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ALPO
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THE LUNAR OBSERVER

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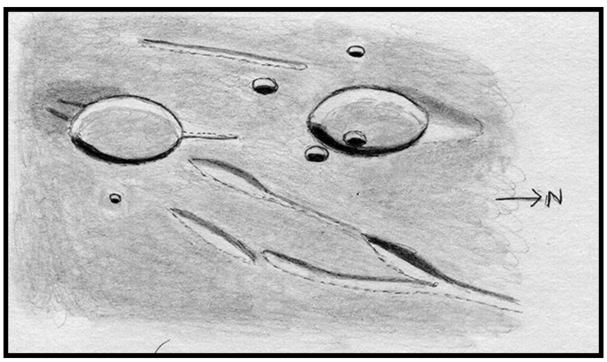
RECENT BACK ISSUES: http://moon.scopesandscapes.com/tlo_back.html

FEATURE OF THE MONTH – JANUARY 2019
CARDANUS & KRAFFT



Sketch and text by Robert H. Hays, Jr. - Worth, Illinois, USA
September 24, 2018 04:40-05:04 UT, 15 cm refl, 170x,
seeing 7/10, transparence 6/6.

I drew these craters and vicinity on the night of Sept. 23/24, 2018. The moon was about 22 hours before full. This area is in far western Oceanus Procellarum, and was favorably placed for observation that night. Cardanus is the southern one of this pair and is of moderate depth. Krafft to the north is practically identical in size, and is perhaps slightly deeper. Neither crater has a central peak. Several small craters are near and within Krafft. The crater just outside the southeast rim of Krafft is Krafft E, and Krafft C is nearby within Krafft. The small pit to the west is Krafft K, and Krafft D is between Krafft and Cardanus. Krafft C, D and E are similar sized, but K is smaller than these. A triangular-shaped swelling protrudes from the north side of Krafft. The tiny pit, even smaller than Krafft K, east of Cardanus is Cardanus E. There is a dusky area along the southwest side of Cardanus. Two short dark strips in this area may be part of the broken ring Cardanus R as shown on the. Lunar Quadrant map. A low straight ridge runs from near the southwest edge of Krafft to west of Cardanus. It looks like a narrow ray, but it has weak shadowing. The Lunar Quadrant map shows Rima Krafft covering the distance between Cardanus and Krafft, but I saw only the southern half of this feature. It appeared very narrow and straight. Two low ridges start northeast of Cardanus and merge east of Krafft. These also appear raylike except for shadowing. The brightest area and darkest shadowing among these ridges is just west of the junction toward Krafft. Another conspicuous segment is just east of the rille. The raylike feature between these segments is much paler, but does not disappear completely. The ray/ridge to the east has a gap about a third the way from its start to the junction.

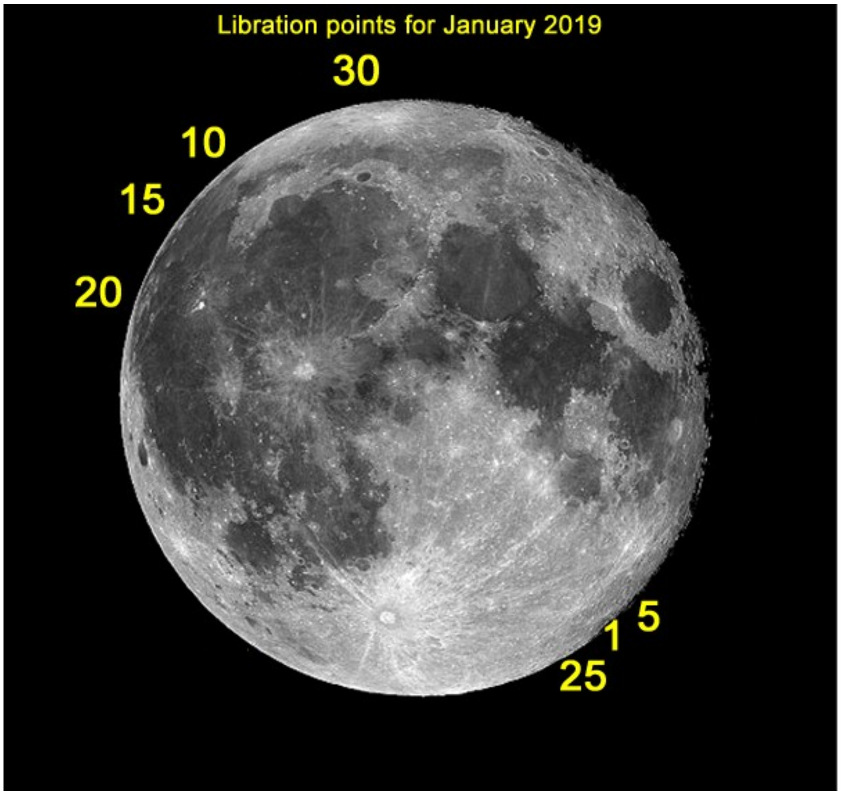
LUNAR CALENDAR

Jan	01	16:50	Moon-Venus: 1.4° S
	03	02:37	Moon-Jupiter: 3.4° S
	05	13:46	Moon South Dec.: 21.6° S
	05	20:28	New Moon
	05	20:41	Partial Solar Eclipse
	06	19:08	Moon Descending Node
	08	23:29	Moon Apogee: 406100 km
	14	01:46	First Quarter
	19	18:20	Moon North Dec.: 21.5° N
	20	17:48	Moon Ascending Node
	21	00:12	Total Lunar Eclipse
	21	00:16	Full Moon
	21	14:58	Moon Perigee: 357300 km
	27	16:11	Last Quarter
	30	18:54	Moon-Jupiter: 3° S
	31	12:36	Moon-Venus: 0.1° S

Feb	01	19:48	Moon South Dec.: 21.5° S
	02	02:18	Moon-Saturn: 0.7° S
	03	01:35	Moon Descending Node
	04	16:04	New Moon
	05	04:26	Moon Apogee: 406600 km
	12	17:26	First Quarter
	16	04:56	Moon North Dec.: 21.6° N
	17	04:42	Moon Ascending Node
	19	04:06	Moon Perigee: 356800 km
	19	10:53	Full Moon
	26	06:28	Last Quarter
	27	09:17	Moon-Jupiter: 2.5° S

LUNAR LIBRATION

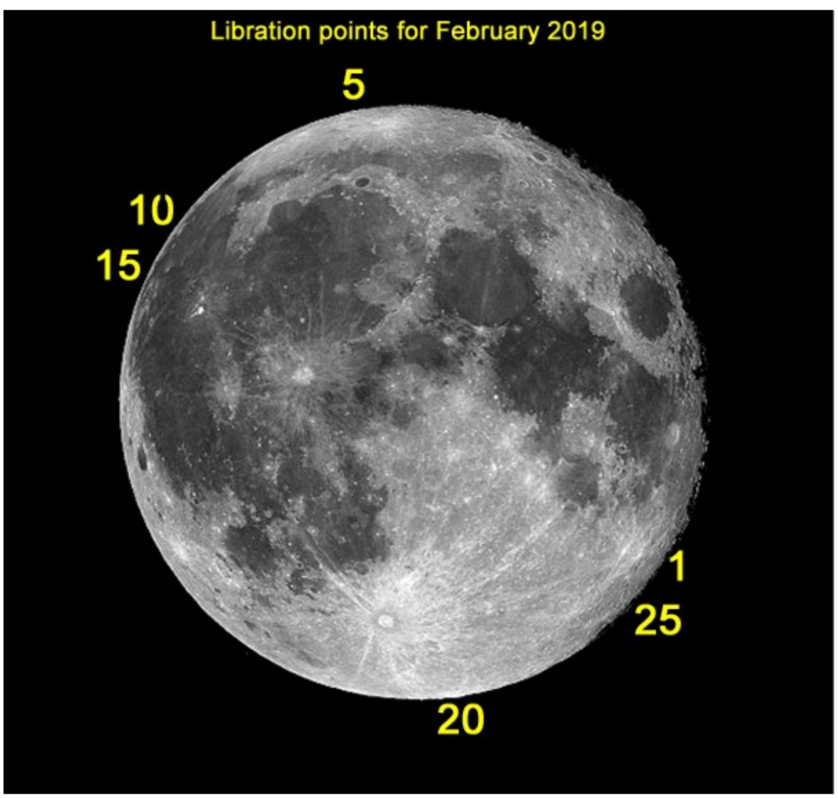
JANUARY - EEBRUARY 2019



Size of Libration

01/01	Lat	-06°07'	Long	+06°56'
01/05	Lat	-02°24'	Long	+03°53'
01/10	Lat	+04°18'	Long	-03°20'
01/15	Lat	+07°15'	Long	-08°33'
01/20	Lat	+02°12'	Long	-04°10'
01/25	Lat	-05°32'	Long	+05°51'
01/30	Lat	-04°52'	Long	+07°24'

NOTE:
Librations are based on a geocentric position at 0 hr. Universal Time.



Size of Libration

02/01	Lat	-03°07'	Long	+05°01'
02/05	Lat	+02°24'	Long	-00°13'
02/10	Lat	+06°41'	Long	-06°23'
02/15	Lat	+03°51'	Long	-07°17'
02/20	Lat	-04°19'	Long	+00°46'
02/25	Lat	-06°13'	Long	+07°28'

NOTE:
Librations are based on a geocentric position at 0 hr. Universal Time.

2019 ALPO MEETING

The 2019 Annual Meeting of the Association of Lunar and Planetary Observers will be held, combined with the South East Region Astronomical League, at Gordon College in Barnesville, GA the weekend of July 12-14.

Additional information will be available in the JALPO and included here as it becomes available.

AN INVITATION TO JOIN THE A.L.P.O.

The Lunar Observer is a publication of the Association of Lunar and Planetary Observers that is available for access and participation by non-members free of charge, but there is more to the A.L.P.O. than a monthly lunar newsletter. If you are a nonmember you are invited to join our organization for its many other advantages.

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

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

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

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 which, for the lunar gallery is:

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 "-")

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

Copernicus_2018-04-25-0916.jpg
(Feature Copernicus, Year 2018, Month April, Day 25, UT Time 0916)

Additional information requested for lunar images (next page) should 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 correction prior to uploading the image(s). However, if they come in the recommended format, it would reduce the effort to post the images a lot.

Observers who submit digital versions of drawings should scan their images at a resolution of 72 dpi and save the file as a 8 1/2' x 11? or A4 sized picture.

Finally a word to the type and size of the submitted images. It is recommended that the image type of the file submitted be jpg. Other file types (such as png, bmp or tif) may be submitted, but may be converted to jpg at the discretion of the coordinator. Use the minimum file size that retains image detail (use jpg quality settings. Most single frame images are adequately represented at 200-300 kB). However, images intended for photometric analysis should be submitted as tif or bmp files to avoid lossy compression.

Images may still be submitted directly to the coordinators (as described on the next page). However, since all images submitted through the on-line gallery will be automatically forwarded to the coordinators, it has the advantage of not changing if coordinators change.

When submitting observations to the A.L.P.O. Lunar Section

In addition to information specifically related to the observing program being addressed, the following data should be included:

Name and location of observer
Name of feature
Date and time (UT) of observation (use month name or specify mm-dd-yyyy-hhmm or yyyy-mm-dd-hhmm)
Filter (if used)
Size and type of telescope used Magnification (for sketches)
Medium employed (for photos and electronic images)
Orientation of image: (North/South - East/West)
Seeing: 0 to 10 (0-Worst 10-Best)
Transparency: 1 to 6

Resolution appropriate to the image detail is preferred-it is not necessary to reduce the size of images. *Additional commentary accompanying images is always welcome.* **Items in bold are required. Submissions lacking this basic information will be discarded.**

Digitally submitted images should be sent to both
Wayne Bailey – wayne.bailey@alpo-astronomy.org
and Jerry Hubbell –jerry.hubbell@alpo-astronomy.org

Hard copy submissions should be mailed to Wayne Bailey at the address on page one.

CALL FOR OBSERVATIONS:
FOCUS ON: Apollo 14 Region – Fra Mauro

Focus on is a bi-monthly series of articles, which includes observations received for a specific feature or class of features. The subject for the **March 2019** edition will be the **Apollo 14 Region – Fra Mauro.** Observations at all phases and of all kinds (electronic or film based images, drawings, etc.) are welcomed and invited. Keep in mind that observations do not have to be recent ones, so search your files and/or add these features to your observing list and send your favorites to (both):

Jerry Hubbell –jerry.hubbell@alpo-astronomy.org
Wayne Bailey - wayne.bailey@alpo-astronomy.org

Deadline for inclusion in the Apollo 14 Region – Fra Mauro article is Feb. 20, 2019

FUTURE FOCUS ON ARTICLES:

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

Subject	TLO Issue	Deadline
Apollo 12 Region – Ocean of Storms	May 2019	April 20, 2019
Apollo 11 Region – 50th Anniversary – Sea of Tranquility	July 2019	June 20, 2019

Focus On: Apollo 15 Region – Mare Imbrium & Hadley Rille

Jerry Hubbell
Assistant Coordinator, Lunar Topographical Studies

This is the third in a series of TLO Focus On articles on the Apollo lunar landing missions that will end on the 50th anniversary of the Apollo 11 mission in the July 2019 issue of TLO. To learn about the background and thinking behind this series of articles to commemorate the Apollo program see the September 2018 TLO Focus On article.

Figure 1*. Apollo 15 Mission Patch, NASA image.*

Apollo 15 was launched on July 26, 1971, at 9:34 AM EDT from the Kennedy Space Center. The crew consisted of Commander David Scott, Command Module Pilot Alfred Worden, and Lunar Module Pilot James Irwin. (Figure 2.) After landing at the foot of Mount Hadley in the Lunar Apennines, on July 30, 1971, at 6:16 PM EDT the lunar module crew spent a little more than 3-days on the surface and performed 4 EVA's during their stay.

Figure 2*. Apollo 15 Astronauts. (from left to right, David Scott, Alfred Worden, and James Irwin. NASA image.*

Apollo 15 was the first of the Apollo "J" missions capable of a longer stay time on the moon and greater surface mobility using the first lunar rover on the moon. The mission objectives were to explore the Hadley-Apennine region, set up and activate lunar surface scientific experiments, evaluate new Apollo equipment, and conduct lunar orbital experiments and photographic the lunar surface from orbit.

