The Lunar Observer

A Publication of the Lunar Section of ALPO

David Teske, editor

Coordinator, Lunar Topographic Studies Section Program

October 2023

In This Issue

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 <u>one person operation; mine</u>. 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. **Images in jpeg formats are usually used.**
3. **Please crop your images so that the edges are not jagged. This sharpens the look up much.**
4. **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).**
5. **Please try to be very limited on end of the month submissions.**
6. **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.**
7. **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 great month. Here in the northern hemisphere, I am so glad that autumn is here. After the oppressive heat of summer, the weather is much better. To our southern hemisphere observers, Happy Spring!

In this issue of The Lunar Observer, please find interesting articles about lunar topography by Rik Hill, Robert H. Hays, Jr., Alberto Anunziato, Paul Walker and Jeff Grainger. As always, Tony Cook investigates Lunar Geologic Change and Buried Craters and Basins. Plus, many beautiful images of Luna from lunar observers all over the world. Thanks for all who contributed.

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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Harvest Supermoon of September 28, 2023 at 10:43 pm local time or September 29, 2023 2h 43m UT. This is the last supermoon of 2023. Seeing was good at 7/10 while the transparency was average at 6/10 with haze some passing high clouds. Image was taken with a Meade 60mm refractor with a 260mm focal length at f/4 on an inexpensive Orion mini-EQ drive and tripod. 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 44 degrees above the horizon at 99.8% phase and 33'06" in size. Image by Gregory T. Shanos from Sarasota, Florida

Lunar Topographic Studies

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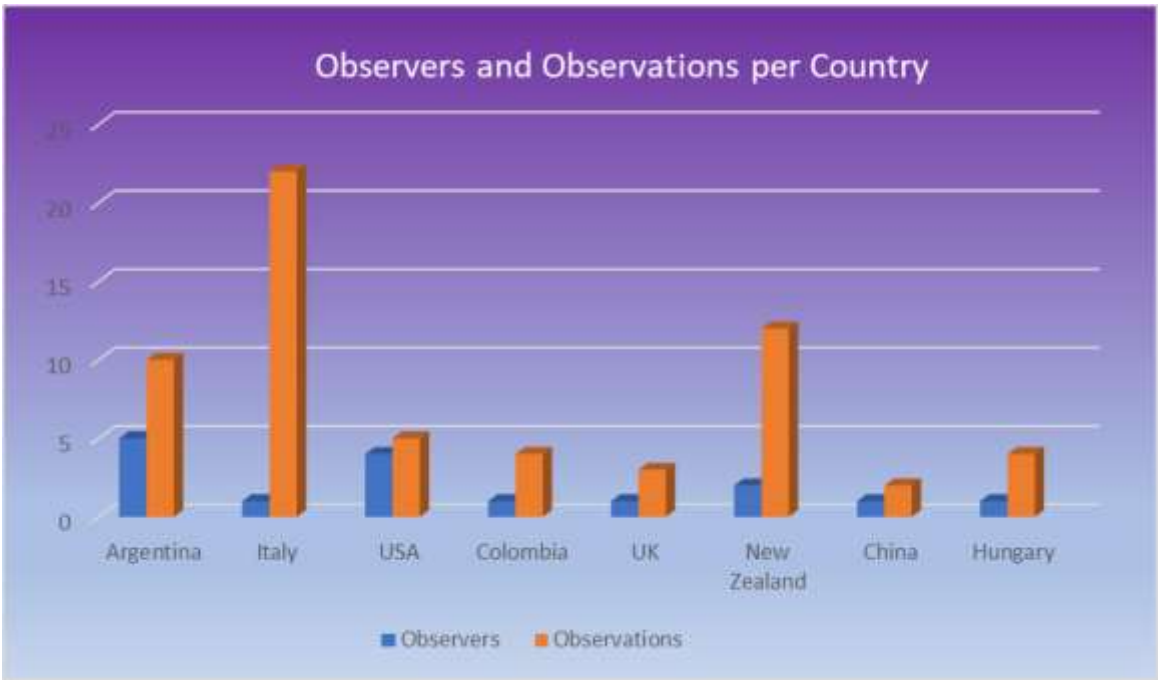
Observations Received

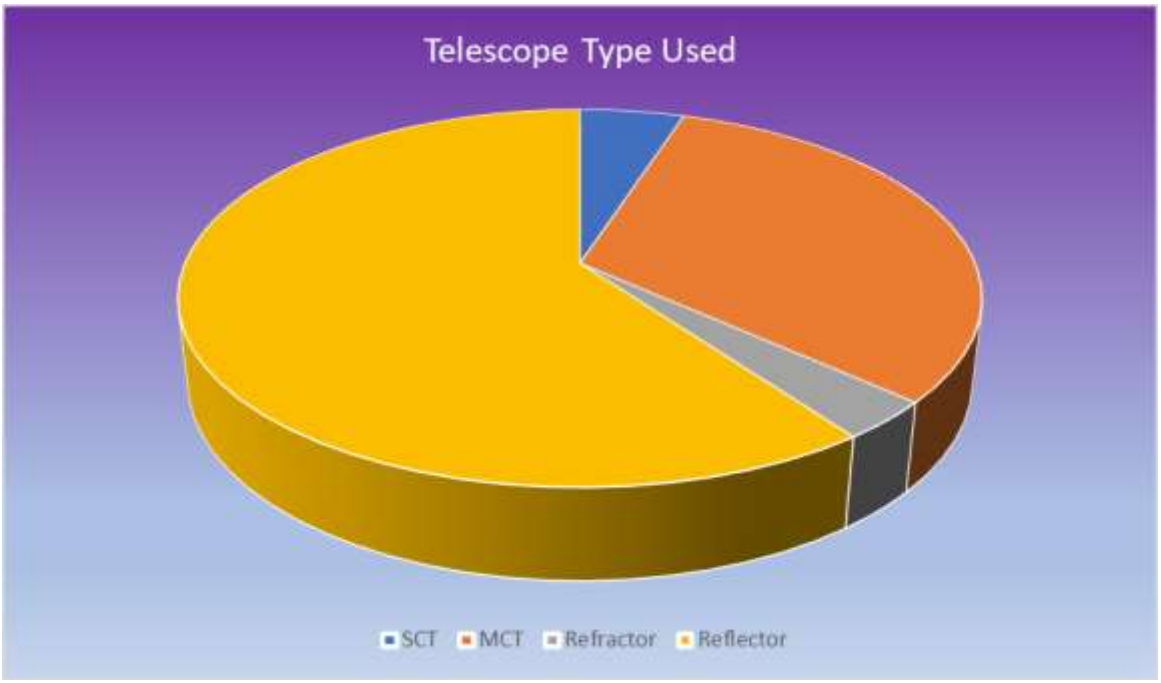
Name	Location and Organization	Image/Article
Alberto Anunziato	Paraná, Argentina	Articles *Traveling With the Vikram Lander,* and *Deciphering Secchi Crater*.
Francisco Alsina Cardinalli	Oro Verde, Argentina	Images of Aristarchus, Linné, Mare Serenitatis and Posidonius.
Jairo Chavez	Popayán, Colombia	Images of the Waxing Crescent Moon, Anaxagoras, Waxing Gibbous Moon and Full Moon.
Maurice Collins	North Palmerston, New Zealand	Image of Chandrayaan-3 landing site and 6.2-day old Moon (2).
Massimo Dionisi	Sassari, Italy	Images of Mare Humboldtianum, Gauss, Petavius, Mare Undarum, Lacus Autumni, Balmer, la Pérouse, Palus Putredinis, Hipparchus, Sinus Fidei, Albategnius, Apenninus, Ptolemaeus, Arzachel, Purbach, Alphonsus, Walther, Sinus Iridum, Hortensius, Milichius, Kies and T. Mayer.
Walter Ricardo Elias	Oro Verde, Argentina, AEA	Images of Aristarchus, Copernicus and Tycho.
István Zoltán Földvári	Budapest, Hungary	Drawings of Rima Furnerius, Pontécoolant, Pomortsev and Mercurius.
Diego Giufrida	Gonnet, Buenos Aires, Argentina	Image of Copernicus.
Jeff Grainger	Cumbria, UK	Article with images *Mare Nectaris: A Review of Major Features.*
Robert H. Hays, Jr.	Worth, Illinois, USA	Article and drawing *Lassell.*
Rik Hill	Loudon Observatory, Tucson, Arizonia, USA	Article and image *Just a Fingernail Clipping*.
KC Pau	Hong Kong, China	Image of Rupes Recta and Gassendi.
Greg Shanos	Sarasota, Florida, USA	Image of the Harvest Moon.
Larry Todd	Dunedin, New Zealand	Images of Mare Orientale (2), Hesiodus, Rupes Recta, Hadley Rille, Plato, Copernicus, Messier, Hercules, Clavius and Vallis Alpes
Gonzalo Vega	Oro Verde, Argentina, AEA	Image of the Waxing Gibbous Moon.
Paul Walker	Middlebury, Vermont, USA	Article and image *Western Mare Tranquillitatis* and *Maginus, Clavius, Blancanus, Klaproth and Casatus*

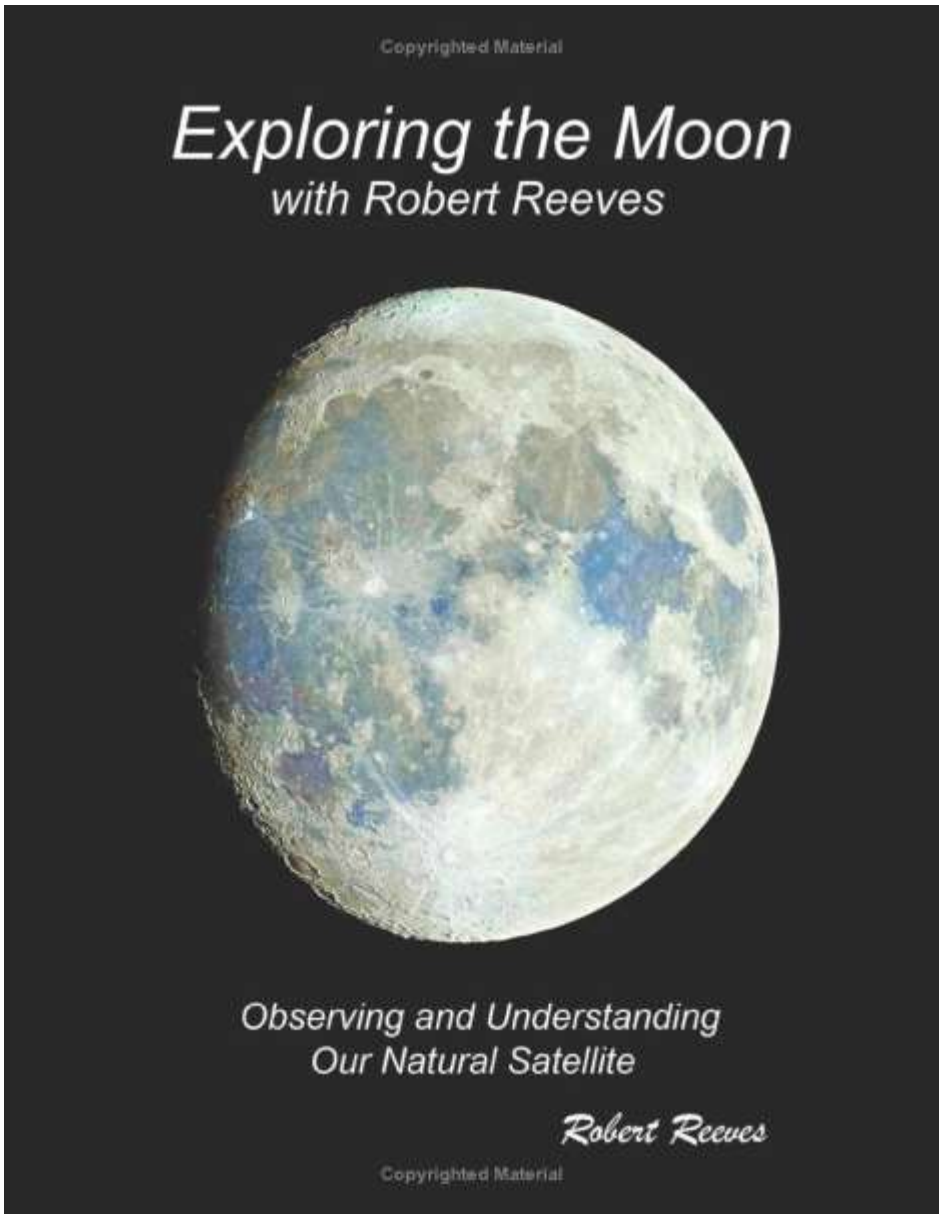
Many thanks for all these observations, images, and drawings.

October 2023 *The Lunar Observer*
By the Numbers

This month there were 62 observations by 16 contributors in 8 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.

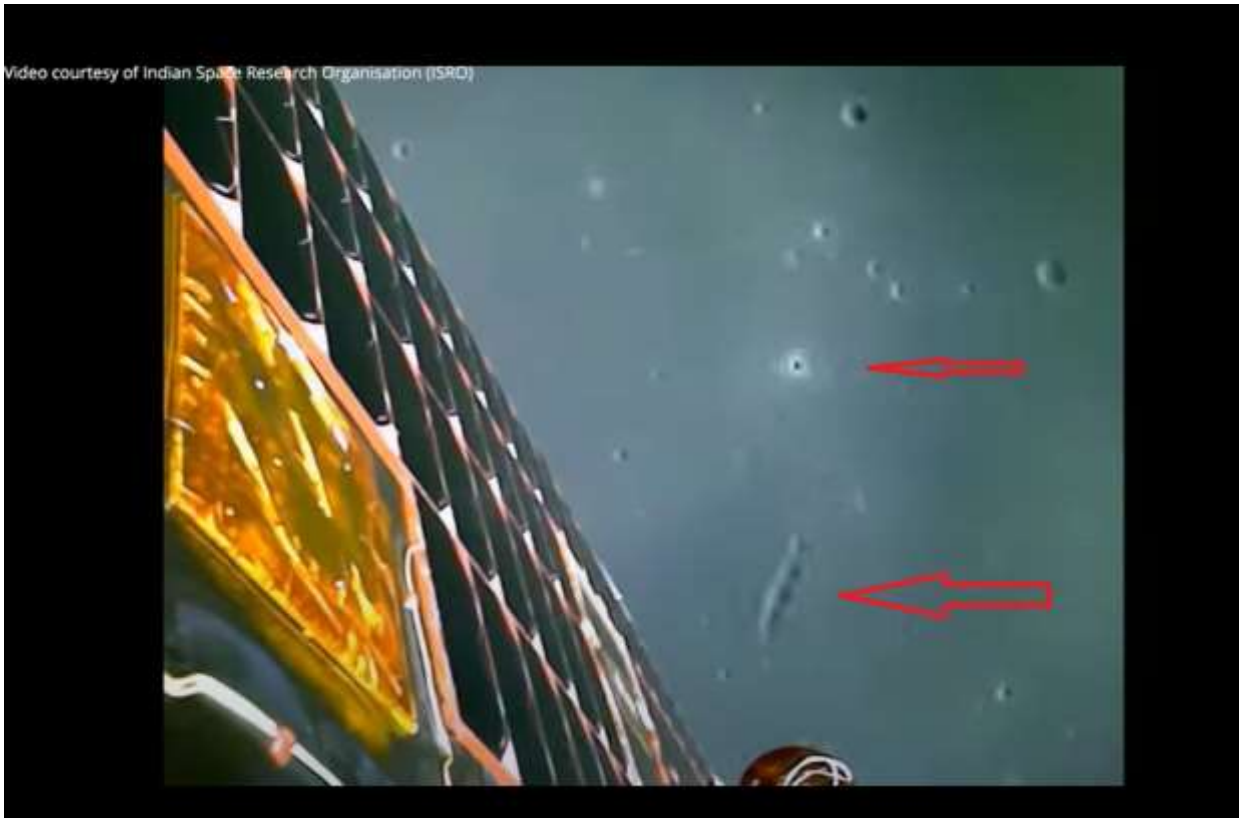
Traveling With the Vikram Lander

Alberto Anunziato

Lovers of the Moon cannot stop observing the details of its surface, even in images that are not intended for selenographic analysis. Doesn't this happen to you? When the high-magnification lenses used by photographers at sports events briefly focus on the Moon over a stadium. Don't you scrutinize what you see? The same happens with the images of probes descending on the lunar surface, although unfortunately they do not always give an easily interpretable landscape. That is why I was fascinated by the images of the Indian Lander Vikram descending near the Manzinus U crater on August 23. The descent was rapid and wonderful images of different selenographic features, very varied from one another, followed one another. The video I used is found on YouTube; it is called Chandrayaan 3 landing-Onboard camera view (https://www.youtube.com/watch?v=IhTQ6bNuP8c&t=56s). If we stop the image, we can make a selection of the features that can be seen in less than 3 minutes. You can see a beautiful selection of craters. We will indicate the exact time in minutes and seconds to which part of said video each image belongs. We start with the little ones. IMAGE 1 0.11 is the "most typical" panorama, a random series of small craters. In those few minutes there are several chains of very evident craters, such as IMAGE 2 2.08 and IMAGE 3 0.19, in which a crater evidently younger than the others is also seen, surrounded by its bright outline of fresh material. IMAGE 4 0.06 shows a larger crater, with the characteristics of a simple crater, one of the smallest on the scale: smooth bowl-shaped floor with a perfectly circular rim, similar to the one we see in IMAGE 5 0.42, with a much less flat floor. We can only glimpse a large crater in IMAGE 6 1.11, of which we only see a very degraded terraced wall. More interesting are the craters that follow. IMAGE 7 0.47 also shows a recent crater, with bright ejecta clearly indicating an oblique impact. The crater that we see in IMAGE 8 1.44 due to its shape and the depth of its shadows... could it be a crater of volcanic origin? What is the origin of the strange shape of the crater that we see in IMAGE 9 0.53? By zooming in on good quality photographic images you can see craters similar to the one we marked with an arrow. And the crater seen in IMAGE 10 0.14 and marked with arrow 1 is similar to the previous one, although to tell the truth it almost doesn't look like a crater. And what we mark with arrow 2 could well be a concentric crater, right? In IMAGE 11 1.32, doesn't it seem like an imitation of Alpetragius? Although it is difficult for the volcanic origin of the enlarged central peak of Alpetragius to be the origin of this central elevation. Rather, it looks like a very large mound, as best seen in IMAGE 12 1.33. And now the most suggestive images to come. What is the irregularly sized pit marked by the arrow in IMAGE 13 2.27? A volcanic pit or a skylight indicating access to a lava tube? A lava tube is a fascinating possibility. Will it be worth delving into the analysis of these images? For example, analyzing the data from the camera used to determine the field of images and thus the size of the features we see?

IMAGES CREDIT: Indian Space Research Organization (ISRO).

*Above **Image 1** 0.11, below **Image 2** 2.08*



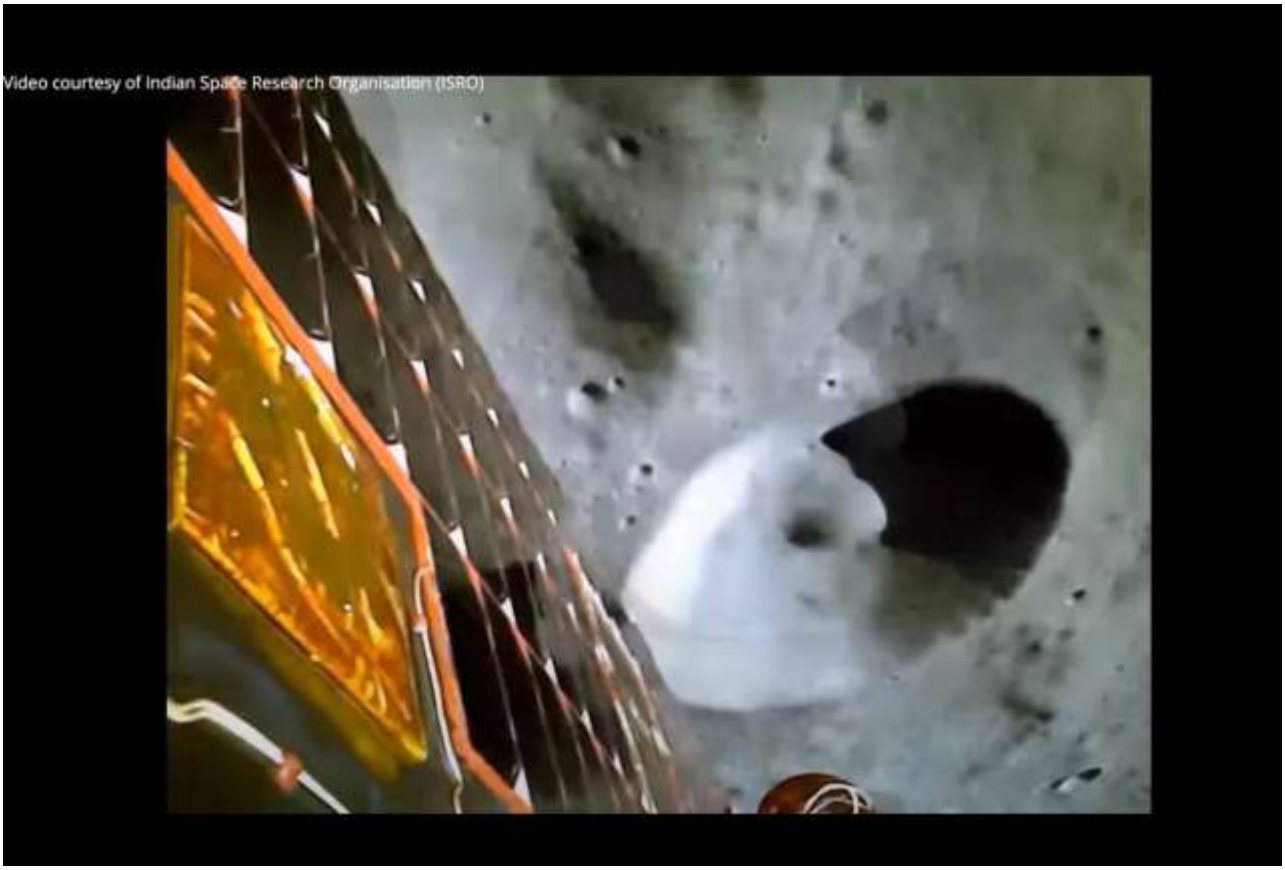
*Above **Image 3** 0.19, below **Image 4** 0.06*

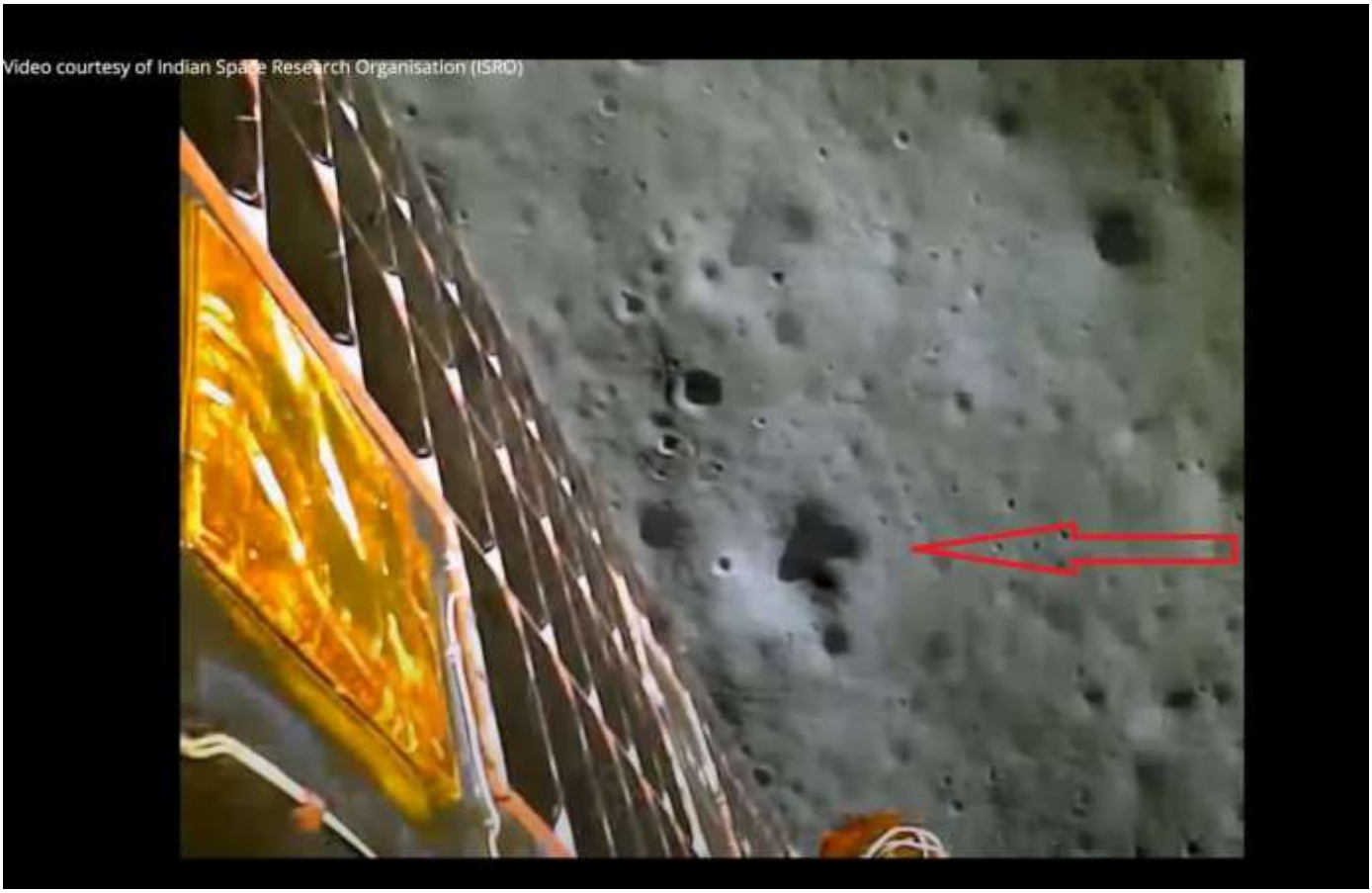
*Above **Image 5** 0.42, below **Image 6** 1.11*

*Above **Image 7** 0.47, below **Image 8** 1.44*

*Above **Image 9** 0.53, below **Image 10** 0.14*

*Above **Image 11** 1.32, below **Image 12** 1.33*





Above ***Image 13*** *2.27*

Western Mare Tranquillitatis

Paul Walker

The first thing that struck me with this image is all the wrinkle ridges! I had no idea Mare Tranquillitatis had so many. But then, I am not usually out observing the Moon's gibbous waning phases at 3 AM local time. And I probably haven't viewed this area under good conditions during the waxing crescent. The 2nd thing was the circular wrinkle ridge in the center of the image. The Virtual Moon Atlas labels it as Lamont crater and describes it as a - Remarkable ghost circular formation with double enclosure situated to the South-East of [the crater] Arago. Form of the wrinkle ridge, concentric and radial in Mare Tranquillitatis. I noticed that the inner wall forms oval ring. I would expect a ghost crater of that size to be more circular. Only now after reading the description did I paid much attention to the larger irregular and incomplete outer ring. The first impression of Lamont is that it is a buried crater. But on closer inspection the "rim" appears to be wrinkle ridges, not a buried crater wall. Doing some more reading I find on Wikipedia that it believed to most likely be a buried crater and that there is also a mass concentration at its location bolstering that interpretation.

Even taking into account the curvature of the Moon, from this image I get the impression that lava flows filled this part of Mare Tranquillitatis more so on the left side than the far right. Especially where it forms a broad sideways "V" on the right side with its vertex pointing left. There is even a wrinkle ridge parallel to each side, accentuating the “V”.

There are several domes visible here, with Arago Alpha (and Argo A 1) and Arago Beta (and Argo B 1) being the most prominent. Most of the time Alpha and Beta are invisible, sometimes they can be seen as subtle but fairly large bumps. I have seen them as subtle bumps before. During brief periods they show their true colors as lumpy bumps. I didn't know they were so bumpy until I processed this image. Here they remind me of Mons Rümker (see the July 2023 TLO) on the northwest edge of the Moon. They are much smaller at only about 1/3 the diameter, however, they have the advantage of location. Many other smaller domes are visible. Just to the upper left of Arago Alpha and Beta, in a nice neat row, are Arago 9, 10 and 1. Just to the upper right of these are Arago 11 and 12. 11 is barely visible here. 12 looks like an elongated crater. The lander Ranger 6 sits between these two. More prominent is Ross F 1. To find it, in the upper part of the image look for a prominent mountain, just left and below that are 3 obvious craters (Ross E, F and G), just to the upper left of the middle one is obvious bump. That's Ross F 1. The description from the VMA states: volcanic shield, extrusive volcanism, hemispherical. mare dome, about size of crater Ross B. If you look carefully (probably have to view it on the ALPO website) but this image shows a slight but good sized (relative to the dome that is) depression on its top. There is also a depression on either side, maybe actually all the way around, giving the impression of a wide moat around it. Straight above that is Ross D 1 which looks more like part of the nearby wrinkle ridges. Again, zooming in on the image, one can see an ever so slight depression offset slightly North of its center. VMA description: volcanic shield, extrusive volcanism. Next, about 1/2 way from Ross E, F and G to the center of Lamont is a funky looking feature. Looks like 3 small craters in a row with 2 hills right on the north side of them. Domes Arago D 1 and Arago 8 are marked on the VMA as just above and just below this feature, respectively. As I was looking at the VMA for features I saw a group of domes hiding in plain sight. On the East flank of Arago (the prominent crater to the left of Lamont) is a jumble of hills with 2 prominent hills below them. These are, starting from the bottom right, are Arago 2, 3 (the prominent hills), 4, 5, 6 and 7 (the jumble of hills). From the image I thought they were just some materials thrown out when Arago was formed.

Recent Topographic Studies
Western Mare Tranquillitatis

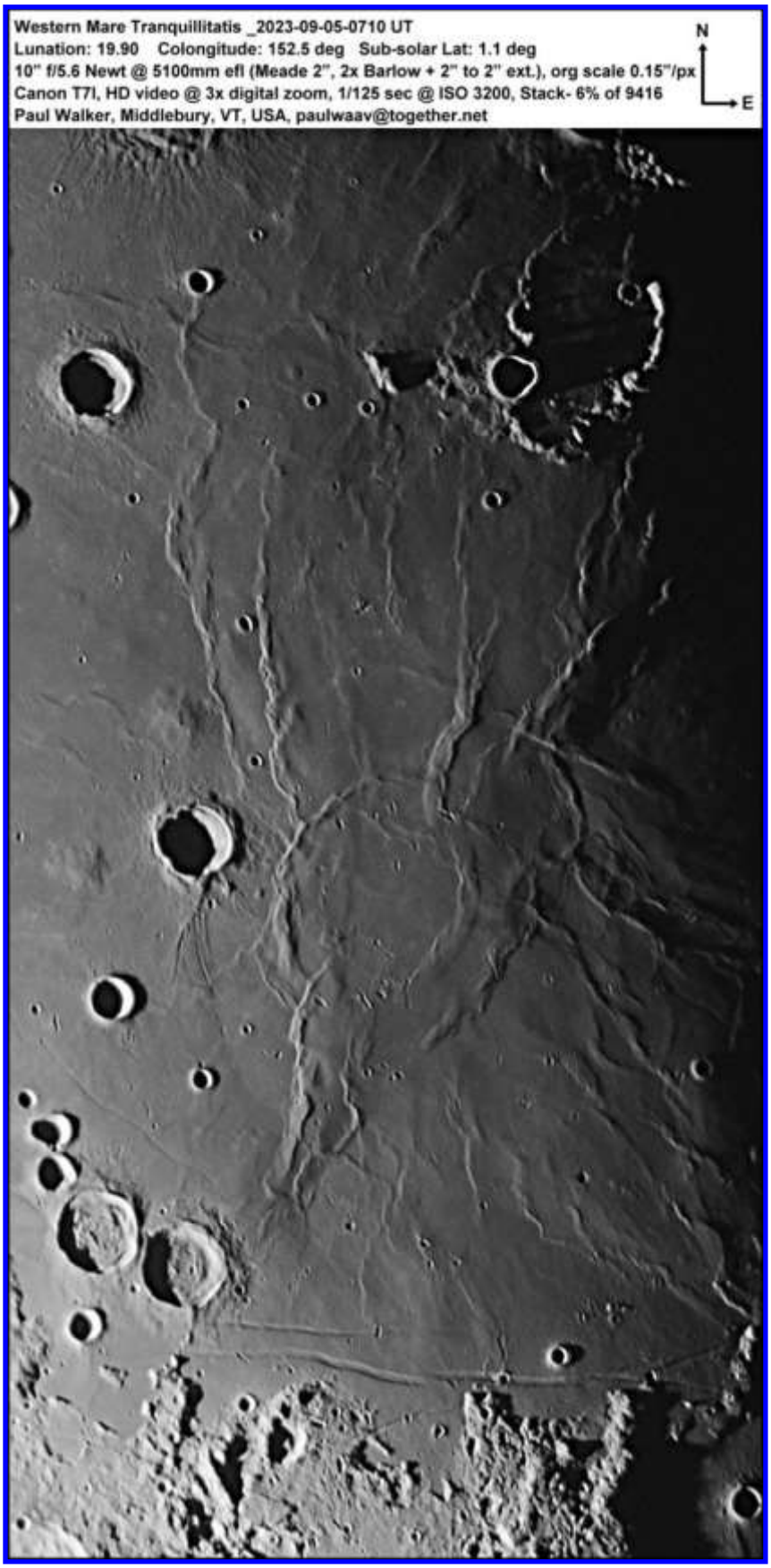
Below Arago is a set of parallel curved rilles, looking like a bird's tail. The narrowest detectable in the image being about 1.3 km (0.8 mi) wide. The VMA doesn't show any name for this feature. It would be interesting to know just how they formed. I imagine by lava flows, especially given all the volcanic domes in the vicinity but maybe they are faults. Moving on to named rilles, there is a rille on the left, about 1/3 the way up a little above a group of prominent craters. It looks like it may be part of Rimae Sosigenis (the name marker for Rimae Sosigenes is on the VMA is up by Sosigenes A crater). We have the Rimae Hypatia complex on south side of Mare Tranquillitatis. This rille is about 4 km (2 mi) wide. In the image, in the middle part there appears to be a much narrower, 0.8-1.1 km (0.5-0.7 mi), rille in the bottom similar to Vallis Alpes. But then, it may be fault between the main fault lines, but one that creates a drop not a rille or just a trick of the lighting. The image doesn't have enough resolution to tell. The high-resolution image in the VMA does not show anything there but it does not have a good enough Sun angle. Checking the Lunar Reconnaissance Orbiter 500MB Mosaic (not version in the VMA), I see nothing that could correspond to what I see on this image. Probably a processing artifact. One does have to be careful to not be too aggressive on the sharpening.

Notice the unusual number of small elongated craters, mostly in and near Lamont. Zooming in on the Virtual Moon Atlas (VMA) to the LRO WAC Mosaic these look like they are probably short sections where lava tubes have collapsed, certainly look volcanic in origin. Most are oriented in similar directions. By my pixel count, these are about 2 km X 4 km (1.3 X 2.5 mi) and would only be visible under good lighting and seeing.

The Apollo 11 landing site is near the bottom of this image. Left of center, a little below the crater Collins. Surveyor 5 is a little to the left of Collins. Too bad I didn't remember this at the time, if I had I would have gotten my first look at Collins and Aldrin. I think I have spotted Armstrong once.

For reference, the effective visual magnification of this image (vertically) is ~765X (5100mm X 3x zoom / 50mm). Visually you will need about 300X to see the smallest features and very good conditions.

