, Oro Verde, Argentina, SLA. 2015 November 29 05:33 UT. Meade LX200 10 inch Schmidt-Cassegrain telescope, teleextender, Canon EOS Digital Rebel XS camera.*

FOCUS ON: Floor Fractured Craters

Image 142, Grimaldi, *David Teske, Louisville, Mississippi, USA. 2023 February 04 02:43 UT, colongitude 68.5º. 3.5 inch Questar telescope, IR block filter, ZWO ASI120mm/s camera. Seeing 8/10.*

Image 143, Reiner Gamma, *Felix León, Santo Domingo, República Dominicana. 2021 March 27 00:35 UT. 127 mm Maksutov-Cassegrain telescope.*

Image 144, Right, Hevelius, *close-up of image 143.*



FOCUS ON: Floor Fractured Craters

CLASS 6

This last category is characterized by being especially shallow craters with few fractures near their walls. There are only 8 and 3 are well known. If we see the images of Cleomedes (126 km in diameter), north of Mare Crisium, from David Teske's of the crescent Moon (IMAGE 145), going through IMAGES 146 to 148, only in IMAGES 149 to 151 can we see a crack not very pronounced near the west wall, which we marked in the image in which it appears most obvious, 152, by Félix León, which is a detail of IMAGE 138, which we saw in the previous category, and in which we marked with an arrow said more prominent crack, which illustrates Garfinkle's definition: “concentric fractures that do not form a complete circle”. A similar case is that of another of the well-known craters of this category, Fracastorius (124 km in diameter), on the southern shore of Mare Nectaris. Can you see the fracture that runs very close to the east wall in IMAGES 153 to 155? It is seen more clearly in Image 156, but just in case we mark it with an arrow in Image 157. Garfinkle thus defines Fracastorius as FFC: “east to west running fracture in center of tilted and partially flooded crater”. The same pattern of cracks near the walls, with a very smooth floor, occurs in the most spectacular crater of this category, Pitatus (98 km in diameter), on the southern shore of Mare Nubium. Here the cracks are more (IMAGES 158 and 159), the most spectacular being the one that runs very close to the northwest wall, which can be seen particularly clearly in IMAGE 160 and its detail IMAGE 161. In IMAGE 162 by Rik Hill is where the set of concentric rhymes of the Pitatus floor is better appreciated. Clearly, Pitatus is the most spectacular of this FFC class and for this reason Schultz chose it as the model for Class 6: “This class contains broad, shallow mare-flooded craters with distinct concentric fractures and rilles tending to be on the floor near the base of the crater’s walls. All of the Class 6 formations are scattered about, but are located at the edges of the maria” (Garfinkle).

***Image 145, 4.70-day old Moon**, David Teske, Louisville, Mississippi, USA. 2023 April 23 01:46-02:00 UT, colongitude 323.2°. Takahashi FOA60Q refractor telescope, IR block filter, ZWO ASI120mm/s camera. Seeing 8-9/10.*

FOCUS ON: Floor Fractured Craters

Image 146, Mare Crisium, *David Teske, Louisville, Mississippi, USA. 2023 January 27 01:52 UT, colongitude 330.6º. 3.5 inch Questar telescope, IR block filter, ZWO ASI120mm/s camera. Seeing 7/10.*

Image 147, Mare Crisium, *David Teske, Louisville, Mississippi, USA. 2023 January 28 01:30 UT, colongitude 347.7º. 3.5 inch Questar telescope, IR block filter, ZWO ASI120mm/s camera. Seeing 9/10.*

FOCUS ON: Floor Fractured Craters

Image 148, Mare Crisium, *David Teske, Louisville, Mississippi, USA. 2023 January 27 01:52 UT, colongitude 330.6°. 3.5 inch Questar telescope, IR block filter, ZWO ASI120mm/s camera. Seeing 7/10.*

Image 149, Mare Crisium, *David Teske, Louisville, Mississippi, USA. 2023 February 28 02:45 UT, colongitude 0.7°. Celestron 6 inch Schmidt-Cassegrain telescope, IR block filter, ZWO ASI120mm/s camera. Seeing 6/10.*

FOCUS ON: Floor Fractured Craters

Image 150, Fabricius, *Sergio Babino, Montevideo, Uruguay. 2018 October 14 23:24 UT. 81 mm refractor telescope., ZWO174 mm camera.*

Image 125, Alphonsus, *Jesús Piñeiro, San Antonio de los Altos, Venezuela. 2021 November 08 22:24 UT. Meade ETX90 mm Maksutov-Cassegrain telescope, Astronomik L2 UV-IR cut filter, ZWO ASI462MC camera.*

FOCUS ON: Floor Fractured Craters

Image 152, Cleomedes, *Felix León, Santo Domingo, República Dominicana. 2022 October 12 04:03 UT. 8 inch Schmidt-Cassegrain telescope, DMK21618AU camera.*

Image 153, Fracastorius, *Jairo Chavez, Popayán, Colombia. 2022 January 08 00:13 UT. 311 mm truss Dobsonian reflector telescope, MOTO E5 PLAY camera.*

FOCUS ON: Floor Fractured Craters

Image 154, Mare Nectaris, *David Teske, Louisville, Mississippi, USA. 2023 February 28 02:24 UT, colongitude 0.6°. Celestron 6 inch Schmidt-Cassegrain telescope, IR block filter, ZWO ASI120mm/s camera. Seeing 6/10.*

Image 155, Fracastorius, *Francisco Alsina Cardinalli, Oro Verde, Argentina, SLA. 2016 January 14 23:20 UT. Meade LX200 10 inch Schmidt-Cassegrain telescope, teleextender, Canon EOS Digital Rebel XS camera.*

FOCUS ON: Floor Fractured Craters

Image 156, Theophilus, *Jesús Piñeiro, San Antonio de los Altos, Venezuela. 2016 January 28 06:35 UT. Meade 10 inch Schmidt-Cassegrain telescope, Canon EOS 50D camera.*

Image 158, Fracastorius, *Felix León, Santo Domingo, República Dominicana. 2022 October 12 05:12 UT. 8 inch Schmidt-Cassegrain telescope, DMK21618AU camera.*

FOCUS ON: Floor Fractured Craters

Image 159, Pitatus, Felix León, Santo Domingo, República Dominicana. 2022 October 12 05:16 UT. 8 inch Schmidt-Cassegrain telescope, DMK21618AU camera.

Image 160, Pitatus, *Marcelo Mojica Gundlach, Cochabamba, Bolivia. 2020 May 01 22:58 UT. 6 inch Sky Watcher Maksutov-Cassegrain telescope, fl 1,800 mm, ZWO ASI178 B/N camera.*

FOCUS ON: Floor Fractured Craters

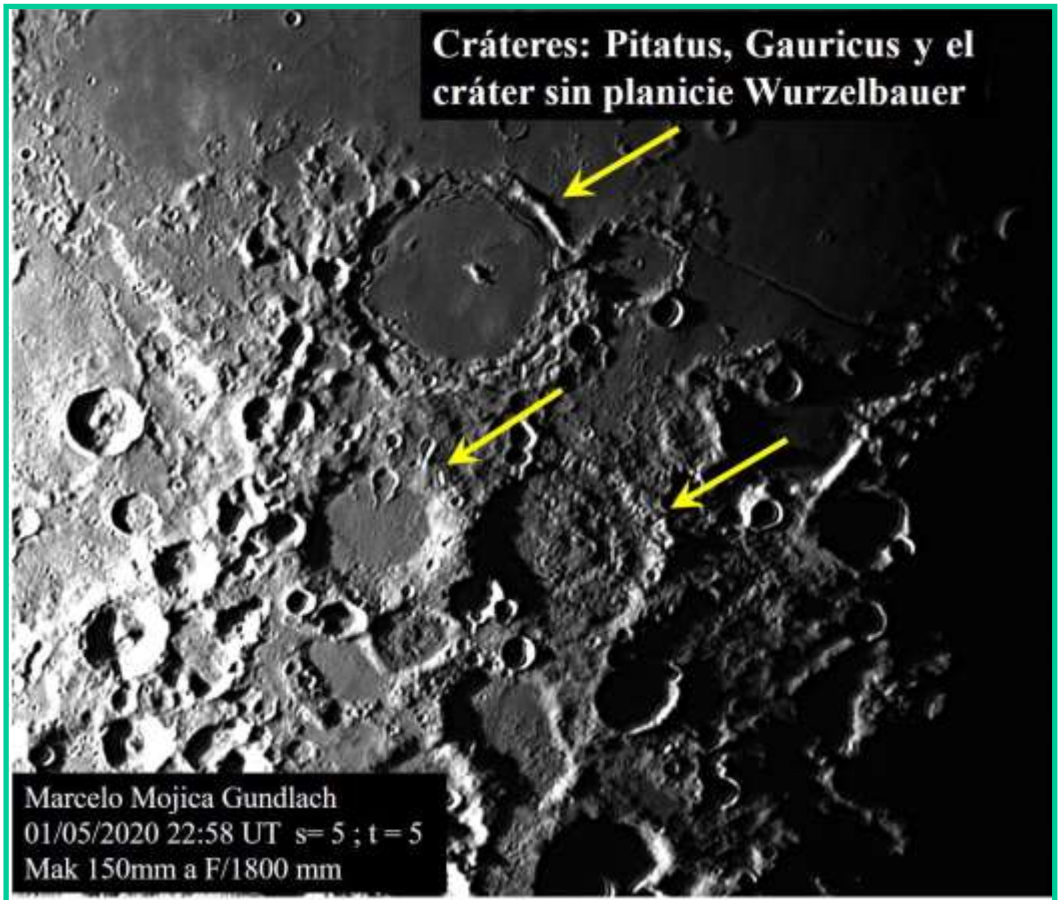


Image 161, Pitatus, *Marcelo Mojica Gundlach, Cochabamba, Bolivia. 2020 May 01 22:58 UT. 6 inch Sky Watcher Maksutov-Cassegrain telescope, fl 1,800 mm, ZWO ASI178 B/N camera.*

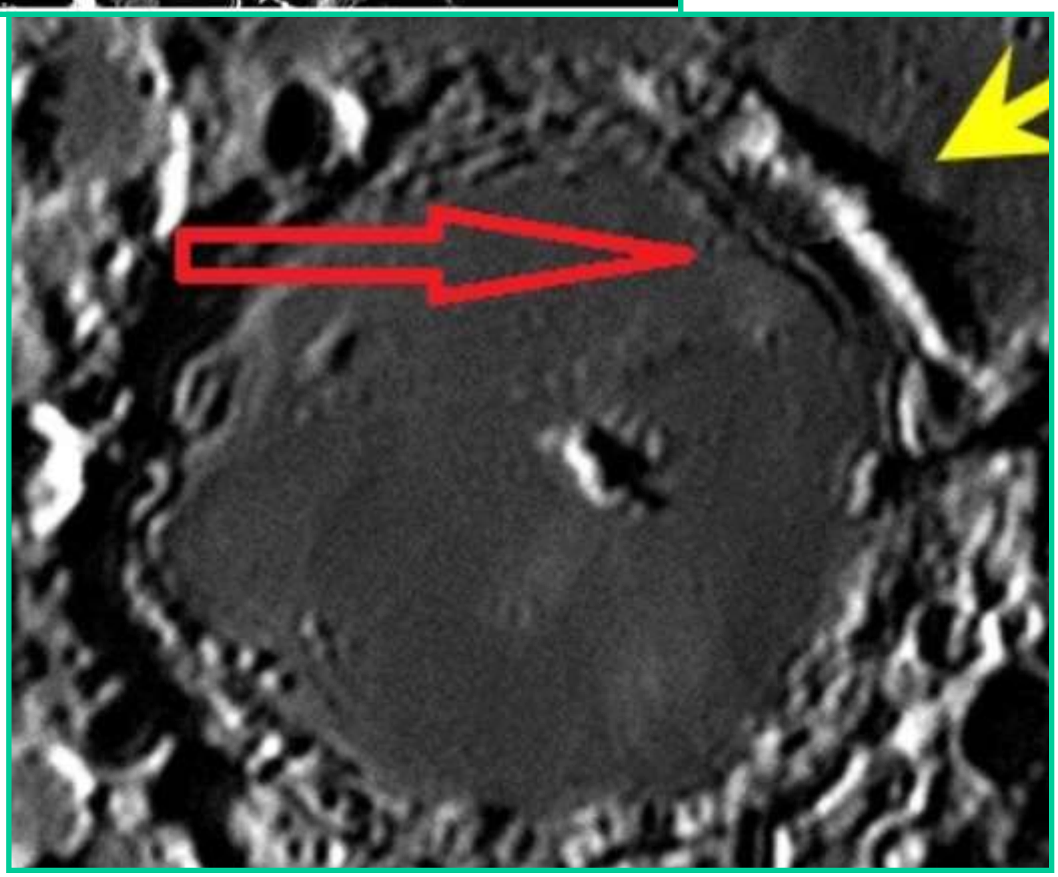


Image 162, Pitatus, *Marcelo Mojica Gundlach, Cochabamba, Bolivia. 2020 May 01 22:58 UT. 6 inch Sky Watcher Maksutov-Cassegrain telescope, fl 1,800 mm, ZWO ASI178 B/N camera. Close-up of image 161.*

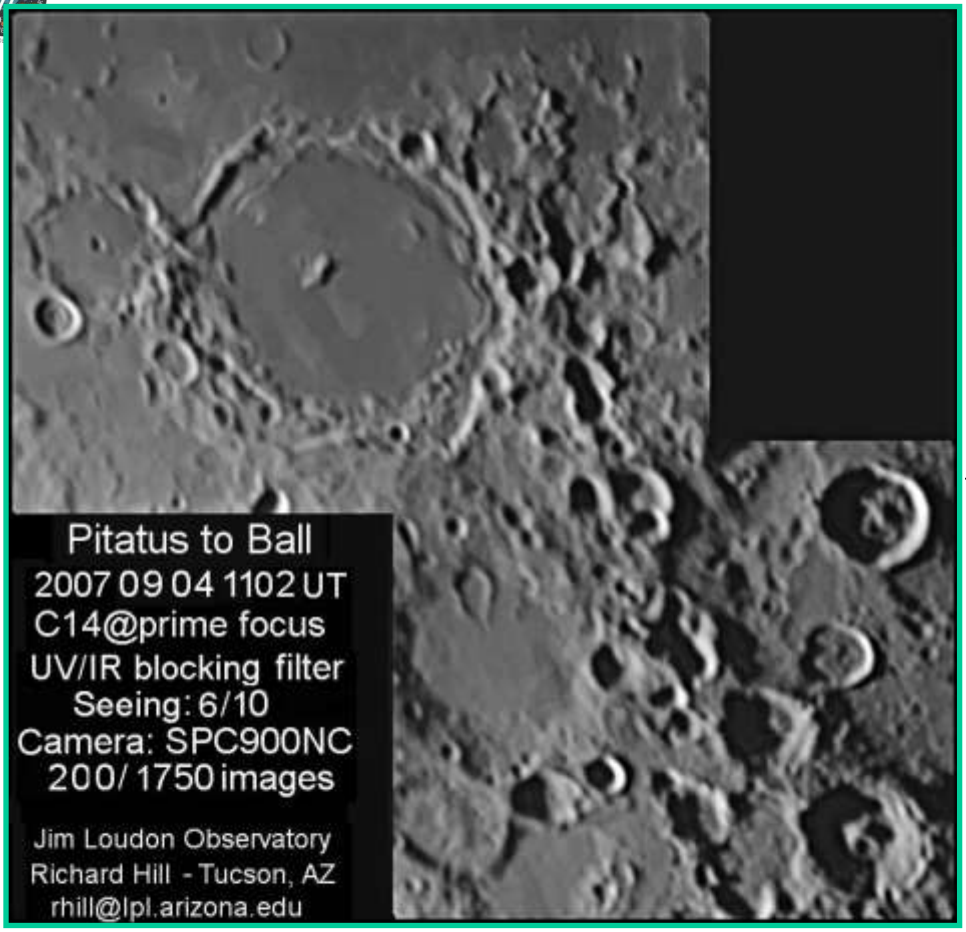


Image 162, Pitatus to Ball, *Richard Hill, Loudon Observatory, Tucson, Arizona, USA. 2007 September 04 11:02 UT. Celestron 14 inch Schmidt-Cassegrain telescope, UV/IR blocking filter, SPC900NC camera. Seeing 6/10*

In addition to these categories, there are a number of FFCs that Garfinkle does not include in any of the above. We have Campanus in IMAGE 163 ("separate fractures on crater's Eastern floor", Garfinkle), on the shore of Mare Nubium. In IMAGE 164 we find FFC on the shore of Mare Fecunditatis: 1) Gutenberg (flooded crater cut by graben rille), 2) Goclenius, which we already saw in Category 3 (bisected by wide graben rille Rima Goclenius), 3) Magelhaens A (concentric fractures), 4) Doesn't Colombo look like an FFC, even though it's not on the list?; and on the shore of Mare Nectaris we found 5) Bohnenberger, which we saw in category 4, and 6) Gaudibert, which we saw in category 4b. In IMAGE 165 we find a spectacular image by Rik Hill of a spectacular FFC: Furnerius, impaled by Rima Furnerius. Another spectacular FFC, not included in the previous categories, is Schickard, characterized by "dark mantled area in southeastern and northern half of crater floor", which we see in IMAGES 166 to 169. IMAGE 170 shows Grimaldi F (1), together Damoiseau and its characteristic concentric fractures (2). IMAGE 171 shows Hippalus, easily discernible because his floor appears crossed by the wide graben rille Rimae Hippalus. In image 172 we see a beautiful and exact sketch of De Gasparis by Jeff de Wit, "partially bisected by wide graben rille Rimae de Gasparis" (Garfinkle).

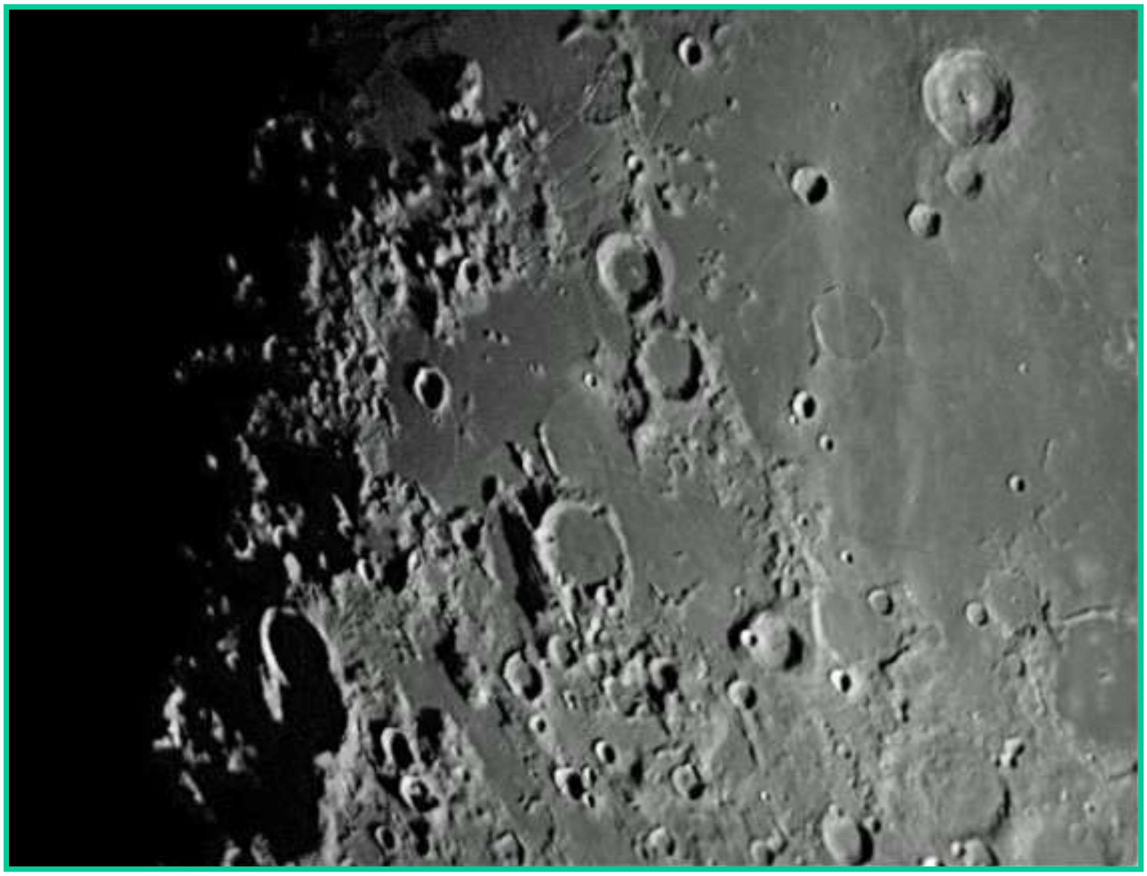


Image 163, Campanusla Condamine, *Francisco Alsina Cardinalli, Oro Verde, Argentina, SLA. 2022 August 08 00:22 UT. 200 mm refractor telescope, QHY5-II camera.*

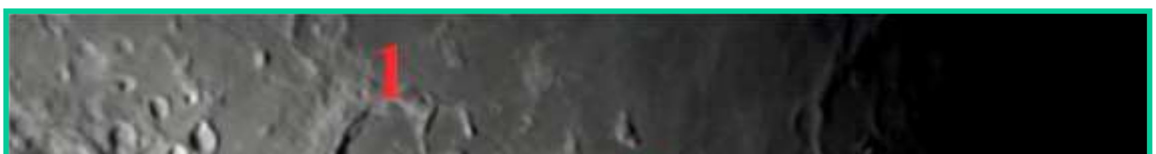


Image 164, Colombo, *Francisco Alsina Cardinalli, Oro Verde, Argentina, SLA. 2015 November 29 05:37 UT. Meade LX200 10 inch Schmidt-Cassegrain telescope, teleextender, Canon EOS Digital Rebel XS camera.*

Image 165, Furnerius, *Richard Hill, Loudon Observatory, Tucson, Arizona, USA. 2018 September 13 01:57 UT. TEC 8 inch f/20 Maksutov-Cassegrain telescope, 610 nm filter, SKYRIS 445M camera. Seeing 8/10.*

