THE LUNAR OBSERVER

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

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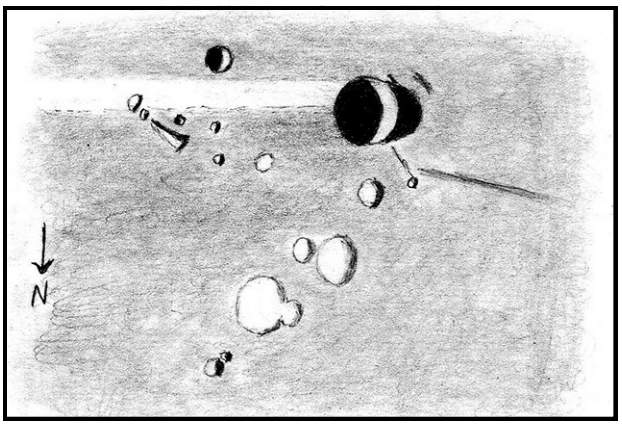
RECENT BACK ISSUES: http://moon.scopesandscapes.com/tlo_back.html

FEATURE OF THE MONTH – SEPTEMBER 2017
HORTENSIUS & DOMES



Sketch and text by Robert H. Hays, Jr. - Worth, Illinois, USA
May 8, 2006 02:00-02:30; UT, 15 cm refl, 170x, seeing 7-8/10.

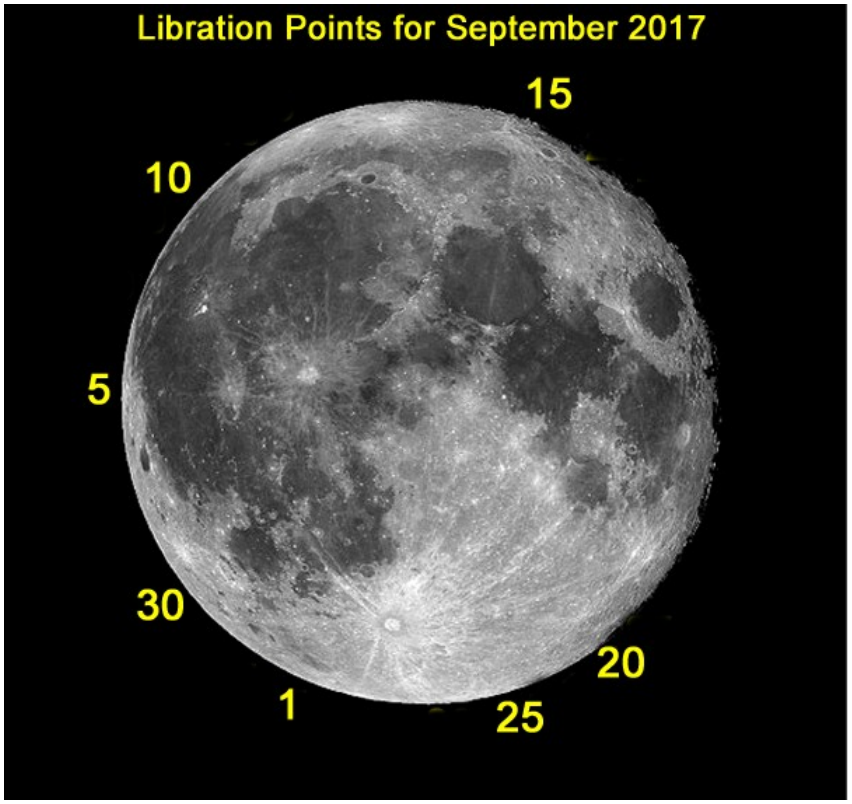
I observed this crater and vicinity on the evening of May 7/8, 2006 before the moon hid ZC 1643 and 80 Leonis. This is a modest, ordinary crater west of Copernicus. Hortensius showed considerable exterior shadow at this time. The presence of several domes to its northeast make this area interesting. The feature closest north of Hortensius is the dome Hortensius omega, according to the Lunar Quadrant map. There are four other domes to the northeast. The larger of the pair nearest H. omega is probably H. tau, according to the map, and the larger of the coalesced pair farther north may be H. phi. All of these domes are at least approximately round with only modest shading on their shadowed sides, but omega's shading appears slightly darker than the others. Hortensius gamma is farther to the northeast, but this is not a dome. H. gamma is a double peak with black shadow. The sizable pit toward the southeast is Hortensius C. North of C is a small group of peaks with a tiny craterlet mixed in. A shadowless bright spot is between this group and Hortensius. A faint ray extends eastward from Hortensius, passing just north of C. Near Hortensius and toward the west are some linear shadows which are either wrinkles or low ridges.