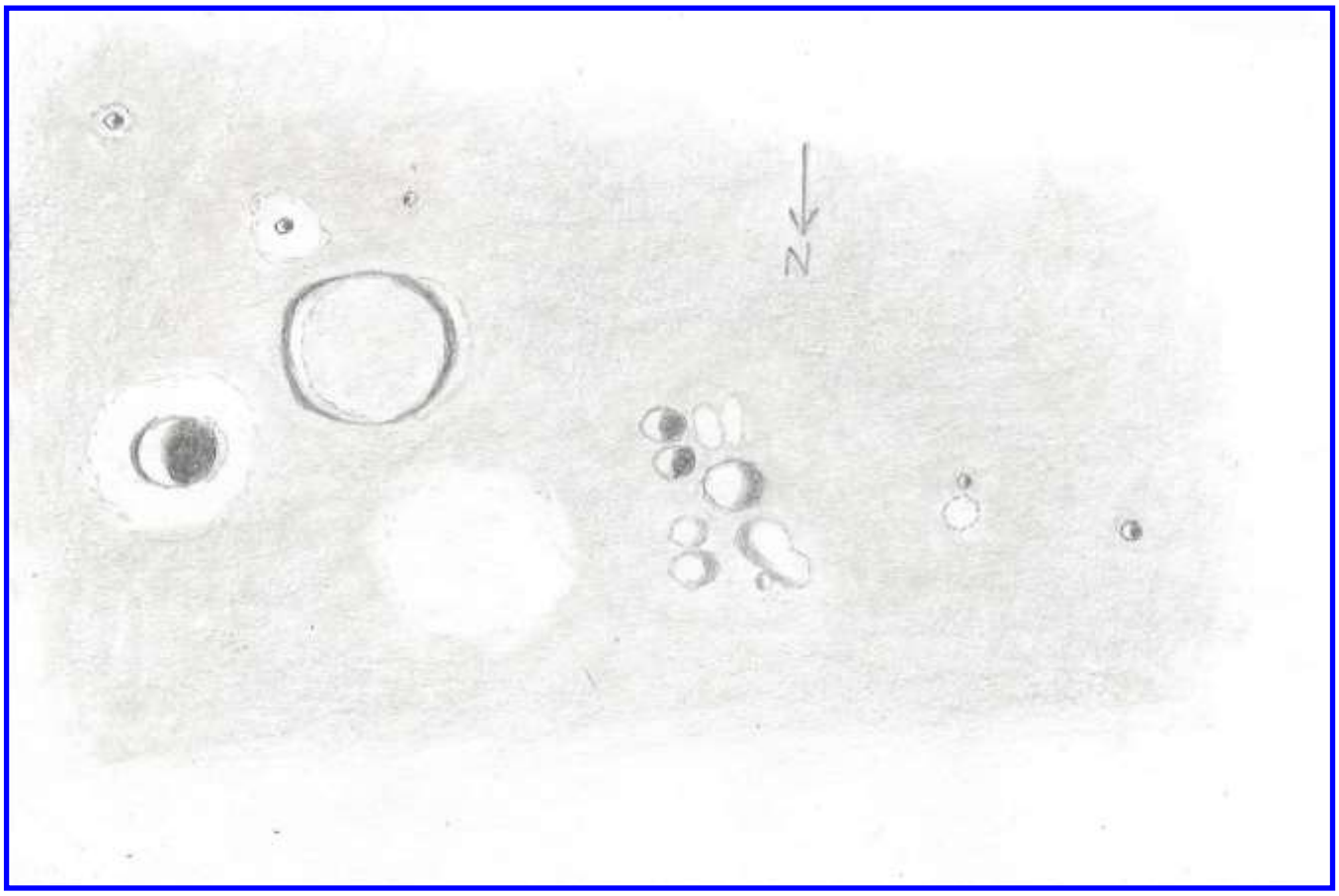
Recent Topographic Studies Western Mare Tranquillitatis



Recent Topographic Studies
Western Mare Tranquillitatis

Lassell

Robert H. Hays, Jr.



Lassell, *Robert H. Hays, Jr., Worth, Illinois, USA. 2023 August 8 07:27-0749: 08:12-08:22 UT. 15 cm reflector telescope, 170 x. Seeing 7-8/10, transparency 6/6.*

I drew this crater and vicinity on the morning of August 8, 2023. Lassell is a shallow crater in northeast Mare Nubium. Some blunt points on its northeast and southeast rims give it a slightly rectangular shape. Its floor appears to be featureless. The deep crater to its northeast is Alpetragius B. The pit just southeast of Lassell is Lassell B, and Lassell A is farther to the southeast. All three of these lettered craters have some sort of halos. That of Lassell A is the smallest. A tiny peak is west of Lassell B. A group of craters is west-northwest of Lassell. The largest one is Lassell C, according to the Lunar Quadrant map. Two nearby deeper ones may be Lassell G and K, K being south of G. What appear to be two shallow saucers are north of Lassell C, but the LQ map shows a bright area there. A mound with a small knob is northwest of Lassell C, and two shadowless bright areas are south of C. A large vague area, slightly brighter than the mare, is north of Lassell. The pit west of Lassell C is Lassell J, and the slightly larger Lassell H is farther to the west. The bright round patch just north of Lassell J is Lassell D, but no shadow is evident there.

Deciphering Secchi Crater

Alberto Anunziato

If we look at IMAGE 1, it seems like chaos that is difficult to interpret, beyond the clue that the title gives us about the name of the crater, which recalls one of the numerous Italian astronomers often ignored by the history of astronomy, Angelo Secchi. Dark and less dark areas, gray areas, bright and brighter areas. Secchi is not very small (25 km in diameter) but it is one of the oldest craters, since it belongs to the pre-Imbrium period, and has suffered about 4000 million years of impacts. Secchi is located in "an often-overlooked area of odd terrain and short rilles. The area surprisingly has a name - Secchi Mountains - although there are hardly hills, much less mountains there.

Image 1, Secchi, *Alberto Anunziato, Paraná, Argentina. 2023 August 05 05:10-05:35 UT. Meade EX105 Maksutov-Cassegrain telescope, 154x.*

The 24 km wide somewhat ill-formed crater Secchi is near the center of the roughness, which may simply be residual highlands between Tranquillitatis and Fecunditatis" (Charles Wood, Seeking Secchi, Lunar Picture of the Day, December 3 2006, http:// www2.lpod.org/wiki/December_3,_2006). A steep, but low-lying area is not ideal for highlighting a heavily eroded crater. How, then, could I distinguish Secchi, even near the terminator? What caught our attention was a very intense glow in that dull and rough area, which was one of the brightest areas of the surface of the entire visible side that night. It was difficult to distinguish that it was a crater wall much higher than the others. It was the east wall of Secchi, what didn't seem so clear was which was the west wall, there seemed to be two parallel walls separated by a shadowy area. Only by searching for Secchi images was I able to correctly interpret the bright and dark areas: the east wall is much taller than the others, casts sharp shadows (like any tall, steep wall), and is much brighter at lunar dawn (it's even a little blinding). The bright area to the east of the darker part of the floor is not the west wall but a series of small elevations in the center of the crater (as seen in IMAGE 2, which is a crop of the image that was chosen as LPOD of the December 3, 2006 and can be found in the link already mentioned). My telescope was unable to resolve the elevations and I perceived them as a bright continuous line. They do not appear to be the typical central elevations of impact craters, and the size of the Secchi diameter would not be compatible with a central peak. However, Elger mentions a central mountain (a trained observer like him can probably distinguish one elevation higher than the others). He says in The Moon that Secchi is a "partially enclosed little ring-plain S. of Taruntius, with a prominent central mountain and bright walls. There is a short cleft running in a N.W. direction from a point near the W. wall. Schmidt represents it as a row of inosculating craters". In addition to the shiny walls, Secchi's most obvious feature, Elger identifies the elevations we see in IMAGE 2 (which would be similar to those seen on the Proclus floor, for example, in high-resolution photographs) as "a short cleft", and remember that Julius Schmidt (one of the great cartographers of the Moon in the 19th century) saw them as a chain of craters. At the limit of the resolution of his instrument, the visual observer must get used to interpreting nuances of dark and light tones in terms of heights and shadows; an exact record can provide information to the extent that it can be corroborated with more precise images.

Image 2, Secchi, *Oscar Canales Moreno In [http:// www2.lpod.org/wiki/ December_3,_2006](http://www2.lpod.org/wiki/December_3,_2006) North is left, west is down.*

Lunar Topographic Studies
Deciphering Secchi Crater

Maginus, Clavius, Blancanus, Klaproth and Casatus

Paul Walker

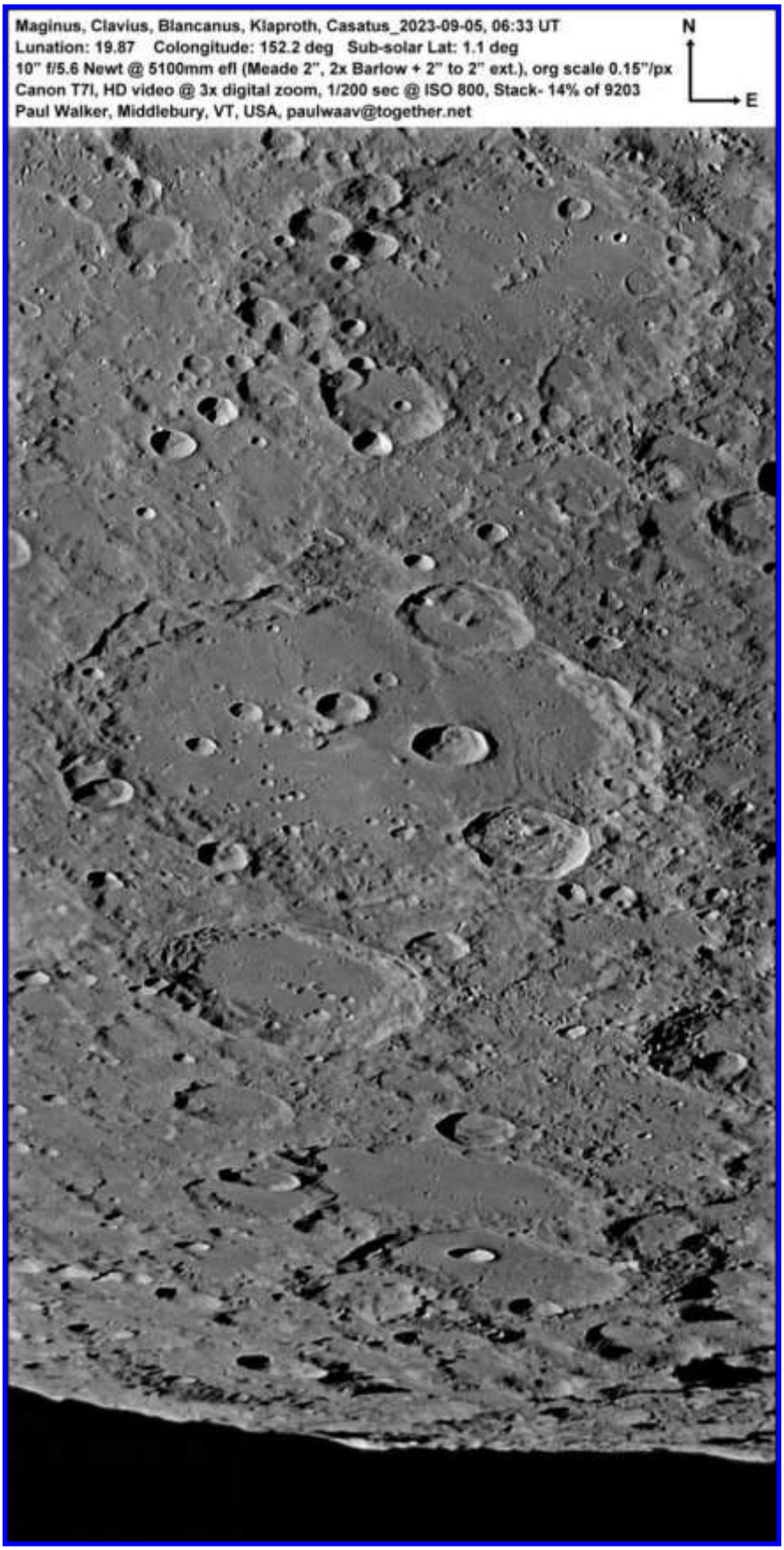
This is one of my favorite features and no doubt for many other people. Something I learned recently from another local club member that makes Clavius even more special for a Vermonter is that the on the north rim of Clavius, at the 1:00 position is the crater, Porter. Named after Russell W. Porter of Springfield, VT. Arctic explorer, architect, telescope builder among other things. He was instrumental in the design of the 200-inch Palomar Telescope and in starting the Springfield Telescope Makers (Stellafane) and more broadly in promoting amateur astronomy in the USA.

There is an interesting difference between the floor of Porter (53 km) and another similar sized crater on Clavius' rim, Rutherfurd (55 km). Porter has a central peak, half the floor is flat, half a bit rough due to the wall slumping. With Rutherfurd there seems to be no central peak and the whole floor is jumbled. Using the Virtual Moon Atlas (VMA) it appears it may have a central peak but it appears to be offset from the center. In considering the reasons for the differences, where Porter is, the wall of Clavius appears lower than where Rutherfurd is located which could mean that the strike that formed Rutherfurd had a "softer" landing. From this image it is hard to tell the relative ages of the 2 craters. However, at them on the VMA at high resolution, Porter clearly looks older. The information in the VMA says that Porter is more than ~3.85 billion years old while Rutherfurd is less than 1.1 billion years old. I would say both the age difference and where the respective asteroids struck are the main contributors to the differences.

The large degraded crater at the top is Maginus (164 km, 100 mi). It appears to be older than Clavius, though still has some of the central peak visible. Just below Clavius is Blancanus (106 km, 64 mi). Skip down a little and you come to Klaproth (119 km, 72 mi). Next is Casatus (111 km, 67 mi) with Casatus C (17 km, 10 mi) inside to the north and Casatus J (22 km, 13 mi) on its south rim. Casatus looks like it could actually be 2 or maybe 3 conjoined craters as it looks like a distorted oval. The lower left (SW) rim looks funky like it was pushed in by a nearby impact except there is no clear sign of such an impact. The pronounced foreshortening makes it hard access.

The smallest craters visible in this image are 1.6-1.9 km (1-1.2 mi) across. For reference, the effective visual magnification of this image (vertically) is ~765X (5100 mm X 3x zoom / 50 mm). Visually you will need about 300X to see the smallest features and very good conditions.

Recent Topographic Studies
Maginus, Clavius, Blancanus, Klaproth and Casatus



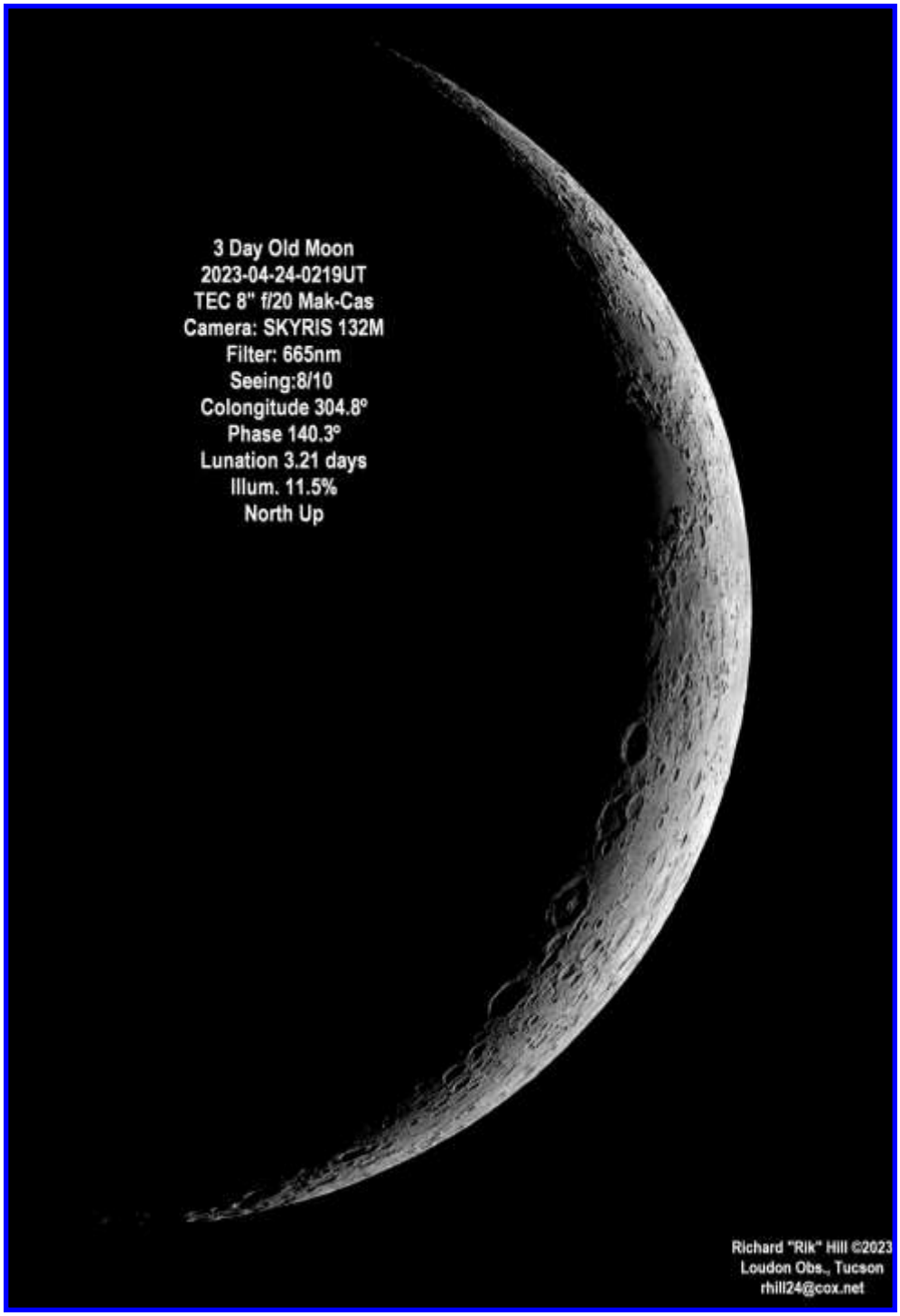
Recent Topographic Studies
Maginus, Clavius, Blancanus, Klaproth and Casatus

Just a Fingernail Clipping

Rik Hill

Usually, I will not do a whole-Moon lunar image but I could not resist with this beautiful crescent hanging like a charm in the twilight glow. My artist father, when I was just a nascent amateur astronomer, would point out the crescent and call it a fingernail clipping in the sky. That allegory always stuck with me over the years. Notice in this image how one cusp is so much sharper than the other. Something to watch for in crescent moons.

In this image we see a row of large craters on the southern terminator starting on the northern end with Langrenus (136 km dia.) with the overlapping craters just below it of Vendelinus (151 km) with Lame (87 km) on its northeastern wall. Below these is Petavius (182 km) with its obvious bright central peak and the last one in the chain below this monster is Furnerius (129 km). Between these last two you can see two more craters, Hase (82 km) and Hase D (57 km). It's interesting that while people have reported seeing (or detecting) Copernicus and Ptolemaeus when on the terminator there are no such reports for Petavius or Langrenus. This, like sighting the earliest moon each month, might be a fun challenge for the naked eye observers.



3-day old Moon, *Richard Hill, Loudon Observatory, Tucson, Arizona, USA. 2023 April 24 02:19 UT, colongitude 304.8°. TEC 8 inch f/20 Maksutov-Cassegrain telescope, 665 nm filter, SKYRIS 132M camera. Seeing 8/10.*

Recent Topographic Studies

NECTARIS BASIN: A REVIEW OF MAJOR FEATURES

Jeff Grainger

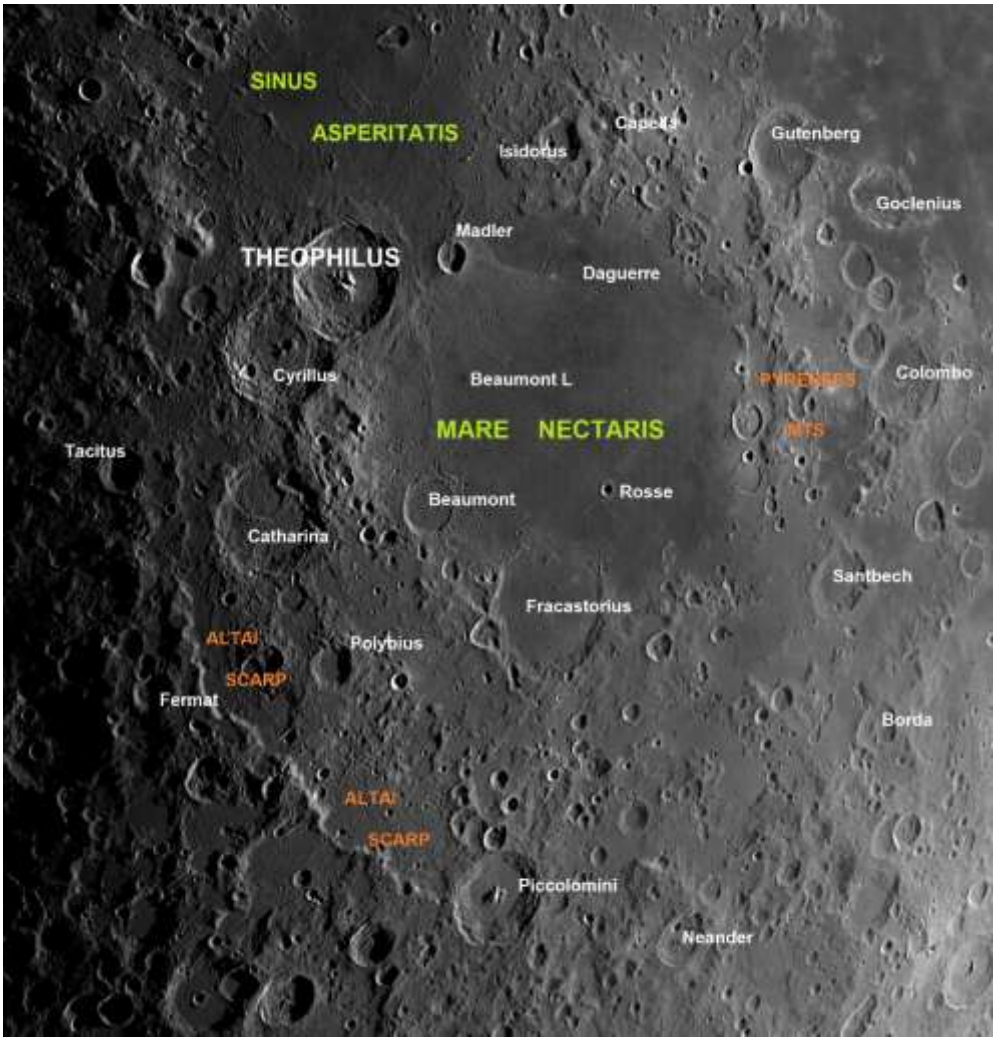
The Nectaris area is spectacular, with some of the most interesting – and dramatic – features on the Moon's surface.

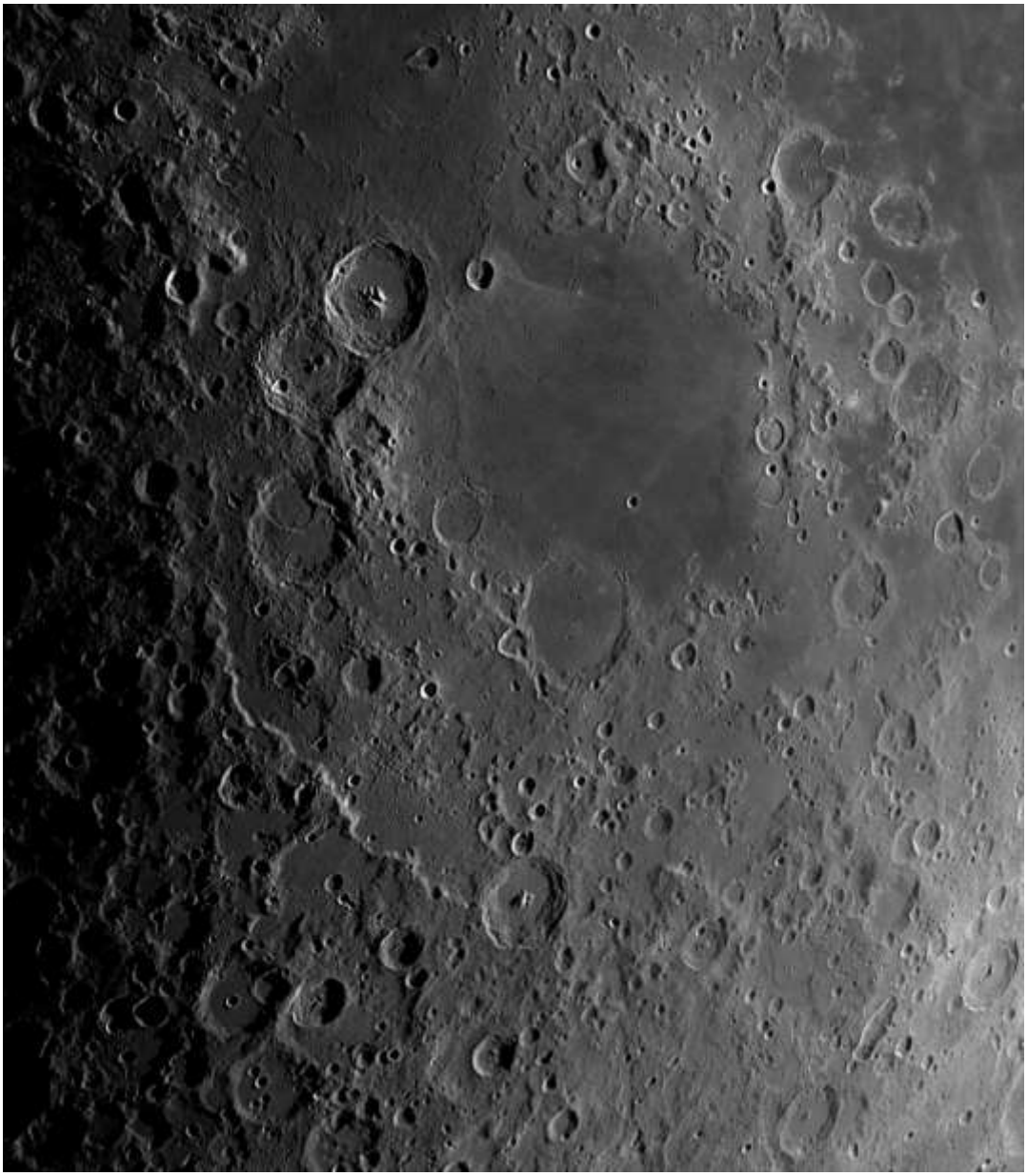
"Theophilus Nectaris" has already been collected together as a REGION survey: a selection of my own images, taken at different points in the lunation [TLO August 2023]

"Theophilus – A Tour…" focused on the CRATER PROFILE with contributions from my images, LRO, Kaguya and QuickMap analyses.

This Study – meant to tie-in with the J100 selection – concentrates on other aspects of the Nectaris environs:

The Multi-Ring structure of the Nectaris Basin.
The Altai Scarp – a major component of the outer ring of the basin (J100: #7)
Tilted and Infilled craters including Fracastorius (J100: #21)
Dark Halo and Ghost craters: Beaumont L (J100: #74) and Daguerre
Boundary mountains – the Pyrenees





Theophilus group and Mare Nectaris: 6.64 days 19.40 UT April 26 2023 [161]
[Altitude: 54°33' Azimuth: 228°52' Libration: 6.5° @ PA 165°]

Nectaris as a Multi-ring basin

The lava section occupies the central section of a much broader impact basin: Mare Nectaris is approximately 350km in diameter, whereas the outer ring (for which there is most evidence) is approx. 860 km in diameter, with the Rupes Altai (Altai Scarp) forming a clear basin edge around the SW quadrant from the west of Cyrillus to Piccolomini, and then extending east towards Borda crater.[1 2]

Suggested Basin Rings:

Ring number	Ring diameter (km)	Ring location
1	240	Wrinkle ridges within mare lavas
2	400	Pyrenees Mountains
3	620	Santbech-Cyrillus
4	860	Altai Scarp

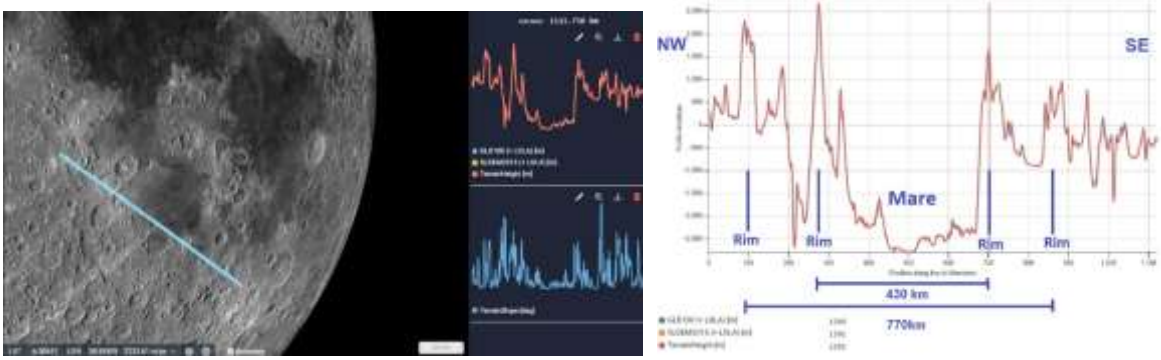
Basin Profiles:

The QuickMap profiles on the next few pages indicate the variation in height, across the basin, in different directions.

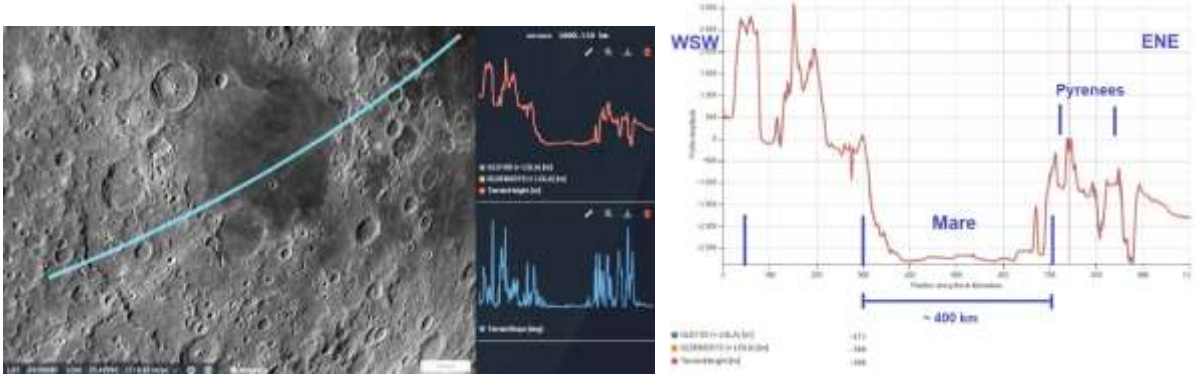
The recurring pattern from these Profiles is indicative of Rings 2 and 4 in the table above.

With a little imagination, the outer ring can be traced around the western flank of Sinus Asperitatis and to the east of the Pyrenees.

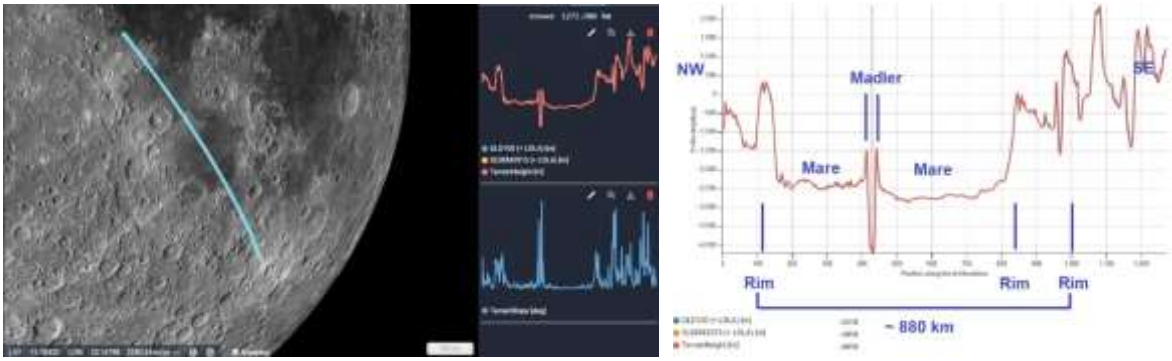
Profile 1, approx. NW – SE



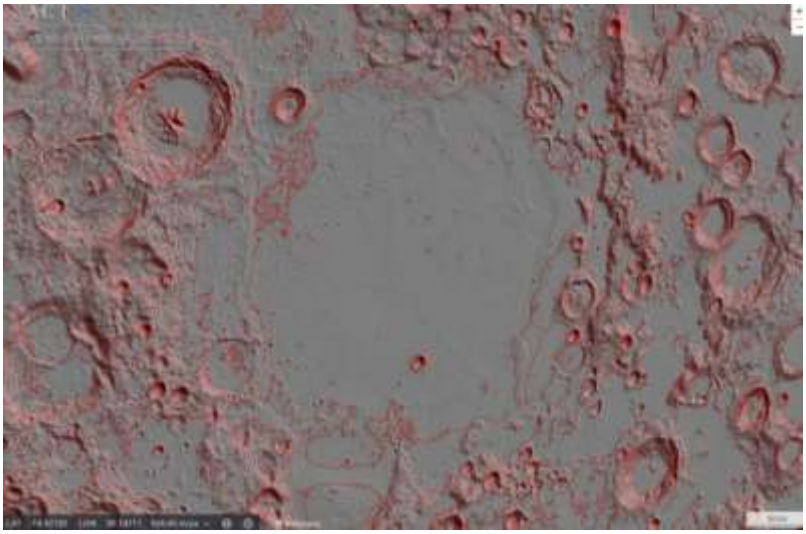
Profile 2, approx. WSW – ENE

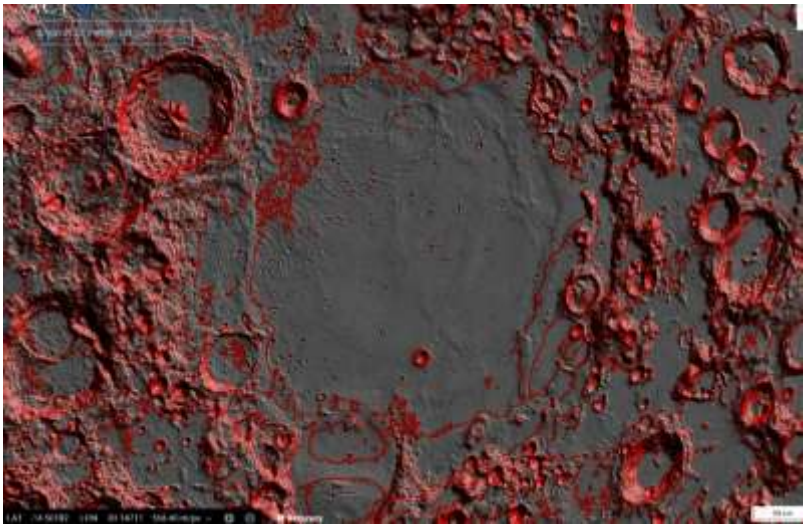


Profile 3, approx. NW – SE



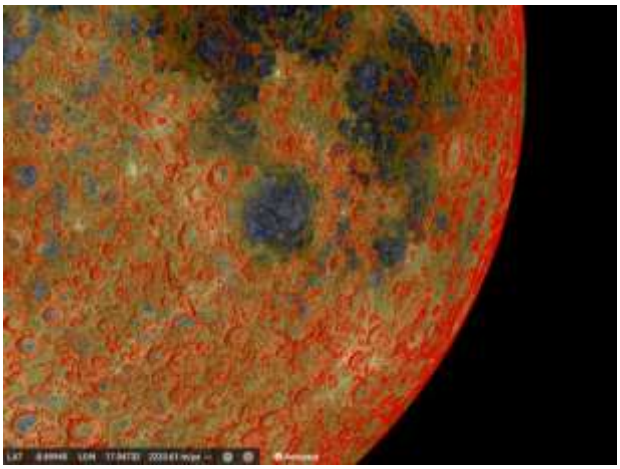
LROC Contour Mapping



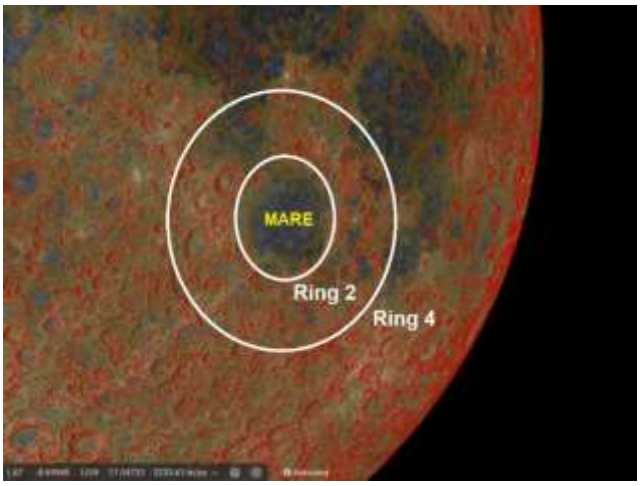


Same image and contours: the lower one has been contrast enhanced to emphasis the topography.
Ring 2, around the mare itself, is evident. Arguments for a wrinkle ridge (Ring 1) arrangement look tenuous.
EXPAND the image with the slider (bottom right) for more detail.