Image 166, Schickard, *Felix León, Santo Domingo, República Dominicana.*

FOCUS ON: Floor Fractured Craters

Image 167, Schickard, *Felix León, Santo Domingo, República Dominicana.*

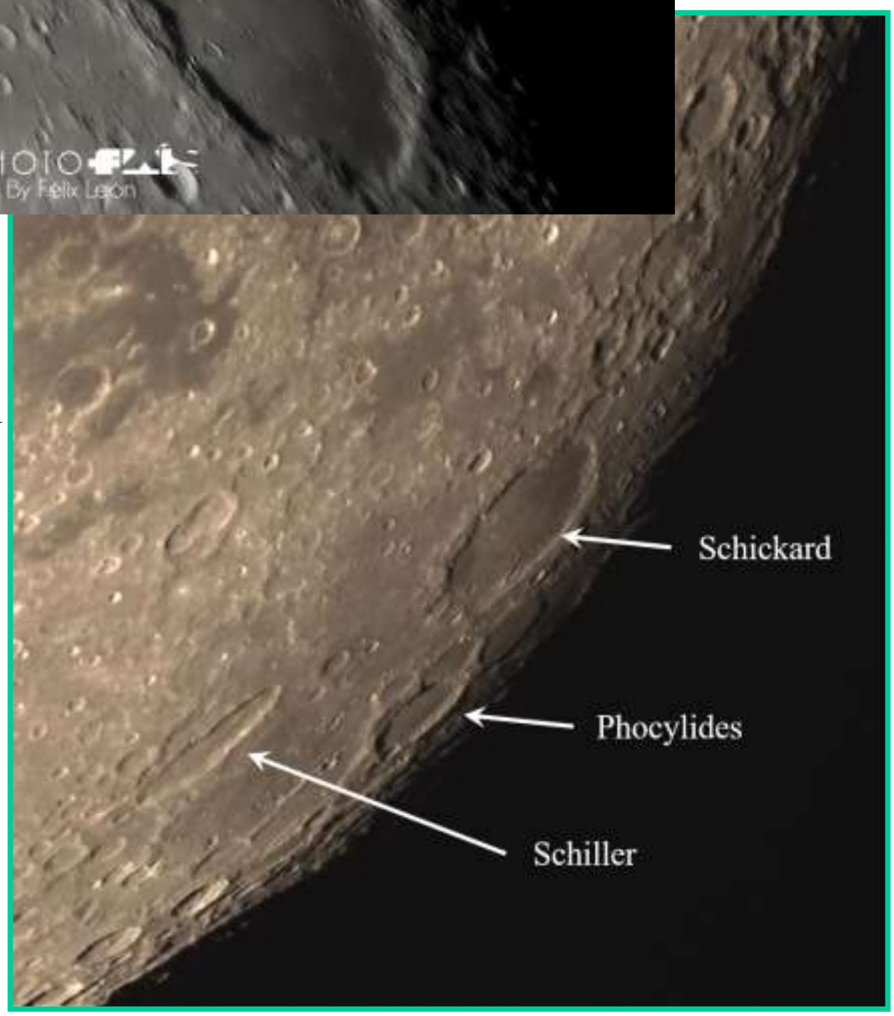


Image 168, Schiller, *Marcelo Mojica Gundlach, Cochabamba, Bolivia. 2022 July 12 00:15 UT. 90 mm Maksutov-Cassegrain telescope, ZWO ASI178 B/N camera.*

FOCUS ON: Floor Fractured Craters

***Image 169, Schickard**, David Teske, Louisville, Mississippi, USA. 2023 May 03 02:41 UT, colongitude 60.9°. Takahashi FOA60Q refractor telescope, IR block filter, ZWO ASI120mm/s camera. Seeing 8/10.*

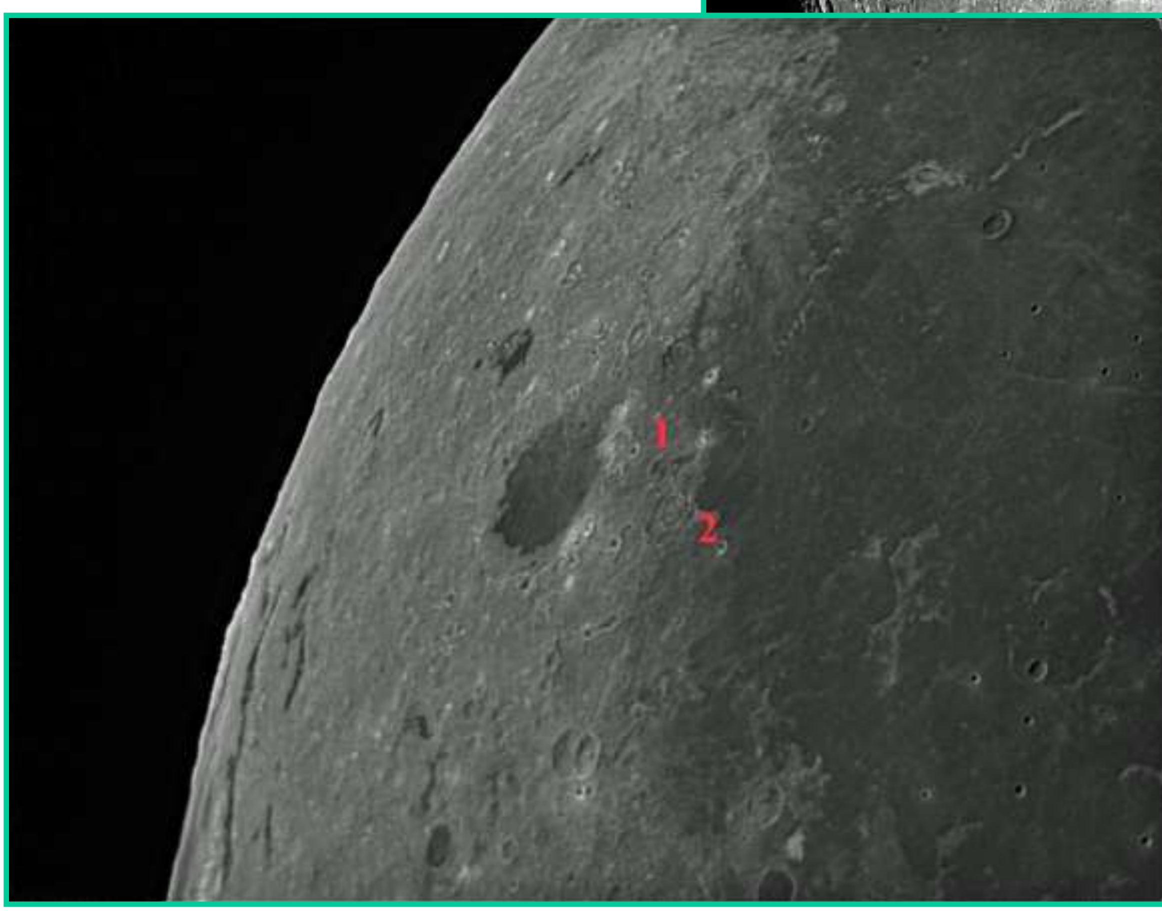


***Image 164, Grimaldi,** Francisco Alsina Cardinalli, Oro Verde, Argentina, SLA. 2016 April 16 08:57 UT. Meade LX200 10 inch Schmidt-Cassegrain telescope, QHY5-II camera.*

FOCUS ON: Floor Fractured Craters

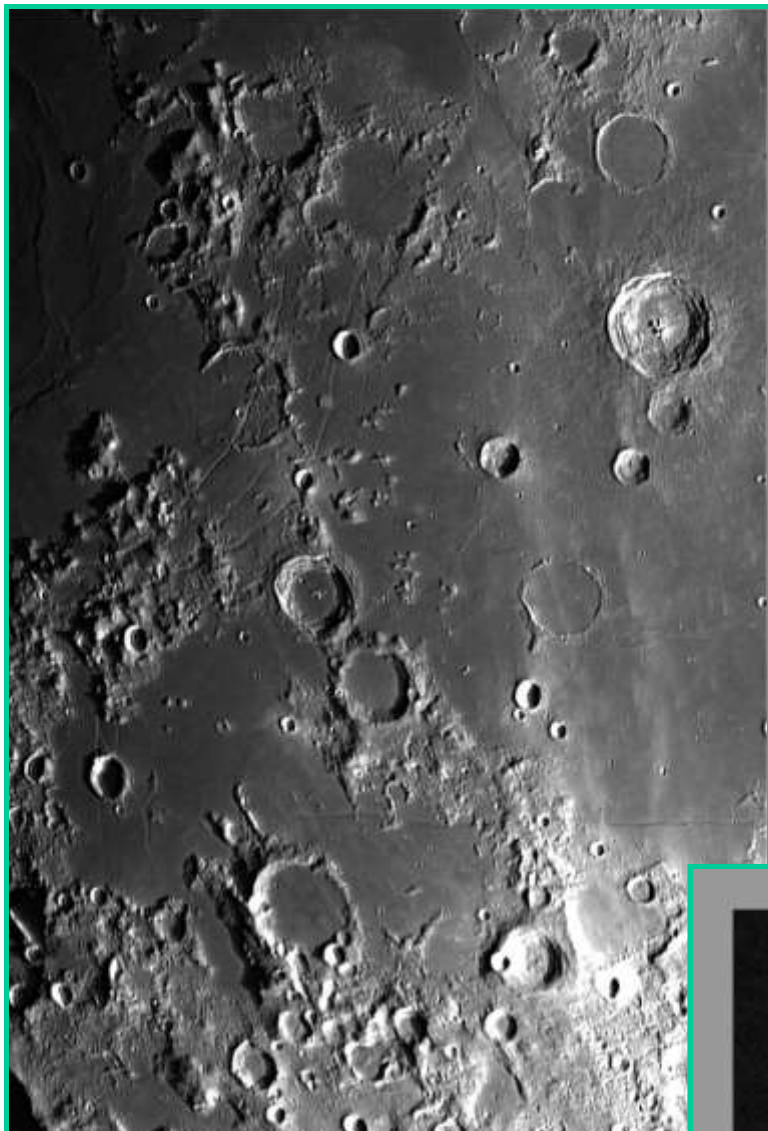


Image 171, Pitatus, *Marcelo Mojica Gundlach, Cochabamba, Bolivia. 2020 April 03 23:30 UT. 6 inch Sky Watcher Maksutov-Cassegrain telescope, fl 1,800 mm, ZWO ASI178 B/N camera.*

Image 172, de Gasparis, *Jef de Wit, Hove, Belgium. 2018 February 27 20:00-21:30 UT. 30 cm Dobsonian reflector telescope, 240 x.*

FOCUS ON: Floor Fractured Craters

Gassendi, *Walter Ricardo Elias, Oro Verde, Argentina, AEA. 2023 August 02 01:30 UT. Sky Watcher 150 mm f/5 reflector telescope, QHY5-II 5C camera.*

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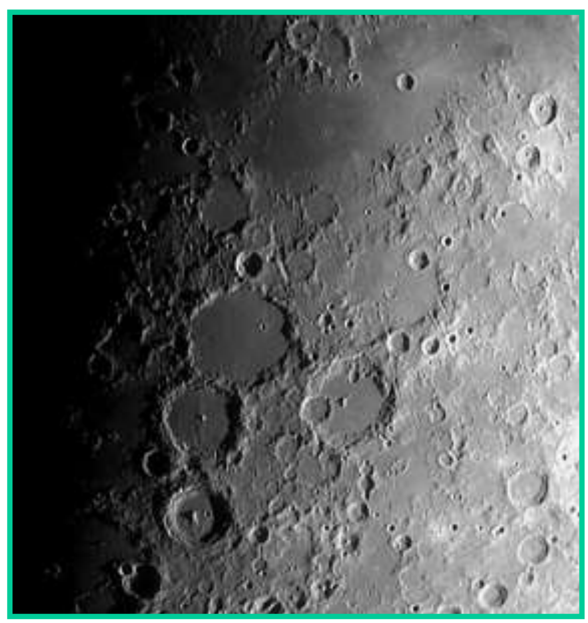
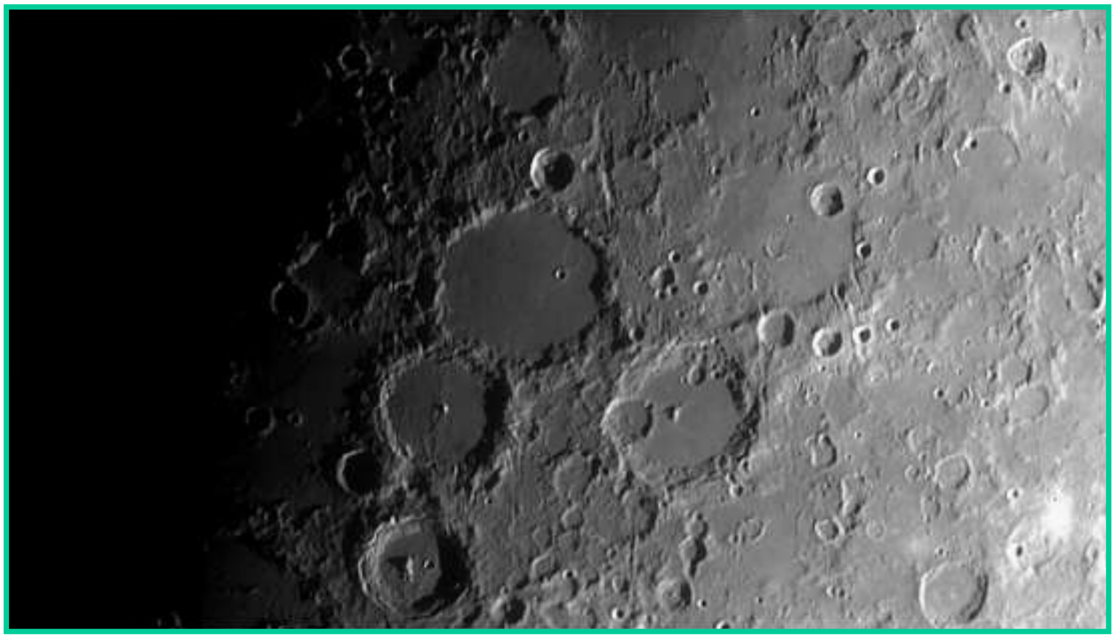
Wood, Charles A. (2003), The modern Moon. A personal view, Sky and Telescope, Cambridge.

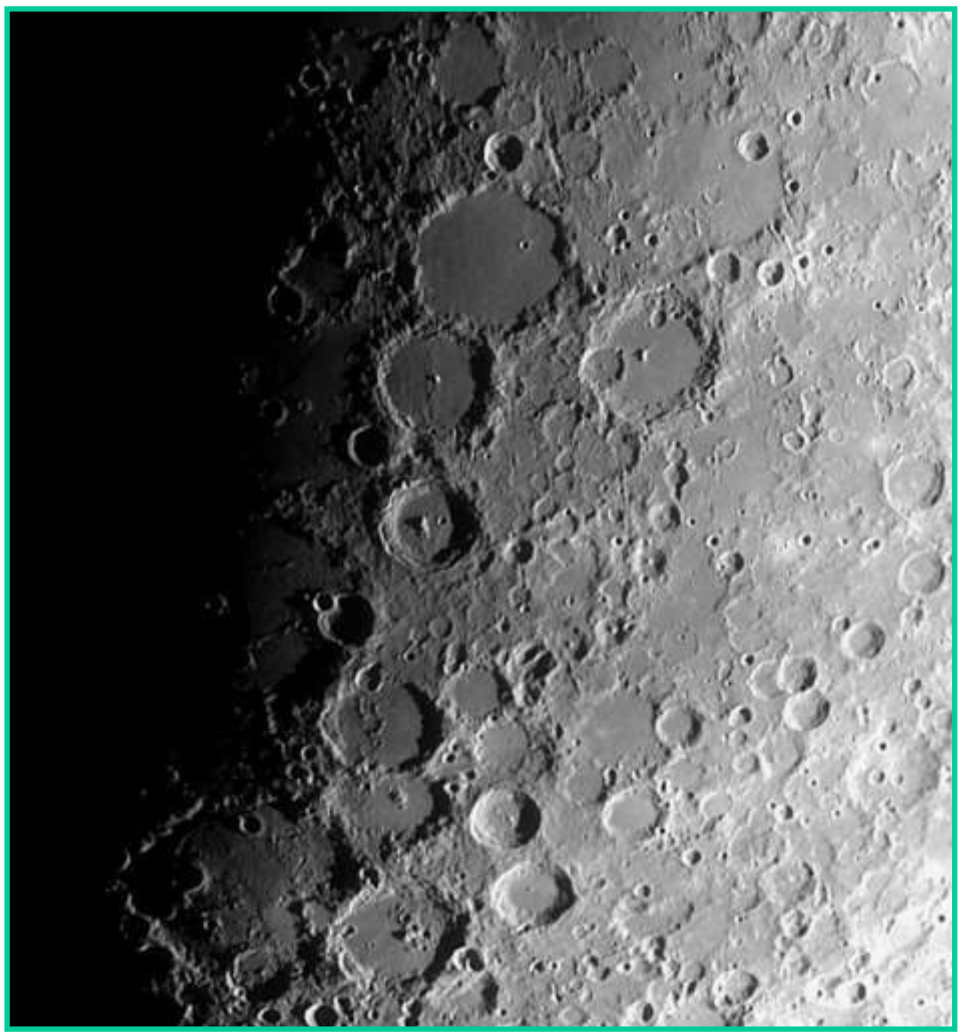


Ptolemaeus, Alphonsus and Arzachel, *Anthony Harding, north-east Indiana, USA. 2023 July 26 02:08 UT, colongitude 9.420°. Orion 90 mm achromat refractor telescope, ZWO ASI290mm/s camera. Seeing 5/10, transparency 3/6.*

FOCUS ON: Floor Fractured Craters



Ptolemaeus, Alphonsus and Arzachel, *Anthony Harding, northeast Indiana, USA. 2023 July 26 02:36 UT, colongitude 9.657°. Orion 90 mm achromat refractor telescope, 2.5x Tele Vue PowerMate, ZWO ASI290mm/s camera. Seeing 5/10, transparency 3/6.*



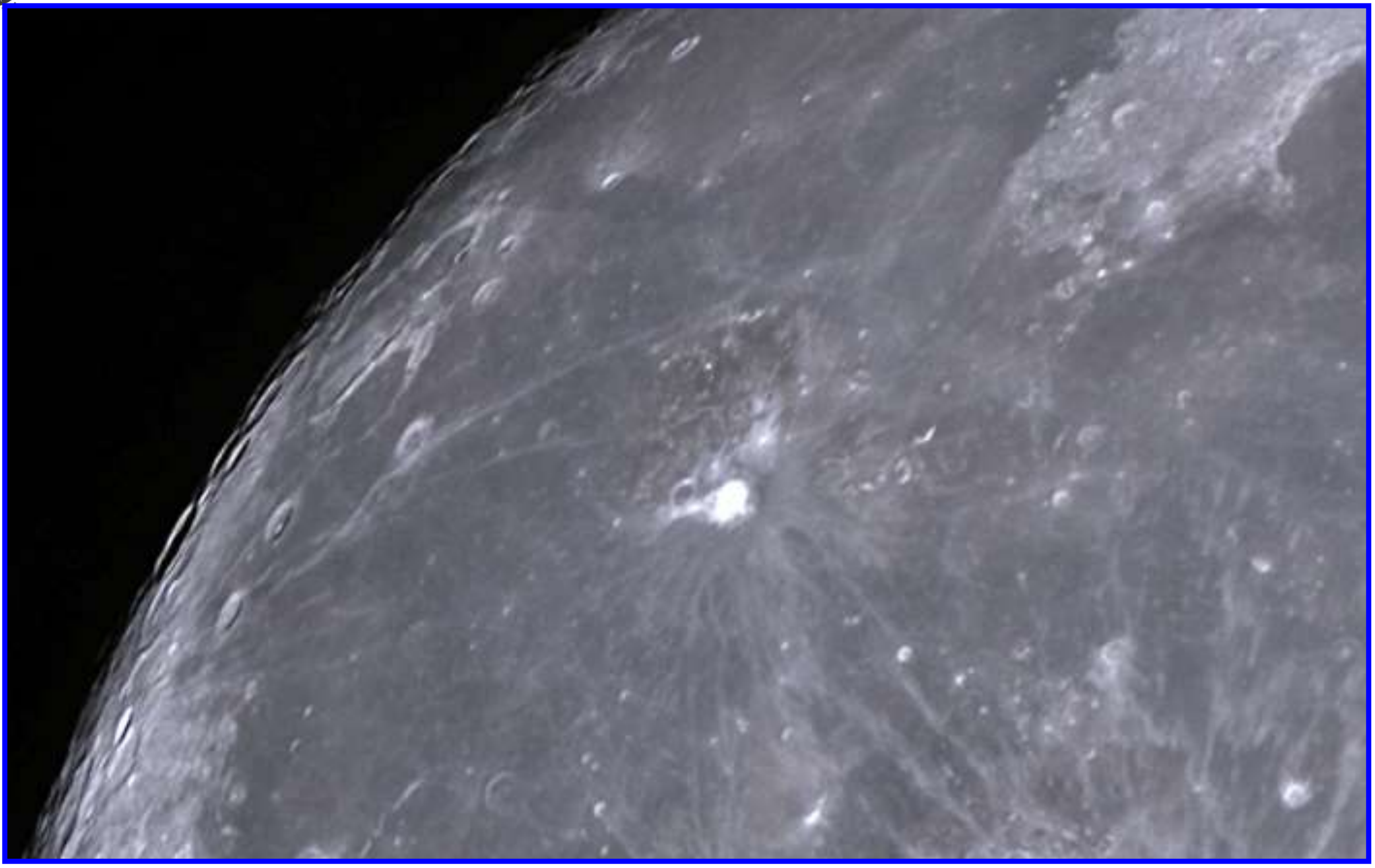
Ptolemaeus, Alphonsus and Arzachel, *Anthony Harding, northeast Indiana, USA. 2023 July 26 02:07 UT, colongitude 9.411°. Orion 90 mm achromat refractor telescope, ZWO ASI290mm/s camera. Seeing 5/10, transparency 3/6. Anthony adds:* "This cropped capture encompasses the craters from Ptolemaeus in the north to Deslandres in the south. The focus of this shot was primarily to capture Ptolemaeus, Alphonsus, and Arzachel. The floor features of Alphonsus came out especially well."

