The Lunar Observer

A Publication of the Lunar Section of ALPO

Edited by David Teske: david.teske@alpo-astronomy.org
2162 Enon Road, Louisville, Mississippi, USA
Back issues: http://www.alpo-astronomy.org/

May 2022

Online readers, click on images for hyperlinks

In This Issue

WOW! Look at that table of contents!! Many thanks to all who contributed to this issue of *The Lunar Observer*! Check out the Focus-On articles in this issue. Please be sure to note the ALPO Virtual Conference on page 5. I certainly hope that all can attend. This conference will be most special for us lunar observers!
Clear skies,

Lunar Topographic Studies

Coordinator – David Teske - david.teske@alpo-astronomy.org
Assistant Coordinator– Alberto Anunziato albertoanunziato@yahoo.com.ar
Assistant Coordinator-Wayne Bailey– wayne.bailey@alpo-astronomy.org
Website: http://www.alpo-astronomy.org/

Observations Received

Name	Location and Organization	Image/Article
Alberto Anunziato	SLA-LIADA, Paraná, Argentina	Articles *East to West on the Mare Frigoris, Wrinkle Ridges from Kirch to Spitzbergen A, Wrinkle Ridges in the Interior of Wargentin*, and images of Mare Frigoris (3).
Sergio Babino	SAO-LIADA, Montevideo, Uruguay	Images of Mare Frigoris (4).
Rafael Benavides	Posadas Observatory MPC J53, Córdoba, Spain	Article and images *Montes Alpes*, images of the Full Moon, Deslandres, Rupes Altai, Posidonius
Juan Manuel Biagi	Oro Verde, Argentina, SLA-LIADA	Image of Harpalus.
Massimo Bianchi	Milan, Italy	Image of Mare Frigoris (2).
Francisco Alsina Cardinalli	SLA-LIADA, Oro Verde, Argentina	Images of Mare Frigoris (3), Archimedes, Aristillus and Plato (2).
Maurice Collins	Palmerston North, New Zealand	Images of the 8-day old Moon and Ptolemaeus.
Don Capone	Waxahachie, Texas, USA	Images of Langrenus and Petavius.
Jairo Chavez	Popayán, Colombia	Images of the 82% Waxing Gibbous Moon, 95% Waxing Gibbous Moon, 99% Waxing Gibbous Moon, Tycho, Plato (2).
Michel Deconinck	Aquarellia Observatory - Artignosc-sur-Verdon - Provence - France	Drawing of Mare Frigoris.
Walter Ricardo Elias	AEA, Oro Verde, Argentina	Images of Aristarchus, Gassendi, Plato (2) Schiaparelli, Walther, Curtis, Mons Piton and Lubbock.
Howard Eskildsen	Ocala, Florida, USA	Articles and images *Agatharchides to Marth , Two Views of Hesiodus A, Pontanus E Concentric Crater, CC and Beer? Intrusion and Extrusion, Archytas G and Egede D, Kies pi, Schiller-Zucchius Basin, Mare Nectaris, The One Who Got It Right*, images of Gambart, Gruithuisen Domes, Marth, Prinz, Piccolomini, Fracastorius, Archytas, Triesnecker Copernicus and Mare Imbrium Lava Flows

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

Lunar Topographic Studies

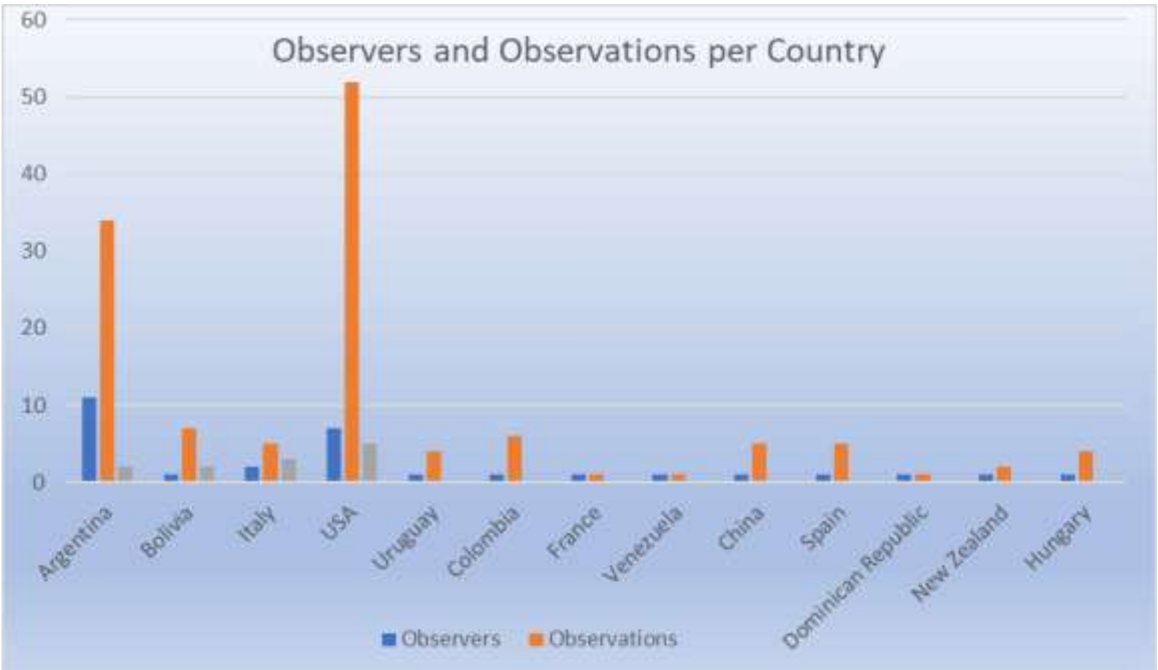
Coordinator – David Teske - david.teske@alpo-astronomy.org
Assistant Coordinator– Alberto Anunziato albertoanunziato@yahoo.com.ar
Assistant Coordinator-Wayne Bailey– wayne.bailey@alpo-astronomy.org
Website: http://www.alpo-astronomy.org/

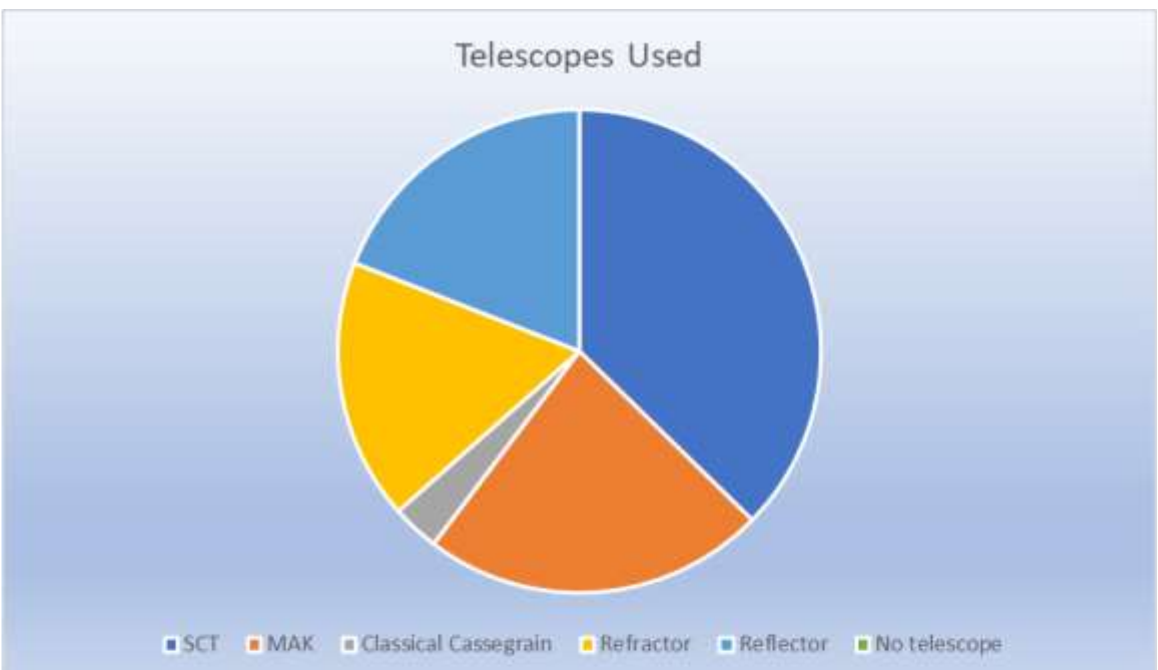
Observations Received

Name	Location and Organization	Image/Article
István Zoltán Földvári	Budapest, Hungary	Drawings of Fontenelle, Harpalus, Horrebow, and Promontorium Agarum.
Desiré Godoy	SLA-LIADA, Oro Verde, Argentina, SLA	Image of Eudoxus.
Victoria Gomez	AEA, Oro Verde, Argentina	Image of Albategnius.
Facundo Gramer	AEA, Oro Verde, Argentina	Image of Hyginus.
Marcelo Mojica Gundlach	LIADA, Cochabamba, Bolivia	Image of Mare Frigoris (6) and Aristoteles.
Robert H. Hays, Jr.	Worth, Illinois, USA	Drawings and articles *Egede A, Fontenelle, la Condamine B* and *Protagoras*.
Rik Hill	Loudon Observatory, Tucson, Arizona, USA	Article and image *Clavius to Moretus, Mare Frigoris, Mare Frigoris Near Full Moon, High Noon, Nicholas' Crater*, and images of Mare Frigoris (8).
Eduardo Horacek	Trapecio Austral-LIADA, Mar del Plata, Argentina	Images of Mare Frigoris (4).
Leguiza, Evangelina	AEA, Oro Verde, Argentina	Image of Censorinus.
Felix León	Santo Domingo, República Dominicana	Image of Plato.
KC Pau	Hong Kong, China	Images of Cassini, Montes Apenninus, Hooked shadow on Copernicus and Copernicus Hooked Shadow Series (2).
Jesús Piñeiro	SLA-LIADA, San Antonio de los Altos, Venezuela	Image of Plato.
Pedro Humberto Romano	SLA-LIADA, San Juan, Argentina	Image of Plato.
Fernando Surá	SLA-LIADA, San Nicolás de los Arroyos, Argentina	Image of Plato
Michael Sweetman	Sky Crest Observatory, Tucson, Arizona, USA	Images of Maurolycus and Walther.
David Teske	Louisville, Mississippi, USA	Images of Lacus Mortis, Eudoxus, Mare Frigoris (5) and Sinus Roris.
Fabio Verza	SNdR, Milan, Italy	Images of Aristoteles, Langrenus and Petavius.
Darryl Wilson	Marshall, Virginia, USA	Article and images Examination of HSV Colorspace Enhanced Imagery of Mare Cognitum, Mare Nubium, the South Polar Highlands and a Wrap up of the HSV Color Enhancement Process.

May 2022 *The Lunar Observer*
By the Numbers

This month there were 127 observations by 30 contributors in 13 countries.



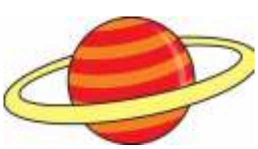


ALPO 2022 Conference
July 22-23, 2022

Due to the continuing nearly worldwide quarantining caused by the Covid-19 pandemic, the 2022 Conference of the ALPO will be held online on Friday and Saturday, July 22 and 23. The ALPO conference times will be: Friday from 1 p.m. to 5 p.m. Eastern Time (10 a.m. to 2 p.m. Pacific Time), Saturday from 1 p.m. to 6 p.m. Eastern Time (10 a.m. to 3 p.m. Pacific Time). The ALPO Conference is free and open to all via two different streaming methods: The free online conferencing software application, Zoom. On the ALPO YouTube channel at https://www.youtube.com/channel/ UCEmixiL-d5k2Fx27Ijfk41A. Those who plan to present astronomy papers or presentations must (1) already be members of the ALPO, (2) use Zoom, and (3) have it already installed on their computer prior to the conference dates. Zoom is free and available at https://zoom.us/.

Those who have not yet joined the ALPO may do so online, so as to qualify to present their work at this conference. Digital ALPO memberships start at only $18 a year. To join online, go to http:// www.astroleague.org/store/ index.php?main_page=product_info&cP ath=10&products_id=39, then scroll to the bottom of that page, select your membership type, click on “Add to Cart” and proceed from there. There will be different Zoom meeting hyperlinks to access the conference each of the two days of the conference. Both links will be posted on social media and e-mailed to those who wish to receive it that way on Thursday, July 22. The Zoom virtual (online) “meeting room” will open 15 minutes prior to the beginning of each day’s activities. Those individuals wishing to attend via Zoom should contact Tim Robertson at cometman@cometman.net as soon as possible. Conference Agenda The conference will consist of initial welcoming remarks and general announcements at the beginning each day, followed by papers and research findings on astronomy-related topics presented by ALPO members. Following a break after the last astronomy talk on Saturday will be presentations of the Walter Haas Observing Award and the Peggy Haas Service Award. A keynote speaker will then follow the awards presentations on Saturday. The selection of a keynote speaker is in progress and the final decision will be announced in the summer issue of this Journal (JALPO64-3). Presentation Guidelines: All presentations should be no more than 15 minutes in length; the preferred method is 12 minutes for the presentation itself plus 3 minutes for follow-up questions. The preferred format is Microsoft PowerPoint. Send all PowerPoint files of the presentations to Tim Robertson at cometman@cometman.net.

To all with interest in the Moon (that is everybody reading this!), Ken Poshedly has allowed me to announce that the keynote speaker is none other that **Charles A. Wood**, the author of The Modern Moon, A Personal View, the Lunar Picture of the Day and many more. This is an incredible opportunity to gain your lunar knowledge!



Basin and Buried Crater Project

Dr. Anthony Cook

Have you ever come across the 500 km diameter "Werner-Airy" impact basin on the near side of the Moon? Probably not as it a highly degraded Pre-Nectarian suspected impact basin. Take a look in Fig 1 and you can see that under the right illumination conditions you can just about make out the circular structure of this suspected impact basin that was named by Don Wilhelm, and whom had some doubts about it being a basin. That is the way of a lot of basins, much careful research is needed, using many different types of observational data, to eventually confirm their existence – something that Don Wilhelms did not have many years ago.

So welcome to a new project within the BAA Lunar Section. The aim here is to image/sketch and characterize known, suspected, and unknown impact basins (i.e. greater than or equal to 300 km across – but there are some multi-ring crater exceptions), and also to catalogue as well as measure the diameters of unnamed buried craters. At this stage we do not intend to do any immediate science with this, at least until we have reached our cataloguing objectives, but to put the catalogue on-line for ourselves, and other researchers to use and reference, and hopefully cite the contribution of the BAA lunar Section.

Figure 1. *The Werner-Airy suspected impact basin as imaged by Anthony Cook on: 2021 Dec 24 UT 00:04-00:11 using a colour web-camera on an undriven Questar telescope. The SW part of the Nectaris impact basin is in the upper right of the image.*

Impact Basins

Why are we doing this? Surely after all these years, all impact basins, and buried craters have been mapped and made it into the International Astronomical Union (IAU) catalogue of named lunar formations? Well amazingly this is not the case as far as I can make out. Many Impact basins do have names – usually after the Mare (if they have this – otherwise a couple of craters that span the basin e.g., Bailly-Newton), but the basin, as a whole, does not have an entry in the IAU database. Planetary scientists have produced catalogues of impact basins, but there are several lists, each by a different group of researchers, and does not appear to be coordinated. Although we are limiting ourselves to 300 km as the cut-off between a basin and a large crater, the demarcation is a little blurred and large craters that have two or more rings can be included too.

Buried Craters
Similarly, there are catalogues of craters and the IAU keeps a list up-to-date of all named craters, but there is relatively little on craters that have been buried by lava, and are barely visible except under shallow illumination. A good example is “Ancient Newton”, an unofficial name for what sometimes resembles a crater beneath Mare Imbrium, located between Plato and Mons Pico. Ancient Newton is only visible under shallow illumination close to the morning or evening terminator.

Why is this important? This applies to basins too - it gives us an idea of what was there before the lava flooded the impact basins. So, we are effectively looking back in time a few hundred million to billions of years.

A good example of a buried crater can be found in Bill Leatherbarrow’s image of the Rupes Recta and Birt area, shown elsewhere in this circular.

Work to be done
I see four areas that amateur astronomers can contribute to this project:

- Compile a catalogue of all known impact basins and buried craters using the lists published by e.g. Paul Spudis, or mentioned in scientific papers of new spacecraft mission results.
- To read through old copies of the Lunar Section circular, and other amateur publications, looking for accounts of suspected impact basins and buried craters, so we can attribute discoverers/proposers of these geological structures.
- Using the basins and buried craters that we know about, to image/sketch these at the telescope, trying to find the best selenographical colongitudes to see them at.
- If you do not have a telescope, or it is cloudy, then to use tools such as LTVT or NASA/ACT QuickMap, to visualize the surface at different illumination angles and directions to spot suspected basins/buried craters, and to characterize/measure their centre location and the diameters of any basin rings, or buried crater perimeters.

Please send any images of the basins/buried craters or your thoughts on what might be basins, to me, and every month I will talk about a specific basin from the list below and show what image or visualization evidence exists for this.

This will be an iterative process and we may find that some basins/buried craters that we thought were previously unknown, had been discovered earlier. I will put the list of basins that we know about, known, suspected, and buried craters onto the following website: https://users.aber.ac.uk/atc/basin_and_buried_crater_project.htm

Basin	Far/Near Side	Lon	E/W	Lat	E/W	Diam (km)	Status	Age	No. Rings	Col-SR1	Col-SR2	Col-SS1	Col-SS2
Al-Khwarizmi-King	F	112	E	1	N	590	Uncertain	PN	2				
Amundsen-Ganswindt	F	120	E	81	S	335	Probable	PN	2				
Antoniadi	F	172	W	70	S	140	Known	UIm	2				
Apollo	F	152	W	36	S	537	Known	PN	3				
Australe	N	93	E	39	S	880	Probable	PN	2				
Bailly	N	69	W	67	S	300	Probable	N	2				
Bailly-Newton	N	41	W	77	S	402	Uncertain	PN	2				
Balmer-Kapteyn	N	70	E	15	S	500	Uncertain	PN	4				
Birkhoff	F	146	W	59	N	325	Probable	PN	2				
Compton	F	104	E	55	N	175	Known	LIm	2				
Coulomb-Sarton	F	123	W	52	N	440	Uncertain	PN	4				
Crisium	N	59	E	17	N	740	Known	N	5				
Cognitum	N	22	W	11	S	350	Uncertain	PN					
Cruger-Sirsalis	N	66	W	15	S	400	Proposed						
Dirichlet-Jackson	F	158	W	14	N	470	Proposed						
Fecunditatis	N	51	E	8	S	690	Uncertain	PN	2				
Fitzgerald-Jackson	F	170	W	23	N	400	Proposed						
Flamsteed-Billy	N	45	W	7	S	570	Uncertain	PN	2				
Fowler-Charlier	F	139	W	37	N	316							
Freundlich-Sharonov	F	175	E	19	N	600	Uncertain	PN	1				
Grimaldi	N	68	W	6	S	172	Known	PN	3				
Grissom-White	F	161	W	44	S	600	Uncertain	PN	1				
Hertzsprung	F	129	W	3	N	570	Known	N	4				
Humboldtianum	N	82	E	57	N	650	Known	N	6				
Humorum	N	39	W	24	S	425	Known	N	6				
Imbrium	N	16	W	33	N	1160	Known	Im	6				
Ingenii	F	164	E	34	S	315	Probable	PN	4				
Insularum	N	31	W	8	N	600	Uncertain	PN	2				
Keeler-Heaviside	F	162	E	10	S	500	Uncertain	PN	4				
Kohlschutter-Lenov	F	158	W	13	N	400	Proposed						
Korolev	F	157	W	4	S	440	Known	N	4				
Lomonosov-Fleming	F	105	E	19	N	620	Proposed	PN	1				
Lorentz	F	95	W	33	N	365	Known	PN	2				
Marginis	N	86	E	13	N	580	Uncertain	PN	1				
Mendeleev	F	142	E	5	N	325	Probable	N	2				
Mendel-Rydberg	N	94	W	50	S	630	Known	N	1				
Milne	F	113	E	31	S	272	Probable	PN	2				
Moscoviense	F	148	E	27	N	420	Known	N	5				
Mutus-Vlacq	N	21	E	52	S	700	Probable	PN	2				
Nectaris	N	36	E	15	S	333	Known	N	5				
Nubium	N	17	W	21	S	690	Uncertain	N	1				
Orientale	N	93	W	19	S	930	Known	Im	6				
Pingré-Hausen	N	82	W	56	S	300	Uncertain	PN	1				
Planck	F	137	E	58	S	314	Probable	PN	2				
Poincaré	N	164	E	57	S	325	Known	PN	2				
Procellarum	N	15	W	23	N	3200	Uncertain	PN	1				
Riemann-Fabry	F	99	E	41	N	320	Uncertain						
Schiller-Zucchius	N	45	W	56	S	335	Known	PN	2				
Schrödinger	F	132	E	75	S	312	Known	Im	2				
Schrödinger-Zeeman	F	165	W	81	S	250	Proposed		2				
Schwarzschild	F	121	E	70	N	212	Probable	N	2				
Serenitatis	N	18	E	28	N	920	Probable	N	5				
Sikorsky-Rittenhouse	N	111	E	68	S	310	Uncertain	N	1				
Smythii	N	88	E	1	N	740	Probable	PN	5				
South Pole-Aitken	F	169	W	53	S	2500	Known	PN	2				
Sylvester-Nansen	N	45	E	83	N	400	Proposed		2				
Tranquillitatis	N	31	E	9	N	700	Uncertain	PN	2				
Tsiolkovskiy-Stark	F	128	E	15	S	700	Uncertain	PN	1				
Wegner-Winlock	F	109	W	42	N	300	Uncertain						
Werner-Airy	N	12	E	24	S	500	Uncertain	PN	1				

Table 1. Known/Probable/Uncertain lunar impact basins – much of the information has come from : http://the-moon.us/wiki/Lunar_Basins_List , but we shall use this as an initial starting block to refine the data-base. Do not worry too much about the status column – this was the best knowledge I could find when compiling the table, undoubtedly new images and spacecraft data will help us refine this. "Age" corresponds to the geological era of formation e.g. Lim, UIM, and Im are Lower Imbrium, Upper Imbrium, and Imbrium.

N is Nectarian, and PN is Pre-Nectarian. We will add selenographical colongitudes into the last four columns when we establish the best start and end times to see the basins at sunrise and sunset conditions on the Moon.

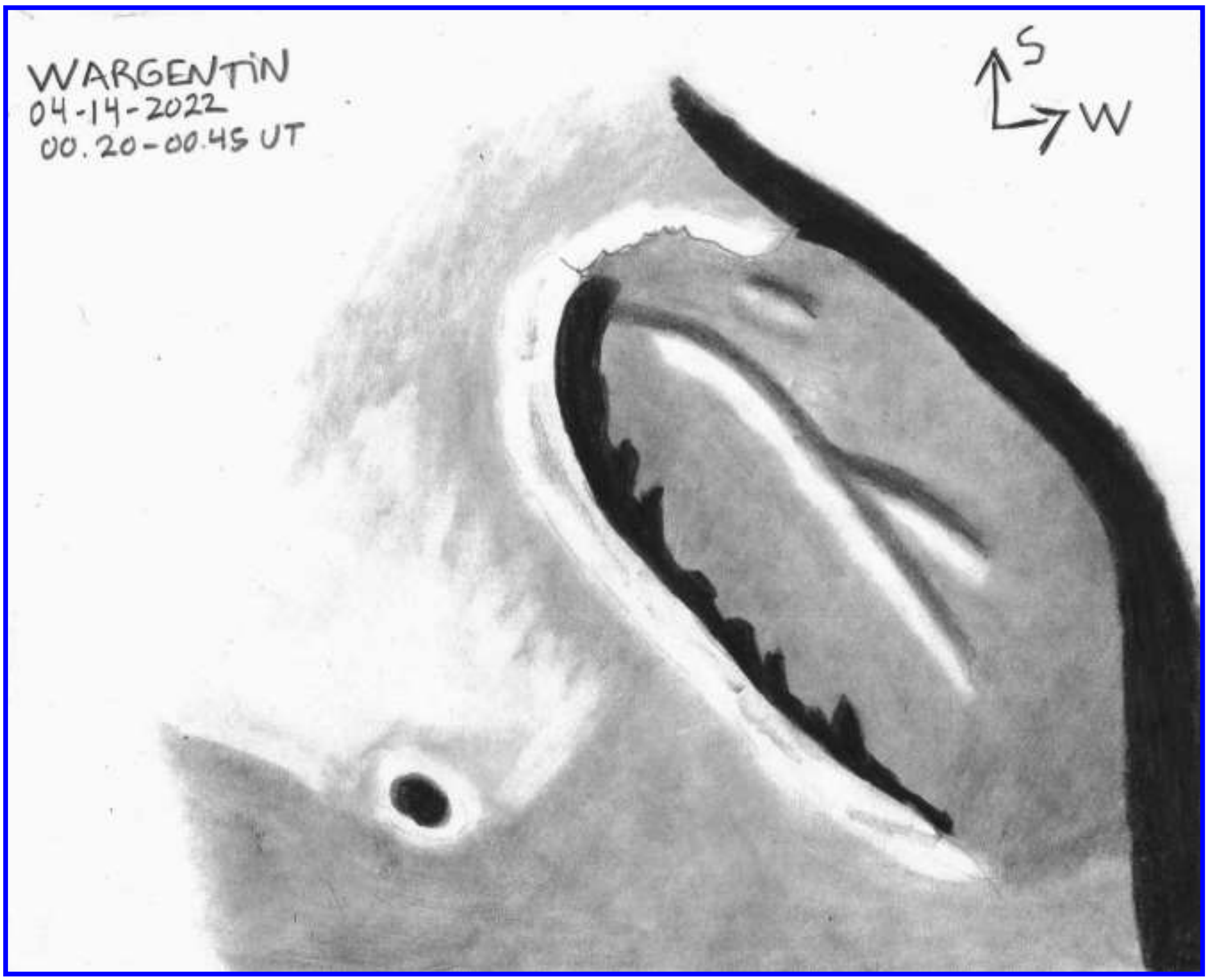
Crater	Far/Near Side	Lon	E/W	Lat	N/S	Diam (km)	Status	Age	Col-SR1	Col-SR2	Col-SS1	Col-SS2
Ancient Newton	N	8.4	W	47.3	N	125	Uncertain					
Nicolet-Thebit	N	6.8	W	22.3	S	212	Proposed					
Sinus Asperitatis	N	28.2	E	5.4	S	87	Proposed					

Table 2. Buried Impact Craters. This catalogue has only just begun, and there are a lot more buried craters on the Moon than these three. Again, the headings are similar to the impact basin catalog, except the craters do not have rings.

The Wrinkle Ridges in the Interior of Wargentin

Alberto Anunziato

Observing the terminator, I said to myself: "enough to tire my friends of The Lunar Observer" with wrinkle ridges, I'm going to draw a crater". Of course, they are much more difficult to draw, so I went for a flat-bottomed crater, which looked spectacular, with the terminator passing right by its west wall: Wargentin, who makes a fascinating trio with Nasmyth and Phocylides. Wargentin's east wall shone brightly, with shadow detail on its terraces, and is superimposed on Nasmyth's west wall, which I only partially drew to locate Wargentin. Most interesting were what looked like central mountains, which I didn't know existed (I thought Wargentin's floor was completely smooth, as well as almost level with the height of its walls). I drew the presumed central mountains as best I could, with their brights and shadows. Looking up Wargentin on the LROC Quickmap I realized that I had drawn… wrinkle ridges once again! Even when I wanted to avoid them, I just draw them. Wargentin is one of the few craters whose lava-covered floor features wrinkle ridges, the others being: Endymion, Vendelinus, Humboldt, Grimaldi, and Egede.



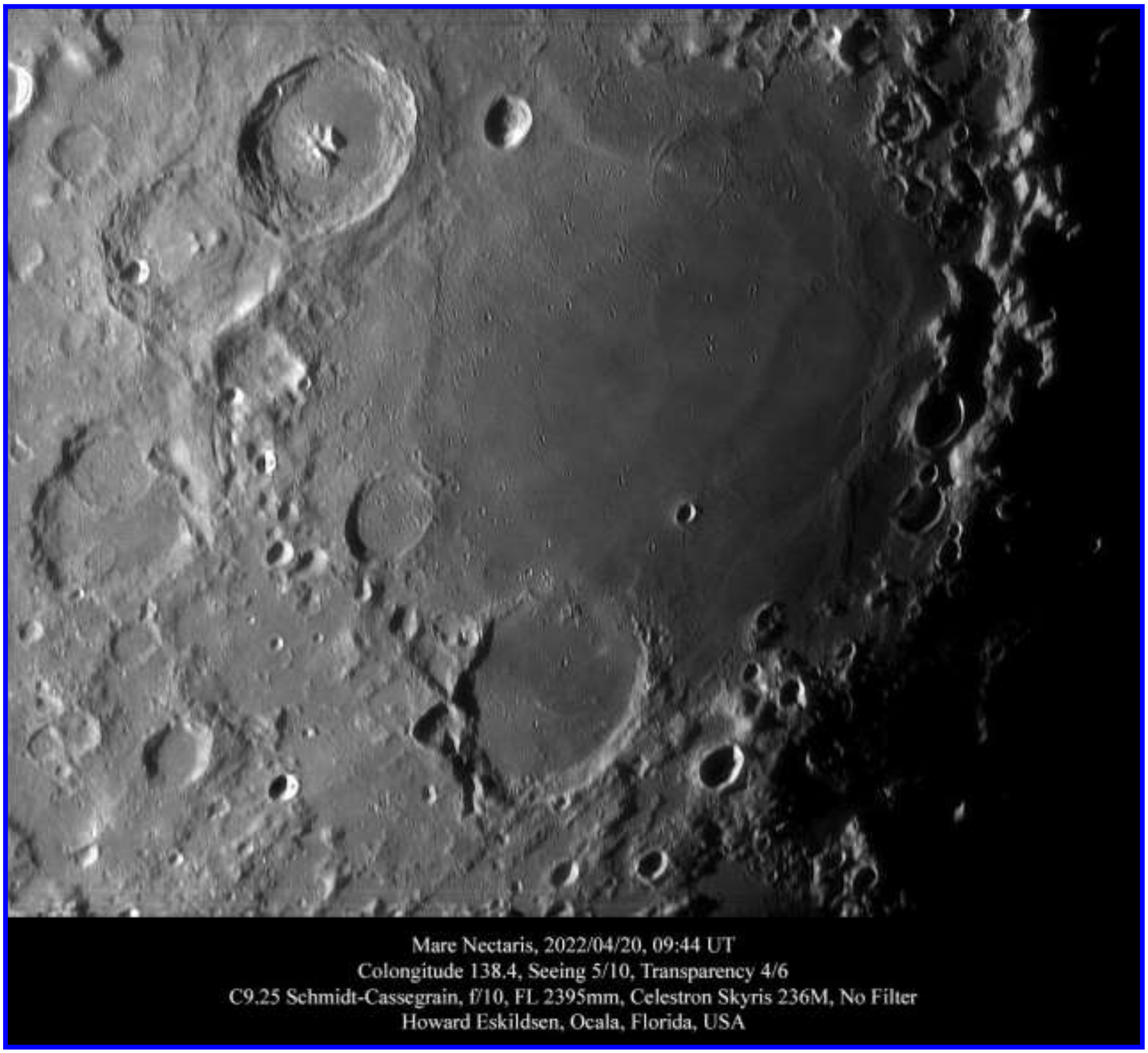
Wargentin, *Alberto Anunziato, Paraná, Argentina. 2022 April 14 00:20-00:45 UT. Meade EX105 mm Maksutov-Cassegrain telescope, 154 x.*

Mare Nectaris

Howard Eskildsen

This image captures the mare basalts that have flooded the floor of Mare Nectaris, as well as the interior of Fracastorius on the bottom of the image. The eastern inner mountainous ring is highlighted in the setting sun on the right portion of the image and the western inner ring arcs from Fracastorius past Catharina, to Cyrillus and Theophilus on the upper left part of the image. Near the top center is the smaller crater Mädler, and to the right of that, the nearly obliterated Daguerre is crossed by a ray from Mädler. Secondary craters from Theophilus pock the floor of the mare and even extend to Fracastorius. Wrinkle ridges arc around the eastern mare margin; I wonder if they bury an inner ring.

I never tire of looking at this area with so many features revealing so much about the ancient Moon. It was also made special by a visit to Dr Ralph Baldwin when he was 97. He had been studying Nectaris and wanted to use one of my photos in his study. That led to an invitation to visit him in south Florida, and a very memorable conversation with a very remarkable person.



Mare Nectaris, *Howard Eskildsen, Ocala, Florida, USA. 2022 April 20 09:44 UT, colongitude 138.4°. Celestron 9.25 inch Schmidt-Cassegrain telescope, SKYRIS 236M camera. Seeing 5/10, transparency 4/6.*

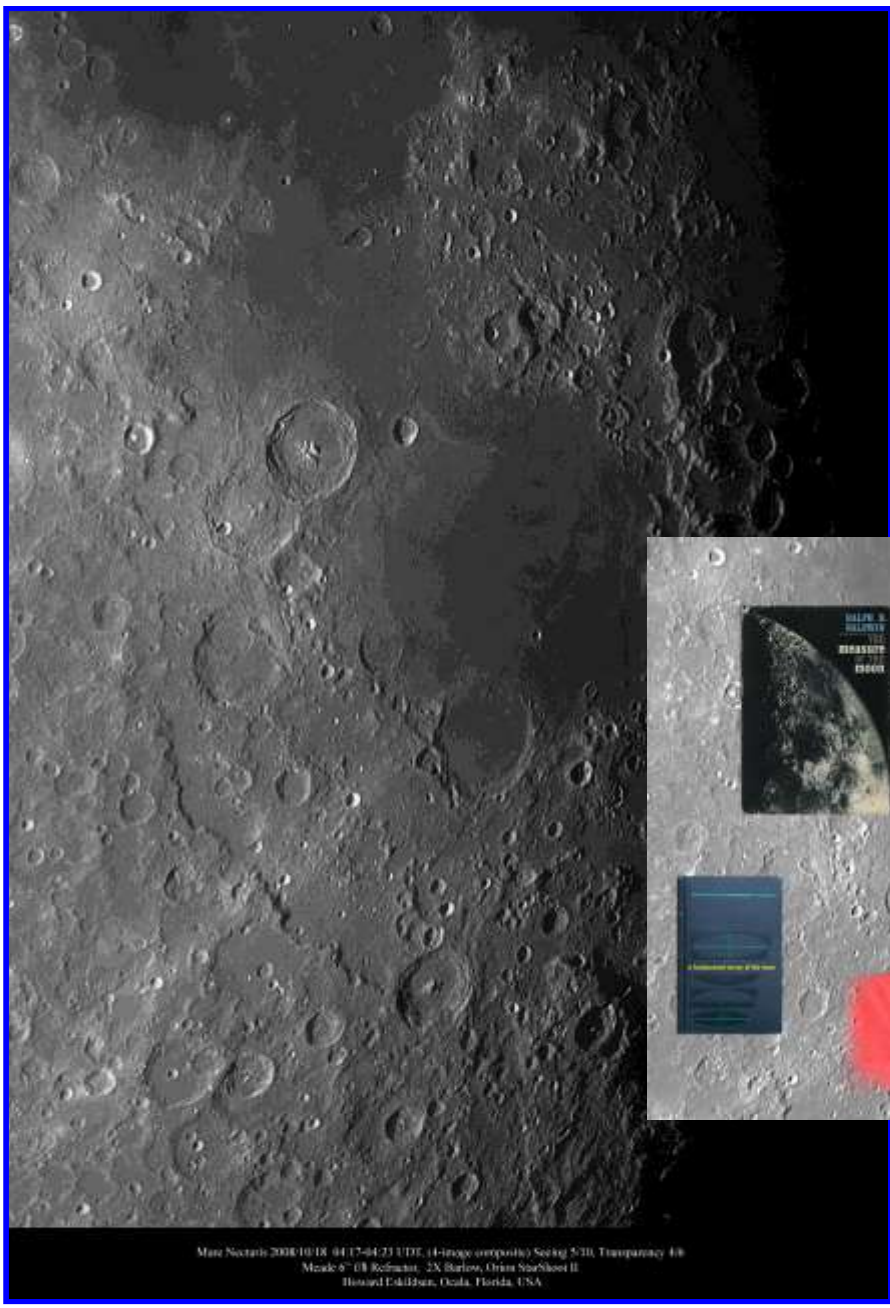
The One Who Got It Right

Howard Eskildsen

Dr. Ralph Baldwin from Grand Rapids, Michigan, studied craters produced by explosives during World War II, and became interested in lunar craters while lecturing at Adler Planetarium. His discovery that the depth to diameter ratios of the craters fit well on a logarithmic curve generated from his explosives studies led him to publish a paper in Popular Astronomy in 1942, since the scientific journals of the day had little interest in the Moon or in his works. Later he published *The Face of the Moon* in 1949, further detailing his theory for crater formation. The scientific journals of the day were not interested in lunar astronomy, and his work was ignored academically at the time.

He published *The Measure of the Moon* in 1963 and *A Fundamental Survey of the Moo*n in 1965, expanding on his previous works. Apollo exploration and rock samples supported his conclusions as did other lunar studies and eventually his views were accepted by the rest of the scientific community. He finally received well-deserved recognition in 2000 when he was presented with the Barringer Medal for his studies in impact cratering. It was duly noted: "Seldom has one man been so right about so many things so early."

I had the privilege of meeting Dr. Baldwin in 2009. Fellow lunar enthusiast Bob O'Connell and I traveled to his home in Naples, Florida. Though he was 97 years old and hard of hearing, he was alert and insightful. He was working on an article about Mare Nectaris for the journal *Icarus* at the time. We left feeling thrilled and inspired by this visit. We were saddened to hear of his passing a year later.



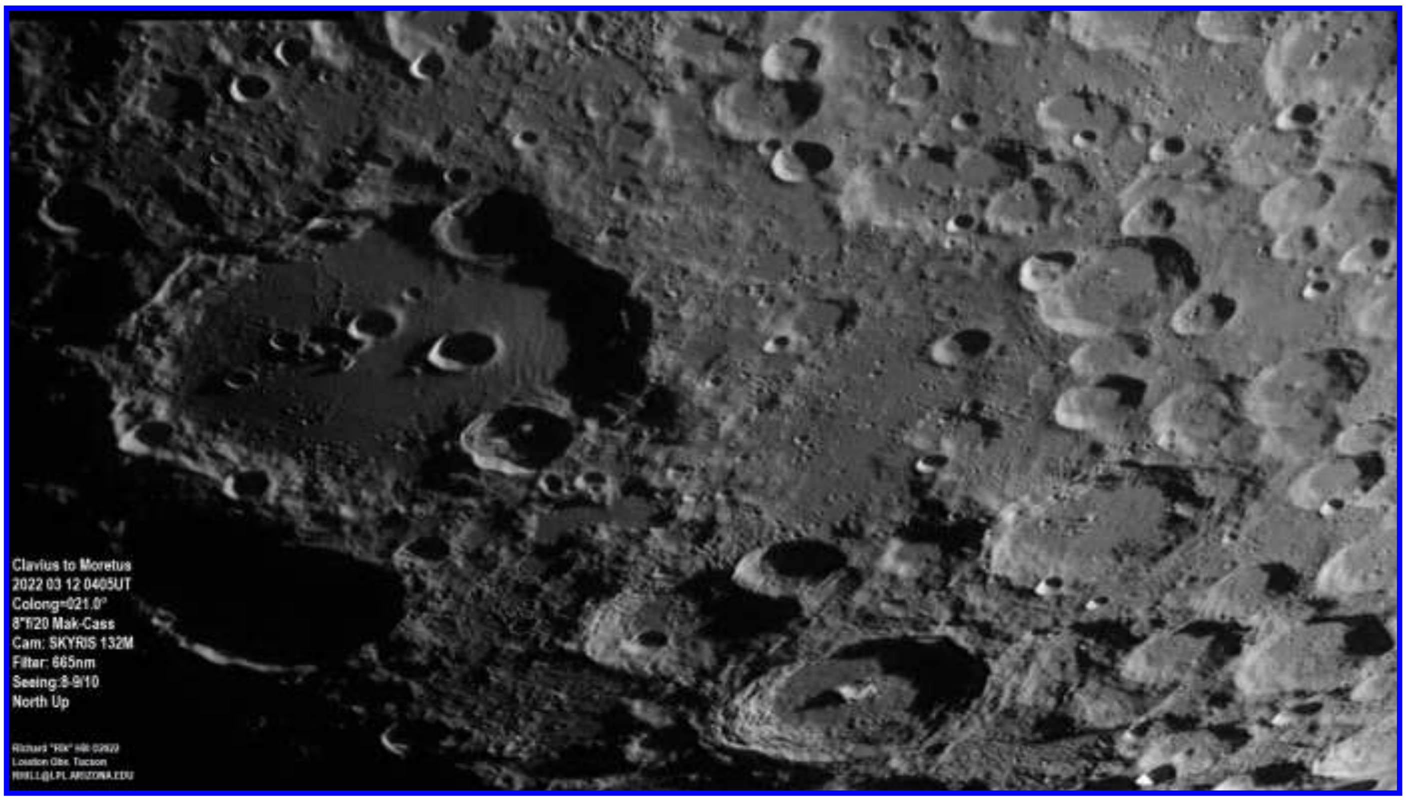
***Mare Nectaris**, Howard Eskildsen, Ocala, Florida, USA. 2008 October 18 04:14 UT. Meade 6" refractor, 2x barlow, Orion StarShoot II. Seeing 5/10, transparency 4/6.*

Clavius to Moretus

Rik Hill

The monster crater on the left side is the 231 km diameter Clavius, one of the larger craters on the nearside of the Moon. It has a fabulous arc of smaller craters on its floor starting with Rutherfurd (56 km) on the bottom wall of Clavius up to Clavius C (28 km) above it, then farther on is Clavius C (21 km) and next is Clavius N (13 km) ending with Clavius J (12 km). This distinctive arc of craters makes Clavius very identifiable. Notice the radial streaks of impact ejecta from Rutherfurd across the floor of the great crater. Also notice the small piece of a flat ridge catching the first sunlight just to the right of Rutherfurd and next to it on the Clavius crater wall is an odd little wisp that is a breach in the wall itself as seen on the LROC QuickMap. Below Clavius is the shadow filled Blancanus and further below is the spectacular crater Moretus with its beautifully terraced walls and clear central peak, very like Tycho just North of Clavius.