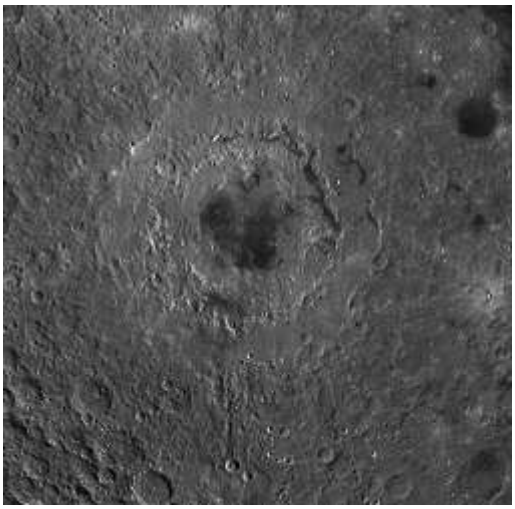
On a larger scale, the contour mapping brings out the scarp arrangement around the western side of Nectaris, emphasizing its Basin nature.



An approximation of the Ring 2 and 4 structure is shown on the following page. This is entirely indicative – a "trend" view, you might say!



Compare this with this LRO image of the Orientale Basin:



Tilted craters with Lava infill

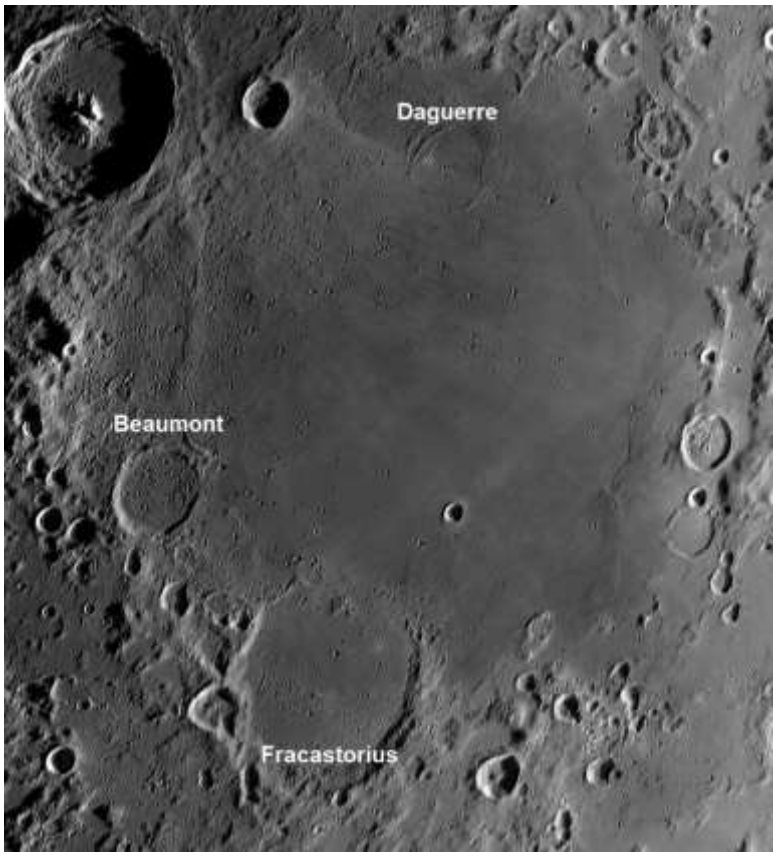
Chuck Wood refers to the "Standard Basin-filling Sequence in his chapter on the Nectaris region and surroundings: [3]

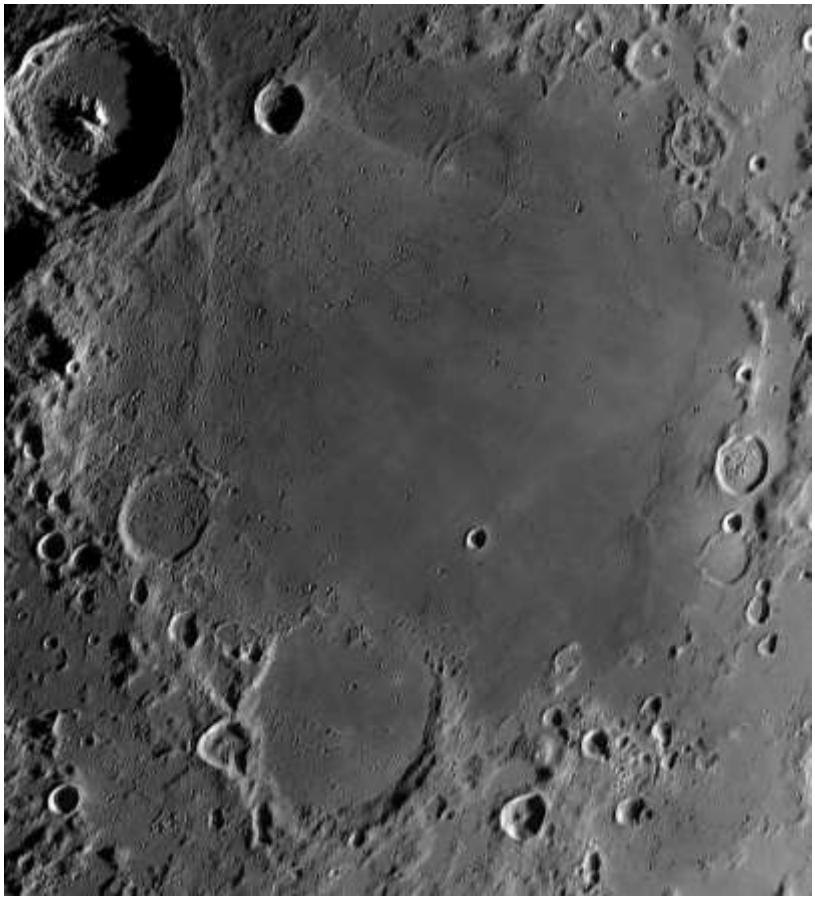
An impact basin is formed.
Craters form on the basin floor.
Moon-wide radioactive heating creates magma which rises along basin fractures to pond in low parts of the basin floor.
The basin floor subsides from the weight of the lava.
Pre-existing craters tilt toward the basin center.
Later lavas bury the lower rims of tilted craters.

Fracastorius and Beaumont:

Wood goes on to say that the Nectaris basin provides us with two excellent examples: the craters Fracastorius and its smaller brother Beaumont. The two are virtually side-by-side in the SW corner of the basin. Near-ghost crater Daguerre, at the N end of the basin, exhibits similar traits: tilted and subsequently infilled….

A map of the relevant area is given below, with the unlabeled image on the next page:





Craters with substantial tilt and infill in the Nectaris region: Fracastorius, Beaumont and Daguerre.
6.07 days 19.00 UT March 27 2023 [142cr]
[Altitude: 56°37’ Azimuth: 224°56’ Libration: 6.6° @ PA 134°]
Note the narrow rille traversing Fracastorius from W to E: ~ 1 to 1.5km wide.

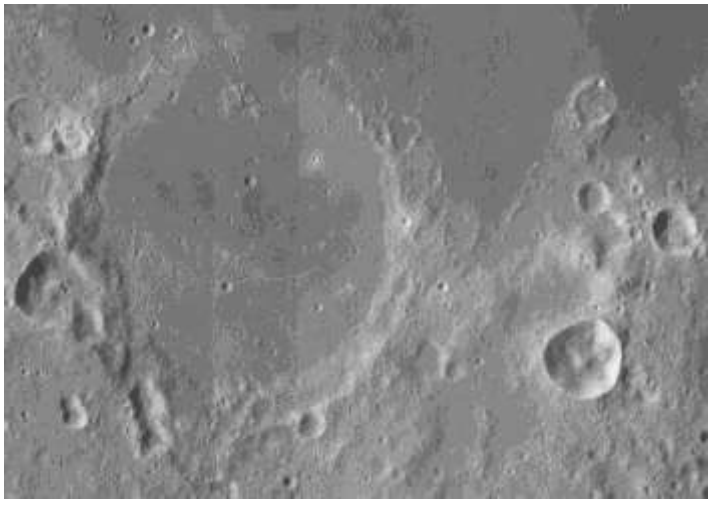
CRATER DATA:

Crater	Diameter (km)	21C	Duplex	Moore
Fracastorius	121	6 E4	13	224
Beaumont	51	6 C3	13	75
Daguerre	46	6 E1	7/8	163

Satellite Imagery:

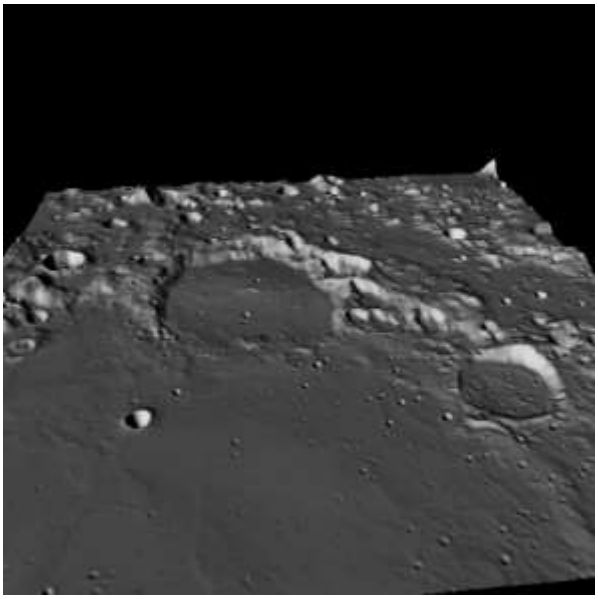
Kaguya view of Fracastorius crater looking South [468, 15s]

Kaguya view of Fracastorius looking N [1376, 31s]

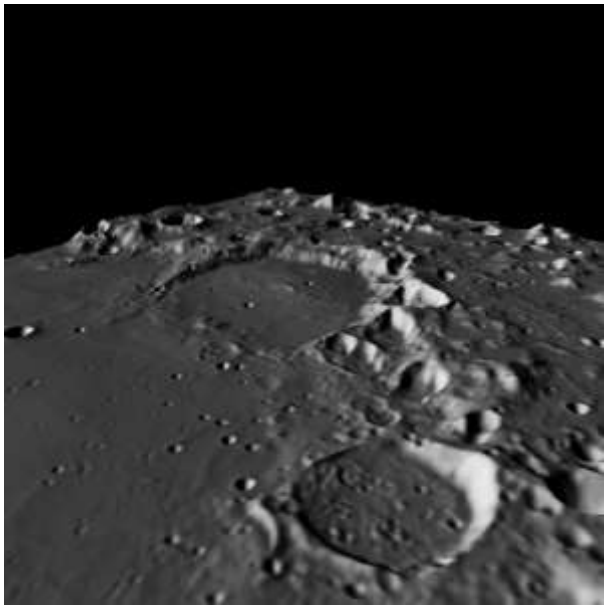


LRO image, with labels, of the Fracastorius region

Rendering:



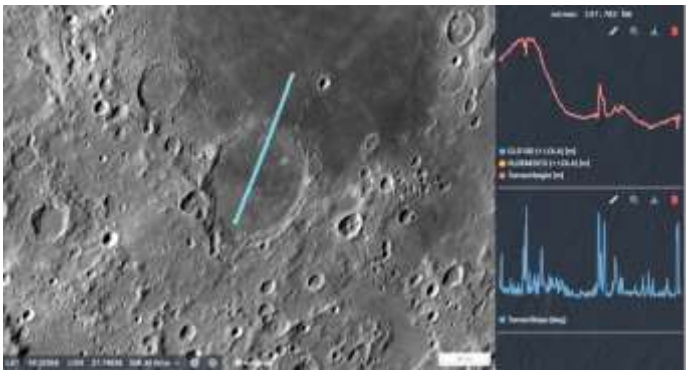
Fracastorius and Beaumont viewed looking S over southern Nectaris.
The degree to which the crater rims have been degraded is apparent, though the tilting of the craters isn't obvious – see the crater floor profile data for this.
Perspective projection, x3 vertical enhancement.

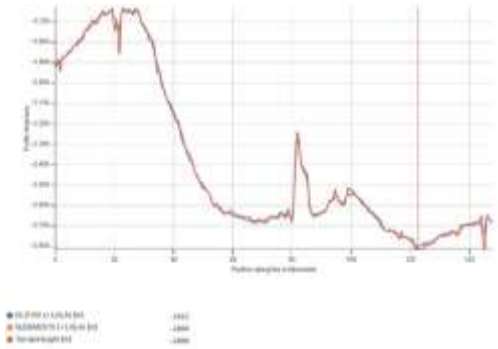


A view looking SE across Beaumont towards Fracastorius.
This more oblique view allows the crater rims to be viewed against the lava level. It's more apparent here that the eastern/western walls are sloping with respect to the lava floor, suggesting a degree of tilt.
Perspective projection, x3 vertical exaggeration.

Profile Data:

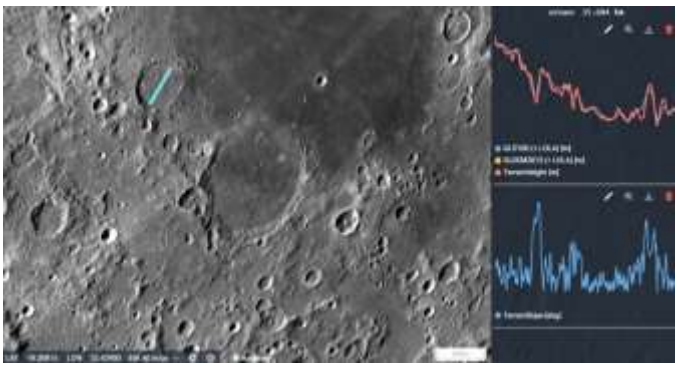
Profile along the axis of Fracastorius SW to NE:

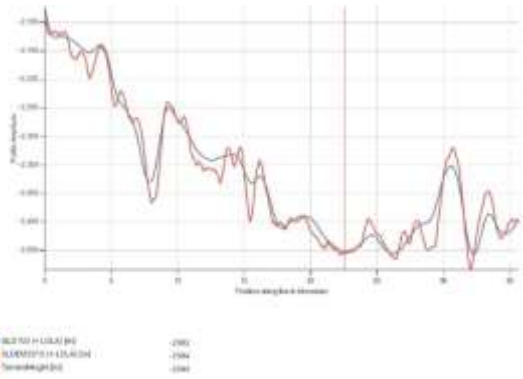




The crater floor is sloping downwards towards the center of the mare basin at around 1 in 40, or ~ 1.5 degrees. Small, but significant.

Profile along the axis of Beaumont SW to NE:





The average tilt here is similar to Fracastorius at ~ 1 in 50.

Rupes Altai (Altai Scarp)

General data (Moore, FOM, 276 [4]): Length ~ 545km, average height ~ 2.4km

Under suitable illumination:

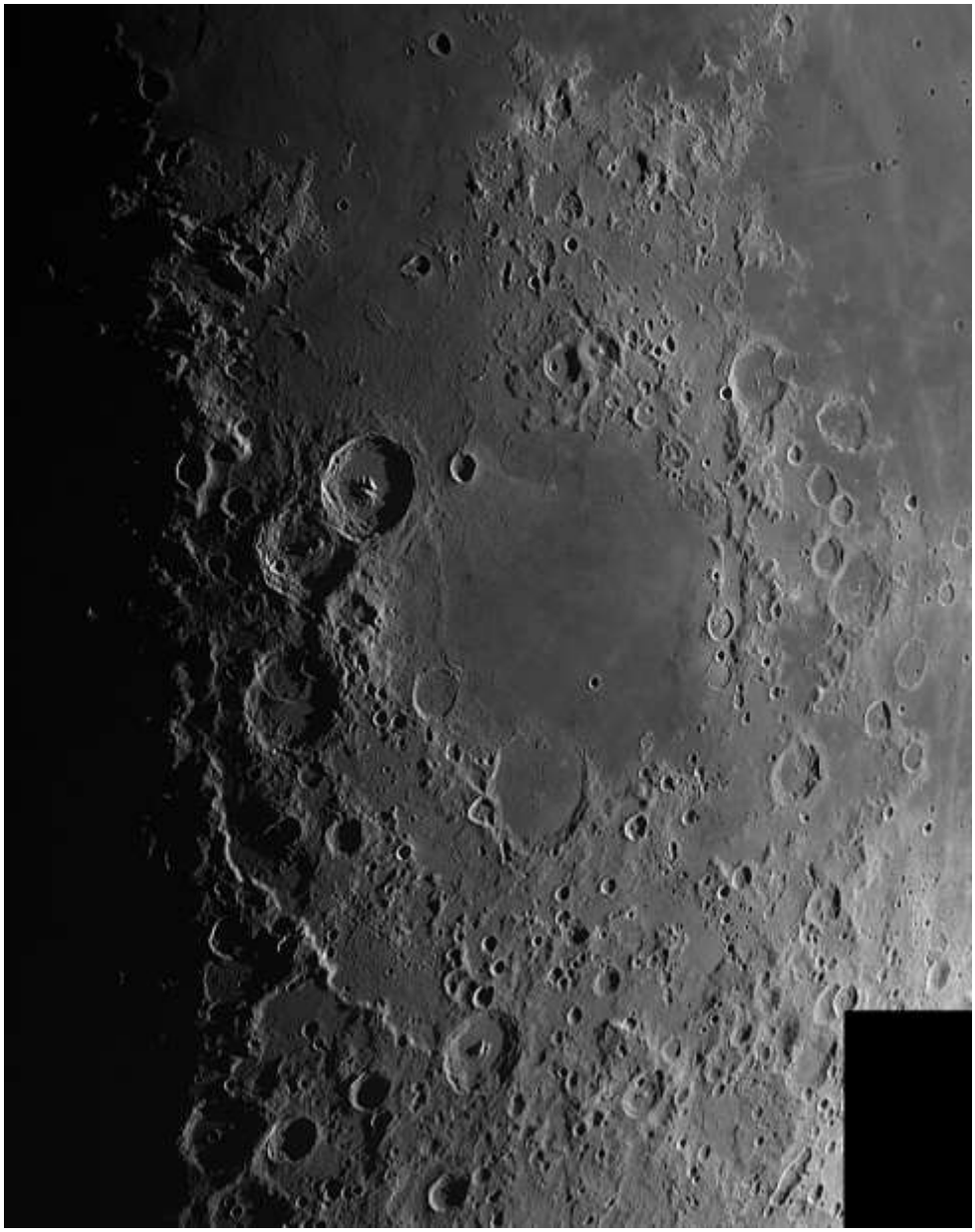
Morning sunlight ~ 6-7 days Scarp brightly illuminated by the low angle rising sun…..

Evening sunlight ~ 19-20 days Scarp casting distinctive shadows from the low angle setting sun……

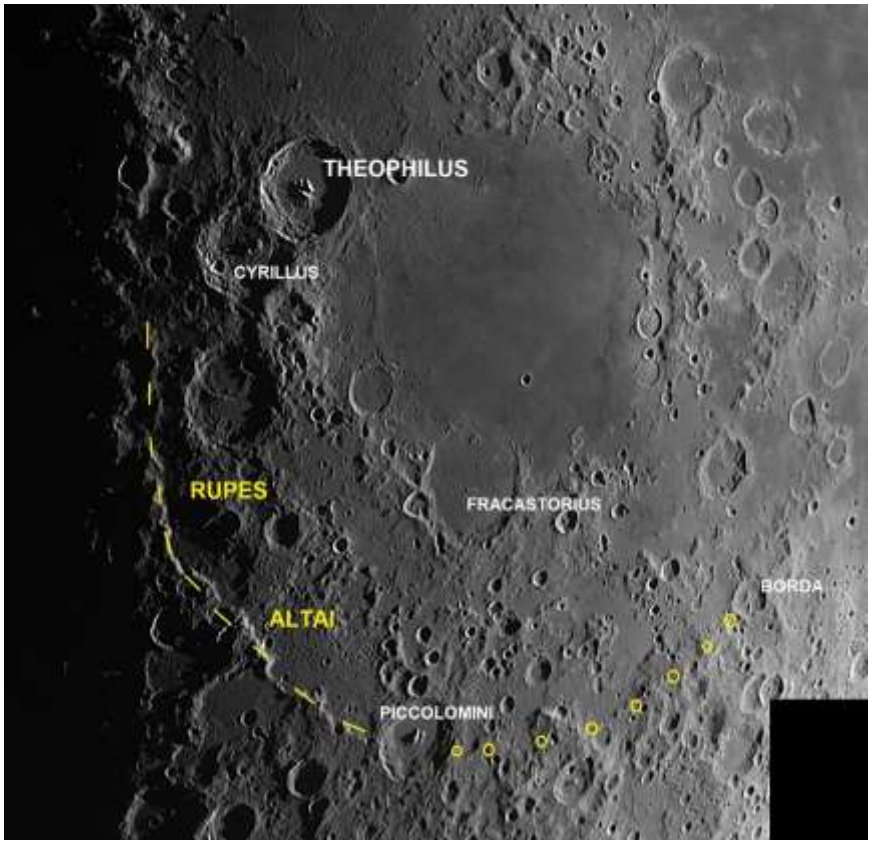
the Altai Scarp is one of the most spectacular features on the Moon's surface.

Originally considered as an ordinary landslip-faulted feature, it was only in the mid-20th century that astronomers (Ralph Baldwin being one of the first [5]) realized that the scarp was but a constituent section in a ring marking the outer parts of a large (~ 900km diameter) impact basin. The central part of this impact basin being lava infilled: the Mare Nectaris.

The image below shows the entire Nectaris Basin shortly after sunrise along the whole length of the Scarp. It extends from near Tacitus, to the SW of Cyrillus around to Piccolomini. This crater is likely a later intrusion into the outer impact ring, as scarp-like features continue on the other side of Piccolomini, around to position angle ~ 135 near Borda crater.



Nectaris Basin: 6.19 days 20.18 UT May 25 2023 [181]
[Altitude: 41°37' Azimuth: 245°09' Libration: 6.0° @ PA 186°]



Satellite Images:

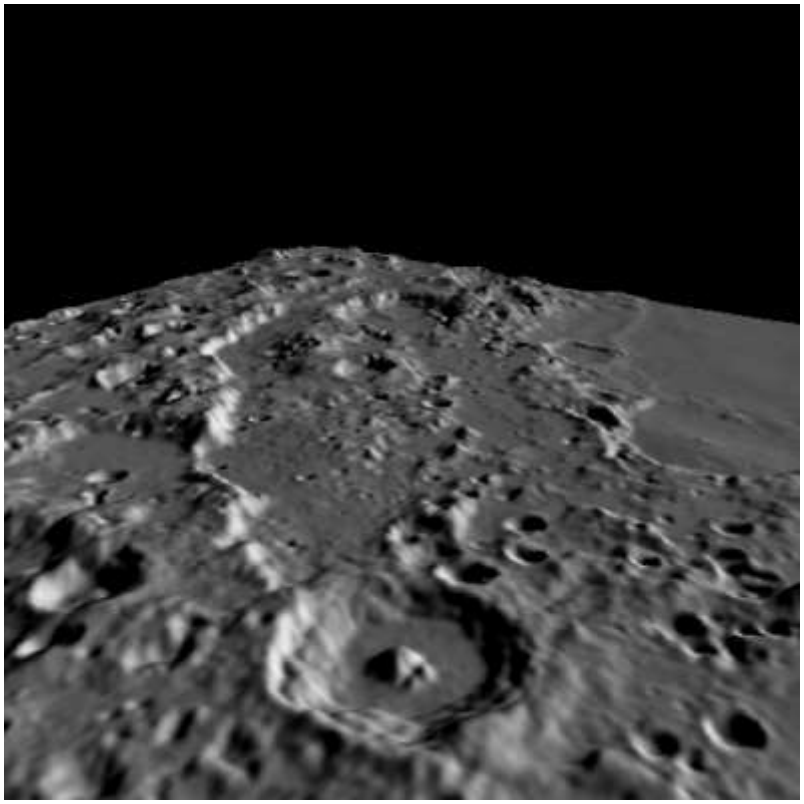
Kaguya images (video 236, 10s and 31s resp.) taken with the probe flying northwards over the western Nectaris Basin:

Piccolomini, with central peak, is to the left.

Beaumont at lower left corner, Catharina lower right.

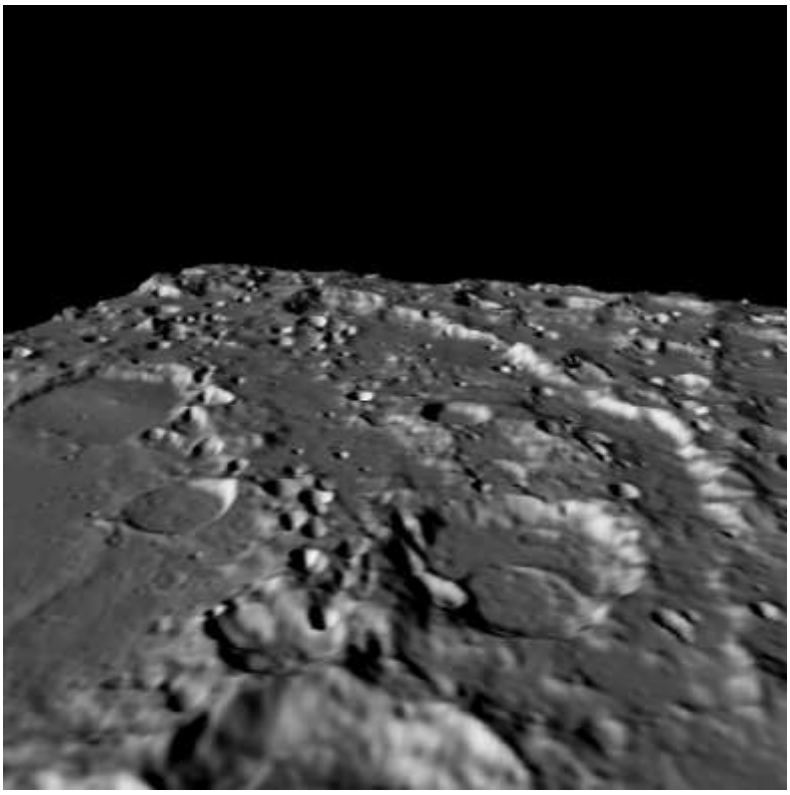
Rendering:

Looking NW from Piccolomini:



Perspective projection, x3 vertical exaggeration.

Looking S from Cyrillus:

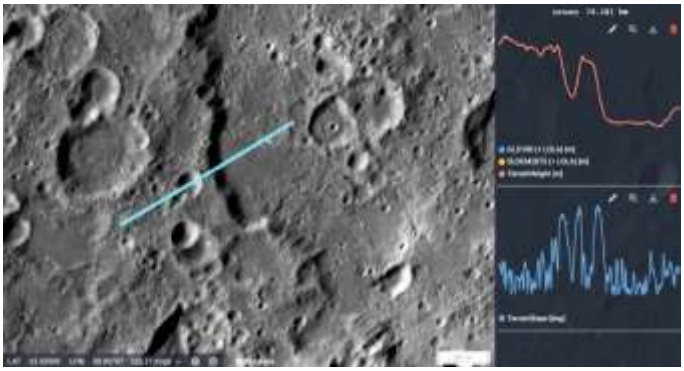


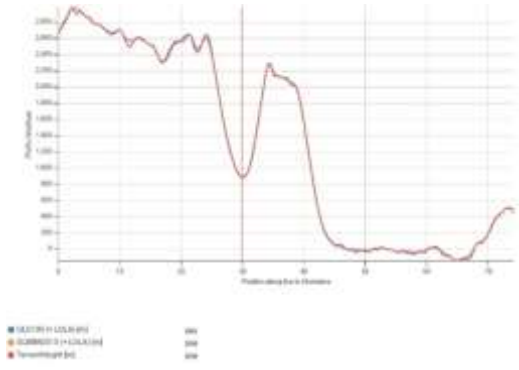
Perspective projection, x3 vertical enhancement.

Scarp Profiles:

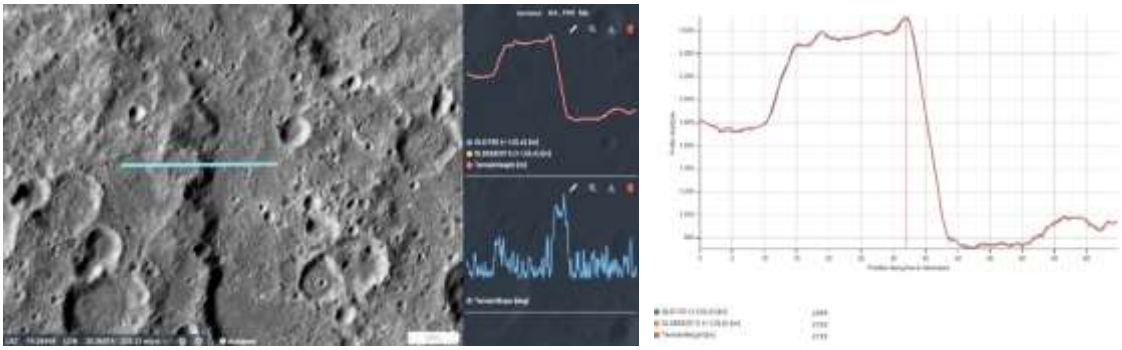
The following pages show the Scarp profile at 3 points along its length….

Profile 1

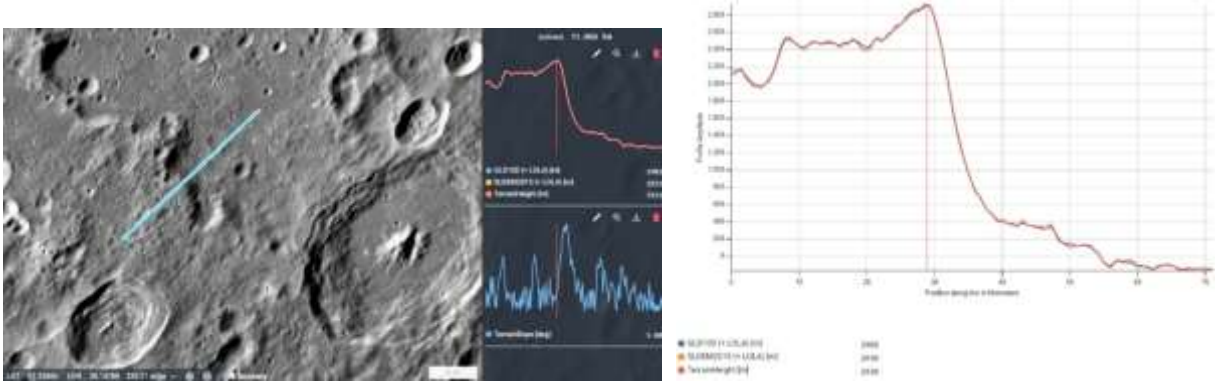




Profile 2



Profile 3



Summary from Profiles:

Profile	Location	Max height (m) *	Drop (m)	Over distance (km)	Gradient	De-grees
1	E of Fermat	2200	2000	14	1 in 7 (0.14)	8
2	N of Fermat, adj. Cyrillus	2000	1800	6	1 in 3.3 (0.3)	17
3	NW of Piccolomi-ni	2900	2400	10	1 in ~ 4 (0.24)	13

* Relative to base of scarp surface – see Profile charts.

As a comparison, the slope of typical crater terracing (as measured in the Crater Profiles) varies from around 1 in 9 (6°, Tycho) to ~ 1 in 5 (11-12°, Copernicus).
The Altai Scarp, averaging ~ 13°, is thus quite steep – much more so than the gentle profiles of e.g. Rupes Cauchy or Rupes Recta.

Ghost and Dark Halo Craters

A LUNAR GHOST CRATER can be thought of as a normal crater which has suffered "encasement" both inside and outside its rim(s) by lava deposits. This results in only the rim of the crater being visible, the rim remaining slightly proud of the surface (as with Daguerre in this study) or, quite often, with the rim top level with the exterior (e.g., Stadius near Copernicus).

If the encasement was removed, we'd be able to see the original crater.

Most ghost craters are located in mare regions, as that's where most of the observable lava flows are found.

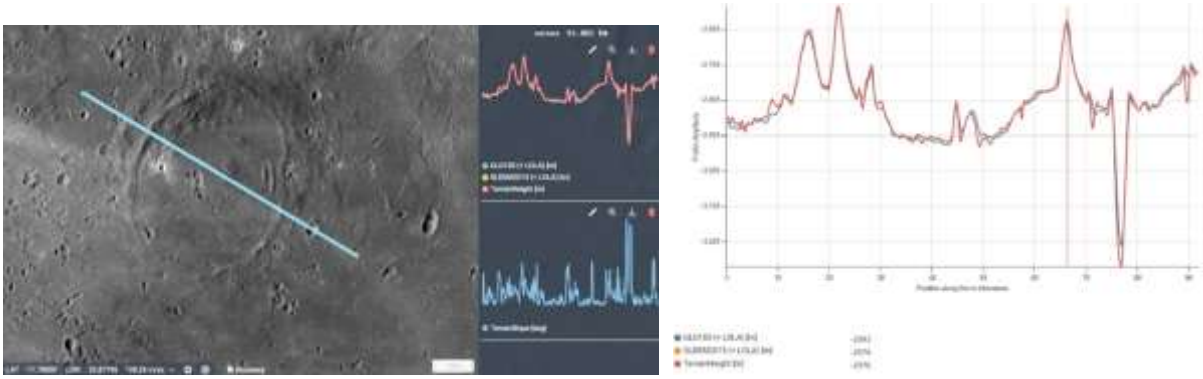
Daguerre crater in Mare Nectaris

11.9S 33.6E Diameter ~ 46km [Moore, COM 163 [6]]

Located at the N end of Mare Nectaris. A view from Kaguya looking N. Mädler is the crater at left, with Isidorus at the top of the image.

Daguerre Profile:

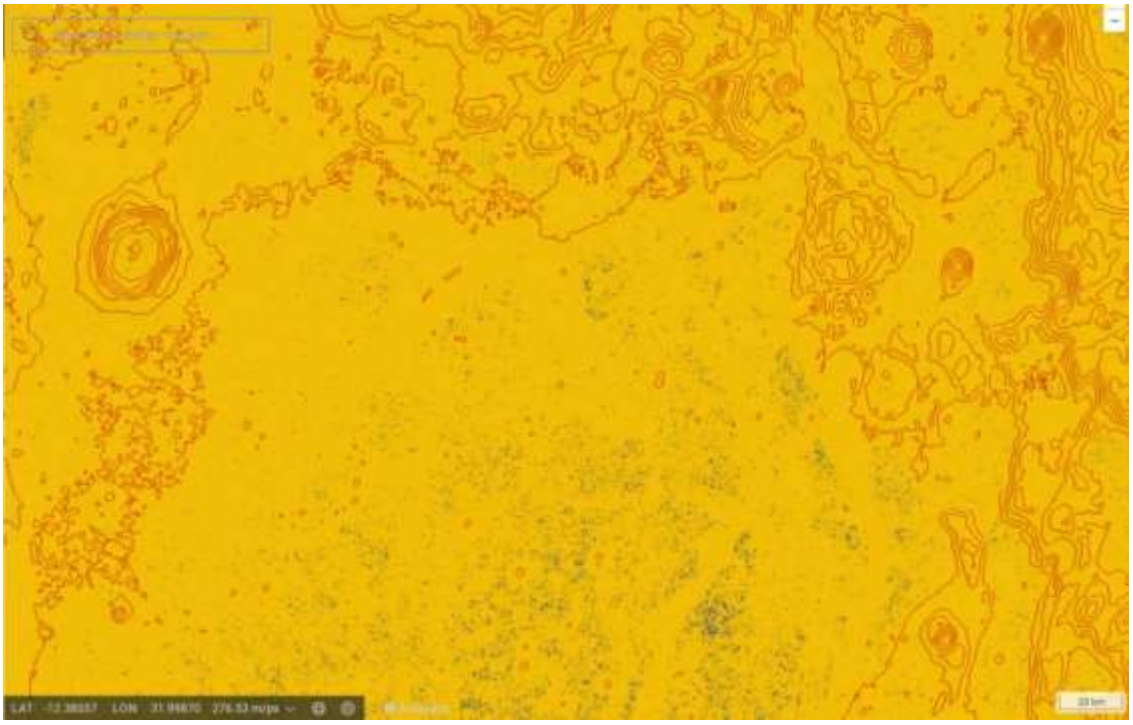
Profile ~ NW to SE:



The profile confirms the peculiar Double Rim to the NW and the diminished rim height (~300m) due to lava in-fill. A 100m high central peak "stub" is still apparent.