FOCUS ON: Floor Fractured Craters

Reiner Gamma, *Inez Beck. 1978 June 20 04:00-04:20 UT. 6 inch reflector telescope, 152x.*

Mons Piton, *Avril Elias, Oro Verde, Argentina, AEA. 2023 July 01 21:40 UT. Sky Watcher 150 mm f/5 reflector telescope, 3x barlow, QHY5-II 5C camera.*

Recent Topographic Studies



Aristarchus, *Maurice Collins, Palmerston North, New Zealand. 2023 August 01 07:49 UT. Meade ETX90 Maksutov-Cassegrain telescope, QHYIII462C camera.*

Plato, *Larry Todd, Dunedin, New Zealand. 2023 July 28 07:23 UT. 8 inch OMC Maksutov -Cassegrain telescope.*

Recent Topographic Studies

Mons Pico, *Avril Elias, Oro Verde, Argentina, AEA. 2023 July 01 21:51 UT. Sky Watcher 150 mm f/5 reflector telescope, 3x barlow, QHY5-II 5C camera.*

16.7-day old Moon, *Maurice Collins, Palmerston North, New Zealand. 2023 August 03 10:52-11:01 UT. Meade ETX90 Maksutov-Cassegrain telescope, QHYIII462C camera.*

Recent Topographic Studies

12.5-day old Moon, *Maurice Collins, Palmerston North, New Zealand. 2023 July 30 06:06-06:10 UT. Meade ETX90 Maksutov-Cassegrain telescope, QHYIII462C camera.*

Aristarchus, *Walter Ricardo Elias, Oro Verde, Argentina, AEA. 2023 July 01 21:02 UT. Sky Watcher 150 mm f/5 reflector telescope, 3x barlow, QHY5-II 5C camera.*

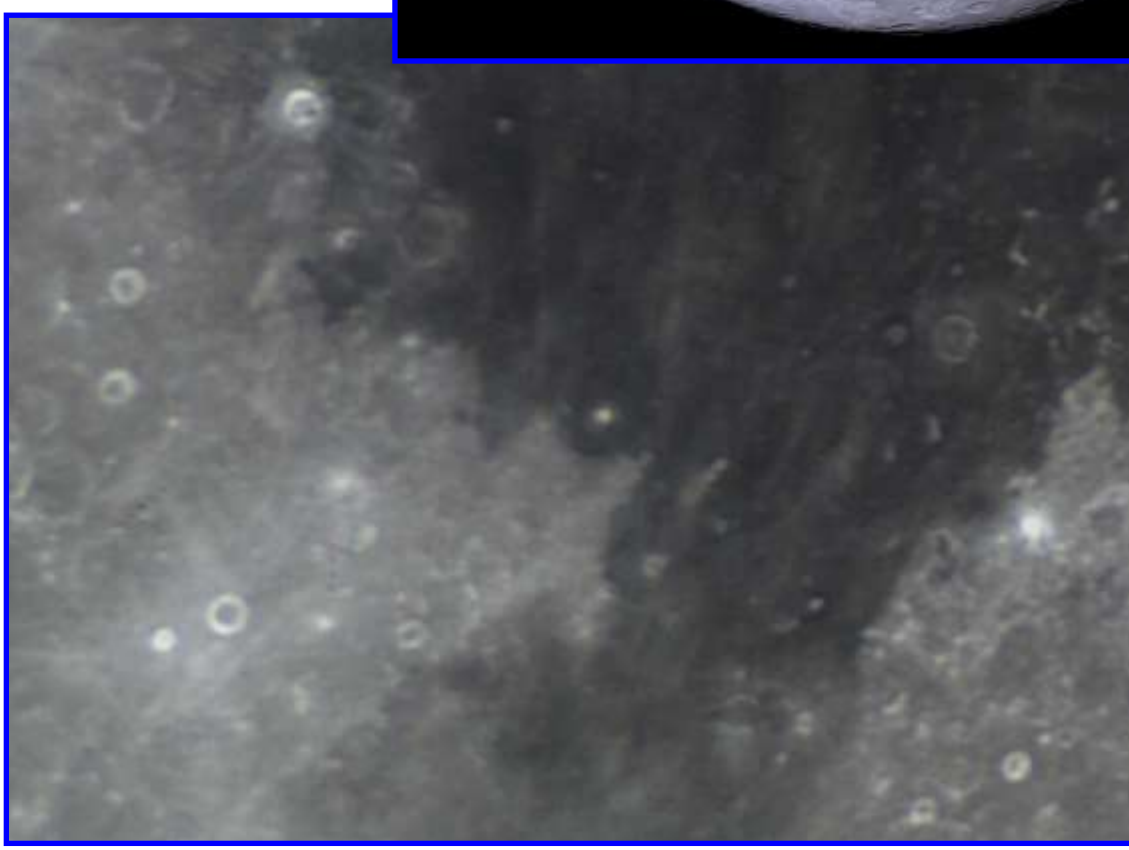
Recent Topographic Studies

12.6-day old Moon, *Maurice Collins, Palmerston North, New Zealand. 2023 July 30 08:07-08:11 UT. Meade ETX90 Maksutov-Cassegrain telescope, QHYIII462C camera.*

Aristarchus, *Walter Ricardo Elias, Oro Verde, Argentina, AEA. 2023 August 02 01:23 UT. Sky Watcher 150 mm f/5 reflector telescope, QHY5-II 5C camera.*

Recent Topographic Studies

14.5-day old Moon, *Maurice Collins, Palmerston North, New Zealand. 2023 August 01 07:36-07:43 UT. Meade ETX90 Maksutov-Cassegrain telescope, QHYIII462C camera.*



Moltke, *Walter Ricardo Elias, Oro Verde, Argentina, AEA. 2023 July 01 21:36 UT. Sky Watcher 150 mm f/5 reflector telescope, 3x barlow, QHY5-II 5C camera.*

Recent Topographic Studies

Darwin, *Walter Ricardo Elias, Oro Verde, Argentina, AEA. 2023 July 01 21:32 UT. Sky Watcher 150 mm f/5 reflector telescope, 3x barlow, QHY5-II 5C camera.*

Messier, *Larry Todd, Dunedin, New Zealand. 2023 August 03 10:21 UT. 8 inch OMC Maksutov-Cassegrain telescope.*

Recent Topographic Studies

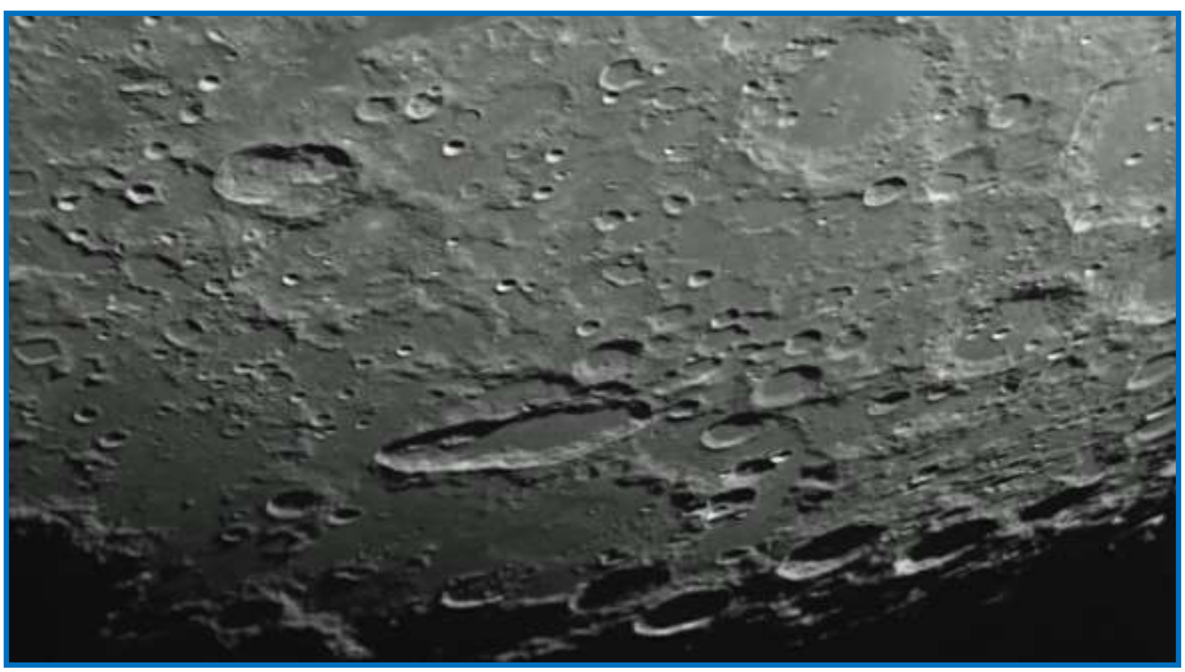
Sinus Iridum, *Maurice Collins, Palmerston North, New Zealand. 2023 July 30 06:11 UT. Meade ETX90 Maksutov-Cassegrain telescope, QHYIII462C camera.*

Mare Crisium, *Walter Ricardo Elias, Oro Verde, Argentina, AEA. 2023 August 02 01:36 UT. Sky Watcher 150 mm f/5 reflector telescope, QHY5-II 5C camera.*

Recent Topographic Studies

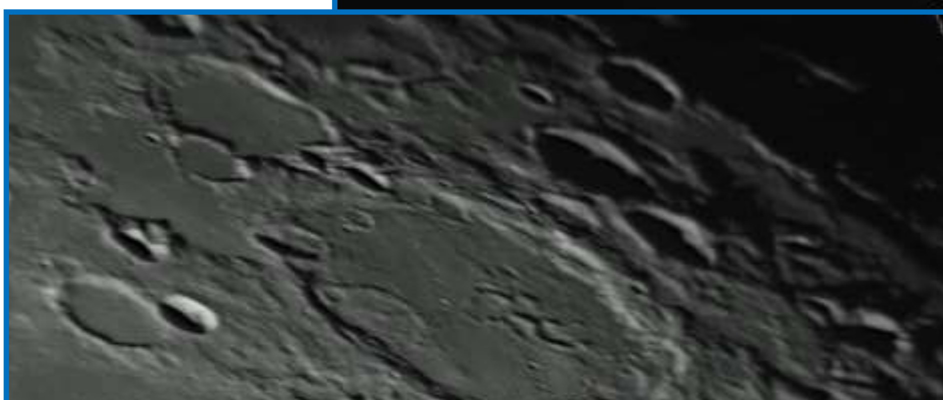
Mare Fecunditatis, *Walter Ricardo Elias, Oro Verde, Argentina, AEA. 2023 August 02 01:41 UT. Sky Watcher 150 mm f/5 reflector telescope, QHY5-II 5C camera.*

Schiller, *Larry Todd, Dunedin, New Zealand. 2023 June 30 10:26 UT. 8 inch OMC Maksutov-Cassegrain telescope.*



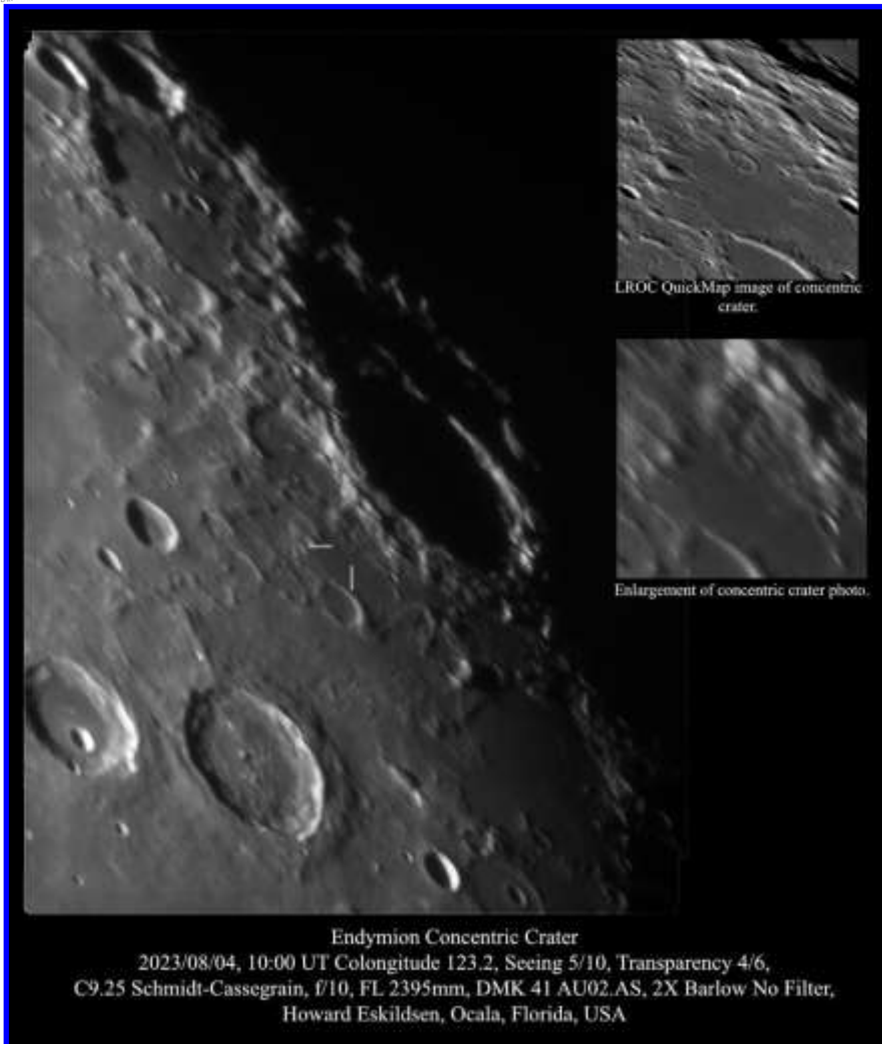
Recent Topographic Studies

Mare Humorum, *Walter Ricardo Elias, Oro Verde, Argentina, AEA. 2023 August 02 01:40 UT. Sky Watcher 150 mm f/5 reflector telescope, QHY5-II 5C camera.*



Messala, *Larry Todd, Dunedin, New Zealand. 2023 August 03 10:45 UT. 8 inch OMC Maksutov-Cassegrain telescope.*

Recent Topographic Studies



Endymion concentric crater*, Howard Eskildsen, Ocala, Florida, USA. 2023 August 04 10:00 UT, colongitude 123.2o. 9.25 inch Celestron Schmidt-Cassegrain telescope, 2x barlow, DMK 41 AU02.AS camera. Seeing 5/10, transparency 4/6. Howard adds:* "Here is an image composite from this morning showing a concentric crater near Endymion, with enlarged section of the photo off to the side, as well as an image of the area from the LROC QuickMap on the upper right. I am optimistic that with some better seeing I should be able to show the inner toroid of the concentric crater."

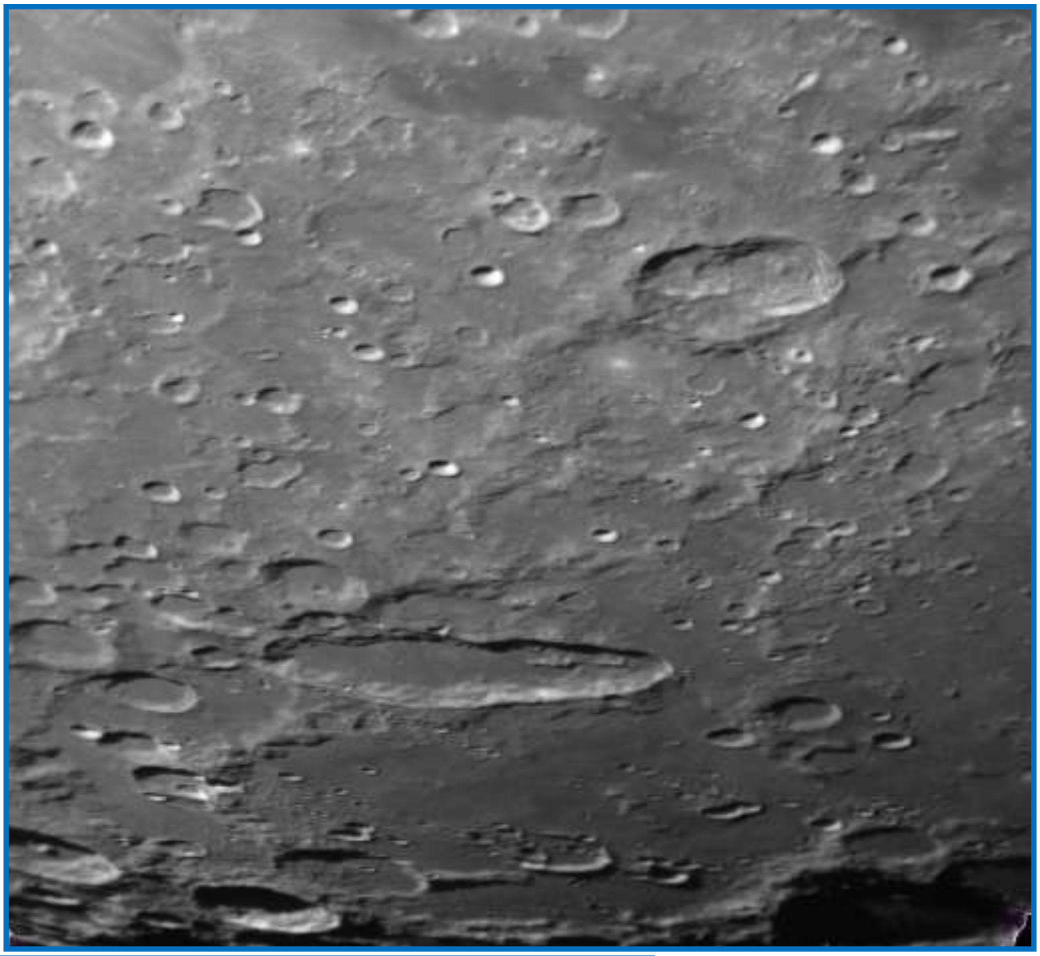
Rümker, *Larry Todd, Dunedin, New Zealand. 2023 July 30 10:45 UT. 8 inch OMC Maksutov-Cassegrain telescope.*

Recent Topographic Studies

Mare Frigoris, *Walter Ricardo Elias, Oro Verde, Argentina, AEA. 2023 August 02 01:43 UT. Sky Watcher 150 mm f/5 reflector telescope, QHY5-II 5C camera.*

Langrenus, *Larry Todd, Dunedin, New Zealand. 2023 August 03 10:27 UT. 8 inch OMC Maksutov-Cassegrain telescope.*

Recent Topographic Studies



Schiller, *Larry Todd, Dunedin, New Zealand. 2023 July 30 07:23 UT. 8 inch OMC Maksutov-Cassegrain telescope.*

***Yerkes Dome**, Howard Eskildsen, Ocala, Florida, USA. 2023 August 04 10:03 UT, colongitude 123.2^o. 9.25 inch Celestron Schmidt-Cassegrain telescope, 2x barlow, DMK 41 AU02.AS camera. Seeing 5/10, transparency 4/6.*

Recent Topographic Studies

Aristarchus, *Maurice Collins, Palmerston North, New Zealand. 2023 July 30 06:12 UT. Meade ETX90 Maksutov-Cassegrain telescope, QHYIII462C camera.*

Clavius, *Larry Todd, Dunedin, New Zealand. 2023 June 30 06:54 UT. 8 inch OMC Maksutov-Cassegrain telescope.*

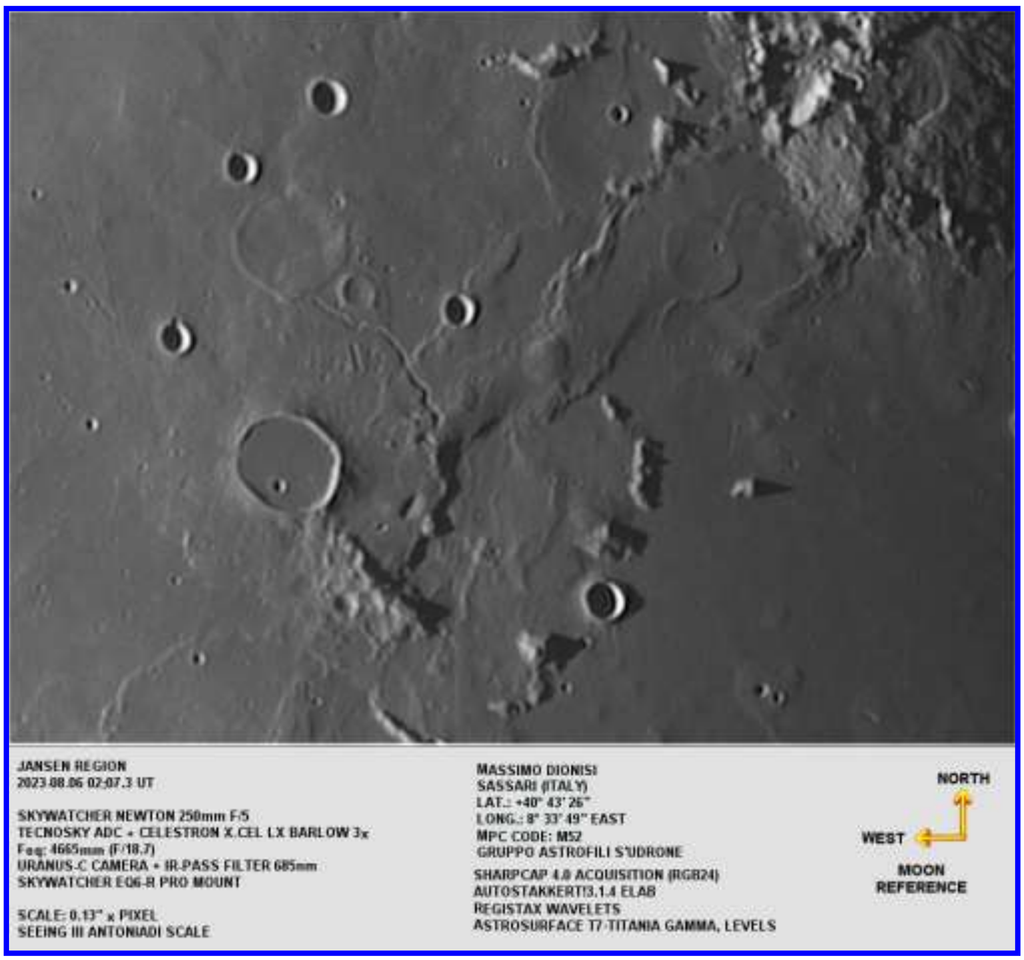
Recent Topographic Studies

Mare Serenitatis, *Walter Ricardo Elias, Oro Verde, Argentina, AEA. 2023 August 02 01:37 UT. Sky Watcher 150 mm f/5 reflector telescope, QHY5-II 5C camera.*

Marius, *Larry Todd, Dunedin, New Zealand. 2023 July 30 06:59 UT. 8 inch OMC Maksutov-Cassegrain telescope.*

Recent Topographic Studies

Mare Frigoris, *Larry Todd, Dunedin, New Zealand. 2023 June 30 06:47 UT. 8 inch OMC Maksutov-Cassegrain telescope.*



Jansen, *Massimo Dionisi, Sassari, Italy. 2023 August 06 02:07 UT. Sky Watcher 250 mm f/5 Newtonian reflector telescope, Technosky ADC, Celestron X-cel LX Barlow, 3x, fl 4,665 mm, IR pass filter 685 nm, Uranus-C camera. Seeing III Antoniadi Scale.*

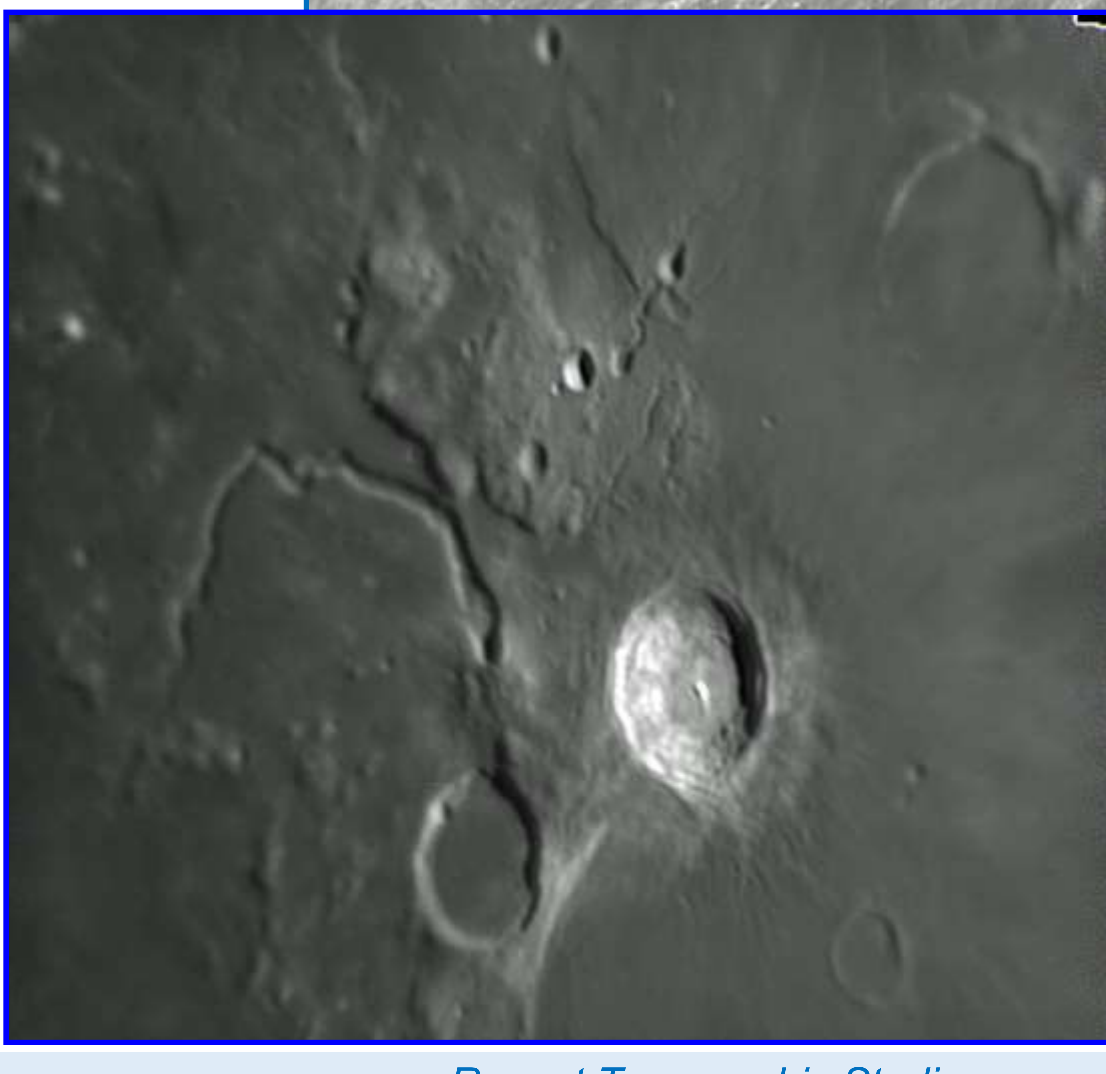
Recent Topographic Studies

Schickard, *Maurice Collins, Palmerston North, New Zealand. 2023 July 30 08:07 UT. Meade ETX90 Maksutov-Cassegrain telescope, QHY-III462C camera.*