Above left of Moretus is Gruemberger (97 km) and to the right of that is Cysatus (5 km). Then to the right of Moretus is Curtius (99 km). North of Curtius, just above the mid-line of the image, is the flat floored crater Zach (73 km). Above right of Zach is a curious gathering or merged and flooded craters. It's not named but is still fascinating and intricate in detail. One of those unnamed treasures you can find all over the Moon.



Clavius to Moretus, *Richard Hill, Loudon Observatory, Tucson, Arizona, USA. 2022 March 12 04:05 UT, colongitude 21.0°. 8 inch f/20 TEC Maksutov-Cassegrain telescope, 665 nm filter, SKYRIS 132M camera. Seeing 8-9/10.*

Montes Alps
Rafael Benavides

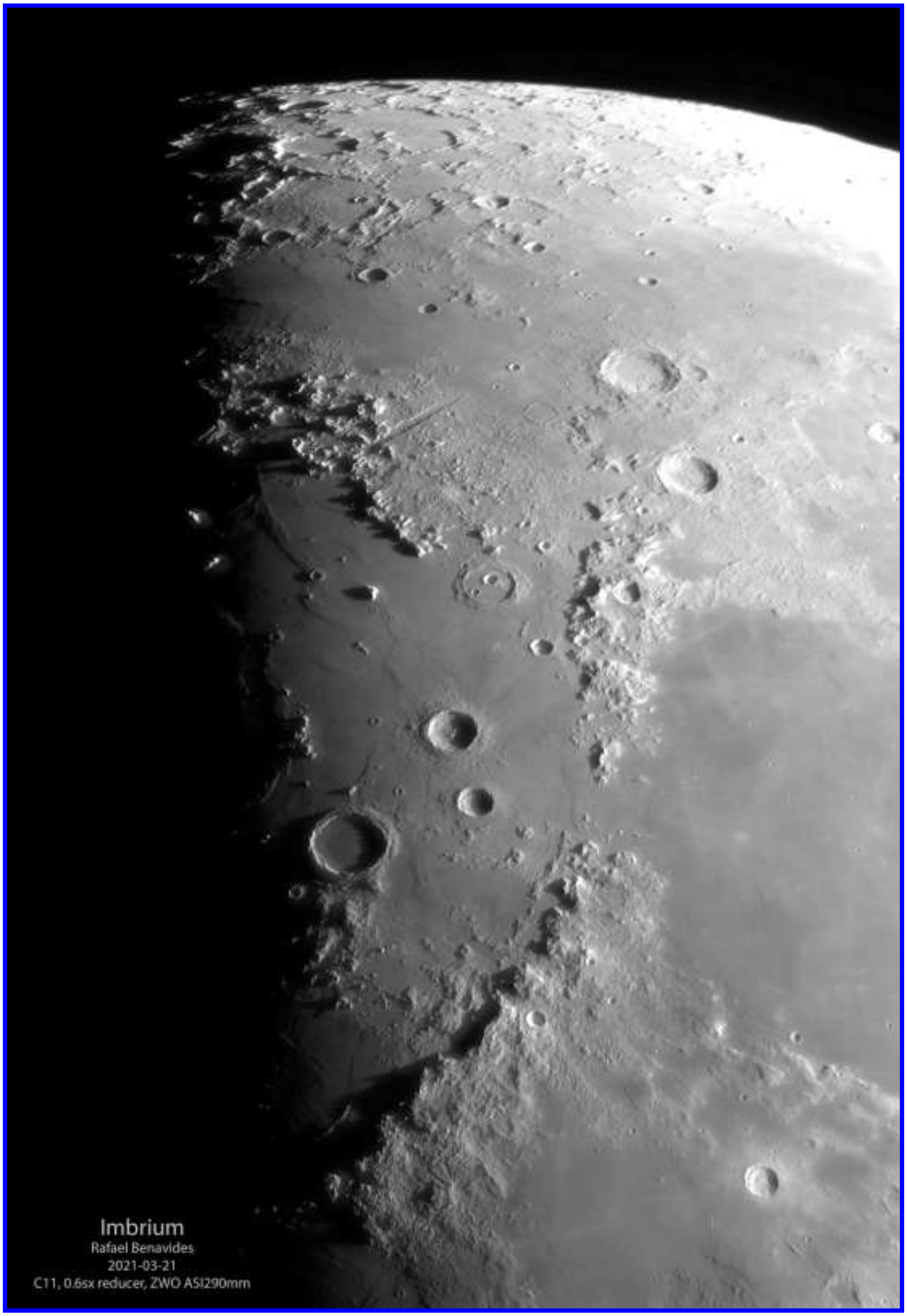


Fig 1. Imbrium, *Rafael Benavides, Posadas Observatory MPC J53, Córdoba, Spain. 2021 March 21. Celestron 11", focal reducer 0,63x, ZWO ASI 290 MM. Seeing 3/10.*

About 4 billion years ago, a huge body, a protoplanet, collided with the Moon, creating a gigantic crater over 1,145 kilometers in diameter that almost destroyed it. The **Montes Alpes** are the northern rim of the huge impact basin that formed. To the east, the Caucasus Mountains and the Apennines form the border. Later this enormous basin was flooded by basaltic lava and originated the Mare Imbrium that we know today. Figure 1 shows this impact basin perfectly illuminated just in the middle.

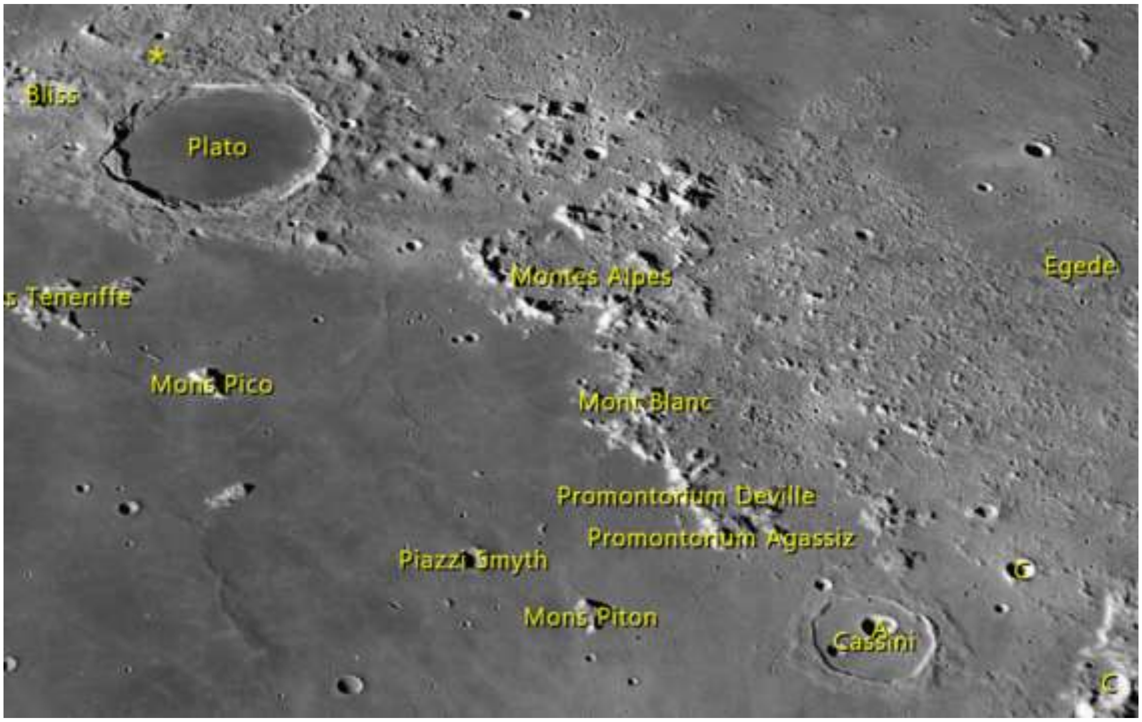


Fig 2. *Alpine mountains and their surroundings with the names of some of the most important features. Virtual Moon Atlas.*

***Fig 3, Montes Alpes,** Rafael Benavides, Posadas Observatory MPC J53, Córdoba, Spain. 2022 January 10. Celestron 11", IR Pass Baader filter, ZWO ASI 290 MM. Seeing 8/10.*

I love to see peaks' shadows of **the Alpes** (figure 3), look at that sawtooth profile. The mountain range is 281 km long and has a maximum width of 80 km. One of the shadows is especially long and corresponds to the highest peak: **Mont Blanc** with 3600 meters of altitude. Further south is the **Promontorium Deville**, a mountainous cape that reaches 2,200 meters at its highest point and stands out for its two main peaks, which we can see better because of the shadows they cast. To the south it closes with **Promontorium Agassiz**, a triangular area of mountains that reaches up to 2400 meters of altitude. Around Mont Blanc we see other formations of similar height, creating a spectacular panorama.

A little further south appears the isolated mass of **Mons Piton** with a base of 25 km. As impressive as it seems when isolated, the shadow is less than that of **Mont Blanc**. In this case it is 2250 meters high. On the left, submerged in the lunar night, the first rays of the Sun begin to illuminate the tops of various isolated mountains, including **Mons Pico**.

The Alpes are divided by a **valley**, which looks like a clean hatchet seen through a telescope. It joins Mare Imbrium with Mare Frigoris, creating a natural corridor through the mountains. It is 166 km long, a width that varies between 10 and 20 km and is bordered by walls that reach 1000 meters in height. The central rille is only 700 meters wide. It seems like a dream to me to see details smaller than 1 km on the lunar surface from home through the telescope. It has always been thought that it was formed by subsidence of the area caused by radial fractures, creating the valley that we see today. The walls are very different, the south is much more rectilinear and the north is more irregular. Today it is believed that the rille was later a lava channel similar to Vallis Schöteri, this lava over time molded the different shapes and contours of the walls.

With the Sun higher we lose the shadows and that feeling of three-dimensionality, although we see the peaks that form the mountain range with total clarity. **Vallis Alpes** cuts it almost in half. It is curious to see how the valley divides the Alps into two distinct parts. The south (where **Mont Blanc** is located) has a front line of large blocks with heights of over 2000 meters and behind there is a wide area of debris, with much smaller formations. On the other hand, the area to the northwest of the valley (left in figure 4) is more homogeneous with large blocks of importance along almost the entire width of the mountain range.

Mons Pico appears fully illuminated. It also has a base of 25 km and a height of 2400 meters.

***Fig 4, Montes Alpes**, Rafael Benavides, Posadas Observatory MPC J53, Córdoba, Spain. 2017 April 6. Celestron 11", IR Pass Baader filter, ZWO ASI 290 MM. Seeing 8/10.*

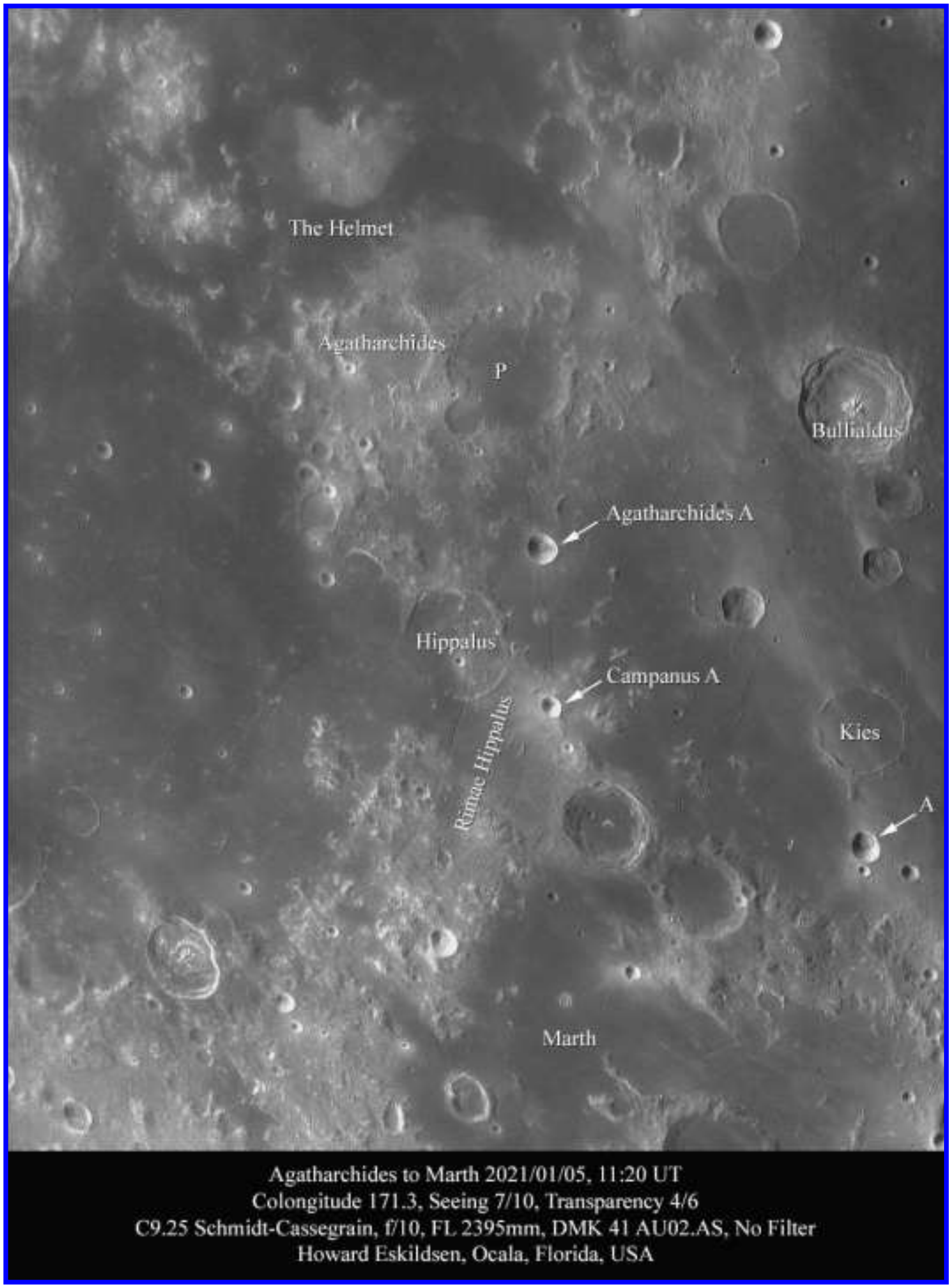
It is worth strolling through the lunar surface as if it were a unique journey, going through every detail, imagining ourselves crossing valleys, sheltered by mountains... Let's not stop dreaming of the Moon...

Agatharchides to Marth

Howard Eskildsen

The curved Hippalus Rills cross vertically across the central image with the western rille crossing its namesake Hippalus crat er. The eastern rille extends from the small bright crater Campanus A northward to Agatharchides A and beyond. North of Agatharchides A, the large, ruined crater Agatharchides P, with two smaller craters on its margins, appears like an oval face with large ears like the Disney dwarf, Dopey.

To its left, Agatharchides crater lies in ruin in bright terrain. Above Agatharchides, a bright highland feature resembles an upside-down helmet, which astronauts on Apollo 16 labeled "The Helmet," and the unofficial moniker has endured.



On the far-right image, Bullialdus shows the classic central peak and terracing of a large impact crater. Below it, the faint ring of Kies rests in Mare Nubium and is nearly filled to the brim with basalt. Below that, the small, bright crater, Kies A has a curious asymmetrical slump pattern with the bulk of the slump on the north half of the crater floor. I had never noticed this before.

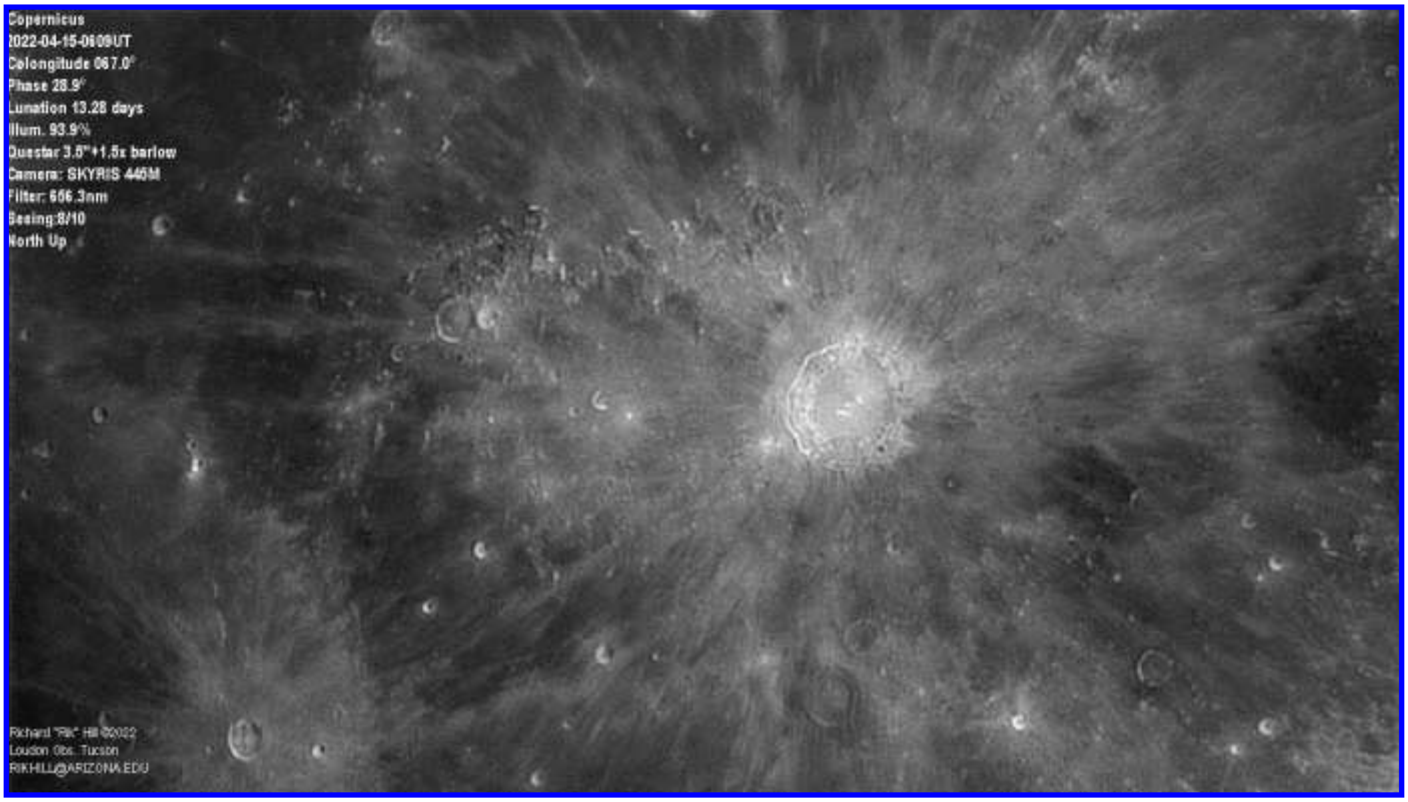
Finally, in the lower margin of the image, the concentric crater Marth shows its two tiny bright concentric rims in the dark plains of Palus Epidemiarum.

Agatharchides to Marth, *Howard Eskildsen, Ocala, Florida, USA. 2021 January 05 11:20 UT, colongitude 171.3°. Celestron 9.25 inch Schmidt-Cassegrain telescope, DMK41AU02.AS camera. Seeing 7/10, transparency 4/6.*

Nicholas' Crater

Rik Hill

Always a favorite target when on the terminator, Copernicus (95 km) is often ignored after that. Here we have it under pretty high Sun but not nearly full moon. The terminator at the time of this image was running through Cavalerius and Pythagoras about 3 days away from full. I processed this so as to show off the ray pattern around the crater, one of the best on the Moon. All this was formed in just a few minutes some 800 million years ago when pieces of the same parent body as asteroid 495 Eulalia crashed into the Earth and Moon. Undoubtedly, pieces of the Moon slammed into Earth from this event as well. The Copernicus impact may also have ushered in the Cryogenian geological period on Earth, with multiple ice ages that lasted from 720-635 million years ago and ended with the Ediacaran Period that had the first complex multicellular life.



Copernicus, *Richard Hill, Loudon Observatory, Tucson, Arizona, USA. 2022 April 15 05:09 UT, colongitude 67.0°. 3.5 inch Questar Maksutov-Cassegrain telescope, 1.5x barlow, 656.3 nm filter, SKYRIS 445M camera. Seeing 8/10.*

The large crater directly below Copernicus is Reinhold (49 km). Then down near the ID name plate is the crater Kepler (32 km) with its lesser ray system. The bright point above Kepler is the little crater Bessarion (10 km). It has an even smaller ray system of its own just coming into view at this Sun altitude. Between Copernicus, Reinhold and Kepler is Mare Insularum. A lesser known, more recently named mare. Above and left of Copernicus are the Montes Carpatus with the large ring crater on the left end, Tobias Mayer (34 km). The crater Eratosthenes is just outside the field of this image in the upper right.

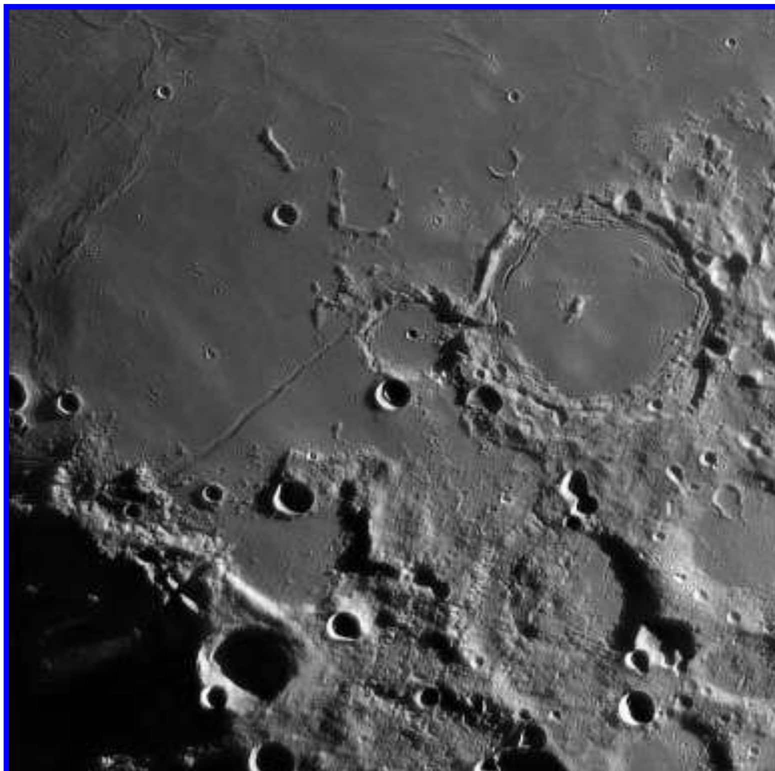
Notice the tiny crater at about 4 o'clock from the center of Copernicus, about 80 or 90 km distant with the dark ejecta blanket around it forming what is called a "dark haloed crater". There are a few more in the field. See if you can locate them.

Two Views of Hesiodus A

Howard Eskildsen

Hesiodus A is one of my favorite concentric craters. Using LROC QuickMap I estimated an outer rim diameter of 14.4 km and an inner rim (the toroid) diameter of 6.9 km, giving a toroid to diameter ratio (T/D) of 0.48. Its depth measured at 1.35 km resulting in a depth/diameter (d/D) ratio of 0.094. Rubble lines the floor of the toroid almost resembling a central peak. For comparison, the Virtual Moon Atlas lists its diameter as 15 km, and the IAU 14.1299 km.

It was fun to watch the change in appearance over two days. On the first image just the western margin of the toroid is visible, but the second image shows the full crater with its markings in good relief.



Hesiodus A, 2022/04/10, 23:53 UT
Colongitude 23.9, Seeing 8/10, Transparency 6/6
C9.25 Schmidt-Cassegrain, f/10, FL 2395mm,
Celestron Skyris 236M, No Filter
Howard Eskildsen, Ocala, Florida, USA

Hesiodus A, *Howard Eskildsen, Ocala, Florida, USA. 2022 April 10 23:53 UT, colongitude 23.9^o. Celestron 9.25 inch Schmidt-Cassegrain telescope, SKYRIS 236M camera. Seeing 8/10, transparency 6/6.*

Hesiodus A, 2022/04/13, 00:37 UT
Colongitude 48.6, Seeing 6/10, Transparency 3/6
C9.25 Schmidt-Cassegrain, f/10, FL 2395mm,
Celestron Skyris 236M, No Filter
Howard Eskildsen, Ocala, Florida, USA

Hesiodus A, *Howard Eskildsen, Ocala, Florida, USA. 2022 April 13 00:37 UT, colongitude 48.6^o. Celestron 9.25 inch Schmidt-Cassegrain telescope, SKYRIS 236M camera. Seeing 6/10, transparency 3/6.*

Pontanus E Concentric Crater

Howard Eskildsen

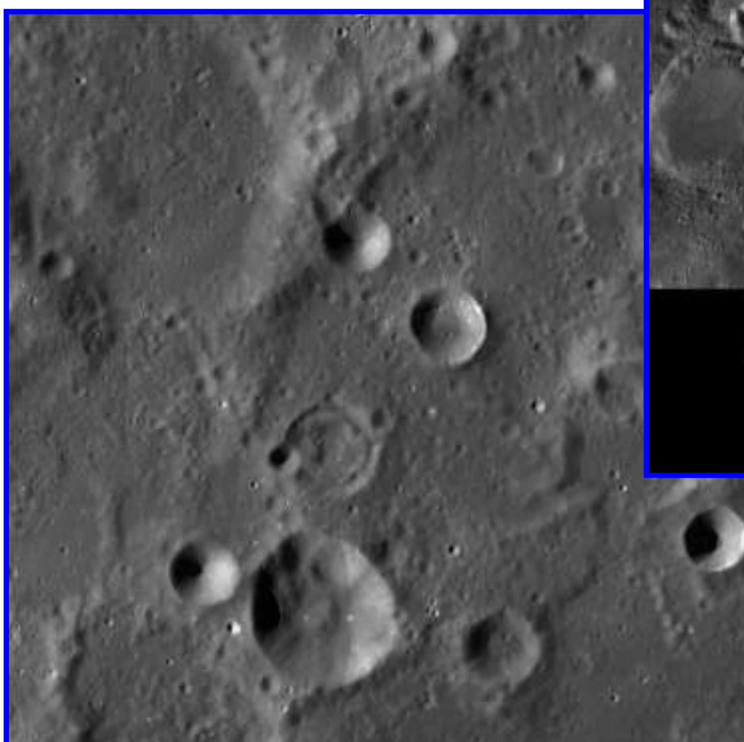
My first attached photo shows the concentric crater Pontanus E in the center of the image. Sacrobosco is on the upper right of the image, while Apianus is lower left with Playfair above it on the left margin of the photo. Pontanus is the larger ruined crater to the lower right of center. For comparison, an image from the LROC WMS Image Map is included; Pontanus E is just to the lower left of center on that image. The third attached image shows one of the QuickMap measurement profiles of the crater from the NE to the SW direction and is included show the interior structure of the crater.

Pontanus E is an unusual highland concentric crater; most concentric craters occur in along mare margins. Measurements I did a few years ago using LROC QuickMap tools gave a mean diameter (D) of 12.5 km for the outer ring and 8.2 km diameter for the inner ring, also known as the toroid (T). The depth (d) of the crater measured 0.848 km. For comparison, the QuickMap data lists the outer diameter (D) as 12.816 km. My measurements gave a toroid to diameter (T/D) ratio of 0.65 and a depth to diameter ratio (d/D) of 0.068 which is shallower than most fresh craters of similar size. This is likely explained by uplift of the lower crater that created the concentric appearance.

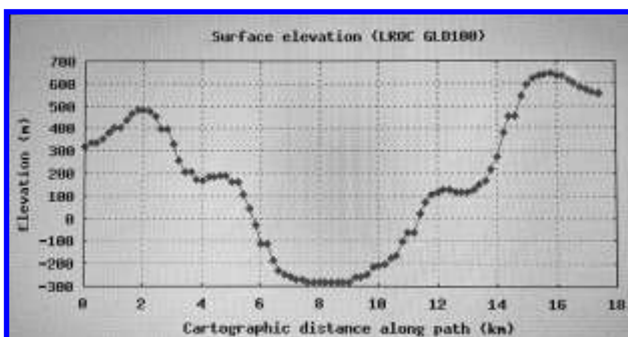
Pontanus E, *Howard Eskildsen, Ocala, Florida, USA. 2022 April 10 23:55 UT, colongitude 23.9°. Celestron 9.25 inch Schmidt-Cassegrain telescope, SKYRIS 236M camera. Seeing 8/10, transparency 6/6.*

Pontanus E, 2022/04/10, 23:55 UT
Colongitude 23.9, Seeing 8/10, Transparency 6/6
C9.25 Schmidt-Cassegrain, f/10, FL 2395mm,
Celestron Skyris 236M, No Filter
Howard Eskildsen, Ocala, Florida, USA

Below, Pontanus E *Concentric crater, LROC*



Pontanus E Concentric Crater, Image from LROC WMS Image Map



Pontanus E Concentric Crater, LROC Quickmap NE-SW Path

Right Pontanus E *concentric crater LROC QuickMap NE-SW*

Examination of HSV Colorspace Enhanced Imagery of Mare Cognitum, Mare Nubium, the South Polar Highlands and a Wrap up of the HSV Color Enhancement Process

Darry Wilson

With this sixth article in the multiband image processing series, we reach the end of our tour of color enhanced lunar surface features. In the first "The Lunar Observer" TLO article (December, 2021) we introduced an algorithm that allows us to increase the saturation of color images of the moon so that color is clearly visible. We saw that more information relating to surface material composition was visible in the color-enhanced images than in grayscale images. Next month we will move on to more sophisticated methods of processing multiband imagery of the moon, but in this article, we will take a look at one area that we have not yet examined. The color images presented here were processed according to the process flow diagram presented in the January, 2022 issue of TLO.

Figure 1 covers Mare Cognitum and Mare Nubium. The crews of Apollo 12 and Apollo 14 explored northern Mare Cognitum and their locations are denoted by the fiducials at the edge of the figure. The titanium abundance at the Apollo 12 landing site is about 3.1% by weight. At the Apollo 14 landing site, it is about 1.7% by weight [Lucy, et. al.]. Neither location is bright blue like areas of Mare Imbrium and Oceanus Procellarum, but the Apollo 12 site is somewhat bluer than the Apollo 14 site, as expected from the higher titanium concentration.

Figure 1, Mare Cognitum and Mare Nubium, Apollo 12 and 14 Sites, *Darryl Wilson, Marshall, Virginia, USA. 2020 November 08 07:31 UT. 18 inch Obsession reflector telescope, SKYRIS 274C camera. 0.45"/pixel. Registax Sharpened HSV Color Enhancement.*

We observe a complex interplay of blue and brown areas caused by the mixing of lava flows as we move southward from Mare Cognitum through Mare Nubium. As we move further southward past the Straight Wall we encounter highlands which are characteristically unsaturated. They are nearly shades of gray.

Southern Mare Nubium and the southern highlands are well displayed in Figure 2. Near the upper left of the figure is an irregular blue lava plain known as Palus Epidemiarum. Nestled between Mare Nubium and Mare Humorum, it contains perhaps the most titanium rich surface in this image. It's a close call though - the lower left quadrant of 60-mile diameter Pitatus, at the southern edge of Mare Nubium, displays a deep shade of blue as well.

Figure 2, Mare Nubium, and Southern Highland, *Darryl Wilson, Marshall, Virginia, USA. 2020 November 08 07:32 UT. 18 inch Obsession reflector telescope, SKYRIS 274C camera. 0.45"/pixel. Registax Sharpened HSV Color Enhancement.*

Curiously, the lower half of the eastern inner wall of Tycho appears distinctly bluish, as does the illuminated part of the floor. This contrasts with the large number of other craters in the area (excluding walled plains such as Pitatus). Tycho seems to be a singular exception here. In the March 2020 issue of "The Lunar Observer" we noted that Tycho exhibited anomalous thermal behavior due to exposed silicates in its interior. Perhaps exposed silicates are more reflective in the blue region of the spectrum than crater interiors covered by regolith.

Figure 3 is a mosaic of the images that were presented in TLO articles two through six. The two that we discuss in this article are in the lower center. Not all of the visible disk was imaged and the unimaged areas are filled in with a featureless dark green. Although the images were radiometrically uncalibrated, since they all came from a single night of observation, using only one telescope, and with (probably) no variability of sensor gain and exposure settings, similar image processing steps resulted in a modicum of color consistency in the results. Minor differences in image quality are evident with close inspection. As the evening progressed, natural phenomena such as invisibly thin intermittent cloud layers and slight dew formation on the secondary occasionally reduced the brightness of some images. This lowered the SNR of the RGB images enough to affect the information content of the HSV images. Color balance problems were most often evident near the terminator since the image SNR is lowest in that area. Additionally, after processing the entire set, it appears that the first images processed (January 2021 TLO article) may have been slightly shifted toward the blue. This would have biased all further results since an effort was made to match color balance with previously processed images.

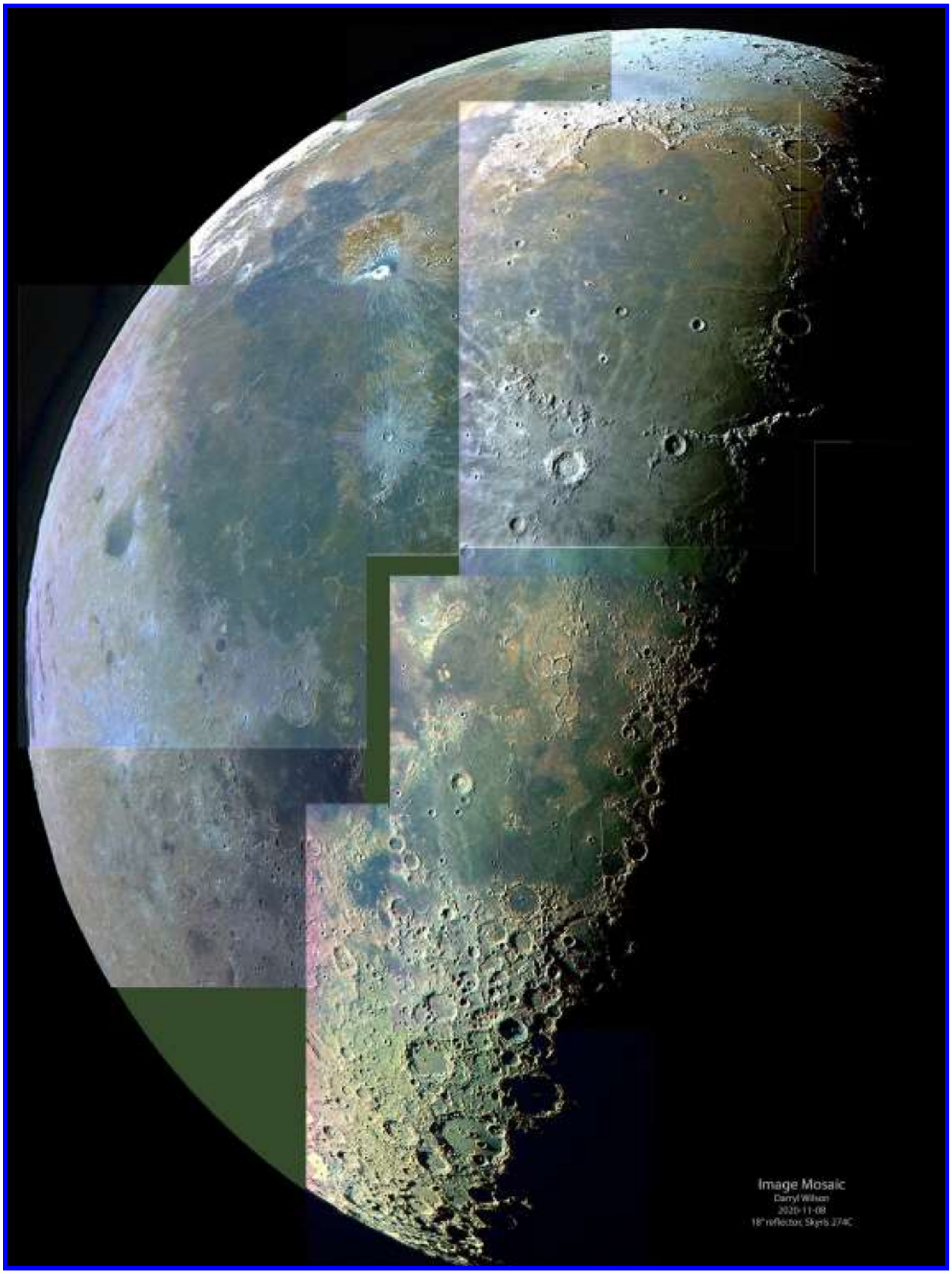


Figure 3, Image Mosaic, *Darryl Wilson, Marshall, Virginia, USA. 2020 November 08 18 inch Obsession reflector telescope, SKYRIS 274C camera. 0.45"/pixel. Registax Sharpened HSV Color Enhancement.*

The image processing steps were similar for all images in the mosaic - but not identical. In every case, manual adjustment of the histogram resulted in a more pleasing final result. This manipulation was sometimes done before the HSV transformation, sometimes after back-transforming to RGB space, and occasionally both before and after. Sometimes the fidelity of the color match in overlap areas was compromised in order to address a more objectionable problem in another part of an image, such as pixel saturation in bright areas or an excessive greenish cast over objects near the terminator. A critical reader can find differences by comparing overlap areas in images from the previous four articles.

Figure 4 is an image of the most recent full Moon - Friday evening April 15, 2022. It is enlightening to compare it to Figure 2 in the January 2022 issue of TLO. Both images were acquired with the same scope and imager. The current image was processed from a stack of 950 frames; the prior one came from a 342-frame stack. Note that with the increased SNR that results from stacking almost three times as many frames, as well as different exposure and gain settings that were optimized for color enhancement processing, more colors are visible in this image. The January image contains mainly reddish and blue hues - just two colors. This image has reds (Mare Frigoris), yellows (Mare Imbrium near Plato), greens (western limb of Oceanus Procellarum), blues (Palus Epidemiarum and several maria), and purples (Mare Frigoris). Five distinct colors in one image!