Contour Map of N Nectaris:

The top contour map shows the N region of the Mare. Aside from a couple of small rim-arcs to the NW, Daguerre is virtually invisible.



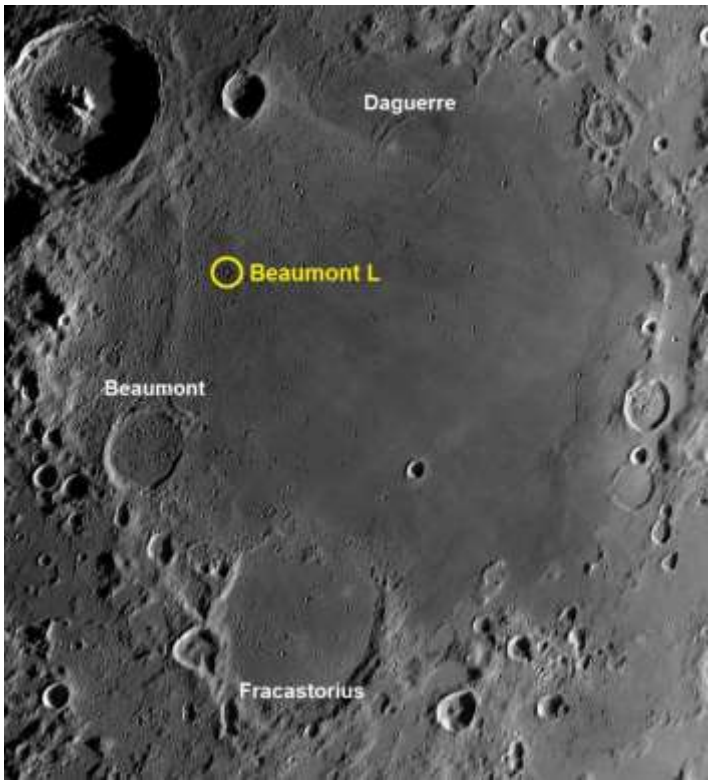
The plan below shows an LRO scan with Terrain Hillshade. The region is identical to the map above, and this time Daguerre is faintly visible.

What are LUNAR DARK HALO CRATERS?

Dark halo craters on the Moon form when the impact occurs on a moderate to high albedo material (another crater's ejecta of highland material) and the projectile excavates an underlying lower albedo material, depositing this darker ejecta around the crater (Head and Wilson 1979 [7])

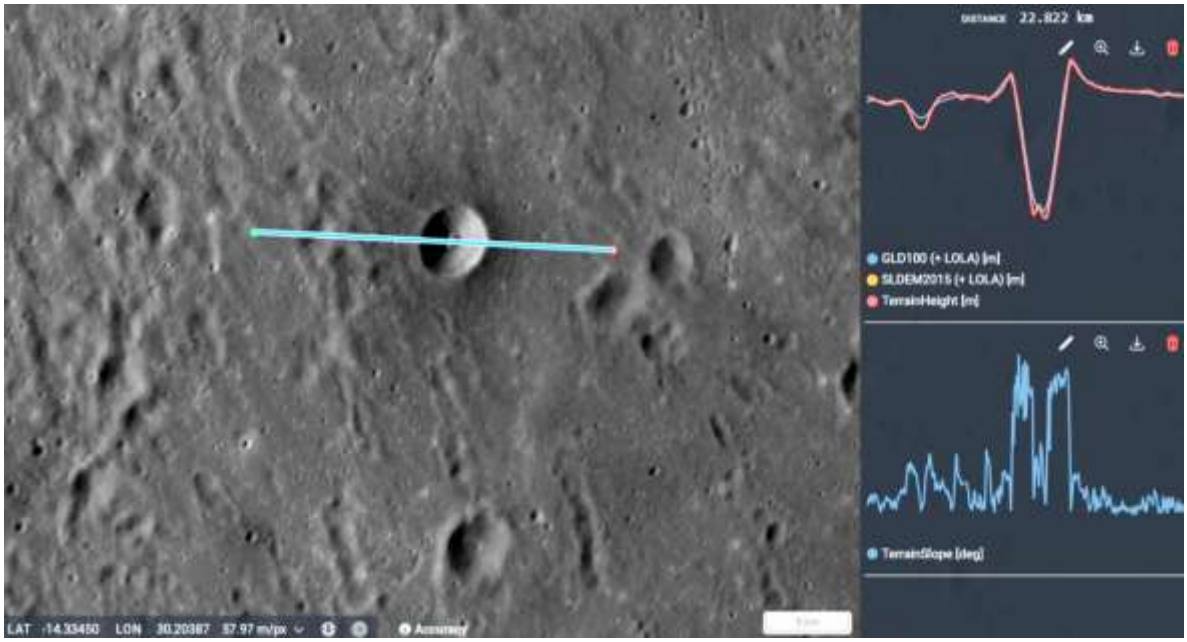
DHC display dark-like deposits around their exterior…the display is indicative of the mode of formation (volcanic or impact) and reveal sub-surface material structure [paraphrase from Moore, FOM, 315 [4]]

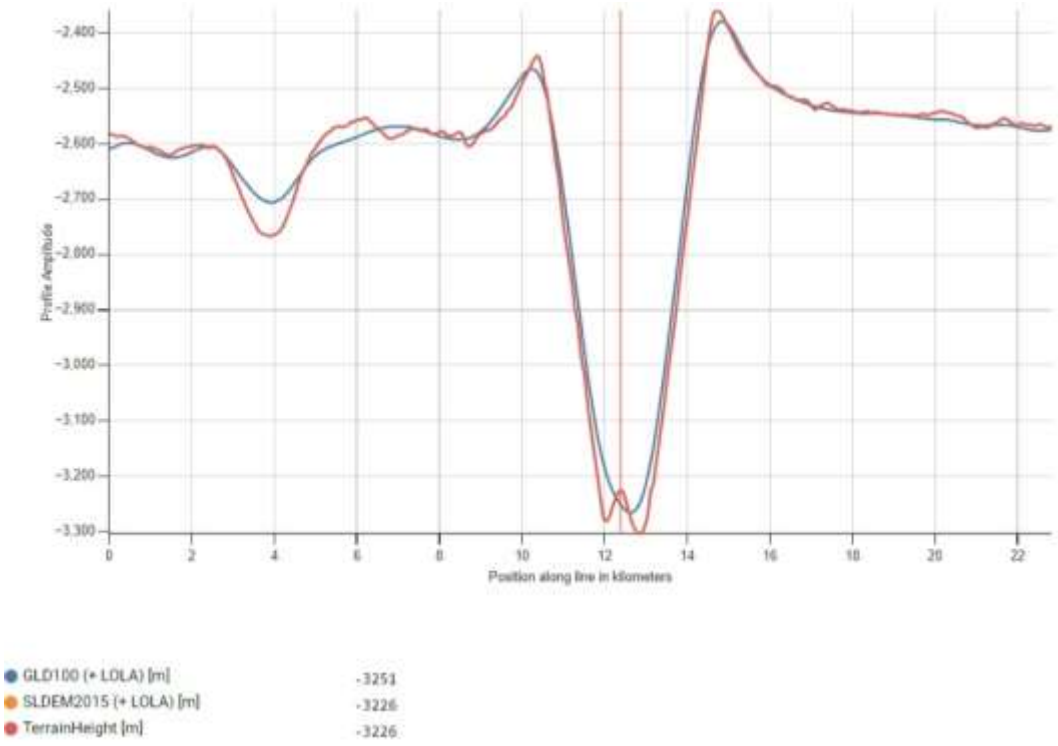
Beaumont L, to the SW of Theophilus is a good example of a DHC.



Apollo 14 AS14-73-10040 image

Beaumont L profile:

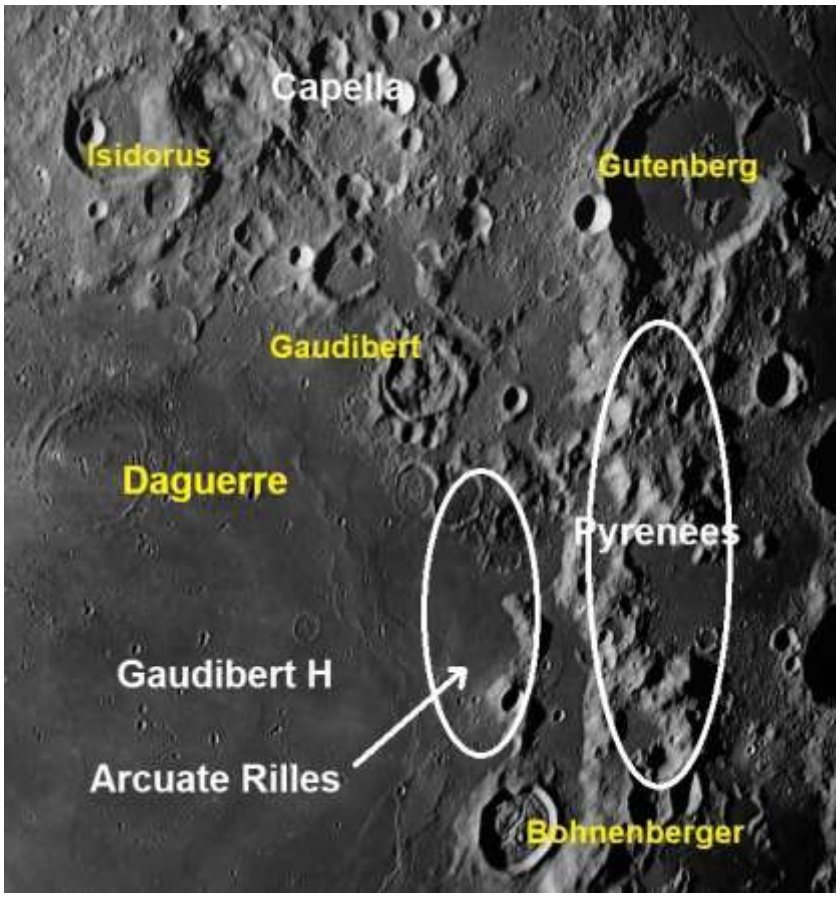




A simple crater ~ 5km diameter, depth ~ 800m

Rilles, Mountains and Interesting Craters

The annotated image below summarizes the features (in WHITE) considered in this section:

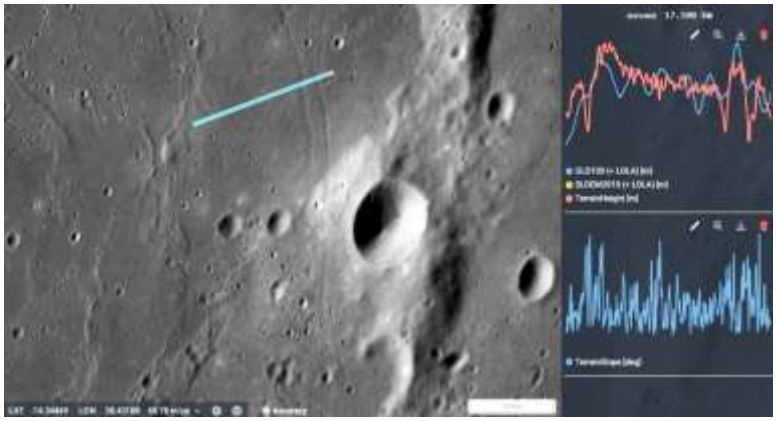


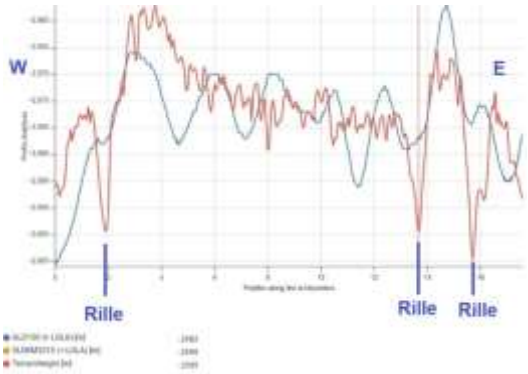
Arcuate Rilles:

ARCUATE RILLES have a smooth curve and are found on the edges of the dark lunar maria. They are believed to have formed when the lava flows that created a mare cooled, contracted, and sank. These are found all over the moon, the classic example being the Hippalus Rilles on the south-eastern border of Mare Humorum. Rima Sulpicius Gallus is another clear example in southwestern Mare Serenitatis.

Unlike the similarly sized Humorum, Mare Nectaris has nothing as distinct. However, a series of parallel rilles runs adjacent to the Mare-Pyrenees border. These rilles are very narrow – I'd say they were < 1km, judging from my images.

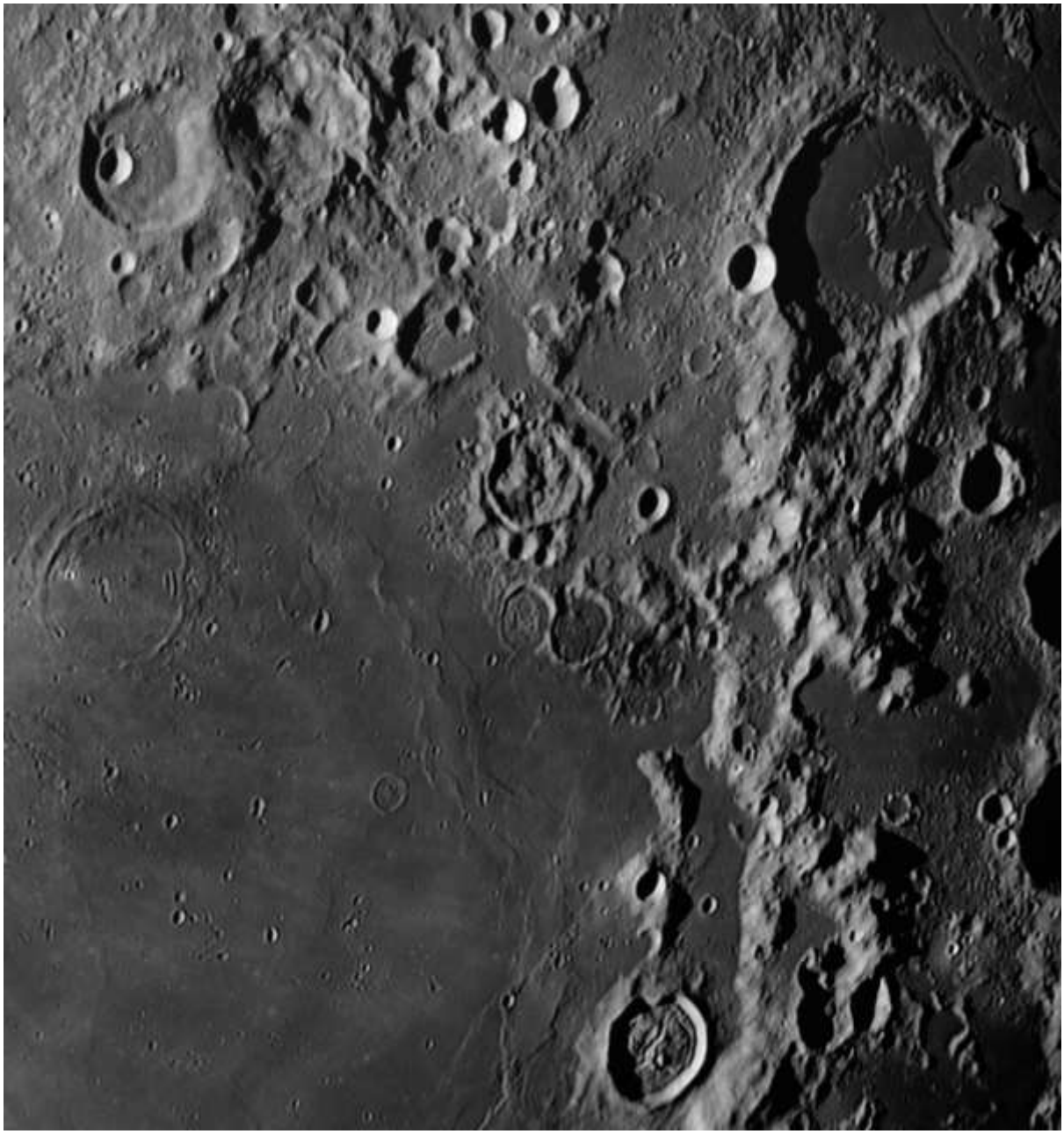
An enlargement of the area indicated above is shown opposite, along with a Profile study….





The LRO data confirms the width of these rilles at ~ 1km MAX.

Pyrenees Mountains:
Length of mountain range: ~ 250km [Moore, FOM, 138 [4]]



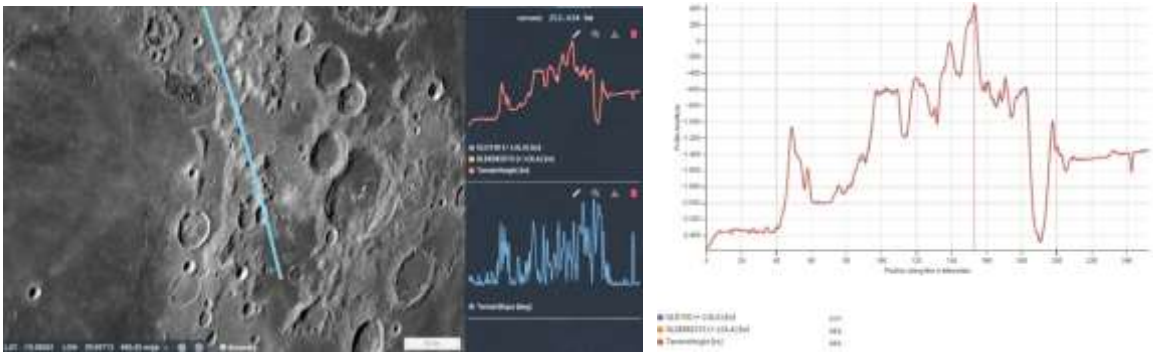
The Pyrenees are well shown here, stretching from the S of Gutenberg to E of Bohnenberger.
17.71d 14 Sept 22 01.20UT [22cr]

Satellite Images:

Two Kaguya views (vid 1370): Top – N end of Pyrenees overlooking Gutenberg.
Bottom – S end of Pyrenees – Bohnenberger is the prominent crater.

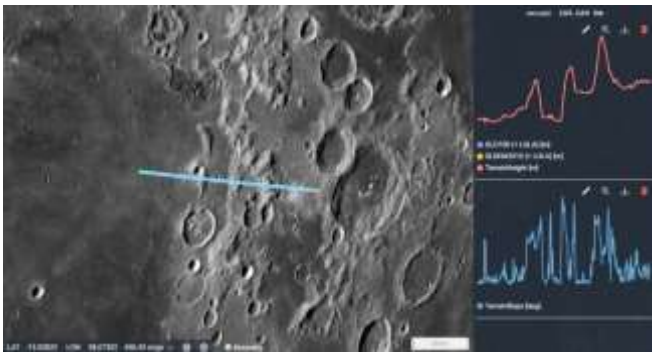
Pyrenees Profiles:

Approx N-S:



The highest peaks, to the NE of Bohnenberger, are around 3000m high, relative to the Mare surface.

Approx W-E:

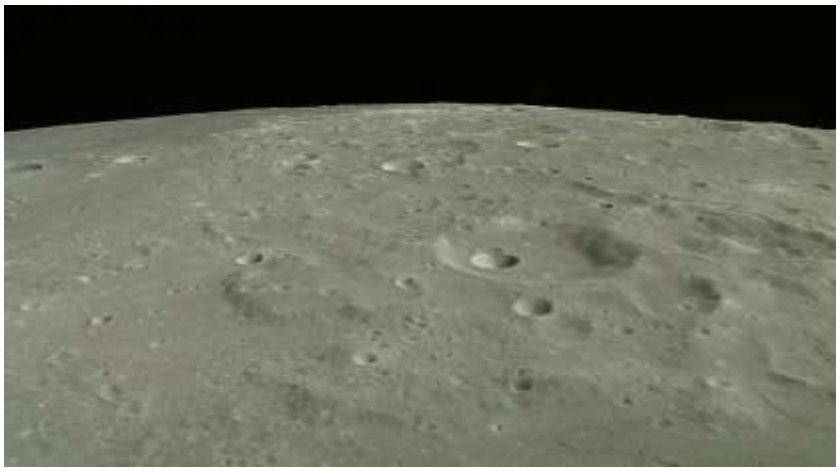


Confirmed maximum altitude ~ 3000m. Interesting to note the different levels of lava in-fill across the profile.

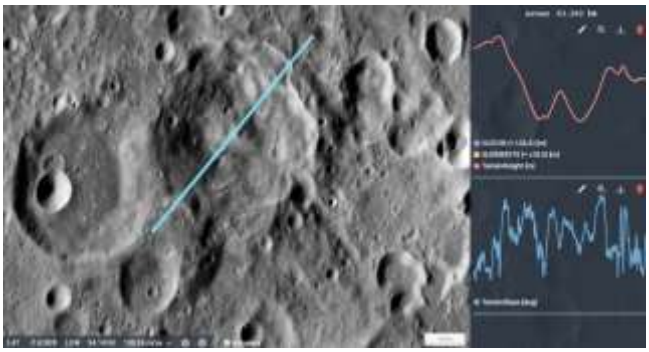
Two "unusual" craters:

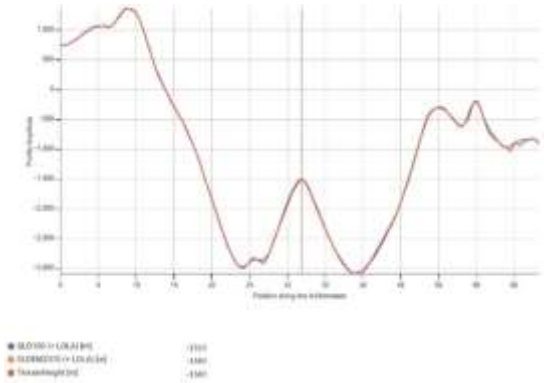
Capella

To the north of the Mare region lie the joined-pairing of Isidorus and Capella. Capella is an ALPETRAGIUS -STYLE crater with (J100, #68) steep crater rims and a virtual absence of crater-floor. The interior is almost entirely filled with a domed central peak which, in Alpetragius's case, resembles an egg!



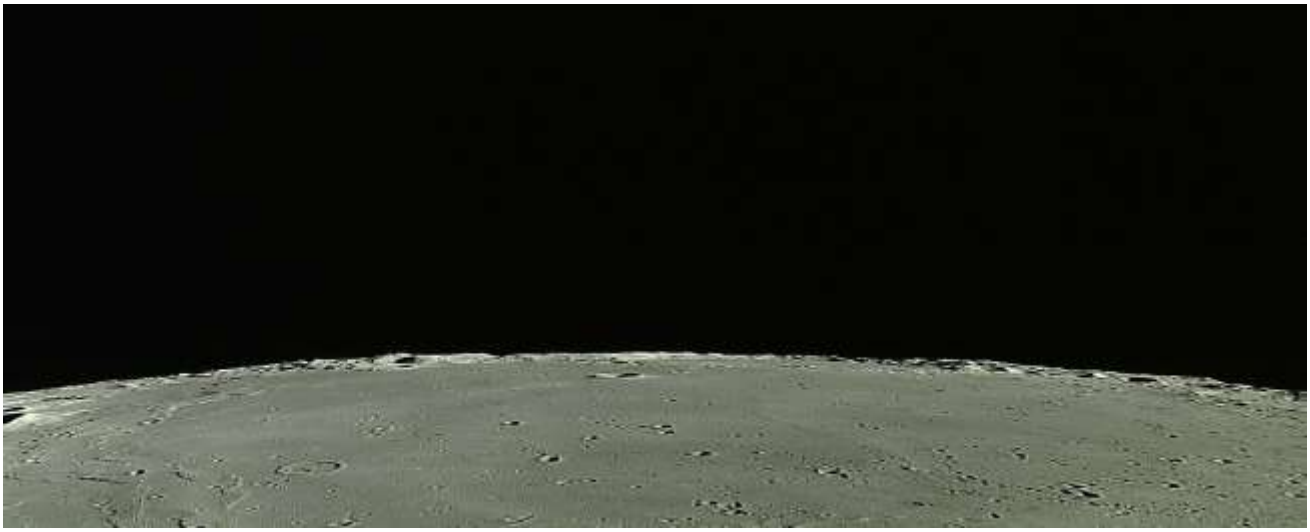
Profile from SW to NE:





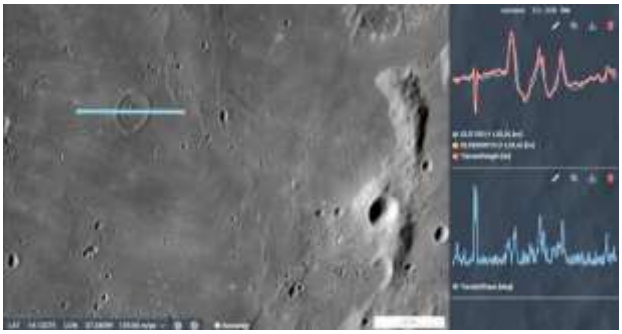
Gaudibert H

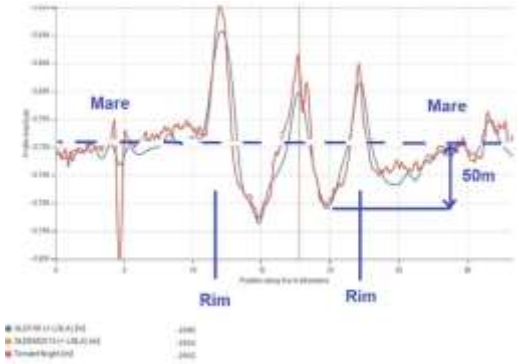
This crater, in the Mare itself, looks like a cross between a normal/ghost/concentric. Despite the lava in-fill it is quite eye-catching: see my image of E Nectaris on page 22 - it's the crater between Daguerre and Bohnenberger.



Kaguya view (vid 468, 1s) looking S over Mare Nectaris. Gaudibert H is to the lower left.

Profile W-E:





The crater is around 10km in diameter. However, lava in-fill has reduced the interior to a depth of ~ 50m below Mare level or ~ 150m below the rim tops. The crater is therefore very shallow and approaching "ghost" category!

References

1 Charles Wood, The Modern Moon – A Personal View, chapter 12, Nectaris, pp. 111-112

2 Wikipedia “Mare Nectaris”

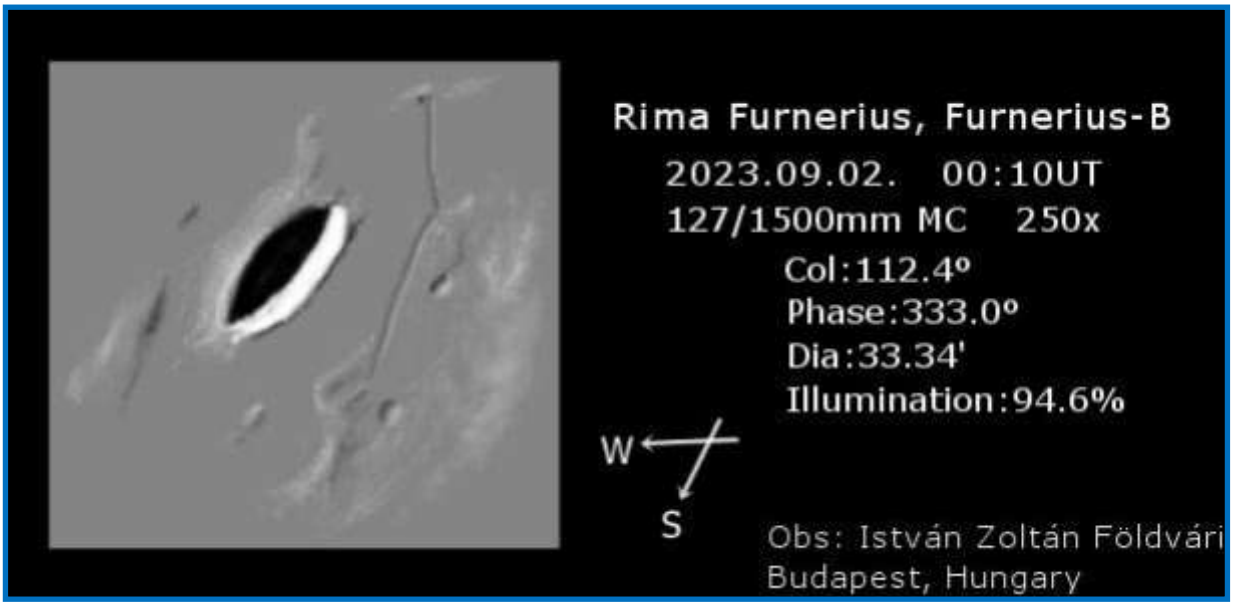
3 Charles Wood, The Modern Moon – A Personal View, chapter 12, Nectaris, p.114

4 John Moore, Features of the Moon, pages as quoted.

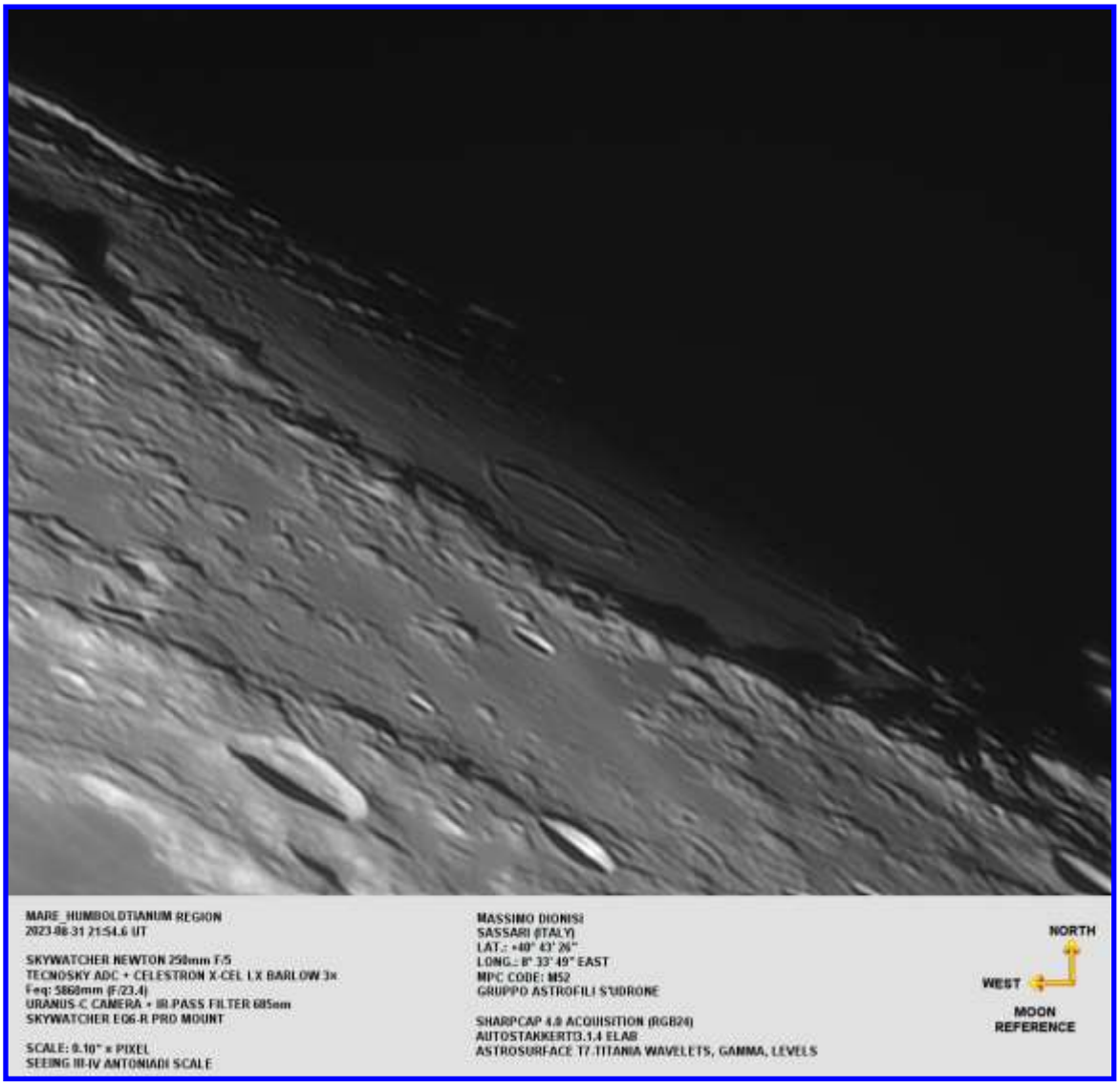
5 Ralph Baldwin, The Face of the Moon, University of Chicago, 1949

6 John Moore, Craters of the Moon, pages as quoted.

7 adsabs.harvard.edu/full/1979LPSC...10.2861H

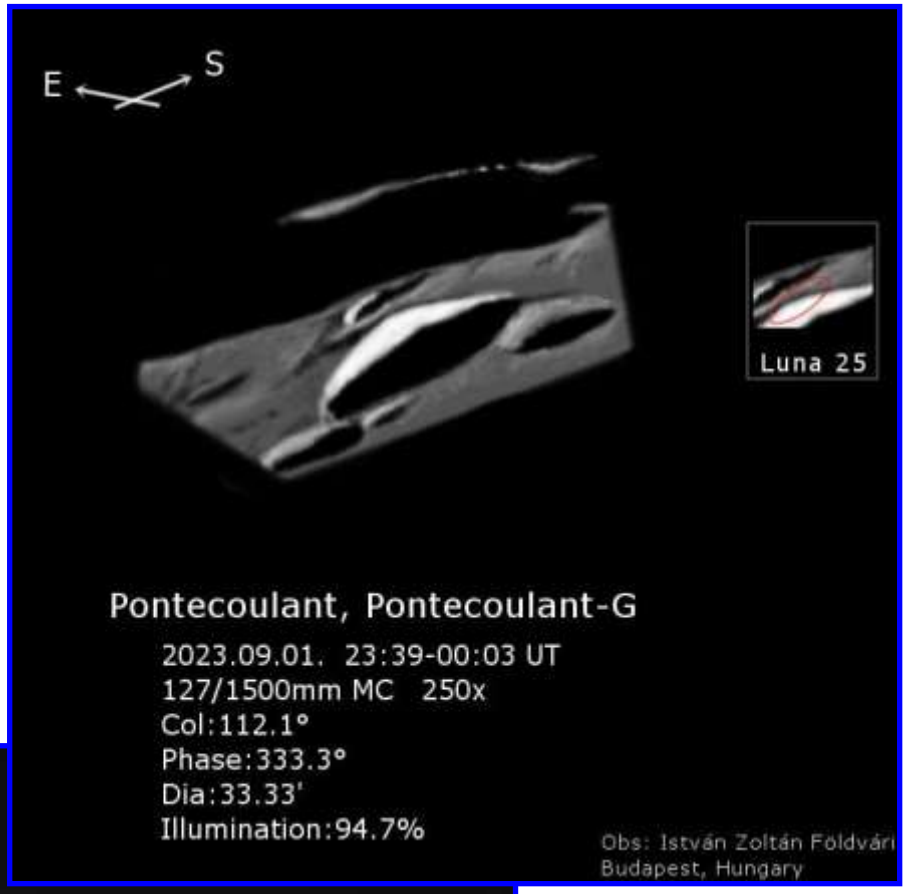


Rima Furnerius and Furnerius B, *István Zoltán Földvári, Budapest, Hungary. 2023 September 02 00:04-00:19 UT, colongitude 112.4º. 127 mm Maksutov-Cassegrain telescope, 1,500 mm focal length, 6 mm orthoscopic, 250x. Seeing 5-8/10, transparency 6/6.*