In the report of the Apollo 15 mission by the U.S. Geological Survey provided by the NASA Lunar and Planetary Institute, the following was investigated:

> *"Three major geologic features were visited during the Apollo 15 mission. These were defined on pre-mission maps compiled from Lunar Orbiter photographs and include: 1) the mare surface of Palus Putredinis in an area that is crossed by a faint ray from either of the craters Aristillus or Autolycus, 2) the Apennine front, and 3) Hadley Rille (fig. 3). It was expected that the mare material would be primarily basalt with some contribution of material from the ray that crosses the mare surface, and that the front might be blanketed by ejecta, probably breccias, from the Imbrium basin. It was also postulated that some material of the front may have been derived from bedrock beneath the blanketing material which was excavated by cratering processes."*

The Apollo Field Geology Investigation Team provides the following summary:

"The Apollo 15 mission produced both expected and unexpected results. As expected, mare basalt samples were collected on the mare plains. No evidence was found to change the pre-mission interpretation of Hadley Rille as a collapsed lava tube or channel. Mare basalts were also sampled almost in situ at the rille edge and the only observations of in situ bedrock ever made on the Moon were those on the Hadley Rille wall. The mare basalts form two distinct chemical groups, both of which have the same age (3.3 b.y.), Srisotopic characteristics, and rare-earth element patterns. The one group, olivinenormative, contains many vesicular specimens, and shows an olivine fractionation trend. Samples are mainly medium- to coarse-grained. The other group, quartz-normative, is pigeonite-phyric and includes both vitrophyric and coarse-grained examples. However, it shows little fractionation at all. A few other mare basalts may represent distinct flows. An unexpected find was emerald green glass, which is a mare volcanic product. It is primitive in chemistry and isotopic characteristics but has an age similar to the mare basalts. It is ubiquitous, but most common on the Apennine Front where it is locally present as fairly pure clods. Several slightly but distinctly different chemical subgroups of this very low-Ti glass occur. Two other volcanic glass types of grossly different chemistry, yellow intermediate-Ti and red high-Ti, are present at the site but are dispersed deposits."

There are several popular targets for observing and imaging in the Apennine/Hadley Rille region of the moon. Craters Archimedes (50 miles, 83-km) , Aristillus (33 miles, 55-km), and Autolycus (24 miles, 40-km) are easy targets for smaller telescopes. The smaller craters Conon (13 miles, 22-km), Galen (6 miles, 10-km), and Aratus (6 miles, 10-km) are excellent targets for larger telescopes.

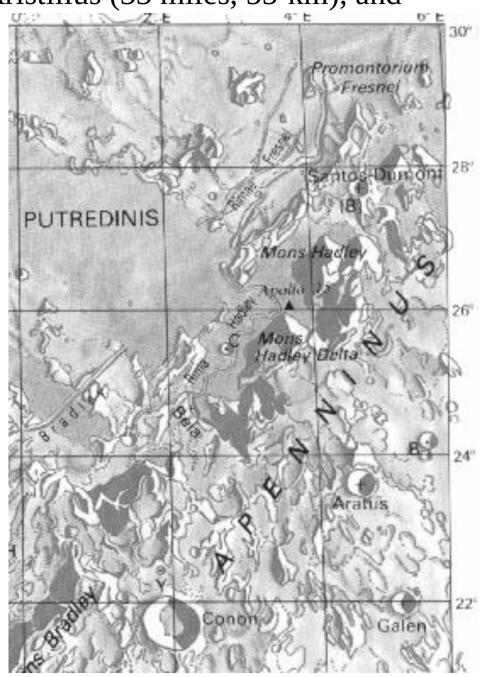


Figure 3. *Chart of the Apollo 15 landing area from Apollo 16 Mission (summary) https://curator.jsc.nasa.gov/lunar/catalogs/apollo15/part1/apollo15mission.pdf.*

The members of the Madrid Astronomy Society (*Alberto Martos, Jorge Arranz, Carlos de Luis and Fernando Bertran)* contributed several images and an extensive description of their observations. Here is a sample describing Figure 6. (photo 1 in the description).

"The sinuous aspect of the rille is clearly visible in photos 1 and 5. At least from its origin, at the foot of an anonymous peak located West of Mons Bradley, and along a half of the 80 km meandering groove carved in the Apennine Front, that passes by the landing site of Apollo 15, where it turns to North downhill, until it reaches a long anonymous massif enclosed by Rimae Fresnel, as if it were the moat of a castle. From this point on, it runs Northwards to Palus Putredinis, where it disappears, the rille narrows or flattens, so that it is not visible in our pictures. Nowadays, the most common opinion held by selenographers about the origin of this rille, points towards a collapsed lava tunnel. This lava tunnel had begun on a graben, whose best vestige today is Mons Hadley Delta. The existence of a pre-Imbrium graben can explain why the splendid orography of the Montes Apenninus does not surround the entire rim of

the basin, but only the southeastern sector, where this graben should have been located before its destruction by the Imbrium impact. Another vestige of its existence is the Apennine platform, which holds the group of concentric clefts, as Rima Bradley, Rima Hadley and Rimae Fresnel."

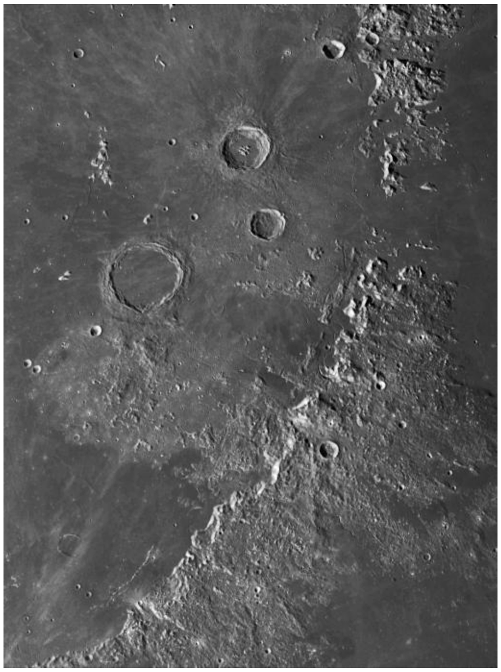


***Figure 4**. Apollo 15 Lunar Apennines/Hadley Rille, David Teske, Louisville, Mississippi, USA. 21 September 2016 0958 UT. Colongitude 49.0°, seeing 5/10, transparency 6/6, Celestron 9.25-inch Edge HD telescope, Mallincam GMTm camera.*

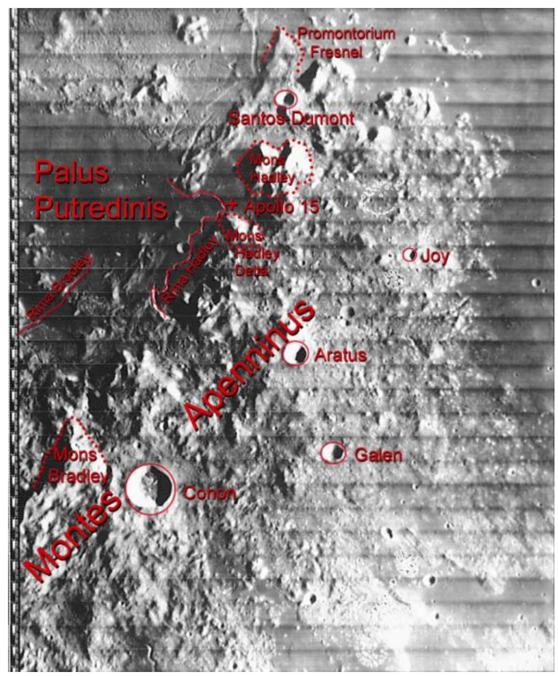


Figure 5. Apollo 15 Landing Site – Descartes and Cayley Plains, Lunar Orbiter Photo Number IV-102-H3

***Figure 6**. Craters Archimedes, Aristillus, and Autolycus, Alberto Martos, Jorge Arranz, Carlos de Luis and Fernando Bertran, Madrid, Spain, 12 January 2011 1658 UT, Newtonian 20 cm f/7.2, Philips TouCam Pro CCD, Seeing 8/10, Transparency 5/6, north/up, east/right.*

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THE APOLLO 15 LANDING SITE AT MONS HADLEY DELTA (A FEAT NOT-WIDELY-KNOWN)

Alberto Martos, Jorge Arranz, Carlos de Luis and Fernando Bertran
Madrid Amateur Astronomy Society.

"After Apollo 17, my favorite is doubtlessly Apollo 15". These words spoken by someone of us who worked in the Madrid tracking station during the Apollo 15 voyage, summarize the results of a critical analysis on the scientific performance of the six Apollo expeditions to the Moon (we prefer the word "expedition", applied to exploration trips to the Moon, rather than the word "mission", which sounds much more military). The flight of Apollo 15 was the first trip of the Apollo "J" type expeditions, with letter "J" standing for a long journey on the Moon surface (2 days and 18 hours, for which we are concerned). Our Apollo 15 preference is based on its main achievements, which can be summarized as follows: first landing far from the lunar equator, at 26 deg North or 790 km (500 mi) away; first standing extra-vehicular activity (SEVA) before setting foot in the lunar surface, consisting of a landscape description to the geologists seated at the Control Center, in Houston, while standing up by the upper hatch of the Lunar Module; deployment of first lunar roving vehicle (LRV) to improve their exploration mobility; roaming 28 km (17 mi) across the lunar surface, surveying three widely apart geological targets, to collect 77 kg (170 lb) of lunar samples (rocks) from three kinds of lunar soils, highlands (plutonic rocks, breccias and impact melts), maria (green glass samples so far unknown and basalts) and Rima Hadley (volcanic lava), as well as sand and dust; finding the oldest rock returned to Earth until then (the Genesis rock, some 4 billion year old); deployment of a third autonomous laboratory ALSEP (Apollo Lunar Surface Experimental Package) on the surface; broadcasting on TV an experimental rehearsal of Galileo's "free-fall" speculation; first launch of a sub-satellite (Particles and Fields Sub-Satellite, or P&FS) from lunar orbit, to explore the lunar environment; and mapping for first time the UV and X-ray reflectance characteristics of the lunar soil, along the ground-path of the orbiting spacecraft, with spectral cameras attached to the SIM (Scientific Instrument Module) bay of the Service Module. This last feature raised to 5 the number of EVAs (Extra Vehicular Activities) carried out by the crew, and this 5th activity being the first EVA accomplished by the CSM (Command and Service Module) pilot.

What made Apollo 15 performance so superior to those of the previous Apollos 11, 12 and 14? As we have tried to point out, the key to the Apollo 15's success was its great mobility furnished by the LRV. But why did those preceding expeditions lack a roving vehicle each? Did the 15's crew get a more powerful Saturn V launcher and therefore, could they carry a heavier payload to the Moon? Not at all. Up to our knowledge, Saturn V rockets were exactly equal to each other for the entire Apollo Project. The clue to the difference was given by the constrictions of flight dynamics, that is, by the orbital characteristics in each particular case. To discern this difference we should dig a little deeper into the Earth-Moon flight paths. We believe it is worthwhile to precede our geological observation with a report of Apollo 15 flight feats.

In the first place we must bear in mind that an Earth-Moon flight path should link two circular orbits located in the Sun-Earth-Moon plane (to increase the flight safety by easing the space maneuvers), one around the Earth, the so-called Earth parking orbit, and the other around the Moon, the so-called Moon capture orbit. The theoretical Earth-Moon flight path, called lunar transfer orbit (LTO), must be an elliptical branch that patches both circular orbits and has its perigee close to the Earth and its apogee close to the Moon. This way, a spacecraft hurled towards the Moon from the perigee, at maximum velocity, will meet its target at apogee, at minimum velocity and will be easily captured by the Moon gravity. To take advantage of Earth rotation and translation velocities at launch, the perigee must lie over the far side of Earth at the launch time and to ease capture by the Moon gravity, the apogee must lie over the far side of the Moon at the time of arrival.

But spaceflight dynamics imposes its laws. The velocity a spacecraft must acquire to reach an apogee located behind the Moon (about 11.1 km/sec), is only 1% lesser than the escape velocity of the Earth-Moon System (11.2 km/sec). For that reason, a small error in excess in determining that velocity vector (speed and bearing) might cause the Apollo spacecraft to be thrown away into solar orbit, without any possibility of rescue. And people at NASA Headquarter did not want to endanger the astronauts on their flights to the Moon. There was a possible solution: decrease the apogee distance to the libration point (L1) of the Earth-Moon System. This solution splits the direct transfer orbit in two branches: one powered from Earth orbit to the libration point (L1); and the second branch, a "free-fall" from L1 point to the insertion in the lunar orbit. As one can easily imagine, the shape of this flight path looks like an "8" that surrounds both Earth and Moon, each within a sinus. In this way the escape danger disappears and as a bonus, the voyage has a free-return trajectory and can be aborted at the apogee, if needed (It was considered that the flight of Apollo 13 could have been aborted at this point). A good deal for NASA people who aimed for a hazardless trajectory.

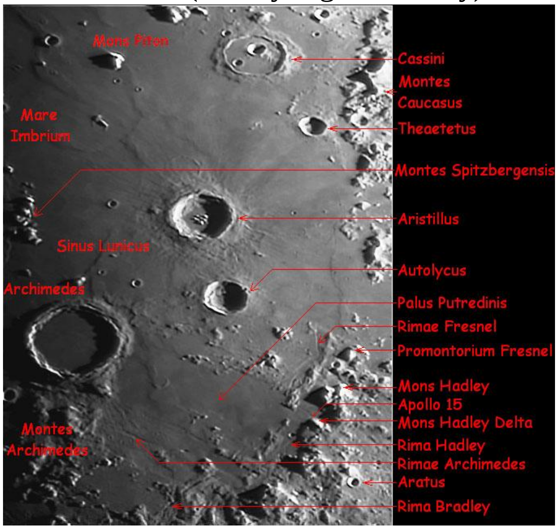
This is all about the pros, but one must ponder on the cons. Actually, with this technique, the libration point (L1) becomes the apogee of the powered trajectory Earth to L1, and also the apolune of the "free-fall" trajectory L1 to Moon. And because of this circumstance, the spacecraft reaches the insertion point in lunar orbit in the perilune, that's to say at the point of maximum velocity, capable of quickening the spaceship back to Earth (that is why this is a free-return trajectory). So, staying around the Moon requires a strong engine ignition backwards to cancel that hyperbolic velocity excess at perilune, to achieve an elliptical lunar orbit, which will be rounded off by firing backwards the spacecraft engine in successive steps through the perilune passes. Some 500 kg of fuel were reserved for these firing maneuvers.

But by the time of Apollo 15, the lunar science committee that advised NASA on the selection of lunar targets, based on their geological significance, pressed on the convenience of landing in sites located far from the equatorial band (chosen for safety reasons for the first flights). They complained that due to the restriction to the equatorial band for the landing sites, all Apollo expeditions had landed so far on mare type terrains and none on highlands type. And they pointed out several targets located outside that band, as Hadley rille, Fra Mauro and Litrow crater. (Other points as Marius Hills and craters Censorinus and Aristarchus had been considered, but were eventually left over, due to the severe three-flight-cut in the duration of the Apollo Program). The scientists' request involved flying to the Moon off the Sun-Earth-Moon plane (the easy one flown so far by previous Apollo ships, that leads to landing in sites located in the equatorial band), to enter into a Moon orbit tilted nominally 25 degrees for Apollo 15 to land close to Rima Hadley, at the foot of Mons Hadley Delta, 6 degrees for Apollo 16 to land at Fra Mauro and 21 degrees for Apollo 17 to land in the Montes Taurus, near the crater Littrow.

Fortunately, in July 1971 NASA planners had already zeroed in on the spacecraft velocity issue and a direct transfer trajectory with only an acceptable not-so-small risk was possible. Apollo 15, 16 and 17, which flew to the Moon off the safety plane, along a direct transfer orbit, were Apollo J-type expeditions, superior to all previous flights because part of the 500 kg of fuel spared by the new flight path, was employed to enhance the Lunar Module, to be able to sustain a 75-hour stay on the Moon surface, and to carry an LRV to improve the crew mobility. Apollo 15 crew was the first expedition to enjoy these improvements and the first to visit a highland soil site (the Apennine Front), a mare soil site (Mare Imbrium) and volcanic rille (Rima Hadley), collecting rocks from each one. All this at the price of the risk of opening a new flight path. A true feat from our point of view.