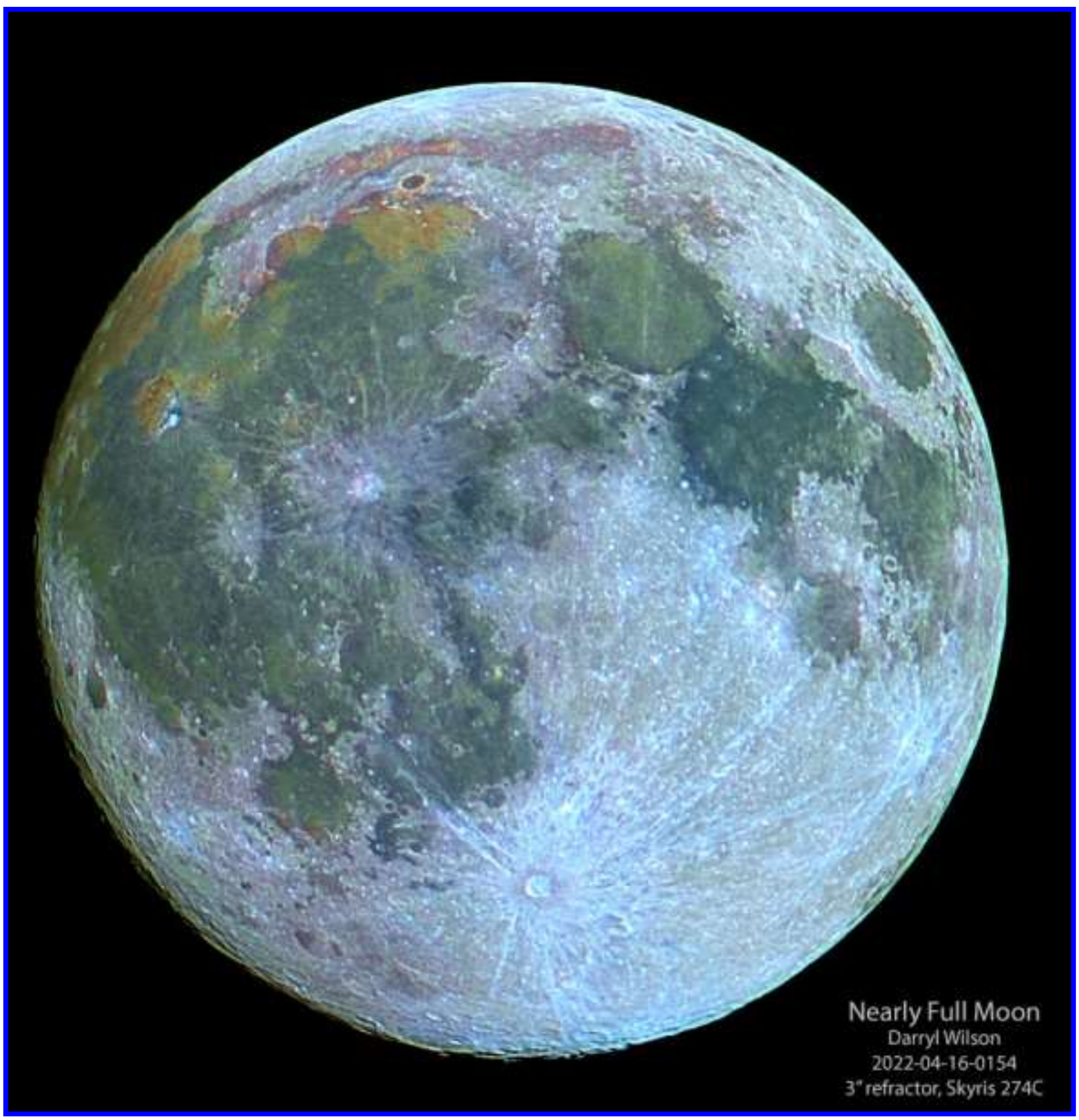


Figure 4, Nearly Full Moon, *Darryl Wilson, Marshall, Virginia, USA. 2022 April 16 01:54 UT. 3 inch refractor telescope, SKYRIS 274C camera. 2.25"/pixel. Registax Sharpened HSV Color Enhancement.*

A line drawn from the western edge of Mare Frigoris to the western edge of Lacus Somniorum passes through Hercules. Both Mare Frigoris and Lacus Somniorum display a purple tint in this region. The color within the area about 100 miles eastward of Hercules is quite unsaturated, as is typical of the highlands, but it shows some signs of having a purple tint behind the brighter highlights. It is possible that the imaginary line that we just drew is the boundary between one surface material type to the east and another to the west. If so, it might correspond to a surface manifestation of the buried magma mega-dike revealed by the GRAIL gravity gradient mapper [Wood]. The color resolution of this image is, unfortunately, insufficient to draw a firm conclusion. Perhaps future work will be informative.

Some color noise is evident is several areas. Near Plato, both Mare Frigoris and Mare Imbrium have noisy red and yellow areas. This can happen when you push the HSV transform near its limit. It can only smoothly resolve color gradations that are clearly distinguished in the data. Eight-bits of data per color channel is sometimes not enough when we are trying to extract color differences from a surface that has almost none of them to begin with.

We conclude with mention of a few thoughts might be helpful for any amateur astronomer who wishes to replicate these results.

First, a stack of 300 images gave much better results than simply transforming one (or a stack of a few) RGB pics. I coregistered and summed all images in a set to form a single image with (large) floating point values for each pixel, then linearly rescale all three bands back into 8-bit (0 to 255) space.

Second, ensure that the RGB values that are passed to the HSV transform are all similar in value for each individual pixel. Moonlight has little saturation. That means that the moonlight that arrives at your telescope is composed of red, green, and blue components of about equal intensity to begin with. The HSV algorithm requires valid data in order to produce realistic results, so you must give it R, G, and B values of about equal intensity. If (for example) the gain setting for your imager caused the blue channel to have digital counts about half of those of the red and green channels, then multiply the blue values by two before transforming from RGB to HSV space.

Third, ensure that the digital counts of any areas that you want to examine for color contrasts (probably the maria) are at least as high as 40 or 50. If they are down around 20 (they will be if you lower the gain to avoid saturation of Aristarchus) then you will probably generate objectionable, noisy results. The H output of the HSV transformation algorithm is quite sensitive to quantization noise when input values are low.

Fourth, avoid nonlinear histogram stretches (e.g., logarithmic, gaussian, square root, equalization, etc.) on the RGB data before the HSV transform. They usually cause color balance distortions.

In this article we looked at the Apollo 12 and Apollo 14 landing sites and saw the titanium content of the returned samples correlate with the degree of blueness of the surface near the sites. We noted that selenological lava flow mixing was apparently a complex process in Mare Cognitum and Mare Nubium. Palus Epidemiarum and Pitatus, two areas usually overlooked by astronomers, were noted to have unusually high titanium concentrations relative to their surroundings. Tycho was also highlighted for an anomalous blue tint on its inner wall and floor. A mosaic of the images that have been discussed in the most recent five articles was included as a visual reference and a discussion point for some technical issues related to the HSV colorspace transformation algorithm. We noted that thin clouds and slight dewing of the secondary may visibly harm image quality. A likely minor systematic color shift towards the blue for most images presented in the last five months was noticed. The effect of improved SNR in the input RGB images was illustrated with an image that revealed five distinct colors on various parts of the lunar surface. Finally, four rules-of-thumb for successful color enhancement of lunar images were suggested.

References:

Giguere, T., Taylor, G. J., Hawke, B. R., and Lucey, P. G. (2000) The titanium contents of lunar mare basalts. *Meteoritics and Planetary Science,* vol. 35, p. 193-200.
http://www.psrd.hawaii.edu/June00/lunarMaria.html

P. Lucey., D. Blewett, and B. Jolliff. "Lunar iron and titanium abundance algorithms based on final processing of Clementine ultraviolet-visible images", Journal of Geophysical Research, Vol. 105, No. E8, Pages 20,297-20,305, August 25, 2000

Rukl, Antonin, Atlas of the Moon, Kalmbach Publishing Co., 1992.

Wilson, Darryl G., "Thermal Observations of Tycho: A First Look", March 2020, "The Lunar Observer", p. 21-29.

Wilson, Darryl G., "A Sharpening Technique in HSV Colorspace for Lunar Surface Material Discrimination, RGB->HSV; enhance S; replace V; HSV->RGB", January, 2022, "The Lunar Observer", 7-10.

Wilson, Darryl G., " A Basic Color Enhancement Technique for Lunar Surface Material Discrimination, RGB->HSV; enhance S; HSV->RGB", December, 2021, "The Lunar Observer", 5-7.

Wood, Charles, "The Moon's Biggest Cold Spot", Sky and Telescope, September 2020, p. 52-53.

CC and Beer? Intrusion and Extrusion

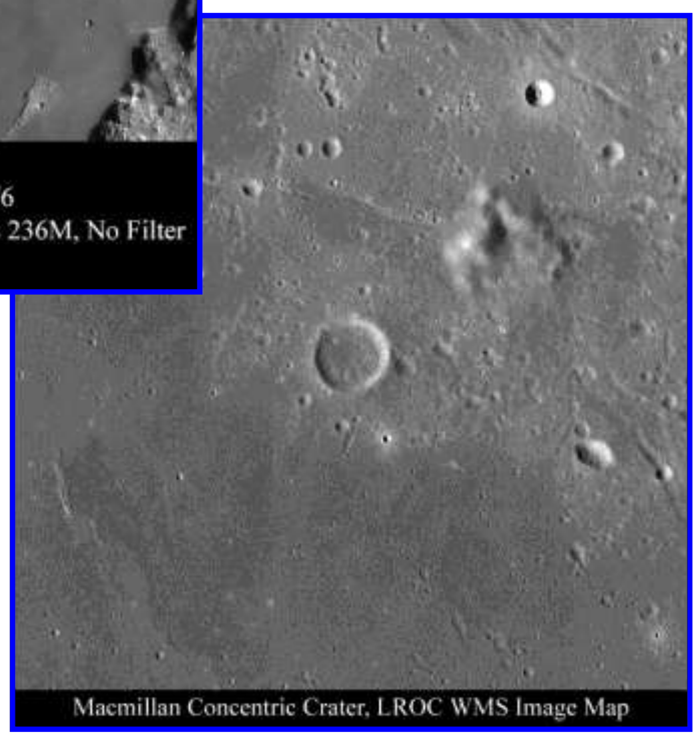
Howard Eskildsen

No, it is not some sort of redneck drink; the caption refers to a concentric crater and to the Beer dome, both of which are visible on this image. Each shows the effects of volcanism. The Beer dome is about 6.2 km in diameter per the Virtual Moon Atlas, and is a volcanic dome caused by extrusion of lava onto the surface. Macmillan crater is a concentric crater with its floor pushed upward by magma intrusion beneath its surface. Neat to see both forms so close together.

My measurements of Macmillan, using the LROC QuickMap showed an outer rim diameter of 6.8 km and the toroid diameter of 4.2 km, with a depth of 0.438 km. The depth/diameter (d/D) ratio works out to .065 and the toroid/diameter ratio (T/D) 0.62. For reference, the VMA listed Macmillan crater at 8 km diameter while the IAU shows it at 6.87987. (Frankly, I am skeptical of that many significant figures for the diameter.)

I expanded the field a bit to also show the craterlets on the floor of Archimedes on the upper right image as well as the tiny crater in the center of the floor of Timocharis on the left side of the image. I have never seen the interior of this totally blacked out before. Always something amazing to see on the Moon.

Macmillan and Beer, *Howard Eskildsen, Ocala, Florida, USA. 2022 April 10 23:55 UT, colongitude 23.9°. Celestron 9.25 inch Schmidt-Cassegrain telescope, SKYRIS 236M camera. Seeing 8/10, transparency 6/6.*



Macmillan Concentric Crater, *LROC WMS Image Map.*

Wrinkle Ridges From Kirch to Spitzbergen A

Alberto Anunziato

We found numerous wrinkle ridges running through Mare Imbrium from south to north, or north to south. At the moment of observation, what caught my attention was the combination of the brightness of the Spitzbergen Mountains and the profile of the dorsa on which they seemed to rise. The land west of the Montes Spitzbergen seemed to rise very gently and the edge of the supposed wrinkle ridge cast a shadow only to the west, not to the east, and a dark, thin shadow. There were subtle differences in brightness in the very bright Montes, with the brightest being the eastern massif and two peaks in the central massif. The crater at the northern end is Kirch, which is joined to Kirch F by a segment of wrinkle ridge, then another segment seems to join Kirch F with the Spitzbergen Mountains and to the south of these there seem to be three segments, or else three crests on a same segment, conspicuously higher, for the crest glowed brightly and the westernmost segment cast a very dark shadow. The southernmost crater is Spitzbergen A. In his extremely helpful catalog of wrinkle ridges in Luna Cognita, which I just read, Robert Garfinkle makes reference to the dorsa in this area: "Even though Mare Imbrium is a circular basin, it contains wrinkle ridges that both conform to the general outline of the basin's shore and other ridges that are scattered across the middle of the mare (…) To the south of the cone crater Landsteiner is the east to west tending Dorsum Grabau. This ropey, flat, discontinuous ridge runs for about 123.69 km (76.85 miles) from the area southwest of Montes Spitzbergen, passing to the east of the bright cone crater Montes Spitzbergen A and ends in the area north of Timocharis".

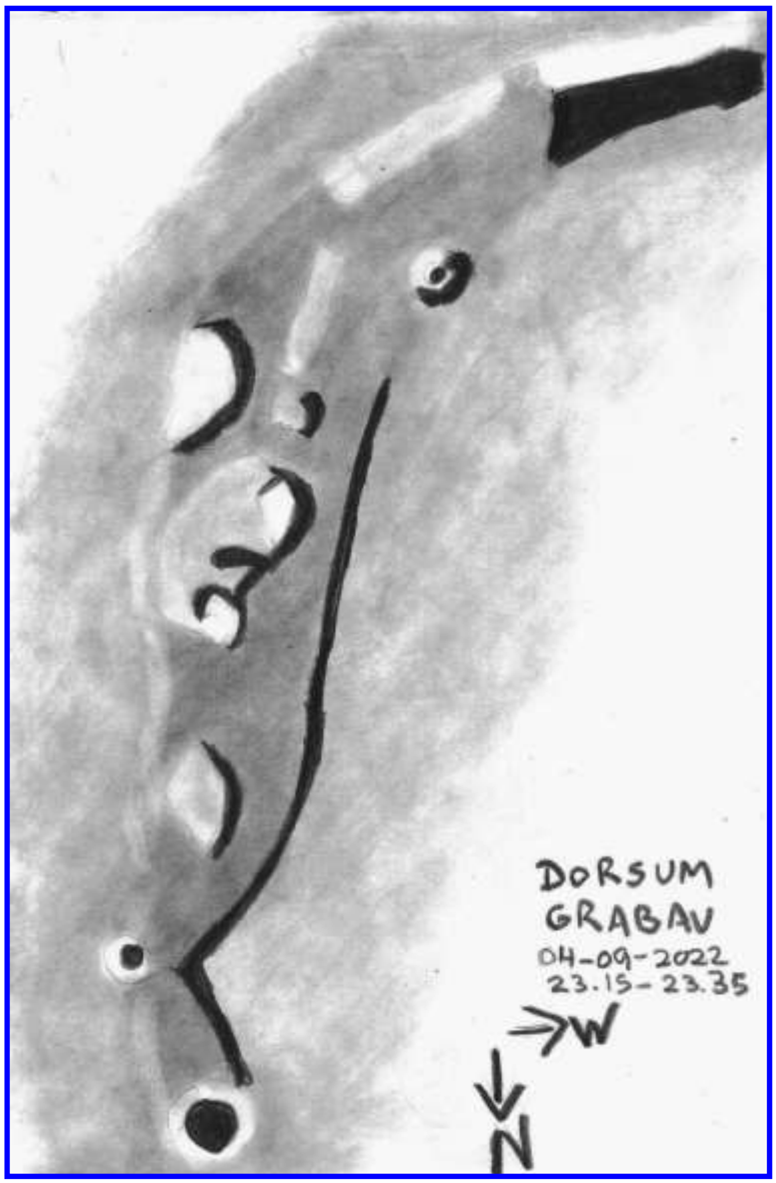


Image 1, Dorsum Graben, *Alberto Anunziato, Paraná, Argentina. 2022 April 09 23:15-23:35 UT. Meade EX105 mm Maksutov-Cassegrain telescope, 154 x.*

If we look at IMAGE 2 (next page), obtained with the Lunar Reconnaissance Orbiter Quickmap and in which the segments of wrinkle ridge are marked in its catalogue, we see that the segment at the upper end, which runs west, belongs to Dorsum Grabau, it is the starting segment, north of Spitsbergen A, of Dorsum Grabau, which continues much further west. Then there are a series of segments that run to the west of the Montes Spitzbergen, which I observed as one, probably because they were beyond the resolution of my telescope, but also because: "Low angles of illumination will show that this cluster of mountains is actually part of a complex of wrinkle ridges, hills and mountains that marks one of the original walls of the Imbrium multi-ringed impact basin" ("The Moon and How to Observe It", Peter Grego). What we are looking at are two systems of wrinkle ridges, the one running north-south through the western Montes Spitzbergen is one of the walls of the Imbrium Basin, while the one running east-west is the eastern end of Dorsum Grabau.

***Image 2 Dorsum Grabau**, LROC QuickMap*

Collecting images of Mare Frigoris, this image appeared (IMAGE 3), which we took a few years ago at the most important observatory in my Province, Entre Ríos in the República Argentina, the "Galileo Galilei" of Oro Verde, and although I appear in the credit, the image could be obtained thanks to the expertise of its owner, César Fornari. We see that the north-south running wrinkle ridge is a unit (not as it appears on the LROC Quickmap) and that it is much lower than Dorsum Grabau, of which we see the jagged top (the "ridge") shining and running on its south edge, with much more definition than in IMAGE 1.

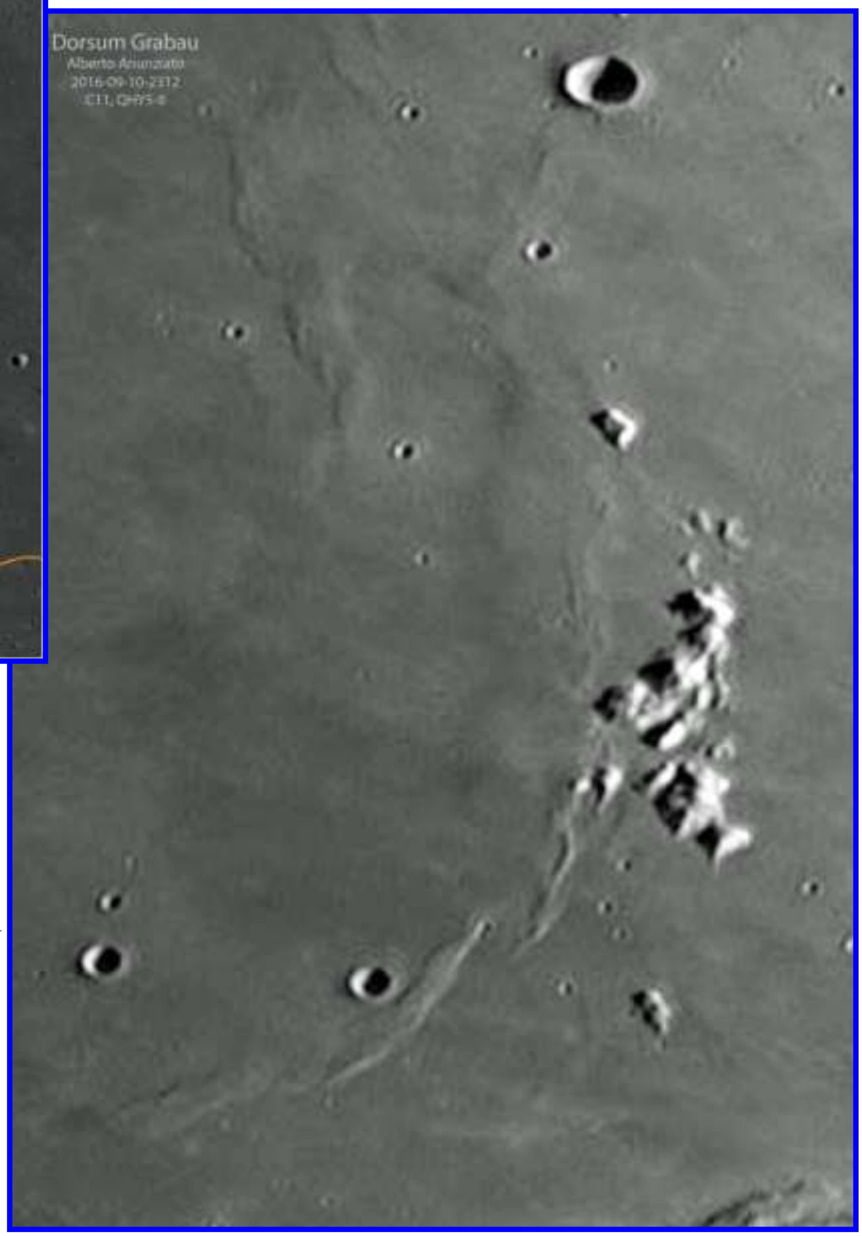


***Image 3, Dorsum Grabau,** Alberto Anunziato, Paraná, Argentina. 2016 September 10 23:12 UT. Celestron 11 Edge HD Schmidt-Cassegrain telescope, QHY5-II camera.*

Schiller-Zucchius Basin

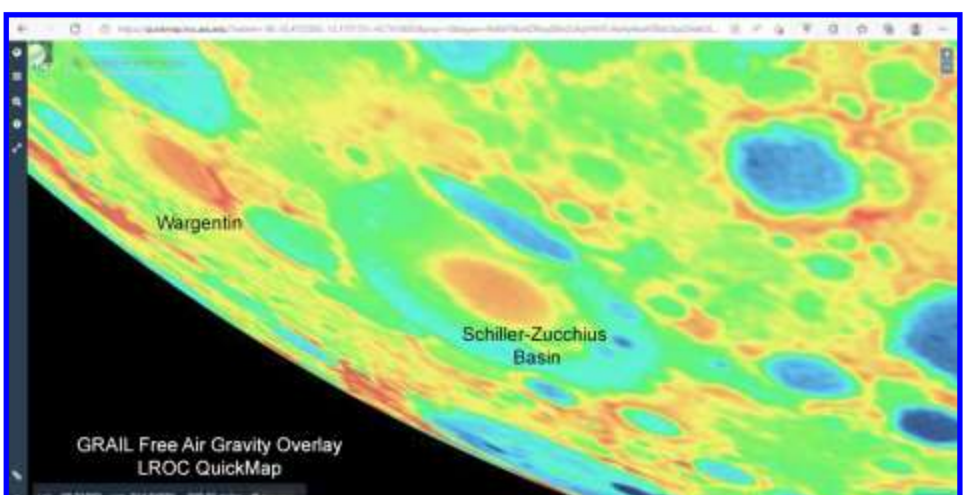
Howard Eskildsen

This image shows the Schiller-Zucchius impact basin (S-Z Basin) which is named in reference to two craters on its outer rim. The elongated crater Schiller lies on the northern margin and Zucchius on the southern margin. The S-Z Basin has an outer ring of 325-335 km and inner ring of 165-175 km, depending on the reference.

Lava flows appear to have softened the interior of the inner ring as well as the low areas between the inner and outer rings. The Grail Free Air Gravity overlay on LROC QuickMap reveals mass variations, red showing higher mass and blue lower mass. The overlay reveals the mass concentration in the center of the basin and with relatively decreased mass in the valley between the rings. As expected, the craters Schiller and Zucchius show decreased mass due to excavation of the lunar surface by their impacts. Curiously, on the left side of the image, the lava-filled crater Wargentin shows a greater mass concentration than the center of the S-Z Basin. Perhaps it has more basalt lava fill than the center of the basin.

Above, Schiller-Zucchius Basin, *Howard Eskildsen, Ocala, Florida, USA. 2022 April 13 00:39 UT, colongitude 48.6°. Celestron 9.25 inch Schmidt-Cassegrain telescope, SKYRIS 236M camera. Seeing 6/10, transparency 3/6.*

Right, Schiller-Zucchius Basin*, GRAIN Free Air Gravity Overlay LROC QuickMap.*



Traveling East to West on the Mare Frigoris

Alberto Anunziato

In this Focus On we are going to take a tour of one of the lesser-known lunar maria, helped by authors that we usually enjoy. We are going on an excursion to Mare Frigoris. In the words of Rik Hill: “In longitude Mare Frigoris may be the longest mare on the Moon. We only see about half of it here stretching the length of this image. It is the flat region north of the great crater Plato (104 km) half cut off by the lower left edge of this image and meanders north of another large crater Aristoteles (90 km) left of center, with the beautifully terraced walls, and then north of the small crater Burg (41 km) on the right edge of the image. It goes a bit farther but that is difficult to show because at any given time (except full moon) because the lighting varies so dramatically across the great extent of this mare. This mare was formed by two very separate events. The eastern portion (right) was formed during the Upper Imbrium epoch (3.2-3.8 billion years ago) while the western portion mostly in shadow here, is Eratosthenian age (1.1-3.2 b.y.a.). It was named by Giovanni Riccioli in 1651. This Jesuit priest was responsible for much of the nomenclature that was eventually accepted by the International Astronomical Union in the 20th century” (IMAGE 1).

Image 1, Mare Frigoris, *Richard Hill, Loudon Observatory, Tucson, Arizona, USA. 2022 March 12 04:05 UT, colongitude 21.0°. 8 inch f/20 TEC Maksutov-Cassegrain telescope, 665 nm filter, SKYRIS 132M camera. Seeing 8-9/10.*

Mare Frigoris Near Full Moon

Rik Hill

We have had some rough seeing because of a cold front that moved through with 3 days of 30-45 mph winds! So, I decided the nights were not going to be of quality that would be advantageous to the 8” aperture and decided to have some fun with my Questar. This is the first of a number of surprisingly good images I obtained. This is a montage of 6 images showing the full extent of Mare Frigoris, contrast enhanced to bring out the Mare in its full glory. It is the longest mare in terms of longitude so the brightness variations were difficult.

Mare Frigoris, *Richard Hill, Loudon Observatory, Tucson, Arizona, USA. 2022 April 15 05:31 UT, colongitude 75.3º. 3.5 inch Questar Maksutov-Cassegrain telescope, 2x barlow, 656.3 nm filter, SKYRIS 445M camera. Seeing 8/10.*

Peter Grego (page 134) notes that “The dusky, gray tract of Mare Frigoris can be seen without optical aid by those with average eyesight”, as we see in the IMAGE 2, a work of art of Michel Deconinck, and in the IMAGE 3 by Walter Elias.

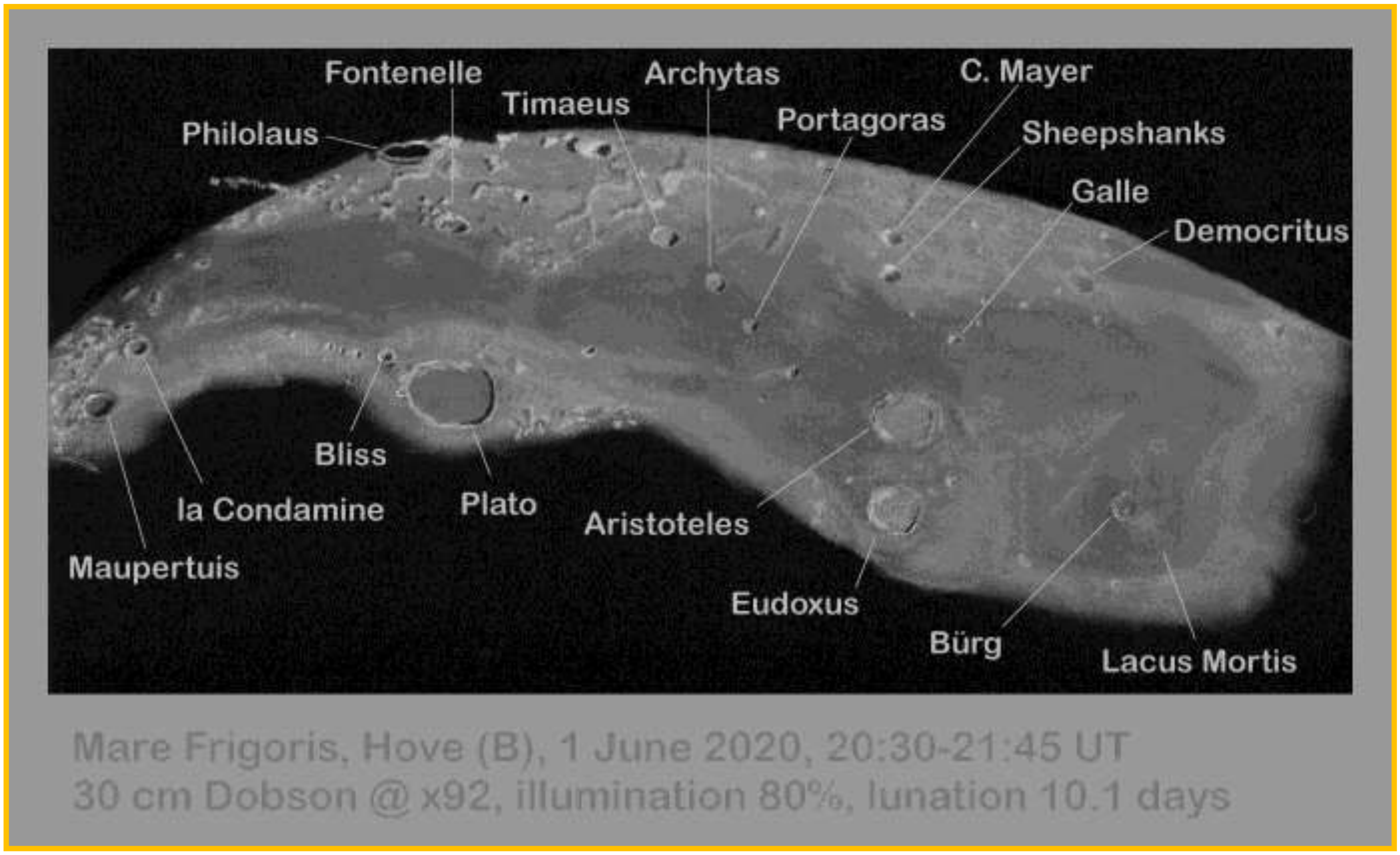


Image 2, Mare Frigoris, *Michel Deconinck, Aquarellia Observatory - Artignosc-sur-Verdon - Provence - France. 2020 June 01 20:30-21:45 UT. 30 cm Dobsonian reflector telescope, 92 x.*

Image 3, Plato, *Walter Ricardo Elias, AEA, Oro Verde, Argentina. 2022 April 14 22:36 UT. Helios 114 mm reflector telescope, QHY5-IIC camera.*

Mare Frigoris is not circular but it is part of a circular impact basin, that of Mare Imbrium: "according to the USGS interpretation, Frigoris is not so much a new kind of elongated mare that needs a unique interpretation as it is a shallow part of Imbrium that is separated by ejecta from the basin's deeper interior. This implies (as does almost any other interpretation) that the cratered land north of Frigoris should be covered with Imbrium ejecta and secondary craters. And it is" (Wood, page 67), as we see in the IMAGE 4 by Massimo Bianchi and in the IMAGE 5 by Sergio Babino. "The Mare Frigoris-Sinus Roris trough is concentric with both the Imbrium and Procellarum basins. It contains generally bright and thin mare materials of different spectral classes from most of Oceanus Procellarum but similar to some of the older units in the adjacent part of northern Mare Imbrium" (Wilhelms, page 243). We can verify this statement by Wilhelms in the image of Rik Hill that accompanies his text "Mare Frigoris near Full Moon" in this same issue of TLO (see page 66).

Image 4, Mare Frigoris, *Massimo Bianchi, Milan, Italy. 2022 February 13 18:12 UT. Vixen VMC260 f/11.5 telescope, Baader CCD G filter, ZWO ASI178 mm camera. Seeing 6/10, transparency 5/6.*

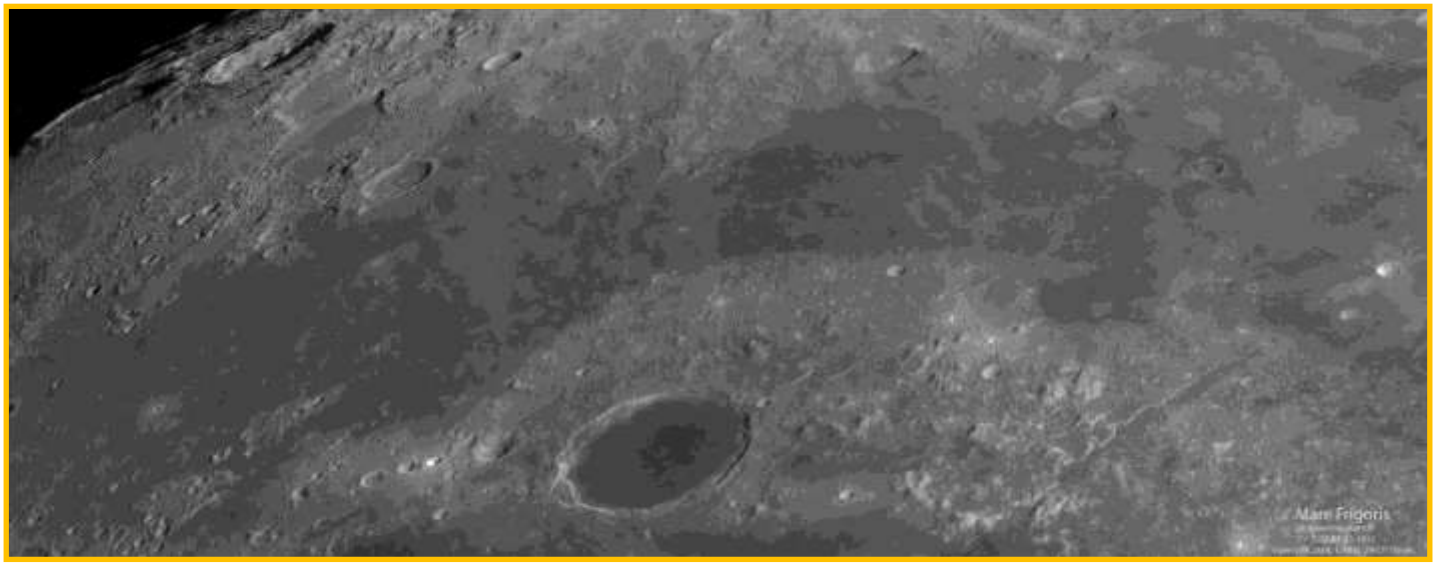


Image 5, Mare Frigoris, *Sergio Babino, SAO-LIADA, Montevideo, Uruguay. 2020 March 14 04:46 UT. 250 mm catadrioptic telescope, ZWO ASI174mm camera.*

Mare Frigoris is the only non circular lunar mare, its "stretches roughly 1500 km in an east-west direction, but only about 200 km from north to south. In fact, it may be even more elongated, but that is difficult to ascertain because the Eastern and western end of Mare Frigoris are poorly defined. To the east Frigoris seems to end near the crater Atlas and Hercules, though mare material extends southward in Lacus Mortis. On the west Frigoris merges with Sinus Roris, which opens out into the vast Oceanus Procellarum" (Wood, page 66). For our brief tour through Mare Frigoris we will use the limits indicated by Wood.

First stage

Our tour begins in the vicinity of what Peter Grego called "one of the strangest-looking parts of the Moon", Lacus Mortis, the remains of a large, flooded crater with a spectacular crater, Bürg, in its center. In IMAGE 6 by Francisco Alsina Cardinalli Lacus Mortis occupies almost the center, IMAGE 6-A is a detail of Lacus Mortis (1) in which we indicate the salient points of our first stage. All the strange beauty of Lacus Mortis appears in David Teske's IMAGE 7. Our exit is the Baily crater (2), 27 km in diameter, a very old crater flooded by lava and the south wall is missing. But no matter, we travel south along a wrinkle ridge (3) to the old and deteriorated Gärtner crater (4), although we will not recognize it because it is precisely the southern wall that is missing. We now travel west to the last stop of our first leg, the Eratosthenian Galle crater (5), 22 km diameter, the first relatively recent impact crater we visited, "The crater rises steeply from the mare surface. The walls are thin, with sharp rim crests" (Garfinkle, page 486).

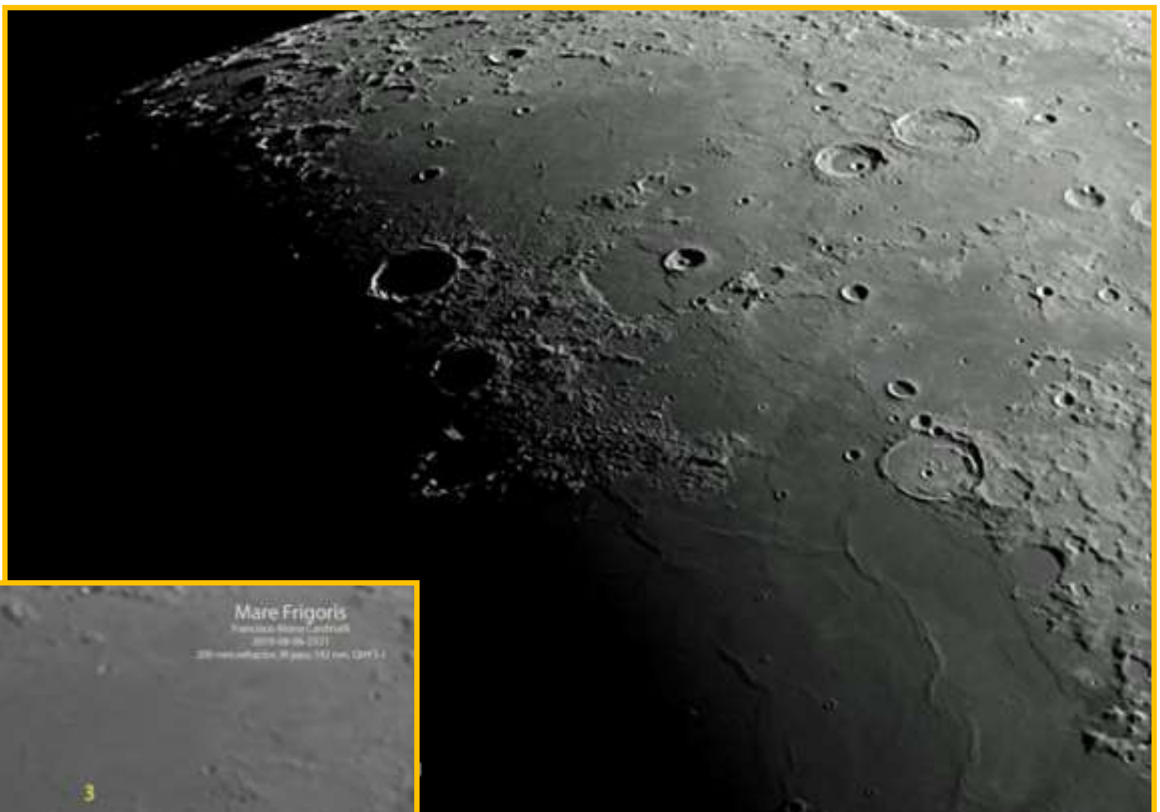


Image 6, Mare Frigoris, *Francisco Alsina Cardinalli, SLA-LIADA, Oro Verde, Argentina . 2019 August 06 23:21 UT. 200 mm refractor telescope, IR pass 742 nm filter, QHY5-I camera.* ***Image 6A below.***

Image 7, Lacus Mortis, *David Teske, Louisville, Mississippi, USA. 2022 February 10 03:13 UT, colongitude 12.2º. 3.5 inch Questar Maksutov-Cassegrain telescope, IR block filter, ZWO ASI120mm/s camera. Seeing 8/10.*

In IMAGE 8 (Alberto Anunziato), 9 (Desiré Godoy) and 10 (Fernando Surá), we can see the eastern half of Mare Frigoris (right of the images).