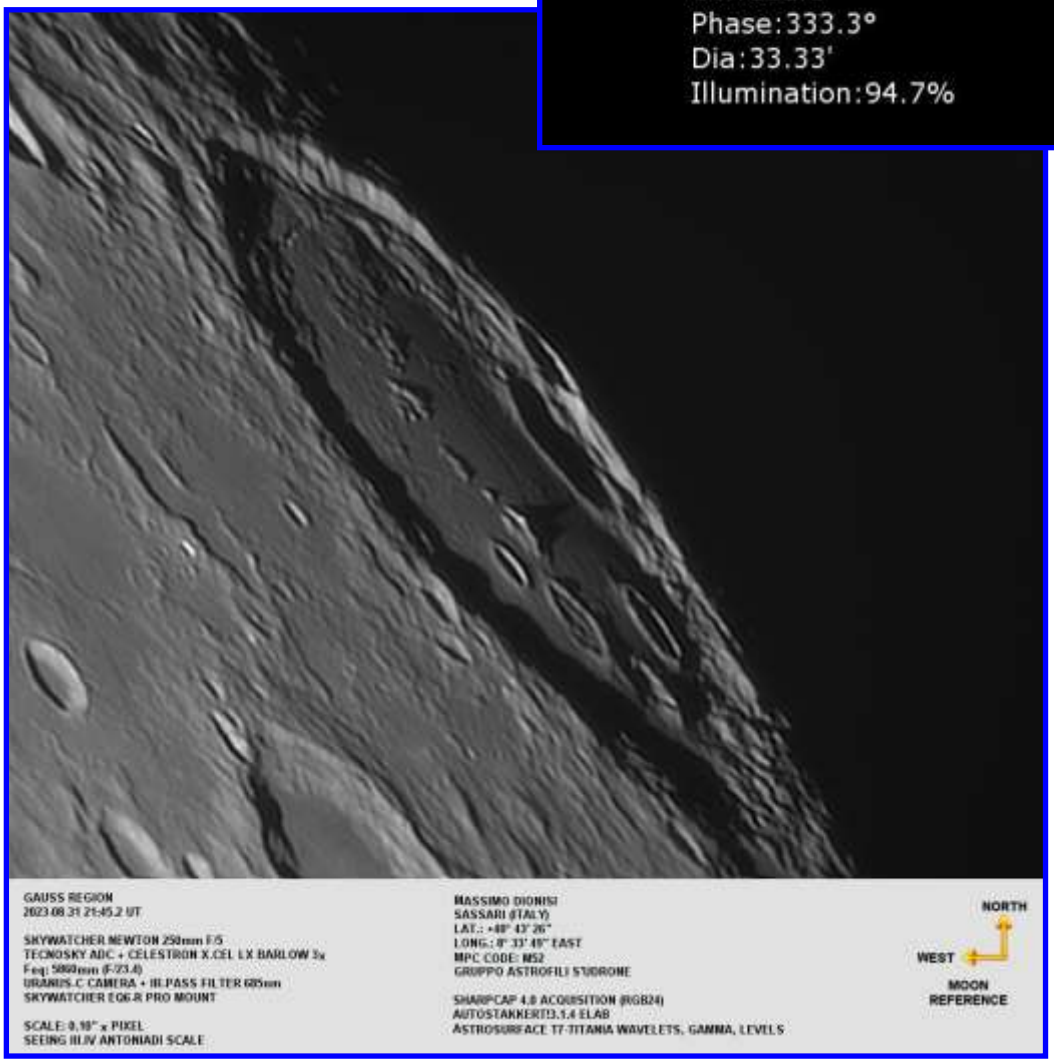


Mare Humboldtianum, *Massimo Dionisi, Sassari, Italy. 2023 August 31 21:54 UT. Sky Watcher 250 mm f/5 Newtonian reflector telescope, Technosky ADC, Celestron X-cel LX Barlow, 3x, fl 5,860 mm, IR pass filter 685 nm, Uranus-C camera. Seeing III-IV Antoniadi Scale.*

Recent Topographic Studies

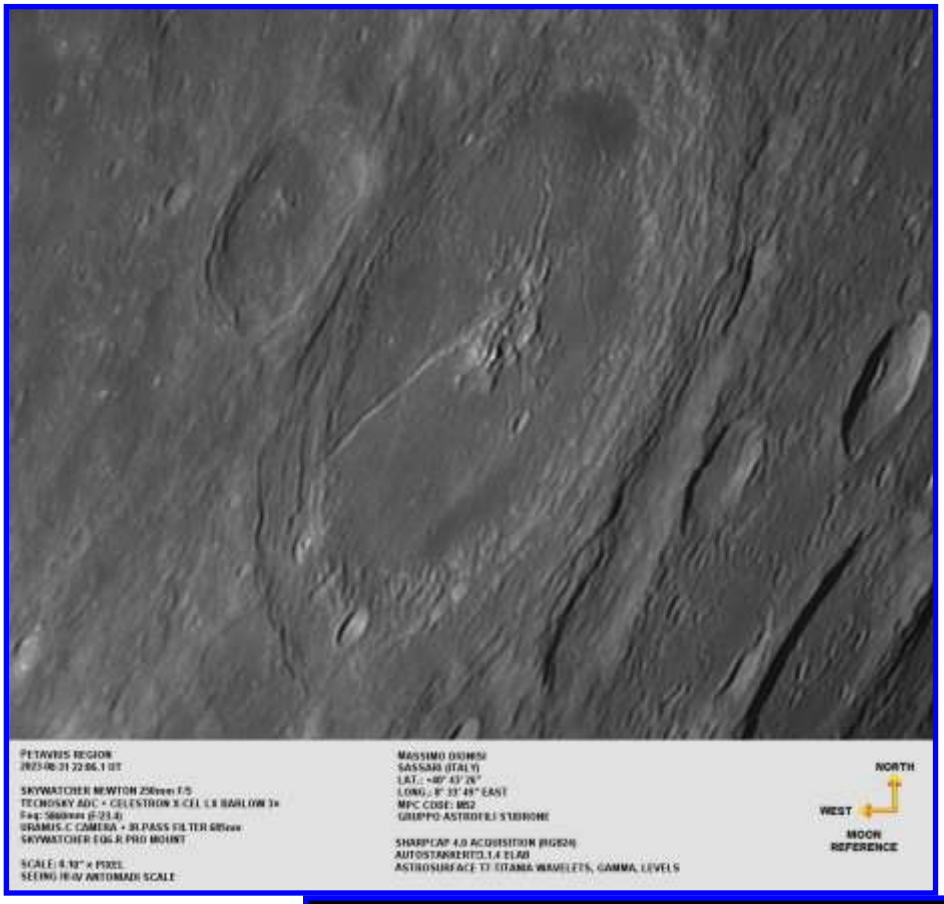


Pontécoolant, Pontécoolant G and Luna 25, *István Zoltán Földvári, Budapest, Hungary. 2023 September 01 23:39-00:03 UT, colongitude 112.1°. 127 mm Maksutov-Cassegrain telescope, 1,500 mm focal length, 6 mm orthoscopic, 250x. Seeing 5-8/10, transparency 6/6.*



Gauss, *Massimo Dionisi, Sassari, Italy. 2023 August 31 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



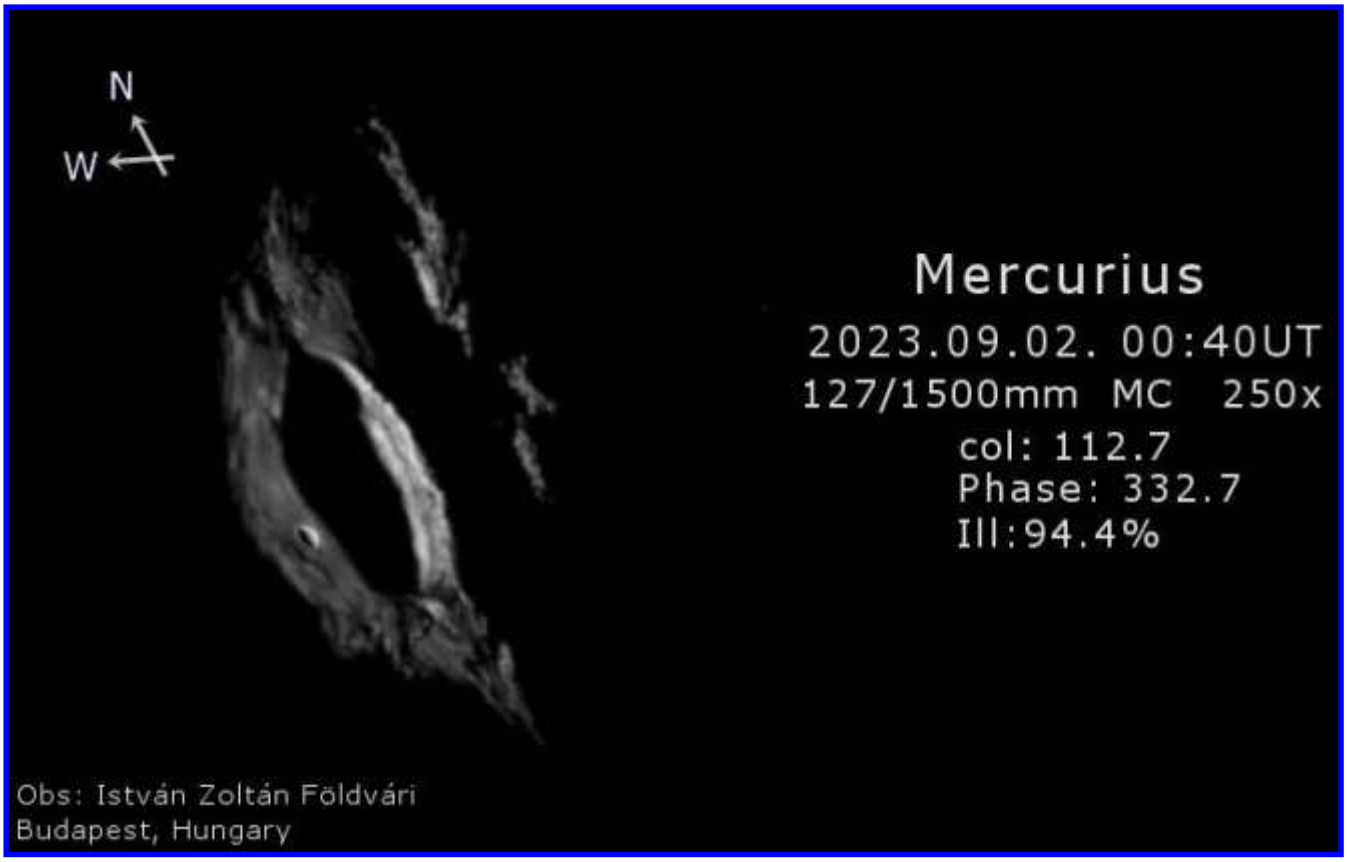
Petavius, *Massimo Dionisi, Sassari, Italy. 2023 August 31 22:06 UT. Sky Watcher 250 mm f/5 Newtonian reflector telescope, Technosky ADC, Celestron X-cel LX Barlow, 3x, fl 5,860 mm, IR pass filter 685 nm, Uranus-C camera. Seeing III-IV Antoniadi Scale.*

Chandrayaan-3 landing site, *Maurice Collins, North Palmerston, New Zealand. 2023 August 25 07:45 UT. Meade ETX90 Maksutov-Cassegrain telescope, QHY5III462C camera. Maurice adds: "*My father asked me where the Indian Chandrayaan-3 landing site was on the Moon. Now that LRO has found it and given the coordinates, I decided to use LTVT to find the spot and then put an arrow on one of my images from 2023 August 25 0755UT to show where it landed. I had no idea myself until I did this, so now we know!"

Recent Topographic Studies

Mare Undarum, *Massimo Dionisi, Sassari, Italy. 2023 August 31 21:31 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.*

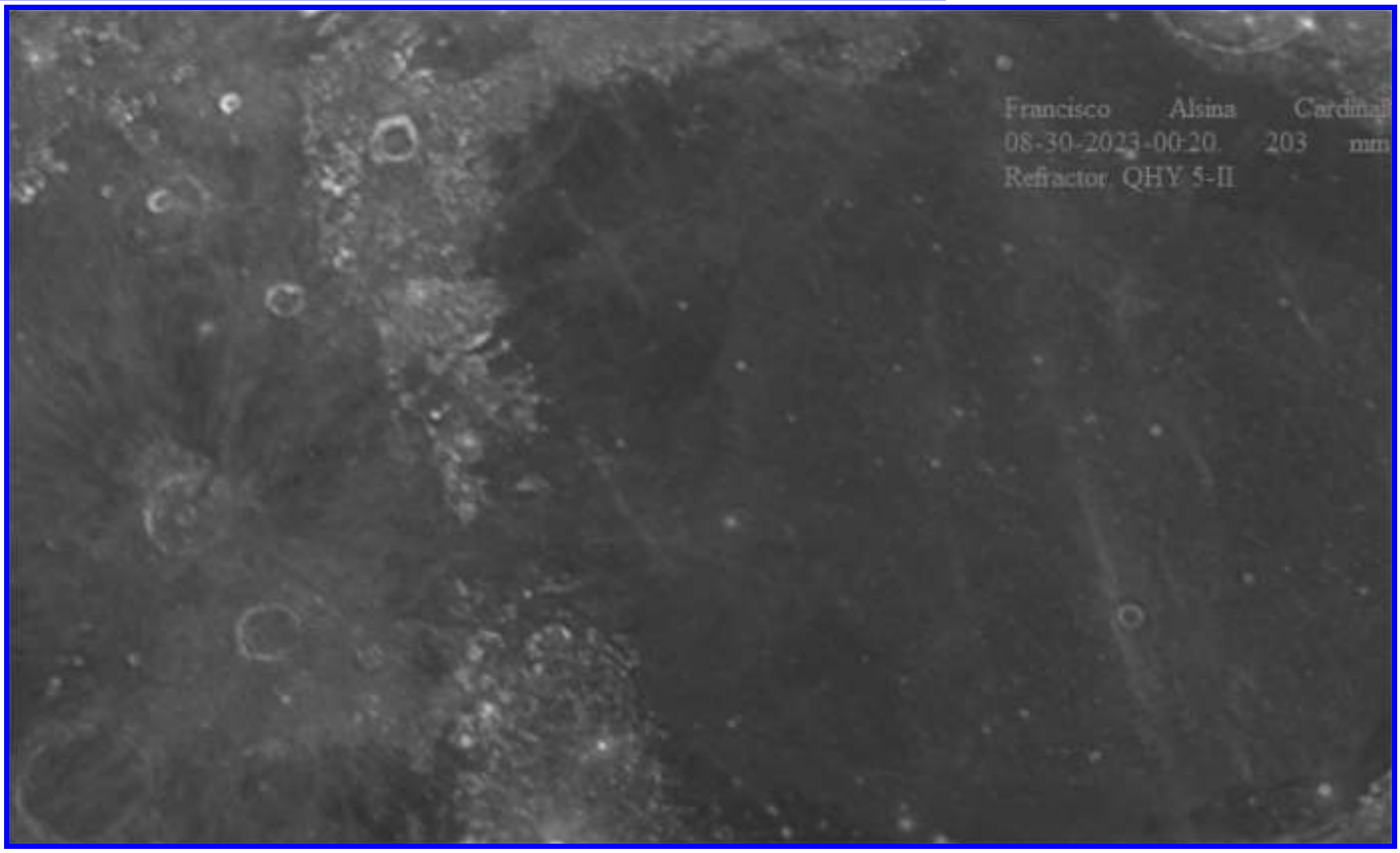
Mercurius, *István Zoltán Földvári, Budapest, Hungary. 2023 September 02 00:39 -00:57 UT, colongitude 112.7°. 127 mm Maksutov-Cassegrain telescope, 1,500 mm focal length, 6 mm orthoscopic, 250x. Seeing 7/10, transparency 6/6.*



Recent Topographic Studies

Lacus Autumni, *Massimo Dionisi, Sassari, Italy. 2023 August 31 21:24 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.*

Linné, *Francisco Alsina Cardinalli, Oro Verde, Argentina. 2023 August 30 00:20 UT. 8 inch Newtonian reflector telescope, QHY5-II camera.*



Recent Topographic Studies

Balmer, *Massimo Dionisi, Sassari, Italy. 2023 August 31 22:13 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.*

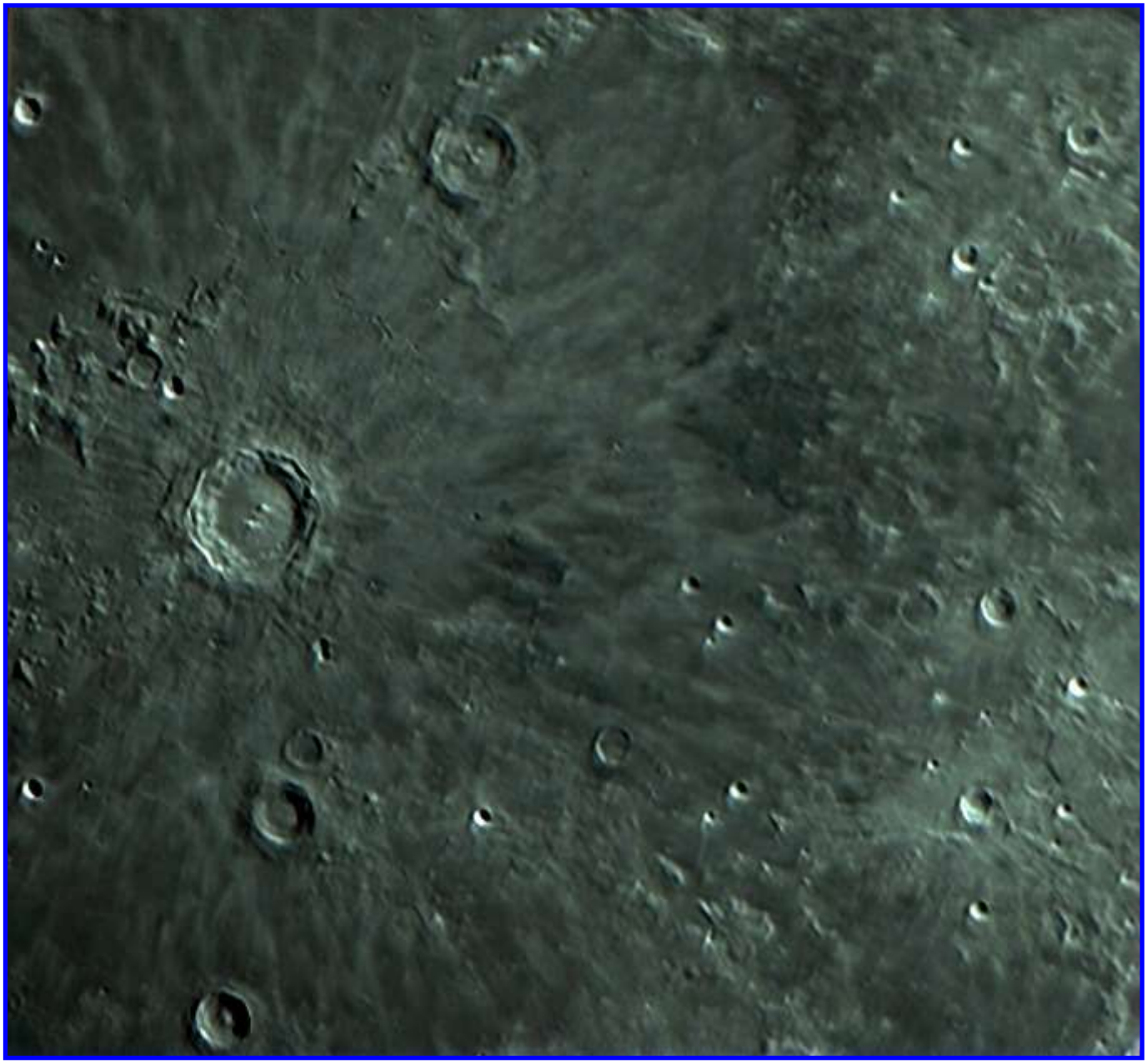
Waxing Crescent Moon, *Jairo Chavez, Popayán, Colombia. 2023 July 19 00:00 UT. 311 mm truss tube Dobsonian reflector telescope, MOTO E5 PLAY camera.*

Recent Topographic Studies

La Pérouse, *Massimo Dionisi, Sassari, Italy. 2023 August 31 22:19 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.*

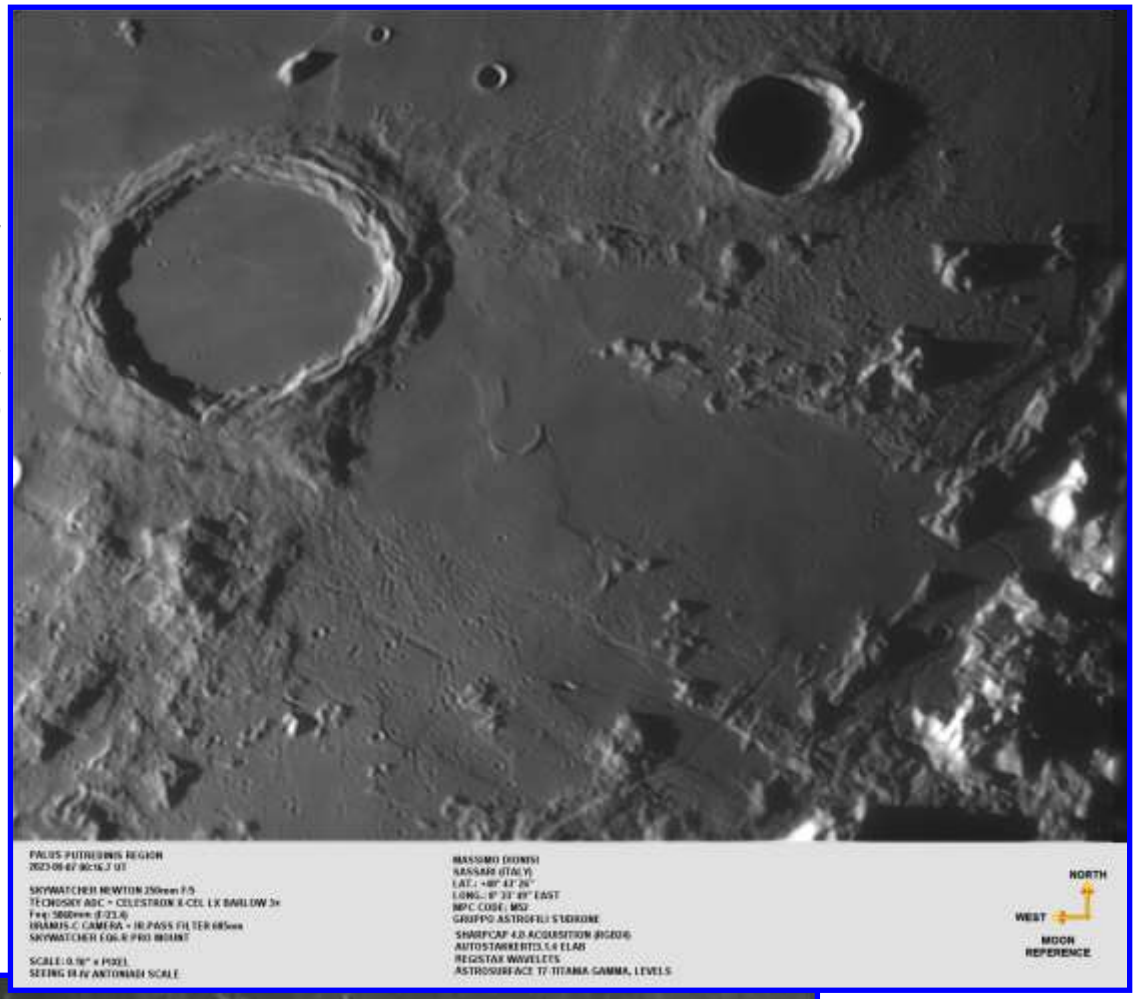
Hesiodus, *Larry Todd, Dunedin, New Zealand. 2023 September 24 07:42 UT. OMC 200 mm Maksutov-Cassegrain telescope, Neptune 11C camera in mono mode.*

Recent Topographic Studies



Copernicus to Eratosthenes, Diego *Giufrida, Gonnet, Buenos Aires, Argentina. 2023 August 26 22:28 UT. Meade 12 inch Dobsonian reflector telescope, Canon EOS 60D camera.* Diego adds: "Copernicus and Eratosthenes take center stage in the image. The first is an impact crater, it has a diameter of 93 km and has an almost hexagonal shape and to enter you have to cross three levels of descending mountains 30 km wide, the depth to the internal sea is 3.8 km. Saturate the image to show the radially outward-scattering rays formed at the moment of impact. The central mountain peaks are 1.2 km high from the low zone. Between centers of the two mentioned craters, the distance that separates them is approximately 300 km. From the lunar surface it would not be possible to see one from the other due to the curvature. Between the two there is a series of small craters as if arranging a line, the smallest in that area are 4 km in diameter. Eratosthenes (it looks like a number 6 with the mountain range that surrounds it), it is 58 km in diameter and 3.57 km deep. Equipment: Meade 12" dobson with EOS 60d canon. Homemade equatorial rig, raw video recording in crop mode 640 x 480. Processing MLV Converter, PIPP, Autostaker (drizle 3), Astrosurface, Fitswork, Gimp."

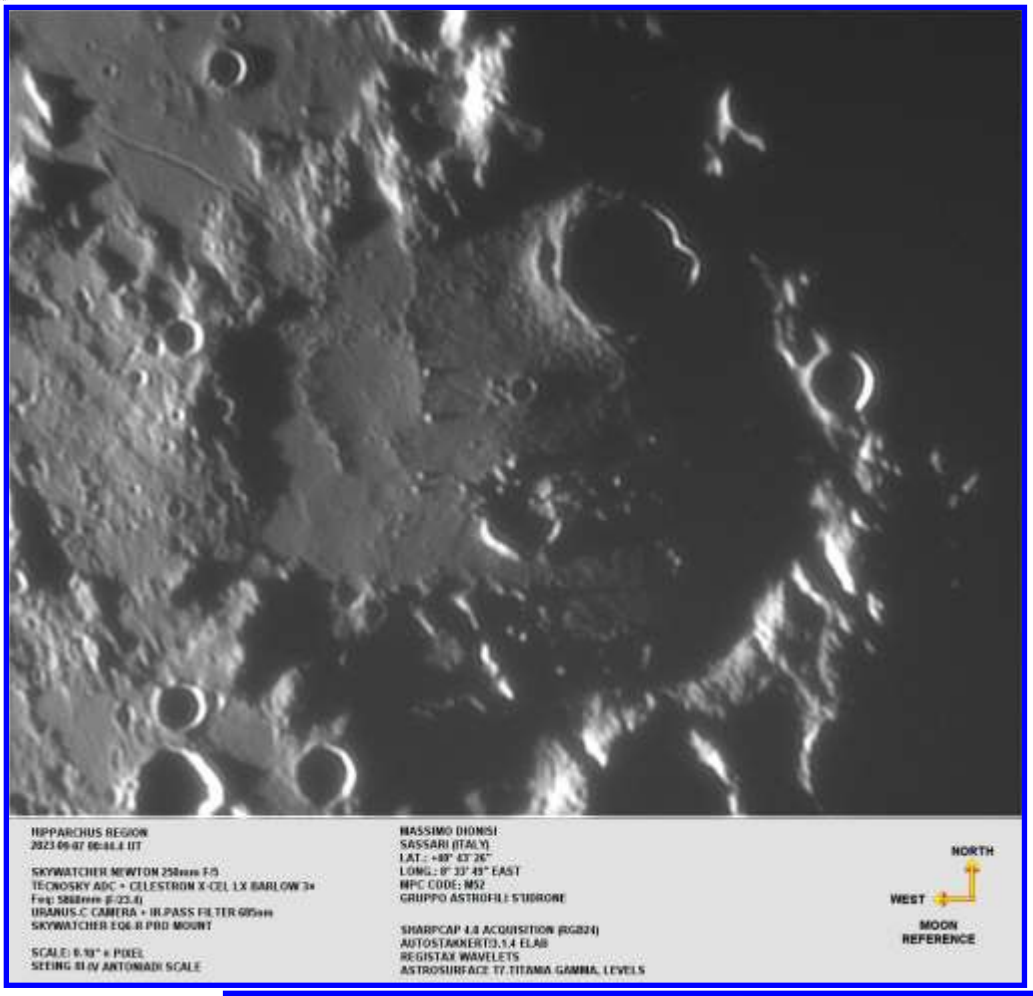
Recent Topographic Studies



Palus Putredinis, *Massimo Dionisi, Sassari, Italy. 2023 September 07 00:16 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.*

Aristarchus, *Francisco Alsina Cardinalli, Oro Verde, Argentina. 2023 August 30 00:39 UT. 8 inch Newtonian reflector telescope, QHY5-II camera.*

Recent Topographic Studies

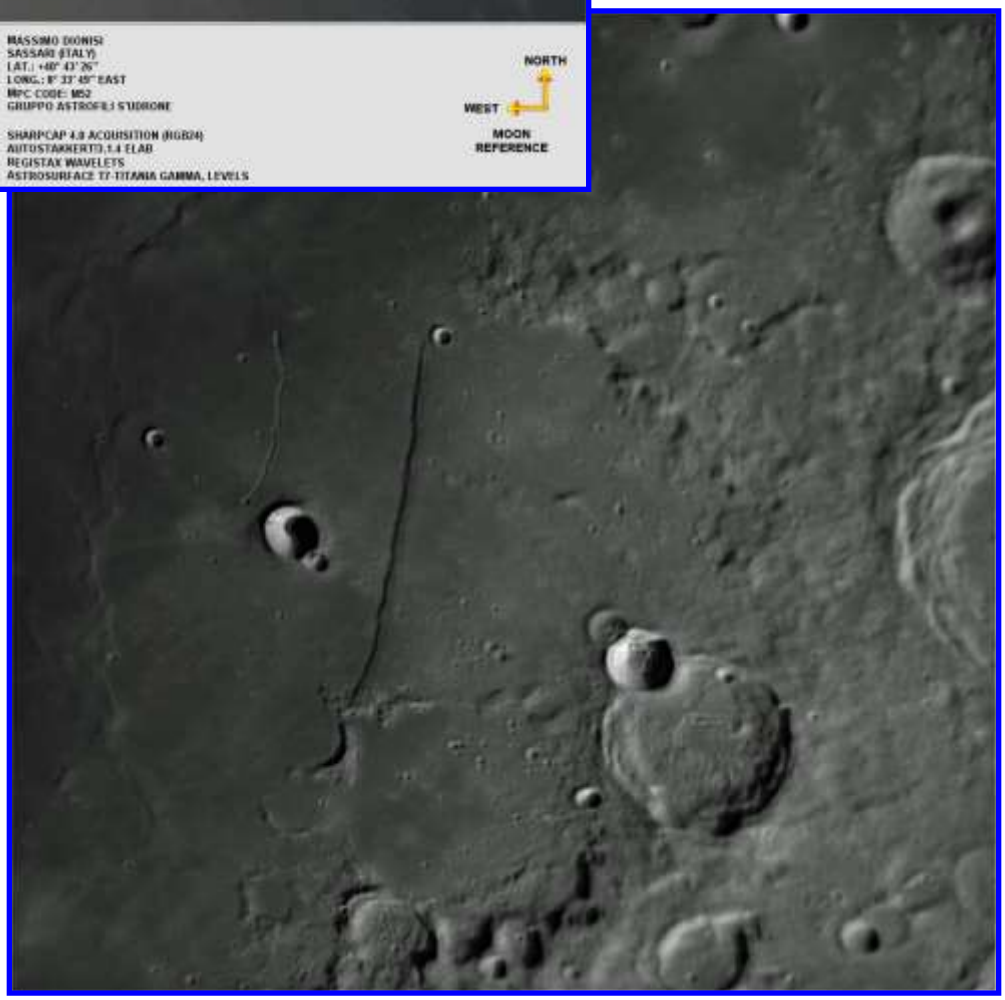


Hipparchus, *Massimo Dionisi, Sassari, Italy. 2023 September 07 00:44 UT. Sky Watcher 250 mm f/5 Newtonian reflector telescope, Technosky ADC, Celestron X-cel LX Barlow, 3x, fl 5,860 mm, IR pass filter 685 nm, Uranus-C camera. Seeing III-IV Antoniadi Scale.*

Anaxagoras, *Jairo Chavez, Popayán, Colombia. 2023 July 30 19:00 UT. 311 mm truss tube Dobsonian reflector telescope, MOTO E5 PLAY camera. North is right, west is up.*

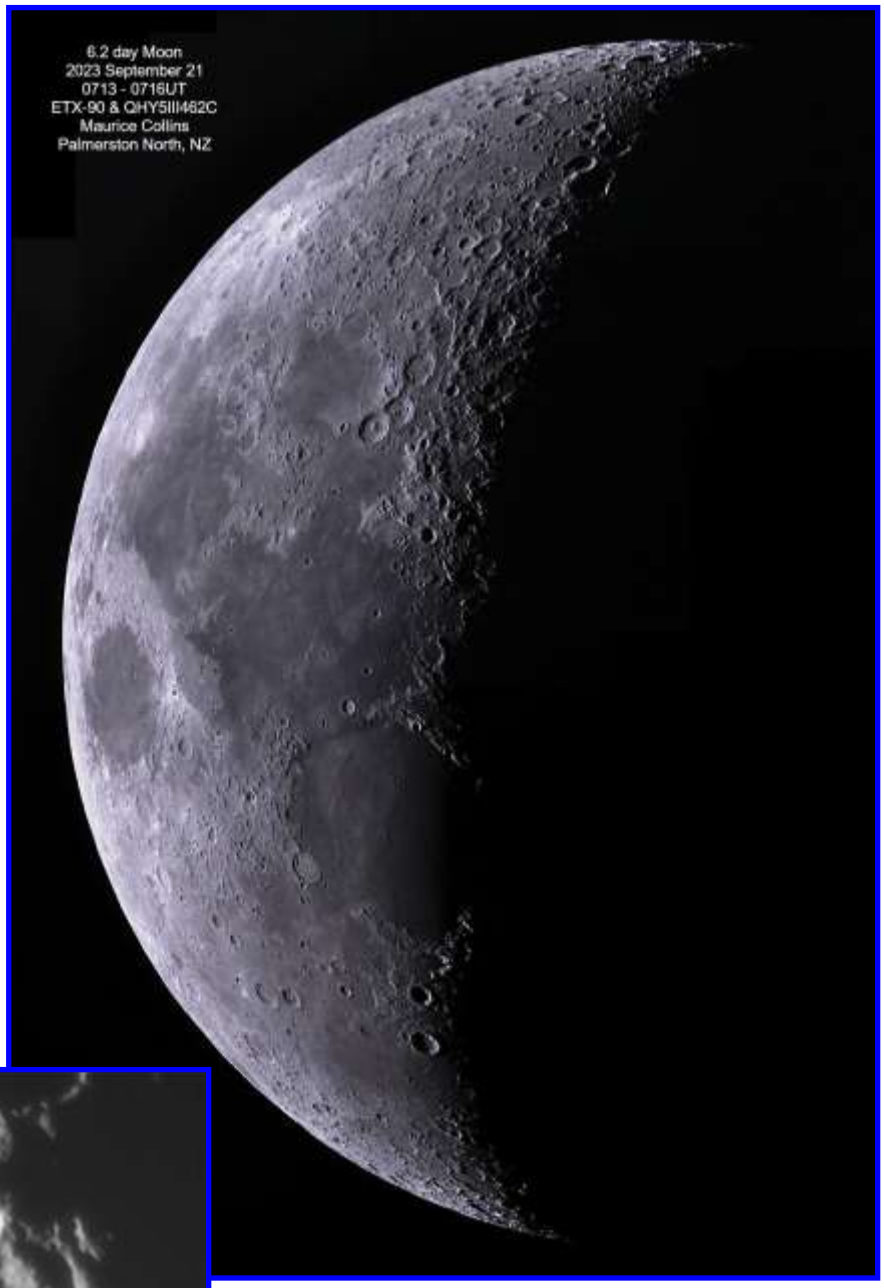
Recent Topographic Studies

Sinus Fidei, *Massimo Dionisi, Sassari, Italy. 2023 September 07 00:29 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.*