Aristarchus, *Larry Todd, Dunedin, New Zealand. 2023 July 30 07:14 UT. 8 inch OMC Maksutov-Cassegrain telescope.*

Recent Topographic Studies

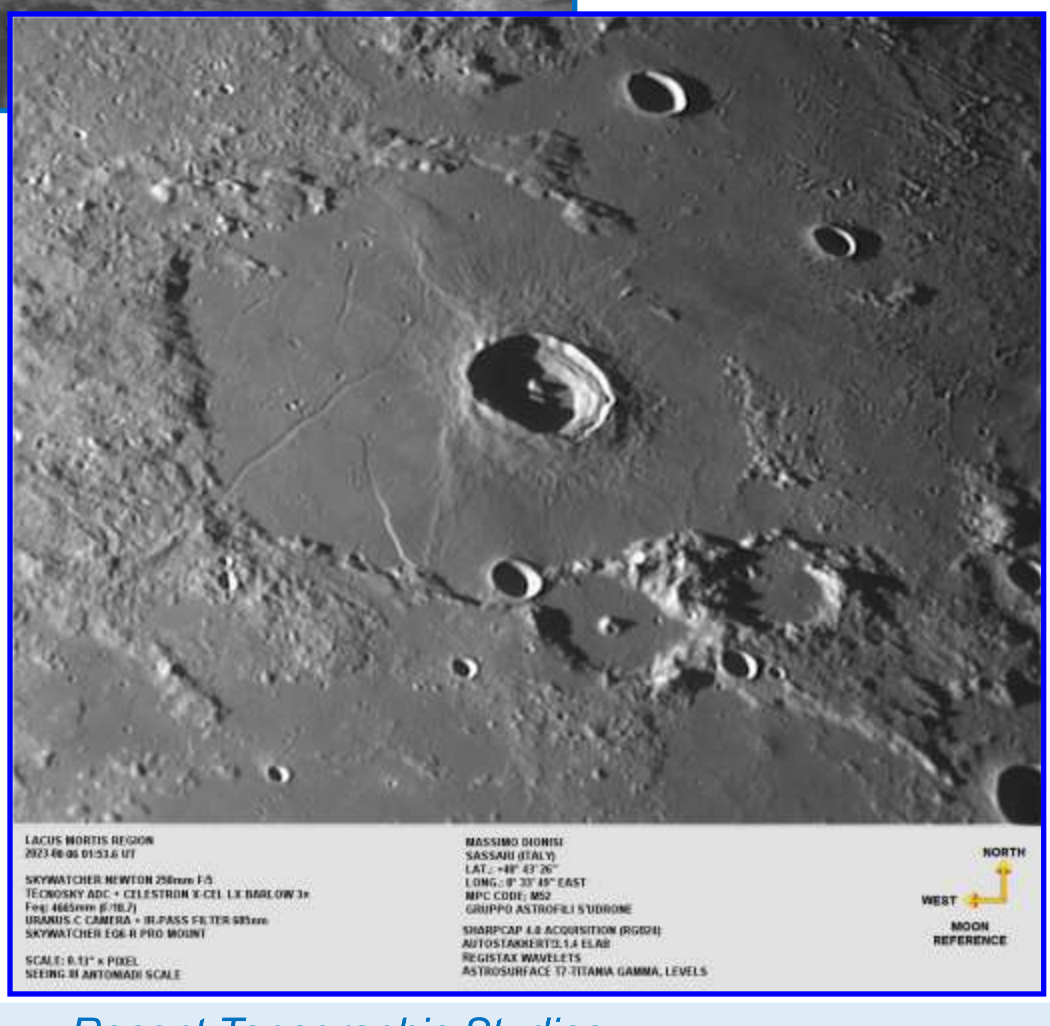
Mare Nectaris, *Walter Ricardo Elias, Oro Verde, Argentina, AEA. 2023 August 02 01:41 UT. Sky Watcher 150 mm f/5 reflector telescope, QHY5-II 5C camera.*



Aristarchus, *Larry Todd, Dunedin, New Zealand. 2023 July 30 10:48 UT. 8 inch OMC Maksutov-Cassegrain telescope.*

Recent Topographic Studies

Aristarchus, *Larry Todd, Dunedin, New Zealand. 2023 July 28 07:30 UT. 8 inch OMC Maksutov-Cassegrain telescope.*



Lacus Mortis, *Massimo Dionisi, Sassari, Italy. 2023 August 06 01:53 UT. Sky Watcher 250 mm f/5 Newtonian reflector telescope, Technosky ADC, Celestron X-cel LX Barlow, 3x, fl 4,665 mm, IR pass filter 685 nm, Uranus-C camera. Seeing III Antoniadi Scale.*

Recent Topographic Studies

Mare Imbrium, *Walter Ricardo Elias, Oro Verde, Argentina, AEA. 2023 August 02 01:39 UT. Sky Watcher 150 mm f/5 reflector telescope, QHY5-II 5C camera.*

Mare Crisium, *Gregory Shanos, Sarasota, Florida, USA. 2023 February 25 01:35 UT. Meade LX200 GPS 10 inch Schmidt-Cassegrain telescope, IR cut filter, ZWO ASI178mm camera. Greg adds: "*Close-up of Mare Crisium on Feb 25, 2023 at 01h 35.4m UT. Moon was at a phase of 37% illuminated. Observing conditions were less than ideal since the image was taken through thickening clouds. The seeing was only average. Image was taken with a Meade LX200GPS 10-inch 2500mm fl f/10 Schmidt-Cassegrain telescope, ZWO ASI 178MM monochrome camera with an IR cut filter. Gregory T. Shanos, Sarasota, Florida.

Mare Crisium is 556 km (345 mi) in diameter and 176,000 square kilometers (68,000 sq mi) in area. It has a very flat floor, with a ring of wrinkle ridges toward its outer boundaries. A mass concentration or gravitational high, was identified in the center of Mare Crisium from Doppler tracking of the five Lunar Orbiter spacecraft in 1968. This gravitational high was confirmed and mapped at higher resolution with later orbiters such as Lunar Prospector and GRAIL. (*from Wikipedia).*

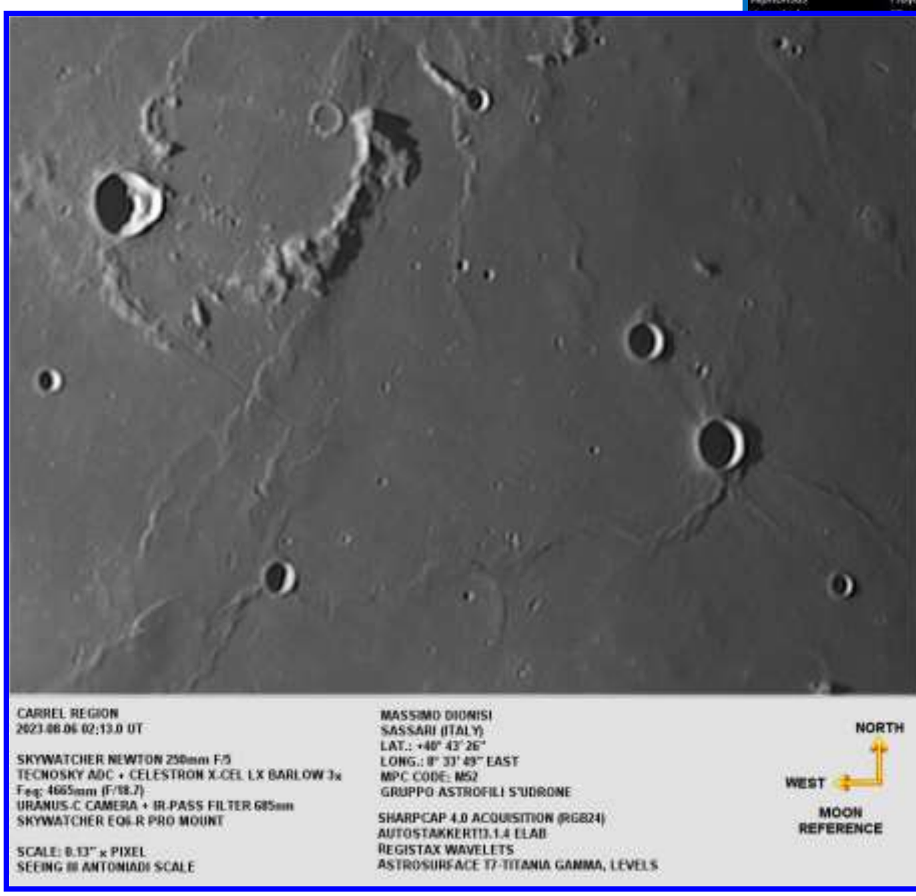
Recent Topographic Studies

Mare Tranquillitatis, *Walter Ricardo Elias, Oro Verde, Argentina, AEA. 2023 August 02 01:35 UT. Sky Watcher 150 mm f/5 reflector telescope, QHY5-II 5C camera.*

16.7-day old Moon, *Maurice Collins, Palmerston North, New Zealand. 2023 August 03 10:45-10:53 UT. Meade ETX90 Maksutov-Cassegrain telescope, QHYIII462C camera.*

Recent Topographic Studies

Albategnius, *Fabio Verza, SNdR, Milan, Italy. 2023 July 25 19:17 UT. Takahashi Mewlon 210 mm Dall-Kirkham telescope, Astronomik ProPlanet IR742 nm filter, Player-One Mars M camera.*



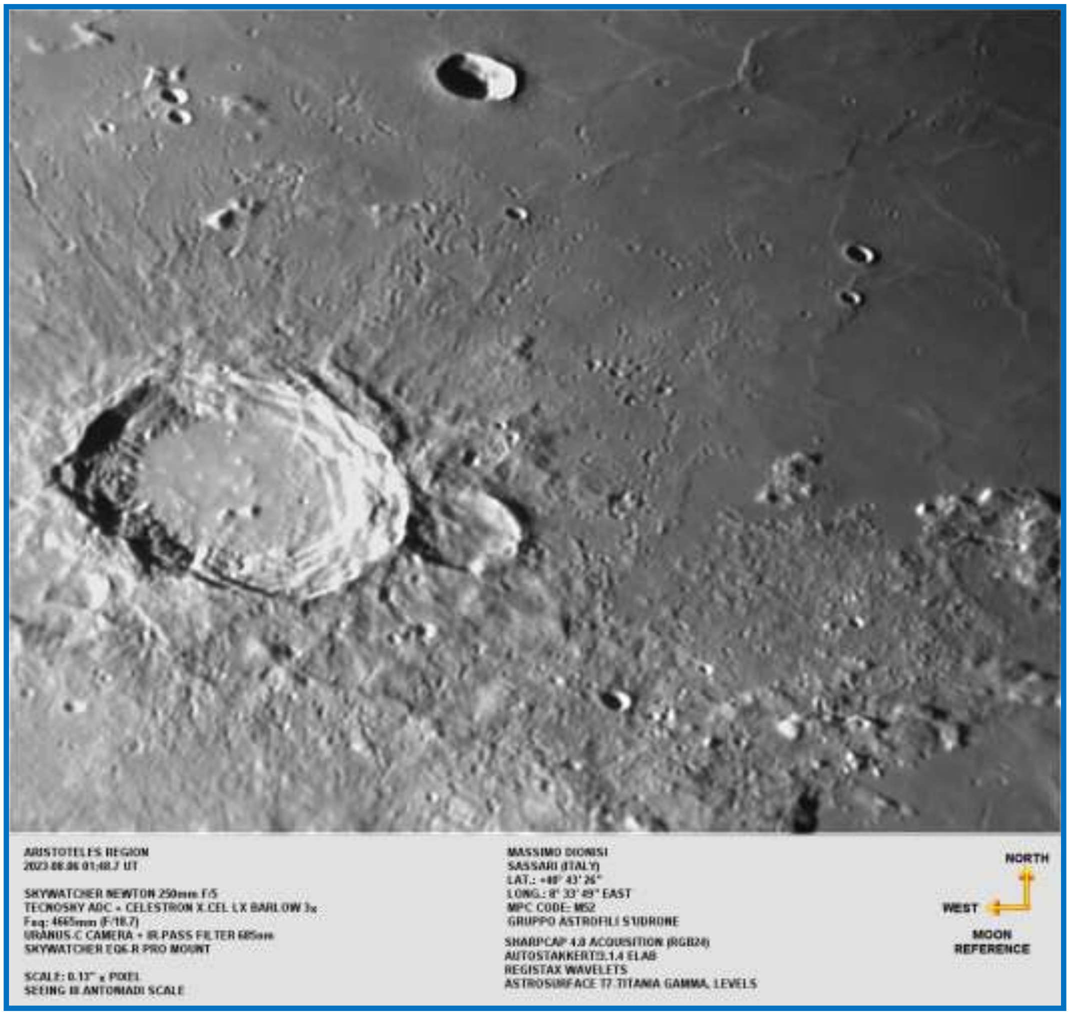
Carrel, *Massimo Dionisi, Sassari, Italy. 2023 August 06 02:13 UT. Sky Watcher 250 mm f/5 Newtonian reflector telescope, Technosky ADC, Celestron X-cel LX Barlow, 3x, fl 4,665 mm, IR pass filter 685 nm, Uranus-C camera. Seeing III Antoniadi Scale.*

Recent Topographic Studies

Montes Caucasus, *Fabio Verza, SNdR, Milan, Italy. 2023 July 25 19:34 UT. Takahashi Mewlon 210 mm Dall-Kirkham telescope, 0.5x reducer, Astronomik ProPlanet IR742 nm filter, Player-One Mars M camera.*

Sinus Iridum*, KC Pau, Hong Kong, China. 2022 April 11 12:11 UT. 250 mm f/6 reflector telescope, 2.5 x barlow, QHYCCD290M camera.*

Recent Topographic Studies



Aristoteles, *Massimo Dionisi, Sassari, Italy. 2023 August 06 01:48 UT. Sky Watcher 250 mm f/5 Newtonian reflector telescope, Technosky ADC, Celestron X-cel LX Barlow, 3x, fl 4,665 mm, IR pass filter 685 nm, Uranus-C camera. Seeing III Antoniadi Scale.*

Harlan and Marinus, *István Zoltán Földvári, Budapest, Hungary. 2019 March 21, 21:12-21:38 UT, colongitude 97.568º. 70 mm refractor telescope, 500 mm focal length, Vixen LV Lanthanum 4 mm, 125x. Seeing 6/10, transparency 5/6.*

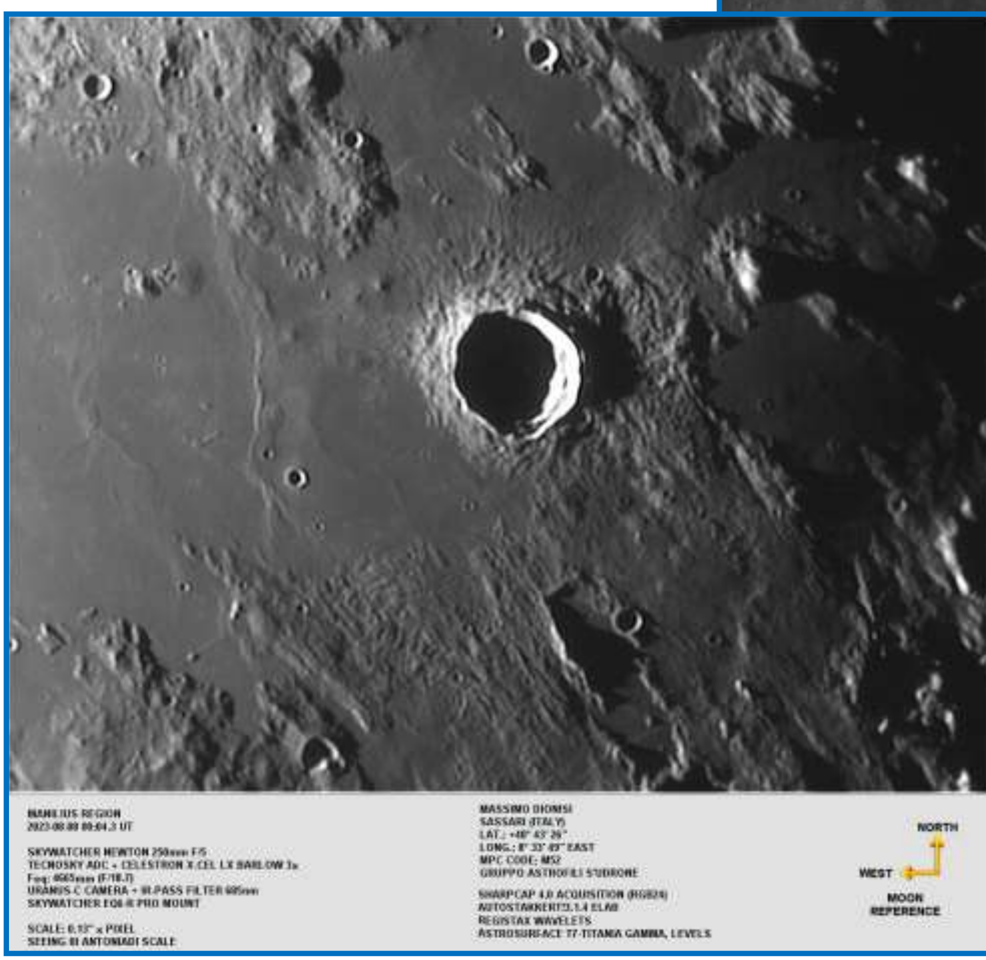
Recent Topographic Studies

Aristoteles, *Massimo Dionisi, Sassari, Italy. 2023 August 06 23:35 UT. Sky Watcher 250 mm f/5 Newtonian reflector telescope, Technosky ADC, Celestron X-cel LX Barlow, 3x, fl 4,665 mm, IR pass filter 685 nm, Uranus-C camera. Seeing III-IV Antoniadi Scale.*

Hadley Rille, *Don Capone, Waxahachie, Texas, USA. 2023 August 07 10:58 UT. Orion xx16g at f/11, UV/IR cut filter, 2 x barlow, ADC, ASI678MC camera.*

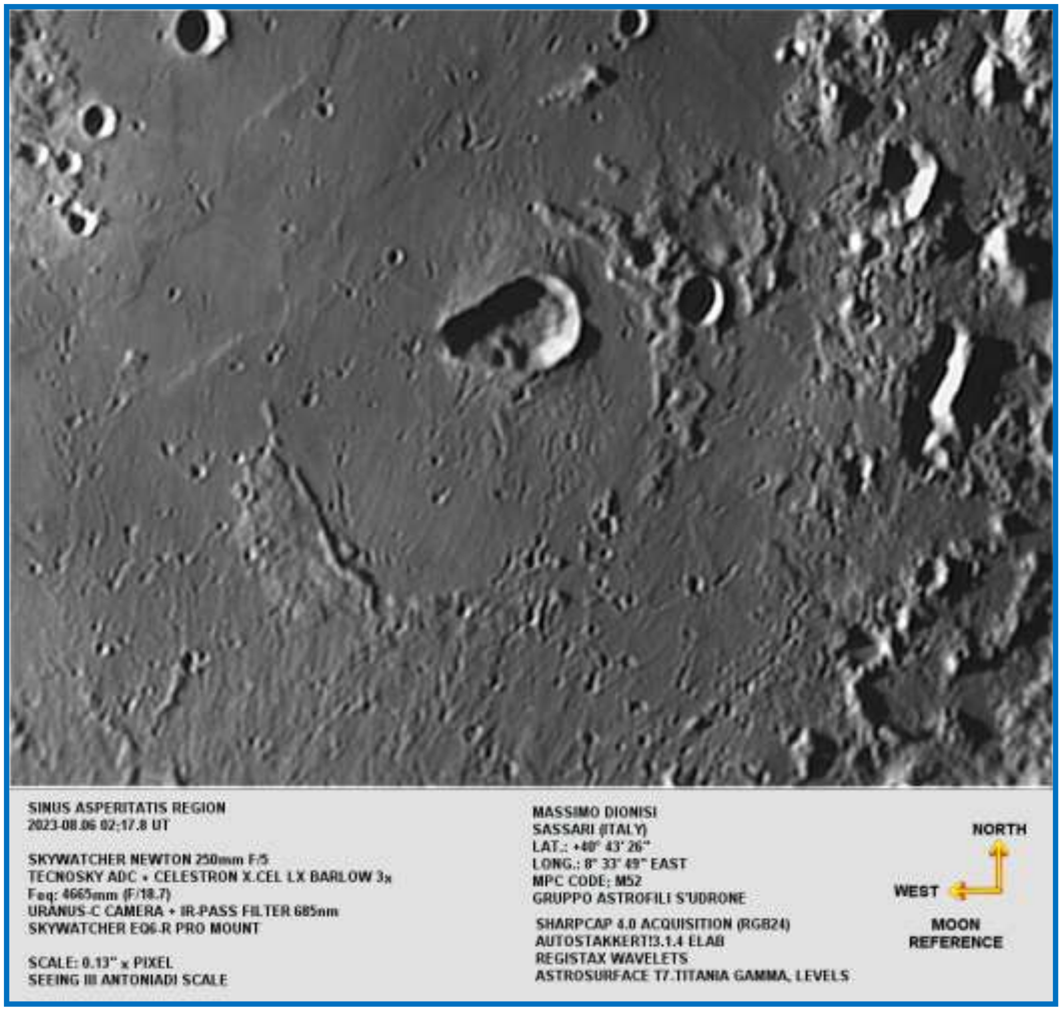
Recent Topographic Studies

Mare Crisium, *Fabio Verza, SNdR, Milan, Italy. 2023 July 25 19:43 UT. Takahashi Mewlon 210 mm Dall-Kirkham telescope, 0.5x reducer, Astronomik ProPlanet IR742 nm filter, Player-One Mars M camera.*