Image 8, Plato, *Alberto Anunziato, SLA-LIADA, Paraná, Argentina. 2020 September 27 00:06 UT. 180 mm Newtonian reflector telescope, QHY5-II camera.*

Image 9, Eudoxus, *Desiré Godoy (SLA-LIADA, Oro Verde, Argentina, SLA . 2020 August 28 23:45 UT. 200 mm refractor telescope, 742 nm filter, QHY5-II camera.*

Image 10, Plato, *Fernando Surá, SLA-LIADA, San Nicolás de los Arroyos, Argentina. 2022 January 12 01:50 UT. 127 mm Maksutov-Cassegrain telescope, CPL Sbony filter, Canon Revel T7i Reflex camera.*

Second stage

In IMAGE 11 by Eduardo Horacek, we appreciate (on the left) Atlas and Hercules, which some consider to be the eastern limit of Frigoris, Lacus Mortis and the craters that we visited in the first stage and also our next destination, Aristoteles. We continue our journey along the eastern part of Mare Frigoris, which "is generally smoother than the west, with only a few minor wrinkle ridges" (Grego, page 134), until we reach Aristoteles, the star of our journey. Peter Grego says of this giant (87 km diameter) from the Eratosthenian period (page 136): "It has a slightly polygonal outline and broad inner walls that display some of the most extensive terracing in any crater on the Moon. The crater's floor is depressed below the mean level of the surrounding terrain, and through a 100 mm telescope it appears relatively smooth, apart from two mountain peaks that protrude from its southern floor. Aristoteles' rim is clear-cut, and displays a scalloped effect (seen in many other large-impact craters of a similar size) caused by large units of rock that have broken away from the wall and slid down it to some extent". We see all the features pointed out by Grego in IMAGE 12 (by Marcelo Mojica) and in the detail (12-A), except that the peaks appear to be 5. The rock collapses, a mark of how young Aristoteles is, can be seen in the magnificent IMAGE 12 BIS by Marcelo Mojica. These and other features of Aristoteles's extraordinarily complex topography, as in Elger's words (page 64) "the arrangement of the parallel ridges and rows of hills on the N.W. and S.E." and "a bright and deep ring-plain" (today we call it "crater), "about 10 miles in diameter, with a distinct central mountain, is connected with the E. wall" (today known as crater Mitchell), can be seen in IMAGE 13 by Fabio Verza and IMAGE 14 by David Teske, in which we also distinguish the secondary craters.

Image 11, Mare Frigoris, *Eduardo Horacek, Trapecio Austral-LIADA, Mar del Plata, Argentina. 2021 November 11 23:41 UT. 150 mm Maksutov-Cassegrain telescope, EOS Rebel T5i camera. North is down, west is right.*

Image 12, Mare Frigoris, *Marcelo Mojica Gundlach, LIADA, Cochabamba, Bolivia. 2018 July 18 23:49 UT. 150 mm refractor telescope, Orion V-block filter, SWO CMOS camera.*

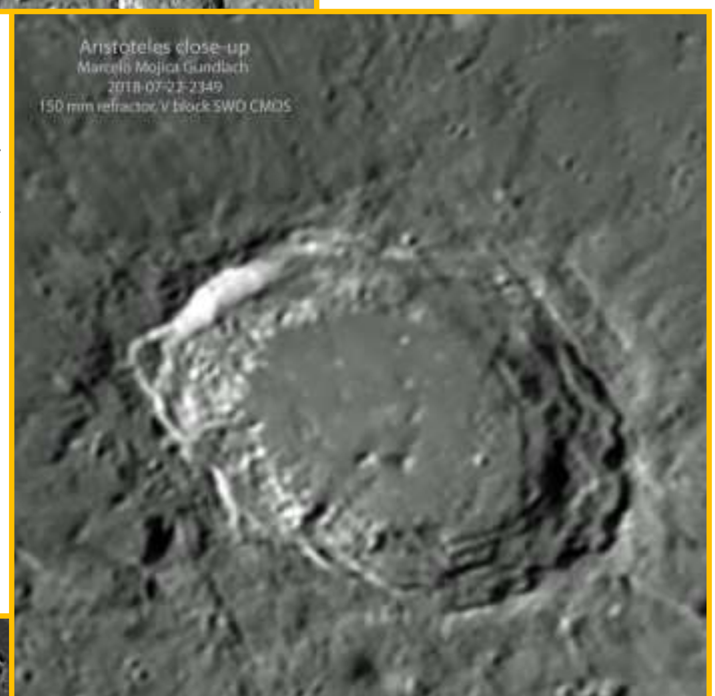


Image 12A, Mare Frigoris, Close-Up of Aristoteles *Marcelo Mojica Gundlach, LIADA, Cochabamba, Bolivia. 2018 July 18 23:49 UT. 150 mm refractor telescope, Orion V-block filter, SWO CMOS camera.*

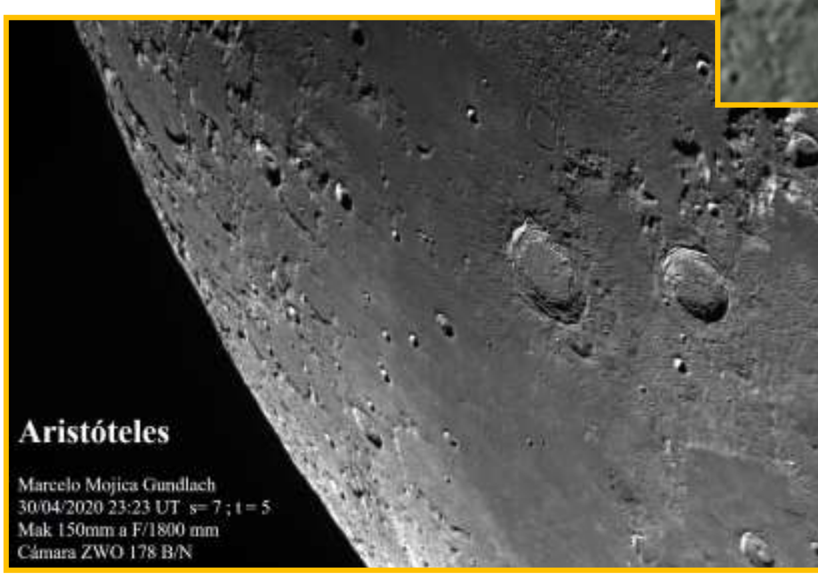


Image 12 BIS, Aristoteles, *Marcelo Mojica Gundlach, LIADA, Cochabamba, Bolivia. 2020 April 30 23:23 UT. 150 mm Maksutov-Cassegrain telescope, ZWO ASI178 B/N camera. Seeing 7/10, transparency 5/6. North left, west up.*

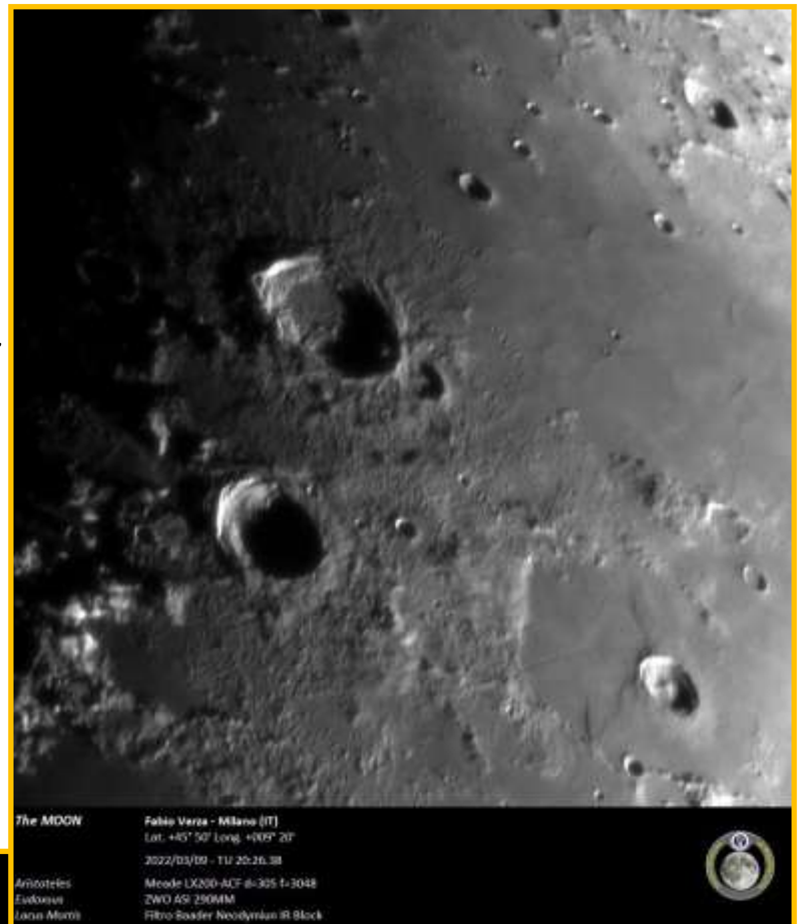


Image 13, Aristoteles, *Fabio Verza, SNdR, Milan, Italy. 2022 March 09 20:26 UT. 12 inch Meade LX200 ACF Schmidt-Cassegrain telescope, Baader Neodymium IR block filter, ZWO ASI290mm camera.*

Image 14, Eudoxus, *David Teske, Louisville, Mississippi, USA. 2022 January 12 01:10 UT, colongitude 18.4°. 4 inch f/15 Skylight refractor telescope, IR block filter, ZWO ASI120mm/s camera. Seeing 9/10.*

Aristoteles appears dominating the landscape of Mare Frigoris in IMAGE 15, IMAGE 16 (both by Francisco Alsina Cardinalli) and IMAGE 17 (by Jesús Piñeiro).

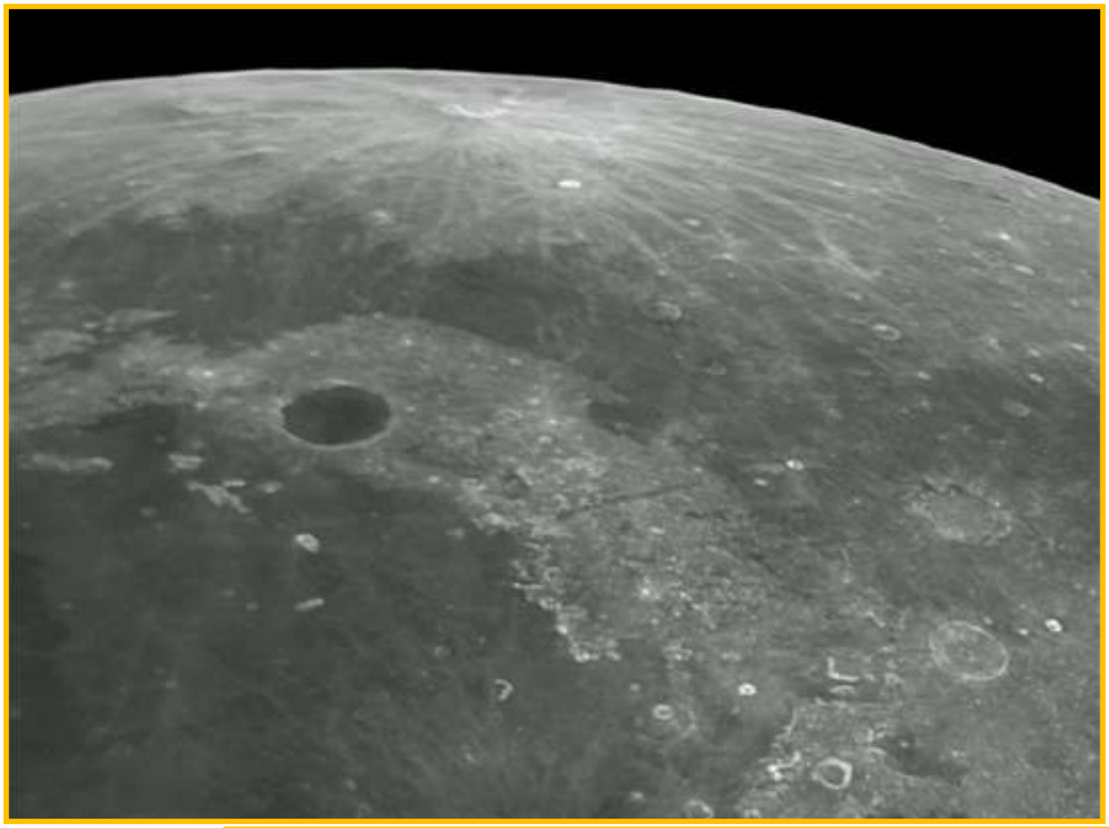


Image 15, Archimedes, *Francisco Alsina Cardinalli, SLA-LIADA, Oro Verde, Argentina . 2016 April 21 22:29 UT. Meade 10 inch LX200 Schmidt-Cassegrain telescope, QHY5-II camera.*

Image 16, Aristillus, *Francisco Alsina Cardinalli, SLA-LIADA, Oro Verde, Argentina . 2018 February 25 00:57 UT. 200 mm refractor telescope, QHY5-II camera*

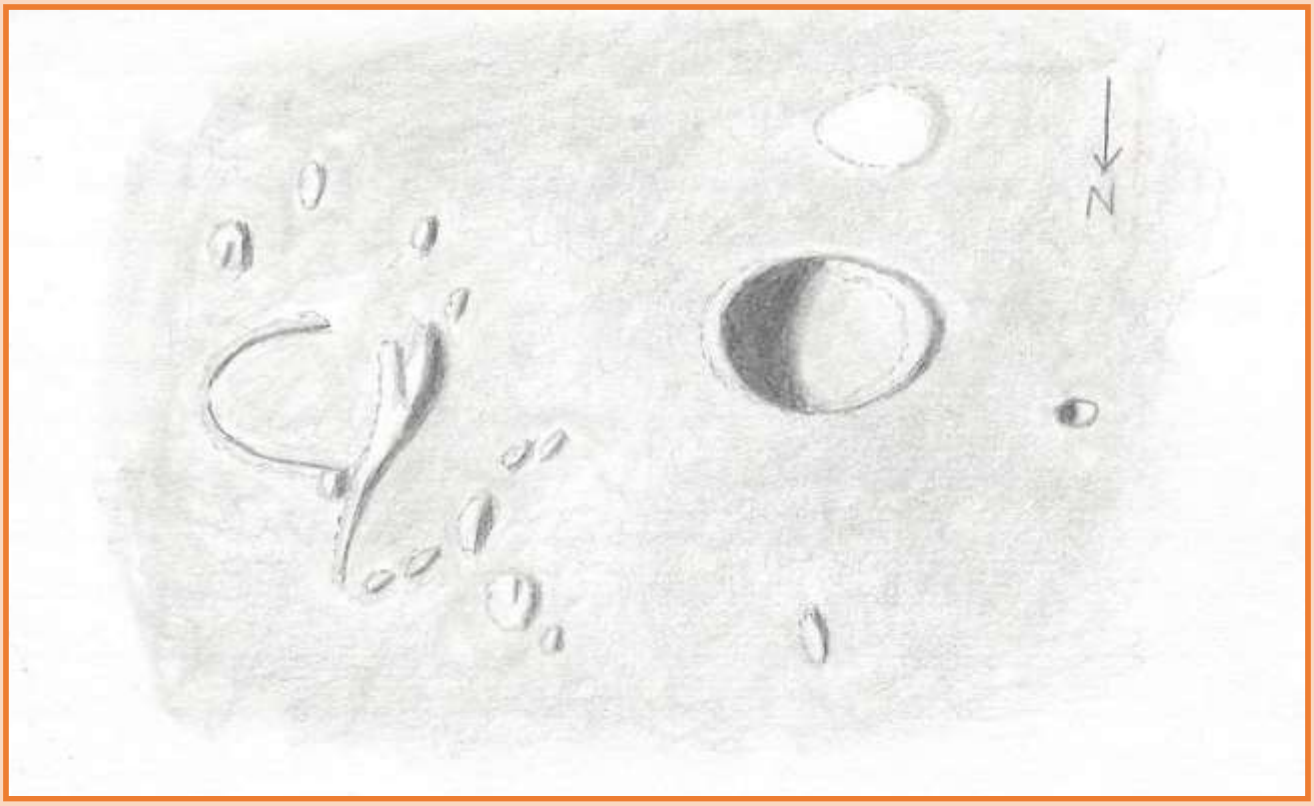
Image 17, Mare Frigoris, *Jesús Piñeiro, SLA-LIADA, San Antonio de los Altos, Venezuela. 2021 August 17 23:29 UT. Meade ETX90 Maksutov-Cassegrain telescope, ZWU UV/IR cut filter, ZWO ASI533MC camera.*

Third Stage

Finally, we leave the rocky outskirts of Aristoteles towards Protagoras. Before we passed by Egede A, the most beautiful bright ray crater in Mare Frigoris. The panorama between Aristoteles and Egede A and the bright rays of the latter appear spectacularly portrayed in the images of Francisco Alsina Cardinalli (IMAGE 18 and IMAGE 19), Sergio Babino (IMAGE 20), Rik Hill (IMAGES 21 to 24), Eduardo Horacek (IMAGES 25 and 26), and David Teske's spectacular series of images (IMAGES 27 to 31). We are treasuring these images, as well as the one by Massimo Bianchi that follows, for the next Focus On northern bright ray craters, in which we will give a special role to Egede A. Protagoras and Egede A are the subject of two texts by Robert H. Hays, Jr., on the following two pages.

Protagoras

Robert H. Hays, Jr.

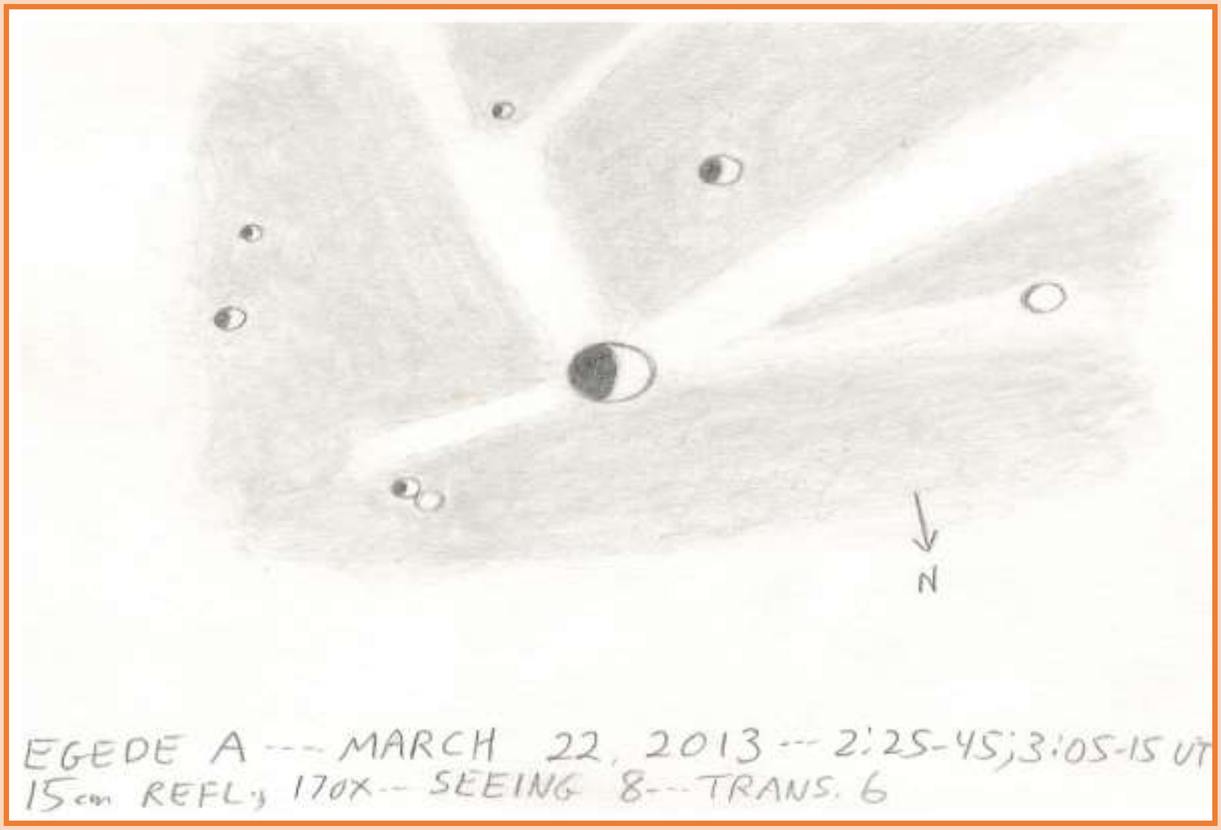


Protagoras, *Robert H. Hays, Jr., Worth, Illinois, USA. 2015 February 28 02:58-03:38 UT. 15 cm reflector, 170 x. Seeing 6-8/10, transparency 6/6.*

I drew this crater and vicinity on the evening of February 27/28, 2015 before the Moon hid the double 20/21 Geminorum. This crater is in Mare Frigoris northwest of Aristoteles. Protagoras is a crisp, slightly egg-shaped crater with the pointed end to the west. Protagoras B is the small pit to the west. There is a conspicuous bright patch to the south. This feature is also slightly egg-shaped, but with the pointed end to the east. It may be a low elevation based on shadowing that was noted. A bright, isolated peak is north of Protagoras. There is a variety of peaks and ridges to the east. Some of them appear to form two or three partial rings. A large mountain, elongated nearly north-south, is the main elevation in this area. This mountain has a forked southern end with a small peak nearby, and a narrow ridge protruding northward. A delicate horseshoe-shaped ridge, with at least one gap, is east of the large mountain. An assortment of peaks between the large mountain and Protagoras are arranged in semicircular patterns. There are three peaks south of the large mountain and the horseshoe ridge. The middle one is brighter than its neighbors, but it has relatively little shadow. None of the detail east of Protagoras is shown on the Lunar Quadrant map.

This first appeared in The Lunar Observer in July 2015

Egede A
Robert H. Hays, Jr.



***Egede A**, Robert H. Jr., Worth, Illinois, USA. 2013 March 22 02:24-02:45; 03:05-03:15 UT. 15 cm reflector telescope, 170x. Seeing 8/10, transparency 6/6.*

I observed this crater and vicinity on the evening of March 21/22, 2013. This crater is in Mare Frigoris north of Egede and west of Aristoteles. Egede A is a moderately large, very crisp crater with a modest ray system. There is a half-circle of craters surrounding Egede A from southwest to northeast that are smaller versions of it. Egede B to the southwest is the largest of the craters. Counterclockwise from Egede B are Egede E, M, C and F. The Lunar Quadrant map shows Egede E and N close together between B and M, but I saw only one crater there. It was probably E since that was more nearly midway between B and M. There appears to be a modest ghost ring just northwest of Egede F. Egede G to the west is about the same size and Egede B, but it is much shallower. I noticed four rays radiating from Egede A. The widest and brightest ray heads west from Egede A, passing between Egede B and G. A fainter ray north of this bright one points toward Egede G. Another ray, nearly as wide and bright as the westward one, heads south from Egede A, and splits just north of Egede E. The main ray continues southward, and a narrow branch goes west from Egede E. A short ray eastward from Egede A peters out just south of Egede F. This eastbound ray appears slightly brighter than the westbound ray near Egede G.

This first appeared in The Lunar Observer in August 2013.

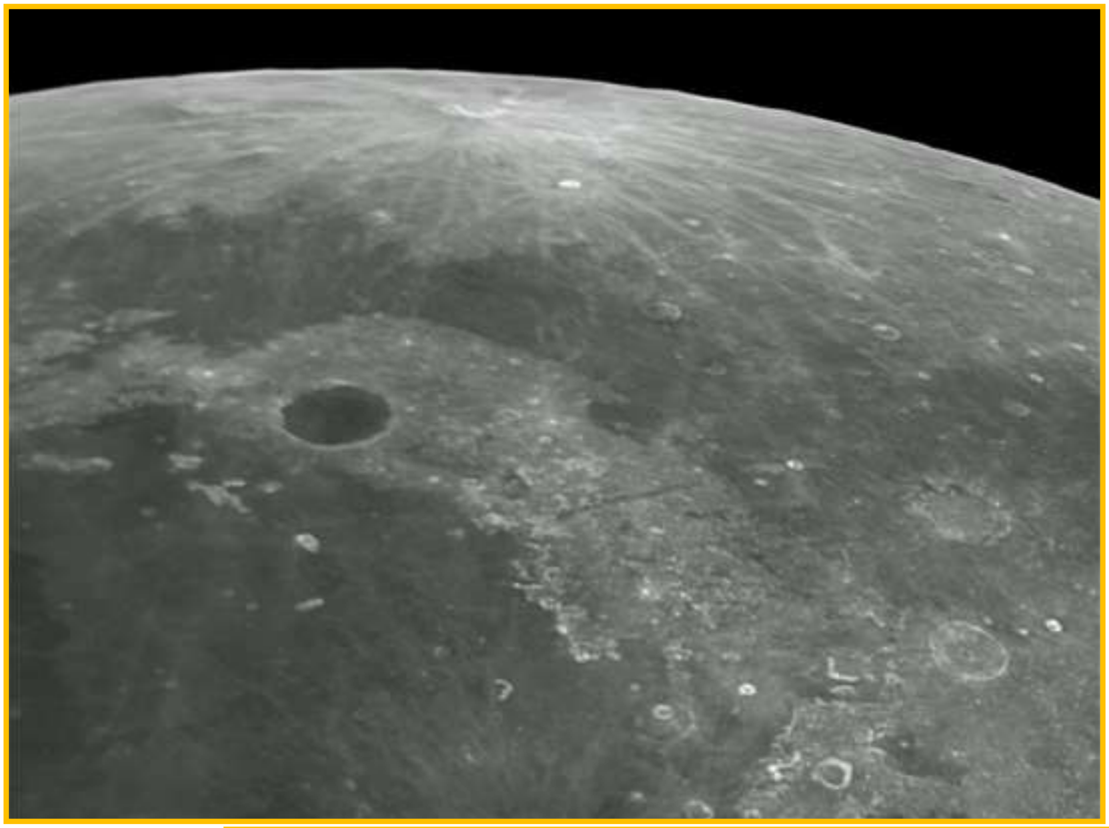


Image 18, Archimedes, *Francisco Alsina Cardinalli, SLA-LIADA, Oro Verde, Argentina . 2016 April 21 22:29 UT. Meade 10 inch LX200 Schmidt-Cassegrain telescope, QHY5-II camera.*

Image 19, Aristillus, *Francisco Alsina Cardinalli, SLA-LIADA, Oro Verde, Argentina . 2018 February 25 00:57 UT. 200 mm refractor telescope, QHY5-II camera*

Image 20, Mare Frigoris, *Sergio Babino, SAO-LIADA, Montevideo, Uruguay. 2020 March 14 04:40 UT. 250 mm catadrioptic telescope, ZWO ASI174mm camera.*

Image 21, Mare Frigoris, *Richard Hill, Loudon Observatory, Tucson, Arizona, USA. 2022 March 12 04:05 UT, co-longitude 21.0°. 8 inch f/20 TEC Maksutov-Cassegrain telescope, 665 nm filter, SKYRIS 132M camera. Seeing 8-9/10.*

Image 22, Montes Alpes, *Richard Hill, Loudon Observatory, Tucson, Arizona, USA. 2016 May 14 02:17 UT. 3.5 inch Questar Maksutov-Cassegrain telescope, 1.7x barlow, 656.3 nm filter, SKYRIS 445M camera. Seeing 8/10.*

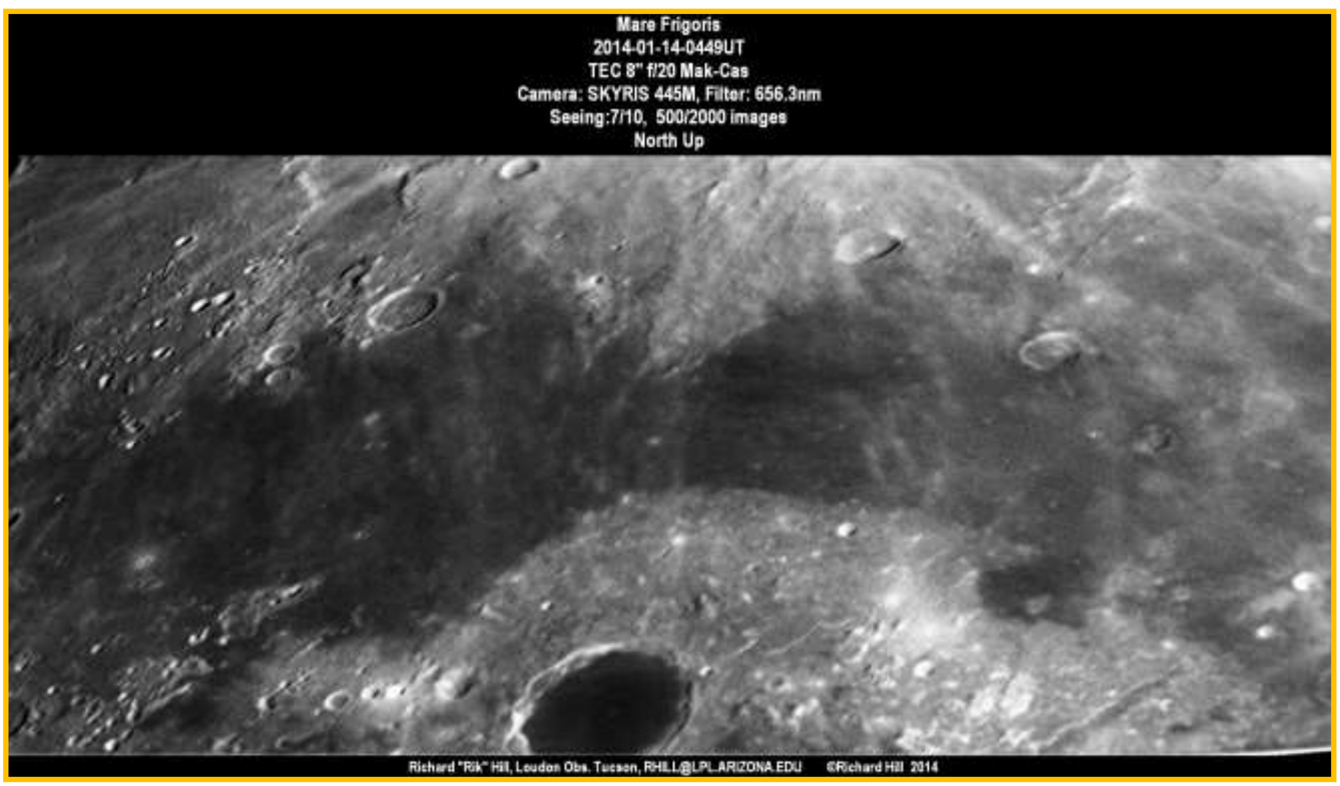


Image 23, Mare Frigoris, *Richard Hill, Loudon Observatory, Tucson, Arizona, USA. 2014 January 14 04:49 UT. 8 inch f/20 TEC Maksutov-Cassegrain telescope, 656.3 nm filter, SKYRIS 445M camera. Seeing 7/10.*

Image 24, Mare Frigoris, *Richard Hill, Loudon Observatory, Tucson, Arizona, USA. 2008 July 24 08:14 UT. 3.5 inch Questar Maksutov-Cassegrain telescope, 2x barlow, UV/IR blocking filter, SPC900NC camera. Seeing 7-8/10.*

Image 25, Mare Frigoris, *Eduardo Horacek, Trapecio Austral-LIADA, Mar del Plata, Argentina. 2021 September 15 01:28 UT, colongitude 12.7°. 150 mm Maksutov-Cassegrain telescope, EOS Rebel T5i camera. North is down, west is right.*

Image 26 Mare Frigoris, *Eduardo Horacek, Trapecio Austral-LIADA, Mar del Plata, Argentina. 2021 August 17 22:32 UT, colongitude 29.4°. 150 mm Maksutov-Cassegrain telescope, EOS Rebel T5i camera. North is down, west is right.*

Image 27, Mare Frigoris, *David Teske, Louisville, Mississippi, USA. 2022 January 11 00:38 UT, colongitude 5.9°. 4 inch f/15 Skylight refractor telescope, IR block filter, ZWO ASI120mm/s camera. Seeing 6-7/10.*

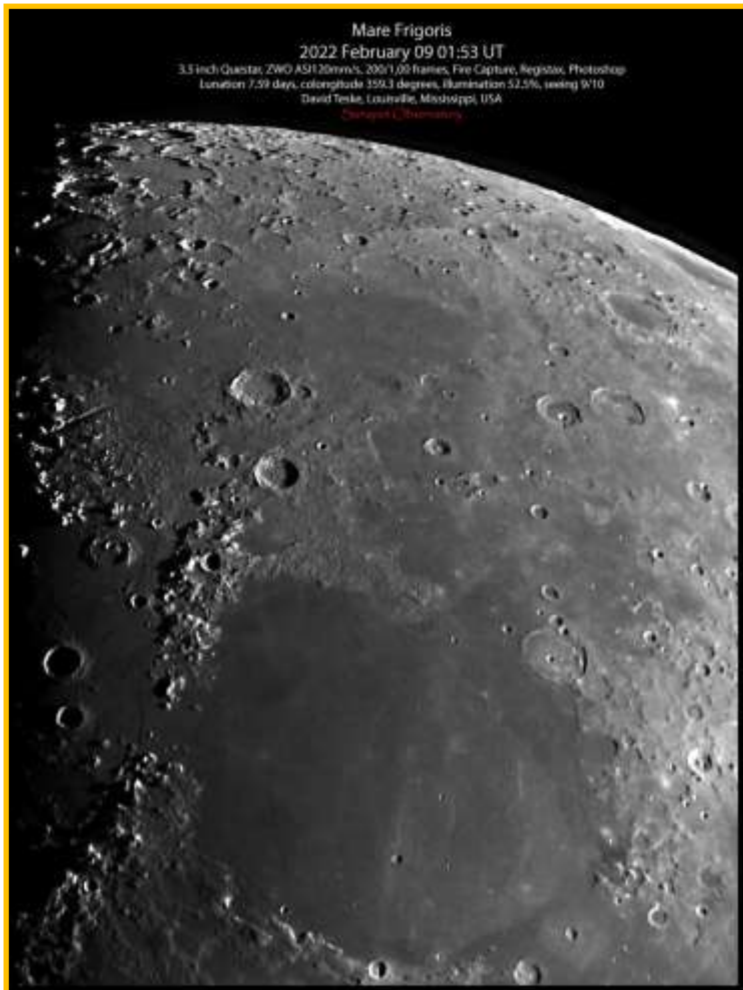


Image 28, Mare Frigoris, *David Teske, Louisville, Mississippi, USA. 2022 February 09 01:53 UT, colongitude 359.3º. 3.5 inch Questar Maksutov-Cassegrain telescope, IR block filter, ZWO ASI120mm/s camera. Seeing 9/10.*

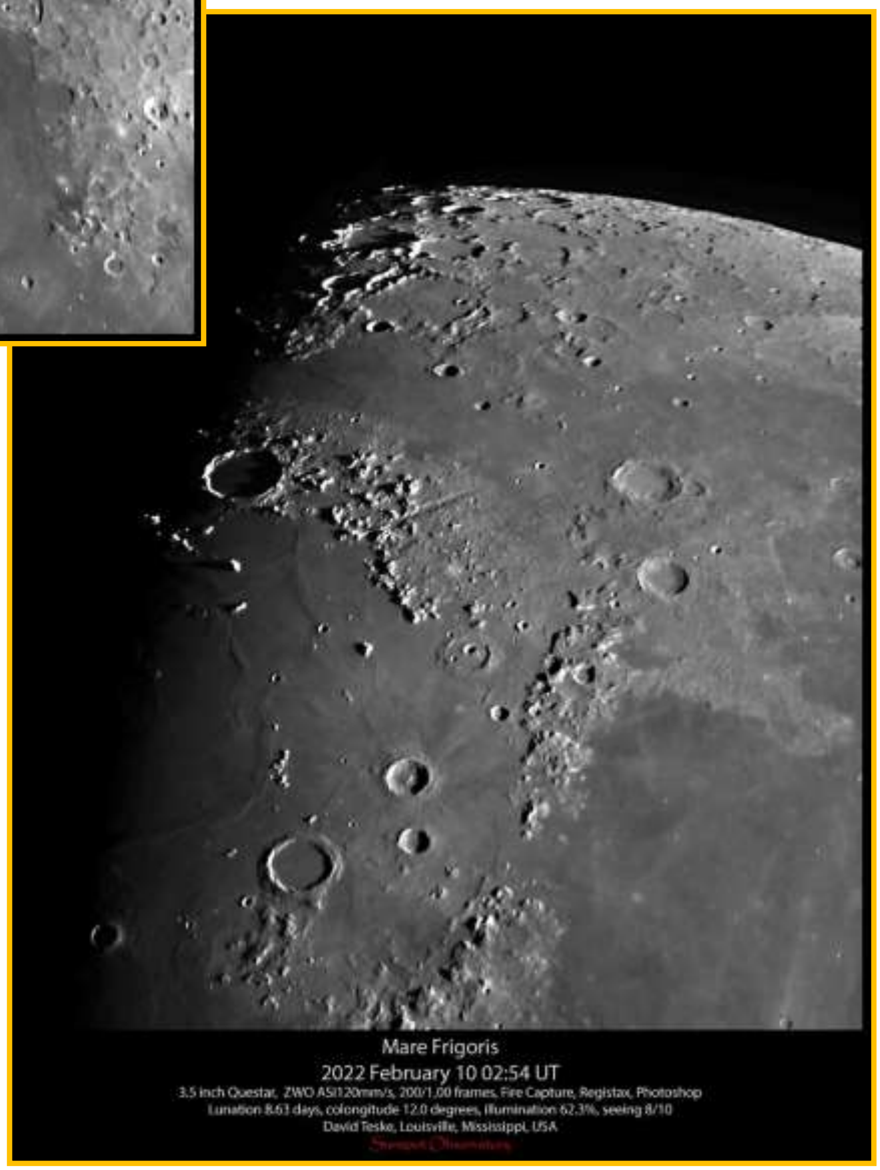


Image 29, Mare Frigoris, *David Teske, Louisville, Mississippi, USA. 2022 February 10 02:54 UT, colongitude 12.0º. 3.5 inch Questar Maksutov-Cassegrain telescope, IR block filter, ZWO ASI120mm/s camera. Seeing 8/10.*

Image 30, Mare Frigoris, *David Teske, Louisville, Mississippi, USA. 2022 February 12 02:22 UT, colongitude 36.1°. 4 inch f/15 Skylight refractor telescope, IR block filter, ZWO ASI120mm/s camera. Seeing 8/10.*

Image 31, Mare Frigoris, *David Teske, Louisville, Mississippi, USA. 2022 February 12 02:23 UT, colongitude 36.1°. 4 inch f/15 Skylight refractor telescope, IR block filter, ZWO ASI120mm/s camera. Seeing 8/10.*

In Massimo Bianchi's image (IMAGE 32) we have already left Aristoteles behind and headed to our next stop: Protagoras (IMAGE 32-A), for which we descend to the north, avoiding the rough terrain, a collection of mounds east of Protagoras (22 km diameter). Garfinkle defines Protagoras thus: "The crater rims are sharp and the interior walls are terraced. There are mounds of slump materials on the crater floor. A couple of light-color bands can be observed on the interior walls", it can all be seen in the detail of Massimo's image.