*   *   *

The Montes Apenninus range is the most beautiful and impressive escarpment of the Moon orography. We observed Montes Apenninus many times in both waxing and waning phases and took many pictures of this rich-featured area, plenty of topographic structures as can be seen in our annotated photo 1. But last time (November 29th, in waning phase), just when we tried to gather some particular information on Mons Hadley Delta related to Apollo 15 expedition, it was unluckily under adverse weather conditions (mainly high humidity). Photos 2 and 3 depict meaningfully the effect of high humidity. To get ride of the humidity that tears the pictures, we endeavor sketching the view at the eyepiece (sketch 1).



<u>PHOTO 1</u>. *January 12, 2011 20:58 UT. observatory 40.3 N, 3.9 W, seeing 4/5; transparency 5/5 colong,, 9.3°, 20 cm f/7.2, newtonian barlow x2, TouCam Pro..*

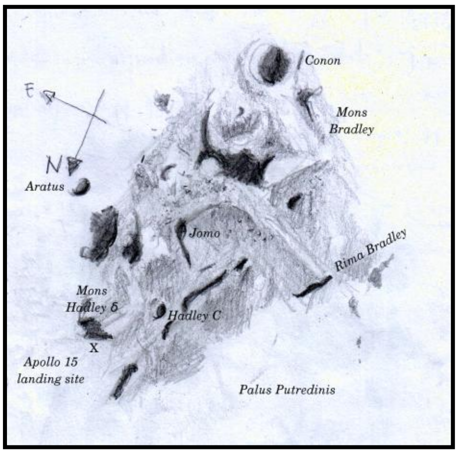
Sketch 1 is not centered on the landing site (X) due to an initial identification error. Instead, it was aimed at a depression indicated by the craterlet chain Carlos (4 km), Taizo (6 km), Béla (11x2 km) and Jomo (7 km), the last one annotated in the sketch. However Rima Hadley was not certainly viewed clearly and was not depicted. It was visible however, and pictured, a “bright ray” of aluminum magma soil, as a clear stroke running towards Northwest and crossing Rima Bradley.

<u>PHOTO 2</u>. *December 16, 2018 16:48UT. observatory 40.4 N, 3.7 W, seeing 4/5; transparency 5/5 colong,, 9.3°, 20 cm f/7.2, newtonian barlow x2, TouCam Pro..*

Even with such a poor visibility we dare to recreate in our imagination, the landing conditions at the end of the two relevant flight paths, we have discussed before: free-return and direct transfer orbit. For the free-return trajectory, the Apollo spaceship crossed the Earth-Moon view line, exactly at apogee of the first branch, or apolune of the second branch (which ever name you prefer). And then entered lunar orbit from the West limb,

<u>PHOTO 3</u> *November 29, 2018 04:00 UT. observatory 40.4N, 3.7W, seeing 4/5; transparency 5/5 colong. 166.2°, 20 cm SCT, QHY5 III...*

to exit the far side from the East limb. This way it crossed the lunar near side in an East-to-West sense. So, a hypothetical Earth based observer would see (if



it were possible) the spaceship moving in front of the Moon face, from right to left.

SKETCH 1 *November 12, 2018 05:25 UT. observatory 40.4 N, 3.7 W, seeing 2/5; transparency 2/5 colong,, 167.3°, 250 mm f/5, dob, 312x..*

But in a direct flight transfer orbit, the Apollo spaceship arrived to the Moon approaching the eastern limb and disappeared from view as it orbited the far side of the Moon, to later appear from the west lunar limb. Then it crossed the near side in front of our eyes, following its elliptical lunar orbit in a West to East sense. This way, the same hypothetical Earth observer we talk about, would see the spaceship flying the Moon face from left to right.

If at this point you think that all this is a worthless wordiness in a geological context, just take a look to photo 4. Observe the Apenninus NW and SE ramps. It is easily visible that the slopes looking at Mare Imbrium, the Apennine Front, plunge abruptly towards the mare lavas, while the face looking towards Mare Vaporum and Mare Serenitatis, ramps down in a much more soft leaning.

PHOTO 4 *November 19, 2008 03:00 UT. observatory 40.3N, 3.9W, seeing 4/5; transparency 4/5 colong. 162.9°, 20 cm f/7.2, newtonian barlow x2, TouCam Pro..*

Now, look at photo 1 the Apollo 15 landing site (that we have marked with a very tiny and thin red cross) close to Rima Hadley, at the foot of the towering Mons Hadley Delta (3500 m tall) and surrounded from North by Mons Hadley (4800 m tall). Then, imagine a 25 degree tilted line coming from NW to SE, crossing over the landing site, and wonder about which way is the good one to land on the target point: from East-to-West (right-to-left) or West-to-East (left-to-right)? If you agree with our own criterion, the only way that makes possible to land close to Rima Hadley, is coming from NW. What means that you have to risk your skin and fly direct transfer for first time. This is the non-widely-known Apollo 15 feat!

After Promontorium Fresnel, which stands alone to the North of the range, Mons Hadley and Mons Hadley Delta are first and second pop-up massifs one meets letting his eye slide down the escarpment and enjoying the breathtaking view in the eyepiece. In the gap between the two massifs, one can distinguish the thin Hadley Delta rille without much difficulty and this encourages him to inspect the landing point, which is known to be next to the elbow that forms the rille where it turns to the North. This is not possible under young Moon because of the long shadows casted by the scarp in this phase. To be able to see it, one better waits for a little older waxing Moon, as is the case in our photos 1 and 2 or stay late one night to see the place under waning Moon, as we did to take photos 3 and 4 and 5.

Down there, where our sight lacks sharpness, David Scott and James Irwin run the LRV collecting rocks from the places we have mentioned (one of them the charismatic Genesis rock), while Alfred Worden radiographed in UV and X-ray the Moon soil along his ground path, to complete their excellent job on the Moon. Just after touch down and while peering from the top hatch of the Lunar Module during SEVA, Scott made a striking discovery: a smaller mount locate at the South East of Mons Hadley Delta (called Mount Silver Spur afterwards), showed a layered surface! Looking more closely, he discovered that Mons Hadley Delta also had the same horizontal stripes, though less noticeably. We observed Mons Hadley Delta in conditions of good visibility, using our most powerful eyepiece (3.6 mm or 400x) with a 20 cm Newtonian telescope, and could distinguish a different clarity between the top of the peaks of Mons Hadley and the rest of the mount peaks in the range, but no strips at all (of course!).

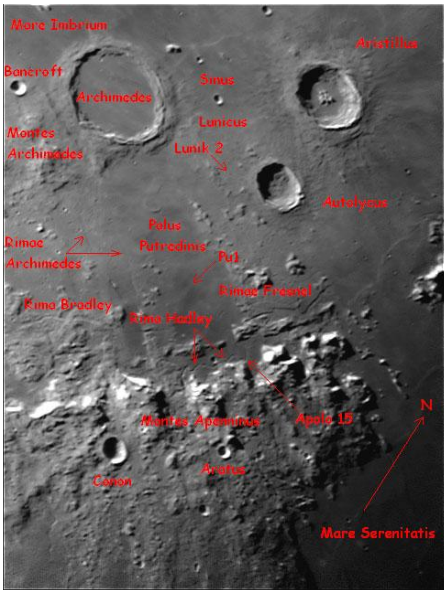


PHOTO 5. *September 29, 2010 02:05UT. observatory 40.3 N, 3.9 W, seeing 4/5; transparency 4/5 colong,, 160.1°, 20 cm f/7.2, newtonian barlow x2, TouCam Pro..*

In reference to the observation of the Mare Imbrium, there is a different story told by the samples coated by a layer of green glass, collected from this basaltic area and brought back home by Apollo 15 crew. From what we have learned in our textbook (which was written by ourselves), the exotic coating that surrounds these samples consists of a layer of aluminum-rich pyroclastic glass, formed by an explosive precocious eruption that occurred 600 million years, before the basaltic lavas emerged from the lunar mantle. ¡There were aluminum lavas long before basaltic lavas arose! And since aluminum is the white component that makes the highland rocks bright, one could expect to see bright lavas somewhere in the Mare Imbrium. If you want to see them, just look at the so-called Archimedes bench in photo 6. It is the whitish tongue that protrudes from Mons Bradley in the Apennine Front, towards Montes Archimedes, to the South of the crater that bears the same name. (It was also depicted as a bright ray in sketch 1). Lavas without basalts! (From then on, the expression “basaltic lava” was no longer a tautology).

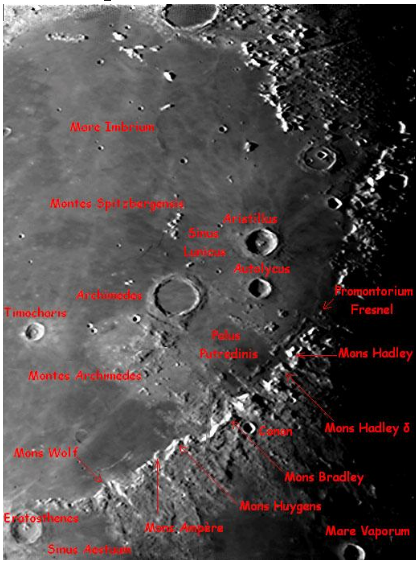


PHOTO 6 *November 19, 2008 02:55 UT. observatory 40.3N, 3.9W, seeing 3/5; transparency 4/5 colong. 162.9°, 20 cm f/7.2, newtonian barlow x2, TouCam Pro..*

The sinuous aspect of the rille is clearly visible in photos 1 and 5. At least from its origin, at the foot of an anonymous peak located West of Mons Bradley, and along a half of the 80 km meandering groove carved in the Apennine Front, that passes by the landing site of Apollo 15, where it turns to North downhill, until it reaches a long anonymous massif enclosed by Rimae Fresnel, as if it were the moat of a castle. From this point on, it runs Northwards to Palus Putredinis, where it disappears, the rille narrows or flattens, so that it is not visible in our pictures. Nowadays, the most common opinion held by selenographers about the origin of this rille, points towards a collapsed lava tunnel. This lava tunnel had begun on a graben, whose best vestige today is Mons Hadley Delta. The existence of a pre-imbrian graben can explain why the splendid orography of the Montes Apenninus does not surround the entire rim of the basin, but only the southeastern sector, where this graben should have been located before its destruction by the Imbrian impact. Another vestige of its existence is the Apennine platform, which holds the group of concentric clefts, as Rima Bradley, Rima Hadley and Rimae Fresnel.

MONTES APENNINUS - Luis Francisco Alsina Cardinalli, Oro Verde, Argentina, December 20, 2015, 02:13 UT. 250mm LX-200,168x with telextender, Canon EOS Digital Rebel.

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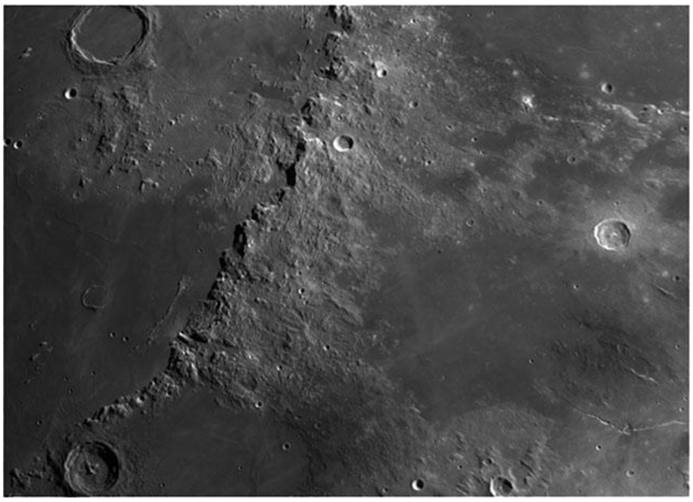
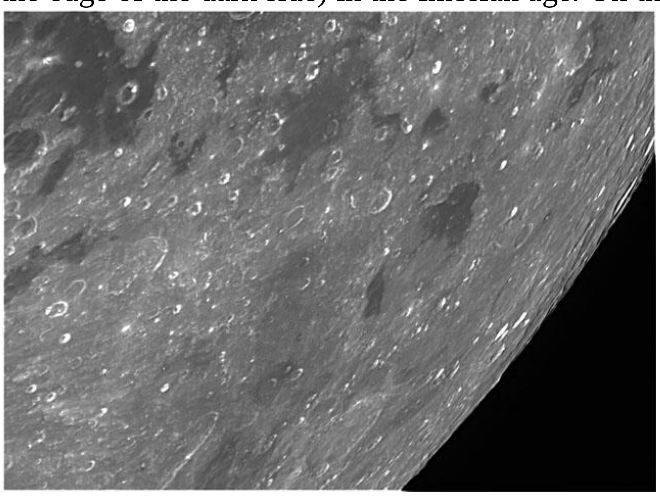
MONS HADLEY - Desireé Godoy - Oro Verde, Argentina. September 10, 2016 22:56 UT. C-11 edge HD, SCT, QHY5-II



A MAP OF THE FLOOR OF SCHICKARD

Alberto Anunziato

The much-maligned Full Moon offers unique and interesting landscapes. In colongitude 87.5º, the details are very scarce and the brightness of the frontal sun light makes it difficult for those little-versed in astrophotography to calibrate well to avoid excessive brightness. But it's a great opportunity to observe the elusive dark zones on Schickard's floor. This ancient crater (fig. 1), a vast walled plain 206 kilometers in diameter, has a floor divided into 3 regions that seem to mark the borders between the provinces of an imaginary state (and in fact the gigantic dimensions of Schickard would allow it). Schickard is a very old crater-prectarian, as seen by its walls, which are not very high due to the constant erosion of space weather. The central illuminated area is covered by the oldest material, expelled by the impact that originated the distant Mare Orientale (at the edge of the dark side) in the Imbrian age. On the east edge of Schickard we can distinguish the brightest area of the image, the craterlet Schickard X. In this central zone there are areas partially flooded by the lava that formed the dark zone to the north.



SCHICKARD– Alberto Anunziato, Oro Verde, Argentina. August 26, 2018 03:40 UT. CPC-1100 f/10, ZWO ASI 120 MM/S.

The northern strip of dark floor is considerably larger than the southern strip. In the northern zone you can see some small bright spots and several small secondary craters and even the details of one of them (in the north end, whose name i could not find out) are distinguishable even with a full moon. In the dark floor located in the south of the crater is much more difficult to distinguish impact craters, so we could presume that it is the area of more recent geology. Both dark zones correspond to volcanic eruptions (after the formation of the lighter floor of the central zone) that would have originated a basalt fluid of low viscosity, with low content of silicates and high content of iron and titanium, very similar to the material of the maria. The source of the lava that formed these more recent dark areas would come from the Lehmann crater, according to the great specialist in the Schickard crater, Keith Abineri ("The floor of the lunar crater Lehmann and the extreme northern dark floor of Schickard base don Orbiter IV HR160 / 2 microfilm", in "Journal of the British Astronomical Association ", 100, 5, 1990).