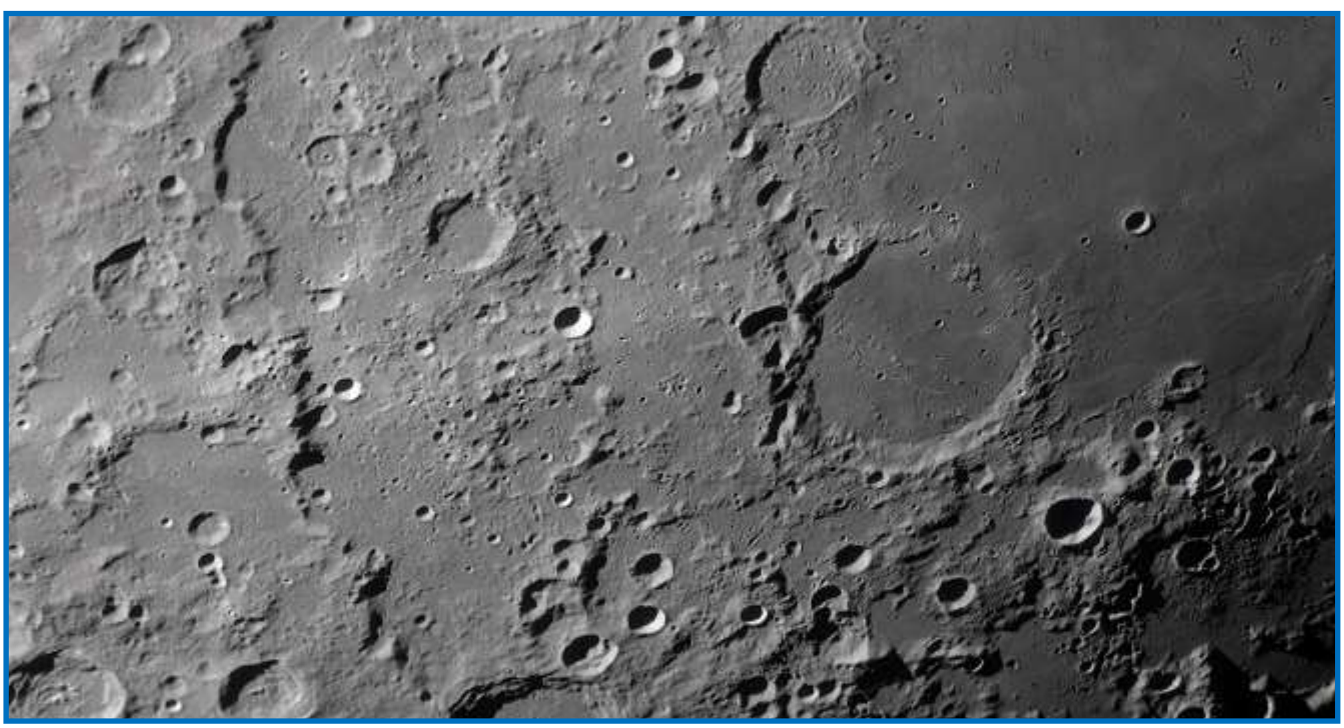


Manilius, *Massimo Dionisi, Sassari, Italy. 2023 August 08 00:04 UT. Sky Watcher 250 mm f/5 Newtonian reflector telescope, Technosky ADC, Celestron X-cel LX Barlow, 3x, fl 4,665 mm, IR pass filter 685 nm, Uranus-C camera. Seeing III Antoniadi Scale.*

Sinus Asperitatis, *Massimo Dionisi, Sassari, Italy. 2023 August 06 02:17 UT. Sky Watcher 250 mm f/5 Newtonian reflector telescope, Technosky ADC, Celestron X-cel LX Barlow, 3x, fl 4,665 mm, IR pass filter 685 nm, Uranus-C camera. Seeing III Antoniadi Scale.*

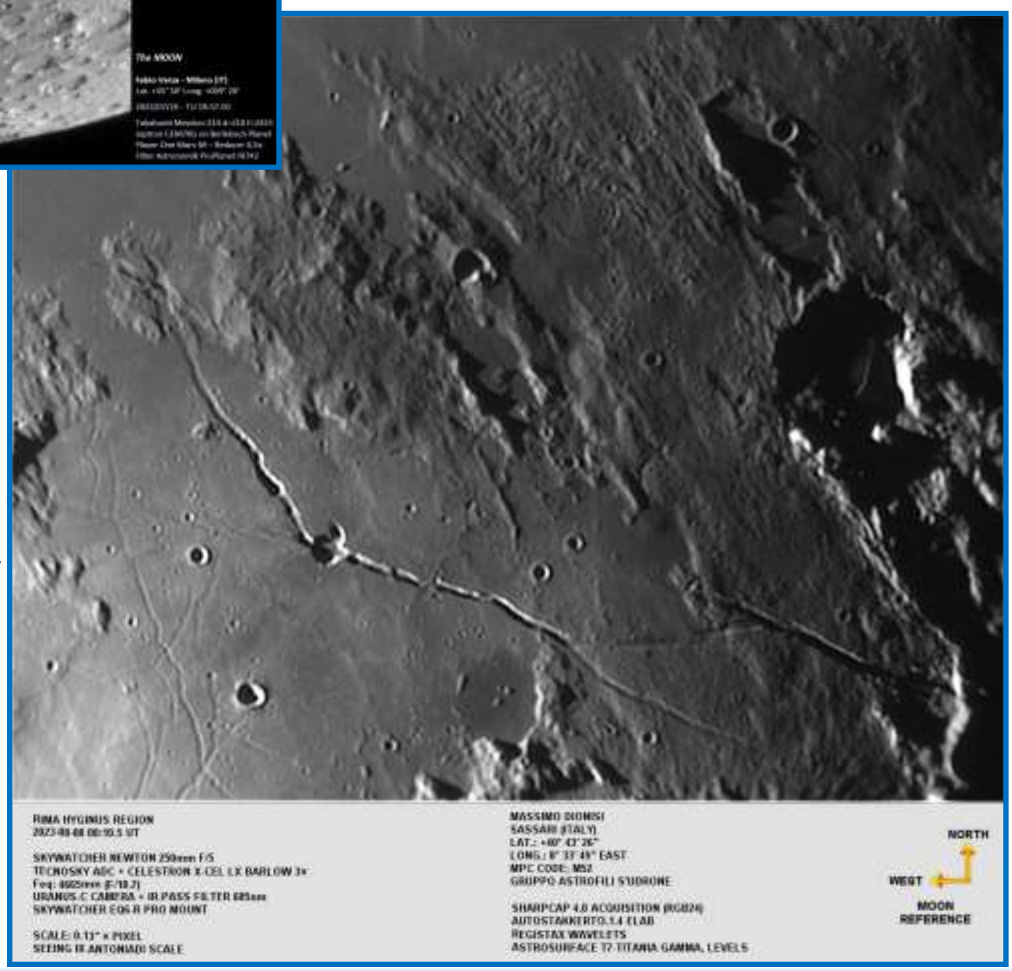


Fracastorius, *Don Capone, Waxahachie, Texas, USA. 2023 August 05 10:04 UT. Orion xx16g at f/11, UV/IR cut filter, 2 x barlow, ADC, ASI678MC camera.*



Recent Topographic Studies

Maurolycus, *Fabio Verza, SNdR, Milan, Italy. 2023 July 25 19:37 UT. Takahashi Mewlon 210 mm Dall-Kirkham telescope, 0.5x reducer, Astronomik ProPlanet IR742 nm filter, Player-One Mars M camera.*



Hyginus, *Massimo Dionisi, Sassari, Italy. 2023 August 08 00:10 UT. Sky Watcher 250 mm f/5 Newtonian reflector telescope, Technosky ADC, Celestron X-cel LX Barlow, 3x, fl 4,665 mm, IR pass filter 685 nm, Uranus-C camera. Seeing III Antoniadi Scale.*

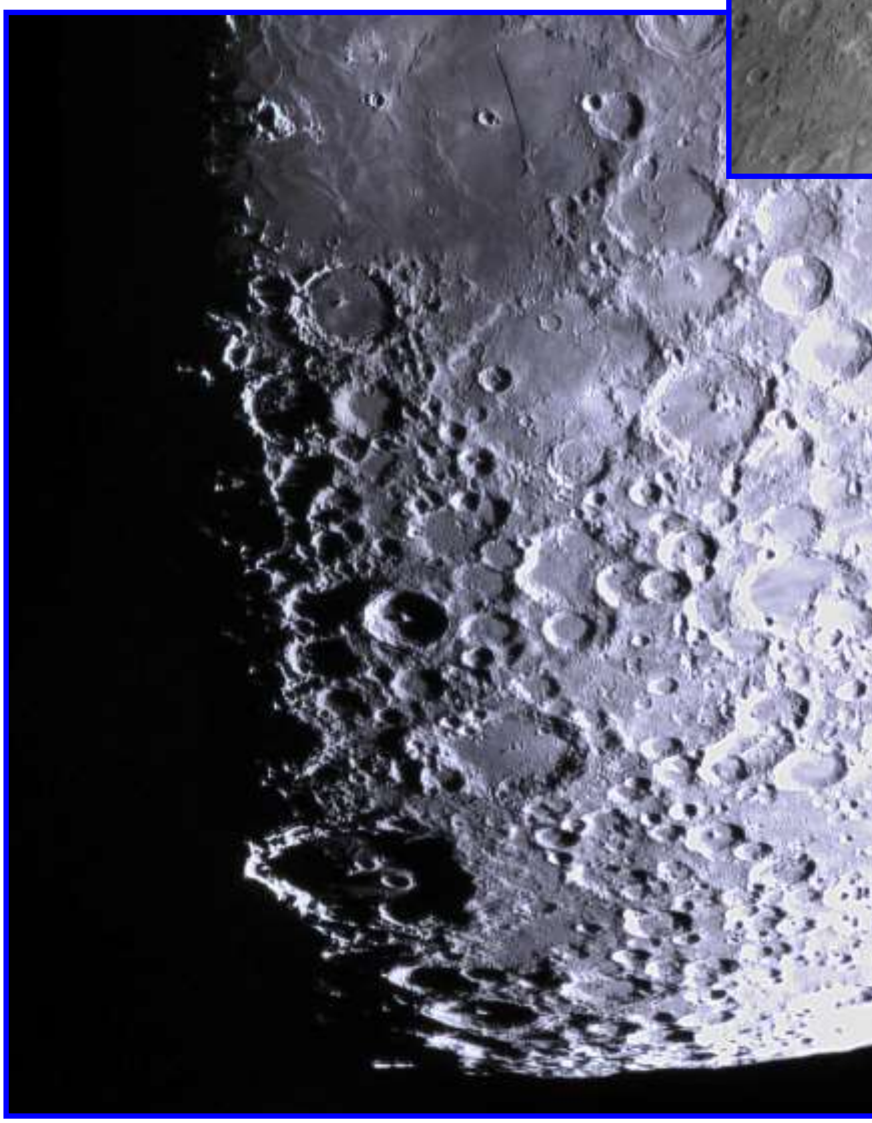
Recent Topographic Studies

Ross, *Massimo Dionisi, Sassari, Italy. 2023 August 06 23:50 UT. Sky Watcher 250 mm f/5 Newtonian reflector telescope, Technosky ADC, Celestron X-cel LX Barlow, 3x, fl 4,665 mm, IR pass filter 685 nm, Uranus-C camera. Seeing III-IV Antoniadi Scale.*

Banachiewicz, Banachiewicz B, E, Knox-Shaw, Schubert, *István Zoltán Földvári, Budapest, Hungary. 2019 March 21, 21:40-22:00 UT, colongitude 97.8º. 70 mm refractor telescope, 500 mm focal length, Vixen LV Lanthanum 4 mm, 125x. Seeing 7/10, transparency 5/6.*

Recent Topographic Studies

Mare Nectaris, *Fabio Verza, SNdR, Milan, Italy. 2023 July 25 19:40 UT. Takahashi Mewlon 210 mm Dall-Kirkham telescope, 0.5x reducer, Astronomik ProPlanet IR742 nm filter, Player-One Mars M camera.*



Clavius, *Maurice Collins, Palmerston North, New Zealand. 2023 August 25 07:59. Meade ETX90 Maksutov-Cassegrain telescope, QHYIII462C camera. Seeing I-II Antoniadi Scale.*

A Very Old Moon

Ron May

***Waning Crescent Moon, 0.7% illuminated**, Ron May, El Dorado Hills , California, USA. 2023 August 15 12:36 UT. 3.5 inch Questar Maksutov-Cassegrain telescope, iPhone 12 camera.*

***Waning Crescent Moon, 0.7% illuminated**, Ron May, El Dorado Hills , California, USA. 2023 August 15 12:40 UT. 3.5 inch Questar Maksutov-Cassegrain telescope, iPhone 12 camera.*

Recent Topographic Studies

A Very Old Moon

Ron May

***Waning Crescent Moon, 0.7% illuminated**, Ron May, El Dorado Hills , California, USA. 2023 August 15 12:40 UT. 3.5 inch Questar Maksutov-Cassegrain telescope, iPhone 12 camera. This image was taken through the finder with some magnification from the iPhone. Below, a last image at 12:54 UT through the Questar.*

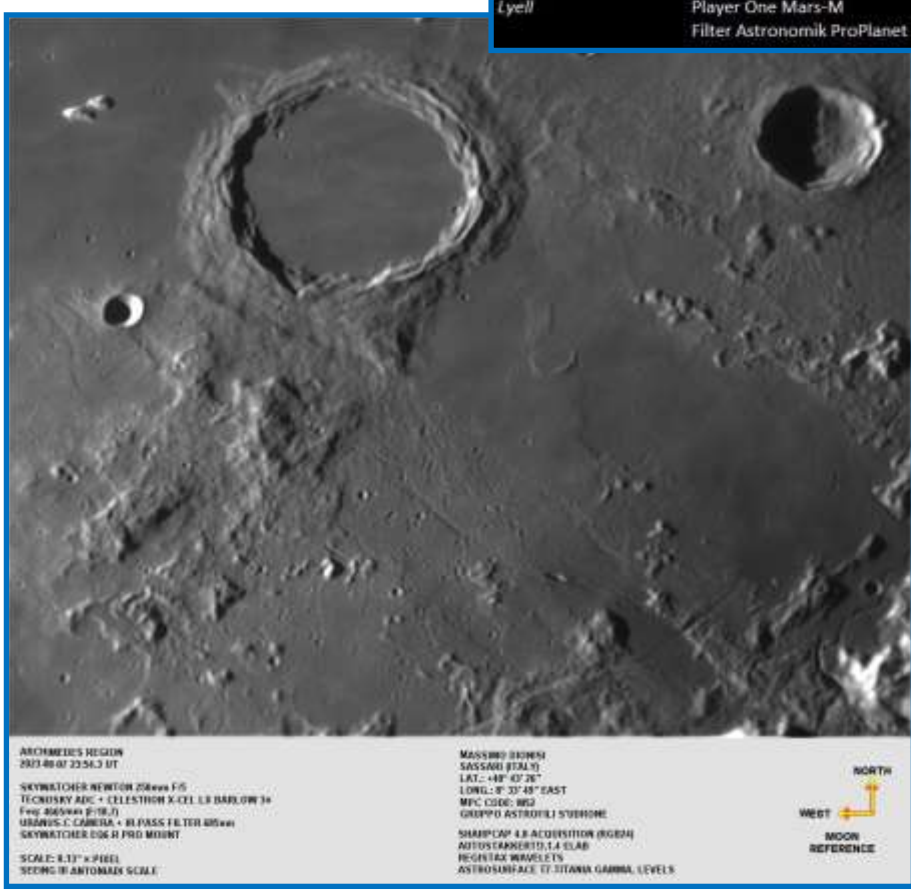
Recent Topographic Studies

Scoresby, *Fabio Verza, SNdR, Milan, Italy. 2023 July 25 19:28 UT. Takahashi Mewlon 210 mm Dall-Kirkham telescope, Astronomik Pro-Planet IR742 nm filter, Player-One Mars M camera.*

Straight Wall, *Don Capone, Waxahachie, Texas, USA. 2023 August 07 11:01 UT. Orion xx16g at f/11, UV/IR cut filter, 2 x barlow, ADC, ASI678MC camera.*

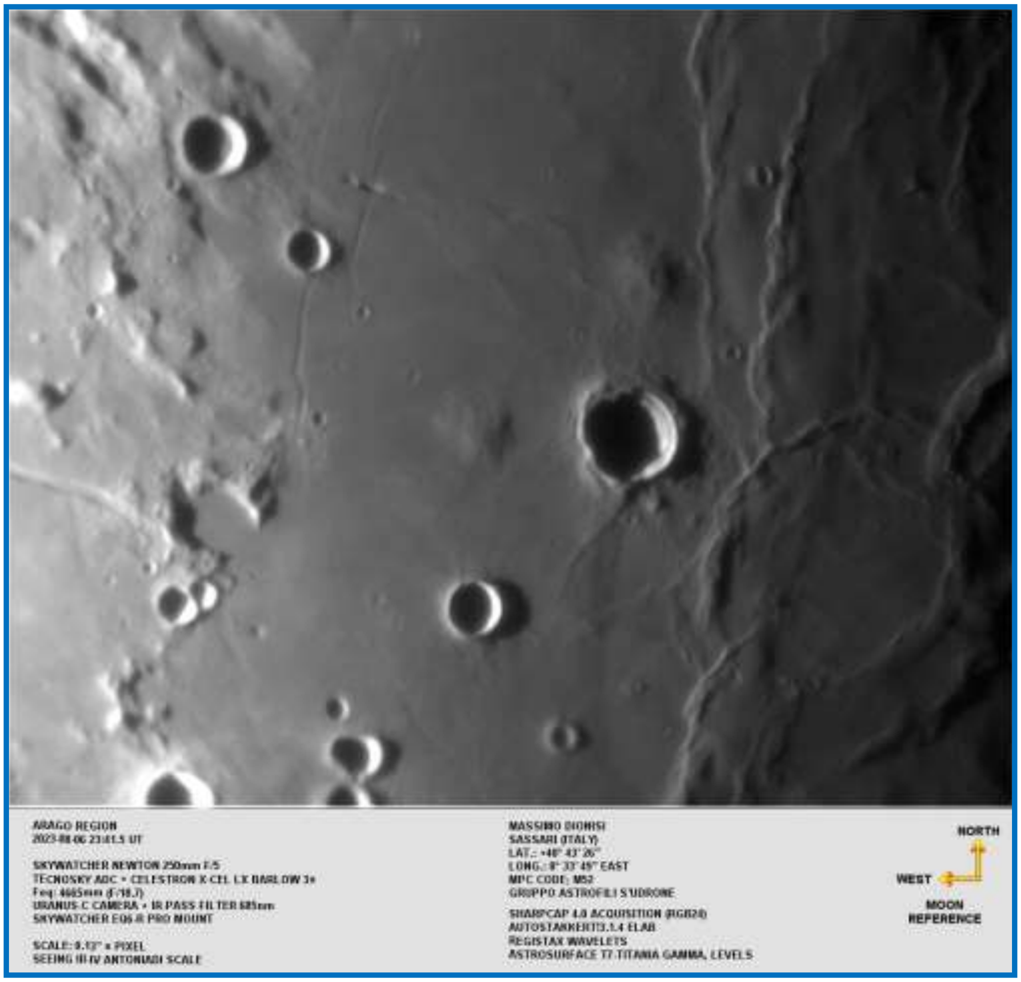
Recent Topographic Studies

Proclus, *Fabio Verza, SNdR, Milan, Italy. 2023 July 25 19:04 UT. Takahashi Mewlon 210 mm Dall-Kirkham telescope, Astronomik Pro-Planet IR742 nm filter, Player-One Mars M camera.*



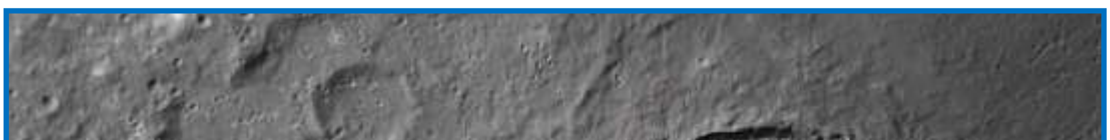
Archimedes, *Massimo Dionisi, Sassari, Italy. 2023 August 07 23:57 UT. Sky Watcher 250 mm f/5 Newtonian reflector telescope, Technosky ADC, Celestron X-cel LX Barlow, 3x, fl 4,665 mm, IR pass filter 685 nm, Uranus-C camera. Seeing III Antoniadi Scale.*

Recent Topographic Studies



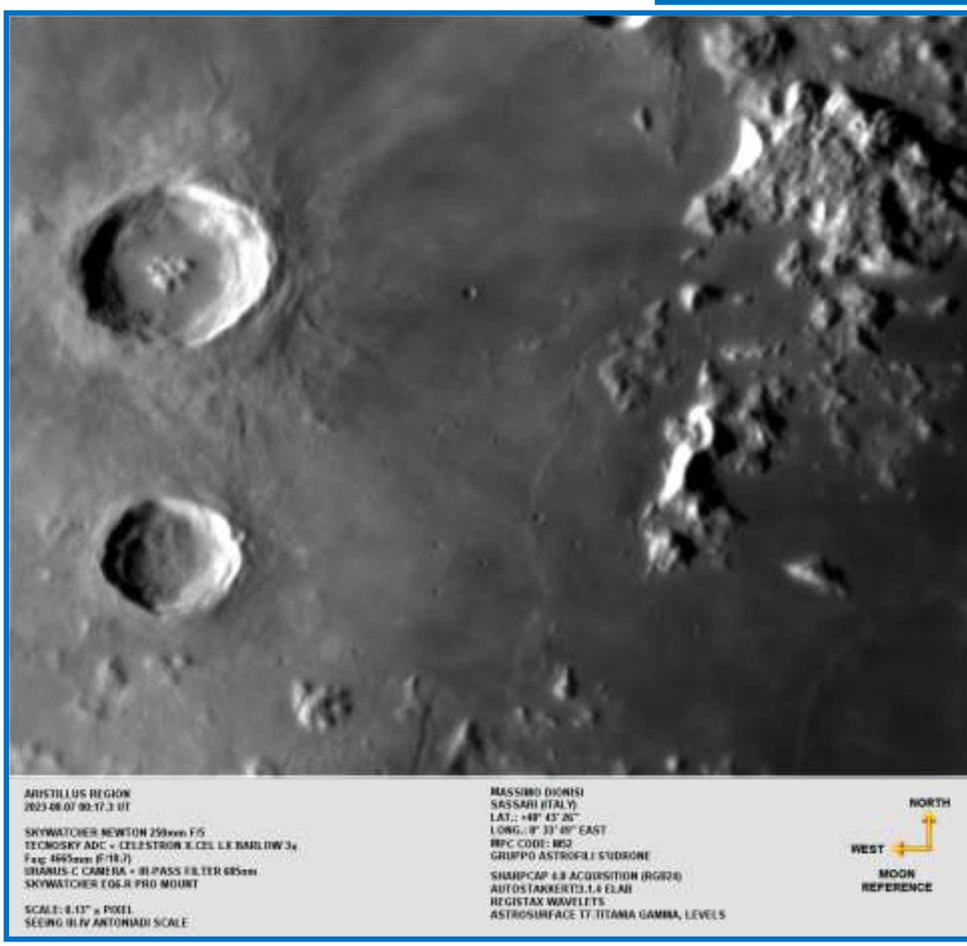
Arago, *Massimo Dionisi, Sassari, Italy. 2023 August 06 23:41 UT. Sky Watcher 250 mm f/5 Newtonian reflector telescope, Technosky ADC, Celestron X-cel LX Barlow, 3x, fl 4,665 mm, IR pass filter 685 nm, Uranus-C camera. Seeing III-IV Antoniadi Scale.*

Theophilus, *Don Capone, Waxahachie, Texas, USA. 2023 August 05 10:05 UT. Orion xx16g at f/11, UV/IR cut filter, 2 x barlow, ADC, ASI678MC camera.*