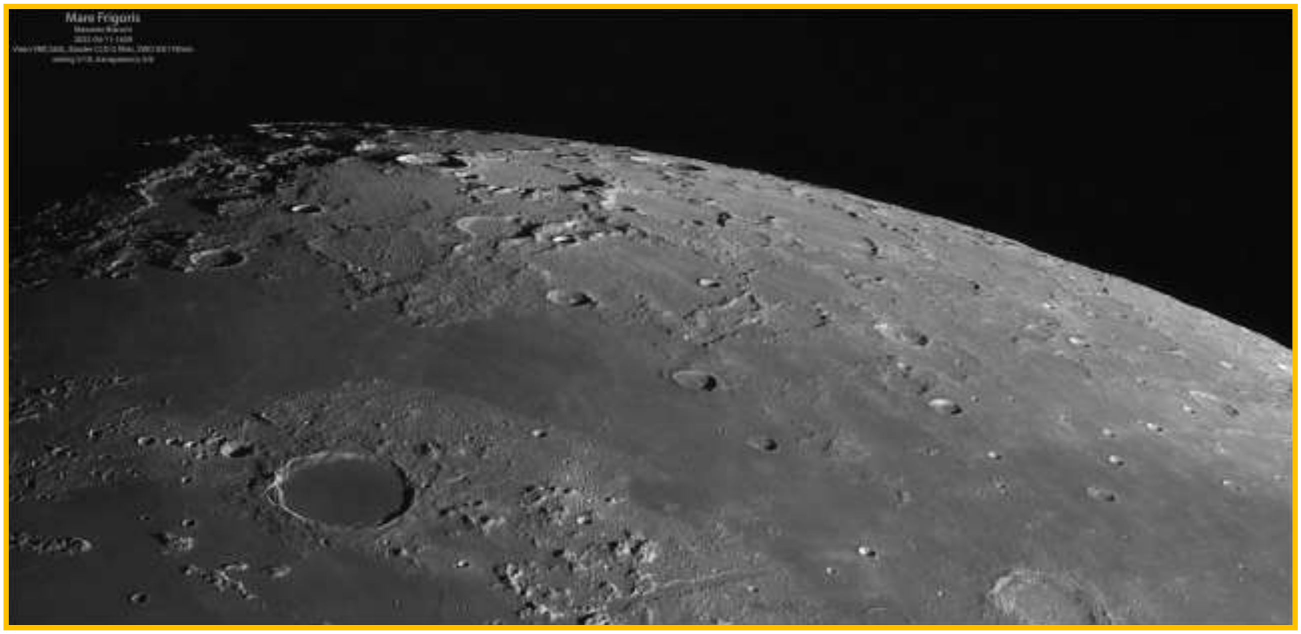


Image 32, Mare Frigoris, *Massimo Bianchi, Milan, Italy. 2022 April 11 16:59 UT. Vixen VMC260 f/11.5 telescope, Baader CCD G filter, ZWO ASI178 mm camera. Seeing 5/10, transparency 5/6.*

Image 32A, Mare Frigoris Protagoras, *Massimo Bianchi, Milan, Italy. 2022 April 11 16:59 UT. Vixen VMC260 f/11.5 telescope, Baader CCD G filter, ZWO ASI178 mm camera. Seeing 5/10, transparency 5/6.*

Further south we go to Archytas (Eratosthenian, 31 km diameter) which has, according to Elger (page 65): "regular walls rising about 5,000 feet above the interior on the N.E., and about 4,000 feet on the opposite side. It has a very bright central mountain. Several spurs radiate from the wall on the S., and a wide valley, flanked by lofty heights, forming the S.E. boundary of W.C. Bond, originates on the N side", which we can see in another detail of Massimo's image (IMAGE 32-B).

Image 32B, Mare Frigoris Archytas, *Massimo Bianchi, Milan, Italy. 2022 April 11 16:59 UT. Vixen VMC260 f/11.5 telescope, Baader CCD G filter, ZWO ASI178 mm camera. Seeing 5/10, transparency 5/6.*

Protagoras, Archytas and our next stop, Timaeus, all located on the north shore of Mare Frigoris, look spectacular in the Rik Hill images: IMAGE 22, IMAGE 23 (crossed by rays from southern Tycho, Anaxagoras) and IMAGE 24 (with its dark interiors), by Howard Eskildsen (IMAGE 33), by Alberto Anunziato (IMAGE 34), by Pedro Romano (IMAGE 35), by Sergio Babino (IMAGE 36 and 38) and by Marcelo Mojica (IMAGE 37).

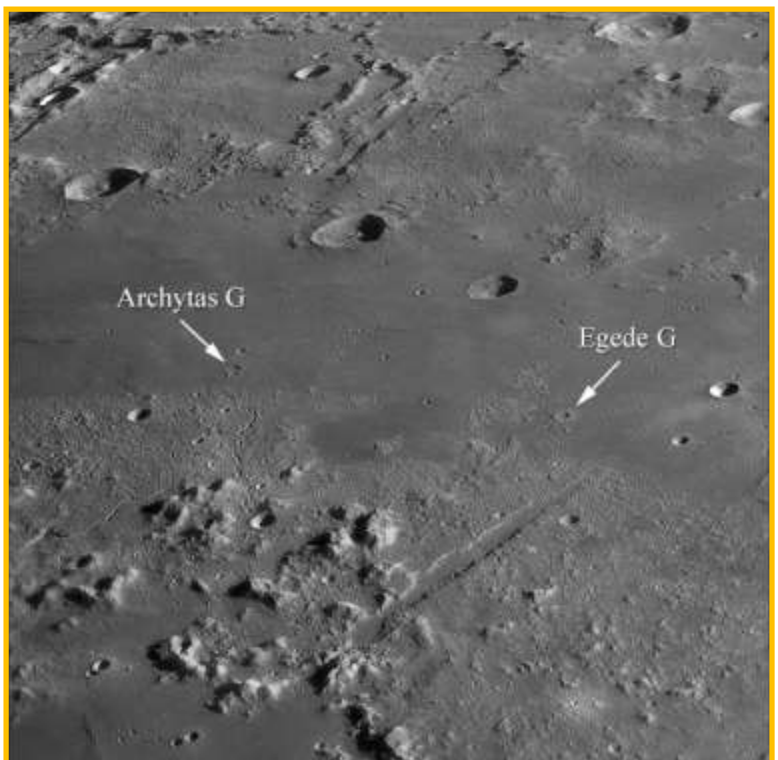


Image 33, Archytas G and Egede G, *Howard Eskildsen, Ocala, Florida, USA. 2022 April 10 23:56 UT, colongitude 23.9°. Celestron 9.25 inch Schmidt-Cassegrain telescope, SKYRIS 236M camera. Seeing 8/10, transparency 6/6.*

Howard adds: Two concentric craters appear on Mare Frigoris not far from the Alpine Valley. Egede G lies closest to the valley and per my LROC QuickMap measurements averages 7.3 km in diameter with a toroid diameter of 5.3 km, and depth of 0.560 km. This yields a d/D ratio of 0.077 and a T/D ratio of 0.73. (Diameter estimate comparison: VMA-7 km, IAU-7.34207 km).

Archytas G lies farther west and is also associated with a dome that is visible at low sun angles. My estimates for its parameters: outer diameter-7.0 km, toroid diameter-4.5 km, depth-0.435. This gives a d/D ratio of 0.062 and a T/D ratio of 0.63. (Diameter estimate comparison: VMA-7 km, IAU-7.21478 km).

Image 34, Plato, *Alberto Anunziato, SLA-LIADA, Oro Verde, Argentina. 2016 December 11 02:13 UT. Meade 10 inch LX200 Schmidt-Cassegrain telescope, Astronomik ProPlanet 742 nm filter.*

Image 35, Plato, *Pedro Humberto Romano, SLA-LIADA, San Juan, Argentina. 2020 October 24 06:24 UT. 102 mm Maksutov-Cassegrain telescope, ZWO ASI 120C camera. North left, west down.*

__Image 36, Mare Frigoris,__ Sergio Babino, SAO-LIADA, Montevideo, Uruguay. 2019 December 10 01:40 UT. 250 mm catadrioptic telescope, ZWO ASI174mm camera.

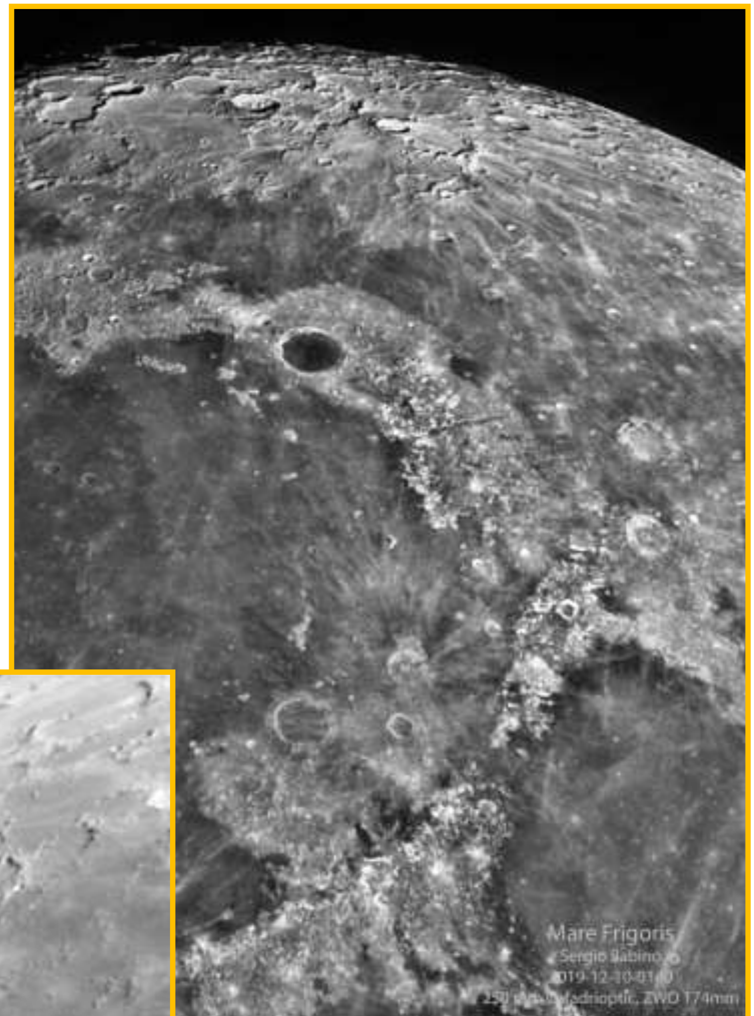
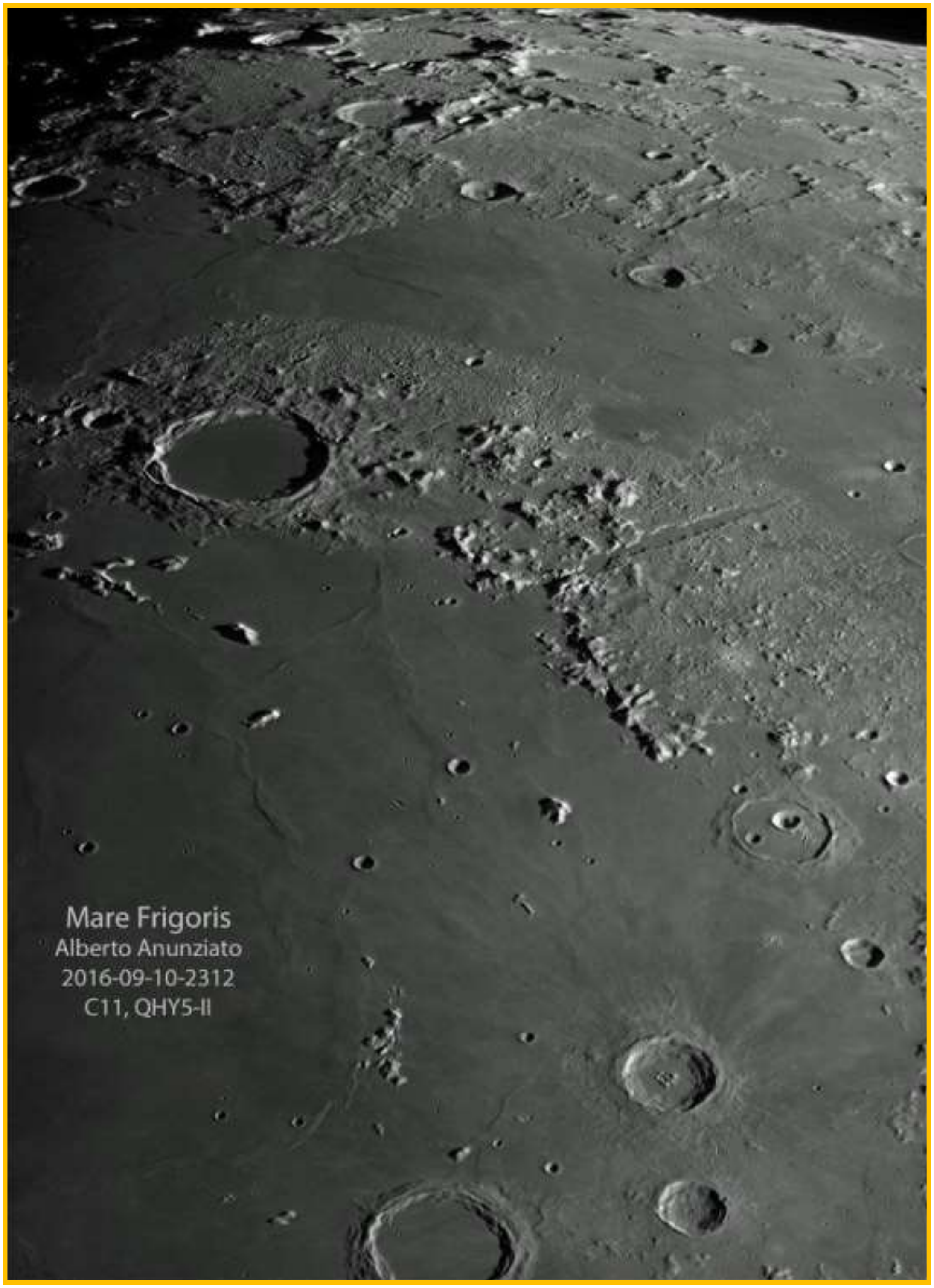


__Image 37, Mare Frigoris,__ Marcelo Mojica Gundlach, LIADA, Cochabamba, Bolivia. 2018 July 18 23:46 UT. 150 mm refractor telescope, Orion V-block filter, SWO CMOS camera.

Image 38, Mare Frigoris, *Sergio Babino, SAO-LIADA, Montevideo, Uruguay. 2019 December 08 00:32 UT. 203 mm catadrioptic telescope, ZWO ASI174mm camera.*

Robert Garfinkle's magnificent description of Timaeus finds its graphic expression in another detail of Massimo Bianchi's image (IMAGE 32-C): “This pentagonal-shaped Eratosthenian-age crater is located on the southwestern corner of the crater W. Bond and the northern shore of Mare Frigoris (…) The crater is about 31.81 km (19.76 miles) in diameter and 3230 m (10,597 feet) deep. The rim crests are sharp and the interior walls are terraced. Except for the mare area, the crater is surrounded by a heavily pockmarked ejecta field. The lack of secondary cratering on this field on the mare indicates that the surface lava layer is younger than Timaeus. A hilly ridge is concentric with the base of the western walls. The crater has a round central peak”.

Image 32C, Mare Frigoris Timaeus, *Massimo Bianchi, Milan, Italy. 2022 April 11 16:59 UT. Vixen VMC260 f/11.5 telescope, Baader CCD G filter, ZWO ASI178*

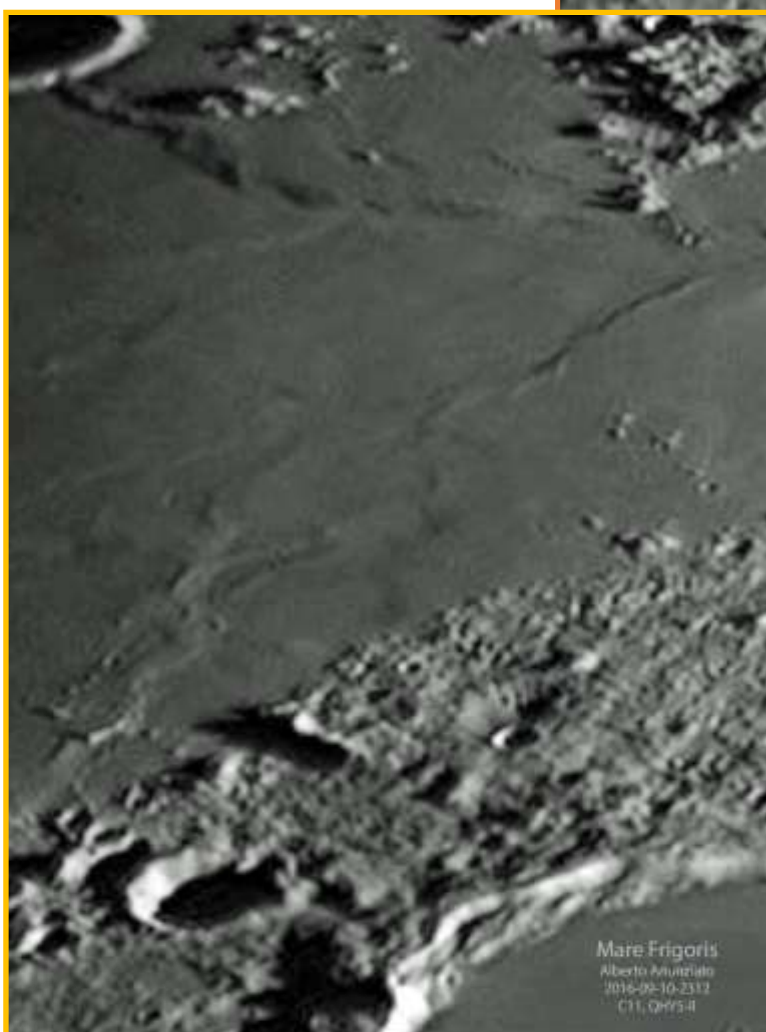


Fourth stage

When we leave Timaeus behind, we enter an area of wrinkle ridges that run in the same direction as Mare Frigoris, from east to west, making them very difficult to observe from the ground as they do not cast the long shadows cast by most wrinkle ridges, which run from north to south, in the terminator. If we were to travel through this dorsa country, our transport would have to get around these elevations to take us to the next stage, the Fontenelle crater in the extreme south. These "low-profile unnamed wrinkle ridges" (as Garfinkle calls them) in the vicinity of Plato can be seen in the image by Alberto Anunziato (IMAGE 39): "The eastern ridge crosses the mare from south of the crater Timaeus, runs west of Archytas and ends as a broad band close to the cone crater Plato H (lat 55.17°N, long 02.03°W) on the southern shore of the mare. This ridge is very low and flat with the middle of it being only a few meters above the mare surface". We see this Eastern ridge in detail A of IMAGE 39. In details B and C of IMAGE 39 we see first two parallel ridges running from east to west and then the intricate network of ridges between the two shores of Frigoris, the south (Bliss) and the north (Fontenelle).

Image 39, Mare Frigoris, *Alberto Anunziato, SLA-LIADA, Oro Verde, Argentina. 2016 September 10 23:12 UT. Celestron 11 inch Edge HD Schmidt-Cassegrain telescope, QHY5-II camera.*

Image 39B (right), 39C (below), Mare Frigoris, *Alberto Anunziato, SLA-LIADA, Oro Verde, Argentina. 2016 September 10 23:12 UT. Celestron 11 inch Edge HD Schmidt-Cassegrain telescope, QHY5-II camera.*



This central area of Mare Frigoris, in the vicinity of Plato (which tends to draw attention and be the star in the image) is crossed by the rays of Anaxagoras, as we see in images 40 by Alberto Anunziato and 41 and 42 by Jairo Andrés Chavez.

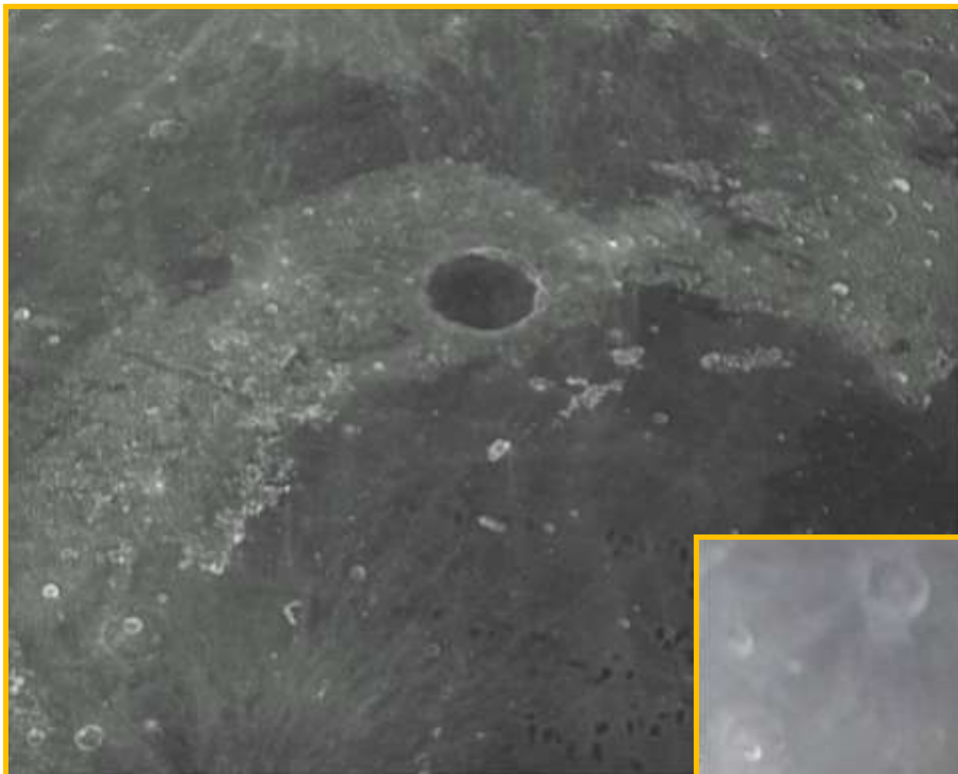


Image 40, Plato/Mons Piton, *Alberto Anunziato, SLA-LIADA, Oro Verde, Argentina . 2017 December 03 04:00 UT. Meade EX105 Maksutov-Cassegrain telescope, QHY5-II camera.*

Image 41, Plato, *Jairo Chavez, Popayán, Colombia. 2019 September 10 02:40 UT. 10 inch Dobsonian truss reflector telescope, Moto E5 Play camera. North down, west right.*

Image 42, Plato, *Jairo Chavez, Popayán, Colombia. 2022 January 15 02:53 UT. 311 mm Dobsonian truss reflector telescope, Moto E5 Play camera. North down, west right.*

In IMAGE 43 to 45, all by Marcelo Mojica, we see in great detail the wrinkle ridge in the central part of Frigoris, starting with Aristoteles.

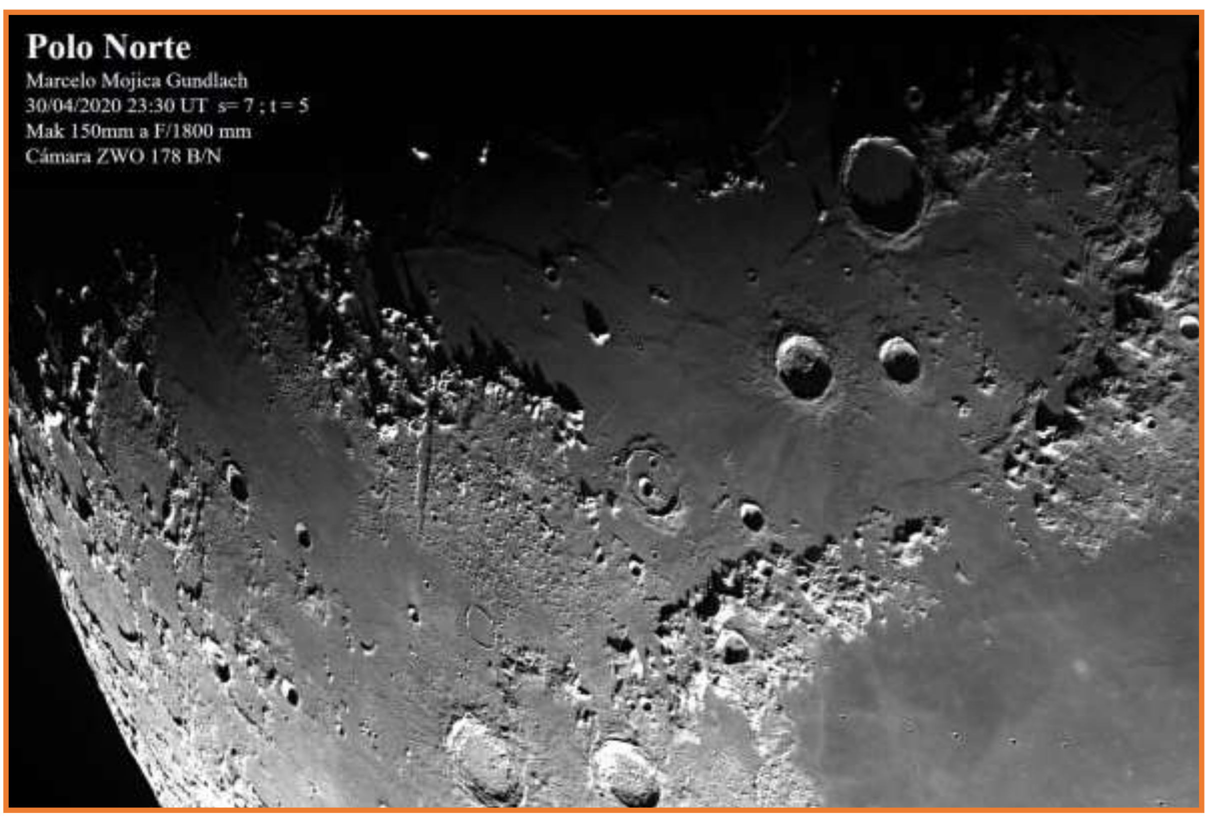


Image 43, Mare Frigoris, *Marcelo Mojica Gundlach, LIADA, Cochabamba, Bolivia. 2020 April 30 23:30 UT. 150 mm Maksutov-Cassegrain telescope, ZWO ASI178 B/N camera. Seeing 7/10, transparency 5/6. North left, west up.*

__Image 44, Mare Frigoris,__ Marcelo Mojica Gundlach, LIADA, Cochabamba, Bolivia. 2020 May 01 22:54 UT. 150 mm Maksutov-Cassegrain telescope, ZWO ASI178 B/N camera. Seeing 5/10, transparency 5/6. North right, west down.

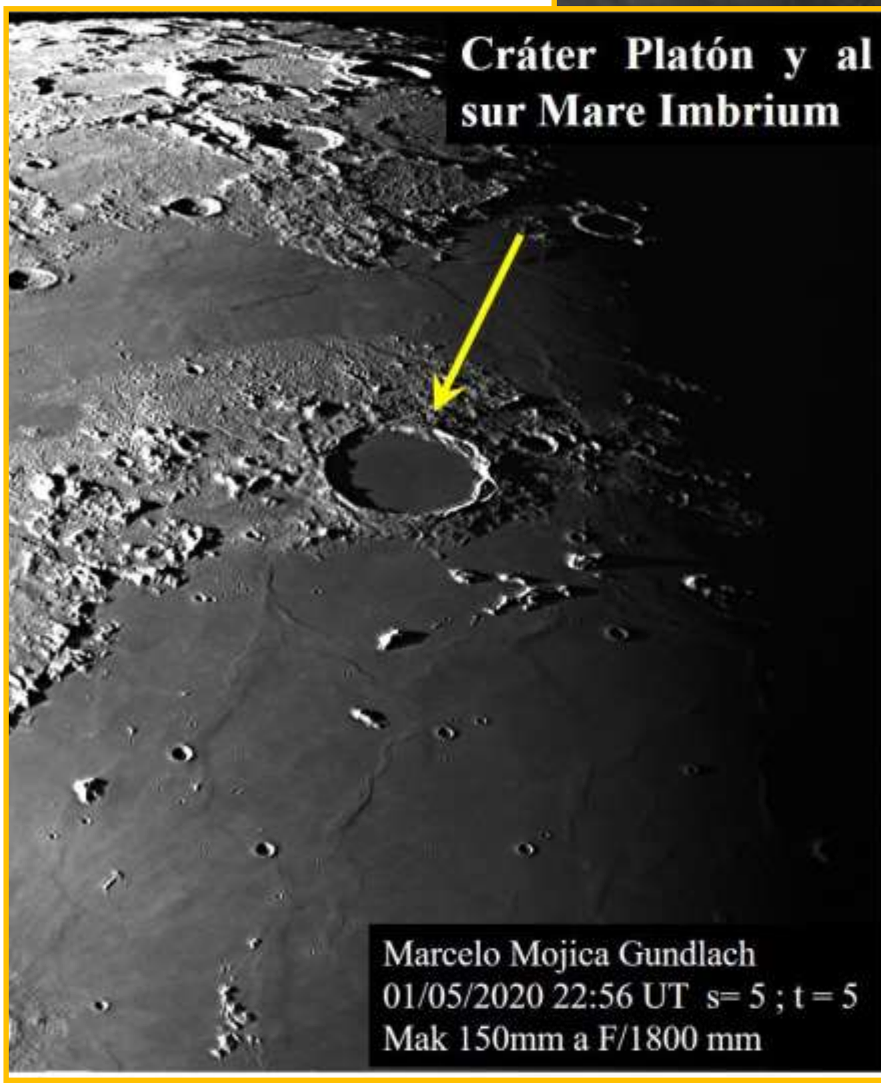


__Image 45, Mare Frigoris,__ Marcelo Mojica Gundlach, LIADA, Cochabamba, Bolivia. 2020 May 01 22:56 UT. 150 mm Maksutov-Cassegrain telescope, ZWO ASI178 B/N camera. Seeing 5/10, transparency 5/6. North up, west right.

Fifth stage

After the crossing of the land of dorsa, we head for Fontenelle. In the images of Félix León (46 and 47 and detail 47-A), we observe the characteristics that Peter Grego assigns to Fontenelle: “On the northern coast of Mare Frigoris, 310 km northwest of Plato, is the clean-cut circular crater Fontenelle (38 km), notable for its small near-central craterlet. From its southern wall, wrinkle ridges run south across the sea to join with several others, to meet with the highlands to the north of Plato”. In these images, as well as in the detail of IMAGE 32 by Massimo Bianchi, we can see that Fontenelle is an FFC (Fractured Floor Crater) and that its floor also has rilles and hummocky.

Image 46, Plato, *Felix León, Santo Domingo, República Dominicana. 2021 January 23, 23:25 UT. 127 mm Maksutov-Cassegrain telescope, DMK21618AU camera. North right, west down.*

Image 47, Plato, *Felix León, Santo Domingo, República Dominicana. 2021 January 23, 23:25 UT. 127 mm Maksutov-Cassegrain telescope, DMK21618AU camera. North right, west down.* ***Below, Image 47A****, close-up of Fontenelle.*

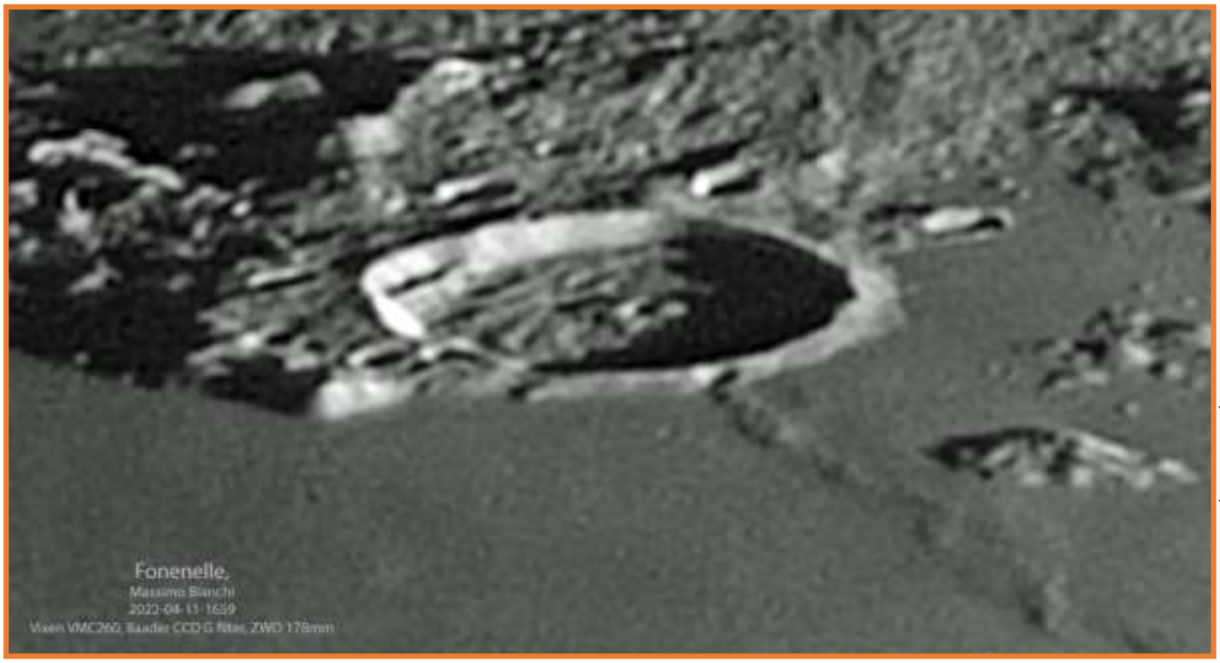
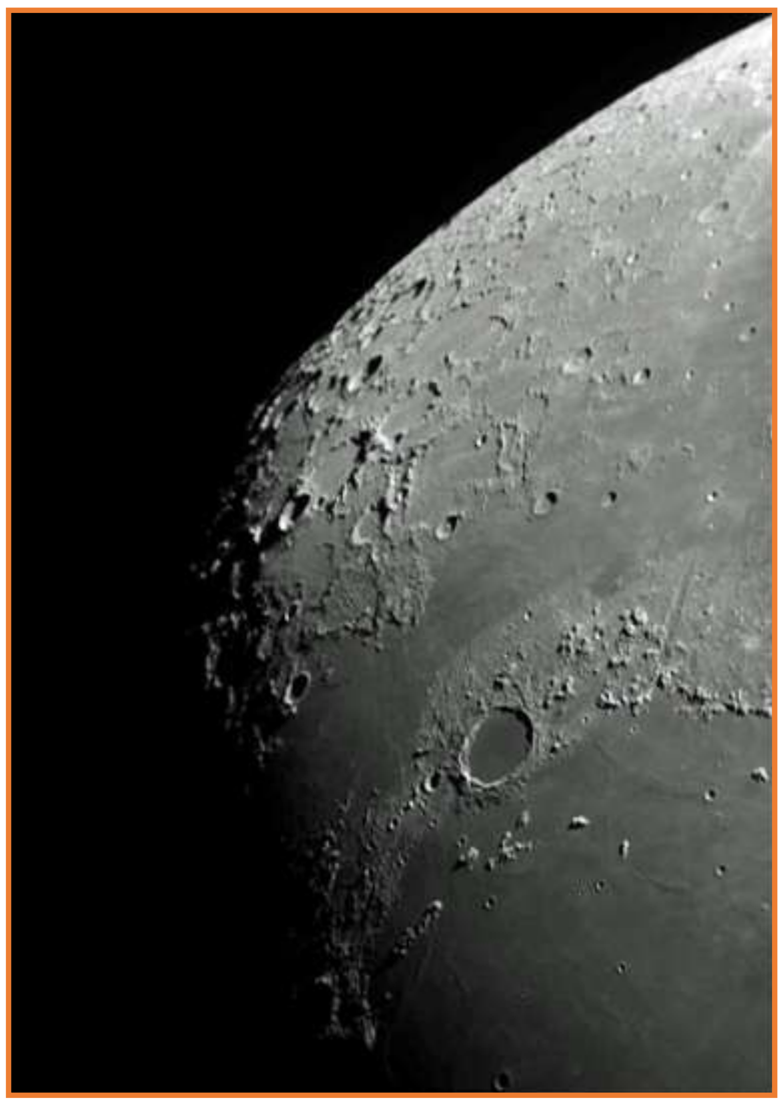


Image 32D, Mare Frigoris Fontenelle *Massimo Bianchi, Milan, Italy. 2022 April 11 16:59 UT. Vixen VMC260 f/11.5 telescope, Baader CCD G filter, ZWO ASI178 mm camera. Seeing 5/10, transparency 5/6.*

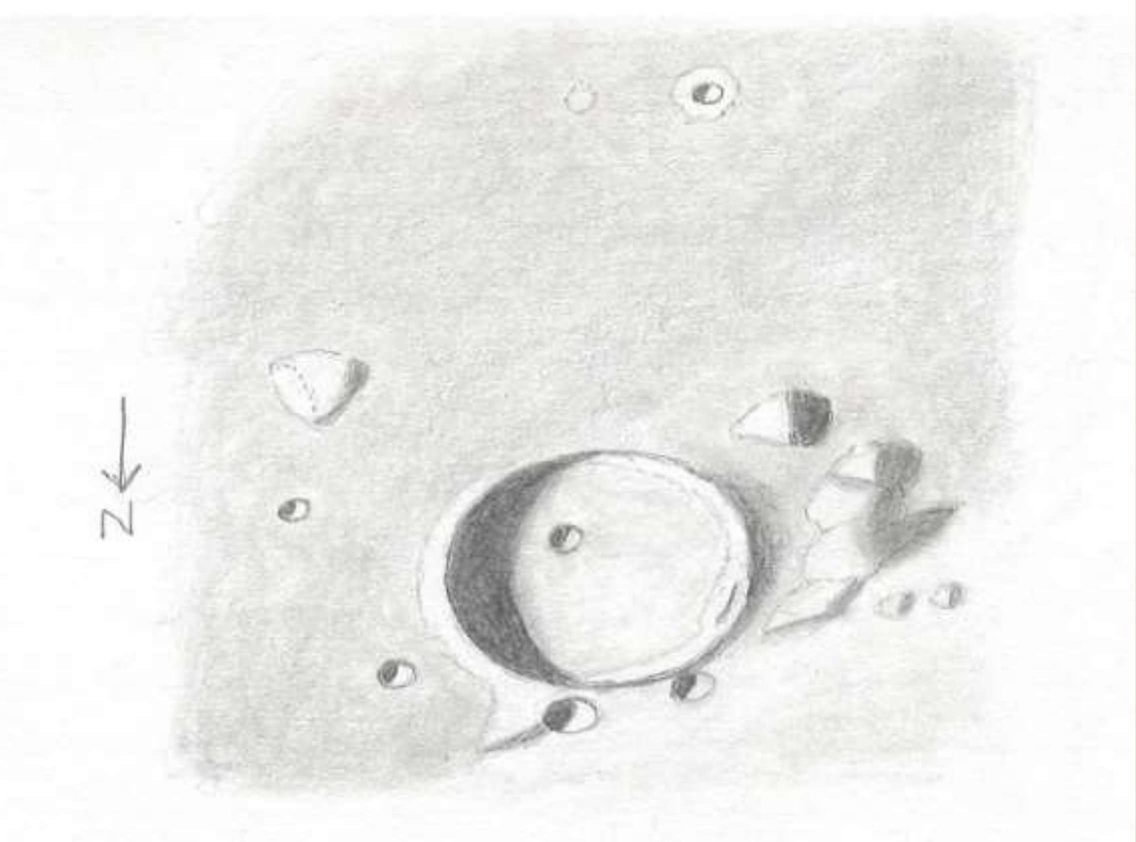


In Marcelo Mojica's image (IMAGE 48), the terminator passes right through Fontenelle and marks the limit of our journey so far. Fontenelle is in similar illumination in Itsvan Zoltan Foldvari's wonderful drawing (IMAGE 49). In this same issue there is a beautiful drawing by Robert H. Hays, Jr of Fontenelle, to which we see on the following page.

Image 48, Mare Frigoris, *Marcelo Mojica Gundlach, LIADA, Cochabamba, Bolivia. 2018 July 22 23:36 UT. 150 mm refractor telescope, Orion V-block filter, SWO CMOS camera.*

Fontenelle

Robert H. Hays, Jr.