LUNAR CALENDAR
SEPTEMBER-OCTOBER 2017 (UT)

2017		UT	EVENT
Sep	01	02:03	Moon Extreme South Dec.: 19.4° S
	06	07:03	Full Moon
	12	12:09	Moon-Aldebaran: 0.4° S
	13	06:25	Last Quarter
	13	16:04	Moon Perigee: 369900 km
	14	13:00	Moon Extreme North Dec.: 19.4° N
	17	18:28	Moon Ascending Node
	18	00:56	Moon-Venus: 0.6° N
	18	04:32	Moon-Regulus: 0.1° S
	20	05:30	New Moon
	22	07:51	Moon-Jupiter: 4° S
	27	00:09	Moon-Saturn: 3.8° S
	27	06:49	Moon Apogee: 404300 km
	28	02:54	First Quarter
	28	10:06	Moon Extreme South Dec.: 19.5° S
Oct	05	18:40	Full Moon
	09	05:51	Moon Perigee: 366900 km
	09	18:05	Moon-Aldebaran: 0.6° S
	11	18:21	Moon Extreme North Dec.: 19.6° N
	12	12:25	Last Quarter
	15	10:54	Moon-Regulus: 0.2° S
	17	10:04	Moon-Mars: 1.9° S
	18	00:21	Moon-Venus: 2.1° S
	19	19:12	New Moon
	24	11:54	Moon-Saturn: 3.6° S
	25	02:25	Moon Apogee: 405200 km
	25	18:13	Moon Extreme South Dec.: 19.7° S
	27	22:22	First Quarter

LUNAR LIBRATION

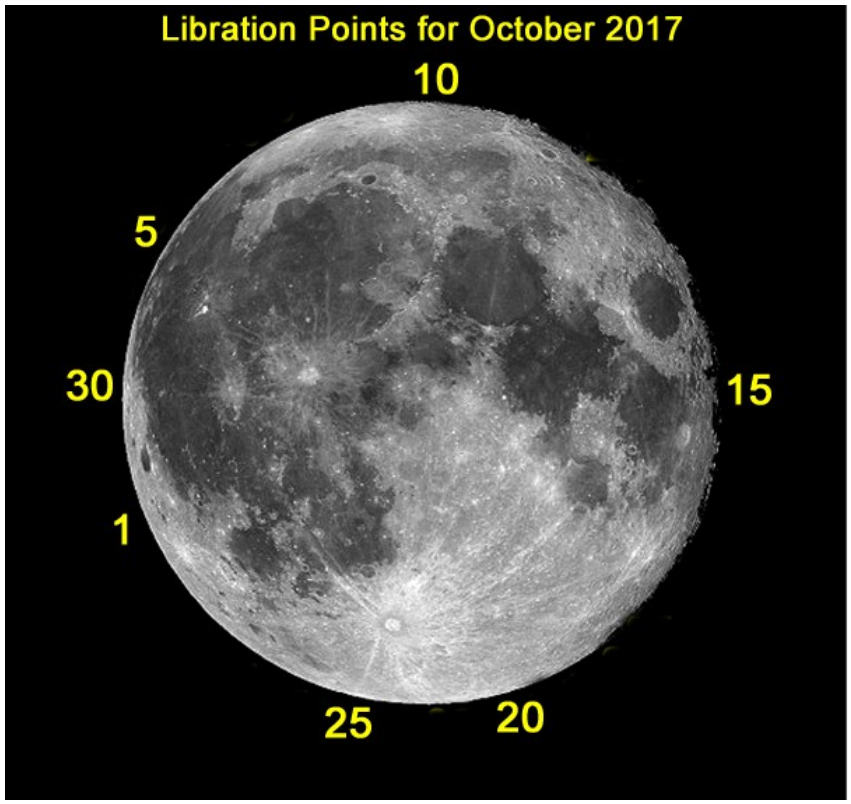
SEPTEMBER-OCTOBER 2017



Size of Libration

09/01	Lat -04°56'	Long -01°24'
09/05	Lat +00°22'	Long -04°55'
09/10	Lat +06°24'	Long -03°28'
09/15	Lat +04°13'	Long +01°34'
09/20	Lat -03°27'	Long +04°43'
09/25	Lat -06°42'	Long +02°30'
09/30	Lat -02°53'	Long -03°41'

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



Size of Libration

10/01	Lat -01°32'	Long -04°41'
10/05	Lat +04°12'	Long -05°26'
10/10	Lat +06°12'	Long +00°20'
10/15	Lat -00°09'	Long +04°36'
10/20	Lat -06°05'	Long +04°09'
10/25	Lat -05°09'	Long -00°49'
10/30	Lat +01°03'	Long -06°35'

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

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.