Recent Topographic Studies

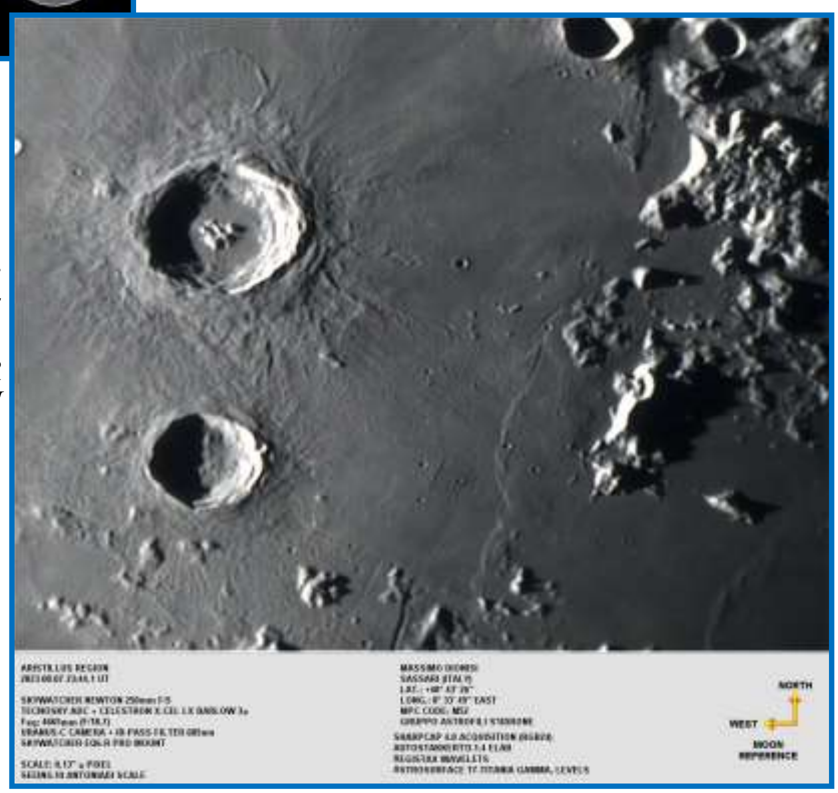
Vallis Alpes, *Fabio Verza, SNdR, Milan, Italy. 2023 July 25 19:08 UT. Takahashi Mewlon 210 mm Dall-Kirkham telescope, Astronomik ProPlanet IR742 nm filter, Player-One Mars M camera.*



Aristillus, *Massimo Dionisi, Sassari, Italy. 2023 August 07 00:17 UT. Sky Watcher 250 mm f/5 Newtonian reflector telescope, Technosky ADC, Celestron X-cel LX Barlow, 3x, fl 4,665 mm, IR pass filter 685 nm, Uranus-C camera. Seeing III-IV Antoniadi Scale.*

Recent Topographic Studies

Theophilus, *Fabio Verza, SNdR, Milan, Italy. 2023 July 25 19:22 UT. Takahashi Mewlon 210 mm Dall-Kirkham telescope, Astronomik ProPlanet IR742 nm filter, Player-One Mars M camera.*



Aristillus, *Massimo Dionisi, Sassari, Italy. 2023 August 07 23:44 UT. Sky Watcher 250 mm f/5 Newtonian reflector telescope, Technosky ADC, Celestron X-cel LX Barlow, 3x, fl 4,665 mm, IR pass filter 685 nm, Uranus-C camera. Seeing III Antoniadi Scale.*

Recent Topographic Studies

Mare Undarum, *Massimo Dionisi, Sassari, Italy. 2023 August 02 21:09 UT. Sky Watcher 250 mm f/5 Newtonian reflector telescope, Celestron X-cel LX Barlow, 3x, fl 3,600 mm, IR pass filter 685 nm, Uranus-C camera. Seeing III-IV Antoniadi Scale.*

Mare Undarum, *Massimo Dionisi, Sassari, Italy. 2023 August 02 21:45 UT. Sky Watcher 250 mm f/5 Newtonian reflector telescope, Technosky ADC, Celestron X-cel LX Barlow, 3x, fl 5,860 mm, IR pass filter 685 nm, Uranus-C camera. Seeing III-IV Antoniadi Scale.*

Recent Topographic Studies

Mare Undarum, *Massimo Dionisi, Sassari, Italy. 2023 August 02 22:59 UT. Sky Watcher 250 mm f/5 Newtonian reflector telescope, Technosky ADC, Celestron X-cel LX Barlow, 3x, fl 5,860 mm, IR pass filter 685 nm, Uranus-C camera. Seeing III-IV Antoniadi Scale. Massimo adds: "*I am sending you some new images of the lunar surface, taken on August 2nd. Unfortunately in the last few days the weather conditions have worsened a lot and I have not been able to take further images.

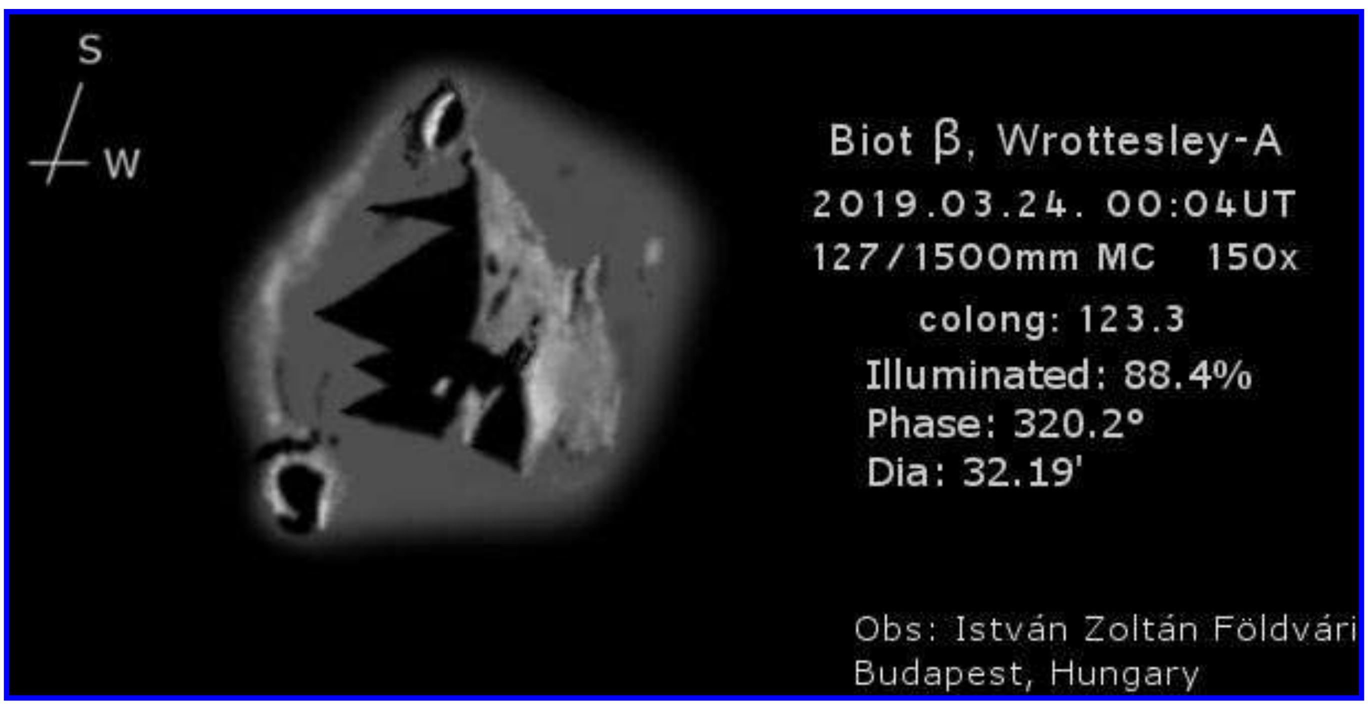
According to Raphael's indications, I concentrated on the Mare Undarum region, visible right on the eastern edge of the visible face. The first image was taken with a Celestron 3x apochromatic barlow, which gave me an equivalent focal length of about 3600mm and a sampling, with the Uranus-C 2.9 micron pixels, of 0.17" per pixel. In the other three I have used a Tecnosky ADC, the same Celestron 3x barlow and I slightly increased the draft with an additional connecting ring, bringing me to an equivalent focal length of about 5860mm and a sampling of 0.10" per pixel. The three images are almost identical, taken at short time intervals from each other."

Mare Undarum, *Massimo Dionisi, Sassari, Italy. 2023 August 02 22:08 UT. Sky Watcher 250 mm f/5 Newtonian reflector telescope, Technosky ADC, Celestron X-cel LX Barlow, 3x, fl 5,860 mm, IR pass filter 685 nm, Uranus-C camera. Seeing III-IV Antoniadi Scale.*

Recent Topographic Studies

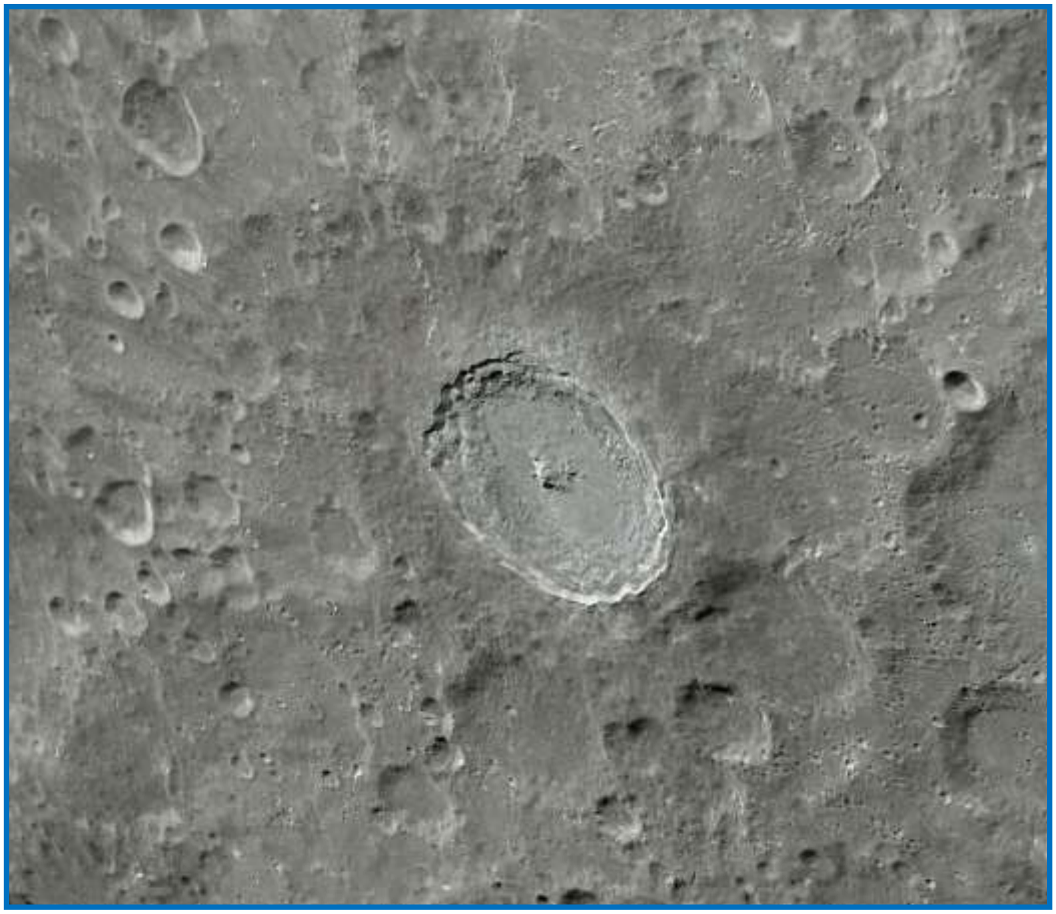
Eratosthenes, *Don Capone, Waxahachie, Texas, USA. 2023 August 07 10:58 UT. Orion xx16g at f/11, UV/IR cut filter, 2 x barlow, ADC, ASI678MC camera.*

Biot β, *István Zoltán Földvári, Budapest, Hungary. 2019 March 23, 23:58-00:13 UT, colongitude 123.3°. 127 mm Maksutov-Cassegrain telescope, 1500 mm focal length, 10 mm eyepiece, 150x. Seeing 6/10, transparency 4/6.*

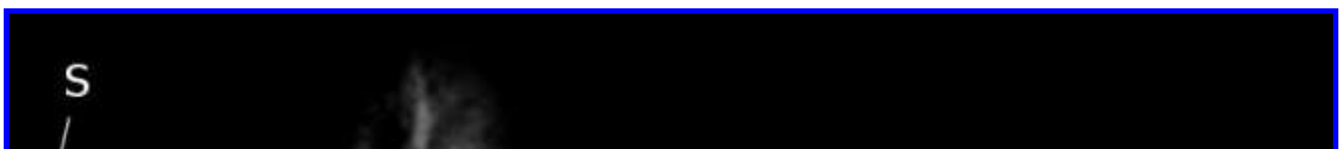


Recent Topographic Studies

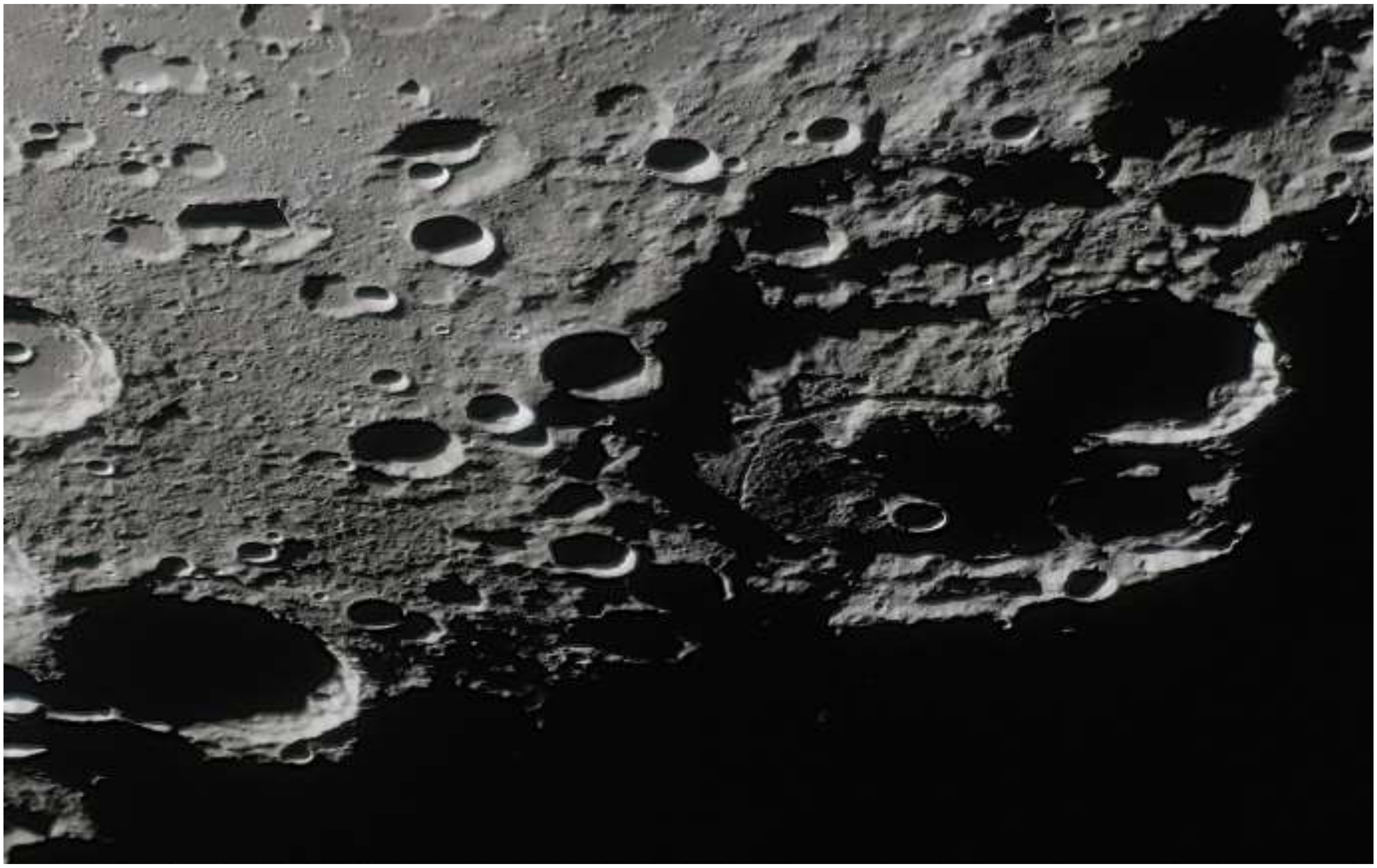
Tycho, *Don Capone, Waxahachie, Texas, USA. 2023 August 05 10:14 UT. Orion xx16g at f/11, UV/IR cut filter, 2 x barlow, ADC, ASI678MC camera.*



La Pérouse, la Pérouse-A, E, *István Zoltán Földvári, Budapest, Hungary. 2019 March 21, 22:20-22:42 UT, colongitude 98.2º. 70 mm refractor telescope, 500 mm focal length, Vixen LV Lanthanum 4 mm, 125x. Seeing 6/10, transparency 5/6.*



Recent Topographic Studies

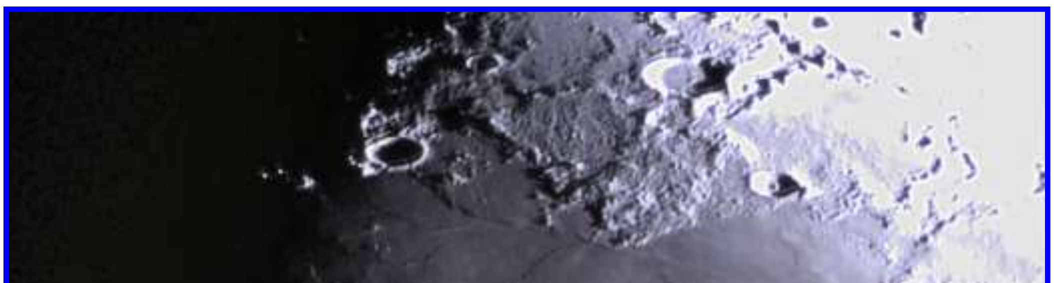


Janssen, *Don Capone, Waxahachie, Texas, USA. 2023 August 05 10:13 UT. Orion xx16g at f/11, UV/IR cut filter, 2 x barlow, ADC, ASI678MC camera.*

Copernicus, *Maurice Collins, Palmerston North, New Zealand. 2023 August 25 07:56 UT. Meade ETX90 Maksutov-Cassegrain telescope, QHYIII462C camera. Seeing I-II Antoniadi Scale.*

Recent Topographic Studies

Kästner, Kästner-B, C, E, *István Zoltán Földvári, Budapest, Hungary. 2019 March 21, 22:01-22:19 UT, colongitude 97.9°. 70 mm refractor telescope, 500 mm focal length, Vixen LV Lanthanum 4 mm, 125x. Seeing 6/10, transparency 5/6.*



Plato, *Maurice Collins, Palmerston North, New Zealand. 2023 August 25 07:44-07:51 UT. Meade ETX90 Maksutov-Cassegrain telescope, QHY-III462C camera. Seeing I-II Antoniadi Scale.*

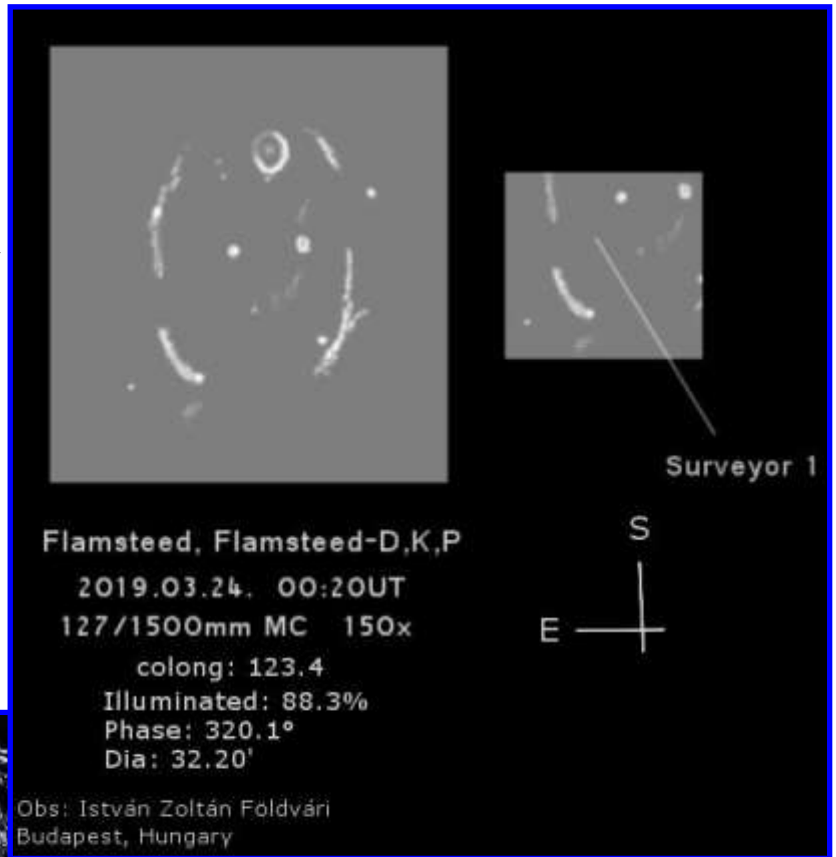
Recent Topographic Studies

Rupes Recta, *Maurice Collins, Palmerston North, New Zealand. 2023 August 25 07:57 UT. Meade ETX90 Maksutov-Cassegrain telescope, QHYIII462C camera. Seeing I-II Antoniadi Scale.*

8.9-Day old Moon, *Maurice Collins, Palmerston North, New Zealand. 2023 August 25 07:44-07:51 UT. Meade ETX90 Maksutov-Cassegrain telescope, QHYIII462C camera. Seeing I-II Antoniadi Scale.*

Recent Topographic Studies

Flamsteed and Flamsteed-D, K, P, *István Zoltán Földvári, Budapest, Hungary. 2019 March 24, 00:14-00:32 UT, colongitude 123.4°. 127 mm Maksutov-Cassegrain telescope, 1500 mm focal length, 10 mm eyepiece, 150x. Seeing 4/10, transparency 4/6.*



8.9-Day old Moon, *Maurice Collins, Palmerston North, New Zealand. 2023 August 25 07:52-07:55 UT. Meade ETX90 Maksutov-Cassegrain telescope, QHYIII462C camera. Seeing I-II Antoniadi Scale.*

Recent Topographic Studies

Mare Imbrium, *Maurice Collins, Palmerston North, New Zealand. 2023 August 25 07:58 UT. Meade ETX90 Maksutov-Cassegrain telescope, QHYIII462C camera. Seeing I-II Antoniadi Scale.*

Theophilus, *Walter Ricardo Elias, Oro Verde, Argentina, AEA. 2023 August 21 22:09 UT. Sky Watcher 150 mm f/5 reflector telescope, 2x barlow, QHY5-II 5C camera.*

Recent Topographic Studies

Vallis Alpes, *Maurice Collins, Palmerston North, New Zealand. 2023 August 25 07:49 UT. Meade ETX90 Maksutov-Cassegrain telescope, QHYIII462C camera. Seeing I-II Antoniadi Scale.*

Proclus, *Walter Ricardo Elias, Oro Verde, Argentina, AEA. 2023 August 21 22:01 UT. Sky Watcher 150 mm f/5 reflector telescope, QHY5-II 5C camera.*

Recent Topographic Studies

Theophilus, *Walter Ricardo Elias, Oro Verde, Argentina, AEA. 2023 August 21 21:59 UT. Sky Watcher 150 mm f/5 reflector telescope, 2x barlow, QHY5-II 5C camera.*

12-Day old Moon, *Maurice Collins, Palmerston North, New Zealand. 2023 August 28 08:51-08:55 UT. Meade ETX90 Maksutov-Cassegrain telescope, QHYIII462C camera. Seeing III Antoniadi Scale.*

Recent Topographic Studies

Langrenus, *Walter Ricardo Elias, Oro Verde, Argentina, AEA. 2023 August 21 21:59 UT. Sky Watcher 150 mm f/5 reflector telescope, 2x barlow, QHY5-II 5C camera.*

Pythagoras, *Larry Todd, Dunedin, New Zealand. 2023 August 29 07:49 UT. 8 inch OMC Maksutov-Cassegrain telescope.*

Recent Topographic Studies

Langrenus, *Walter Ricardo Elias, Oro Verde, Argentina, AEA. 2023 August 21 21:59 UT. Sky Watcher 150 mm f/5 reflector telescope, QHY5-II 5C camera.*

Aristarchus, *Maurice Collins, Palmerston North, New Zealand. 2023 August 28 08:58 UT. Meade ETX90 Maksutov-Cassegrain telescope, QHY-III462C camera. Seeing III Antoniadi Scale. Maurice adds:* "I managed to get a clear night last night and got some images and a quick look at the Moon. Seeing was average A-III as we had had rain during the day and it was cold and damp, just saturated air. But Aristarchus and Marius Hills looked nice on the terminator!"