Fontenelle, *Robert H. Hays, Jr., Worth, Illinois, USA. 2013 April 21 04:05-04:37; 04:49-05:05 UT. 15 cm reflector, 170 x. Seeing 8/10, transparency 6/6.*

I sketched this crater and vicinity on the night of April 20/21, 2013 while watching the Moon hide 14 Sextantis. Fontenelle sits on the north edge of Mare Frigoris well north of Plato. Librations were favorable for it that night. The interior of Fontenelle appears smooth except for a modest pit southeast of its center. There is some evidence of terracing inside its west rim. The craters Fontenelle H and R are along the north rim of Fontenelle. A wide, sharp projection from Fontenelle's rim is partly overlapped by Fontenelle R. The crater east of R is Fontenelle P, and a small pit is south of P and east of Fontenelle. The triangular peak just south of that pit is Fontenelle epsilon. (The peak is shown on the Lunar Quadrant map, but the nearby pit it not.) Fontenelle epsilon had a bright sunward side. There is a clustering of peaks west of Fontenelle not shown on the LQ map. The southernmost one showed a bright pointed sunward side and dark shadow. It is definitely a more conspicuous feature than Fontenelle epsilon. The other large peaks had lighter shadow and blended together. It was not easy to tell where one peak ended and another began. Two small detached peaks are farther west. The blended peaks apparently form a boundary of Mare Frigoris as does the sharp projection at Fontenelle R. The terrain is lighter north of these features. Fontenelle G is the small pit well to the south. This crater is surrounded by a halo. A small shadow-less bright spot is just east of Fontenelle G. The area between Fontenelle and Fontenelle G appears very smooth.

This first appeared in The Lunar Observer in September 2013

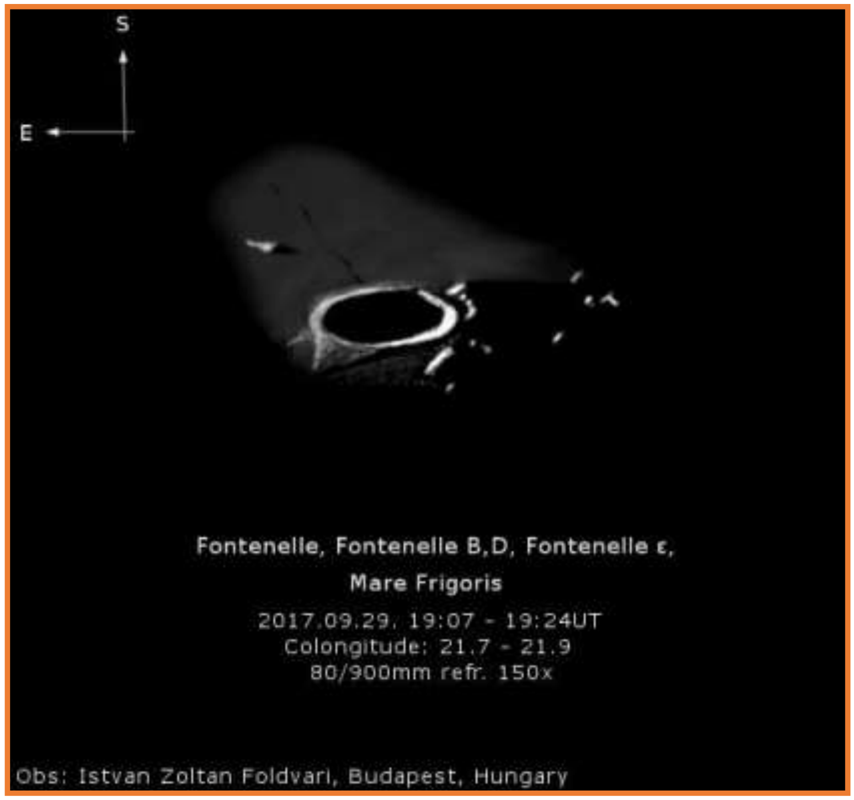
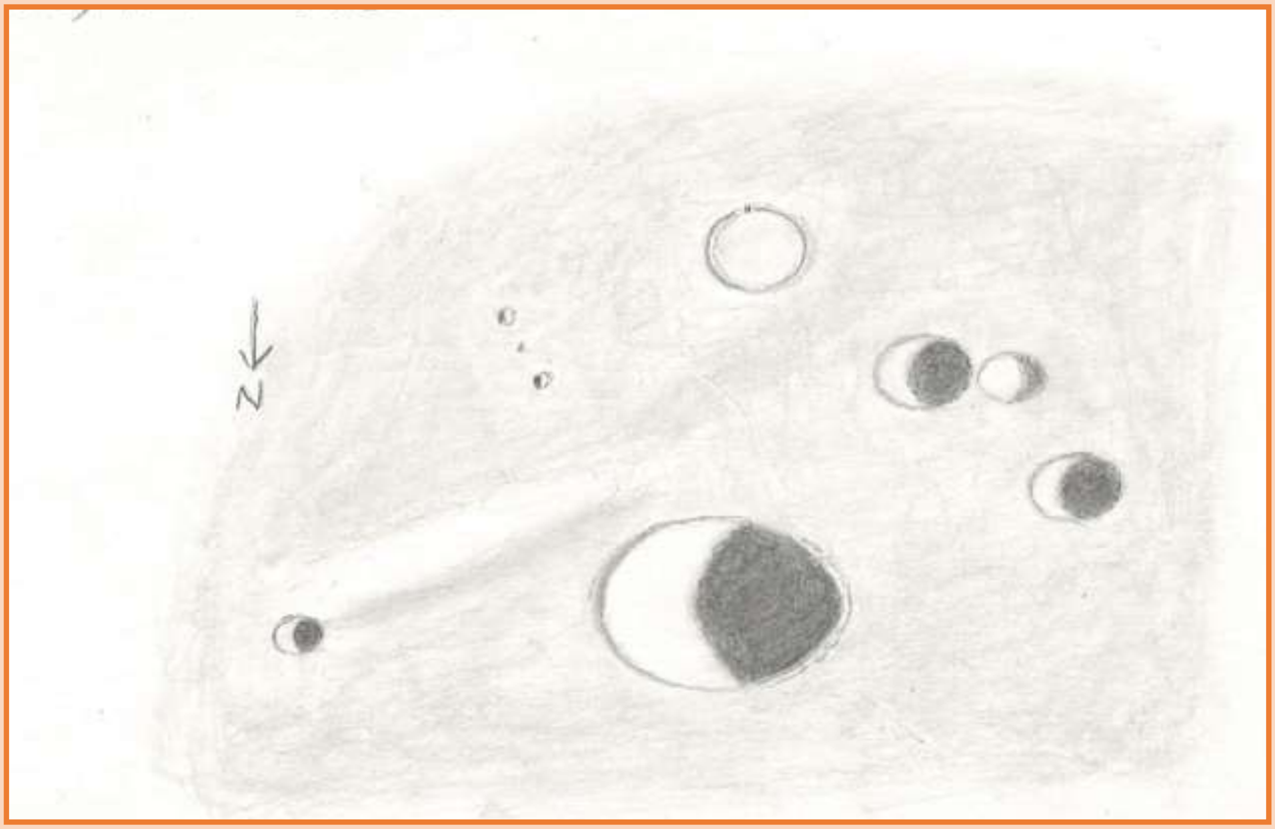


Image 49, Fontenelle, *István Zoltán Földvári, Budapest, Hungary. 2017 September 29, 19:07-19:24 UT, colongitude 21.7º to 21.9º. 80 mm refractor telescope, 900 mm focal length, 150 x.*

Now we change direction and head south to reach La Condamine, but first we must avoid a series of arc-shapes, ghosts of ancient small craters, between La Condamine and J. Herschel, as we see in IMAGE 50 of Rik Hill, the two prominent craters near J. Herschel are J. Herschel F (left) and La Condamine B (which appears to have small bright rays, right). In Rik Hill's IMAGE 51 we see La Condamine. Details of this interesting ancient 38 km diameter crater can be seen in the drawing and text by Robert H. Hays Jr., on the following page.

la Condamine B

Robert H. Hays, Jr.



la Condamine B, *Robert H. Hays, Jr., Worth, Illinois, USA. 2013 September 27 09:35-10:05 UT. 15 cm reflector, 170 x. Seeing 8/10, transparency 6/6.*

I drew this crater and surrounding area on the morning of September 27, 2013. This is the largest crater of a modest group in Mare Frigoris north of la Condamine. The main feature here is a crisp, slightly egg-shaped crater with the pointed end to the west. The substantial interior shadow showed a blunt point at its center. La Condamine T is the small crater to the east. A wide, low ridge or wrinkle starts at this crater and extends westward, petering out south of la Condamine B. A tight group of three craters is to the southwest. La Condamine E is the northwestern crater of this group, while la Condamine F is to the southeast. These two craters appear to be identical in size, depth and crispness. The third crater is between la Condamine E and F, and is smaller and shallower than these two. This crater is shown, but not labeled on the Lunar Quadrant map. A very shallow ghost ring, about as wide as E and F, is to their southeast, and south of la Condamine B. This appears to be a flooded crater. What's left of it is a fine, narrow rim that appears to be complete, but there may be tiny, unnoticed gaps. A dot of shadow on its south rim may indicate a high point. Two small peaks are east of the ghost ring, and a minute bit of shadow between them may be from a third peak.

This first appeared in The Lunar Observer in January 2014

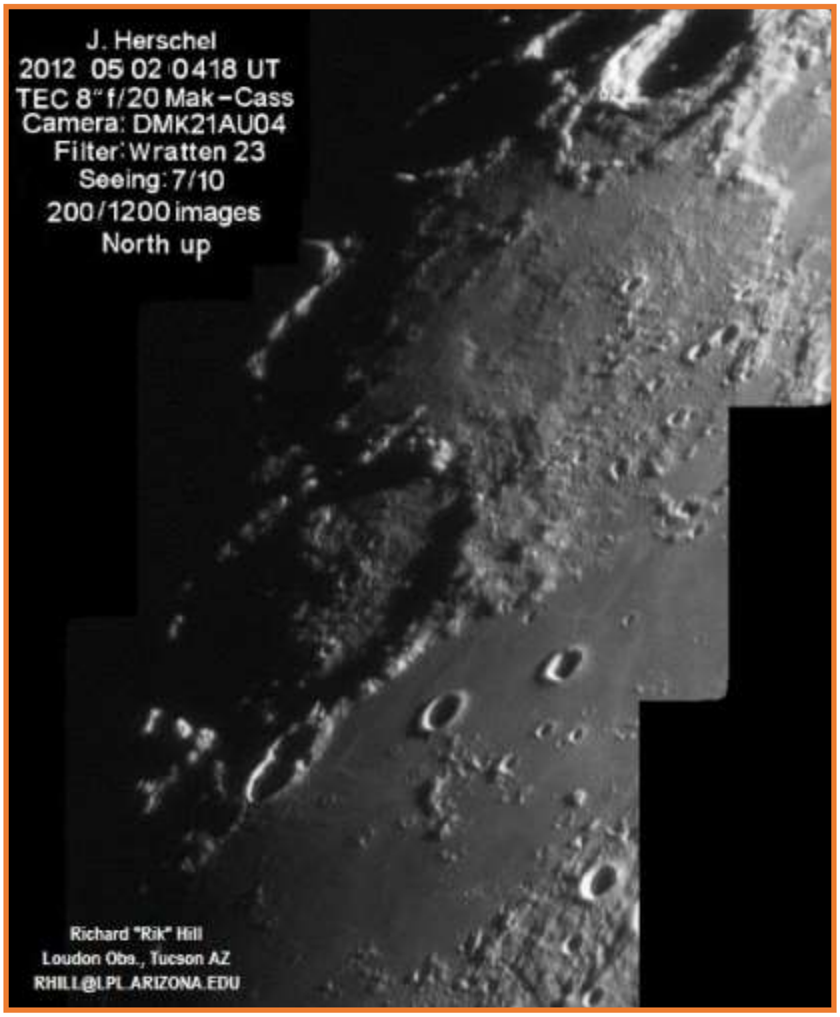


Image 50, J. Herschel, *Richard Hill, Loudon Observatory, Tucson, Arizona, USA. 2012 May 02 04:18 UT. 8 inch f/20 TEC Maksutov-Cassegrain telescope, Wratten 23 filter, DMK21AU04 camera. Seeing 7/10.*

Image 51, below, Sinus Iridum to Plato, *Richard Hill, Loudon Observatory, Tucson, Arizona, USA. 2020 April 04 04:20 UT. 6 inch Dynamax Schmidt-Cassegrain telescope, 2x barlow, 665 nm filter, Skyris 665 nm camera. Seeing 7-8/10.*

Sixth stage

We head to the western end of Mare Frigoris, toward the end of our journey, towards Harpalus Station, where Mare Frigoris and Sinus Roris meet, as seen in IMAGE 52 by Eduardo Horacek and IMAGE 53 by David Teske

Image 51, Mare Frigoris, *Eduardo Horacek, Trapecio Austral-LIADA, Mar del Plata, Argentina. 2021 July 22 00:17 UT, colongitude 60.3º. 150 mm Maksutov-Cassegrain telescope, EOS Rebel T5i camera. North is down, west is right.*

Image 52, Sinus Roris, *David Teske, Louisville, Mississippi, USA. 2022 March 20 07:22 UT, colongitude 116.9º. 4 inch f/15 Skylight refractor telescope, IR block filter, ZWO ASI120mm/s camera. Seeing 7/10.*

The trip from Fontenelle to Harpalus can be seen in the IMAGE 54 by Francisco Alsina Cardinalli: 1.-Fontenelle; 2.-Fontenelle B and Fontenelle D; 3.-La Condamine S; 4.-La Condamine B; 5.-J. Herschel F; 6.-Horrebow and Horrebow A; 7.-Harpalus B; 8.- Harpalus C; 9.-Harpalus.

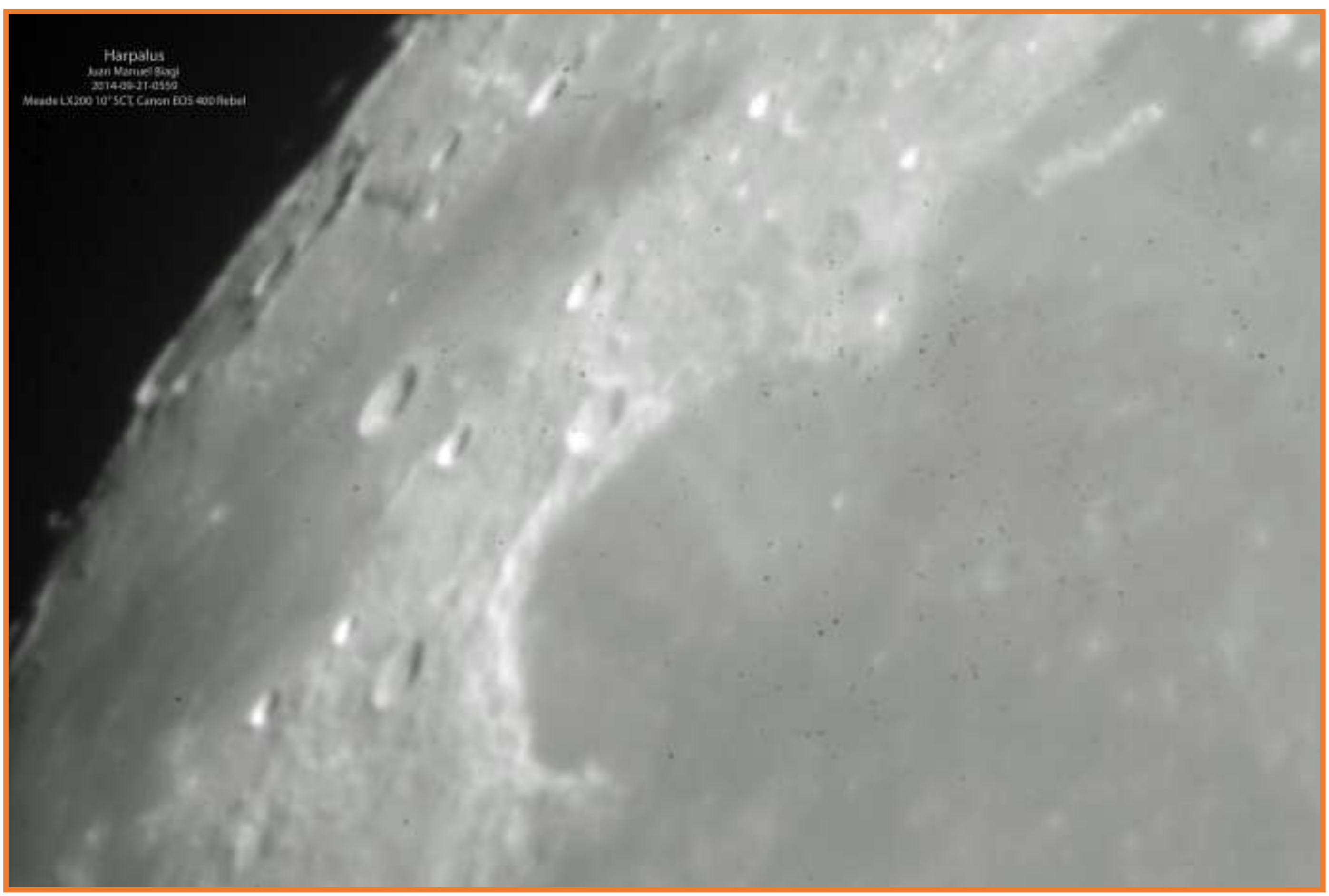
Image 54, Mare Frigoris Craters, *Francisco Alsina Cardinalli, SLA-LIADA, Oro Verde, Argentina. 2019 February 17 03:20 UT. 200 mm refractor telescope, QHY5-II camera. North down, west right.*

Harpalus is a prominent 40 km diameter Copernican crater at the eastern edge of the Sinus Roris. Garfinkle characterizes Harpalus as having a "sharp polygonal rim, rumpled eject blanket, streamers of secondary craters, and bright rays", which Grego calls "somewhat faded". In IMAGE 55 and 56 by Francisco Alsina Cardinalli and its detail, Please note the details of craters Harpalus and Horrebow drawn be István Zoltán Földvári. Harpalus appears spectacular, the rays are not visible but its complex topography of terraced walls and ridges is, which is also seen in the images by Juan Manuel Biagi (57 and 58). Thus we arrive at the end of our journey, signaled by IMAGE 59 by Jairo Andrés Chavez.

Image 55, Plato, *Francisco Alsina Cardinalli, SLA-LIADA, Oro Verde, Argentina. 2019 February 17 03:20 UT. 200 mm refractor telescope, QHY5-II camera. Below,* ***Image 55A****, a close-up of Harpalus.*

Image 56, Mare Frigoris, *Francisco Alsina Cardinalli, SLA-LIADA, Oro Verde, Argentina. 2019 February 17 03:40 UT. 200 mm refractor telescope, QHY5-II camera.*

Image 57, Mare Frigoris, *Juan Manuel Biagi, Oro Verde, Argentina, SLA-LIADA. 2014 September 21 05:59 UT. Meade LX200 10 inch Schmidt-Cassegrain telescope, Canon EOS 400 Rebel camera.*



Harpalus, *István Zoltán Földvári, Budapest, Hungary. 2015 October 24, 20:19-19:24 UT, colongitude 55.5º to 55.7.º. 80 mm refractor telescope, 900 mm focal length, 150 x. Seeing 6/10, transparency 3/6.*

Horrebow, *István Zoltán Földvári, Budapest, Hungary. 2019 April 15, 20:26-20:42 UT, colongitude 42.0º to 42.1.9º. 70 mm refractor telescope, 500 mm focal length, 125 x. Seeing 6/10, transparency 4/6.*

Image 58, Mare Frigoris, *Juan Manuel Biagi, Oro Verde, Argentina, SLA-LIADA. 2014 September 21 05:59 UT. Meade LX200 10 inch Schmidt-Cassegrain telescope, Canon EOS 400 Rebel camera.*

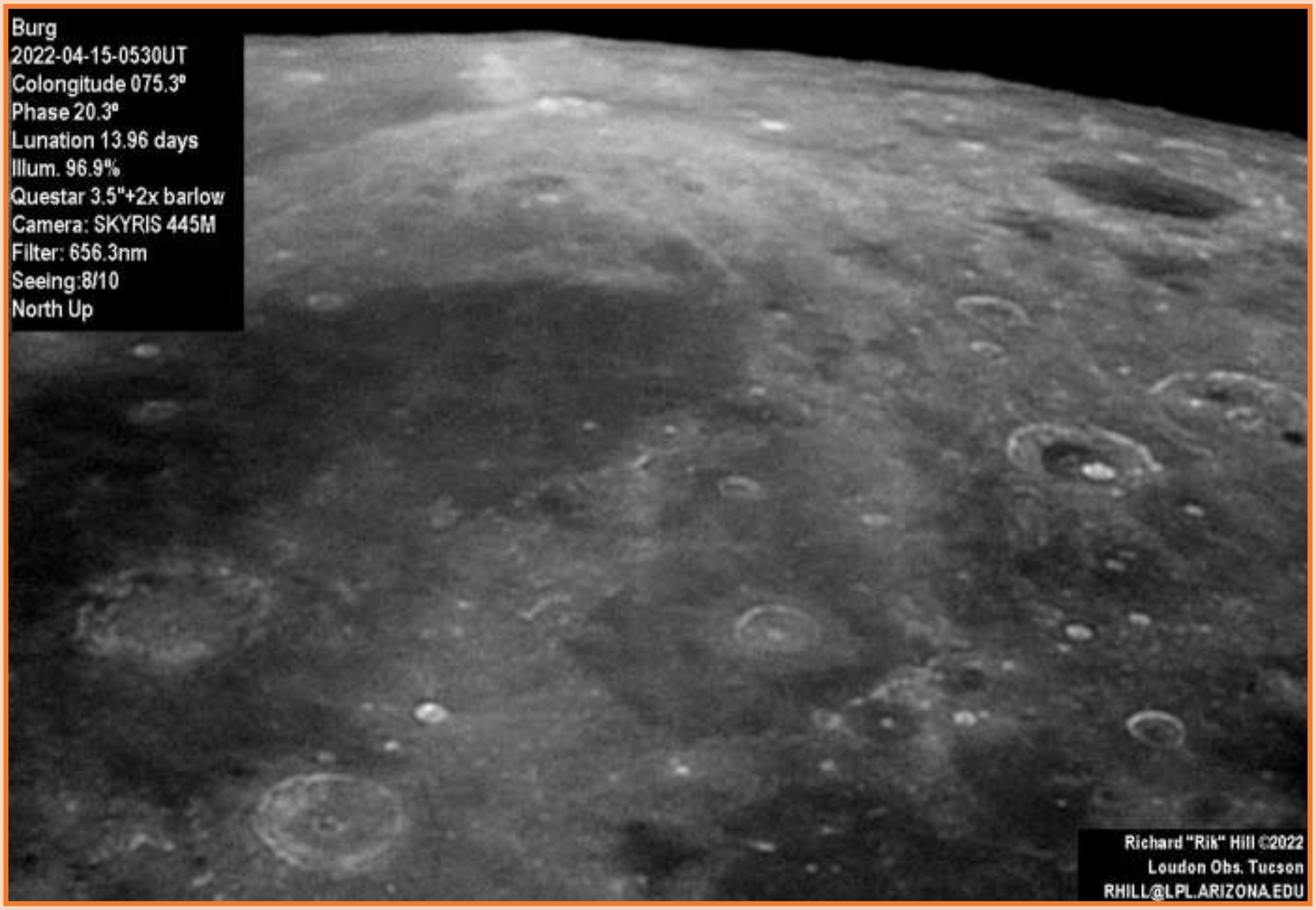
Image 59, Plato, *Jairo Chavez, Popayán, Colombia. 2021 January 15 02:53 UT. 311 mm Dobsonian truss reflector telescope, Moto E5 Play camera. North upper right, west upper left.*

High Noon

Rik Hill

While doing some imaging with the Questar this week under high Sun on the Moon, this region caught my eye. First was the large dark pool on the right side of this image, the great Endymion (129 km) crater some 3.9-4.5 billion years old. I can find no information on when this was flooded with lava but the flat dark floor makes this easy to spot. Then I noticed the bright crater to the left and wondered the origin of this ray system. There are two craters in that vicinity, Strabo (56 km) and Thales (32 km). After some detective work, I discovered that the rays do not come from Strabo but rather the smaller Thales adjacent to the south. This is similar to several other spots on the Moon where a small undistinguished crater on the terminator blossoms into a spectacular spray under high Sun.

Below Endymion is a good-sized crater with a small bright crater on its floor. This is Hercules (71 km) with Hercules G (13 km) on the floor. To the right is a slightly larger crater Atlas (90 km). Notice the small dark regions on the floors of both these craters. Below center in this image is the crater Bürg (41 km) sitting in the middle of an almost complete hexagon, Lacus Mortis (155 km). Above Lacus Mortis is a large mare region. This is the eastern reaches of Mare Frigoris that goes on to meander west for nearly 80 degrees on longitude. Then we have two more large craters in the lower left corner. The bottom most crater is Eudoxus (70 km) with Aristoteles (90 km) above it. I'm so used to seeing the grand splash pattern around the latter crater when it's on the terminator. These features all look different under high noon Sun, "pardner"!



Bürg, *Richard Hill, Loudon Observatory, Tucson, Arizona, USA. 2022 April 15 05:30 UT, colongitude 75.3°. 3.5 inch Questar Maksutov-Cassegrain telescope, 2x barlow, 656.3 nm filter, SKYRIS 445M camera. Seeing 8/10.*

BIBLIOGRAPHY:

Elger, Thomas G. (1895), The Moon, George Philip & son, London.

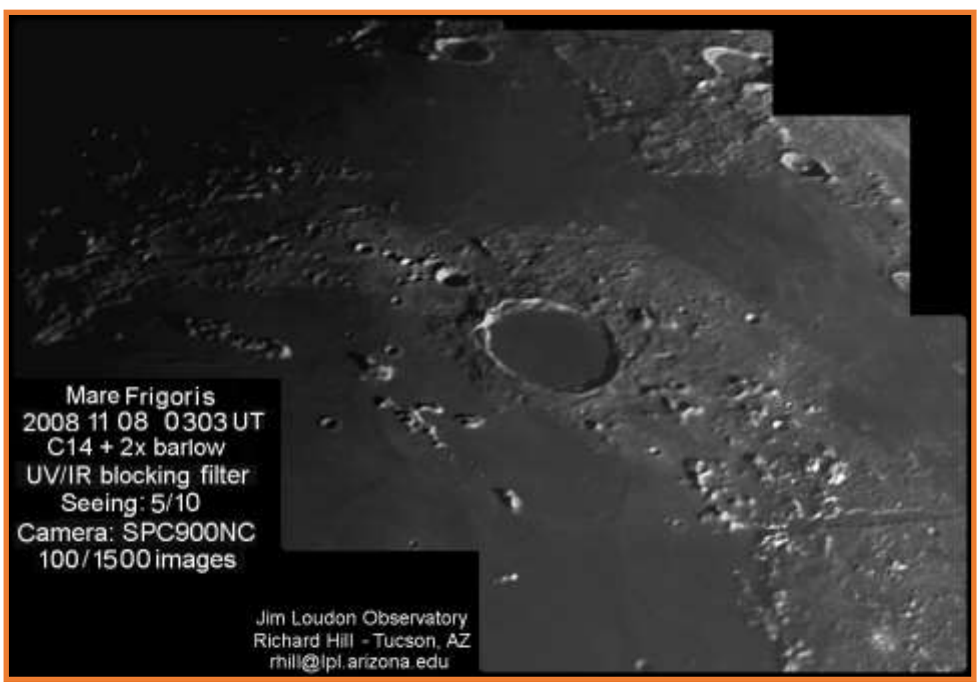
Garfinkle, Robert (2020), Luna Cognita, Springer, New York.

Grego, Peter (2005), The moon and how to observe it, Springer.

Wilhelms, Don (1987): "The Geological History of the Moon", United States Government Printing Office, Washington, 1987.

Wood, Charles A. (2003), The Modern Moon. A Personal View, Sky and Telescope, Cambridge.

Mare Frigoris, *Richard Hill, Loudon Observatory, Tucson, Arizona, USA. 2014 August 07 04:04 UT. 3.5 inch Questar Maksutov-Cassegrain telescope, 1.7x barlow, UV/IR blocking filter, SKYRIS 445M camera. Seeing 8/10.*



Mare Frigoris, *Richard Hill, Loudon Observatory, Tucson, Arizona, USA. 2008 November 08 03:03 UT. 14 inch Celestron Schmidt-Cassegrain telescope, UV/IR filter, SPC900NC camera. Seeing 5/10.*

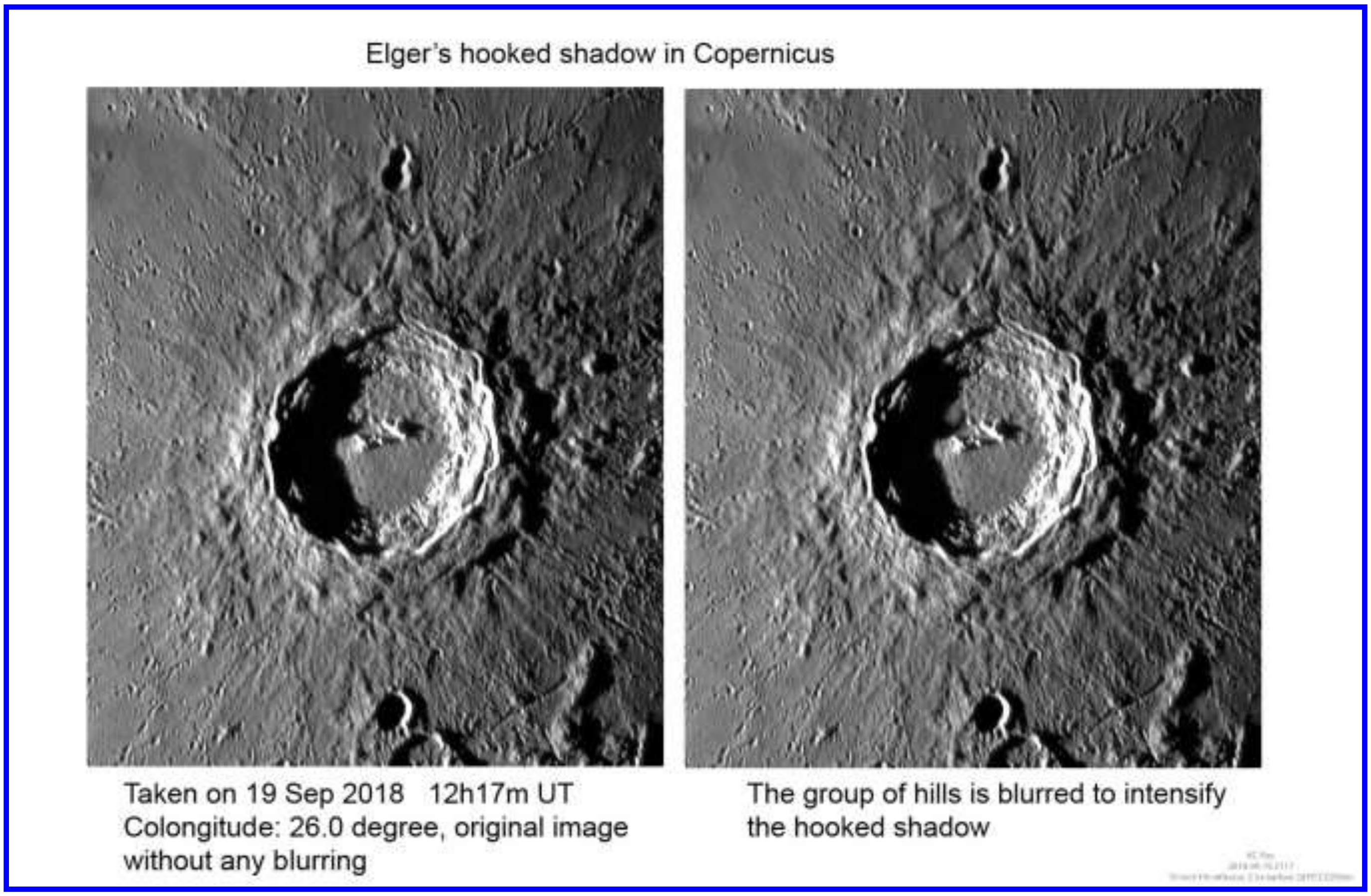
Cassini, *KC Pau, Hong Kong, China. 2022 March 10 13:26 UT. 10 inch f/6 reflector, 2.5 x barlow, QHY-CCD290M camera.*

8-day Moon*, Maurice Collins, Palmerston, New Zealand. 2022 April 09 0727—0742 UT. FLT 110 mm refractor telescope, 3x barlow, QHY5III462C camera.*

Montes Apenninus, *KC Pau, Hong Kong, China. 2022 March 10 13:37 UT. 10 inch f/6 reflector, 2.5 x barlow, QHYCCD290M camera.*

Imbrium lava flows, *Howard Eskildsen, Ocala, Florida, USA. 2022 April 11 00:11 UT, colongitude 24.1°. Celestron 9.25 inch Schmidt-Cassegrain telescope, SKYRIS 236M camera. Seeing 8/10, transparency 6/6.*

Howard adds: This was another image from last night that I hadn't expected to get. I had already put away the camera when I discovered that the remnants of ancient Imbrium lava flows were visible, so the camera was reattached and images obtained. Except for the obvious flow margins in the lower left central image, the margins are subtle, so arrows were placed on the second image to point to along some of the flows.



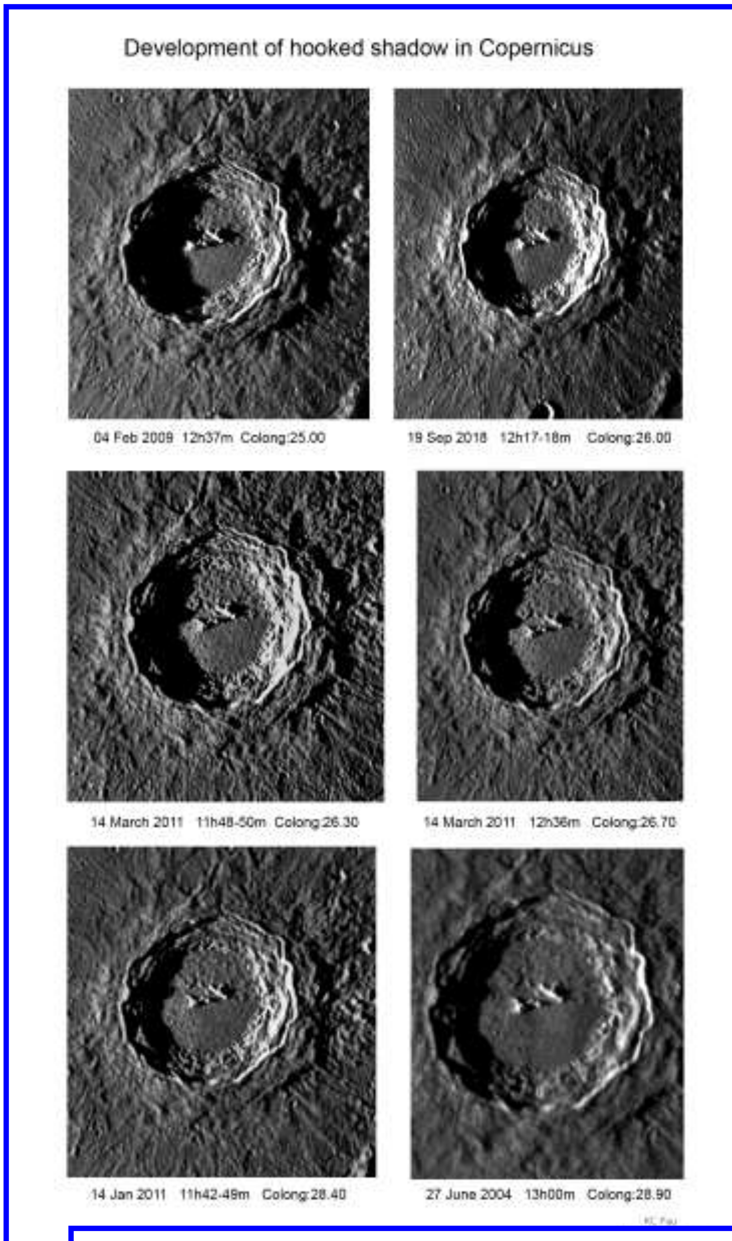
Hooked Shadow on Copernicus, *KC Pau, Hong Kong, China. 2018 September 19 12:17 UT. 10 inch f/6 reflector, 2.5 x barlow, QHYCCD290M camera.*

Fig.1 Copernicus drawn by Thomas Gwyn Elger on 11th March 1889.

KC adds: I enclose a set of photo showing the Elger's hooked shadow in Copernicus (enclosed), that is mentioned by Bill Leatherbarrow in April 2022 LSC issue. My photo is taken on 19 September 2018 at 12h17m UT with 250mm f/6 Newtonian reflector + 2.5X barlow + QHYCCD290M camera and colongitude is 26.0 degree, which is quite close to Elger's 26.4 degree. The main part of the hook is cast by the scallop feature on the eastern rim of Copernicus, the other part is the short shadow cast by a group of small hills nearby. The hills are blurred in one of the photos in order to enhance the appearance of the hook and to simulate the condition that Elger observed. I think Elger's telescope could resolve only part of the hill group so that the group appeared as a dark spot on his drawing. Thus, the hooked shadow was more prominent.

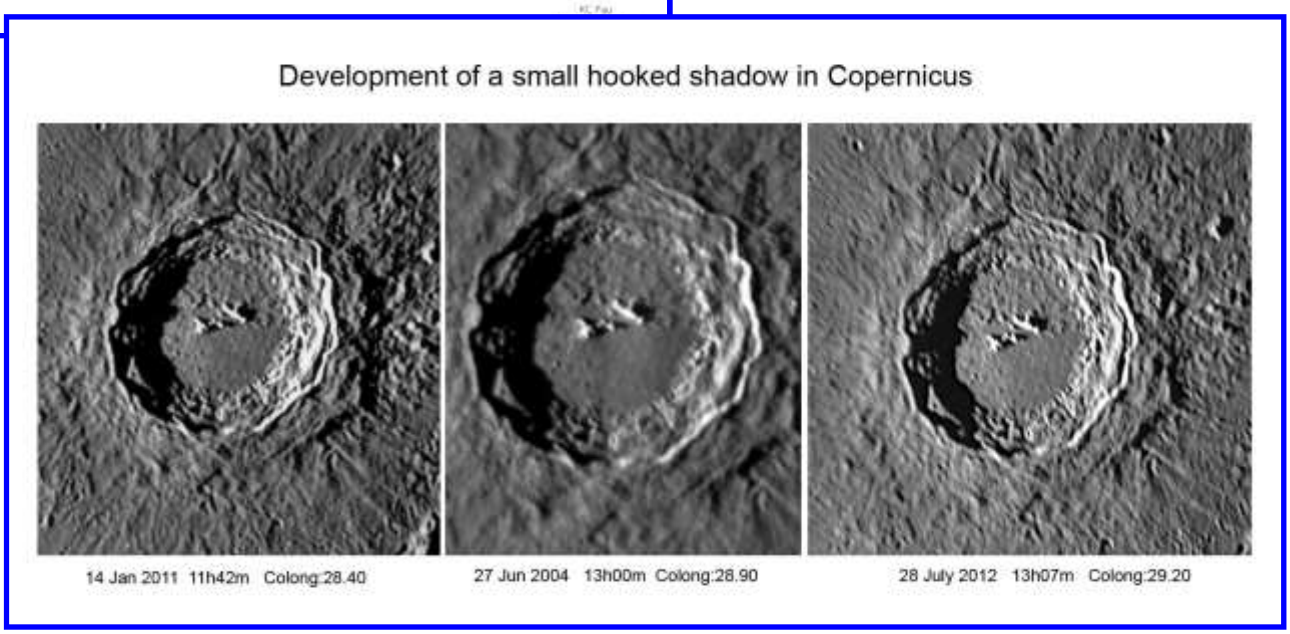
Hooked Shadow on Copernicus, *Thomas Gwyn Elger. 1889 March 11 19:50-20:45. 8.5 inch reflector telescope, 340 x, very good seeing. South is up.*

See also BAA Lunar Circular Volume 59, Number 4 April 2022 page 16.