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, dd/mm/yyyy)
Size and type of telescope used Magnification (for sketches)
Filter (if used)
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

Full resolution images are preferred-it is not necessary to compress, or 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: Dorsa-Wrinkle Ridges

Focus on is a bi-monthly series of articles, which includes observations received for a specific feature or class of features. The subject for the **November 2017** edition will be **Dorsa (also known as wrinkle ridges).** 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 subtle 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 Dorsa article is October 20, 2017

FUTURE FOCUS ON ARTICLES:

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

Subject	TLO Issue	Deadline
Montes & Mons – Mountains and Mountain Ranges	**Jan. 2018**	**Dec. 20, 2017**
Rima – Rilles	**Mar. 2018**	**Feb. 20, 2018**
Craters – Latest and Greatest	**May 2018**	**Apr. 20, 2018**

Focus On: Lunar Domes

Jerry Hubbell
Assistant Coordinator, Lunar Topographical Studies

Lunar Domes, as a group, are very interesting subset of lunar formations and lay testament to the volcanism that drove a large part of the topography of the lunar surface. Early exploration of lunar domes was recorded in 1935. Nigel Longshaw, on his lunar domes webpage states:

> "…Domes were formally thought to be quite rare, although certain areas of major dome distribution had received attention by several early lunarians, for example S.R.B. Cook's observations of the Milichius/Tobias Mayer area in 1935 and Schlumberger's drawing of the Hortensius domes published in "The Moon", by W. Goodacre…"

In the ALPO, the study of lunar domes as a separate subject in lunar topographical studies has been in place probably for more than 70 years. In 1958, Abbey, L. B. and Both, E. E. published a catalog of lunar domes in the *Strolling Astronomer,* volume 12, p 96. Later in 1969, an article by Kenneth J. Delano titled "A Revised Catalog of Lunar Domes" was published in the *Strolling Astronomer,* volume 21, p 76-79 and provided an updated list of lunar domes for ALPO members to observe.

Later, other groups were formed to identify and catalog lunar domes based on small telescope observations. The Geological Lunar Research Group (GLR Group) was established by Piergiovanni Salimbeni and Raffaello Lena in 1997. This group also produces the publication *Selenology Today* which provides many detailed articles on lunar domes. It is well worth the time to look over and examine each issue. The most recent issues of *Selenology Today* include articles about lunar domes. Articles about the detailed studies of groups of domes are available including an article in issue #35, "Domes in northern Mare Tranquilitatis: Morphometric analysis and mode of formation" written by Raffaello Lena and Paolo Lazzarotti (GLR Group). The group has also established a blog specifically about lunar domes and includes a detailed description of the formation of the individual domes in the atlas.

The general study of the effect on topographical features due to volcanism and subsurface lava flows due to lunar impacts is well established. The specific impact on lunar topography and the terrain due to the formation of lunar domes is a very specialized field of study, but the goal is to gather data on the general formation of the lunar crust. This is why it is of particular interest to professional and amateur lunar scientists.

Here is an excerpt from the Lunar Domes Atlas GLR Group webpage on the "Overview of Lunar Domes" and provides an excellent description of how and why lunar domes were formed:

> "Lunar domes formed during the terminal phases of lunar eruptions and mostly occur in the maria. Few domes have been reported in the highlands. These volcanic constructs formed during the later stages of volcanic episode on the Moon, characterized by a decreasing rate of lava extrusion and a comparably low eruption temperature, resulting in the formation of effusive domes. Most lunar

domes are hemispherical and have summit pits and are formed by outpouring of magma from a central vent (effusive eruption). The profile of domes that are flat suggests that there was no gradual inclination at the vent (the rising lava did not build up the dome in a series of flows) but a subsurface intrusion of magma, a possible intrusive origin, and interpreted as terrestrial laccoliths. In this case, magma accumulates within the lunar crust, slowly increasing in pressure and causing the crustal rock above it to bow upward…"

It continues:

"…the steeper domes represent the result of cooler, more viscous lavas with high crystalline content. Knowledge about the morphometric properties of lunar domes (diameter, height, volume) allows to estimate the rheologic properties of the magma which formed the dome, i.e. its viscosity and eruption rate as well as the duration of the effusion process and the feeder dikes geometry."

Contributing images to the study of lunar domes is very well established in the ALPO, and is well worth the time and effort to learn how to effectively image, identify, and measure with tools such as the Lunar Terminator Visualization Tool (LTVT). Here are a few submitted observations of lunar domes and the notes provided by the observers:

"…Even relatively far from the terminator (colongitude 41.1 °), with a moon illuminated at 86.2%, and with a small telescope, the solitary dome Kies Pi is visible as a bright spot of 12 km diameter, the highest and the brightest point In Kies panorama, the only tenuous shadow was on the edge of the Kies flooded crater. Kies Pi was remarkable even in the bright surface of a 10.49 days moon, although I did not see its famous summit craterlet…"

Figure 1. Kies Pi, Alberto Anunziato, Paraná, Argentina, May 7, 2017 0303-0330 UT, 105-mm Mak-Cass, 154x, Seeing 7/10, Colongitude 41.1 °.