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JOHNNY WE HARDLY KNEW YE

Rik Hill

In my note (North by northwest) where I focused on Pythagoras, I pointed out a barely discernible large crater J.Herschel (dia. 160km, fig. 1), named after John Herschel but often ignored or overlooked ("we hardly knew ye"). Here it is about 2 days earlier in another lunation, a much more impressive walled plain some 3.8-4.5 billion years old, strewn with smaller impacts.

On the lower left wall is Horrebow (26km) still deep in shadow with Horrebow A forming the upper part of a figure-8. Above Herschel is a sinuous ridge that is a combination of the eastern walls of Anaximander (the lower portion) and Carpenter that cuves west.

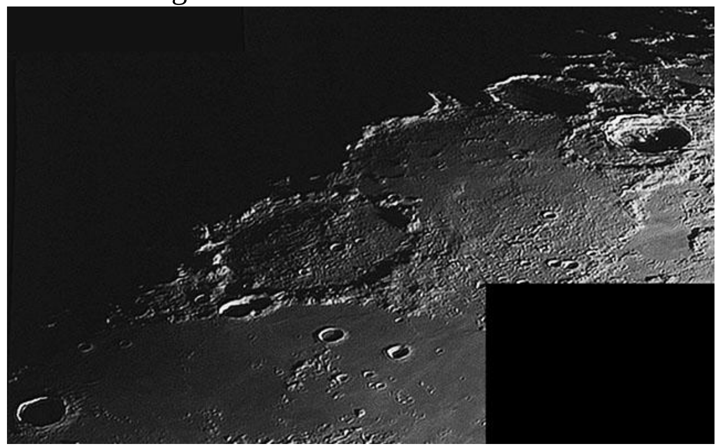

FIGURE 1. ***J. HERSCHEL*** – *Richard Hill – Tucson, Arizona, USA November 19, 2018 03:19 UT. Colongitude 44.5°. Seeing 7/10. TEC 8" f/20 Mak-Cass, SKYRIS 445M, 850 nm filter.*

There are two large craters to the upper right. The largest with shadows crossing its floor, is Anaximenes (82km). to the east of it is Philolas (73km), an obviously fairly young crater wiht clearly terraced walls sitting in the remnants of a larger, very ancient (unnamed) crater. In the lower left of this image is the crater Harpalus (41km) which has a nice radial ejecta pattern but it cannot be seen at this lighting.

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LUNAR LARGESS

Rik Hill

It just doesn't seem fair how some areas of the moon are ho-hum and others full of spectacular features within a few hundred kilometers. This area falls in the latter category. At top (fig. 1) we have the dramatic Theophilus (104km dia.) overlapping Cyrillus (100km) and below them is Catharina (also 104km). Each is filled with impressive details from rimae to detailed central peaks. These three would be enough for most regions of the moon but to the right of center on this image is the "U"-shaped, mostly shadow filled Fracastorius (128km) an ancient crater flooded by lavas during the infilling of the Mare Nectaris impact basin. Just above and to the left is a smaller copy of this feature, Beaumont (54km) flooded the same way but with a little more of its wall showing. Notice the beautiful unnamed wrinkle ridge between Theophilus and Beaumont as well as the numerous unnamed rimae overlain by hundreds of secondary craters from the Theophilus impact.

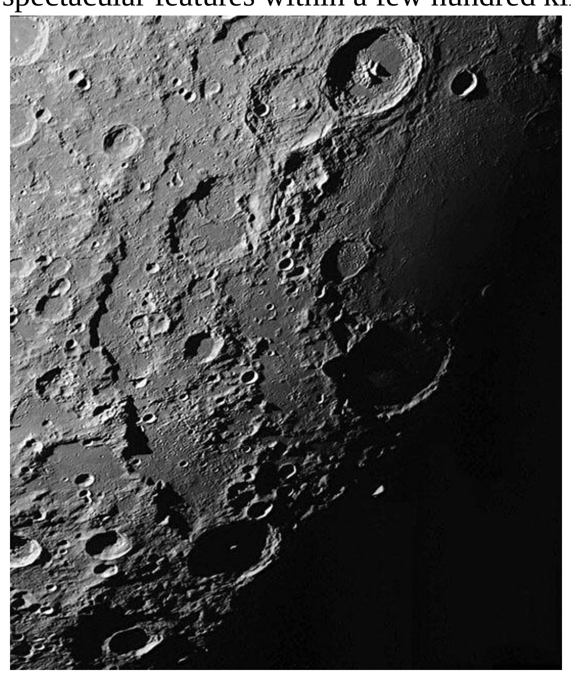

FIGURE 1. ***FRACASTORIUS*** – *Richard Hill – Tucson, Arizona, USA September 29, 2018 07:29 UT. Colongitude 144.6°. Seeing 8/10. TEC 8" f/20 Mak-Cass, SKYRIS 445M, 610 nm filter.*

To the lower left (southwest) of Fracastorius, due south of Catharina is the shadow filled Piccolomini (90km) with only it's eastern interior wall showing in the setting sun and the slightest hint of sparkling light on its central peak. Southwest of it is another shadow filled crater, Stiborius (46km) and north of that the similar sized Rothman (43km). Arcing up from Piccolomini is the Altai Scarp now called Rupes Altai. This wonderful cliff, a concentric pressure ring from the Nectaris impact, stretches 427km across the surface almost to Cyrillus. The highest portion of this escarpment is found just north of Rothman and measures as high as 1km evidenced by the great shadow.

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PEAR-SHAPED CRATERS

Rik Hill

North of Theophilus, in the lower left corner of this image (fig. 1), is Sinus Asperitatis running diagonally across this image, with the pear-shaped crater Torricelli in the middle. The crater is listed as 24km diameter which refers to the larger portion with extension adding a few more kilometers to the west. This odd shape is due to the merge of two impacts though the wall between the two is very low step. It sits on the northern edge of an unnamed ancient flooded crater some 90km across whose walls can be made out in this low angle sunset lighting. Near the bottom middle of this image is the shadow filled crater Isidorus (43km) that appears pear-shaped as well. Note how the mountains around Isidorus are soft looking, overlain by ejecta from the tremendous Theophilus impact. Compare them to the peaks north of Torricelli. You will see at the top edge of the image the crater Maskalyne (26km) and left *(west) of it is the small crater Moltke (7km) with Rimae Hypatia just south of it. It was just beyond this point, on the north edge of this image where Tranquility Base of Apollo 11 was established.

FIGURE 1. ***TORRICELLI*** *– Richard Hill – Tucson, Arizona, USA September 29, 2018 07:14 UT. colongitude 144.6°. Seeing 8/10. TEC 8" f/20 Mak-Cass, SKYRIS 445M, 610 nm filter.*

Above Isidorus is yet another pear-shaped crater that points back at Isidorus. This is Isidorus B (30km) and to the left (west) of it is a very curious trench-like feature labeled Isidorus C. It's about 5km wide and 15km long and in LROC Quick Map images looks like a large footprint! It is the result of multiple impacts and later modification from slumping and possibly some volcanic activity. It makes a good study on the best nights with an aperature of 150mm or more.

UNDER THE RAINBOW

Rik Hill

Situated on the western shores of Mare Imbrium, south of (and overshadowed by) Sinus Iridum are a curious collection of mountains, domes to be more precise, called (north to south) Gruithuisen northwest, Gamma and Delta or in the Lunar Dome Atlas, G3, G1 and G2. Seen here (fig. 1) they are above center with the two southern domes being rather obvious and the northwestern one being a small peak casting a long thin shadow. This whole region is filled with little gems but often missed because of the grandeur of the Sinus. The northernmost of the three is also the shortest being only 1020m in height with the next one south being 1900m and the southernmost 1740m. They were all formed from eruptions of rather viscous during, appropriately enough, the Imbrium epoch (3.85-3.2 billion years ago). The crater from which they derive their names, Gruithuisen (17km dia.) is south of the small patch of unnamed mountains south of G2. Further south is a nice triangular patch of mountains, also unnamed with a wrinkle ridge Dorsum Bucher to the west (left).

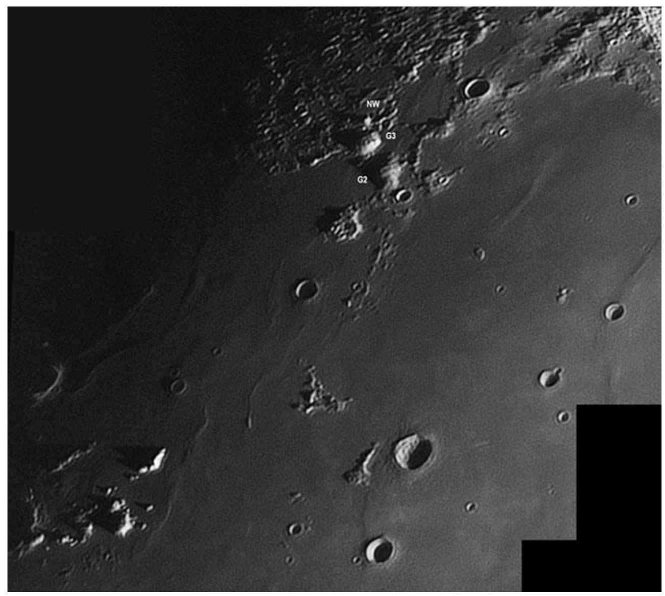

FIGURE 1. ***GRUITHUISEN*** *– Richard Hill – Tucson, Arizona, USA September 29, 2018 07:14 UT. colongitude 144.6°. Seeing 8/10. TEC 8" f/20 Mak-Cass, SKYRIS 445M, 610 nm filter.*

To the east of these mountains is a 26km diameter crater, Delisle and below it Diophantus (19km). Note the curious patch of mountains to the west of Delisle. These are Mons Delisle and possibly the remains of a now buried crater. To the northeast of Delisle is the small crater Heis (15km) and above that C. Herschel (14km) for the astronomer Caroline Herschel. Further west of Delisle are the Montes Harbinger just north of Aristarchus and north of them Dorsum Argand and the small crater Angstrom (10 km), small but not sub-millimeter!

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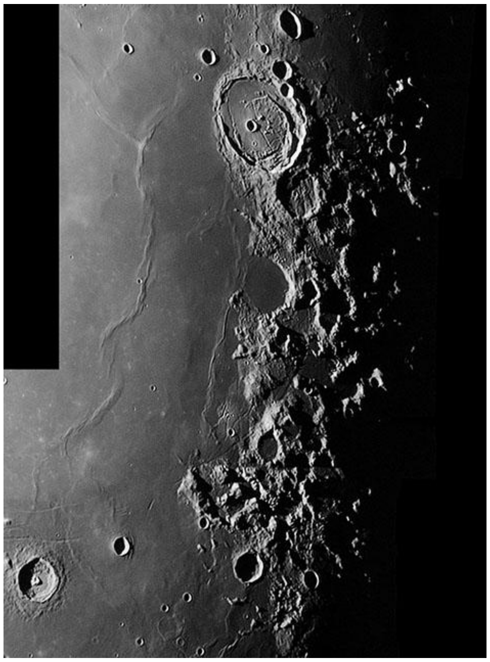
SOUTH OF POSIDONIUS

Rik Hill

A spectacular view of the waining moon terminator dominated by the 99km diameter crater Posidonius at top with the magnificent Rimae Posidonius and the rim of a totally flooded crater on the floor inside the main crater walls. Adjacent to the south wall is the crater Chacornac (53km) with a floor heavily faulted and crossed by rimae. It is older than Posidonius and Mare Serenitatis to the left. Further south is the cirque that is Le Monnier (63km) with the wrinkle ridge Dorsa Aldovandri that looks like it's pouring out of Le Monnier. It runs for 124km south, down the coastline on the shores of Mare Serenitatis. It ends at a curious cluster of three mountains that are the site for the Taurus-Littrow Apollo 17 base. The landing site is just off the northern tip of the



middle mountain which was named South Massif. The oval crater just above these mountains is Littrow (32km) and to its left is a small crater Clerke (7km). Note the system of unnamed rimae surrounding this latter crater and the spectacular east-west fault just south of Littrow.

FIGURE 1. ***POSIDONIUS_PLINIUS*** *– Richard Hill – Tucson, Arizona, USA September 29, 2018 07:09 UT. colongitude 144.6°. Seeing 8/10. TEC 8" f/20 Mak-Cass, SKYRIS 445M, 610 nm filter.*

Below the Apollo 17 site is the crater Vitruvius (31km) deep in shadow and to its left is the smaller Dawes (19km) with a couple little ridges on its right (east) side. Farther on is the crater Plinius (44km) surrounded by its hummocky ejecta blanket and the nice graben-like Rimae Plinius to the north. One last thing is the largest thing in the image. One branch starts from Plinius and the other from Dawes and moving north they merge to form the great Serpentine Ridge (as I learned it in the early 1960s) now known as Dorsa Smirnov and runs all the way up Serenitatis to north and west of Posidonius.

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IN AND AROUND THE LAKE OF DEATH

David Teske

Northeast of Mare Serenitatis lies Lacus Mortis, this is the Lake of Death (fig. 1). This area has abundant interesting lunar formations of a variety of ages. Lacus Mortis itself is an extensively eroded large crater about 150 km in diameter. Lava from the Mare Serenitatis region covers an area of 210,000 km^2. The western wall is the only wall that remains as the eastern rim is partially eroded or missing. This western rim is very straight, and I note that this can be seen easily at high Sun angles. As a rather hexagonal-shaped crater, Lacus Mortis is one of the Moon's oldest impact features, with an estimated age of more than 4 billion years.

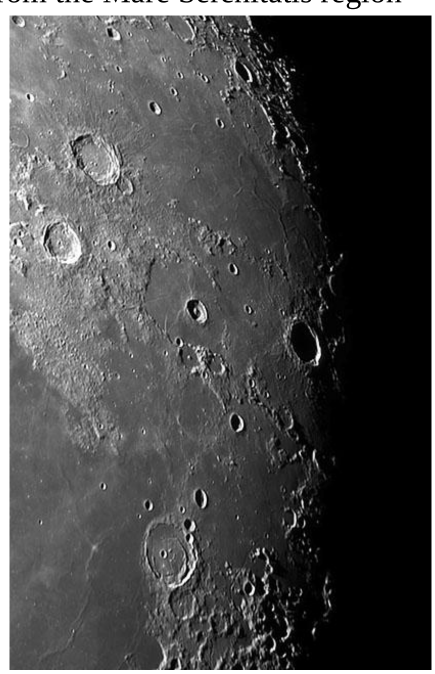

FIGURE 1. ***LACUS MORTIS*** *– David Teske, Louisville, Mississippi, USA, October 28, 2018 10:17 UT. Colongitude 137.5°, seeing 7/10, 102 mm APO refractor, 2.5 x Power Mate, zwoASI120mms*

Right in the middle of Lacus Mortis is the prominent young crater Bürg. This crater is named after Johann Tobias Bürg, an Austrian astronomer who lived from 1766 to 1834. Dated to the Copernican age, Bürg is 39 km in diameter crater with a sharp-edged crater wall that rises 2.2 km above the crater floor and 1.8 km above the floor of Lacus Mortis. Bürg has a dominant central peak that appears to be split in two and terraced walls with many deep cracks and breaks. These terraces are scalloped and wavy and there is much slumping on the interior slopes, so much so that a finger of slumping reaches the central mountain peak. Bürg sits upon a triangular wedge of higher ground that may be Lacus Mortis' original central uplift. Two ridges can be seen running from Bürg to the northern and southern rims of Lacus Mortis. This may be ejecta from the impact of Bürg that is somewhat similar to mare ridges. Perhaps most interesting in this area are the two sections of a rille system lying at right angles to each other known as Rimae Bürg. The western rille is a typical fracture zone. The southern section changes from a rille to an escarpment. At sunset, this fault is brightly illuminated. The east side of the fault is the high side. The fault indicates a vertical force, but the rille could form only by horizontal extension.