Jansen, *Walter Ricardo Elias, Oro Verde, Argentina, AEA. 2023 August 21 21:57 UT. Sky Watcher 150 mm f/5 reflector telescope, QHY5-II 5C camera.*

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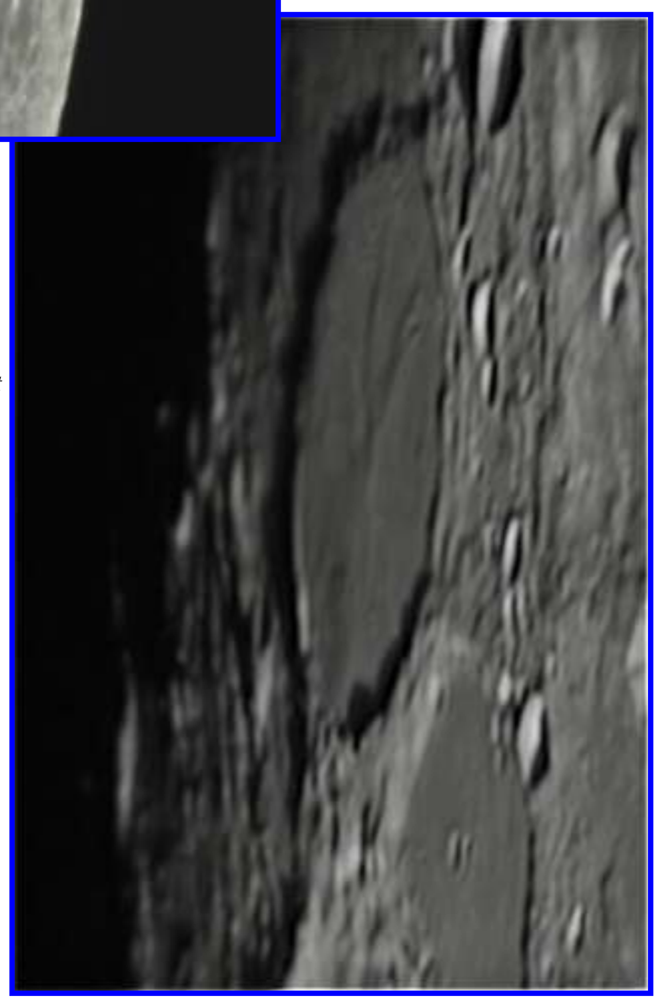
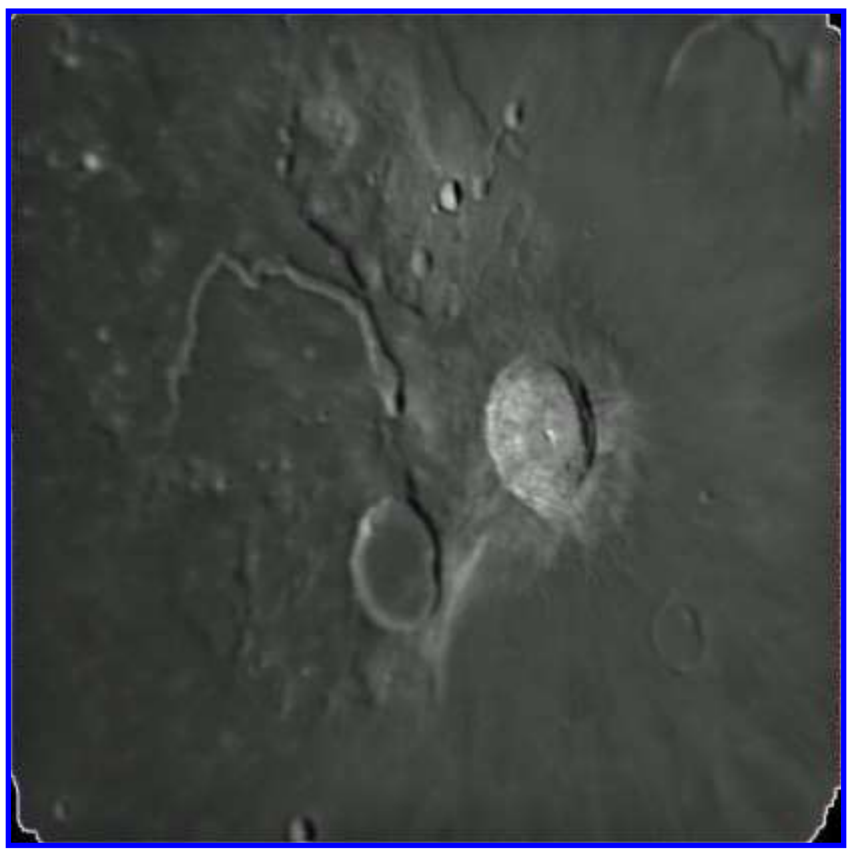


Wargentin, *Larry Todd, Dunedin, New Zealand. 2023 August 29 07:55 UT. 8 inch OMC Maksutov-Cassegrain telescope*

Recent Topographic Studies

Mons Rümker, *Maurice Collins, Palmerston North, New Zealand. 2023 August 29 08:30 UT. Celestron 8 inch Schmidt-Cassegrain telescope, QHYIII462C camera.*



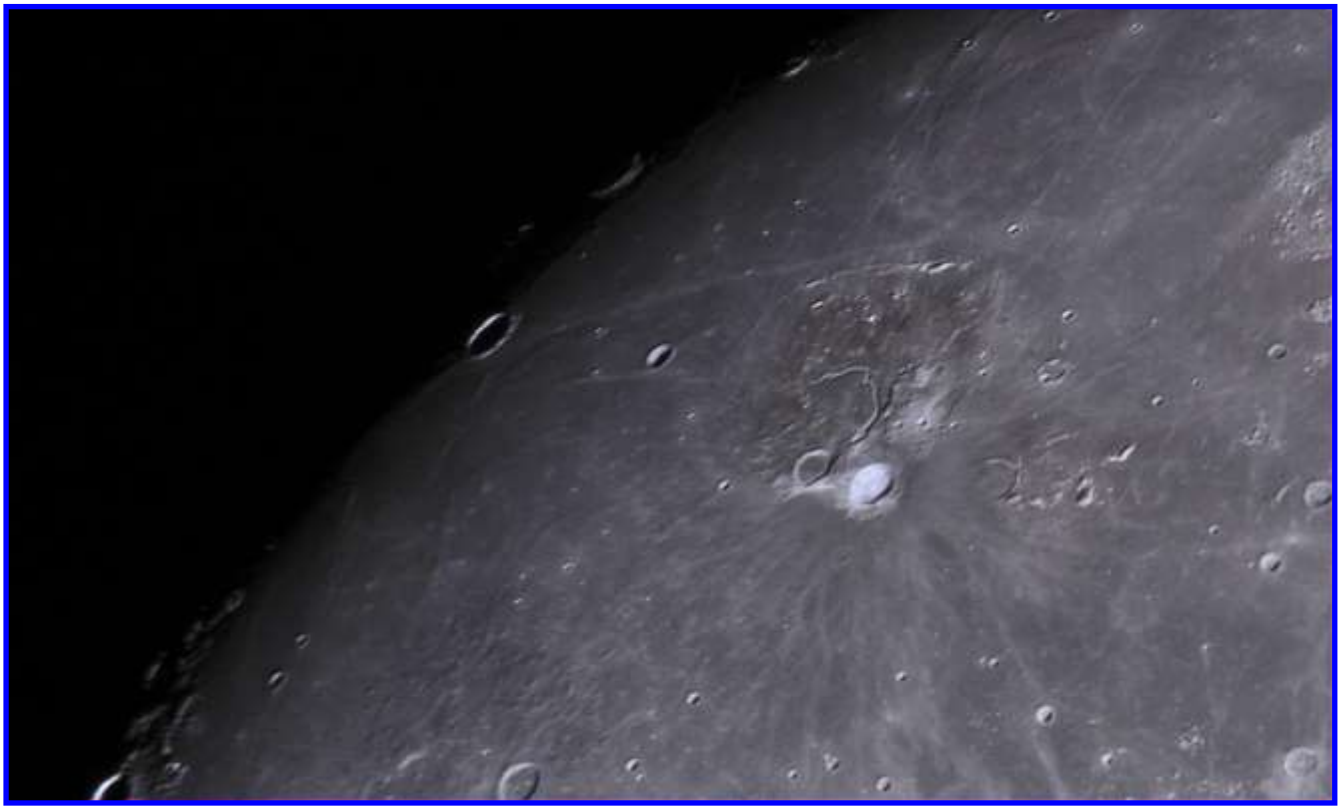
Aristarchus, *Larry Todd, Dunedin, New Zealand. 2023 August 29 08:04 UT. 8 inch OMC Maksutov-Cassegrain telescope*

Recent Topographic Studies

***12.9-day old Moon,** Maurice Collins, Palmerston North, New Zealand. 2023 August 29 07:49-08:00 UT. Celestron 8 inch Schmidt-Cassegrain telescope, QHYIII462C camera.*

***Rümker,** Larry Todd, Dunedin, New Zealand. 2023 August 29 07:44 UT. 8 inch OMC Maksutov-Cassegrain telescope*

Recent Topographic Studies



Aristarchus, *Maurice Collins, Palmerston North, New Zealand. 2023 August 29 07:46 UT. Celestron 8 inch Schmidt-Cassegrain telescope, QHYIII462C camera.*

Rümker, *Larry Todd, Dunedin, New Zealand. 2023 August 29 07:37 UT. 8 inch OMC Maksutov-Cassegrain telescope*

Recent Topographic Studies

Parting Shot
The Super Blue Moon.

Supermoon of August 30, 2023 at 11:24 pm local time or August 31, 2023 3h 24m UT. This image was taken approximately 23 hours after Category 3 Hurricane Idalia was churning northward in the Gulf of Mexico. Fortunately, the skies cleared around 11:00 pm local time and I was able to obtain this image. The ground was still wet after over three inches of rain. Amazingly, the seeing was above average at 6/10 while the transparency was below average 4/10 with haze and passing cloud banks. Image was taken with a Meade 60mm refractor with a 260mm focal length at f/4 piggybacked on a tracking equatorially mounted Meade 2080 Schmidt-Cassegrain telescope. Camera utilized was a ZWO ASI 178MM with an Optolong UV-IR cut filter. Aligned and stacked with Autostakkert 3.14 sharpened with Registax 6.1 and Photoshop CS4. The moon was 38 degrees above the horizon at 99.9% phase and 33'26" in size.

Recent Topographic Studies

Parting Shot
The Super Blue Moon.

14-day old Moon, *Maurice Collins, Palmerston North, New Zealand. 2023 August 30 08:33-08:45 UT. Meade ETX 90 Maksutov-Cassegrain telescope, QHYIII462C camera.*

Recent Topographic Studies

Lunar Geologic Change Detection Program

Coordinator Dr. Anthony Cook- atc@aber.ac.uk
Assistant Coordinator David O. Darling -DOD121252@aol.com

2023 September

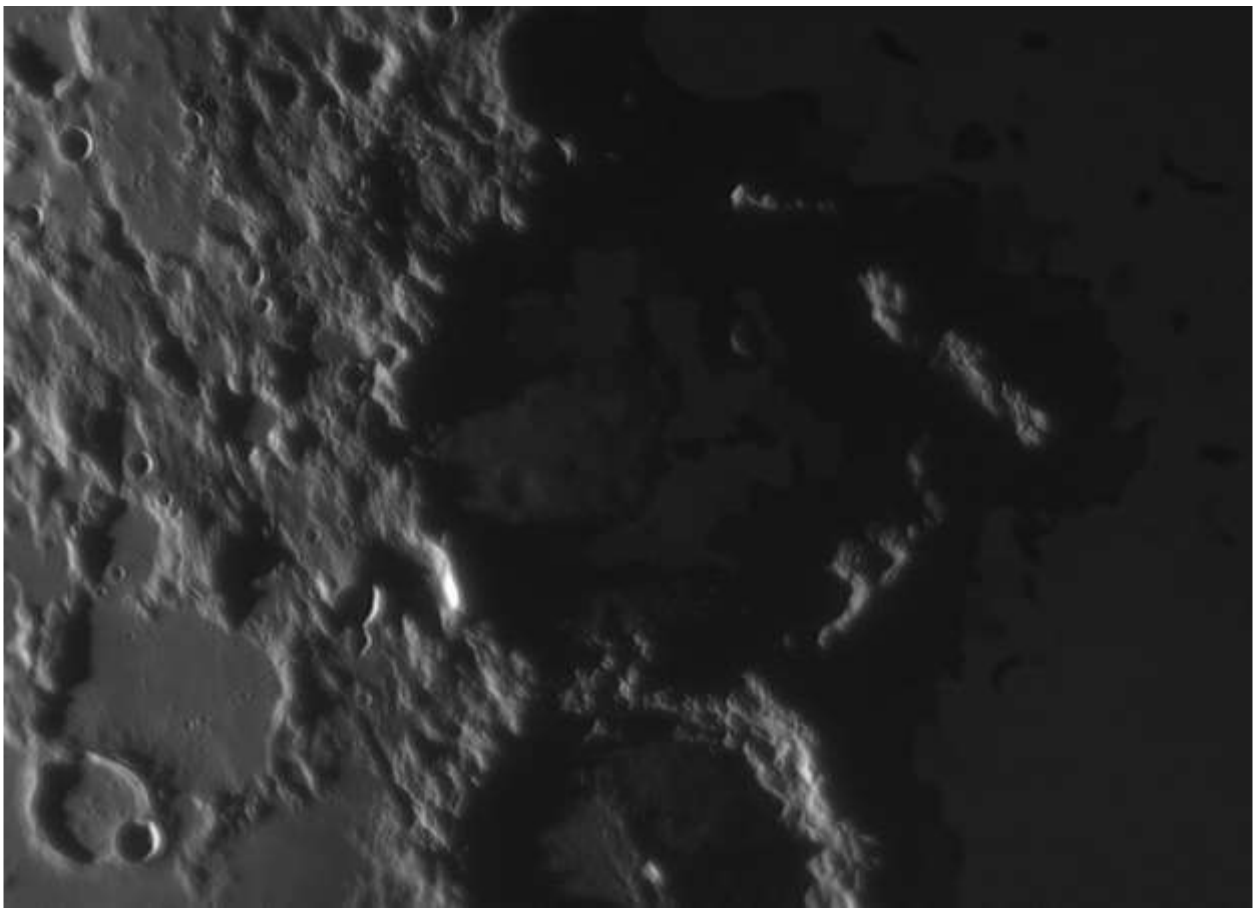


Figure 1. *Ptolemaeus, orientated with north towards the top as imaged by Bill Leatherbarrow on 2023 Aug 09 UT 04:43 with an ASI290MM camera and an Astronomik near IR 742nm pass filter.*

LTP Reports: Although not a LTP, Bill Leatherbarrow sent me an interesting image of the floor of Ptolemaeus (Fig 1) taken at sunset over this region. It shows a hazy, almost "ashen-light" like appearance to the floor. However, let's not get too hasty here, and remember at this time during a summer morning in the UK, the morning sky brightness is increasing rapidly in strength, so it is quite likely during the image stacking that the background in earlier images is darker than the later images, so I think the effect is probably a processing artefact, as it shows up well beyond the terminator too. Interestingly, it does not show up, beyond the terminator in an image he took of Clavius (not shown here) 4 min earlier at 04:39, but the scattered light in our atmosphere would have been less then.

During August I attempted to persuade observers to look for Perseid impact flashes in earthshine. From the UK we were thwarted by poor weather and an anti-social time to observe the Moon in the early hours of the morning.

However, from Europe we have three reports from 2023 Aug 13:

00:50:05UT estimated mag 0 naked eye flash (not a Perseid) seen visually by P. Slansky from near Sölden, Austria
02:28:03UTC a candidate Perseid impact flash videoed in earthshine by D. Koschny from Bavaria, Germany
02:29:01UT candidate mag 8-9 (I band) Perseid impact flash videoed in earthshine by A. Liakos from Greece

As all these flashes are unconfirmed, it is very important, that if you were observing the Moon at this time, that you check your observational records and let me and especially ALPO's impact flash coordinator, Brian Cudnik, know.

News: I have been asked to coordinate citizen science observing of impact flashes, during the Italian CubeSat LUMIO mission, due to launch in 2027. LUMIO will look for impact flashes on the far side of the Moon, but it is very important to compare this with the observed flux rate on the near side too. In order to do this, we need to set up an International Network of participating societies and observers. ALPO already has a group of observers in the USA (and some overseas), coordinated by Brian Cudnik, and the UAI has a team of observers in Italy, but we need a wider range of longitudinal coverage across the world. I would therefore like to ask our members outside the UK and USA if they could please email me contact details of any national or regional astronomical societies, in their own countries, that are the equivalent to the ALPO or BAA so that I may send them a research proposal to participate in LUMIO.

We also have an Indian Mission, Chandraayan-3 currently sitting on the Moon, between Manzinus C and Simpelius N craters, which should last one lunar day before its electronics may succumb to the cold lunar night. It has a seismometer on board, which apart from detecting deep, shallow and thermal quakes, can also detect quakes from impacts. It is therefore possible that if we attempt to look for impact flashes on the night side of the Moon, before the mission ends, this could help the Indian Space Agency ISRO, to geolocate the impact sites. Please therefore have a go at videoing the night side of the Moon, and let Brian Cudnik know if you detect any impact flashes. Details on when to observe and how to go about observing impact flashes can be found on:

https://www.pvamu.edu/pvso/cosmic-corner/lunar-meteor-watch/ & https://users.aber.ac.uk/atc/lunar_schedule.htm

and

https://users.aber.ac.uk/atc/flash/lifs.pdf & https://www.amazon.com/Meteoroid-Impacts-Observe-Astronomers-Observing-ebook/dp/B008BC5XII/ref=sr_1_2?keywords=cudnik&qid=1693435372&sr=8-2 .

A similar observing programme may run during the Artemis 3 manned surface mission, and beyond, so it's a good opportunity now to gain some practice and tune your impact flash observing skills.

Routine reports received for July included: Maurice Collins (New Zealand - ALPO/BAA/RASNZ) imaged: Aristarchus, Eratosthenes, Gassendi, Milichius, Plato, Schickard, Sinus Iridum, Tycho, and several features. Anthony Cook (Newtown & Mundesley, UK – ALPO/BAA) imaged/videoed: several features & earthshine in the Short-Wave IR and in visible light. Walter Elias (Argentina – AEA) imaged: Aristarchus, Darwin, Moltke, Mons Pico and Mons Piton. Les Fry (West Wales, UK – NAS) imaged the Moon. Ivan Walton (Cranbrook, UK - BAA) imaged: Copernicus, Geminus, and Tycho.

Analysis of Reports Received (July):

Darwin: On 2023 Jul 01 Walter Elias (AEA) imaged this crater under similar illumination to the following Sir Patrick Moore report:

Darwin 1945 Oct 19 UT 23:23 - P. Moore (UK) saw 3 brilliant points of light on wall. 12" reflector used. NASA catalog ID #495, NASA weight=3. ALPO/BAA weight=3.

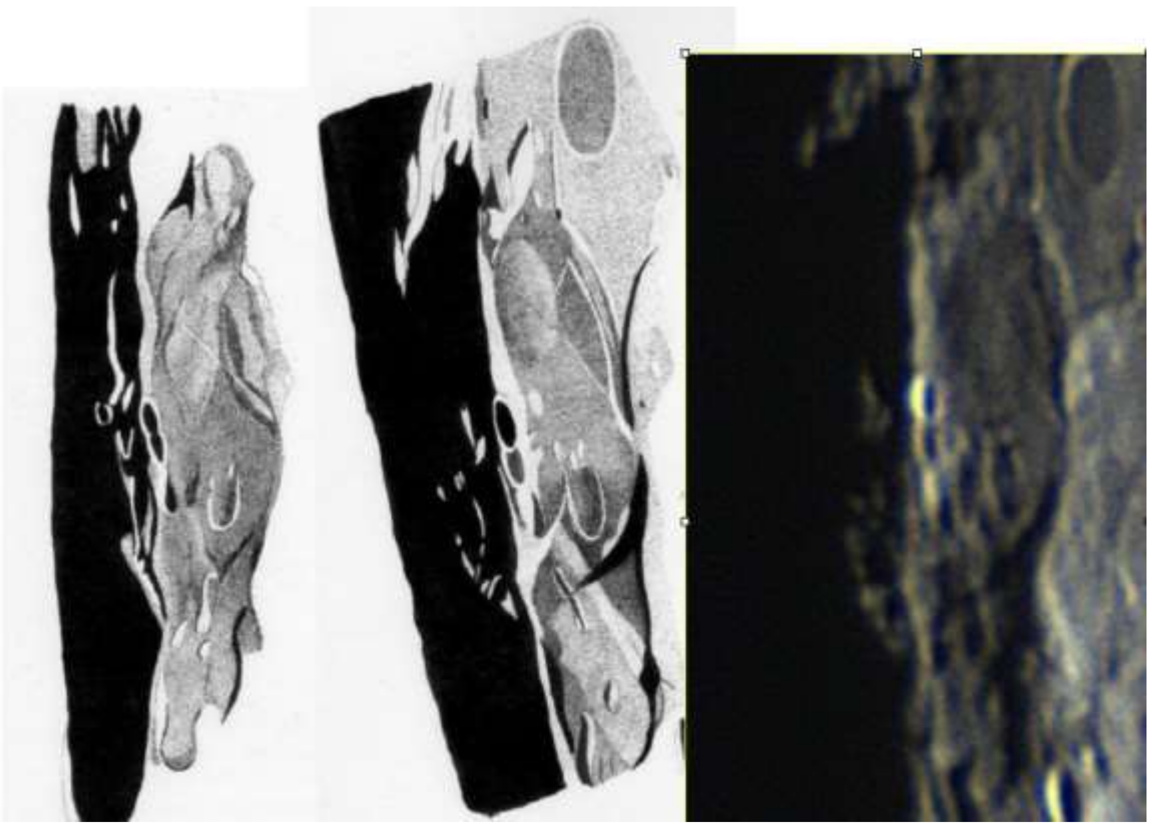


Figure 2. *Darwin orientated with north towards the top.* ***(Left)*** *As sketched by Collin Ebdon (BAA) on 1998 Nov 02 UT 22:50-00:40.* ***(Center)*** *As sketched by Collin Ebdon (BAA) on 2002 Oct 19 UT 22:00-23:15.* ***(Right)*** *As imaged by Walter Elias (AEA) on 2023 Jul 01 UT 21:32.*

The sketches and image in Fig 2 show what Darwin would have looked like, according to the predictions, if everything was normal – ignoring libration. Three craterlets can be seen on the west rim of Darwin, but none are especially bright, and there are no three bright points elsewhere along the entire rim. I decided to take a look at the data in the Cameron catalog. She uses a UT of “21:00?”, and this is what I have used in my database. However, as you can see in the description above, Moore gives 23:23, which is more accurate. So, the predictions are wrong. I have since updated the database and recalculated the predictions and Fig 2 (Left) would have been the closest that we have in the archives, to the Patrick Moore report. But it still shows no sign of those three bright points. I shall therefore leave the weight of this LTP report at 3.