Development of Hooked Shadow in Copernicus, *KC Pau, Hong Kong, China. 10 inch f/6 reflector, 2.5 x barlow, QHYCCD290M camera.*

Development of a Small Hooked Shadow in Copernicus, *KC Pau, Hong Kong, China. 10 inch f/6 reflector, 2.5 x barlow, QHYCCD290M camera.*

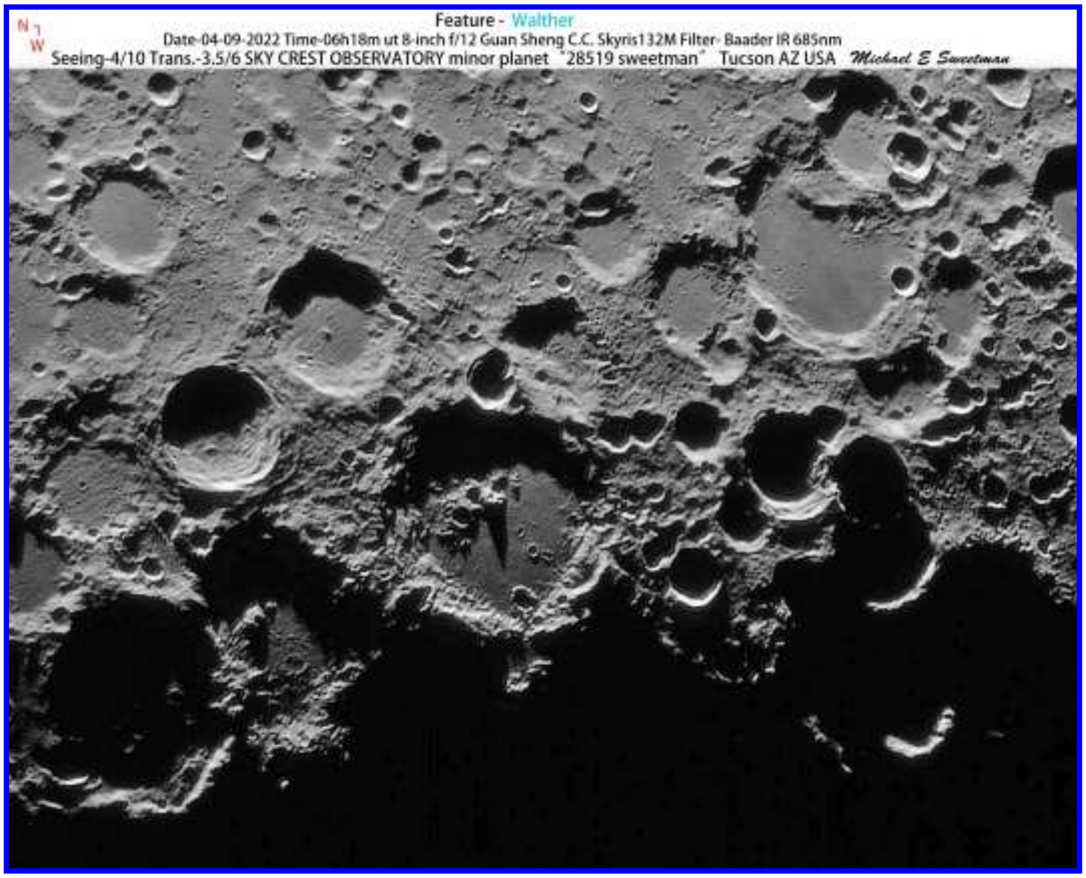


Triesnecker, *Howard Eskildsen, Ocala, Florida, USA. 2021 January 05 11:33 UT, colongitude 171.5°. Celestron 9.25 inch Schmidt-Cassegrain telescope, SKYRIS 236M camera. Seeing 7/10, transparency 4/6.*

Schiaparelli, *Walter Ricardo Elias, AEA, Oro Verde, Argentina. 2022 April 14 22:40 UT. Helios 114 mm reflector telescope, QHY5-IIC camera.*

Maurolycus, *Michael Sweetman, Sky Crest Observatory, Tucson, Arizona, USA. 2022 April 08 05:18 UT. 8 inch Guan Sheng Classical Cassegrain telescope, Baader IR 685 nm filter, Skyris 132M camera. Seeing 4/10, transparency 3.5/6.*

Plato, *Walter Ricardo Elias, AEA, Oro Verde, Argentina. 2022 April 09 22:31 UT. Celestron CPC1100 Schmidt-Cassegrain telescope, ZWO ASI120mm/s camera.*



Walther, *Michael Sweetman, Sky Crest Observatory, Tucson, Arizona, USA. 2022 April 09 06:18 UT. 8 inch Guan Sheng Classical Cassegrain telescope, Baader IR 685 nm filter, Skyris 132M camera. Seeing 4/10, transparency 3.5/6. North left, west down.*

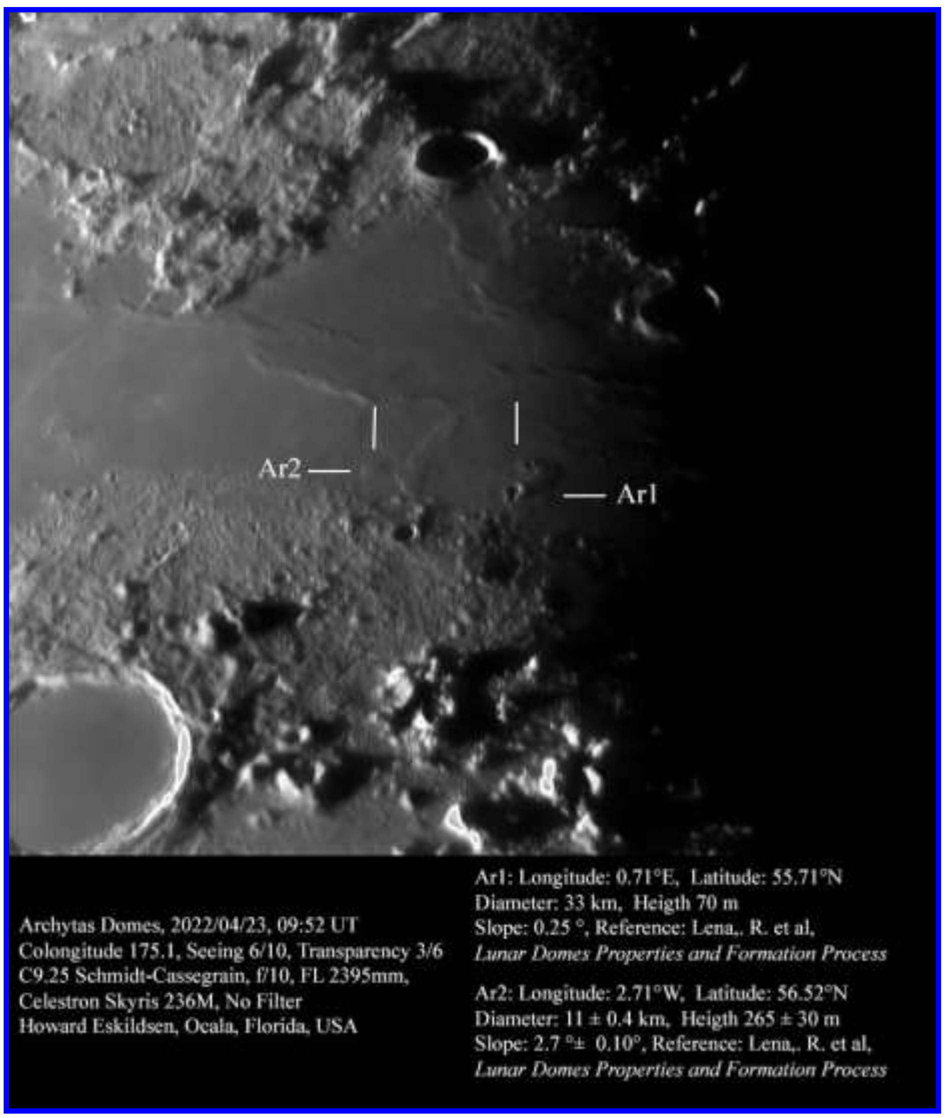
Censorinus, *Evangelina Leguiza, AEA, Oro Verde, Argentina. 2022 April 09 00:23 UT. Celestron CPC1100 Schmidt-Cassegrain telescope, ZWO ASI120mm/s camera.*

***Ptolemaeus**, Maurice Collins, Palmerston, New Zealand. 2022 April 09 0738 UT. FLT 110 mm refractor telescope, 3x barlow, QHY5III462C camera.*

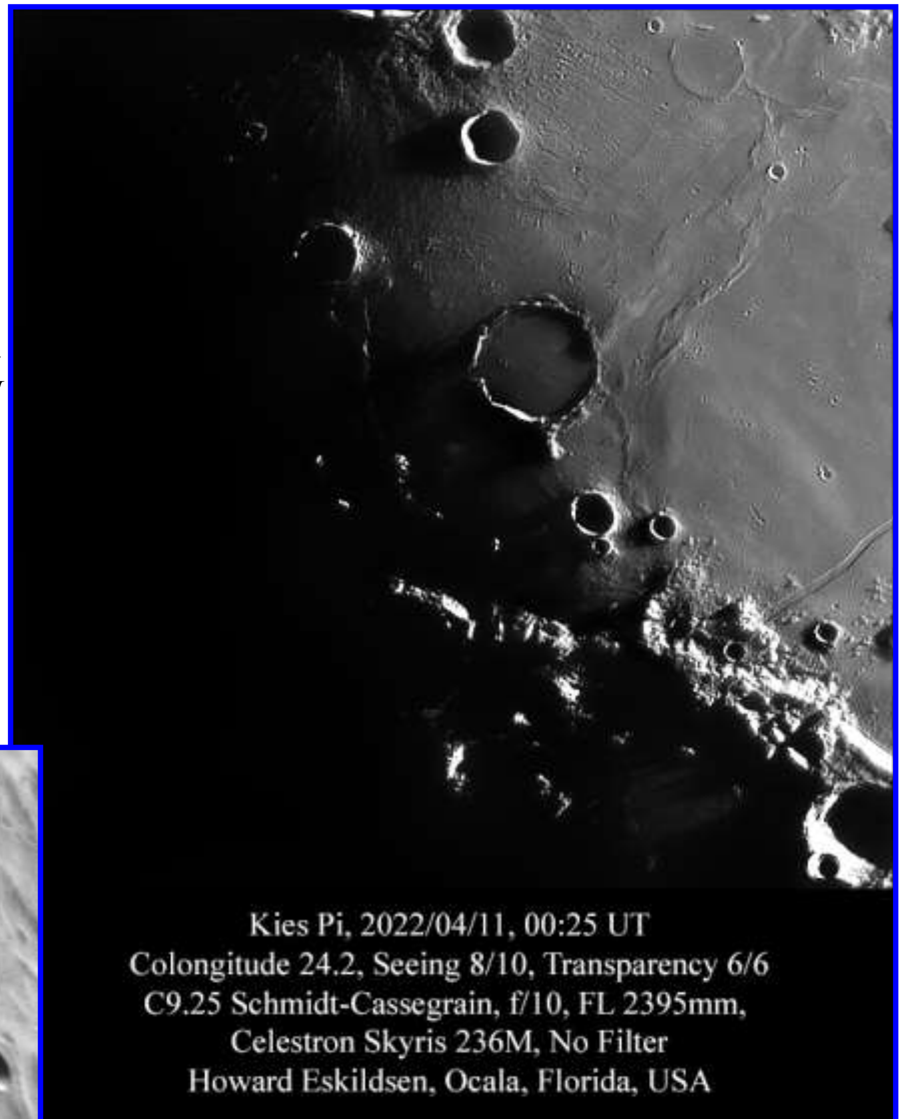
***Copernicus,** Howard Eskildsen, Ocala, Florida, USA. 2022 April 10 23:51 UT, colongitude 23.9°. Celestron 9.25 inch Schmidt-Cassegrain telescope, SKYRIS 236M camera. Seeing 8/10, transparency 6/6.*

Gassendi, *Walter Ricardo Elias, AEA, Oro Verde, Argentina. 2022 April 14 22:34 UT. Helios 114 mm reflector telescope, QHY5-IIC camera.*

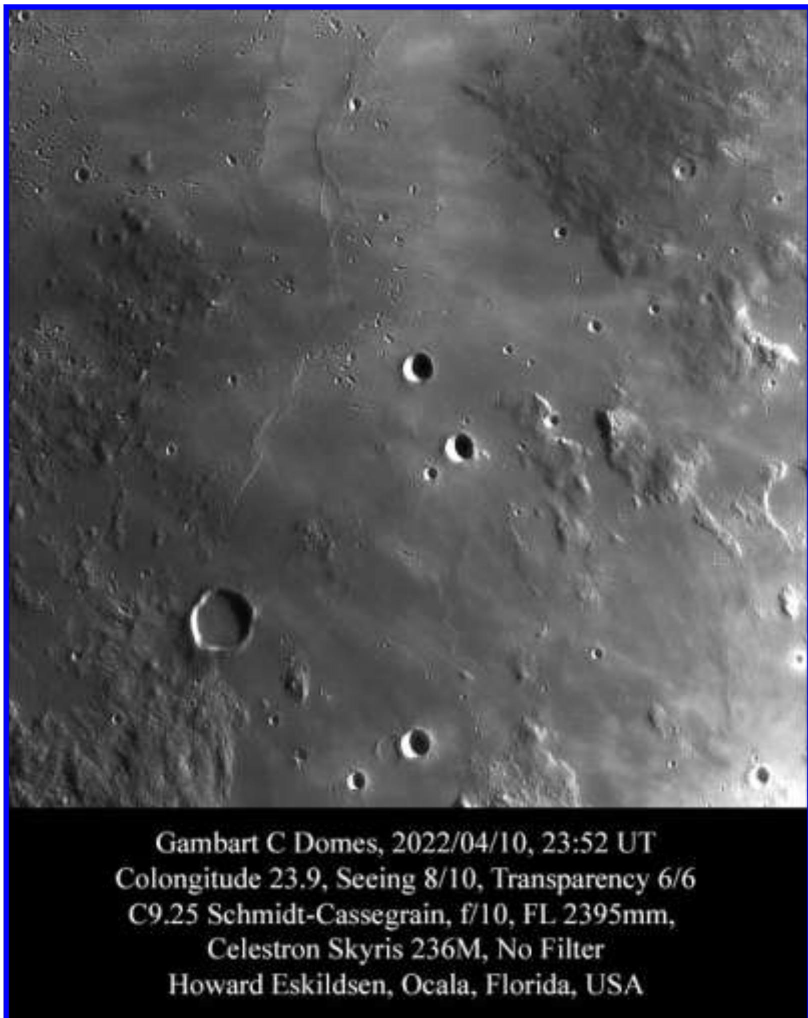
Archytas Domes, *Howard Eskildsen, Ocala, Florida, USA. 2022 April 23 09:52 UT, colongitude 175.1°. Celestron 9.25 inch Schmidt-Cassegrain telescope, SKYRIS 236M camera. Seeing 6/10, transparency 3/6.*



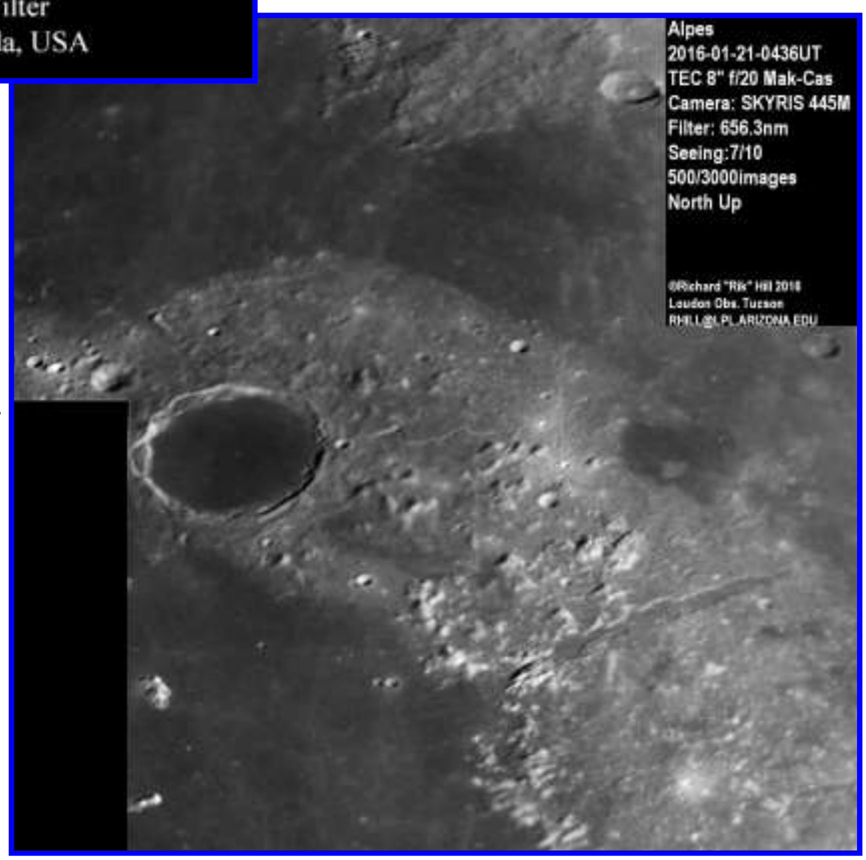
Kies Pi, *Howard Eskildsen, Ocala, Florida, USA. 2022 April 11 00:25 UT, colongitude 24.2°. Celestron 9.25 inch Schmidt-Cassegrain telescope, SKYRIS 236M camera. Seeing 8/10, transparency 6/6.*



Langrenus, *Fabio Verza, SNdR, Milan, Italy. 2022 April 05 18:28 UT. 12 inch Meade LX200 ACF Schmidt-Cassegrain telescope, Baader Neodymium IR block filter, ZWO ASI290mm camera.*



Gambart C Domes, *Howard Eskildsen, Ocala, Florida, USA. 2022 April 10 23:52 UT, colongitude 23.9°. Celestron 9.25 inch Schmidt-Cassegrain telescope, SKYRIS 236M camera. Seeing 8/10, transparency 6/6.*



Alpes, *Richard Hill, Loudon Observatory, Tucson, Arizona, USA. 2016 January 21 04:36 UT. 8 inch f/20 TEC Maksutov-Cassegrain telescope, 656.3 nm filter, SKYRIS 445M camera. Seeing 7/10.*

Promontorium Agarum *István Zoltán Földvári, Budapest, Hungary. 2014 October 10, 20:32-20:46 UT, colongitude 115.2º to 115.4º. 80 mm refractor telescope, 900 mm focal length, 150 x.*

99% Waxing Gibbous Moon, *Jairo Chavez, Popayán, Colombia. 2022 April 16 01:30 UT. 311 mm Dobsonian truss reflector telescope, Moto E5 Play camera.*

Aristarchus, *Walter Ricardo Elias, AEA, Oro Verde, Argentina. 2022 April 14 22:21 UT. Helios 114 mm reflector telescope, QHY5-IIC camera.*

Posidonius*, Rafael Benavides, Posadas Observatory MPC J53, Córdoba, Spain. 2022 January 10 21:10 UT. Celestron 11 inch Schmidt-Cassegrain telescope, Baader Planetarium IR Pass filter, ZWO ASI290mm/s camera. Seeing 8/10, transparency 6/6.*

82% Waxing Gibbous Moon, *Jairo Chavez, Popayán, Colombia. 2022 April 13 02:43 UT. 311 mm Dobsonian truss reflector telescope, Moto E5 Play camera.*

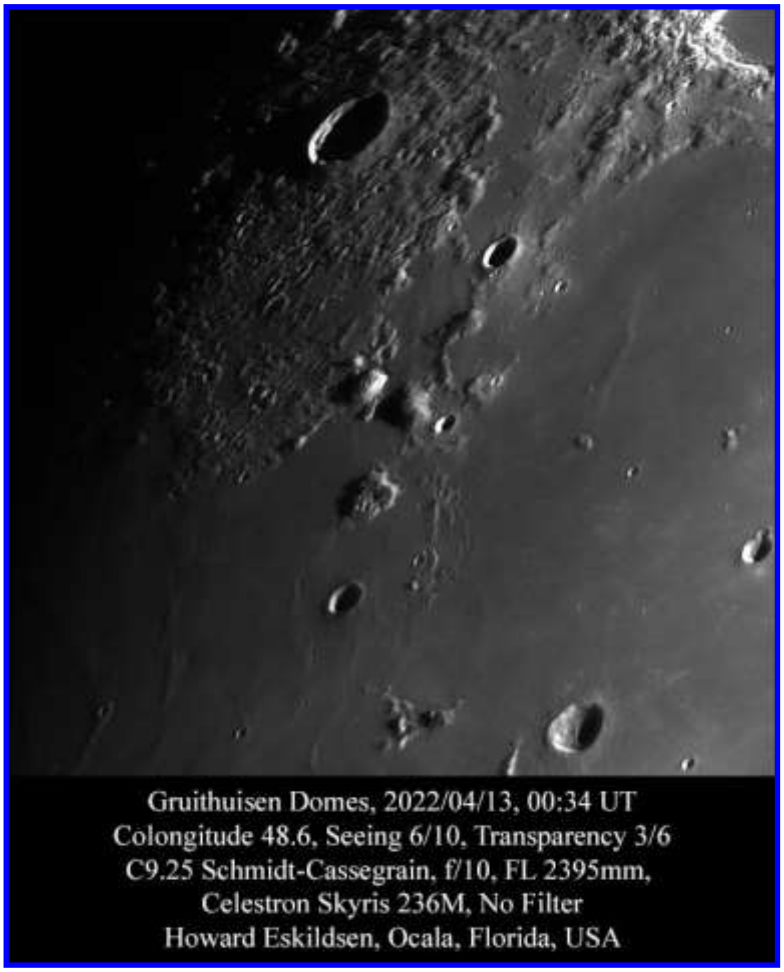
Cutis, *Walter Ricardo Elias, AEA, Oro Verde, Argentina. 2022 April 09 22:36 UT. Celestron CPC1100 Schmidt-Cassegrain telescope, ZWO ASI120mm/s camera.*

Langrenus, *Don Capone, Waxahachie, Texas, USA. 2022 March 19 05:54 UT. 10 inch Meade 2180 Schmidt-Cassegrain telescope, ADC, 1.5x barlow, ASI485MC camera.*

Walther, *Walter Ricardo Elias, AEA, Oro Verde, Argentina. 2022 April 09 00:16 UT. Celestron CPC1100 Schmidt-Cassegrain telescope, ZWO ASI120mm/s camera.*

Petavius, Don Capone, Waxahachie, Texas, USA. 2022 March 19 06:14 UT. 10 inch 2180 Meade Schmidt-Cassegrain telescope, ADC, 1.5x barlow, ASI485MC camera.

Albategnius, Victoria Gomez, AEA, Oro Verde, Argentina. 2022 April 09 00:18 UT. Celestron CPC1100 Schmidt-Cassegrain telescope, ZWO ASI120mm/s camera.

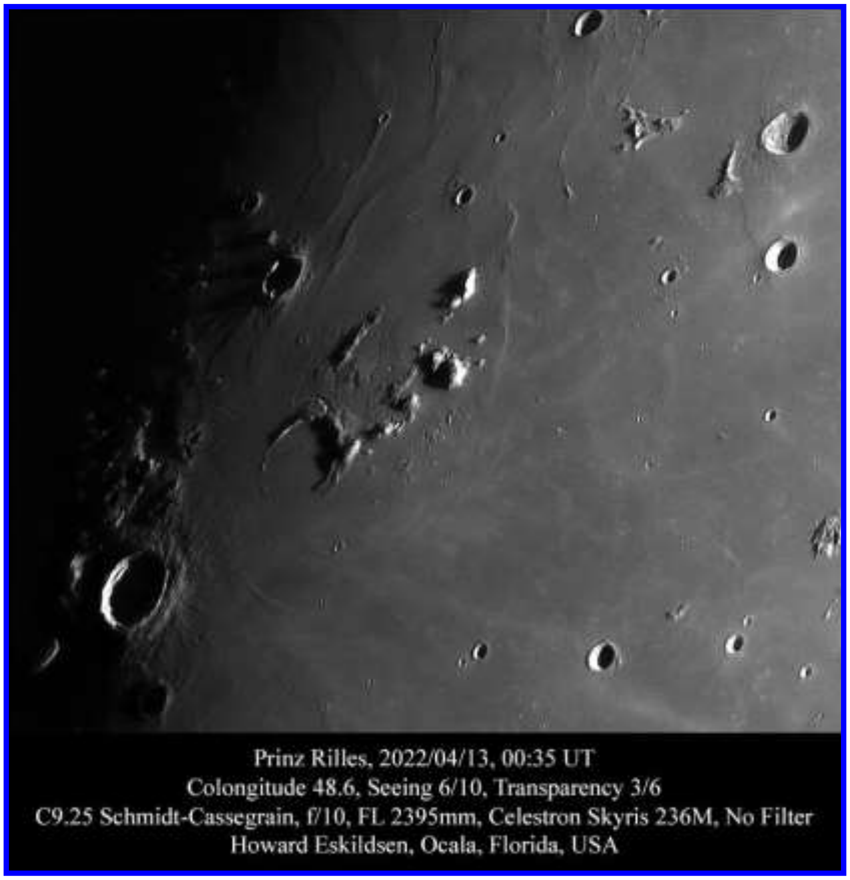


Gruithuisen Domes, *Howard Eskildsen, Ocala, Florida, USA. 2022 April 13 00:34 UT, colongitude 48.6°. Celestron 9.25 inch Schmidt-Cassegrain telescope, SKYRIS 236M camera. Seeing 6/10, transparency 3/6.*

Below, Tycho, *Jairo Chavez, Popayán, Colombia. 2022 April 14 00:27 UT. 311 mm Dobsonian truss reflector telescope, Moto E5 Play camera. North down, west right.*

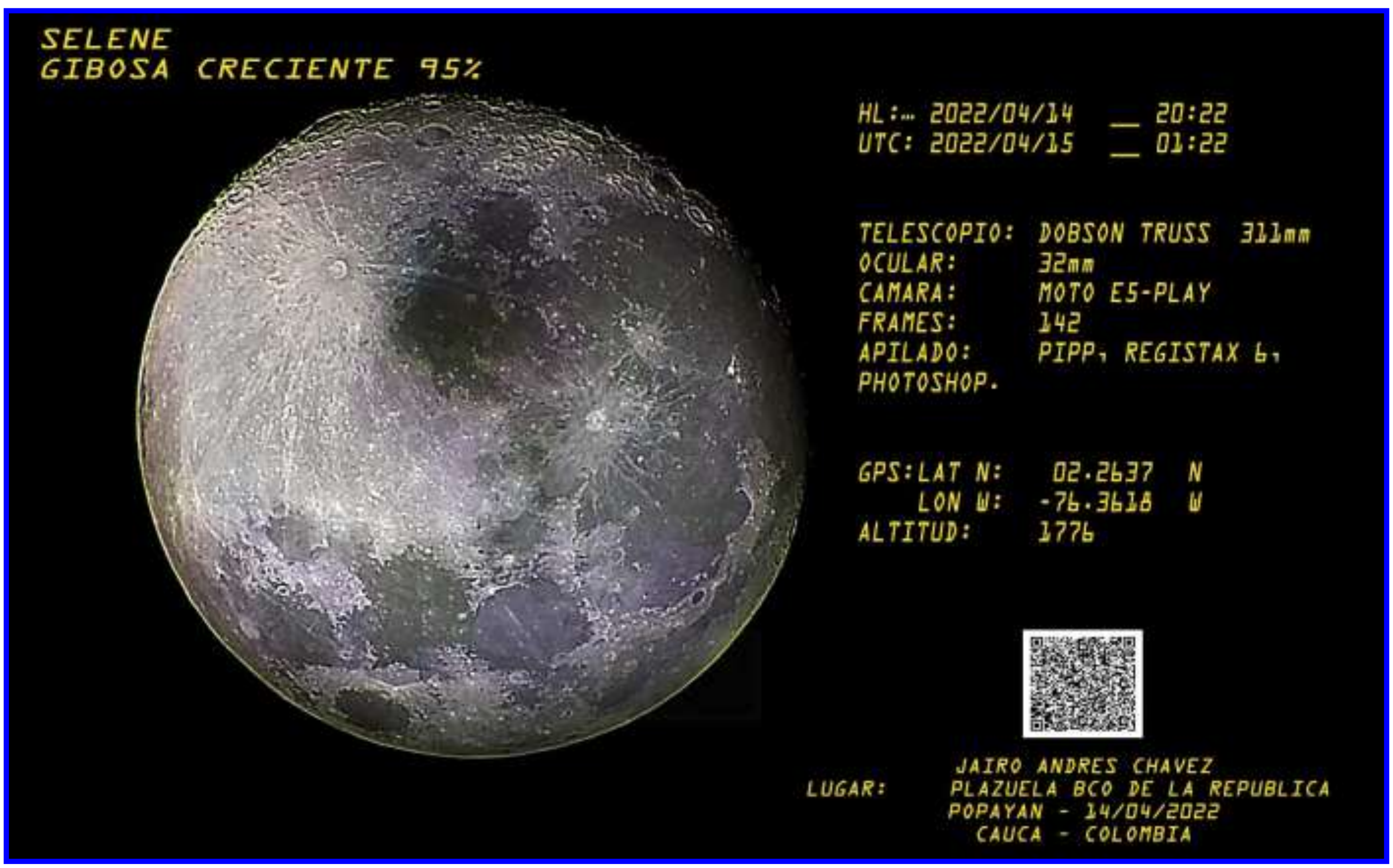
Marth, *Howard Eskildsen, Ocala, Florida, USA. 2022 April 13 00:38 UT, colongitude 48.6°. Celestron 9.25 inch Schmidt-Cassegrain telescope, SKYRIS 236M camera. Seeing 6/10, transparency 3/6.*

Lubbock, *Walter Ricardo Elias, AEA, Oro Verde, Argentina. 2022 April 09 00:12 UT. Celestron CPC1100 Schmidt-Cassegrain telescope, ZWO ASI120mm/s camera.*

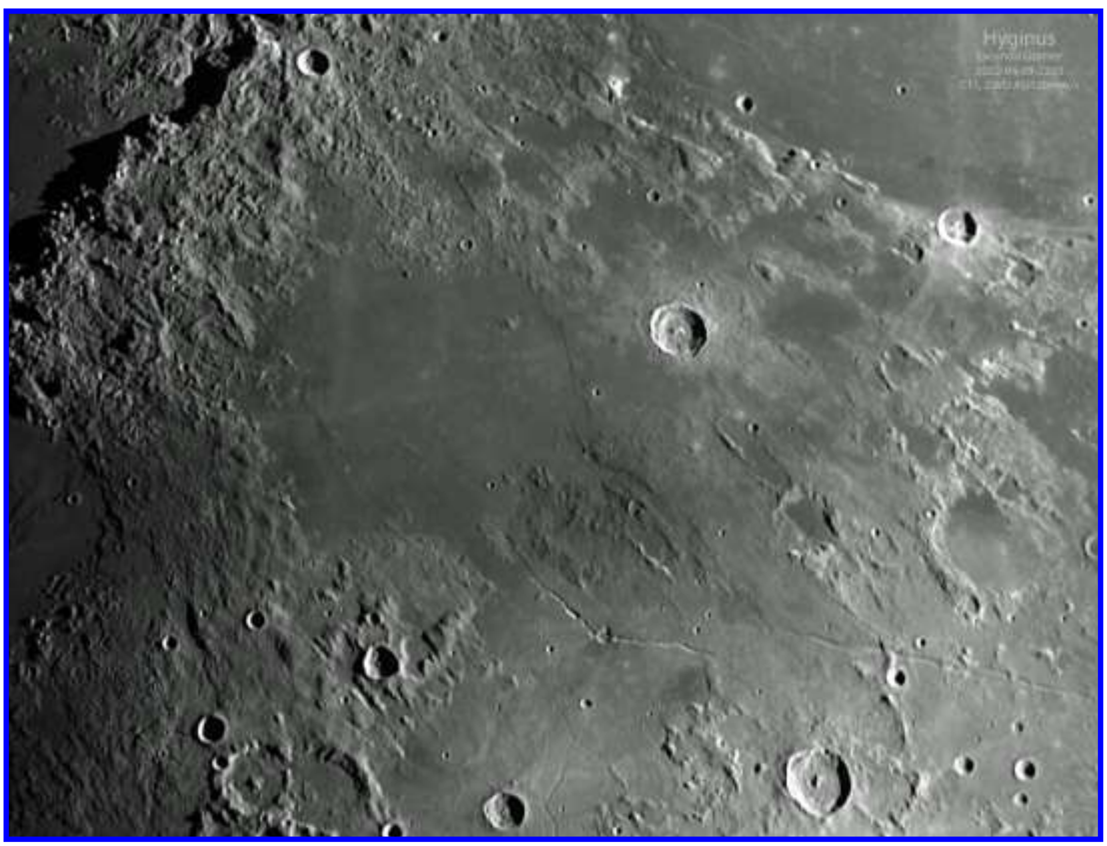


Prinz Rilles, *Howard Eskildsen, Ocala, Florida, USA. 2022 April 13 00:35 UT, colongitude 48.6º. Celestron 9.25 inch Schmidt-Cassegrain telescope, SKYRIS 236M camera. Seeing 6/10, transparency 3/6.*

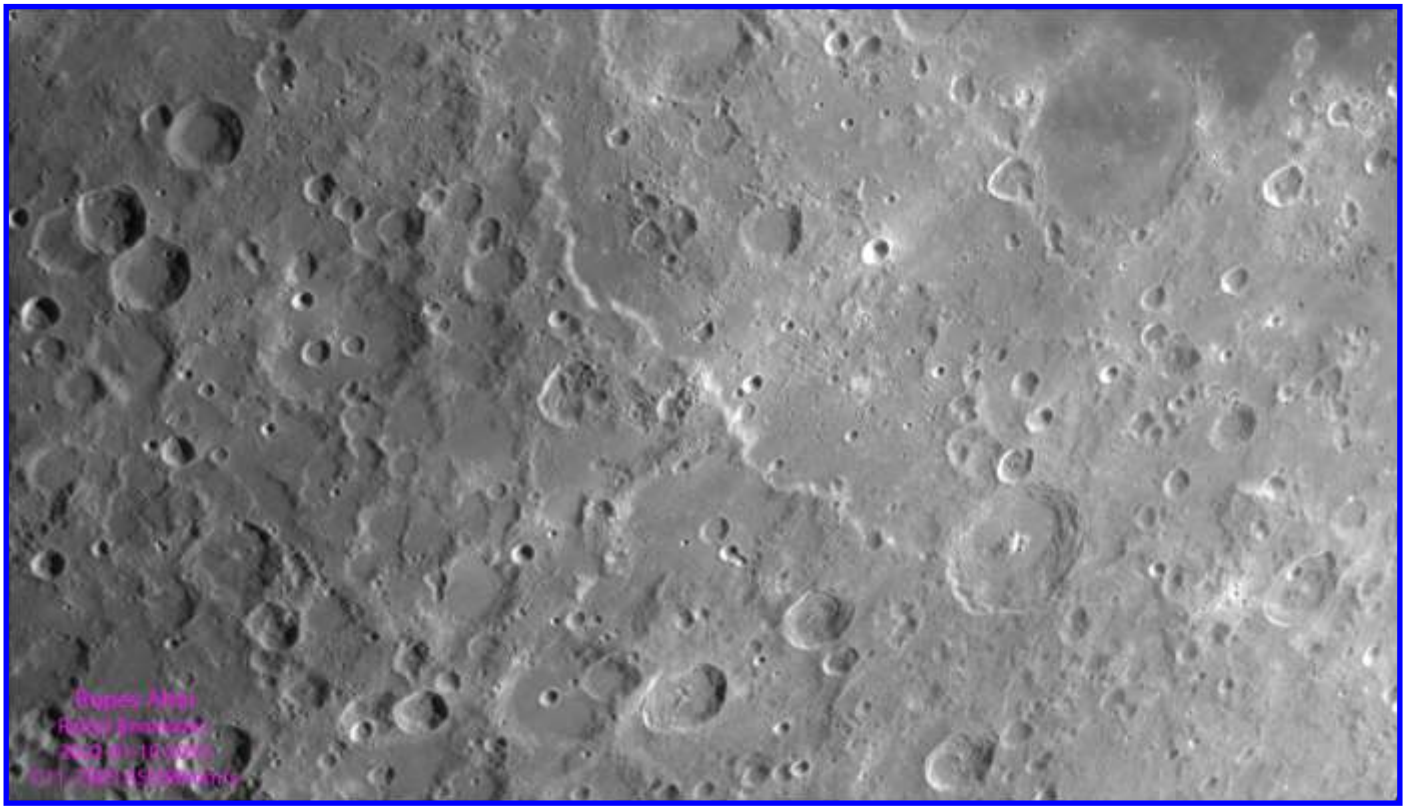
Below, 95% Waxing Gibbous Moon, *Jairo Chavez, Popayán, Colombia. 2022 April 15 01:22 UT. 311 mm Dobsonian truss reflector telescope, Moto E5 Play camera.*



***Nisan Moon**, Rafael Benavides, Posadas Observatory MPC J53, Córdoba, Spain. 2022 April 16 20:30 UT. DSLR Canon 200 -D, Sigma 150-500 mm, f/5-6.3. Seeing 5/10, transparency 3/6.*

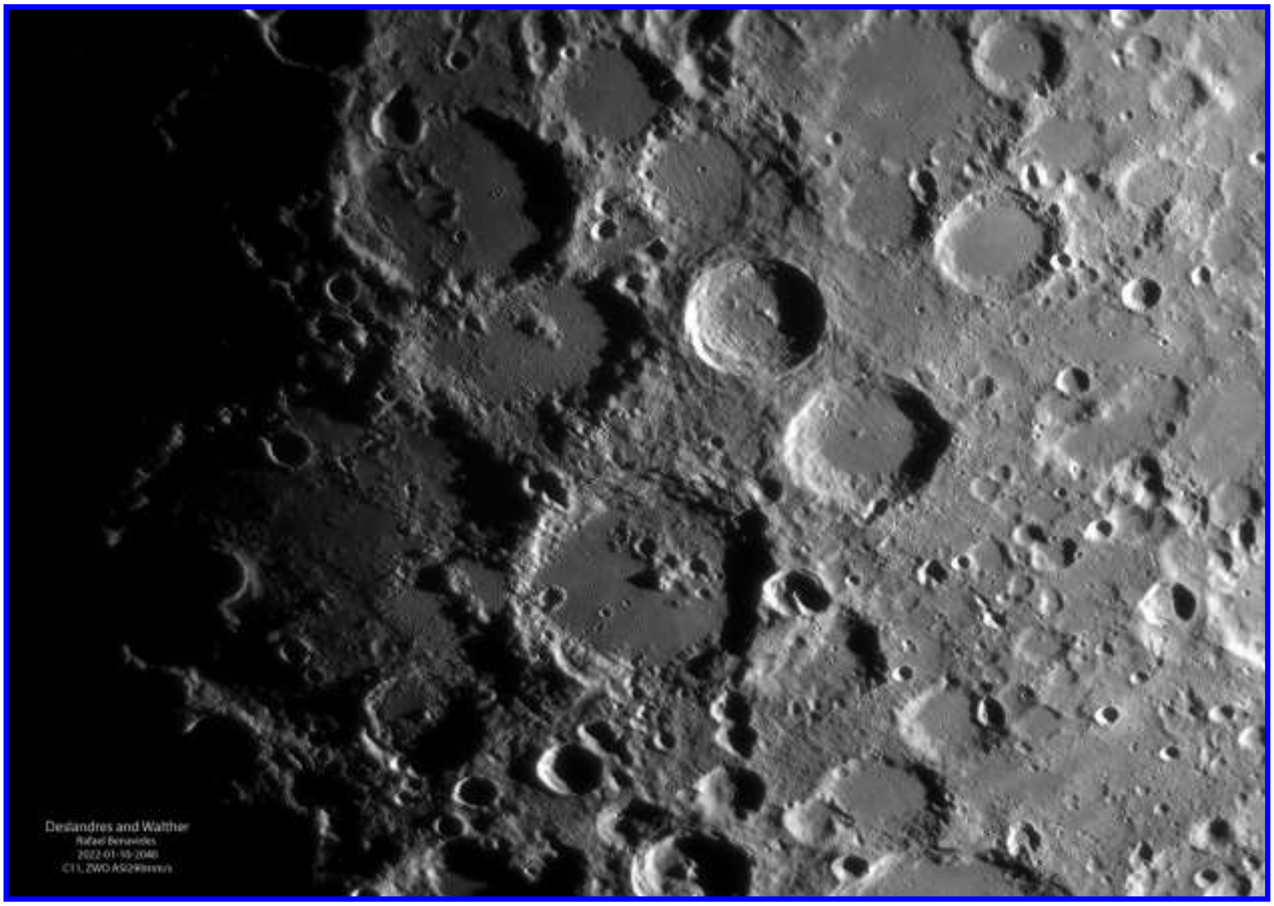


***Hyginus,** Facundo Gramer, AEA, Oro Verde, Argentina. 2022 April 09 22:33 UT. Celestron CPC1100 Schmidt-Cassegrain tel-escope, ZWO ASI120mm/s camera.*