The southern edges of Lacus Mortis have two interesting craters on its shore. Mason, named after Charles Mason, an English astronomer who lived from 1730 to 1787, is an elliptical crater 33 by 43 km with a flat floor. Plana, named after Giovanni A. A. Plana, an Italian astronomer and mathematician who lived from 1781 to 1864, with a diameter of 44 km has a central peak. Both of these craters are partially ruined old craters. Plana has a darker floor than Mason. Between Plana and Mason lies a tremendous triangular mountainous mass of material that is centered at the intersection of their two rims with that of Lacus Mortis. The mass appears to have spread downwards onto the floors of the three craters.

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OBSERVATIONS RECEIVED

ALBERTO ANUNZIATO - ORO VERDE, ARGENTINA. Digital images of Alphonsus, Eratosthenes, Schickard, Sinus Iridum(2) & Tycho.

FRANCISCO CARDINALLI - ORO VERDE, ARGENTINA. Digital images of Montes Apenninus & Pytheas(3).

DESIREÈ GODOY - ORO VERDE, ARGENTINA. Digital image of Mons Hadley.

RICHARD HILL – TUCSON, ARIZONA, USA. Digital images of Fracastorius, Gruithuisen, J.Herschel, Posidonius-Plinius & Torricelli.

JERRY HUBBELL – LOCUST GROVE, VIRGINIA, USA. Digital image of 10 day Moon.

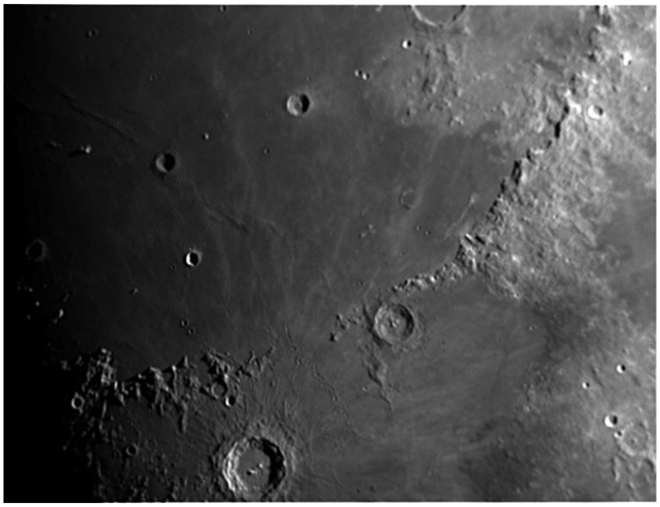
MADRID AMATEUR ASTRONOMY SOCIETY – MADRID, SPAIN. Images of Mons Hadley(6 digital, 1 drawing).

MICHAEL SWEETMAN – TUCSON, ARIZONA USA. Digital images of Rimae Sirsalis & Rupes Recta.

DAVID TESKE - LOUISVILLE, MISSISSIPPI, USA. Digital image of Lacus Mortis & Montes Apenninus.

KACPER WIERZCHOS - FORT LAUDERDALE, FLORIDA USA. Drawings of Posidonius B(2).

RECENT TOPOGRAPHICAL OBSERVATIONS



PYTHEAS - Luis Francisco Alsina Cardinalli, Oro Verde, Argentina, December 9, 2016, 03:45 UT. 250mm LX200 SCT, QHY5 II, Astronomik 742 IR pass filter.

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10 day MOON - Jerry Hubbell · Wilderness, Virginia USA.. December 18, 2018 01:54 UT. Explore Scientific 102 mm FCD100 ED APO refractor, colongitude 36.7°. Seeing 7/10, transparency 4/6. QHY163C.

RIMAE SIRSALIS Michael Sweetman - Tucson, Arizona, USA, November 21, 2017 08:08 UT. Seeing 5/10, transparency 3/6. 4” achromatic refractor, f/20. Skyris 132M, Baader fringe killer filter.

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BANDED CRATERS PROGRAM

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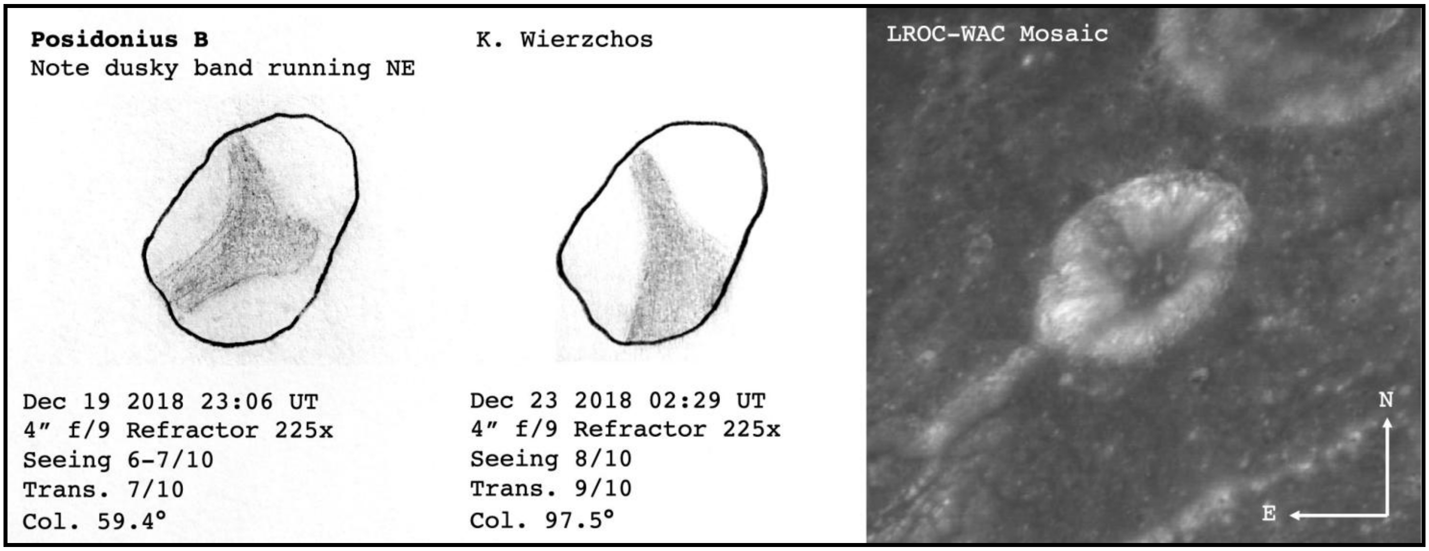

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LUNAR GEOLOGICAL CHANGE DETECTION PROGRAM

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A Happy 2019 to our readers – let us hope for a lot of clear sky and ample opportunities to observe! This month we are still playing catch up due to teaching duties at University distracting me from Lunar Section activities. So, will just be summarizing observations received and undertaking scarcely little analysis this month as we have used up more pages than normal in this newsletter, as a result of the catchup. Next month I will publish a table to show how the weights have changed for any past LTP covered by the repeat illumination observations.

Reports have been received from the following observers for October: Jay Albert (Lake Worth, FL, USA - ALPO) observed: Agrippa, Aristarchus, Plato, Poisson, Proclus, Ptolemaeus, Ross D and Theophilus. Francisco Alsina Cardinali (Argentina - AEA) imaged Eudoxus, Mare Crisium, Maskelyne, Maurolycus, and Proclus. Maurice Collins (New Zealand – ALPO/BAA/RASNZ) imaged: Alphonsus, Aristarchus, Clavius, Copernicus, earthshine, Gassendi, Mare Nectaris, Proclus, Schiller, Tycho and took some whole Moon images. Marie Cook (Mundesley, UK – BAA) observed: Aristarchus, Kepler and Plato. Walter Ricardo Elias (Argentina – AEA) imaged Promontorium Agarum, and the south pole. Valerio Fontani (Italy – UAI) imaged Aristarchus, Cichus and Copernicus. Desiree Godoy (Argentina – AEA) imaged Biela and Manzinus. Leo Mazzei (Italy - Gruppo Astrofili Montagna Pistoiese/UAI) imaged Cichus and Copernicus. Robert Stuart (Rhayader, UK – BAA) imaged: several features. Franco Taccogna (Italy – UAI) imaged Aristarchus, Cichus and Copernicus. Aldo Tonon (Italy-UAI) imaged Aristarchus and Montes Teneriffe. Gary Varney (Pembroke Pines, FL, USA – ALPO) imaged: Aristarchus, Doppelmayer, Janssen, J. Herschel, Mare Tranquilitatis, the South Pole, and several other features. Fabio Verza (Italy – UAI) imaged Aristarchus. Ivor Walton (Cranbrook, UK – CADSAS) imaged Theophilus, Tycho and several features. Luigi Zanatta (Italy - UAI) imaged Aristarchus.

Reports have been received from the following observers for November: Alberto Anunziato (Argentina – LIADA) observed: Aristarchus, Geminus, and Proclus. Marie Cook (Mundesley, UK – BAA) observed: Aristarchus. Maurice Collins (New Zealand – ALPO/BAA/RASNZ) imaged: Copernicus, Sinus Iridum and took some whole Moon images. Walter Ricardo Elias (Argentina – AEA) imaged: Alphonsus, Alpetragius, Censorinus, Eratosthenes, Plato, Proclus and Tycho. Valerio Fontani (Italy – UAI) imaged Montes Spitzbergen. Rik Hill (Tucson, AZ, USA – ALPO/BAA) imaged Copernicus, J. Herschel and Gruithuisen. Nigel Longshaw (UK – BAA) observed Mons Lahire. Leonardo Mazzei (Italy - Gruppo Astrofili Montagna Pistoiese/UAI) imaged Mons Spitzbergen and the Full Moon. Robert Stuart (Rhayader, UK – BAA) imaged: Agatharchides, Clavius, Copernicus, Encke, Gassendi, Hainzel, Lambert, Longomontanus, Mare Cognitum, Mare Nubium, Palus Epidemiarum, Plato, Ramsden, Reinhold, Sinus Iridum, and several features. Franco Taccogna (Italy – UAI) imaged: earthshine, Eratosthenes, Torricelli, Montes Spitzbergen, Plato, the Full Moon, and several features. Aldo Tonon (Italy – UAI) imaged Torricelli, Gary Varney (Pembroke Pines, FL, USA - ALPO) imaged Mare Crisium and several features. Derrick Ward (Swindon, UK – BAA) imaged Agrippa, Plato and Pytheas.

News: The Chinese have launched a mission to the Moon involving a lander/rover to the far side and a relay satellite placed in a halo orbit around a Lagrange point. The lander is due to touch down on 2019 Jan 03 (or later?). At one point it was discussed putting a lunar impact flash camera onto the relay satellite to monitor the Moon's night side, however I am unaware whether this got the go-ahead or not?

If any readers are interested there is some Europlanet software to which can be used to look for impact flashes on the Moon using recordings of AVI video. This is available from: http://users.aber.ac.uk/atc/alfi.htm. The software is different to the existing Lunar Scan program, but it is intended as a freeware project which will be built upon and improved, permitting sustainability.

LTP reports: No LTP were observed in October or November.

Routine Reports: Below are a selection of reports received for October and November that can help us to re-assess unusual past lunar observations – if not eliminate some, then at least establish the normal appearance of the surface features in question:

Promontorium Agarum: On 2018 Oct 13 UT 22:54 Walter Ricardo Elias (AEA) imaged this region under similar illumination, to within ±0.5° to the following Patrick Moore report:

Prom. Agarum 1995 Feb 05 UT 18:10-19:20 Observer: P. Moore (Sussex, UK, 15" reflector) - obscuration seen - Antoniadi II seeing, and Moon high up. BAA Lunar Section report. ALPO/BAA weight=3. **[REF 12]**

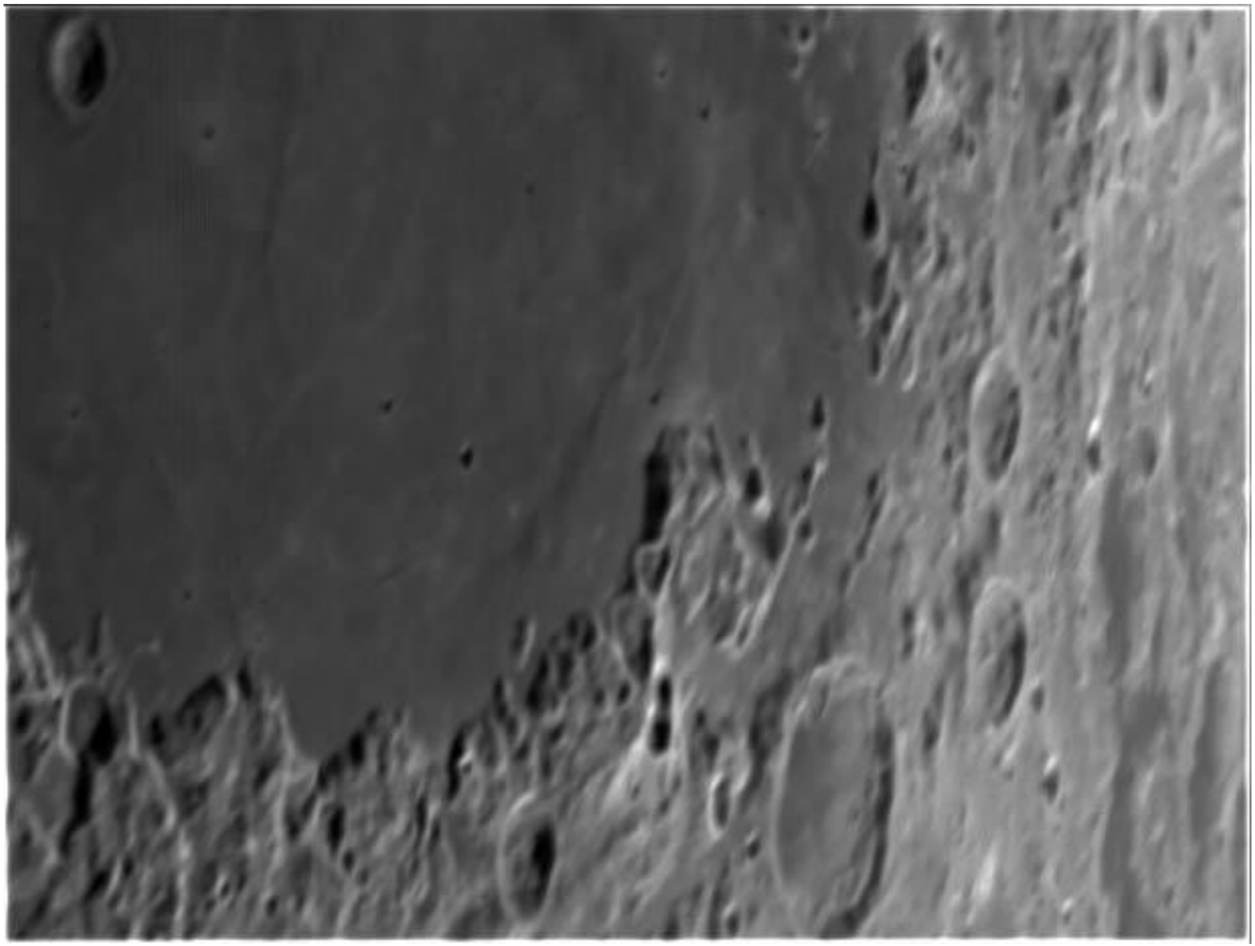

Figure 1. Promontorium Agarum in Mare Crisium as imaged by Walter Ricardo Elias (AEA) on 2018 Oct 13 UT 22:54. Orientated with north towards the top.