Bullialdus: On 2023 Jul 27 UT 23:30 Ivan Walton (observing remotely via a robotic scope in Chile) observed this crater under similar illumination to the following report:

On 1975 Mar 22 at UT 21:17-21:23 Findlay and Ford (Mills Observatory, Dundee, UK, 25cm refractor, Wratten 25 and 44a filters used) A white spot was observed on the rim of Bullialdus that was perhaps slightly brighter in red than in white light. The observers however decided that they did not regard this as a LTP. This is a BAA Lunar Section Observation. ALPO/BAA weight=1.

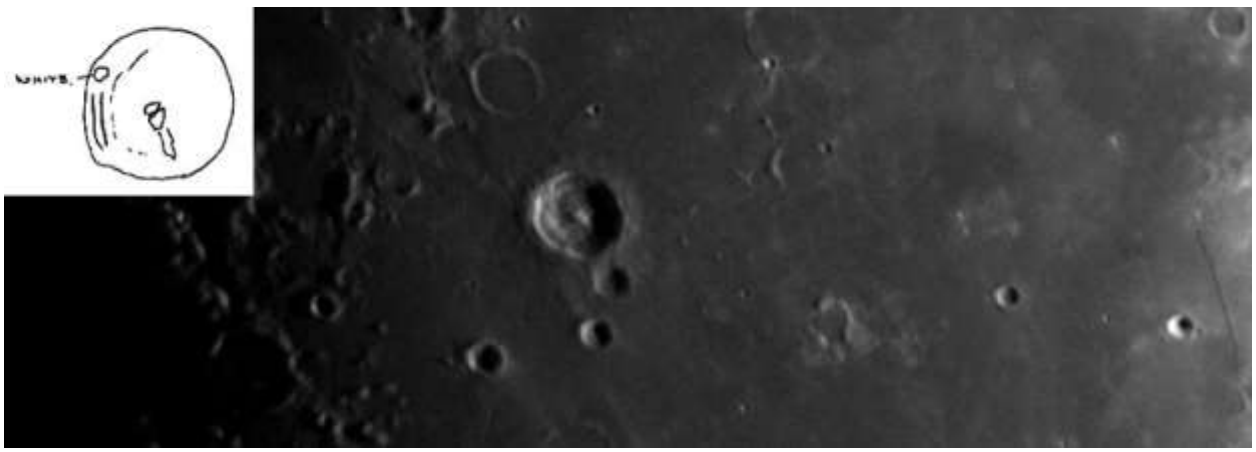


Figure 3. *Bullialdus orientated with north towards the top. Taken by Ivan Walton on 2023 Jul 27 UT 23:30, using a robotic telescope in Chile, through a blue filter. The insert sketch is a rotated version of a sketch by Findlay and Ford made on 1975 Mar 22 at 21:17-21:23.*

Although Ivan’s image is monochrome (Fig 3), it is nevertheless a useful context image as you can quite clearly see the white spot on the rim of the crater that Findlay and Ford were discussing, as depicted in the insert. We shall leave the weight at 1 for now.

Langrenus: On 2023 Jul 30 Maurice Collins (ALPO/BAA/RASNZ) imaged this area in a whole lunar disk image, under similar illumination to the following observation by Sir Patrick Moore:

On 1992 Feb 16 at UT 01:05-01:35 P. Moore (Selsey, UK, 12.5" reflector, seeing=III) found the north rim area to be both very bright and misty - though he did not think it to be a LTP but wanted it to be recorded, just in case. The Cameron 2006 catalog ID=440 and the weight=1. The ALPO/BAA weight=1.

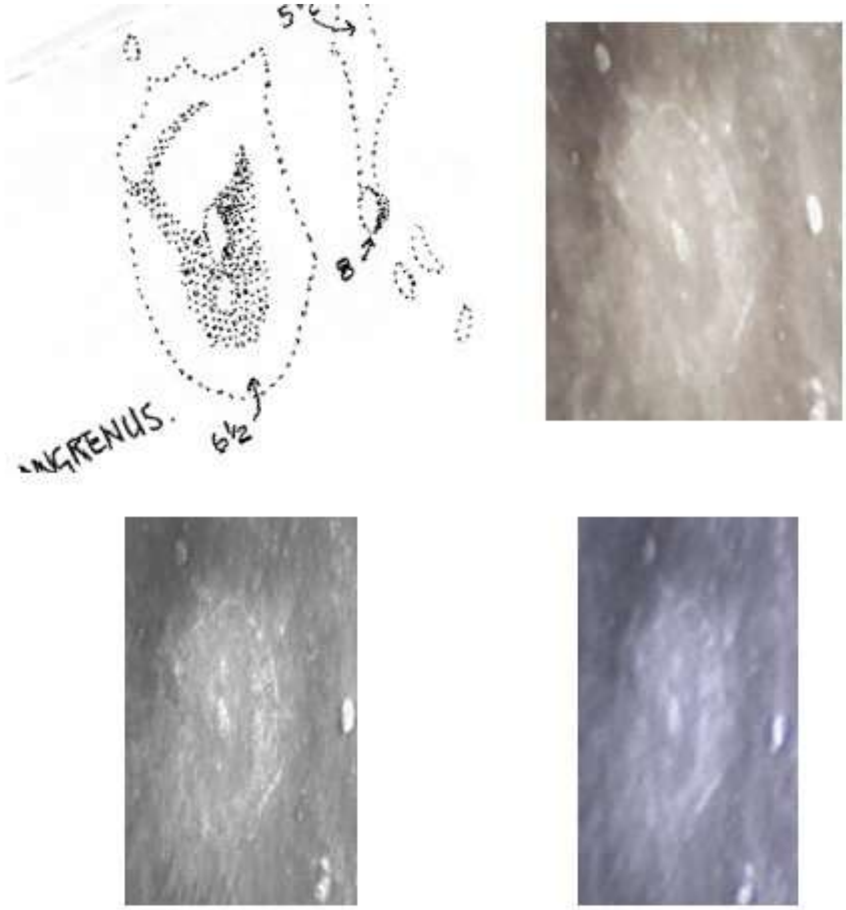


Figure 4. *Langrenus orientated with north towards the top.* ***(Top Left)*** *A sketch by Nigel Longhurst (BAA) with visual intensity numbers added, made on 2001 Sep 29 UT 19:22-22:12 (note original image was oriented north at the bottom but has been inverted and annotation rotated so it's readable.* ***(Top Right)*** *Subsection from an image mosaic taken by Rolf Hempel (BAA) on 2011 Apr 15 UT 20:14-20:44.* ***(Bottom Left)*** *An image taken by Brendan Shaw (BAA) taken on 2014 Mar 13 UT 21:43.* ***(Bottom Right)*** *Subsection of an image taken by Maurice Collins (ALPO/ BAA/RASNZ) taken on 2023 Jul 30 UT 06:06-06:10.*

Interestingly the image by Maurice Collins (Fig 4 – Bottom Right), and indeed a couple of other images from the archive (Fig 4 Top Right and Bottom Left), and a visual estimate (Fig 4 – Top Left), show no resemblance to Patrick Moore description of the north rim being "very bright". As to the "misty" description, well that could be true for many other parts of the rim. We have covered this report before in the 2018 Nov newsletter, when again the northern rim was described as neither misty nor very bright. In view of the fact that Patrick Moore's description of the very bright rim, is at odds with the normal appearance in Fig 1, I think we should increase the weight of this LTP report from 1 to 2.

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. 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 .

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

Basin and Buried Crater Project

Coordinator Dr. Anthony Cook- atc@aber.ac.uk

No images or sketches have been sent in specifically for the BBC project, taken during August, so I thought that I would pick a candidate buried crater from the catalog and look at evidence for there being a crater there. So this month's buried crater is: QMCA 63, which is located at 24.5˚E 4.9˚N with a diameter of 137 km. QMCA stands for "Quasi-Circular Mass Anomaly" meaning something shows up in the gravity data that is typical for what one would expect a buried crater to look like. The QMCA's listed come from the paper by: A.J. Evans, J. M. Soderblom, J. C. Andrews-Hanna, S. C. Solomon, and M. T. Zuber (2016), Identification of buried lunar impact craters from GRAIL data and implications for the nearside maria, Geophys. Res. Lett., 43, 2445–2455, doi:10.1002/2015GL067394.

So, let's look at the NASA Quick Map web site and see what is present at this location. I always like to take a look at azimuth direction plots of the slope on the surface as these are usually quite revealing, at least on mare plains. Fig 1 shows that the proposed center of QMCA 63 is on the western edge of the Lamont buried crater. Lamont is sometimes thought to be a double ring crater with an inner ring of 60 km and an outer ring of 120 km. However, despite the normal usefulness of slope azimuth plots, I can see no evidence of circular structures centered on QMCA 63's position.

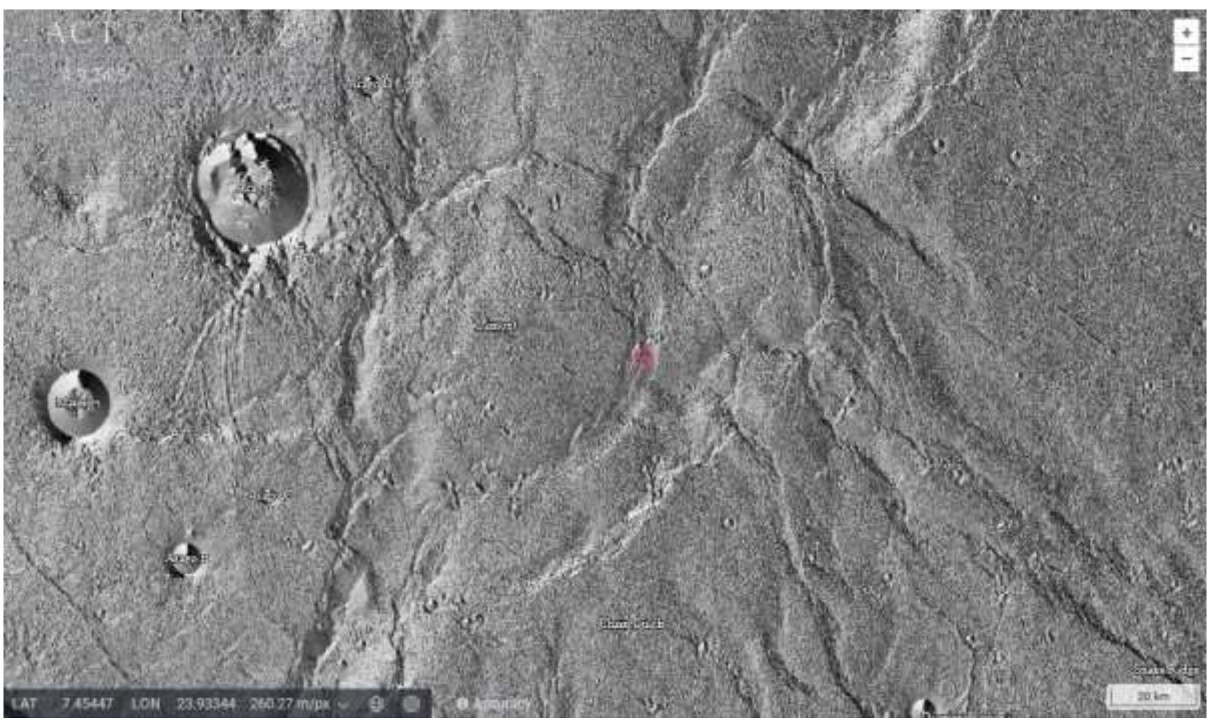


Figure 1 *LROC Quickmap SLDEM2015 topographic slope azimuth direction plot. The location of the center of the proposed QMCA 63 buried crater is represented by the pink circle and cross in the center of the image. The scale bar on the bottom right is 20 km long.*

Sometimes straight forward slope plots can show up shallow topography that might form part of buried craters (see Fig 2), but yet again, there are no circular structures of a diameter of 137 km (or otherwise) centered on where QMCA 63 ought to be situated.

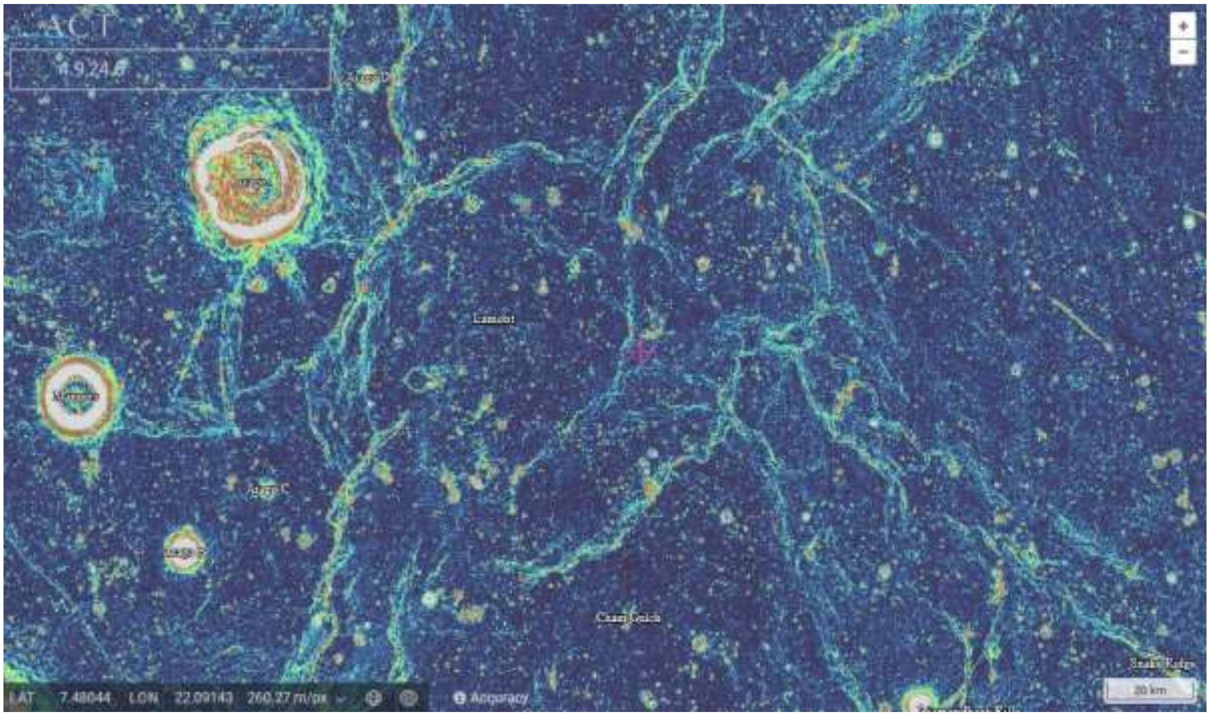


Figure 2 *LROC Quickmap SLDEM2015 topographic slope plot, scaled from 0 to 25m. Anything that is white has a slope of greater than 25˚*

One final effort to see if any circular structures are present is to look at the gravity data; in this case the crustal thickness map (Fig 3). This shows the location of a known mascon beneath the surface. Lamont is noticeably to the west of this.

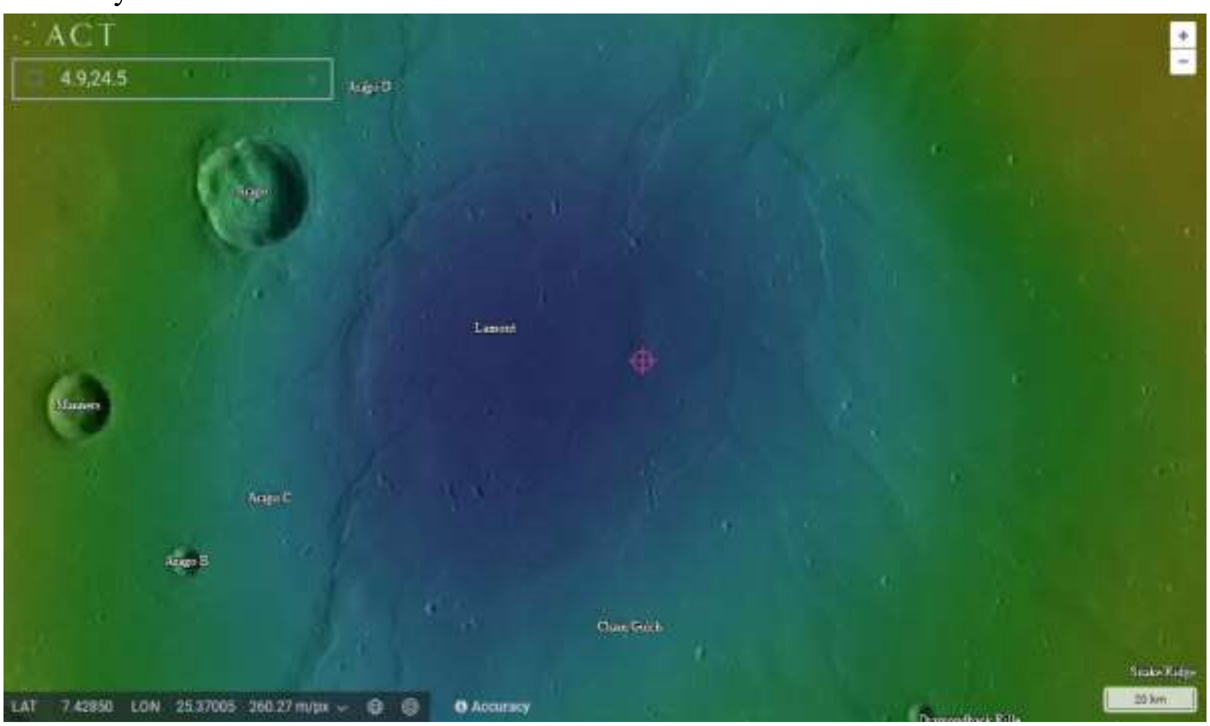


Figure 3*. LROC Quickmap crustal thickness map; dark blue is 10 km thick and green is 25 km thick.*

The presence of the mascon has been known about for decades, but there is no evidence for the remains of a buried crater directly above the location of the Mascon. Therefore, I will lower the weight of this proposed crater to 1, as we need more than just a hint of a gravitational signature. What may have been there has since been eroded, buried by lava and even melted and collapsed from its base down due to the thinness of the crust here. Lamont, to the west is another example, of possibly a later crater that can barely still be seen except close to sunrise or sunset, though it is elliptical compared to nearby craters suggesting a shallow impact direction to the surface.

If you think that you have discovered a new impact basin, or unknown buried crater, please check whether it has been found previously on the following web site, and if not email me its location and diameter so that I can update the list.

https://users.aber.ac.uk/atc/basin_and_buried_crater_project.htm.

Alternatively, if you want an observational challenge, try to see if you can image one of more of the basins or buried craters at sunrise/set and establish what colongitude range they are best depicted at. Or you can even do this “virtually” with LTVT software. As you can see from the tables on the web sites there are lot of blank cells to fill in on the sunrise and sunset colongitude columns – so a good opportunity for you to get busy!

Lunar Calendar September 2023

Date	UT	Event
3	0744	Moon at ascending node
4	2000	Jupiter 3° south of Moon
5	0900	Uranus 3° south of Moon
5	2000	Moon 1.2° south of Pleaides
6		East limb most exposed (+7.7°)
6	2221	Last Quarter Moon
9		Greatest northern declination (+28.0°)
10		South limb most exposed (-6.7°)
10	0400	Pollux 1.5° north of Moon
12	1600	Moon at apogee 406,291 km
15	0140	New Moon lunation 1246
16	1900	Mars 0.7° south of Moon, occultation North America, northern South America
17	1918	Moon at descending node
21	0800	Antares 0.9° south of Moon, occultation Russia to Micronesia
21		West limb most exposed (-6.8°)
22	1932	First Quarter Moon
23		Greatest southern declination (-28.3°)
25		North limb most exposed (+6.7°)
27	0100	Saturn 3° north of Moon
28	0100	Moon at perigee 359,911 km
28	1700	Neptune 1.4° north of Moon, occultation Antarctica
30	0957	Full Moon
30	1649	Moon at 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 non-member you are invited to join our organization for its many other advantages.

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

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

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

SUBMISSION THROUGH THE ALPO IMAGE ARCHIVE

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

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

It is helpful if the filenames follow the naming convention :

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
Alberto Anunziato–albertoanunziato@yahoo.com.ar
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: Dorsa Smirnov

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 November 2023, will be Dorsa Smirnov. 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):

Alberto Anunziato – albertoanziato@yahoo.com-ar
David Teske – david.teske@alpo-astronomy.org

Deadline for inclusion in the Dorsa Smirnov Focus-On article is October 20, 2023

FUTURE FOCUS ON ARTICLES:

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

Subject	TLO Issue	Deadline
Dorsa Smirnov	**November 2023**	**October 20, 2023**
Sinus Iridum	**January 2024**	**December 20, 2023**
Lacus Mortis	**March 2024**	**February 20, 2024**
Chains of Craters	**May 2024**	**April 20, 2024**
Mare Nectaris	**July 2024**	**June 20, 2024**

Focus-On Announcement
Hiking in the Moon: Dorsa Smirnov

It costs nothing to dream about the future. If the Moon will surely be humanity's first step out of its terrestrial cradle, the place where we do everything a second time, there will also be a time for us to take our passion for the trails to our second home. And when we get used to walking in the regolith, perhaps the new challenge will be the gentle heights that almost completely cover the maria, we are talking about the wrinkle ridges. Although Dorsa Smirnov would not be the first option for a walk, due to the steepness of its crests, it is ideal for a telescopic tour. It is the most complex and extensive dorsal system on the Moon. It is located on the eastern edge of the Mare Serenitatis and is better known as Serpentine Ridge (an ancient name that also included what is now known as Dorsa Lister). We will tour the Serpentine Ridge structure, trying to see the topographic details of this fascinating series of elevations. Please check your files for images of these spectacular dorsa and forward them by October 20, 2023 to Alberto Anunziato and David Teske.

NOVEMBER 2023 ISSUE-Due October 20, 2023: DORSA SMIRNOV

JANUARY 2024 ISSUE-Due December 20, 2023: SINUS IRIDUM

MARCH 2024 ISSUE: Due February 20, 2024: LACUS MORTIS

FOCUS ON MAY 2024: Due April 20, 2024: CHAIN OF CRATERS

FOCUS ON JULY 2024: Due June 20, 2024: MARE NECTARIS


Serpentine Ridge, 2020/05/28, 00:37 UT
Colongitude 338.7, Seeing 7-8/10, Transparency 5/6
C9.25 Schmidt-Cassegrain, f/10, FL 2395mm, Celestron Skyris 236M, No Filters
Howard Eskildsen, Ocala, Florida, USA

Focus-On Announcement
A Dream Landscape: Sinus Iridum

Few places on the Moon are as evocative as Sinus Iridum, The Bay of the Rainbow. An ancient crater flooded by the lavas of Mare Imbrium is, at the same time, a pareidolia of a bay, and the near side itself is a pareidolia of land and sea. We have known for centuries that it is not a mountainous bay, but it continues to fascinate us as if it were the Cote d'Azur from another world. Beyond science fiction, which has chosen it several times to situate its adventures, we propose to share images to learn a little more about this dream land of contrasts.

NOVEMBER 2023 ISSUE-Due October 20, 2023: DORSA SMIRNOV

JANUARY 2024 ISSUE-Due December 20, 2023: SINUS IRIDUM

MARCH 2024 ISSUE: Due February 20, 2024: LACUS MORTIS

FOCUS ON MAY 2024: Due April 20, 2024: CHAIN OF CRATERS

FOCUS ON JULY 2024: Due June 20, 2024: MARE NECTARIS

Larry Todd