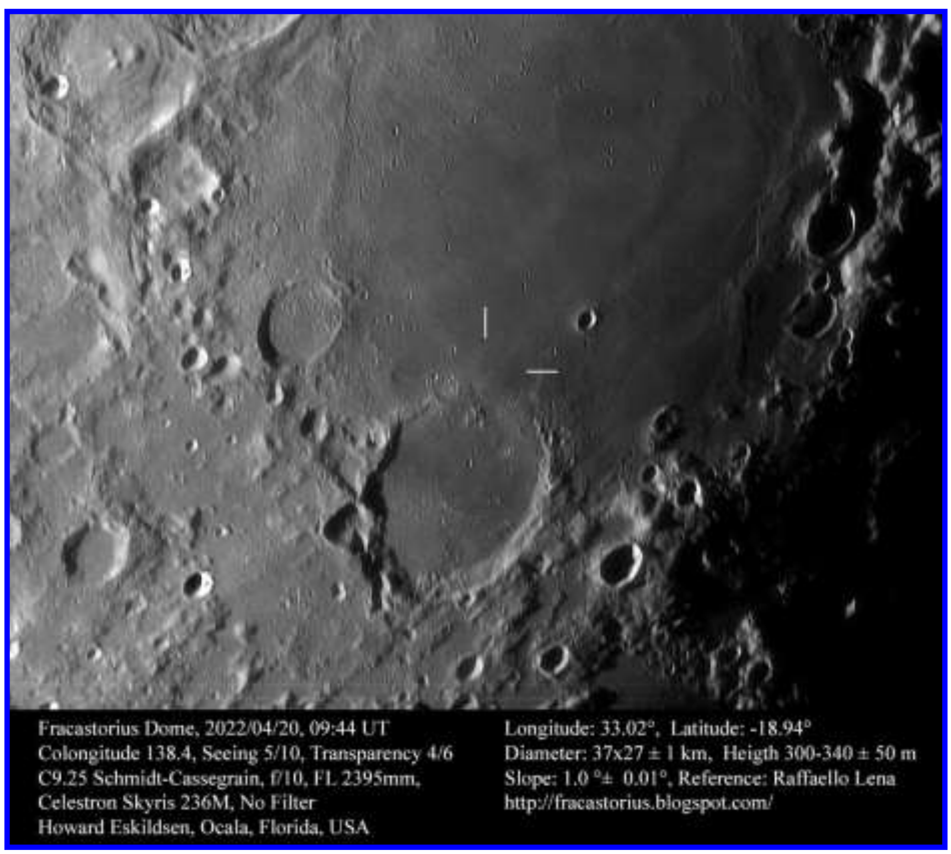


***Rupes Altai**, Rafael Benavides, Posadas Observatory MPC J53, Córdoba, Spain. 2022 January 10 20:52 UT. Celestron 11 inch Schmidt-Cassegrain telescope, Baader Planetarium IR Pass filter, ZWO ASI290mm/s camera. Seeing 8/10, transparency 5/6.*

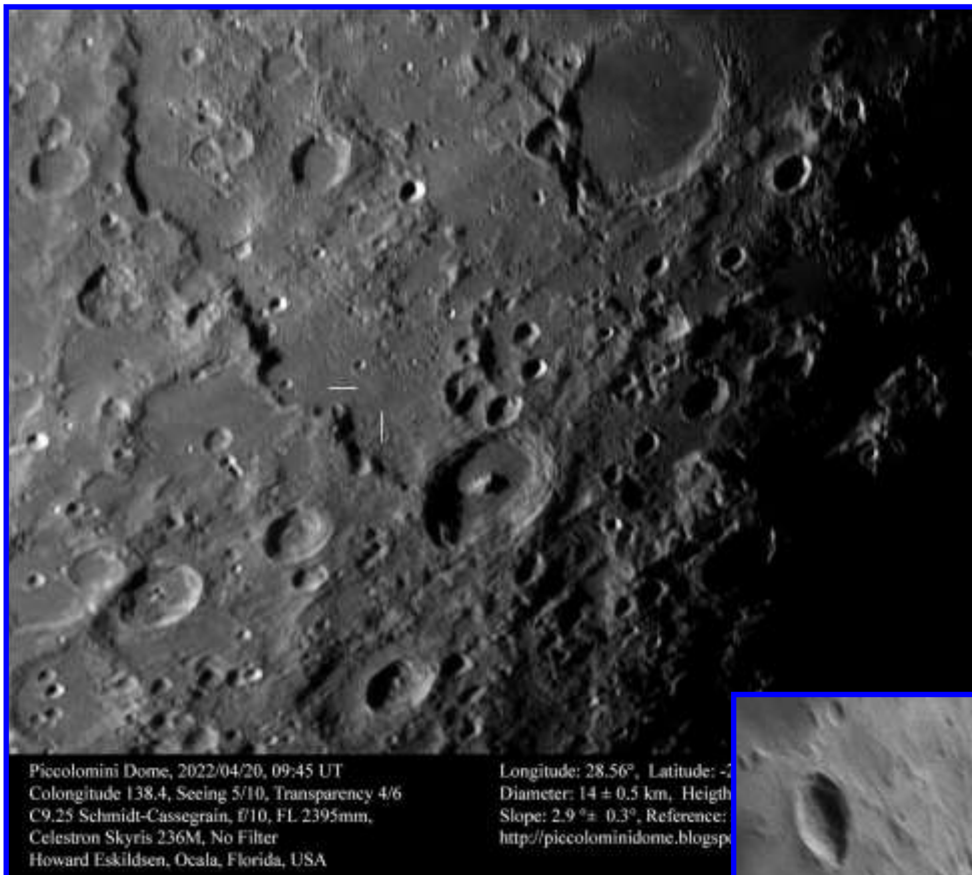
***Mons Piton,** Walter Ricardo Elias, AEA, Oro Verde, Argentina. 2022 April 09 00:04 UT. Celestron CPC1100 Schmidt-Cassegrain telescope, ZWO ASI120mm/s camera.*



***Deslandres and Walther**, Rafael Benavides, Posadas Observatory MPC J53, Córdoba, Spain. 2022 January 10 20:40 UT. Celestron 11 inch Schmidt-Cassegrain telescope, Baader Planetarium IR Pass filter, ZWO ASI290mm/s camera. Seeing 8/10, transparency 5/6.*



***Fracastorius Dome,** Howard Eskildsen, Ocala, Florida, USA. 2022 April 20 09:44 UT, colongitude 138.4°. Celestron 9.25 inch Schmidt-Cassegrain telescope, SKYRIS 236M camera. Seeing 5/10, transparency 4/6.*



Piccolomini Dome, *Howard Eskildsen, Ocala, Florida, USA. 2022 April 20 09:45 UT, colongitude 138.4°. Celestron 9.25 inch Schmidt-Cassegrain telescope, SKYRIS 236M camera. Seeing 5/10, transparency 4/6.*

Petavius, *Fabio Verza, SNdR, Milan, Italy. 2022 April 05 18:17 UT. 12 inch Meade LX200 ACF Schmidt-Cassegrain telescope, Baader Neodymium IR block filter, ZWO ASI290mm camera.*

Lunar Geologic Change Detection Program

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

2022 May

LTP reports: Alexandre Amorim (Brazil) observed Fracastorius on 2022 Apr 21 UT 01:35-02:12 and noted a little bright spot near the center of the otherwise completely shadow filled crater. The bright spot was surrounded by a coma effect. Clouds intervened but by 02:12 the spot was no longer visible, just a thin patch of light close to the crater's center. Observations started when the Moon's altitude was 15° and ended when it was 23° above the horizon. Alexandre used a 90mm f/10 refractor, with 25 & 10mm eyepieces. This should not necessarily be regarded as a LTP as it might just be some hillocks on the floor poking through the sunset terminator. Nevertheless, until we get a repeat illumination observation, we shall assign an ALPO/BAA weight of 1 to this report.

Routine Reports received for March included: Jay Albert (Lake Worth, FL, USA – ALPO) observed: Alphonsus, Aristarchus, Messier, Plato, Proclus, Ross D and Torricelli B. Alberto Anunziato (Argentina – SLA) observed: earthshine, Kies, Moltke, Plato, Proclus and Ross D. Anthony Cook (Newtown – ALPO/BAA) videoed earthshine and imaged several features in visible light and the thermal IR. Walter Elias (Argentina – AEA) imaged: Aristarchus and Grimaldi. Valerio Fontani (Italy – UAI) imaged: Censorinus, Fra Mauro, Herodotus, and Lansberg. Les Fry (West Wales, UK – NAS) imaged: Harpalus, J Herschel, Letronne, Mare Humorum, Mersenius, Prinz and Schiller. Rik Hill (Tucson, AZ, USA – ALPO/BAA) imaged: Clavius, Endymion, and Mare Frigoris. Massimo Giuntoli (Italy – BAA) observed: Cavendish E. Mark Radice (near Salisbury, UK – BAA) imaged: Aristarchus and Gassendi. Trevor Smith (Codnor, UK – BAA) observed: Aristarchus, Herodotus, Lichtenberg, Lyell, Mersenius, Plato, Schickard, and Vallis Schroteri. Bob Stuart (Rhayader, UK – BAA) imaged: Clavius, Copernicus, Gassendi, Hainzel, Mare Frigoris, Mersenius, Ramsden, Schiller, Sinus Iridium, and Vitello. Ivan Walton (Kent, UK – BAA) imaged: Atlas, Gutenberg, Janssen, and Mare Crisium.

Routine Reports Received:
Note that time is unfortunately limited this month for a full analysis, so it will be left mostly up to the reader to compare the original and modern-day observations:

Lyell: On 2022 Mar 07 UT 20:27 Ivan Walton (BAA) imaged this area under some 29 min before, and Trevor Smith observed visually 20:55-21:20UT under similar illumination (±0.5°) to the following report:

Lyell 1972 Nov 10 UT 23:43 Observed by Bartlett (Baltimore, MD, USA, 3" refractor x54, x100, x200S=3, T=5) "At apparent center of floor & edge of morning shadow an elongated, N-S irreg. obj. dull whitish-gray, albedo=4 like a c.p. (photo in Kwasan atlas in 1963 taken at col. 339.3 deg has a faint suggestion of a bright spot in that place- (plate 20) LO IV66 h2 & 73 H2, sun elev. @ 20deg show an even, dark floor with a very small crater right in center -- unresolvable at earth. Kwasan photo's spot could be an artifact" NASA catalog weight=3. NASA catalog ID #1349. ALPO/BAA weight=2.

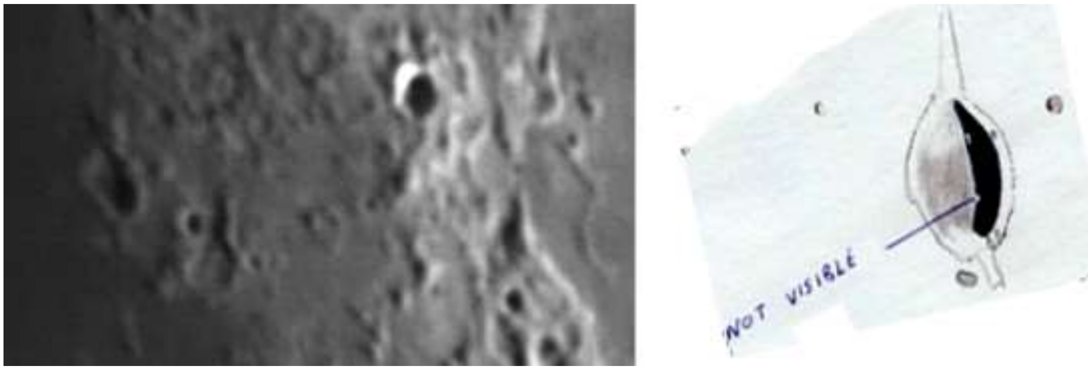


Figure 1. *Lyell on 2022 May 07 and orientated with north towards the top.* ***(Left)*** *As imaged by Ivan Walton (BAA) at 20:27 UT – Lyell is the crater on the far left.* ***(Right)*** *a sketch by Trevor Smith from 20:55-21:20 UT, made using a 16" Newtonian at x247 under Antoniadi III-IV seeing conditions.*

Ivan's image (Fig 1 – Left) gives a good context view of the area. Trevor has a detailed sketch in Fig 1 (Right) and notes that: *"The eastern floor was one third in shadow. The northern floor was lighter in color than the southern interior floor. A prominent lone mountain stood out well to the eastern exterior floor of Palus Somni some 5km or so away from Lyell. On the western border of Lyell's interior black shadow was a noticeable white elongated spot. This was elongated in a north to south direction and looked quite impressive at times of better seeing. It was difficult to say if this was an isolated peak from or close to the east rim on looking at a photograph in my Cambridge Photographic Moon Atlas Map 19A, it shows a linear mt or ridge to the north/east interior rim. I wonder if this is the object I saw. A lone mountain or offset central peak is well shown on the photograph but this is situated further to the south. I could not see this Mt as it was still covered in black shadow. I believe that if I had observed a few moments later then this peak would have been visible as the rising lunar Sun would have just caught its peak protruding through the craters eastern rim shadow! I am not certain that the linear Mt or ridge on the Cambridge photograph is the object depicted in my quick sketch, and to me it may be (the linear ridge) a little too far to the east."*. We have covered this LTP before in the 2021 Apr newsletter. We shall leave the ALPO/BAA weight at 2 for now.

Plato: On 2022 Mar 12 UT 01:35-01:40 and 01:45-02:05 Alberto Anunziato and Jay Albert observed this crater respectively under similar illumination to the following report:

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

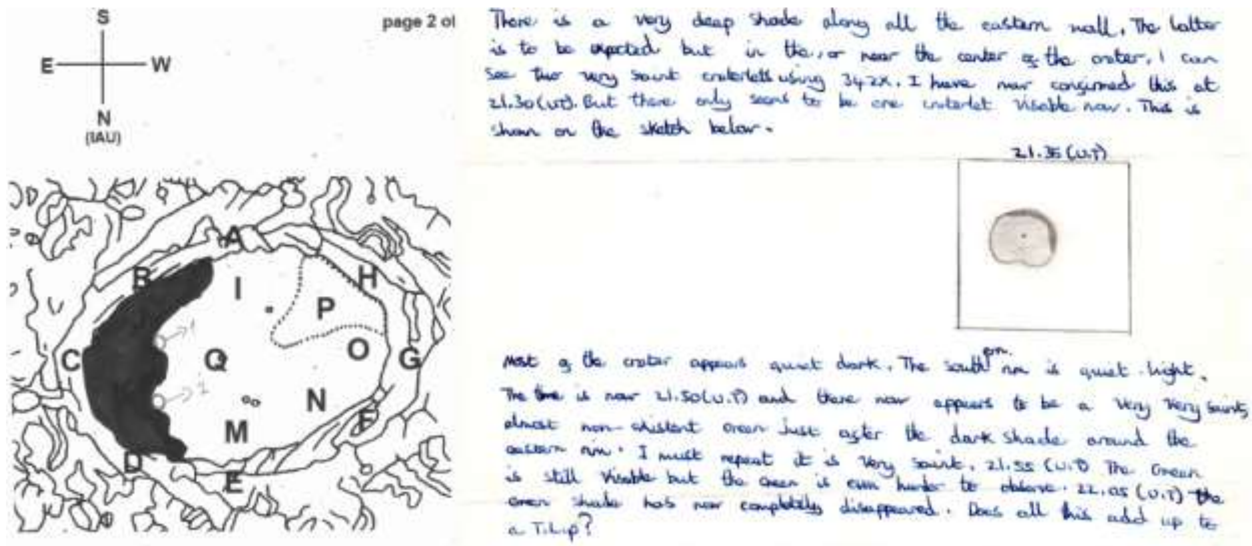


Figure 2. *Plato crater.* ***(Left)*** *shadow extent as observed by Alberto Anunziato on 2022 Mar 12 UT 01:35-01:40 and orientated with north towards the top.* ***(Right)*** *Observation by Nathan King (BAA) from 1983 Apr 21 UT 21:25-22:05. 6-inch f/8 reflector used, seeing was Antoniadi I (very good) and transparency was good. Very little atmospheric spectral dispersion seen. South appears to be to the top in his sketch, but it maybe mirror reversed?*

Jay was using a Celestron NexStar Evolution 8" at x290, the seeing was 7/10, and the transparency was 3rd magnitude. Plato was sharp and detailed with the central, N pair and S craterlets visible. The E wall shadow was prominent and extended about 1/3rd of the distance to the central craterlet. He saw no "faint green color" around the shadow's edge or the E rim. No green or other spurious color was seen in or around the crater. Alberto, using a 105 mm Maksutov-Cassegrain (Meade EX 105) at a magnification of x154 and under 3/10 seeing, commented that just in the limit of the eastern shadow he could see two faint white spots as indicated in Fig 2 (Left). I dug out the original observation by Nathan King (Fig 2 – Right). We have covered repeat illumination observations of this crater before in p26 of the July 2018 newsletter and in p22 of the 2019 June newsletter. I think in view of the quality of the 1983 sketch, I will lower the weight from 2 to 1, though the green color is still intriguing.

Schickard: On 2022 Mar 14 UT 19:47 Bob Stuart (BAA) obtained a regional/context view, at 20:22 UT Les Fry NAS imaged the southern part of this crater, and at 20:55-21:30 Trevor Smith visually observed under similar illumination to the following report:

Schickard 1972 Sep 19 UT 19:45-20:25, 20:00-23:30 Observed by Watkins (Herts., Eng. 4.5" reflector, x225, S=G) Amery (Reading, Eng. 12" reflector?), Fitton (Lancashire, Eng., 8.5" reflector) and Moore (Selsey, Eng., 12.5" reflector, 4.5" refractor 45-225x, S=P) "Luminous, nebulous spot attracted Watkin's att'n. Got brighter. Checked 'scope--not instru. Obj. had greenish-gray color, size @ 15km. Amery & Fitton with blink devices noted nothing unusual at later times (2000-2330h). Aris., Plato, Gass. were neg. at 1930-2025h (date not given, guessed at fr. available info.). Turbulence, lasting secs. at a time." NASA catalog weight=2. NASA catalog ID #1344. ALPO/BAA weight=2.

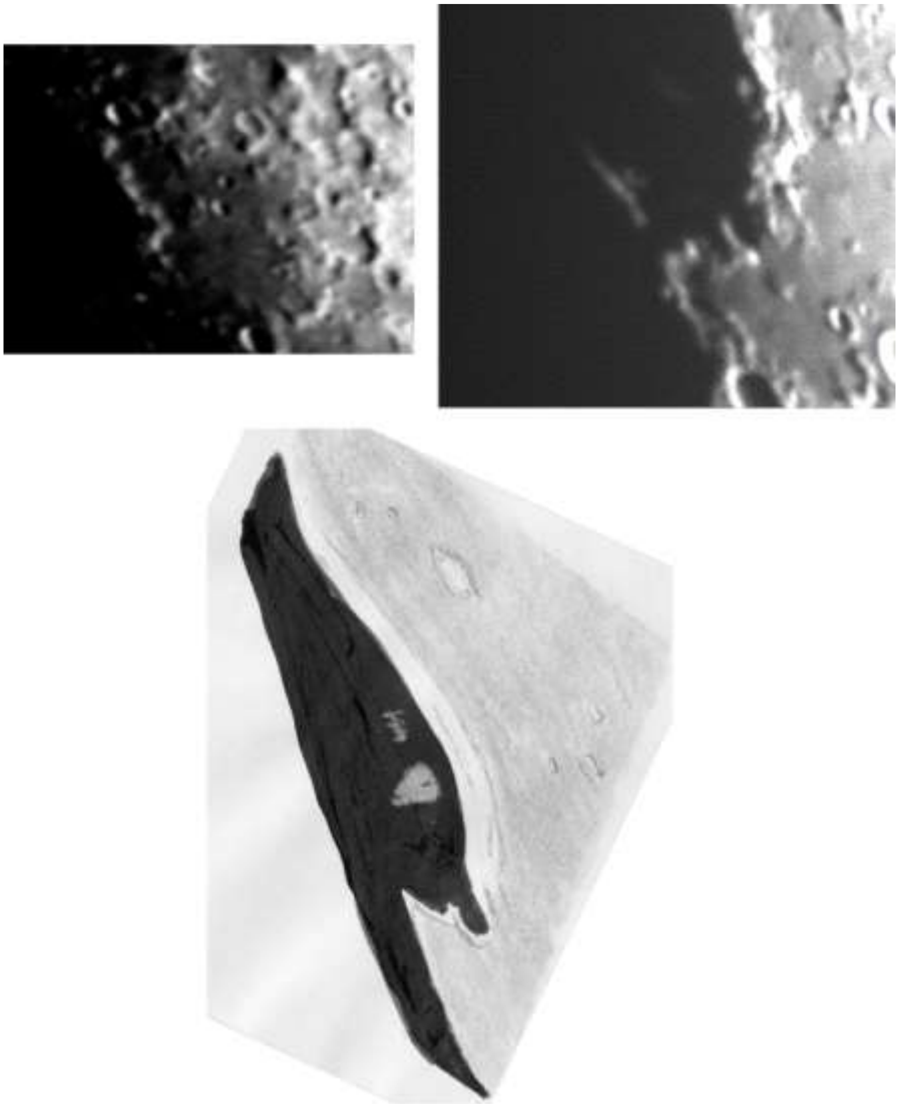


Figure 3. *Schickard as imaged on 2022 Mar 14 and orientated with north towards the top.* ***(Top Left)*** *A section of a regional/context view by Bob Stuart taken at 19:47 UT.* ***(Top Right)*** *An image of the southern half of the crater, taken by Las Fry (NAS) at 20:22 UT.* ***(Bottom)*** *A sketch by Trevor Smith made on 20:55 IT with a 16 inch Newtonian at x247 under Antoniadi III seeing conditions.*

Quite clearly Bob's image (Fig 3 – Top Left) was taken too early to show much of the western rim of the crater, or indeed anything on the shadow filled floor – but at least it illustrates how rapidly sunlight affects this crater at sunrise, as by just 35 minutes later Les has captured (Fig 3 – Top Right) a faint dusky illumination on the floor – presumably as the sunrise rays start to break over the eastern rim? This is undoubtedly what Watkins saw back in 1972, and as would be expected the nebulous spot would have gotten brighter as the Sun rose. It is also confirmed in Trevor's sketch (Fig 3 – Bottom). Then moving on to Trevor's visual account: *"I looked and at once saw a light grey patch emanating from near the north/east rim in a south/west direction. As it cut into the black shadow covering Schickard's floor. For a second or two it took me quickly by surprise but I quickly realized it was simply caused by a relatively low portion of Schickard's north/east rim letting the sunlight through or rather over it. As I watched, the grey area did indeed slightly increase in brightness as the Sun's altitude rose slowly, bringing the lunar dawn to Schickard's floor! A small lone mt was at the N/E edge of this greyish spot which was elongated in a N/E to S/W direction. A few km to the north was a faint greyish area which brightened as I watched. By 21:12 UT it was quite obvious and by 21:20 UT it was almost the same brightness as the first spot. Black long spires of shadow appearing across this second grey patch. A third greyish patch was also visible to the south of the first patch. To my eyes the patches were light grey in color and I could see no green in them."*

It seems that the only oddity about this LTP report was not the luminous patch on the shadow filled floor, but why the spot had a greenish-gray color to it? We shall leave the ALPO/BAA weight at 2 for now.

Herodotus: On 2022 Mar 14 Mark Radice, Valerio Fontani and Trevor Smith all made observations during the following Lunar Schedule request:

BAA Request: Some astronomers have occasionally reported seeing a pseudo peak on the floor of this crater. However, there is no central peak! Please therefore image or sketch the floor, looking for anything near the center of the crater resembling a light spot, or some highland emerging from the shadow. All reports should be emailed to: a t c @ a b e r . a c . u k

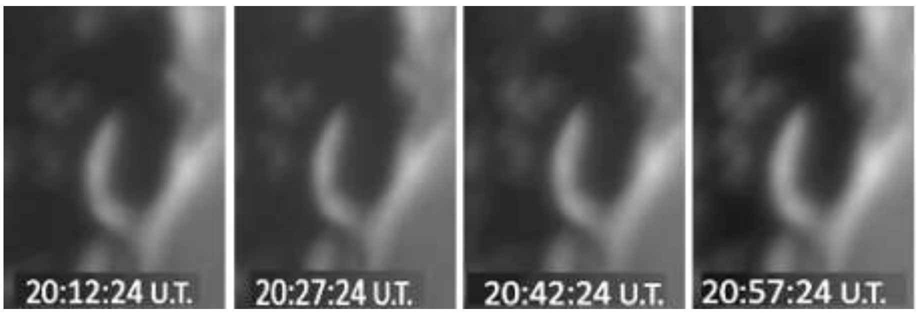


Figure 4. *Herodotus, with north towards the top, as imaged by Valerio Fontani (UAI) on 2022 Mar 14 at the UT's given in the image.*

Aristarchus
14 March 2022 2102UT
C11 f20 ASI224MC 685nm IR filter

Mark Radice RefreshingViews.com

Figure 5. *Aristarchus, with north towards the top, as imaged by Mark Radice (BAA). For the dates, UT, instrument details etc, see the text in the image.*

Trevor observed visually with his 16" Newtonian (Seeing Antoniadi III) from 20:05-20:15 but could not see any sign of a pseudo peak, nor any obscurations or temporary greying of the shadow. Valerio Fontani (UAI produced an image sequence (Fig 4), but again no sign of what was being requested. Finally, Mark Radice obtained a detailed regional view of the area (Fig 5), but again there is no sign of a pseudo peak of lightning in shade of the shadow.

Cavendish E: On 2022 Mar 16 UT 21:00 Massimo Giuntili (BAA) continued to monitor this crater to see if it repeats a flare up in brightness that he saw in the past. On this occasion he observed the northern floor was bright but not brilliant. The seeing was Antoniadi III when using his 120 mm refractor (x200). Col. 78.4, sub sol. lat. 1.3, libration: lat. - 5.59 and long. - 5.

Aristarchus: On 2021 Mar 21 UT 01:29 Walter Elias (AEA) imaged this crater under similar illumination to the following report:

Aristarchus 1989 Dec 16 Darling, alerted by Keyes saw Aris >> brighter obj on moon (as it normally is) Comet ray & N rim of Herod. >> could see no detail - Aris. except two bands, moon was pale yellow (low alt.)with halo around it. Nothing unusual elsewhere. Cameron 2006 catalog extension ID #384 and weight=0. ALPO/BAA weight=1, just in case there is some merit in this report?

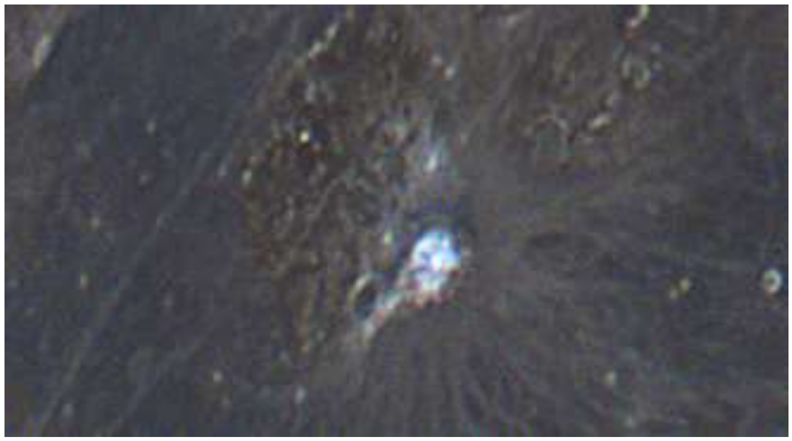


Figure 6. *Aristarchus, with north towards the top, as imaged by Walter Elias (AEA) on 2022 Mar 21 UT 01:20 and orientated with north towards the top.*

As you can see from Fig 6, albeit the resolution is limited, there should be at least four bands visible in Aristarchus, and although there are no other bright features to compare with in the image, the crater does look rather bright – which is normal. In view of the fact that the Moon was of low altitude back in 1989 and indeed was yellow in color as there was a lot of atmosphere in the way, I think we it would be most unusual not to have some detail missing. I will therefore lower the weight back down to the Cameron value of 0, effectively removing it from thew ALPO/BAA LTP database.

General Information: For repeat illumination (and a few repeat libration) observations for the coming month - these can be found on the following web site: http://users.aber.ac.uk/atc/lunar_schedule.htm . By re-observing and submitting your observations, only this way can we fully resolve past observational puzzles. To keep yourself busy on cloudy nights, why not try “Spot the Difference” between spacecraft imagery taken on different dates? This can be found on: http://users.aber.ac.uk/atc/tlp/spot_the_difference.htm . If in the unlikely event you do ever see a LTP, firstly read the LTP checklist on http://users.aber.ac.uk/atc/alpo/ltp.htm , and if this does not explain what you are seeing, please give me a call on my cell phone: +44 (0)798 505 5681 and I will alert other observers. Note when telephoning from outside the UK you must not use the (0). When phoning from within the UK please do not use the +44! Twitter LTP alerts can be accessed on https://twitter.com/lunarnaut .

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

Lunar Calendar May 2022

Date	UT	Event
2	1400	Mercury 1.8° north of the Moon
4	1400	Ceres 0.01° north of Moon, occultation Cape Verde Islands to India
5	1300	Moon at apogee 405,285 km
6		Greatest northern declination +26.9°
9	0021	First Quarter Moon
9		South limb most exposed -6.8°
12		West limb most exposed -7.0°
16	0414	Full Moon TOTAL LUNAR ECLIPSE N and S America
17	1500	Moon at perigee 360,298 km
17	2300	Moon 0.6° south of Neptune
19		Greatest southern declination -27.0°
22	1843	Last Quarter Moon
22	0500	Saturn 4° north of Moon
22		North limb most exposed +6.8°
24	1900	Mars 3° north of Moon
24		East limb most exposed +6.7°
25	0000	Jupiter 3° north of Moon
27	0300	Venus 0.2° north of Moon, occultation Madagascar to Micronesia
28	1400	Uranus 0.3° north of Moon, occultation South America to Africa
30	1130	New Moon, lunation 1230

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

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

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: Wonders of the Full Moon

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 June 2022 Focus-On will be the craters rayed craters of the Moon's northern hemisphere. 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

FUTURE FOCUS ON ARTICLES:

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

Subject	TLO Issue	Deadline
Bright Rays North	**July 2022**	**June 20, 2022**
Bright Rays South	**September 2022**	**August 20, 2022**
Ever Changing Eratosthenes	**November 2022**	**October 20, 2022**

Focus-On Announcement

WONDERS OF THE FULL MOON

The full moon is loved by almost everyone, except for the majority of astronomers. But when the near side is illuminated almost completely by frontal light, it is the opportunity to enjoy a unique spectacle: the bright ray craters. It is a field of study favorable to amateur observation with scientific value: how far does each bright ray reach? Are some rays brighter than others coming from the same crater? Are they altered by the relief over which they pass? And many other questions that ALPO's Bright Lunar Rays Project has as its objectives.

Bright Lunar Rays Project Objectives:
https://moon.scopesandscapes.com/ALPO%20Rays%20Project.htm

List of rayed craters and other non-crater features:
https://moon.scopesandscapes.com/alpo-rays-table.pdf

JULY 2022 ISSUE-Due **June 20th, 2022**: **NORTHERN BRIGHT RAY CRATERS**
SEPTEMBER 2022 ISSUE-Due **August 20th, 2022: SOUTHERN BRIGHT RAY CRATERS**

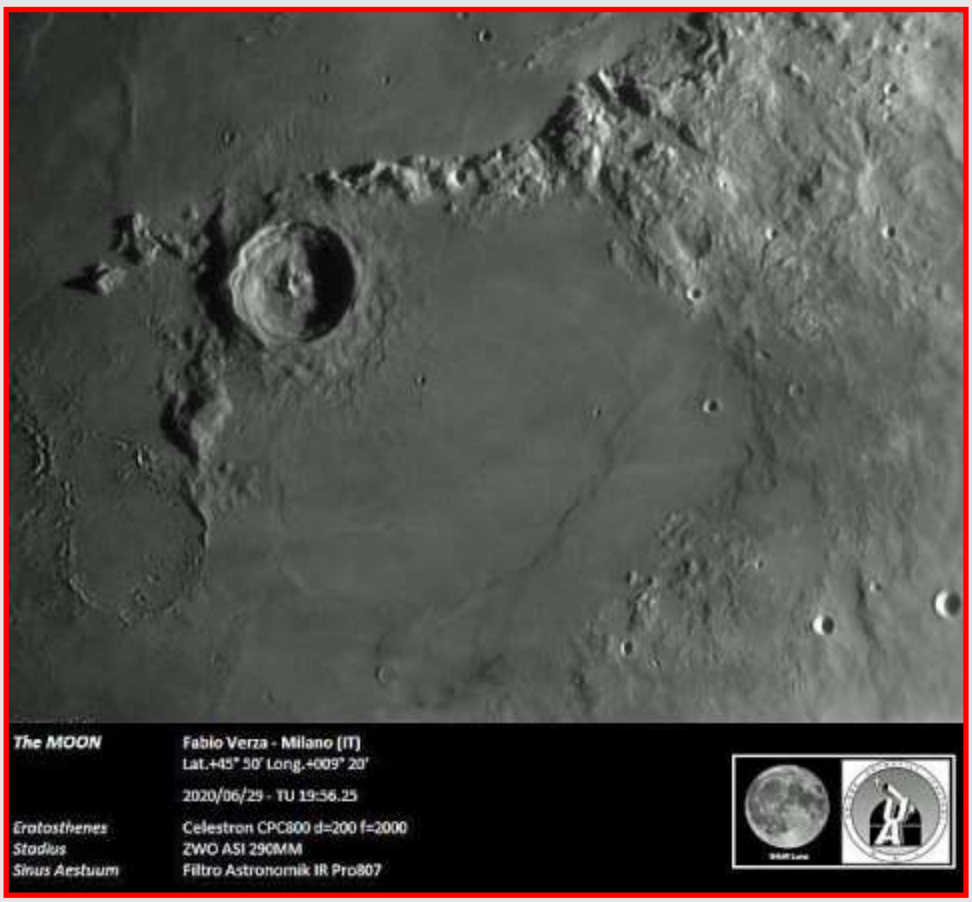
Leandro Sid

Focus-On Announcement

EVER CHANGING ERATOSTHENES

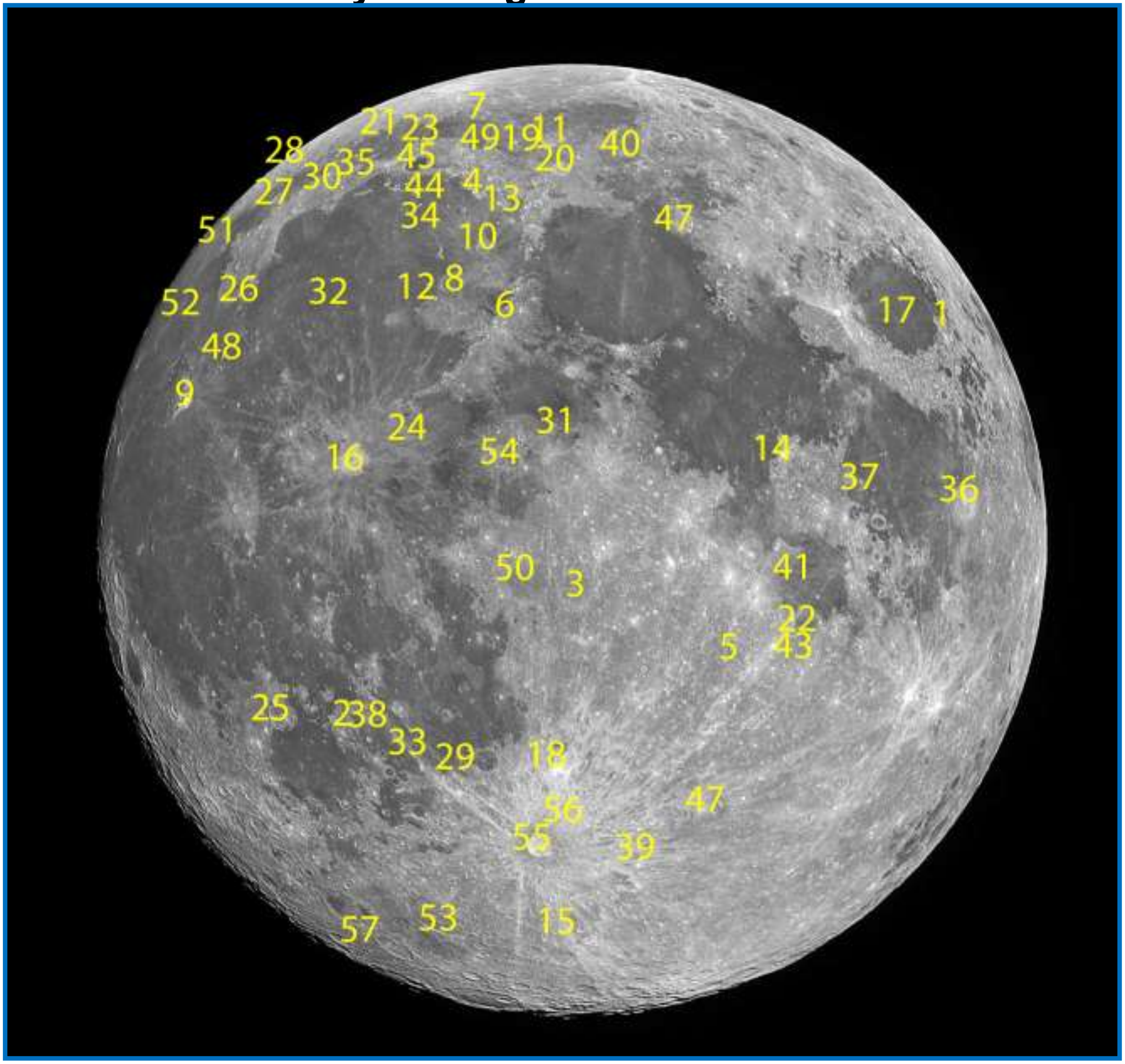
Eratosthenes is a model impact crater, albeit "unfairly" overshadowed by the younger Copernican craters. It is interesting to observe its rim, well defined and with linear segments, its spectacular terraced walls, the central peaks, its irregular and fractured floor full of mounds, and its majestic ramp-shaped ejecta field, formerly known as “glacis”. Eratosthenes is very changeable, it is seen as a deep well of darkness near the terminator, passing through its phase of maximum splendor in the first or last quarter and to practically disappear in full moon, buried by the ejecta of its younger relative, Copernicus. And in addition to Copernicus, Eratosthenes has other very interesting sights: the complex topography of Sinus Aestuum and the grandeur of the Montes Apenninus.

NOVEMBER 2022 ISSUE-**Due October 20th, 2022: ERATOSTHENES**



Fabio Verza

Key to Images In This Issue



1. Agarum, Promontorium
2. Agatharchides
3. Albategnius
4. Alpes, Montes
5. Altai, Rupes
6. Apenninus, Montes
7. Archytas
8. Archimedes
9. Aristarchus
10. Aristillus
11. Aristoteles
12. Beer
13. Cassini
14. Censorinus
15. Clavius
16. Copernicus
17. Curtis
18. Deslandres
19. Egede
20. Eudoxus
21. Fontenelle
22. Fracastorius
23. Frigoris, Mare
24. Gambart
25. Gassendi
26. Gruithuisen
27. Harpalus
28. Herschel, J.
29. Hesiodus
30. Horrebow
31. Hyginus
32. Imbrium, Mare
33. Kies
34. Kirch
35. la Condamine
36. Langrenus
37. Lubbock
38. Marth
39. Maurolycus
40. Mortis, Lacus
41. Nectaris, Mare
42. Petavius
43. Piccolomini
44. Piton, Mons
45. Plato
46. Pontanus
47. Posidonius
48. Prinz
49. Protagoras
50. Ptolemaeus
51. Roris, Sinus
52. Schiaparelli
53. Schiller
54. Triesnecker
55. Tycho
56. Walther