Alas we do not have any sketches from Patrick Moore on the observation from 1995, but at least we now have a good image of what the area would normally look like in Fig 1, and you can judge for yourself whether there is anything resembling an obscuration there. Many thanks to the skills of Walter for capturing this for us.

Biela & Maskelyne: On 2018 Oct 16 UT 00:40 Desiree Godoy (AEA) & 01:10 UT Francisco Alsina Cardinali (AEA), imaged these two regions under similar illumination, to within ±0.5° to the following report:

Biela, Maskelyne 1969 May 23 UT 02:32-03:00 Observed by Skinner, Perez, Barry, Bernie, Madison (Edinburgh, TX, USA) described in NASA catalog as: "Bright W.rim & 2 spots on N. & SE rim had blink (red -- Trident MB device) & event was in progress at start of obs. Saw nothing without image tube. Could not focus camera so no photos. Blink had ceased when image tube was replaced. Temporary bright reddish spot nr. Mask. photographed, (Apollo 10 watch). 17" reflector used. NASA catalog weight=5. ALPO/BAA weight=5. **[REF 13]**

Although neither Fig 2 or 3 are in color, at least we now have good reference images to compare the original LTP descriptions against thanks to these AEA astrophotographers.

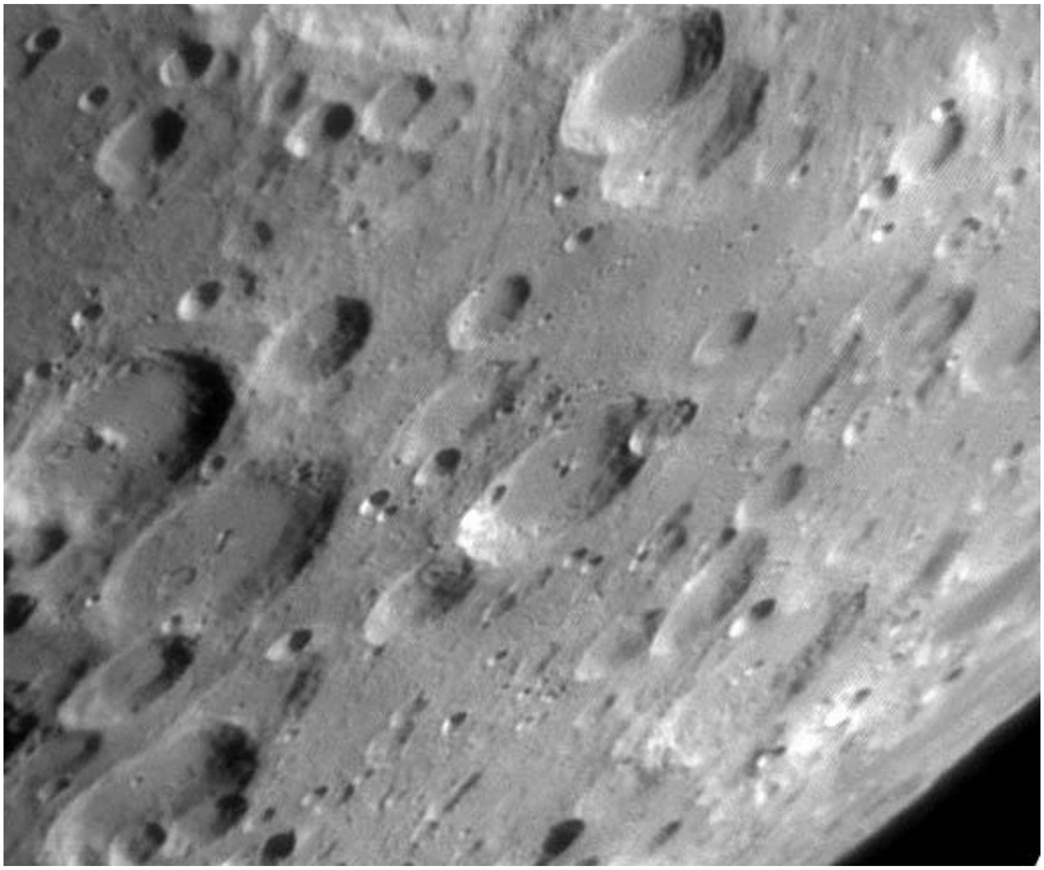

Figure 2. The crater Biela (center) in an image orientated with north towards the top. Monochrome image captured by Desiree Godoy (AEA) on 2018 Oct 16 UT 00:40.

Figure 3. The crater Maskelyne (center) in an image orientated with north towards the top. Monochrome image captured by Francisco Alsina Cardinali (AEA) on 2018 Oct 16 UT 01:10.

Agrippa: On 2018 Oct 18 UT 01:00-01:35 Jay Albert (ALPO) observed/imaged, and Gary Varney (ALPO) imaged this crater under similar illumination, to within ±0.5° to the following report:

Agrippa 1961 Oct 18 UT 00:43-01:00 Observed by Bartlett (Baltimore, MD, USA, 5" reflector x180, S=2-3, T=5) "Shadow of c.p. remained greyish, wall shad. normal black. Not due to seeing as wall & landslide shad. not affected. Not caused by refl. sunlight because other similar obs. showed different aspects." NASA catalog weight=4. ALPO/BAA weight=2. NASA catalog ID #750. **[Ref 14]**

Figure 4. Agrippa and Godin, orientated with north towards the top, taken on 2018 Oct 18 by ALPO observers. **(Left)** Taken at 01:26UT by Jay Albert. **(Center)** Taken at 01:56UT by Gary Varney. **(Right**) Taken at 02:15 UT by Jay Albert.

Jay, using a Celestron NexStar Evolution 8” (Transparency=3, seeing 5-6 out of 10) observed visually from 01:00-01:35UT and noted that the shadow of the central peak, whilst small, had a core that was as black as the shadow of the interior eastern wall. The central peak’s shadow was slightly less intense at the edges. Cellphone photos attempted (Fig 4 – Left and Right). Magnifications of 185x and 290x were used for the visual observing. Gary Varney (ALPO) captured a whole Moon image in between these two times at 01:56 UT, also using a cellphone at the eyepiece (Fig 4 – Center).

Torricelli B: On 2018 Oct 18 UT 07:32-07:49 Maurice Collins (ALPO/BAA/RASNZ) imaged this area under the same illumination, to within ±0.5°to the following 1989 report:

On 1989 Jun 12 at UT 21:18-22:25 G. North (Herstmonceux, UK, Coude, seeing=V) noted at 21:18UT that Torricelli B was "barely visible"- possibly this was seeing related. M. Cook (Frimley, UK, 8" reflector, seeing=IV) found Torricelli B to be extremely dull - impossible to judge shadows on floor in contrast to Cens." Holmes (Rockdale, England, UK, 8" reflector, seeing=II-III) at UT21:30 also found Torricelli B difficult to find at magnifications less than 200x. Cameron comments that "Dulling is common on it at high Sun but illumination doesn't seem to be the cause or related". The Cameron 2006 catalog ID=365 and weight=5. The ALPO/BAA weight=3. **[REF 15]**

Fig 5 shows that Torricelli B was not especially bright, and could be regarded as dull, though to be sure we need to compare this to other images taken under similar illumination, and where possible topocentric libration.

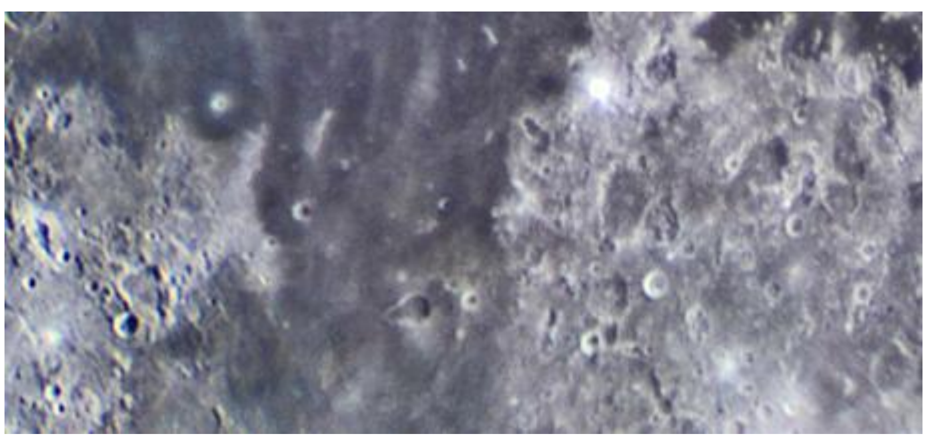

Figure 5. 2018 Oct 18 UT 07:32-07:49 – Torricelli B is the small crater at the center of the image. This image is from a larger mosaic of the whole Moon captured by Maurice Collins (ALPO/BAA/RASNZ). The image is orientated with north towards the top. Image color saturation has been increased to 50%.

Copernicus: On 2018 Oct 18 two repeat illumination events occurred which were covered by UAI observers on a couple of overlapping periods on the 18th. Similar illumination (to within ±0.5°) for the 2006 Jun 05 event spanned approximately 18:50-20:50 UT and similar illumination (to within ±0.5°) for the 1990 Apr 04 event spanned approximately 20:15-21:30UT:

On 2006 Jun 05 G. Burt made a drawing over a period of 30 minutes. Upon examining drawing, and comparing with photos made under similar illumination was struck by the abnormality of a small white blob in the north east corner of the shadowed floor. There should be no raised topography between the wall and the central peaks that could give rise to this. The making of the sketch overlapped with an earlier drawing made by Rony de Laet (Belgium) which did not show this blob. Subsequent attempts to find sketches/images at very similar illumination angles have failed to show the blob in the north east corner of the shadowed floor. ALPO/BAA weight=3. **[REF 16]**

On 1990 Apr 04 at UT 21:30-21:50 B. LeFranc (France?) reported observing a white flame effect in Copernicus crater (sketch made) - though Foley comments that the actual location was east of the crater. The Cameron 2006 catalog ID=398 and the weight=2. The ALPO/BAA weight=2. **[REF 17]**

A selection of the images that the UAI observers made are shown in Fig 6 along with the 2006 sketch by Geoff Burt. For the 2006 event you can see previous repeat illumination observations in the 2013 Mar and 2018 Jan newsletters. For the 1990 event, we have covered this in the 2016 Jan newsletter. The 19:33 and the 20:23 UT images are fairly close in terms of similarity to Geoff Burt's sketch. The 20:56 UT image by Valerio Fontani has the most similar illumination for the 1990 report, but alas we have no sketch in the archives from that LTP.

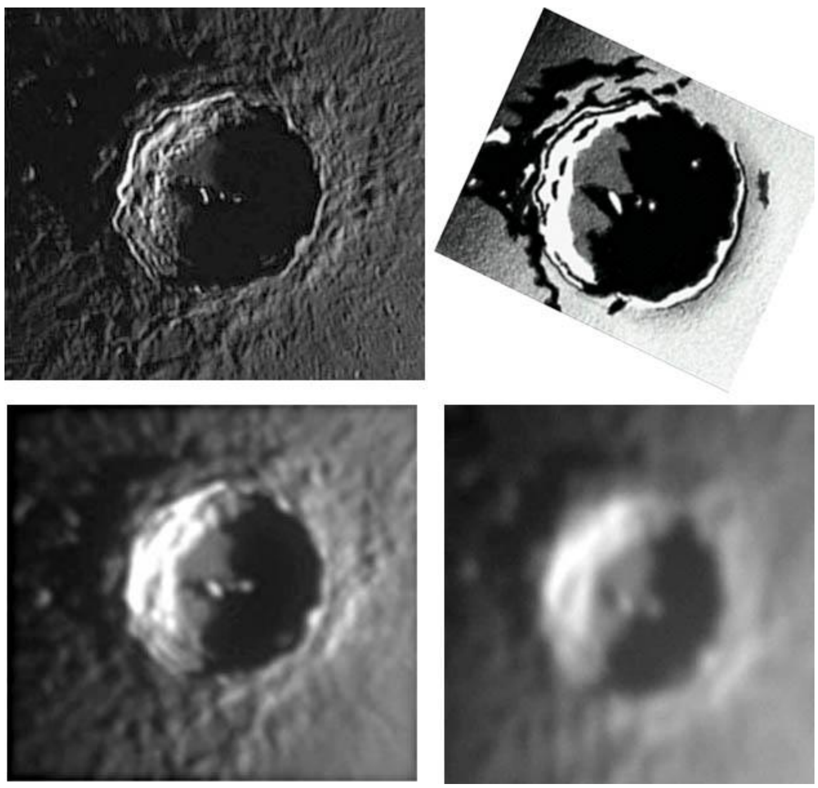

Figure 6. Copernicus orientated with north towards the top. **(Top Left)** An image taken by Franco Taccogna (UAI) on 2018 Oct 18 UT 19:33. **(Top Right)** A sketch made by Geoff Burt (SPA) on 2006 Jun 05 UT 21:00-22:00. **(Bottom Left)** An image by Leo Mazzei (Gruppo Astrofili Montagna Pistoiese/UAI) made on 2018 Oct 18 UT 20:23 under worsening observing conditions. **(Bottom Right)** An image by Valerio Fontani (UAI) made on 2018 Oct 18 UT 20:56 made under difficult observing conditions.

Plato: On 2018 Oct 19 UT 19:50-20:00 Marie Cook (BAA) observed this crater visually under similar illumination conditions (to within ±0.5°) to the following report:

Plato 1969 May 26 UT 20:30-21:05 Observed by Farrant (Cambridge, England, 8" reflector, x160, S=G) "Had misty portion of SW(ast. ?) floor from 2030-2105h at which time it was gone. Clearly seen, had ill-defined boundaries & was an easy obj. to see. Alt.=33 deg. (Apollo 10 watch)." NASA catalog weight=3. NASA catalog ID No. 1148. ALPO/BAA weight=2. **[REF 18]**

Marie comments that the crater was sharp and clear. A thin shadow was seen close to the wall. The floor was normal and no misty patch was seen.