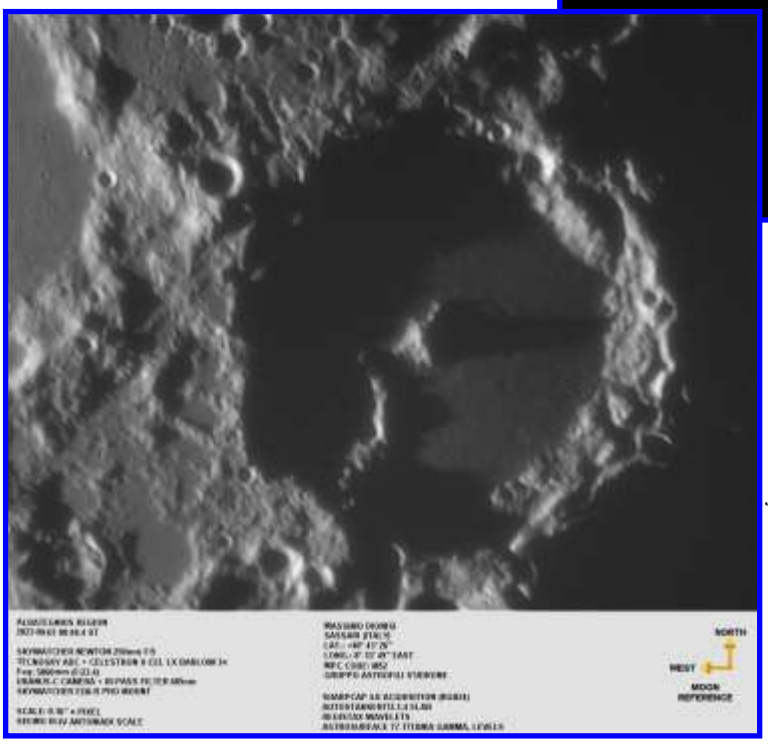


Rupes Recta, *Larry Todd, Dunedin, New Zealand. 2023 September 24 07:37 UT. OMC 200 mm Maksutov-Cassegrain telescope, Neptune 11C camera in mono mode.*

Recent Topographic Studies

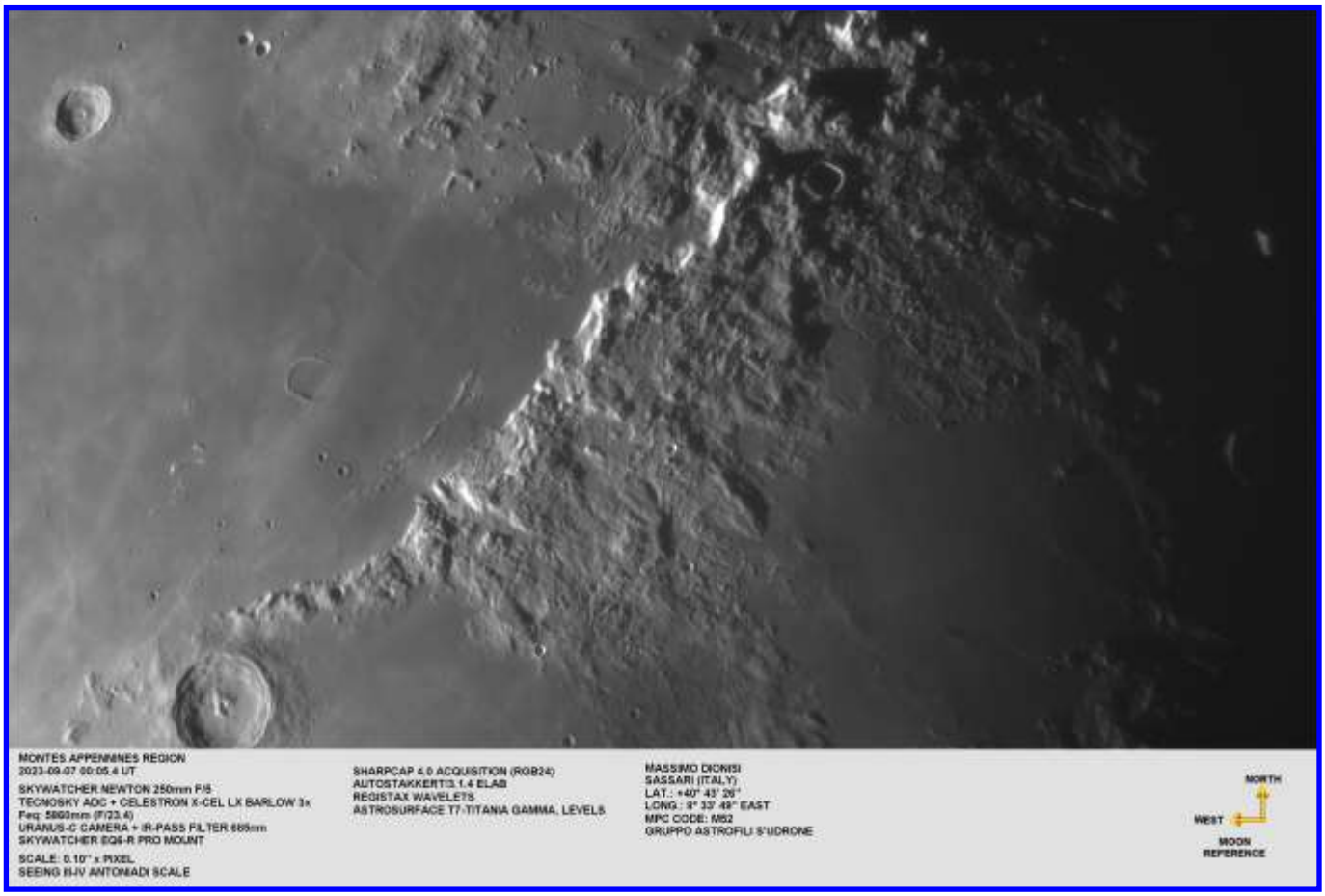


6.2-day old Moon, *Maurice Collins, North Palmerston, New Zealand. 2023 September 21 07:13-07:16 UT. Meade ETX90 Maksutov -Cassegrain telescope, QHY5III462C camera.*



Albategnius, *Massimo Dionisi, Sassari, Italy. 2023 September 07 00:48 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

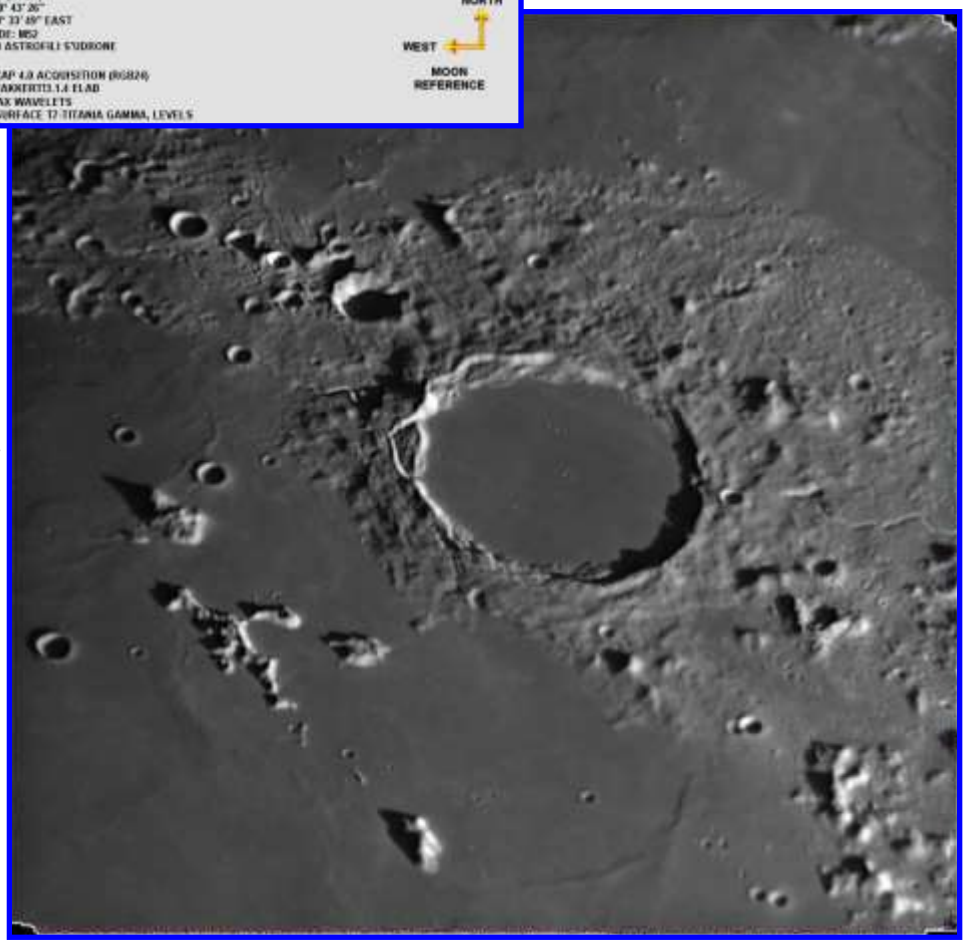


Apenninus, *Massimo Dionisi, Sassari, Italy. 2023 September 07 00:05 UT. Sky Watcher 250 mm f/5 Newtonian reflector telescope, Technosky ADC, Celestron X-cel LX Barlow, 3x, fl 5,860 mm, IR pass filter 685 nm, Uranus -C camera. Seeing III-IV Antoniadi Scale.*

Hadley Rille, *Larry Todd, Dunedin, New Zealand. 2023 September 24 07:30 UT. OMC 200 mm Maksutov-Cassegrain telescope, Neptune 11C camera in mono mode.*

Recent Topographic Studies

Ptolemaeus, *Massimo Dionisi, Sassari, Italy. 2023 September 07 00:52 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.*



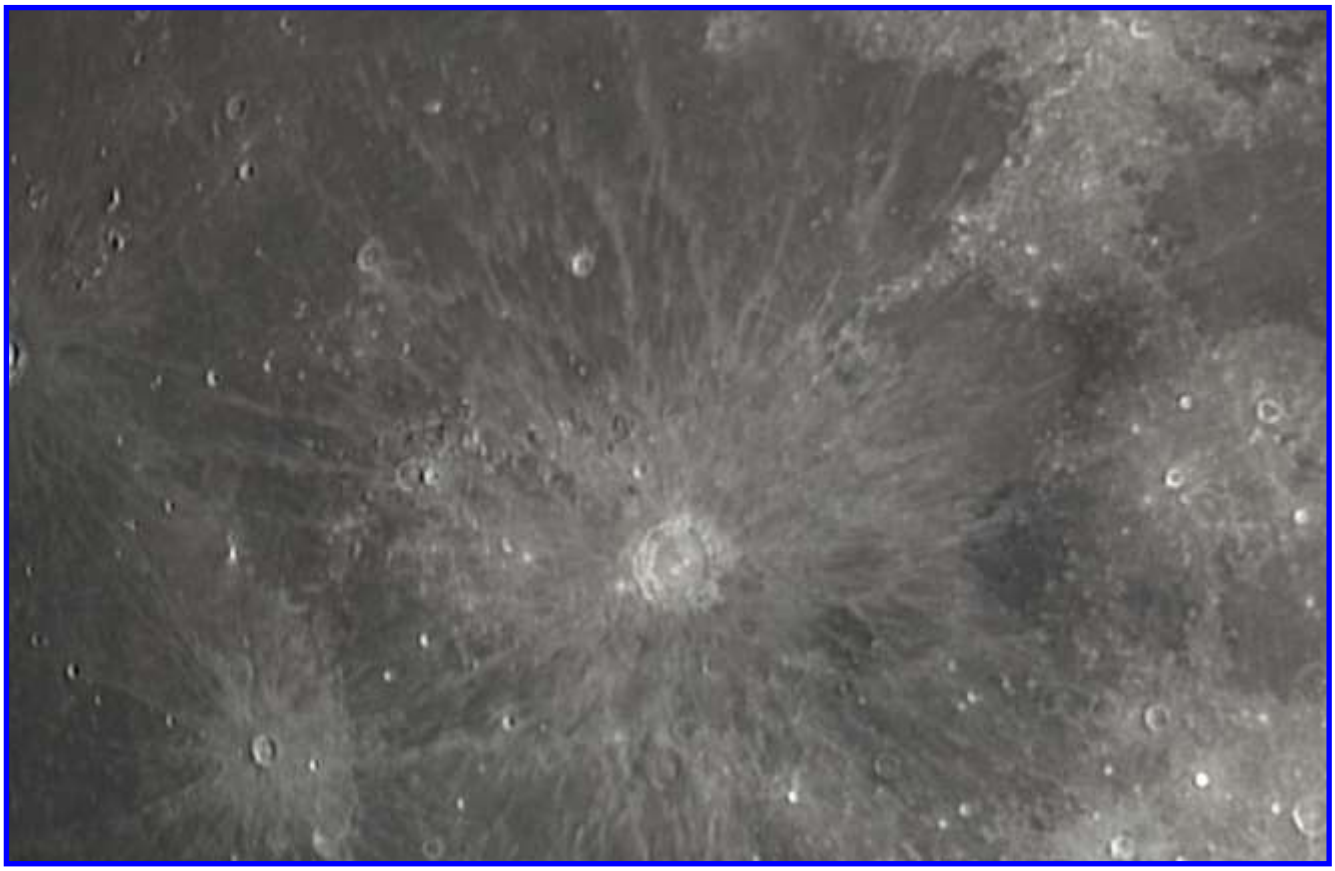
Plato, *Larry Todd, Dunedin, New Zealand. 2023 September 24 07:25 UT. OMC 200 mm Maksutov-Cassegrain telescope, Neptune 11C camera in mono mode.*

Recent Topographic Studies

Stewart and Pomortsev, *István Zoltán Földvári, Budapest, Hungary. 2023 September 02 00:19-00:38 UT, co-longitude 112.5°. 127 mm Maksutov-Cassegrain telescope, 1,500 mm focal length, 6 mm orthoscopic, 250x. Seeing 7/10, transparency 6/6.*

Aristarchus, *Walter Ricardo Elias, Oro Verde, Argentina, AEA. 2023 September 27 23:42 UT. Helios 114 mm reflector telescope, QHY5 IIC camera.*

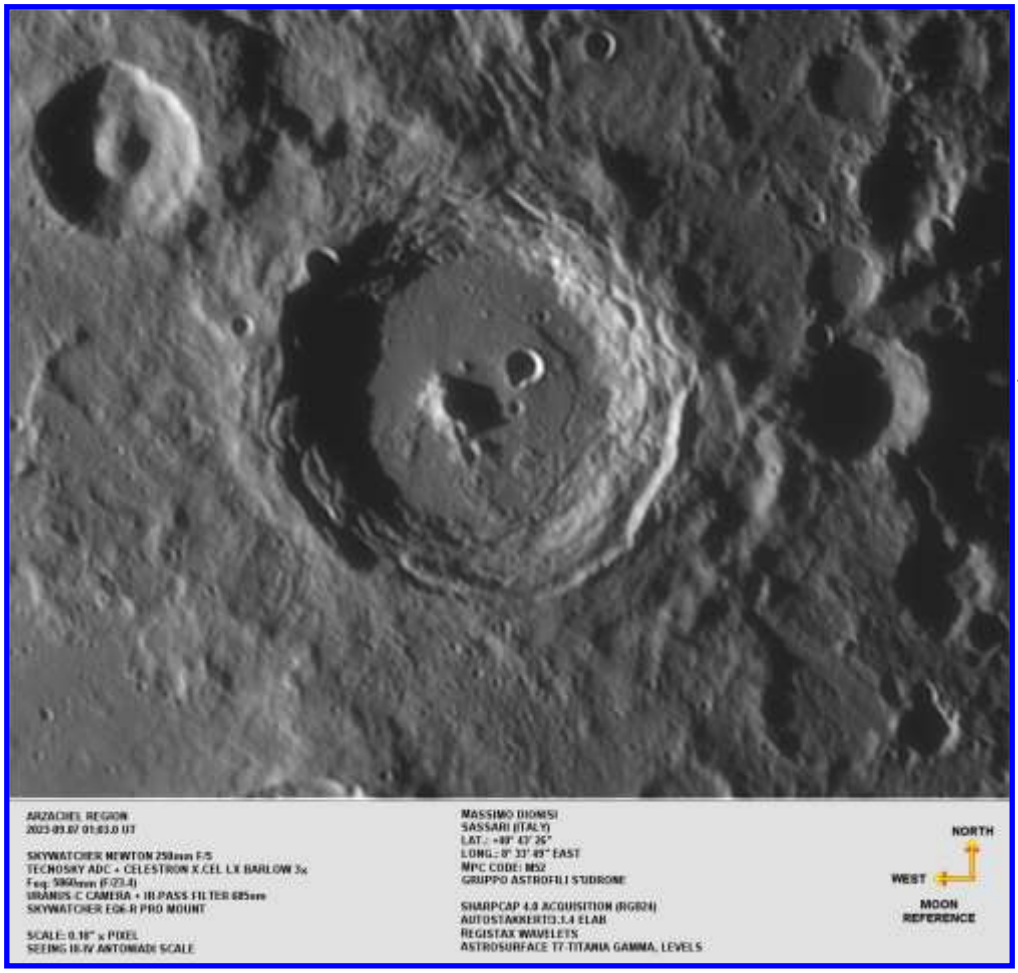
Recent Topographic Studies



Copernicus, *Walter Ricardo Elias, Oro Verde, Argentina, AEA. 2023 September 27 23:47 UT. Helios 114 mm reflector telescope, QHY5 IIC camera.*

Copernicus, *Larry Todd, Dunedin, New Zealand. 2023 September 24 07:34 UT. OMC 200 mm Maksutov-Cassegrain telescope, Neptune 11C camera in mono mode.*

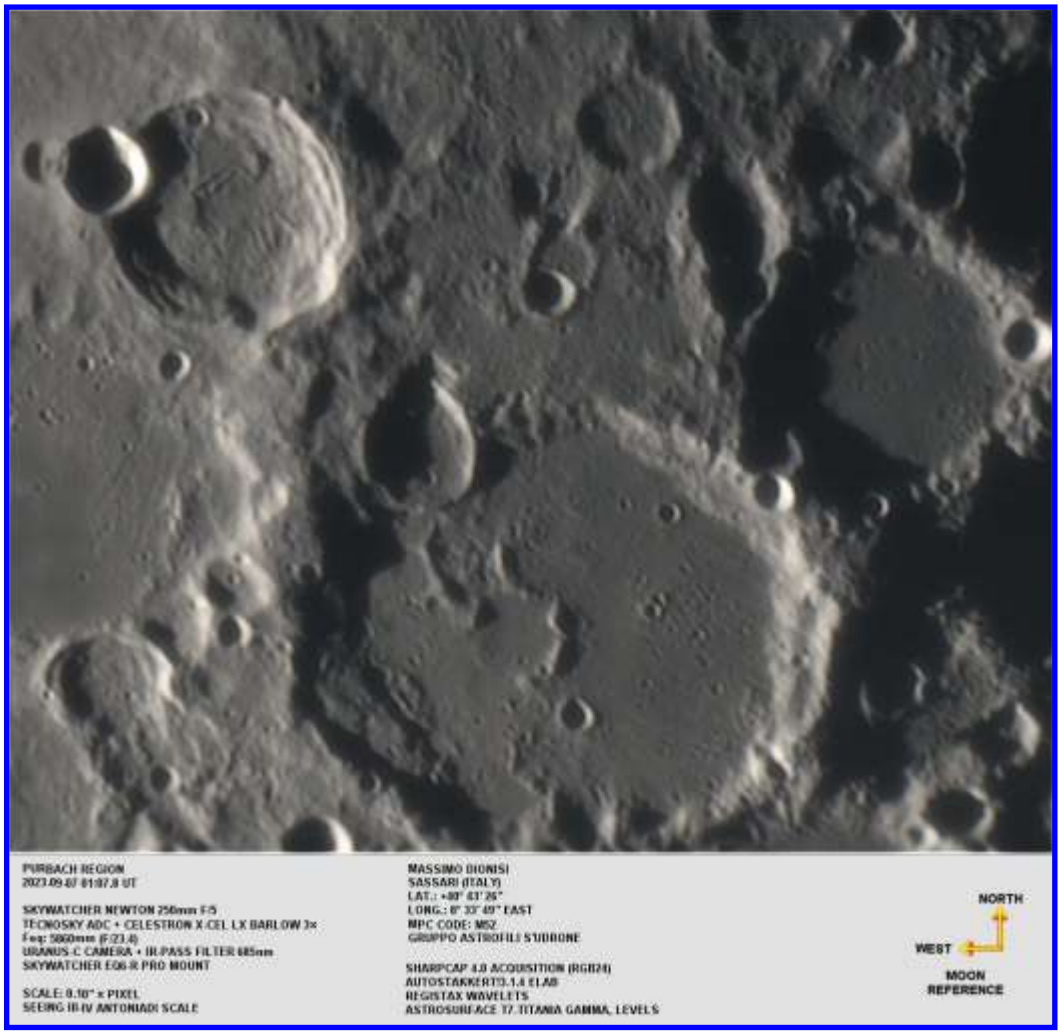
Recent Topographic Studies



Arzachel, *Massimo Dionisi, Sassari, Italy. 2023 September 07 01:03 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.*

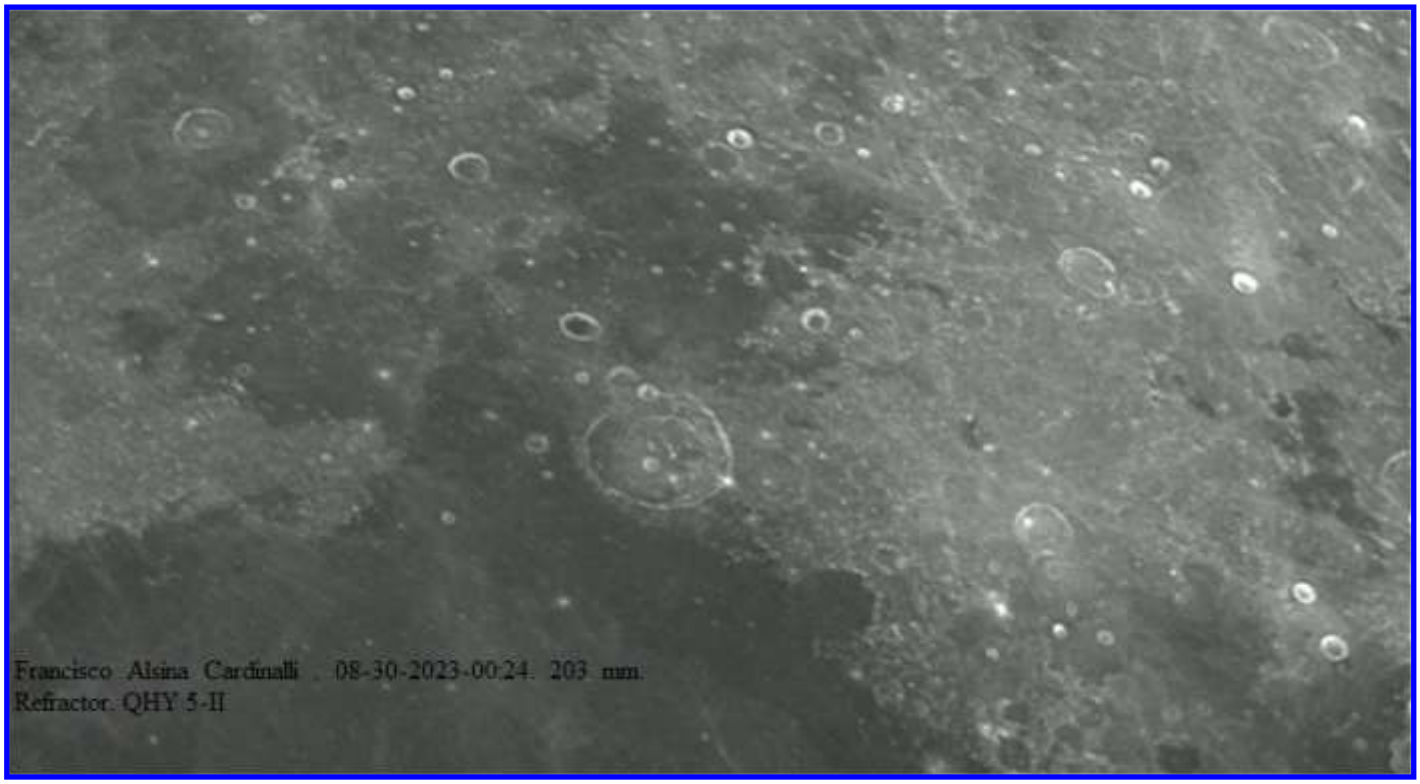
Tycho, *Walter Ricardo Elias, Oro Verde, Argentina, AEA. 2023 September 27 23:53 UT. Helios 114 mm reflector telescope, QHY5 IIC camera.*

Recent Topographic Studies



Purbach, *Massimo Dionisi, Sassari, Italy. 2023 September 07 01:07 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.*

Posidonius, *Francisco Alsina Cardinalli, Oro Verde, Argentina. 2023 August 30 00:24 UT. 8 inch Newtonian reflector telescope, QHY5-II camera.*



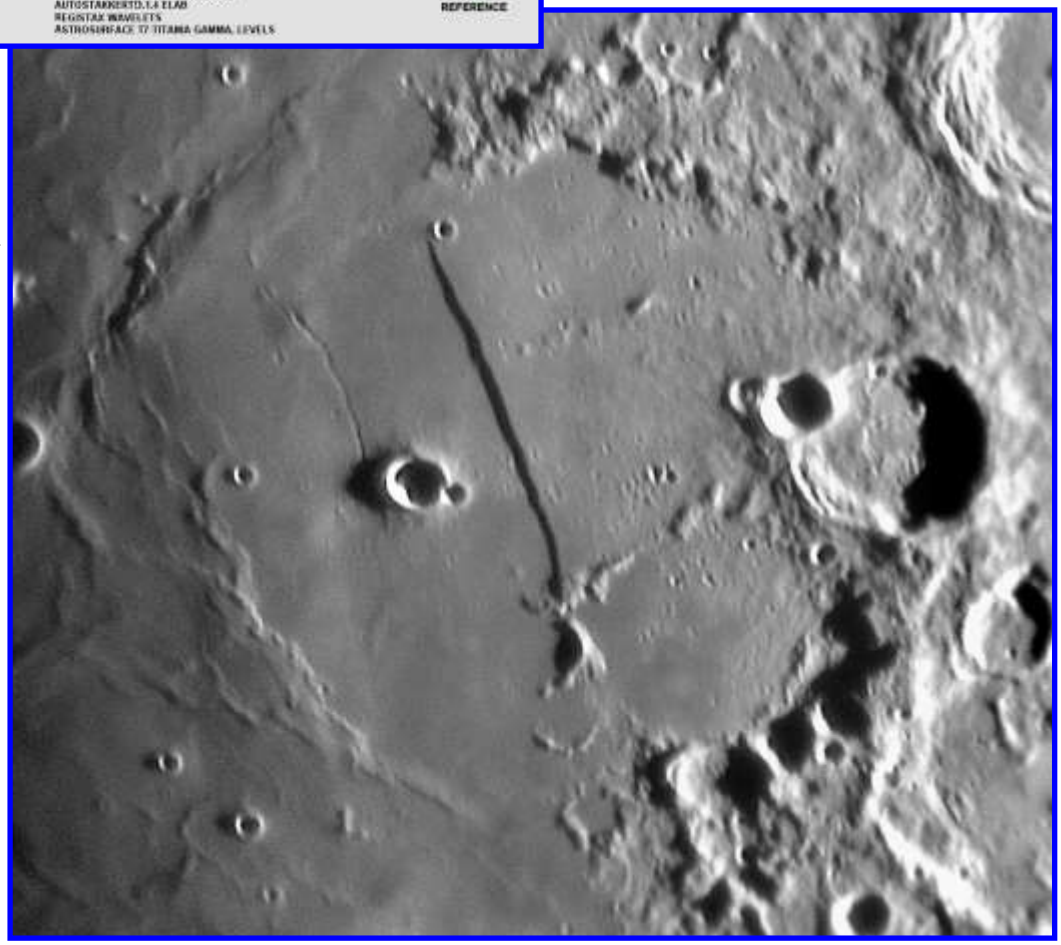
Recent Topographic Studies

Mare Orientale, *Larry Todd, Dunedin, New Zealand. 2023 February 10 16:27 UT. OMC 200 mm Maksutov-Cassegrain telescope, Neptune 11C camera in mono mode.*

The Waxing Gibbous Moon*, Gonzalo Vega, Oro Verde, AEA. 2023 September 23 19:50 UT. 130 mm Newtonian reflector telescope, 900 mm focal length, EQ3 Goto mount, Moto 60S camera.*

Recent Topographic Studies

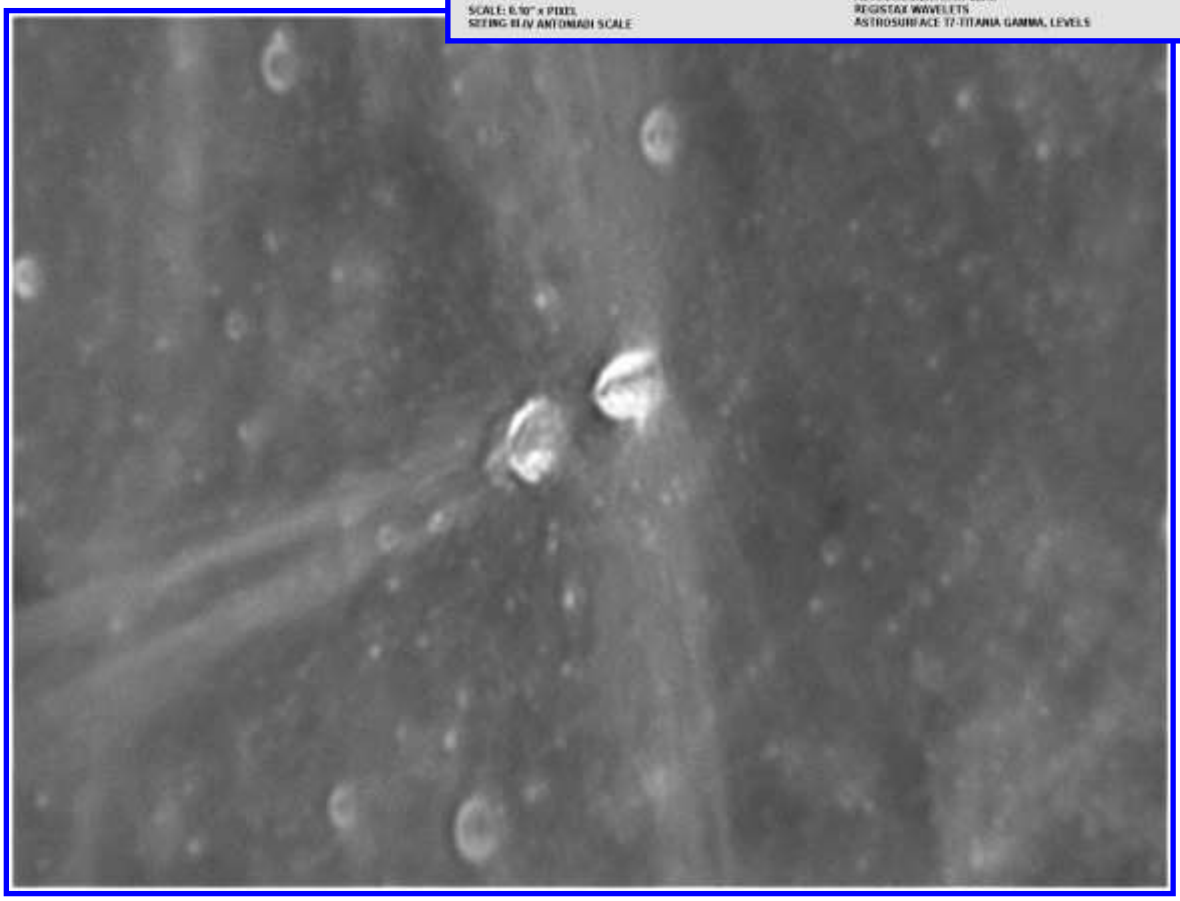
Alphonsus, *Massimo Dionisi, Sassari, Italy. 2023 September 07 00:56 UT. Sky Watcher 250 mm f/5 Newtonian reflector telescope, Technosky ADC, Celestron X-cel LX Barlow, 3x, fl 5,860 mm, IR pass filter 685 nm, Uranus-C camera. Seeing III-IV Antoniadi Scale.*



Rupes Recta, *KC Pau, Hong Kong, China. 2023 September 23 11:18 UT. 10 inch f/6 Newtonian reflector telescope, 2.5x barlow, QHY-CCD290M camera.*

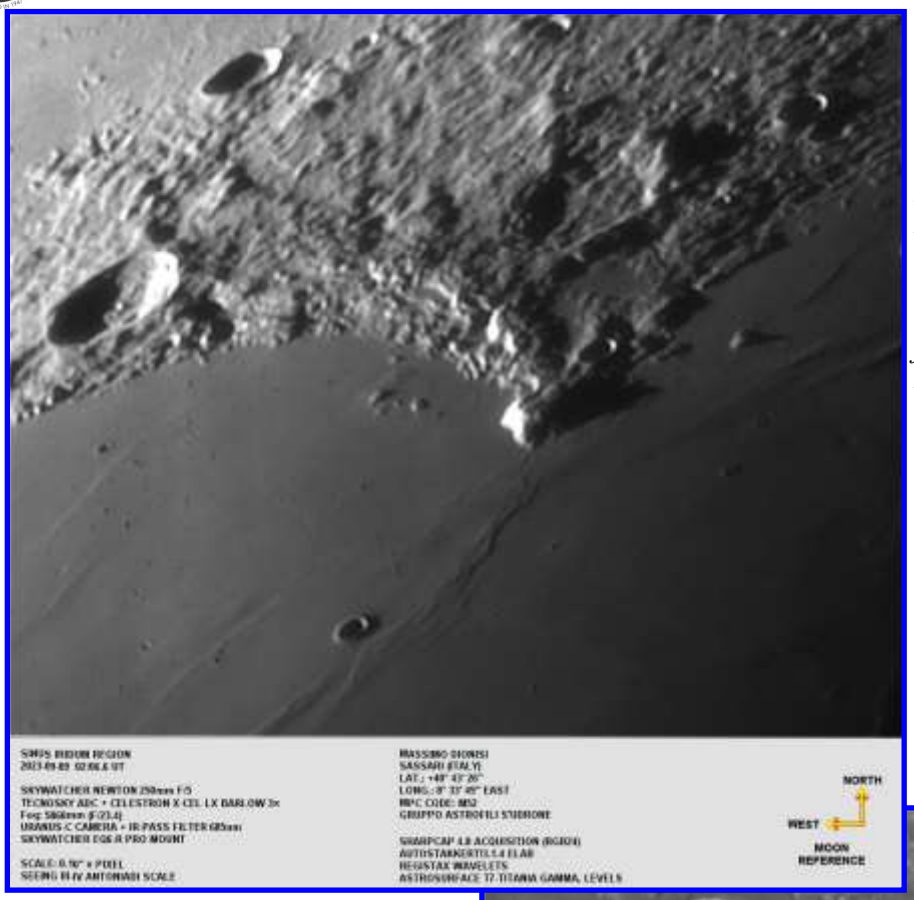
Recent Topographic Studies

Walther, *Massimo Dionisi, Sassari, Italy. 2023 September 07 01:12 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.*

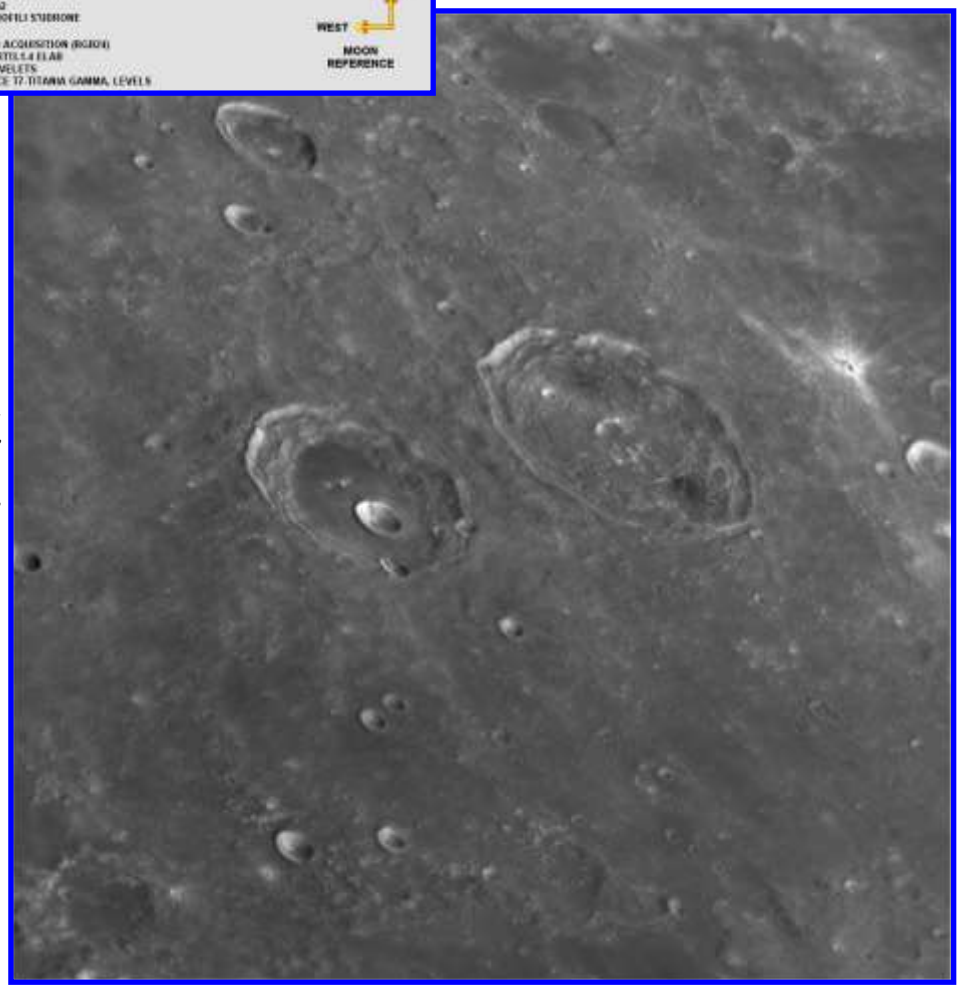


Messier, *Larry Todd, Dunedin, New Zealand. 2023 September 24 07:51 UT. OMC 200 mm Maksutov-Cassegrain telescope, Neptune 11C camera in mono mode.*