Aristarchus: On 2018 Oct 20 UAI observers imaged Aristarchus under similar illumination (to within ±0.5°) to the following two reports:

Aristarchus 1966 Jul 29 UT 03:40 Observed by Simmons (Jacksonville, FL, USA, 6" reflector x192, S=7, T=4-5) and Corralitos Observatory (Organ Pass, NM, USA, 24" reflector + Moonblink) "Spot on S.wall vis. only in red filter, brightness 8deg. Slightly brighter than surrounding wall. No confirm. Says it might be part that reflected better. Not confirmed by Corralitos Obs. MB." NASA catalog ID #968. NASA catalog weight=1. ALPO/BAA weight=1. **[REF 19]**

On 1982 Sep 29 at UT 05:52UT D. Louderback (South Bend, WA, USA, 8" reflector, x240) saw approximately 7-8 diameters from Aristarchus (72W, 15N) a star-like point on the dark side - uncertain if this was on the limb or inside the disk of the Moon. Cameron 2006 catalog ID=185 and weight=1. ALPO/BAA weight=1. **[REF 20]**

Figure 7. Aristarchus as imaged by UAI observers on 2018 Oct 20, orientated with north towards the top. **(Top Left)** 19:22 UT imaged by Franco Taccogna. **(Top Center)** 19:45 UT imaged by Fabio Verza. **(Top Right)** 20:18 UT as imaged by Luigi Zanatta. **(Bottom Left)** 21:17 imaged by Valerio Fontani. **(Bottom Right)** 21:26 UT imaged by Aldo Tonon.

The repeat illumination conditions for the above two reports spanned the time range of approximately 18:45-20:45 and 19:35-23:25 on 2018 Oct 20. The corresponding observations are shown in Fig 7. I wonder if the 1982 observation was due to an occultation?

Plato: On 2018 Oct 26 UT 21:25 Ivor Walton (CADSAS) imaged this crater under the same illumination conditions (to ±0.5°) to the following spectroscopic report:

Plato 1965 Sep 13 UT 07:20 McCord (Mt Wilson, CA, USA, 60" reflector with spectrograph) - "Line depth ratio in spectra a/b (H), c/d (K) were abnormally high compared with 23 other areas, but not quite as pronounced as other areas on other dates." NASA catalog weight=5, NASA catalog ID #895. ALPO/BAA weight=5. **[REF 21]**

Although Fig 8 cannot help us spectroscopically, it does at least show what the crater would have looked like at the time the 1965 observation was made. Please be aware that solar absorption line filling/shallowing in lunar reflection spectra maybe explained by "inelastic scattering of sunlight with a small wavelength shift" – see Potter, Mendall and Morgan (1984), which in turn is related to the surface temperature - which of course is high at local lunar noon.

Alphonsus and Plato: On 2018 Oct 30 UT 08:28 Robert Stuart (BAA) took a monochrome image of the Moon during daylight hours here in the UK which was under similar illumination (±0.5° to the following two LTP reports:

On 1958 Dec 02 at UT 06:00 an unknown observer detected a LTP on the Moon (Alphonsus). The reference for this is from Palm, 1967 Icarus. The Cameron 1978 catalog ID=709 and weight=0. The ALPO/BAA weight=1. **[REF 22]**

On 1975 Mar 04 at UT03:46-06:01 P.W.Foley (Wilmington, Dartford, Kent, UK, 12" reflector) observed blueness along the southern wall of Plato. This is a BAA observation. The Cameron 1978 catalogue ID is #1403 and has a weight of 1. The ALPO/BAA weight=1. **[REF 23]**

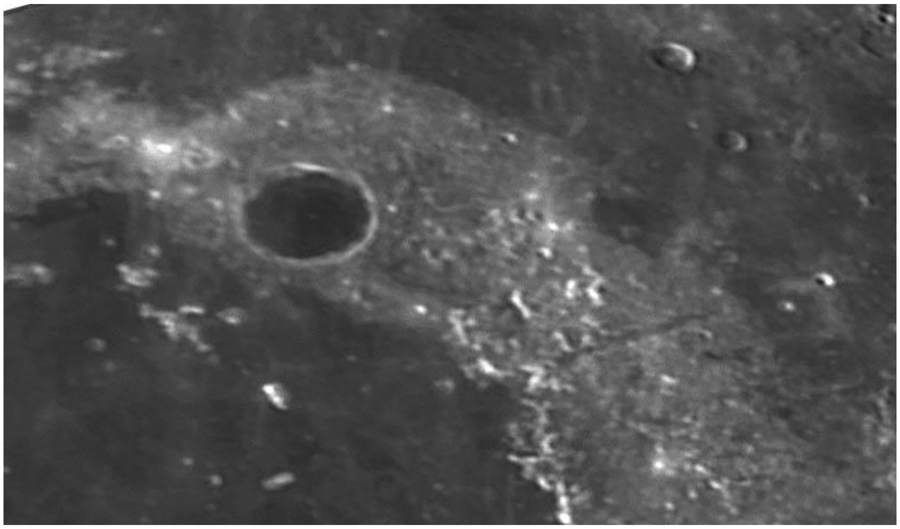

Figure 8. Plato, from a larger image, by Ivor Walton (BAA) as imaged on 2018 Oct 26 UT 21:25 and orientated with north towards the top.

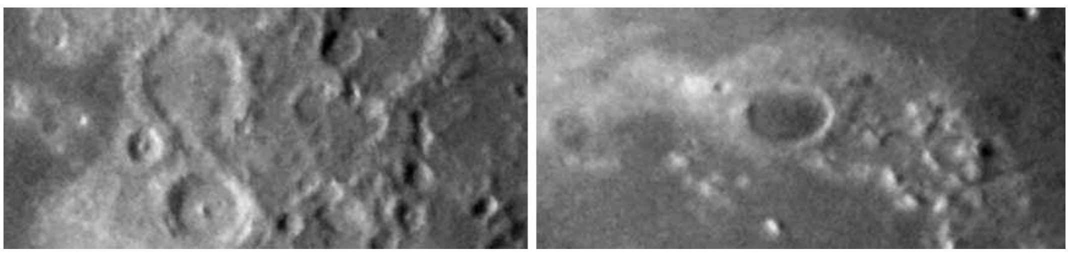

Figure 9. 2018 Oct 30 UT 08:28 – subsections of a whole Moon image by Robert Stuart (BAA) orientated with north towards the top. **(Left)** Alphonsus**. (Right)** Plato.

Although limited by resolution in this day light shoot (Fig 9), at least we now have the normal appearances of these craters to compare with.

Torricelli: On 2018 Nov 14 UAI observers: Franco Taccogna and Aldo Tonon, imaged this crater under similar colongitudes to a scheduled repeat illumination request:

ALPO Request: On 2011 Dec 31 Raffaella Braga (UAI) found the north rim or Torricelli to be very bright at the start of the observing session but dimmed considerably later. He was not sure on the normal appearance of this crater, hence why it is really important to establish this by re-observing under similar illumination. Minimum telescope aperture required: 3", and try to use a refractor if possible. **[REF 24]**

You can judge for yourself (See Fig 10) whether the north rim of Torricelli is very bright and varies in brightness in this time sequence. Although similar in illumination, the 2011 observation may differ in viewing angle (topocentric libration).

Montes Spitzbergen: On 2018 Nov 15 three UAI observers imaged this area to see if they could solve whether a suspected lava flooded valley was a sunken valley or simply a couple of semi-parallel wrinkle ridges:

Fig 11 hints at a raised ridge SW and NW of Montes Spitzbergen. However, it looks like the start colongitude needs to be adjusted slightly (perhaps by as little as 0.1°) so the area is less in shadow in future predictions

Eratosthenes: On 2018 Nov 16 UT 23:50 Walter Ricardo Elias (AEA) observed this crater under the same illumination, to within ±0.5° to the following observations from British planetary geologist: Peter Cattermole:

Eratosthenes 1954 May 11 UT 20:00 Observer: Cattermole (UK, 3" refractor) "Central peak invis. tho surroundings were sharp". NASA catalog ID #563, NASA weight=4. ALPO/BAA weight=2. **[REF 25]**

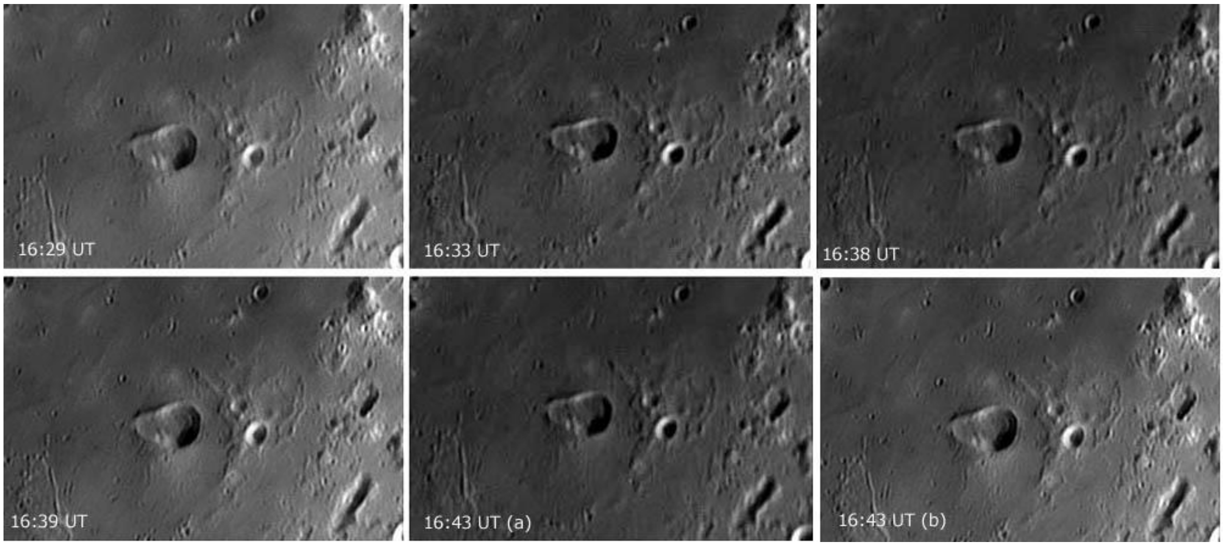

Figure 10. Torricelli as imaged by UAI observers on 2018 Nov 14 and orientated with north towards the top. **16:29 UT** by Aldo Tonon. **16:33 UT** by Franco Taccogna. **16:38 UT** by Franco Taccogna. **16:39 UT** by Aldo Tonon. **16:43 UT (a)** by Franco Taccogna. **16:43 UT (b)** by Aldo Tonon.

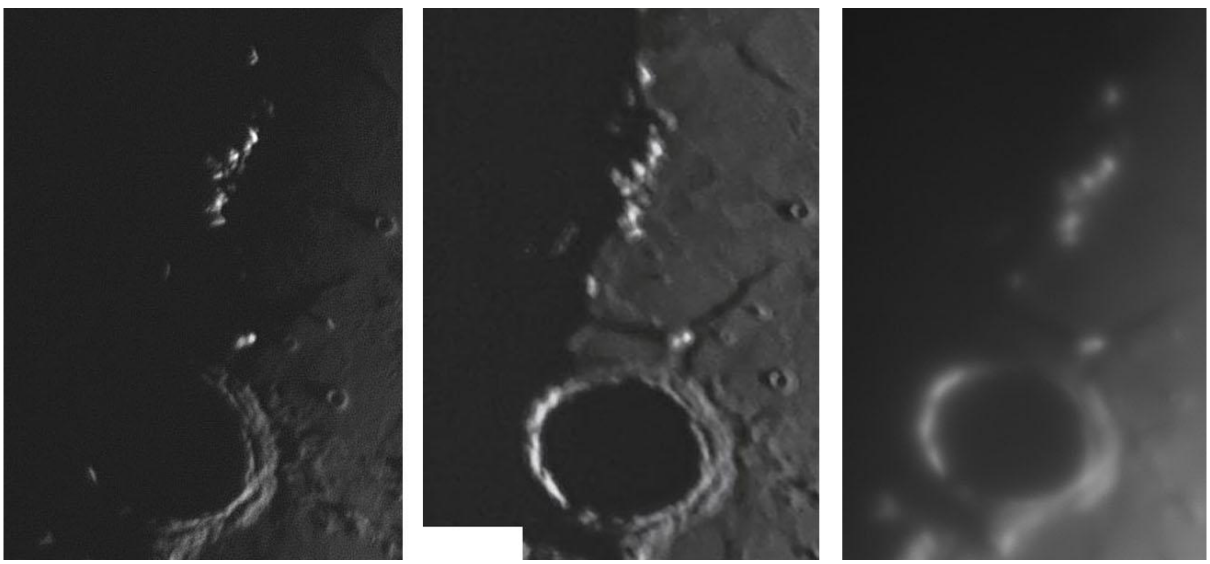

Figure 11. Montes Spitzbergen are taken on 2018 Nov 15 by UAI members, and orientated with north towards the top. **(Left)** 16:52UT by Franco Taccogna. **(Center)** 19:49UT by Valerio Fontani. **(Right)** 20:16UT by Leonardo Mazzei (Gruppo Astrofili Montagna Pistoiese).

Walter’s image (Fig 12) shows a great amount of detail in the crater and three components to the central peak area – no peaks are missing here!

Mons Lahire: On 2018 Nov 17 UT 17:15-17:36 Nigel Longshaw observed this mountain under similar illumination (to within ±0.5°) to the following 1920’s era report:

La Hire 1922 Nov 28 UT 22:00? Observer Wilkins (England). NASA catalog states: "Shadow cut thru by white streak (real LTP?. Pickering's atlas shows same phase & col. & shadow is all dark; elong. in peaks are N-S not E-W)" 15" reflector used. NASA Catalog assigns a weight of 4. NASA catalog LTP ID No. #388. ALPO/BAA weight=2. **[REF 26]**

Nigel used a 4” refractor at x106 and x260 under good transparency and III-IV Antoniadi scale seeing. Nigel did not see the shadow cut by a white streak, but instead the shadow mostly finished at the ridge to the west, though perhaps continued beyond this, to the terminator, as a dark streak (perhaps an optical illusion?). The appearance was similar to what he had seen on 2017 Oct 29 during another repeat illumination observing session.

Figure 12. Eratosthenes on 2018 Nov 16 UT 23:50 by Walter Ricardo Elias (AEA), and orientated with north towards the top.

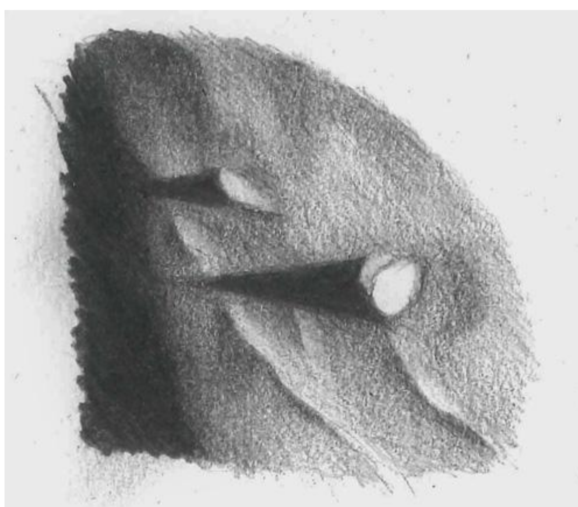

Figure 13. limited by resolution in this day light shoot, at least we now have the normal appearances of these craters to compare with.

Pytheas: On 2017 Nov 17 UT 19:29 Derrick Ward (BAA) imaged this crater under the same sun angles, to within ±0.5° to the following visual report:

> *On 1982 Aug 29 at UT 02:13-02:30 Robotham (Springfield, ON, Canada, x97 and x160) found that the west rim of Pytheas crater was very bright, especially at lower magnifications, being one of the brightest spots on the Moon. The Cameron 2006 catalog ID=182 and weight=3. ALPO/BAA weight=2.* **[REF 27]**

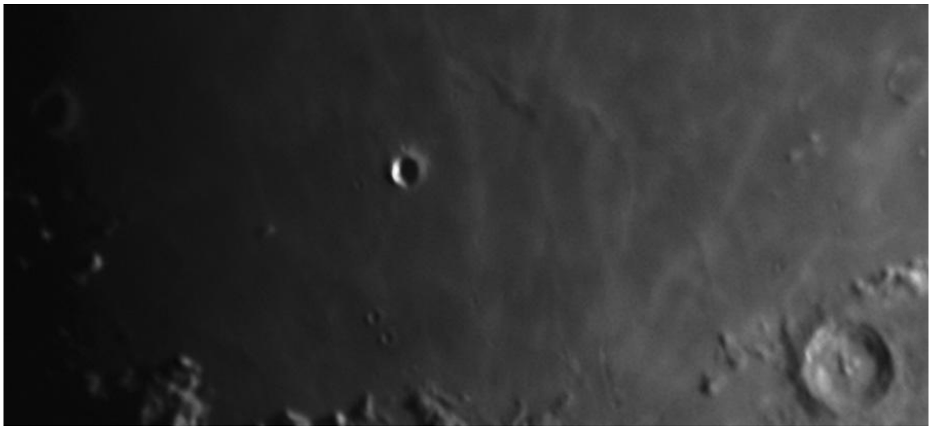

Figure 14. Pytheas crater on 2017 Nov 17 UT 19:29 taken by Derrick Ward (BAA). Orientated with north towards the top.

It certainly would appear that west rim of Pytheas (Fig 14) is very bright – though whether it is one of the brightest spots on the Moon is less certain from this image.

Plato: On 2018 Nov 18 UT 09:11-09:32 Maurice Collins (ALPO/BAA/RASNZ) produced a whole Moon mosaic, and part of this covered the Plato region during the repeat illumination (to within ±0.5°) of the following 1969 report:

Plato 1969 May 26 UT 20:30-21:05 Observed by Farrant (Cambridge, England, 8" reflector, x160, S=G) "Had misty portion of SW(ast. ?) floor from 2030-2105h at which time it was gone. Clearly seen, had ill-defined boundaries & was an easy obj. to see. Alt.=33 deg. (Apollo 10 watch)." NASA catalog weight=3. NASA catalog ID No. 1148. ALPO/BAA weight=2. **[REF 28]**

Figure 15. Plato taken on 2018 Nov 18 UT 09:11-09:32 by Maurice Collins (ALPO/BAA/RASNZ). Orientated with north towards the top.

The color image (Fig 15) that Maurice took shows the SW quarter of the floor to be lighter than the rest at the time the image was taken, though we cannot tell if this is transient – though my years of observing experience suggests this is unlikely.

Alphonsus: On 2018 Nov 18 UT 18:34 Robert Stuart (BAA) took a large area image mosaic of the Moon under both similar sun angle illumination and viewing angle, to ±1°, to the following report:

Alphonsus 1959 Feb 18 UT 21:00? Observed by Hole (Brighton, England, 24" reflector) "Red patch (Moore in Survey of the Moon says Jan. '59). Moore says, Warner, in Eng. saw it bright red in an 18-in refr. Hedervari & Botha in Hungary saw red patch & several in US (indep. confirm. ?)" NASA catalog weight=5. NASA catalog ID #714. ALPO/BAA weight=5. **[REF 29]**

Bob's image (Fig 16), although in monochrome, is a great reference image to compare the Hole LTP report against because both illumination and topocentric libration line up to match what the 1959 observers should have seen if everything was normal in appearance.

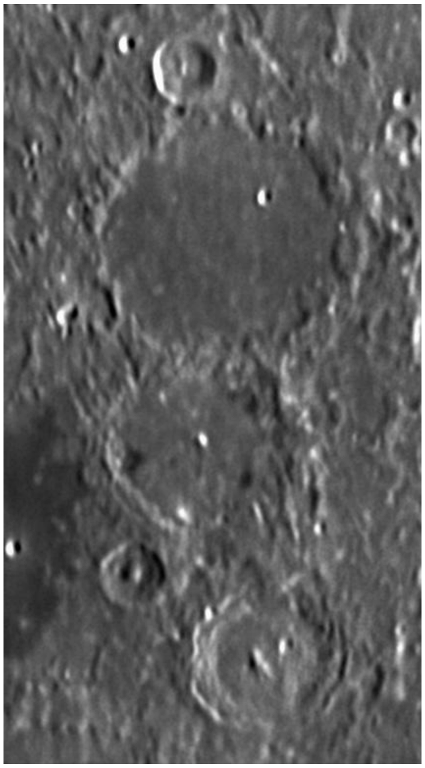

Figure 16. Ptolemaeus, Alphonsus and Arzachel from a larger image taken by Robert Stuart on 2018 Nov 18 UT 18:34. Orientated with north towards the top.

Aristarchus: On 2018 Nov 21 UT 18:50-19:10 Marie Cook (BAA) visually observed this crater under the same illumination (±0.5°) to the following:

Aristarchus 1959 Jan 23 UT 06:20 - Observer: Alter (Mt Wilson, CA, 60" reflector x700) "Brilliant blue in interior later turning white. Photos obtained. (MBMW has this entry twice for diff. dates because source gave UT date as 23rd.)" NASA catalog weight=5. NASA catalog ID = #712. ALPO/BAA weight=4. **[REF 30]**

Aristarchus-Herodotus 1964 Sep 20 UT 04:15-04:50 - Observers: Crowe & Cross (Whittier, CA, USA, 19" reflector x390) "Several red spots in area between the 2 craters. No change in phenom. so stopped observing" NASA catalog weight=5 (very good). NASA catalog ID #849. Near Aristarchus 1788 Apr 19 UT 20:00? Observed by Schroter (Lilienthal, Germany) Event described as: "Small area very brilliant & other bright spots". No additional references given. NASA Catalog Event #44, NASA Weight=4. ALPO/BAA weight=1. **[REF 31]**

Marie was observing under moderate transparency and Antoniadi III seeing conditions. She noted no red spots in the area between Herodotus and Aristarchus. There was no blue visible in the interior of Aristarchus, though some atmospheric spectral dispersion on its exterior. The crater basically appeared normal.

Aristarchus: On 2018 Nov 25 UT 03:20-03:46 and 04:08-04:22 Alberto Anunziato (LIADA) observed this crater under three repeat illumination predictions, to within ±0.5°for the following:

Aristarchus 1964 Oct 23 UT 02:35-02:45 Observed by Bartlett (Baltimore, MD, USA, 3" refractor, 133 & 200x, S=3-5, T=4) "South floor region granulated, 6 deg bright with very faint trace of pale yellow color; rest of crater 8 deg bright." NASA catalog weight=4 (good), NASA catalog ID #859. **[REF 33]**

Aristarchus 1983 Oct 23 UT 19:00-01:30 Observer: Foley (Kent, UK, 12" reflector, seeing=II) noticed at 19:00UT an extended bright spot on E wall and extending beyond. This was brighter than other areas of the crater. There was also occasional star-like glistening. Foley comments that the inside of Aristarchus was slightly obscured. The LTP started fading from UT20:30 and finished by 01:30UT. six out of nine independent observers confirmed the effects seen. In total 14 observers observed, 9 reported back and 6 found abnormalities in Aristarchus though all encountered variable seeing conditions - some had spurious color. Cameron comments that this was one of the best recorded/confirmed LTP events. All CED brightness measurements obtained were very high. Moore, Nicolson and Clarke (5" refractor and 15" reflector, 230-350xseeing III) found the crater to be very bright at 19:11UT through a 5" refractor and there was a blob on the east rim

(Bartlet's EWBS?) at 19:14UT. Nicolson also saw a very bright star-like area on the eastern wall but this was not defined as it usually is. The crater was also very bright at 22:43UT using the 15" reflector available to these observers. At 01:07UT they used a Moon blink and discovered that the bright region was bright in blue light and less bright in red - although this was not a detectable blink when switching rapidly between filters. They found that the crater had returned to normal by 01:15UT. M.C. Cook (Frimley, UK, seeing III-IV) observed a large diffuse spot on the east of the crater that was brighter in blue than in red light and the CED device gave a high reading. J.D. Cook (Frimley, UK, seeing III-IV) made a sketch that showed the bright spot extended on the east wall - again the CED reading was high and a lot of detail was visible on the floor. A.C. Cook (Frimley, UK, seeing III-IV) also noted remarkable detail and the bright (as confirmed by CED) blob on the eastern rim. G. North (Sussex, UK, seeing III-II) also confirmed the bright blob on the eastern wall. Wooller found the north west wall was a dirty yellow color - though no color was seen elsewhere in or outside the crater. Mosely found the crater to be bright and his sketch revealed the extension of the bright blob on the eastern rim and again a great deal of interior detail. Amery (Reading, UK, seeing III) found Aristarchus to be "a brilliant splash against dulled background in violet filter, especially polarizing filter. CED + polarizer readings high, but not as high as previous night". Mobberley (Suffolk, UK, seeing III-IV) remarked that "spurious color a total mess around Aristarchus & nothing abnormal seen". A photograph was taken at 20:50UT reveals the bright blob and entire detail. Peters (Kent, UK, seeing III-II) observed Aristarchus with a UV screen from 20:15-21:23UT and commented that although being very bright, there was no variation between white and UV. It was checked with a Moon Blink device and the radial bands were clearly seen in white light, < in blue. The Cameron 2008 catalog ID=233 and the weight=5. The ALPO/BAA weight=4. **[REF 34]**

On 2002 Sep 23 at UT22:45-23:56 C. Brook (Plymouth, UK) noticed that the bands inside Aristarchus varied (UT22:45-22:56) in definition whilst the rim of Herodotus and the rays of Kepler and Copernicus remained sharp. These bouts of variation were 1-2min in duration. At 23:56UT when he checked again the periodic blurring's of the bands were still present. The observer suspected atmospheric effects. M.Cook (Frimley, UK) observed 22:00-22:30 and could see only 2 bands on the west wall - but this may have been because of poor transparency. The ALPO/BAA weight=1. **[REF 35]**

Alberto reported that the crater was extremely bright and the appearance of the bands seemed to vary but with atmospheric seeing. Most of the time it was difficult to distinguish the bands during the first session (Fig 17 – Left), except at times of good transient seeing. When resuming the observation from 04.08 to 04.22 UT, under better seeing, the bands appeared more defined and four were observed (Fig 17 – Right). No color was seen. Everything looked normal.

Figure 17. Aristarchus as sketched by Alberto Anunsiato on 2018 Nov 25. **(Left)** 03:20-03:40 UT. **(Right)** 04:08-04:22 UT.

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

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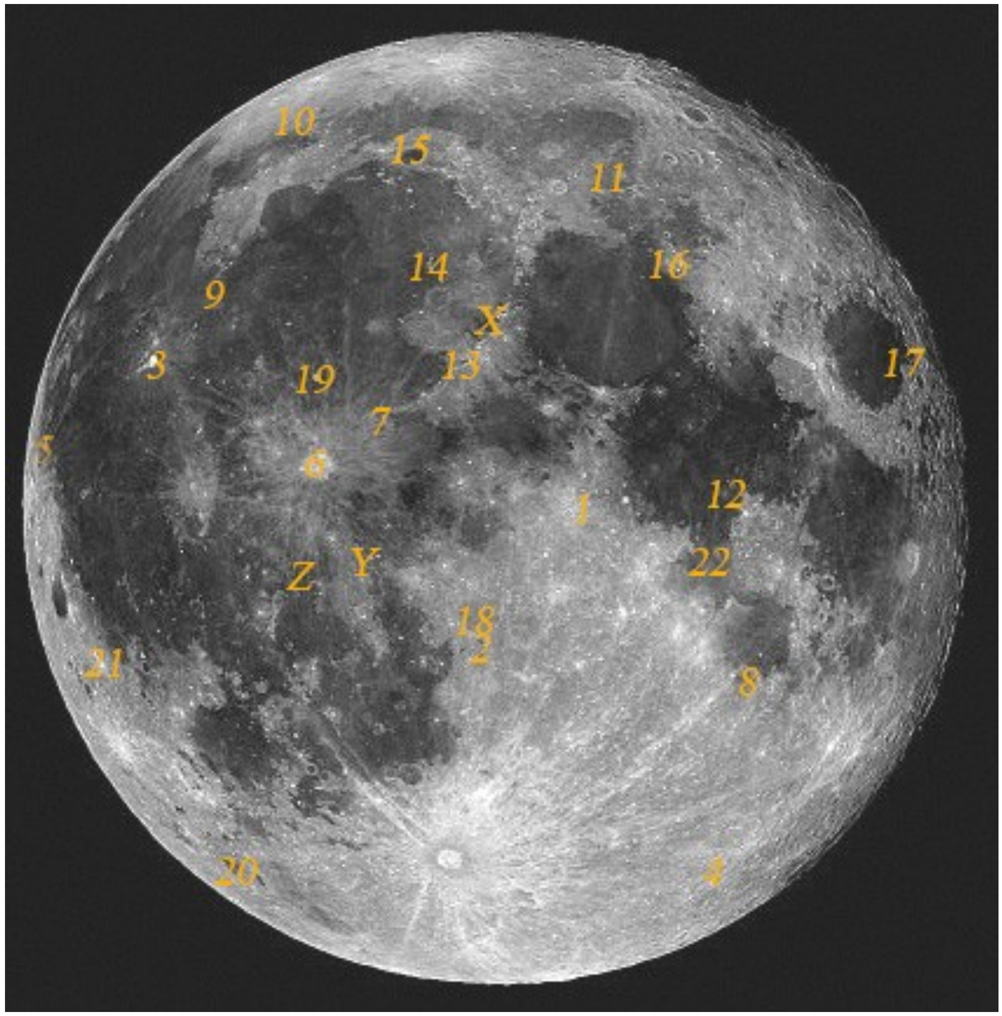
KEY TO IMAGES IN THIS ISSUE

1. Agrippa
2. Alphonsus
3. Aristarchus
4. Biela
5. Cardanus
6. Copernicus
7. Eratosthenes
8. Fracastorius
9. Gruithuisen
10. J. Herschel
11. Lacus Mortis
12. Maskelyne
13. Montes Apenninus
14. Montes Spitzbergen
15. Plato
16. Posidonius
17. Promontorium Agarum
18. Ptolemaeus
19. Pytheas
20. Schickard
21. Sirsalis
22. Toricelli



FOCUS ON targets

X = Apollo 15 Mare Imbrium-Hadley Rille
Y = Apollo 14 Fra Mauro
Z = Apollo 12 Ocean of Storms