Recent Topographic Studies

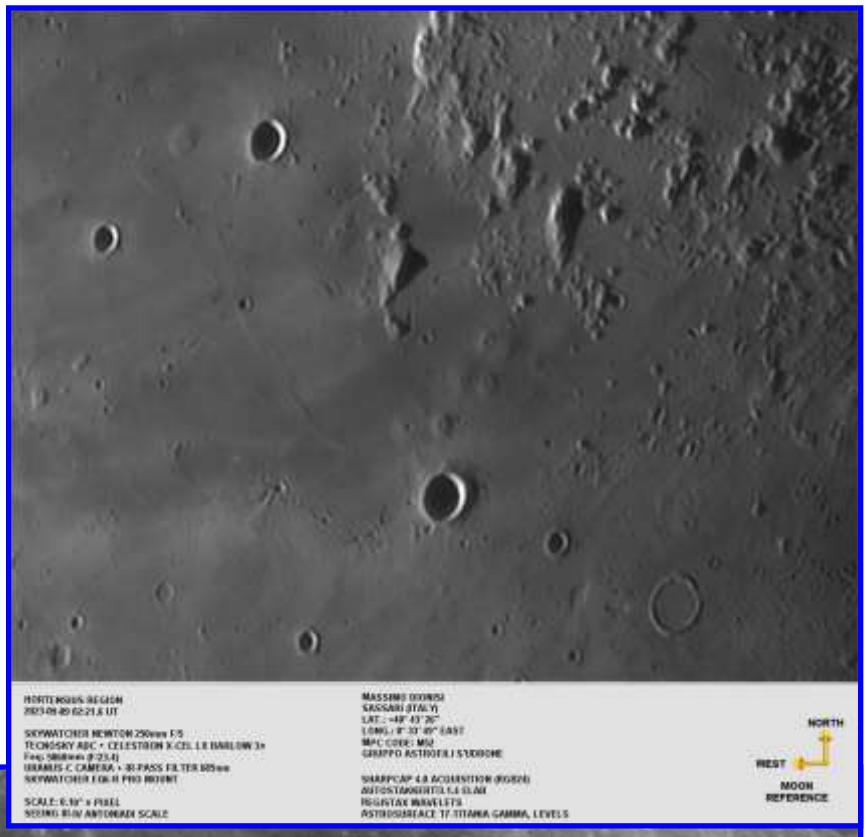


Sinus Iridum, *Massimo Dionisi, Sassari, Italy. 2023 September 09 02:06 UT. Sky Watcher 250 mm f/5 Newtonian reflector telescope, Technosky ADC, Celestron X-cel LX Barlow, 3x, fl 5,860 mm, IR pass filter 685 nm, Uranus-C camera. Seeing III-IV Antoniadi Scale.*



Hercules and Atlas, *Larry Todd, Dunedin, New Zealand. 2023 September 24 07:55 UT. OMC 200 mm Maksutov-Cassegrain telescope, Neptune 11C camera in mono mode.*

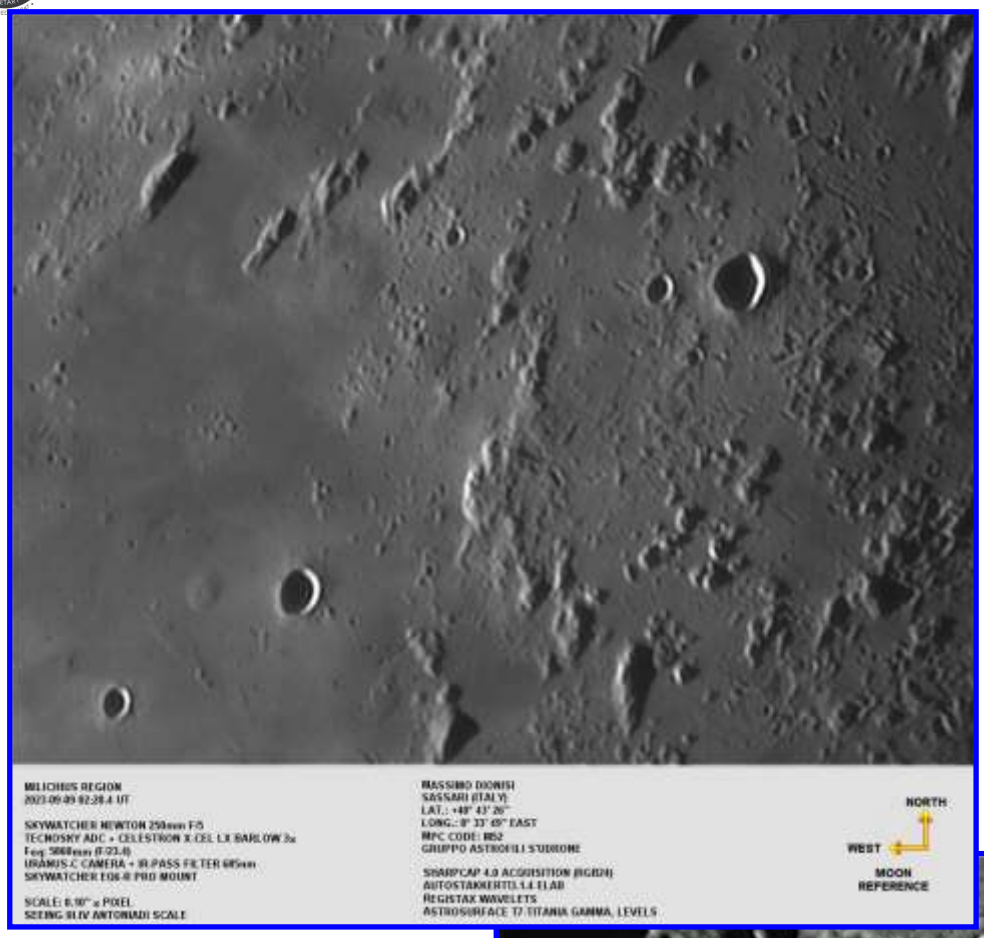
Recent Topographic Studies



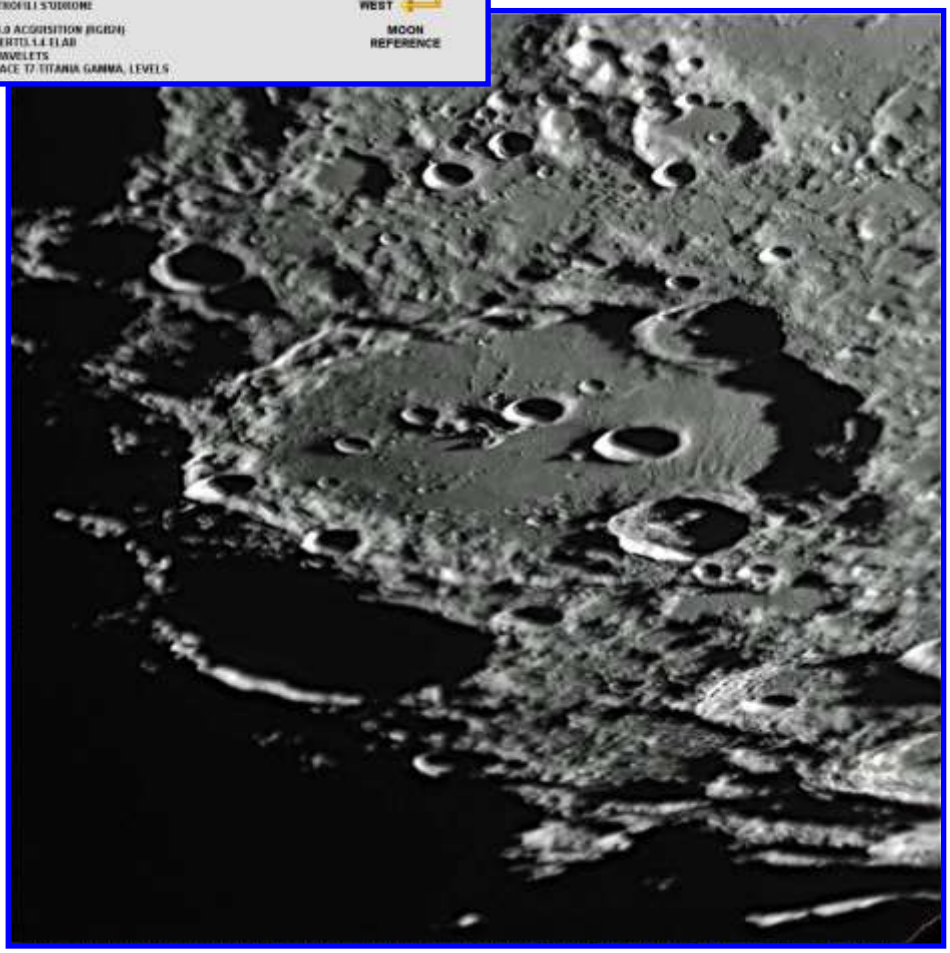
Hortensius, *Massimo Dionisi, Sassari, Italy. 2023 September 09 02:21 UT. Sky Watcher 250 mm f/5 Newtonian reflector telescope, Technosky ADC, Celestron X-cel LX Barlow, 3x, fl 5,860 mm, IR pass filter 685 nm, Uranus -C camera. Seeing III-IV Antoniadi Scale.*

Mare Serenitatis, *Francisco Alsina Cardinalli, Oro Verde, Argentina. 2023 August 30 00:24 UT. 8 inch Newtonian reflector telescope, QHY5-II camera.*

Recent Topographic Studies

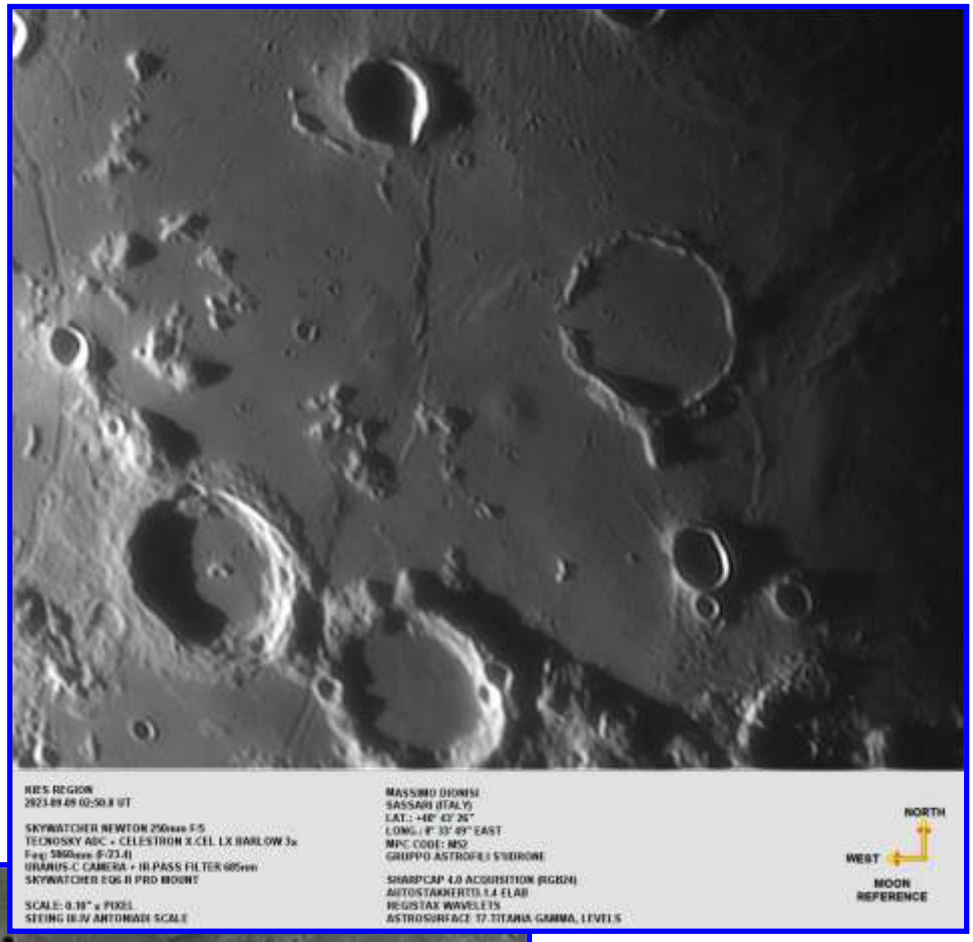


Milichius, *Massimo Dionisi, Sassari, Italy. 2023 September 09 02:28 UT. Sky Watcher 250 mm f/5 Newtonian reflector telescope, Technosky ADC, Celestron X-cel LX Barlow, 3x, fl 5,860 mm, IR pass filter 685 nm, Uranus-C camera. Seeing III-IV Antoniadi Scale.*

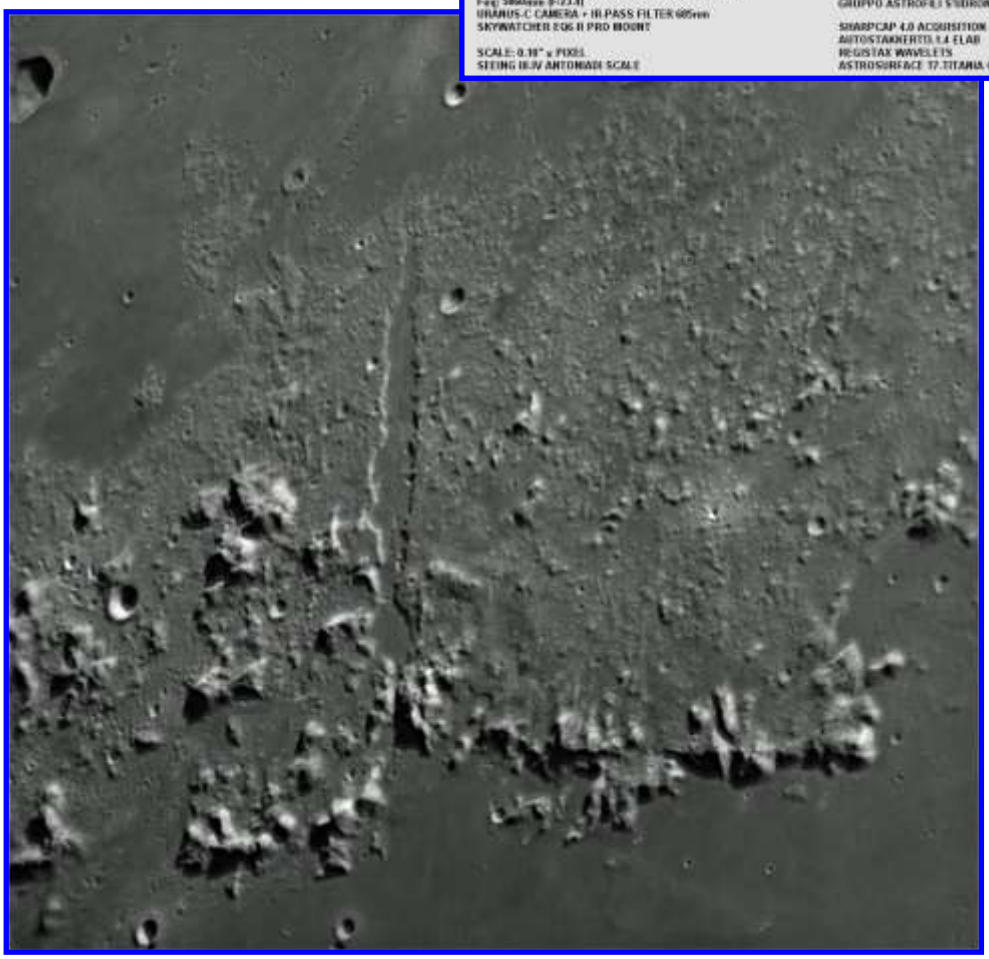


Clavius, *Larry Todd, Dunedin, New Zealand. 2023 September 24 07:47 UT. OMC 200 mm Maksutov-Cassegrain telescope, Neptune 11C camera in mono mode.*

Recent Topographic Studies



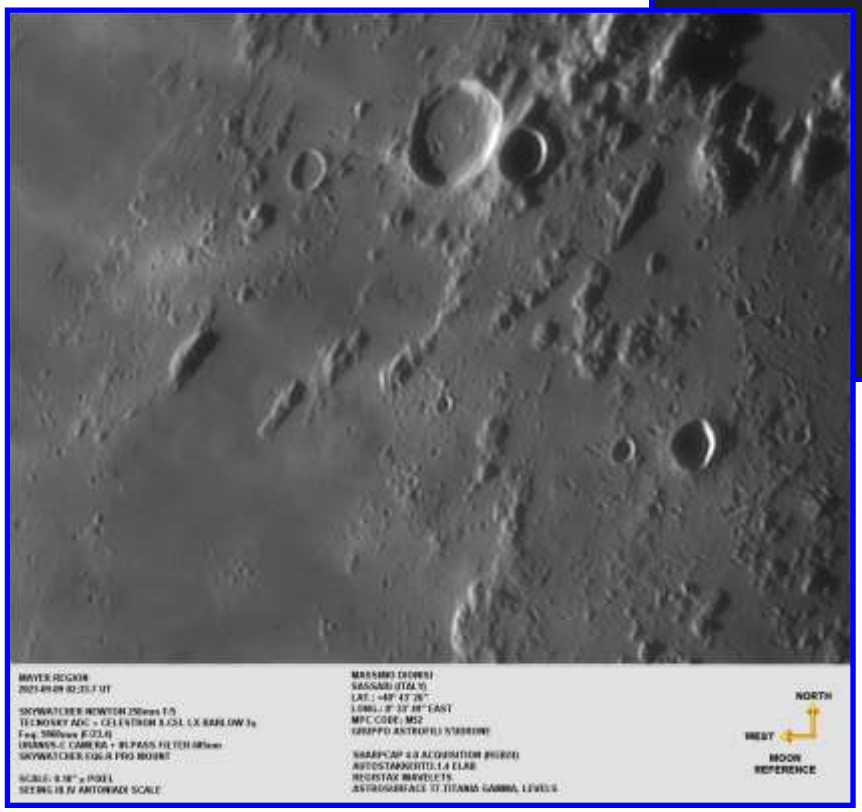
Kies, *Massimo Dionisi, Sassari, Italy. 2023 September 09 02:50 UT. Sky Watcher 250 mm f/5 Newtonian reflector telescope, Technosky ADC, Celestron X-cel LX Barlow, 3x, fl 5,860 mm, IR pass filter 685 nm, Uranus-C camera. Seeing III-IV Antoniadi Scale.*



Vallis Alpes, *Larry Todd, Dunedin, New Zealand. 2023 September 24 07:58 UT. OMC 200 mm Maksutov-Cassegrain telescope, Neptune 11C camera in mono mode.*

Recent Topographic Studies

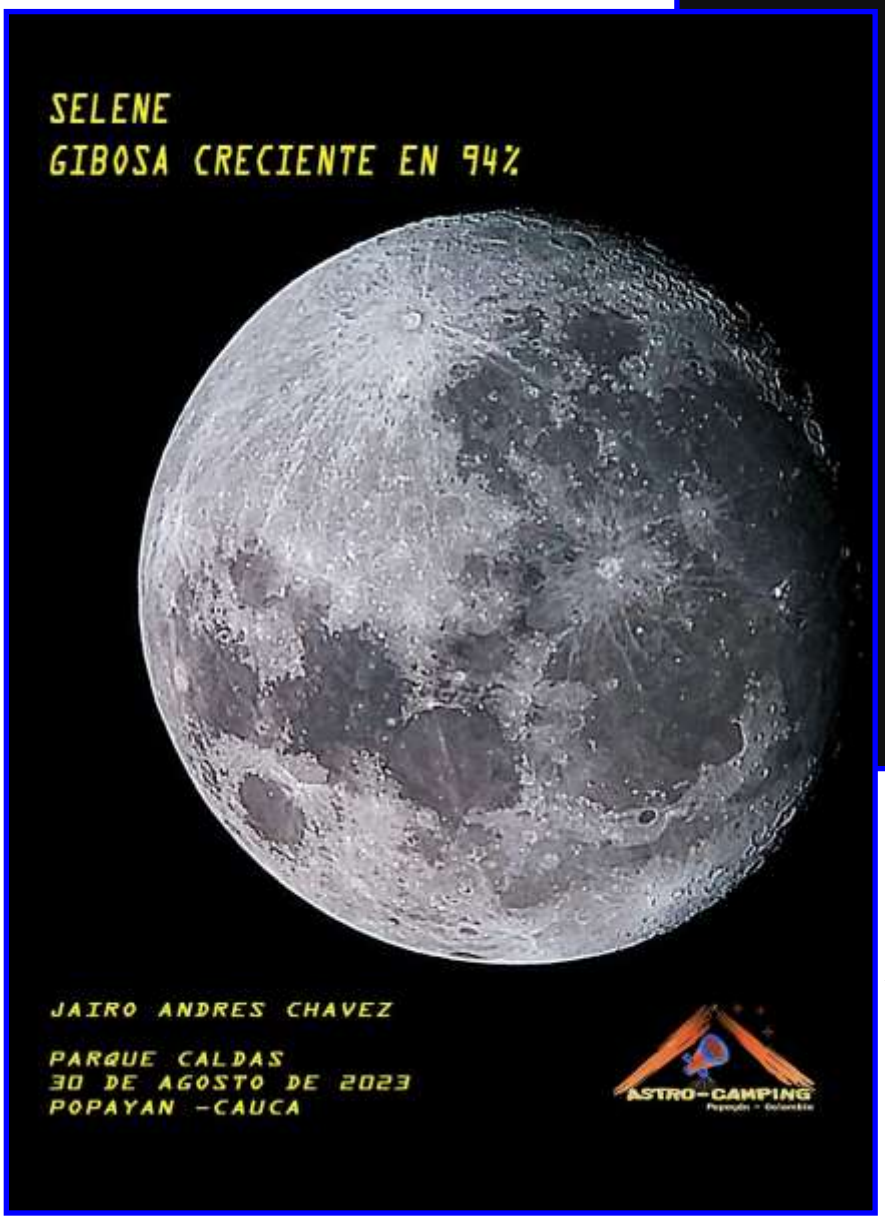
Gassendi, *KC Pau, Hong Kong, China. 2023 September 25 12:52 UT. 10 inch f/6 Newtonian reflector telescope, 2.5x barlow, QHYCCD290M camera.*



T. Mayer, *Massimo Dionisi, Sassari, Italy. 2023 September 09 02:33 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.*

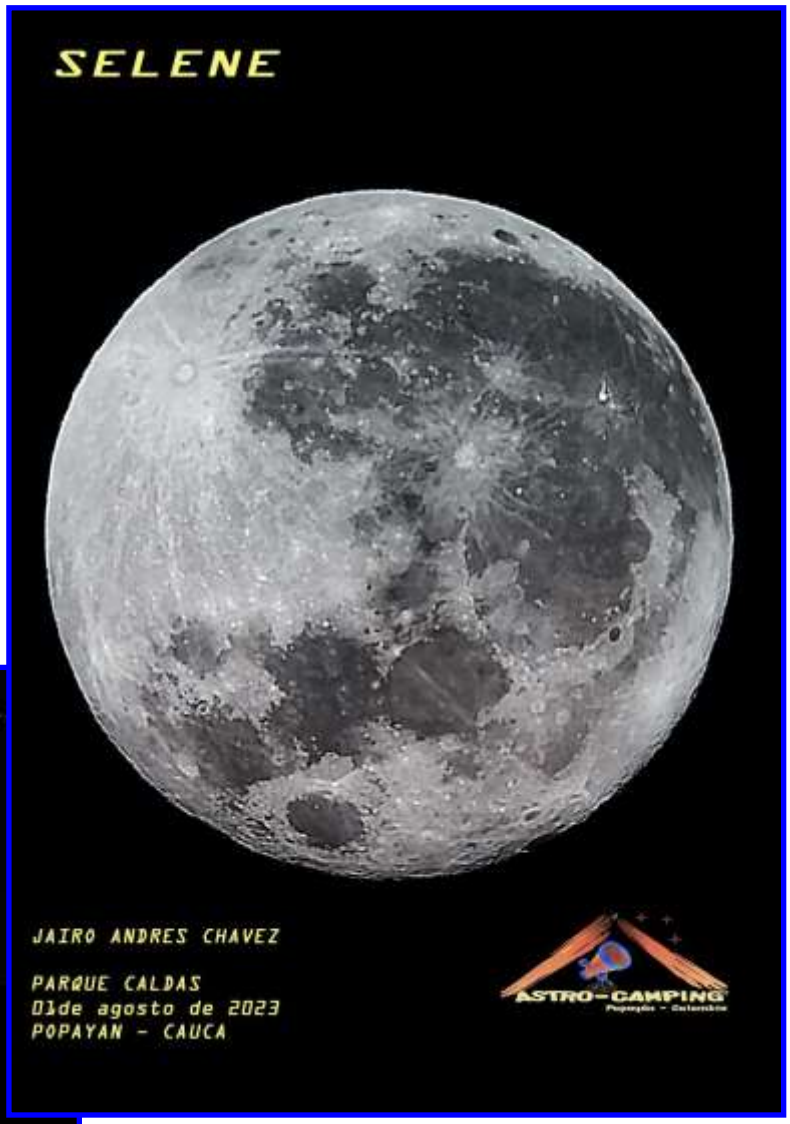
Recent Topographic Studies

Mare Orientale, *Larry Todd, Dunedin, New Zealand. 2023 April 07 09:40 UT. OMC 200 mm Maksutov-Cassegrain telescope, Neptune 11C camera in mono mode.*

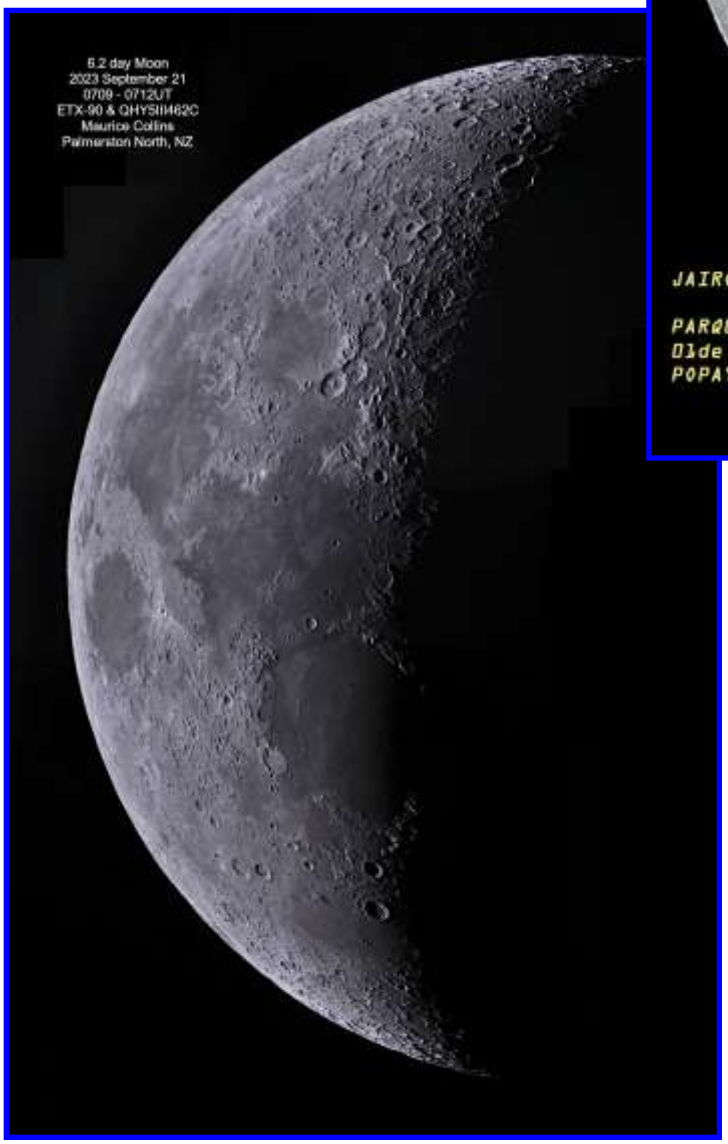


Waxing Gibbous Moon, *Jairo Chavez, Popayán, Colombia. 2023 July 31 19:01 UT. 311 mm truss tube Dobsonian reflector telescope, MOTO E5 PLAY camera.*

Recent Topographic Studies



Full Moon, *Jairo Chavez, Popayán, Colombia. 2023 August 02 02:26 UT. 311 mm truss tube Dobsonian reflector telescope, MOTO E5 PLAY camera.*



6.2-day old Moon, *Maurice Collins, North Palmerston, New Zealand. 2023 September 21 07:09-07:12 UT. Meade ETX90 Maksutov-Cassegrain telescope, QHY5III462C camera.*

Recent Topographic Studies

Lunar Geologic Change Detection Program

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2023 October

LTP Reports: No LTP or impact flash reports were received for Aug other than what was mentioned last month for three candidate impact flashes.

Routine reports received for August included: Alberto Anunziato (Argentina – SLA) observed: Plato, Ross D and Theophilus. Francisco Alsina Cardinalli (Argentina – SLA) imaged: Aristarchus and Mare Serenitatis. Maurice Collins (New Zealand - ALPO/BAA/RASNZ) imaged: Aristarchus, Clavius, Copernicus, Mare Imbrium, Mons Rumker, Plato, Rupes recta, Vallis Alpes, and several features. Walter Elias (Argentina – AEA) imaged: Aristarchus. Bill Leatherbarrow (Sheffield, UK – BAA) imaged Clavius and Ptolemaeus. Eugenio Polito (Italy - UAI) imaged Aristarchus. Anthony Cook (Newtown & Mundesley, UK – ALPO/BAA) imaged/videoed: several features & earthshine in the Short-Wave IR and in visible light. Ivan Walton (Cranbrook, UK - BAA) imaged: several features.

Analysis of Reports Received (August):

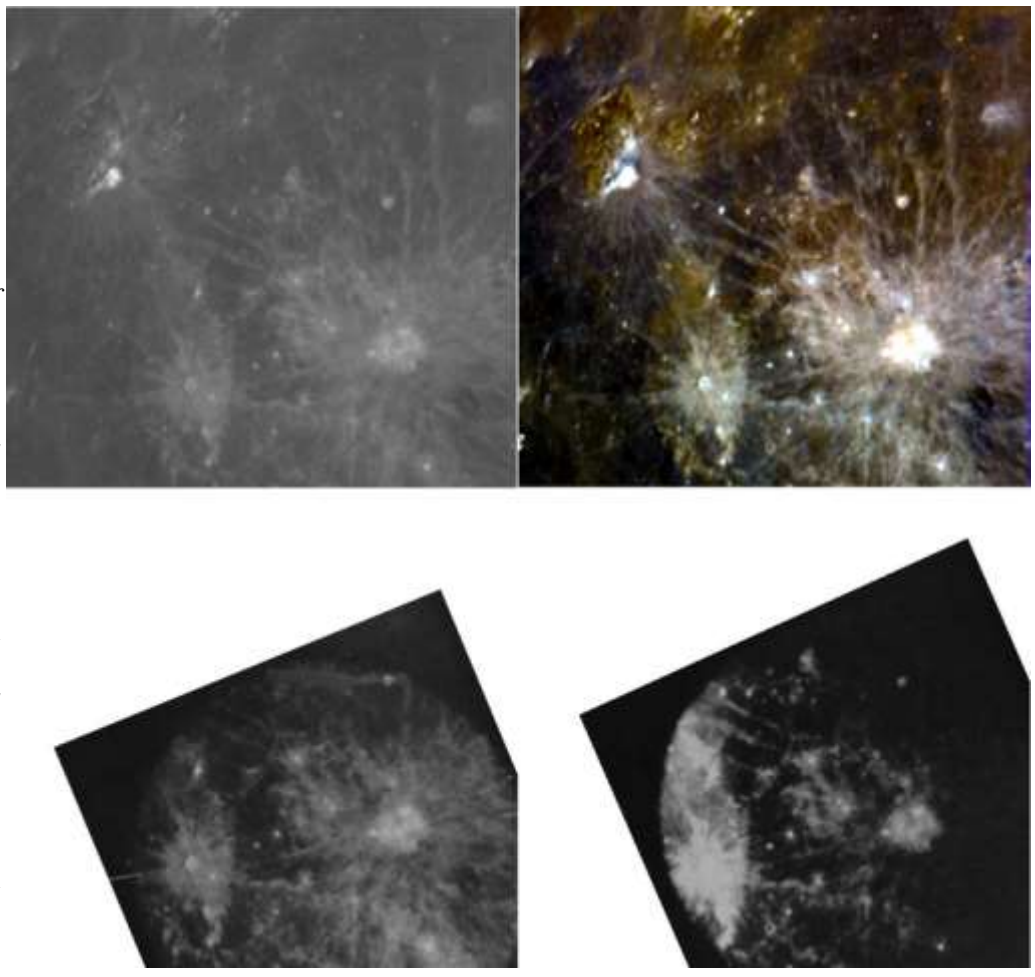

Figure 1. *Aristarchus, Kepler, Copernicus area, orientated with north towards the top.* ***(Top Left)*** *A non-enhanced image by Walter Elias (AEA) taken on 2023 Aug 02 UT 01:23.* ***(Top Right)*** *A processed version of the image, in the top left, which has been color normalized and then had its color saturation increased.* ***(Bottom Left)*** *A yellow-green band (545nm, FWHM=9.5nm) photographic image (0.5 sec exposure) taken on 1963 Nov 02 UT 00:35 from Pic du Midi observatory by Manchester University observers: Zdenek Kopal and Thomas Rackham.* ***(Bottom Left)*** *A red band (672.5nm, FWHM=4.5) photographic image (5 sec exposure) taken on 1963 Nov 02 UT 00:20 from Pic du Midi observatory by Manchester University observers: Zdenek Kopal and Thomas Rackham.*

Aristarchus/Copernicus/Kepler: On 2023 Aug 02 Walter Elias (AEA) imaged this crater under similar illumination and topocentric libration to the following report:

On 1963 Nov 01 at UT 00:20-00:35 Kopal and Rackham (Pic du Midi, France, 24" reflector) observed in Kepler an enhancement in red light at 672.5nm and 545.0nm. Luminescence ~86% +/-3% of background. According to the Cameron catalog, Moore (12" reflector, UK) noted something unusual between 22:30 and 03:00 but this might apply to Kepler, Copernicus, and/or Aristarchus and that was seen 23:30-03:00? - the catalog is not very clear. The Cameron 1978 catalog ID=779 and weight=5. The ALPO/BAA weight=5.

This 1963 LTP is especially interesting as it is a weight 5 report (highly reliable), which is either confirmed by 2 independent observers, or there are some unequivocal scientific measurements that confirm the reality of the report. In this case we have two professional astronomers, using a 24-inch aperture scope at one of the world's best observatories for planetary observation, showing a significant 86% difference between images taken in yellow-green, and red light, around Kepler and to its north. See Fig 1 (Bottom Left) and compare it to (Bottom Right). Even allowing for the fact that the exposures and contrast were different, the left-hand side of the red filter image is a lot brighter in the vicinity of Kepler, and the effect is over a large area. The effect was first noted in red/green pairs taken at 22:35 and 22:42 UT, and then the effect faded, and then it returned at 00:20 to 00:35UT. Comparison images, in the same two filters, made in between these times, and on another night, failed to show this significant change in color. In their Sky and Telescope paper of March 1964, Kopal and Rackham, speculated that radiation particles, from two small flares that occurred on the Sun, some 8.5 hours earlier perhaps instigated some large-scale luminescence on the lunar surface, covering an estimated 60 thousand square km. However, we now know, with hindsight, that luminescence from protons does not have this kind of effect on the Moon, as lunar soils returned by Apollo have been bombarded by radiation in the laboratory and do not luminesce by such amounts.

The effect is certainly not due to natural surface color on the Moon. For a start Fig 1 (top right) does not show any significant red around Kepler and to the north, and secondly the LTP report from 1963 had variability, which natural surface color does not exhibit in this kind of short time scale.

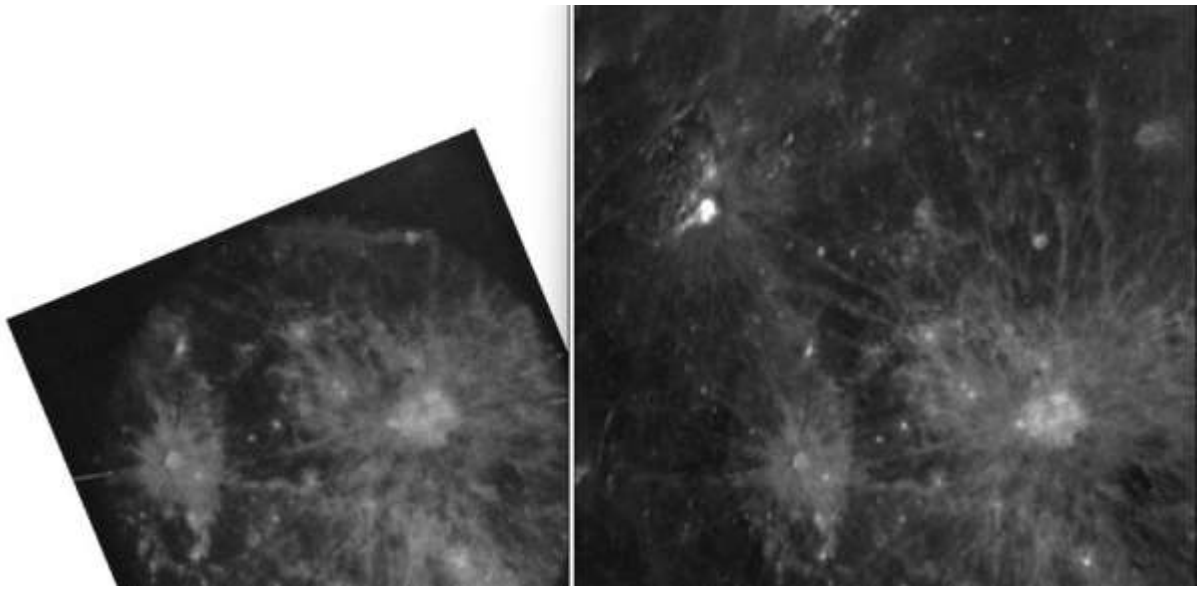

Figure 2. *Aristarchus, Kepler and Copernicus region with north towards the top.* ***(Left)*** *A green band image from 1963 Nov 02.* ***(Right)*** *Walter's image, contrast stretched to approximate to the contrast in the Pic du Midi image.*

So let us compare Walter's image with each filter image from 1963, and see if we can learn something. Firstly, the green 1963 image (Fig 2 – left) does not appear much different to Walter's image (Fig 2 – Right). So, this tells us that in green light, back in 1963, everything looked perfectly normal, as you can hardly tell any difference between the two images.

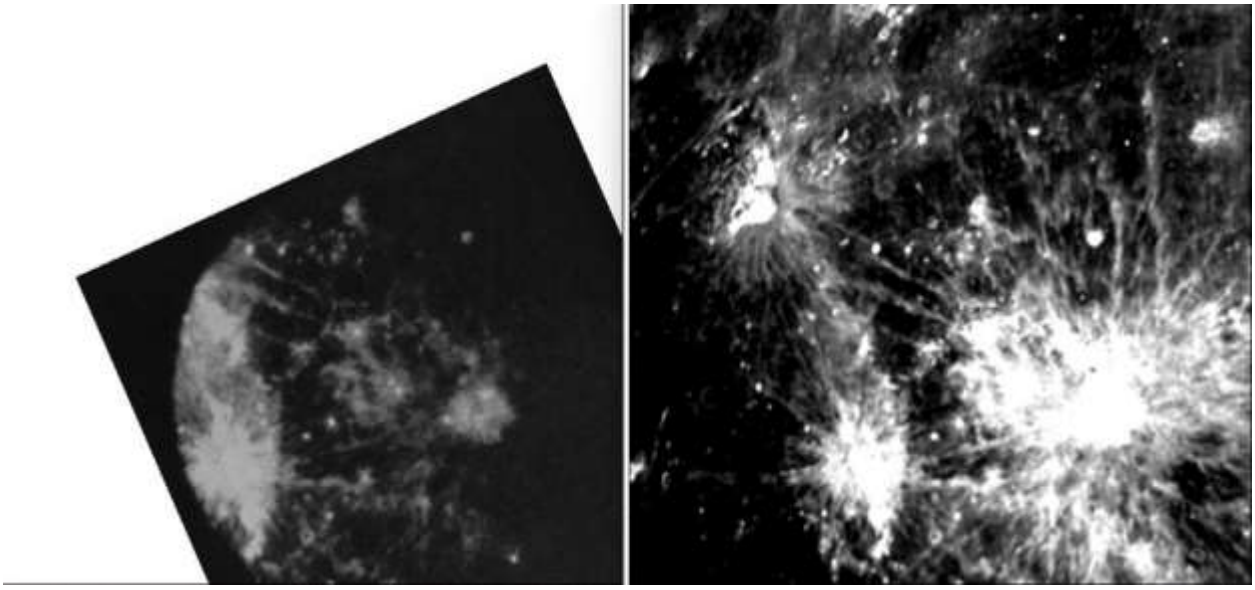

Figure 3. *Aristarchus, Kepler and Copernicus region with north towards the top.* ***(Left)*** *A red band image from 1963 Nov 02.* ***(Right)*** *Walter's image, contrast stretched to approximate to the contrast in the Pic du Midi image, in the vicinity of Kepler crater.*

However, when we switch to red light (Fig 3 - Left), and compare to Walter's image (Fig 3 – Right), everything changes. It was quite difficult to decide what part of the Moon to match the contrast on, so I picked Kepler crater. What is odd is how much darker Copernicus is – or rather Copernicus is normal and Kepler is brighter. All the surface texture, and detail around Kepler is largely the same in both red light and visible light. However, look to the north of Kepler, and you will find a bright elongated rays around Bessarion crater, just to the NW of this, is a bright area (going up to the circular edge of the Pic du Midi scope field of view) that is not visible on Walter's visible light image.

So, what might be causing these very large areal brightness anomalies? The luminescence idea proposed by the Manchester University astronomers is not tenable for lunar soil. One more mundane possibility could be that by the time the red filter images were taken, something like condensation or frost may have formed on the filter optical surface, darkening the area around Copernicus, temporarily, or maybe some undetected (by the observers) cloud was passing across the Moon. Either way the effect would have to vanish during the calibration images (when nothing was seen) and come back again for the later images – this may not be very likely.

One other point, Patrick Moore said that he had confirmed a LTP in the area, however the Cameron report is a bit sketchy as to which crater, he was referring to, and alas I don't have access to the Patrick Moore log book for that night – maybe it's in the Science Museum archives in London?

I will lower the weight of this report from 5 to 4, as the red filter image is not what I would expect from even a large area LTP.

One other thing to note is how bright Aristarchus appears in Walter's image (Fig 1 – Top Left) in comparison to Kepler and Copernicus. However, what is missing was how bright it was compared to other bright craters such as Tycho, Hell, Proclus, Censorinus etc., as these are out of the field of view. This has been a common problem with accounts of when observers say that Aristarchus is "very bright", without ever comparing it to other bright areas on the Moon.

Aristarchus: On 2023 Aug 03 UT 21:40-22:20 Eugenio Polito (UAI) imaged this crater under similar illumination that spanned some of the following three reports:

Aristarchus 1964 Oct 23 UT 02:35-02:45 Observed by Bartlett (Baltimore, MD, USA, 3" refractor, 133 & 200x, S=3-5, T=4) "South floor region granulated, 6 deg bright with very faint trace of pale-yellow color; rest of crater 8 deg bright." NASA catalog weight=4, NASA catalog ID #859. ALPO/BAA weight=2.

Aristarchus 1983 Oct 23 UT 19:00-01:30 Observer: Foley (Kent, UK, 12" reflector, seeing=II) noticed at 19:00UT an extended bright spot-on E wall and extending beyond. This was brighter than other areas of the crater. There was also occasional star-like glistening. Foley comments that the inside of Aristarchus was slightly obscured. The LTP started fading from UT20:30 and finished by 01:30UT. six out of nine independent observers confirmed the effects seen. In total 14 observers observed, 9 reported back and 6 found abnormalities in Aristarchus though all encountered variable seeing conditions - some had spurious color. Cameron comments that this was one of the best recorded/ confirmed LTP events. All CED brightness measurements obtained were very high. Moore, Nicolson and Clarke (5" refractor and 15" reflector, 230-350xseeing III) found the crater to be very bright at 19:11UT through a 5" refractor and there was a blob on the east rim (Bartlet's EWBS?) at 19:14UT. Nicolson also saw a very bright star-like area on the eastern wall but this was not defined as it usually is. The crater was also very bright at 22:43UT using the 15" reflector available to these observers. At 01:07UT they used a Moon blink and discovered that the bright region was bright in blue light and less bright in red - although this was not a detectable blink when switching rapidly between filters. They found that the crater had returned to normal by 01:15UT. M.C. Cook (Frimley, UK, seeing III-IV) observed a large diffuse spot on the east of the crater that was brighter in blue than in red light and the CED device gave a high reading. J.D. Cook (Frimley, UK, seeing III-IV) made a sketch that showed the bright spot extended on the east wall - again the CED reading was high and a lot of detail was visible on the floor. A.C. Cook (Frimley, UK, seeing III-IV) also noted remarkable detail and the bright (as confirmed by CED) blob on the eastern rim. G. North (Sussex, UK, seeing III-II) also confirmed the bright blob on the eastern wall. Wooller found the north west wall was a dirty yellow color - though no color was seen elsewhere in or outside the crater. Mosely found the crater to be bright and his sketch revealed the extension of the bright blob on the eastern rim and again a great deal of interior detail. Amery (Reading, UK, seeing III) found Aristarchus to be "a brilliant splash against dulled background in violet filter, especially polarizing filter. CED + polarizer readings high, but not as high as previous night". Mobberley (Suffolk, UK, seeing III-IV) remarked that "spurious color a total mess around Aristarchus & nothing abnormal seen". A photograph was taken at 20:50UT reveals the bright blob and entire detail. Peters (Kent, UK, seeing III-II) observed Aristarchus with a UV screen from 20:15-21:23UT and commented that although being very bright, there was no variation between white and UV. It was checked with a Moon Blink device and the radial bands were clearly seen in white light, < in blue. The Cameron 2008 catalog ID=233 and the weight=5. The ALPO/BAA weight=4.

On 2002 Sep 23 at UT22:45-23:56 C. Brook (Plymouth, UK) noticed that the bands inside Aristarchus varied (UT22:45-22:56) in definition whilst the rim of Herodotus and the rays of Kepler and Copernicus remained sharp. These bouts of variation were 1-2min in duration. At 23:56UT when he checked again the periodic blurring's of the bands were still present. The observer suspected atmospheric effects. M. Cook (Frimley, UK) observed 22:00-22:30 and could see only 2 bands on the west wall - but this may have been because of poor transparency. The ALPO/BAA weight=1.

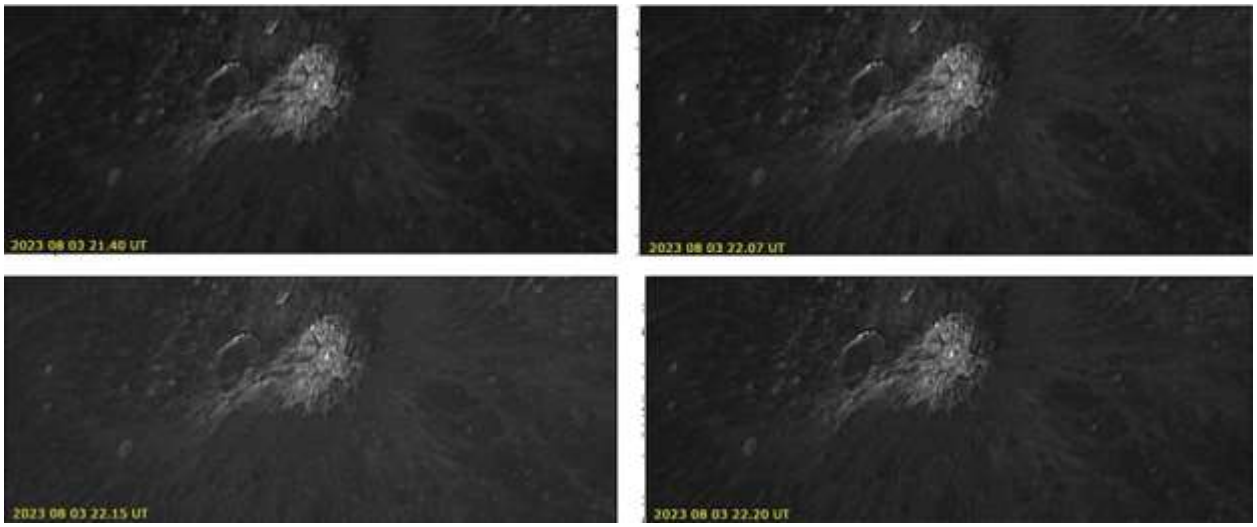

Figure 4. *Aristarchus as imaged in monochrome by Eugenio Polito (UAI) on 2023 Aug 03 and orientated with north towards the top. UTs are given in the images. Note that for some of the past LTP reports above, different sets of images may fall within the repeat illumination criteria of ±0.5˚ for those reports.*

For the 1964 LTP report, the south floor does not look especially granulated (See Fig 4) compared to other parts of the floor - just a lot of detail. It is doubtful if Bartlett could have seen such detail through his 3" refractor. We shall leave the weight at 2 for now as color was also involved. We have covered this report before in the 2019 Jan newsletter.

For the 1983 report there is an extension coming off the east wall over the rim into the mare (See Fig 4), but it is simply not the brightest spot on the crater. The honor of the brightest spot goes to the central peak, or maybe a bright spot just inside the NW rim. Certainly, there is no sign of the star-like point on the eastern rim as reported by Nicolson. I did find a sketch made by myself and this can be seen in Fig 5., which looks more like the images that Eugenio took, than what was earlier described by Foley, however according to Foley the LTP had started fading by that stage. I think we shall leave the weight at 4 for now, but we have one of the most detailed images yet of what the crater should have looked like if it had been normal during that event in 1983. We have covered this report before in the 2019 Jan newsletter.

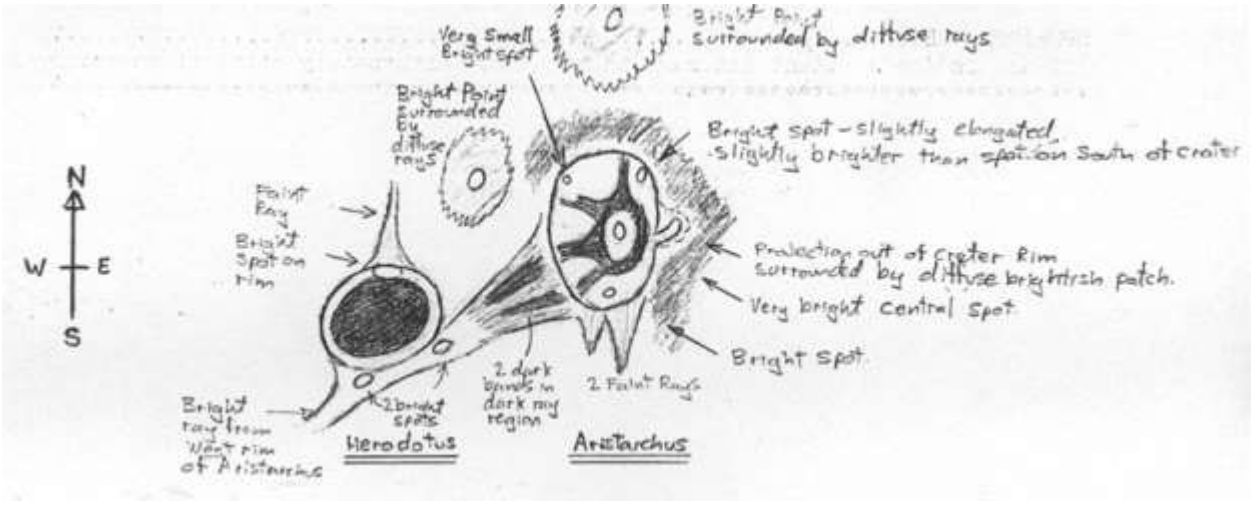

Figure 5. *A sketch of Aristarchus made by Tony Cook (BAA) on 1983 Oct 23 UT 20:35-20:50 and 21:34-21:55. A 6" Newtonian was used at x144.*

For the 2002 LTP, looking at the images in Fig 4, there appears to be no variation in the bands, which might infer the seeing conditions, at the time of the LTP, were to blame. We shall leave the weight at 1 for now. We have covered this report before in the 2019 Jan newsletter.

Plato: On 2023 Aug 05 UT 04:50-05:02 Alberto Anunziato (SLA) observed this crater under similar illumination to the following report:

Plato 1886 Nov 14 UT 1:45 Observed by Lihou (France?) "Brilliant band N-S, area marked G in NE was only slightly visible, poorly defined. Drawing (there were rays on the floor)." NASA catalog weight=3. NASA catalog ID #253. ALPO/BAA weight=3.

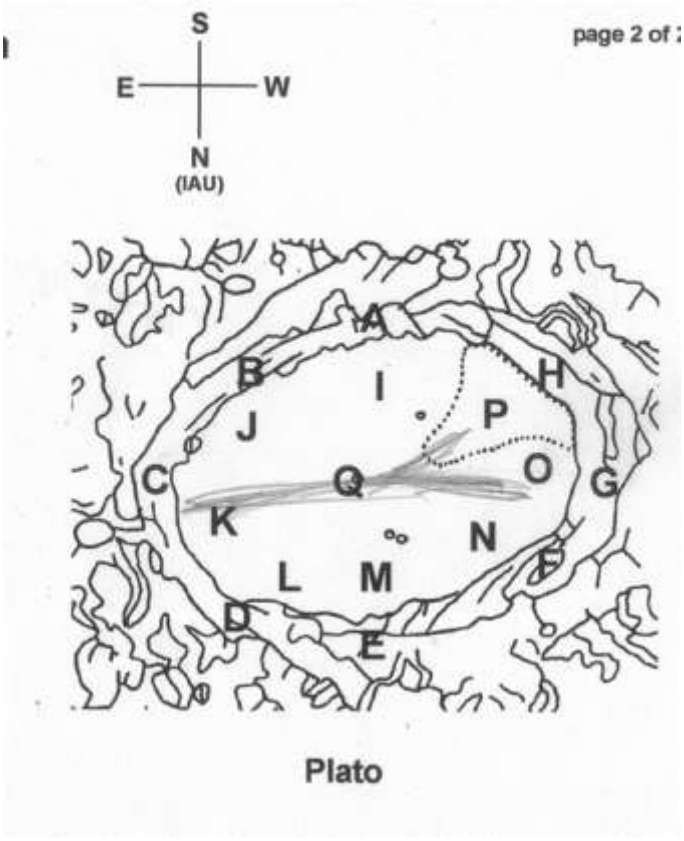

Figure 6. *A prepared sketch of Pato showing the location of a W-E trending suspected ray, made by 2023 Aug 05 UT 04:50-05:02 by Alberto Anunziato (SLA). Orientation of sketch as depicted by arrows.*

Alberto commented that Plato looked normal, but no bright N-S band seen, only a glimpse of a ray W-E (See Fig 6). We shall leave the weight of the original report at 3.

Briggs: On 2023 Aug 29 UT 07:46 Maurice Collins (ALPO/BAA/RASNZ) imaged this area as part of a larger region just 6 min after the similar illumination window to the following report:

On 2010 Apr 27 at UT 00:10-00:30 and 01:45-02:00 P. Grego (St Dennis, UK, 20 and 30cm reflectors) noticed a craterlet just to the east of Briggs and an E-W trending lineament or wrinkle ridge that did not show on NASA LAC charts. Further checks did not reveal it on Lunar Orbiter mosaics, or on very recent LROC images of the area. Possibly these are very low relief features that show only under very shallow illumination conditions. The ALPO/BAA weight=1 until we get confirmation at repeat illumination.

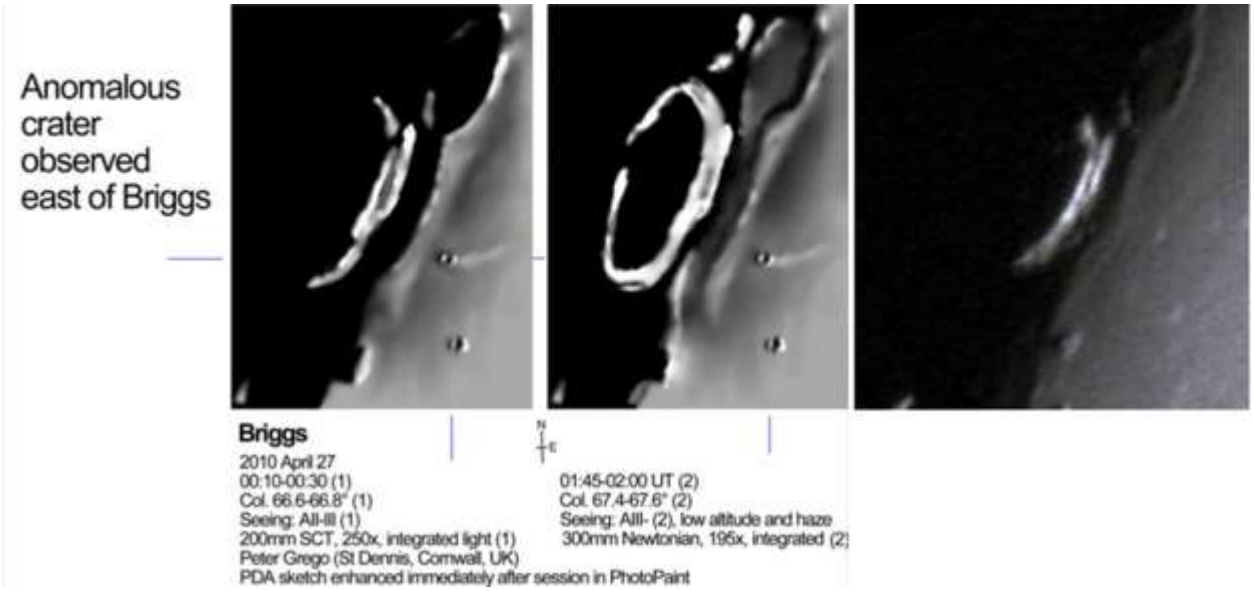

***Figure** 7. Briggs, orientated with north towards the top. **(Left & Centre)** Sketches by Peter Grego (BAA/SPA) with information about the observations adjacent to the sketches. **(Right)** An image by Maurice Collins, taken on 2023 Aug 29 UT 07:46.*

Fig 7 (Right) shows how accurate Peter Grego's sketches (Fig 7 Left & Centre) were, and in Maurice's image, you can see a couple of mounds to the E and SE of Briggs that correspond to the craterlets that Peter draw. The repeat illumination prediction description needs updating as I have checked the LROC Quickmap web site, and in the shaded relief tool I can certainly see craterlets here. What I cannot see though so is the curved W-E ray or ridge coming off the northern most of those two craterlets. For this reason, we shall leave the weight at 1, but I will update the description accordingly. We have covered repeat illumination observations of this crater before in the 2013 Mar and 2016 Feb newsletters.

Aristarchus: On 2023 Aug 30 UT 00:39 Francisco Alsina Cardinalli (SLA) imaged this crater under similar illumination conditions to the following four past LTP reports:

Aristarchus-Herodotus 1964 Sep 20 UT 04:15-04:50 - Observers: Crowe & Cross (Whittier, CA, USA, 19" reflector x390) "Several red spots in area between the 2 craters. No change in phenom. so stopped observing" NASA catalog weight=5 (very good). NASA catalog ID #849.

On 1965 Sep 09 at UT 13:20 Presson observed an orange-red strip on the floor of Aristarchus. Cameron says that this was confirmed later by Bartlett? The Cameron 1978 catalog ID=892 and weight=2. The ALPO/BAA weight=2.

On 1979 Oct 04 at UT21:05-23:40 P.W. Foley (Kent, UK, 12" reflector, x360, seeing=II) detected color in Aristarchus (and also in Bullialdus - there was a LTP alert at this time for Bullialdus) but nowhere else on the Moon. Aristarchus had a CED brightness value of 3.8 at 21:05 (though at this time no color) and 3.4 at 23:40 and the floor was now slate blue/gray in color. Other features remained constant in brightness. The Cameron 2006 catalog ID=72 and the weight=0. The ALPO/BAA weight=1.

Aristarchus 1959 Jan 23 UT 06:20 - Observer: Alter (Mt Wilson, CA, 60" reflector x700) "Brilliant blue in interior later turning white. Photos obtained. (MBMW has this entry twice for diff. dates because source gave UT date as 23rd.)" NASA catalog weight=5. NASA catalog ID = #712. ALPO/BAA weight=4.

Figure 8. *Aristarchus as imaged by Alsina Cardinalli (Argentina – SLA) on 2023 Aug 30 UT 00:39 in monochrome and orientated with north towards the top.*

Although Alsina's image (Fig 8) is in monochrome, it does provide a useful context image of what the crater would have appeared like to the observers concerned, if its appearance was normal. We have covered the 1959 report in the 2015 Feb, 2018 Jan & Feb, and 2019 Jan newsletters. The 1964 report was covered before in the 2019 Jan newsletter, the 1965 and 1979 reports in the 2015 Feb newsletter.

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 .

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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 September, so I thought that I would pick another candidate buried crater from the catalog, and look at evidence for there being a crater there. So, this month's buried crater is: PFC 31, which is located at 1.5˚W 15.5˚N with a diameter of 52 km. PFC stands for "Partly Filled Crater". The PFC'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 there at this location. The WAC nearside mosaic (with shadows) does not look too promising at the centre of Fig 1, though there seems to be some dark material roughly in the right location, but this could be volcanic dome related in origin other than just routine mare material.

Figure 1 *LROC Quickmap WAC nearside mosaic with shadows centred on the approximate location of PFC 31. Note that the scale bar on the bottom right corner is 10 km long.*

As always, azimuth direction plots of the slope on the surface can be quite revealing. Fig 2 shows that the proposed PFC 31 has a nice arc of the south rim visible, but other parts of the rim are either destroyed or buried under the mare.

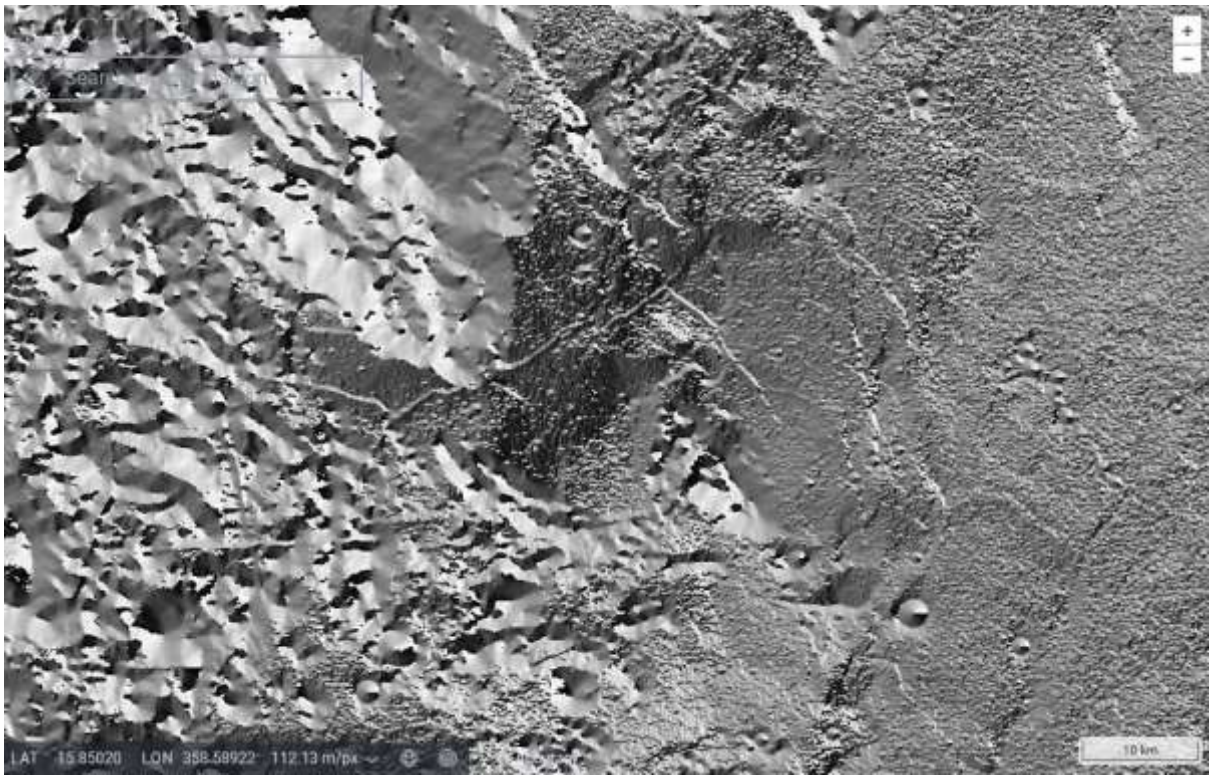

Figure 2 *LROC Quickmap ACT Layers (Experimental): Terrain Azimuth. The scale bar on the bottom right is 10 km long.*

So, the PFC 31 impact crater appears to be centred on 0.2W, 15.2N and is approximately 30 km in diameter, not the previously published 52 km.

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 October 2023

Date	UT	Event
2	0300	Jupiter 3° south of Moon
2	1700	Uranus 3° south of Moon
3	0500	Moon 1.1° south of the Pleiades
4		East limb most exposed (+7.1°)
6	1348	Last Quarter Moon
6		Greatest northern declination (+28.3°)
7	1100	Pollux 1.4° north on Moon
8		South limb most exposed (-6.8°)
10	0400	Moon at apogee 405,425 km
10	1000	Venus 6° south of Moon
14	1755	New Moon, lunation 1247, annular solar eclipse North and South America
15	0111	Moon at descending node
15	1600	Mars 1.0° north of Moon
18	1400	Antares 0.8° south of Moon, occultation Azores, Europe, Middle East
19		West limb most exposed (-5.5°)
20		Greatest southern declination (-28.2°)
22		North limb most exposed (+6.8°)
22	0329	First Quarter Moon
24	0800	Saturn 3° north of Moon
26	0300	Moon at perigee 364,872 km
28	0314	Moon at ascending node
28	2024	Full Moon, partial lunar eclipse South America, Europe, Asia, Africa
29	0800	Jupiter 3° south of Moon
30	0200	Uranus 3° south of Moon
30	1500	Moon 1.1° south of Pleiades

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

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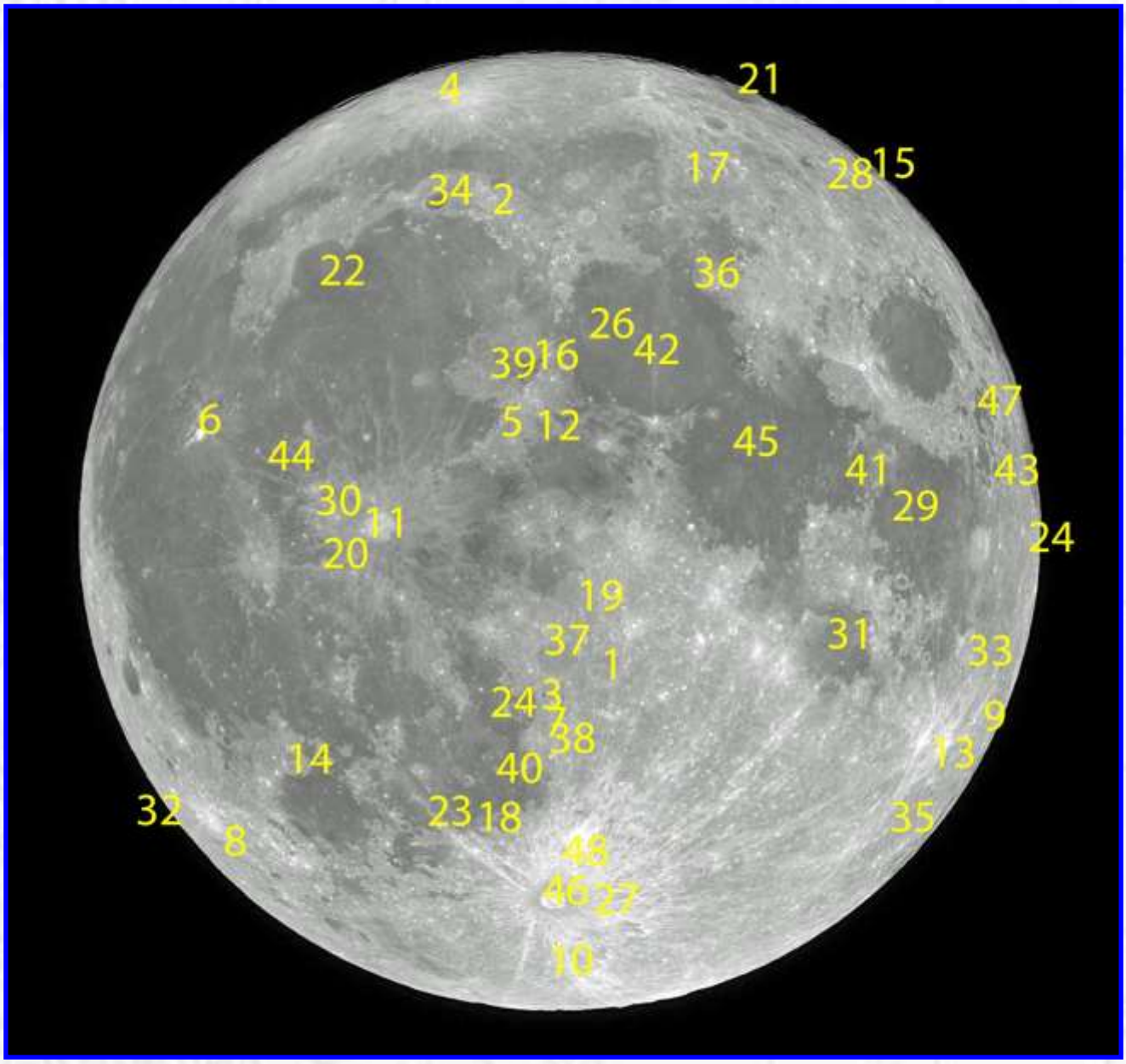
FOCUS ON JULY 2024: Due June 20, 2024: MARE NECTARIS

Larry Todd

Key to Lunar Images In This Issue



Gregory Shanos

1. Albategnius
2. Alpes, Vallis
3. Alphonsus
4. Anaxagoras
5. Apenninus, Montes
6. Aristarchus
7. Arzachel
8. Autumni, Lacus
9. Balmer
10. Clavius
11. Copernicus
12. Fidei, Sinus
13. Furnerius
17. Hercules
18. Hesiodus
19. Hipparchus
20. Hortensius
21. Humboldtianum
22. Iridium, Sinus
23. Kies
24. la Pérouse
25. Lassell
26. Linné
27. Maginus
28. Mercurius
29. Messier
33. Petavius
34. Plato
35. Pontécoulant
36. Posidonius
37. Ptolemaeus
38. Purbach
39. Putredinis, Palus
40. Recta, Rupes
41. Secchi
42. Serenitatis, Mare
43. Stewart
44. T Mayer
45. Tranquillitatis, Mare