"…I only perceived Arago Alpha, indirectly, by the shadow of its outline. As a black hole, which we can not observe but infer its existence by the effects on nearby visible bodies, Arago Alpha could only be inferred by the scarce shadow that projected on Mare Tranquilitatis…"

"…On the same night, twenty minutes after drawing Arago Alpha, I observed Arago Beta, much brighter than Arago Alpha. Part of that difference in brightness can be attributed to the difference in solar altitude between the schedules of both observations, but it would seem a correct inference to attribute the difference in

brightness (visible most clearly in the sketch in which both appear) to the highest height of Arago Beta…

Figure 2. Arago Alpha and Beta, Alberto Anunziato, Paraná, Argentina, April 16, 2017 0500-0525 UT, 105-mm Mak-Cass, 154x, Seeing 7/10, Colongitude 41.1°, north/up, east/right.

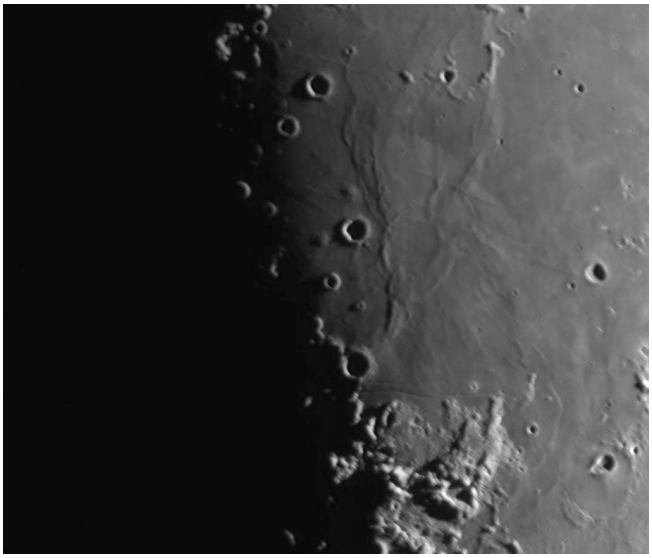


Figure 3. Domes Near Arago, David Teske, Louisville, MS, May 2, 2017 0146 UT, 140 mmMaksutov, Mallincam Skyraider GMTm camera, Seeing 4-5/10,

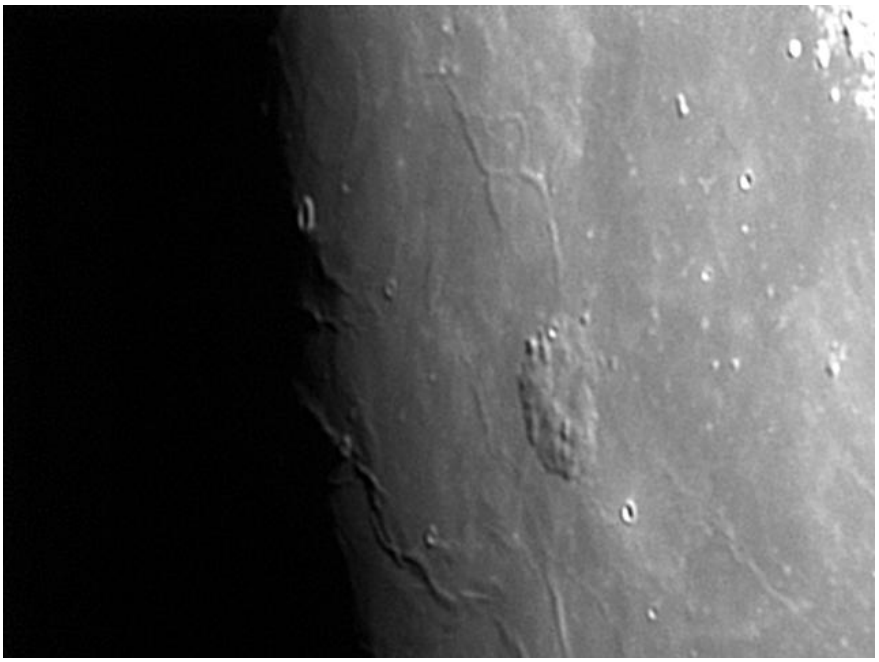


Figure 4. Lunar Domes on Mons Rümker, Jerry Hubbell, Locust Grove, VA, January 6, 2012 0133 UT, 5-inch APO refractor, DMK 41AU02 CCD video camera, Seeing 6/10, north/up, east/right.

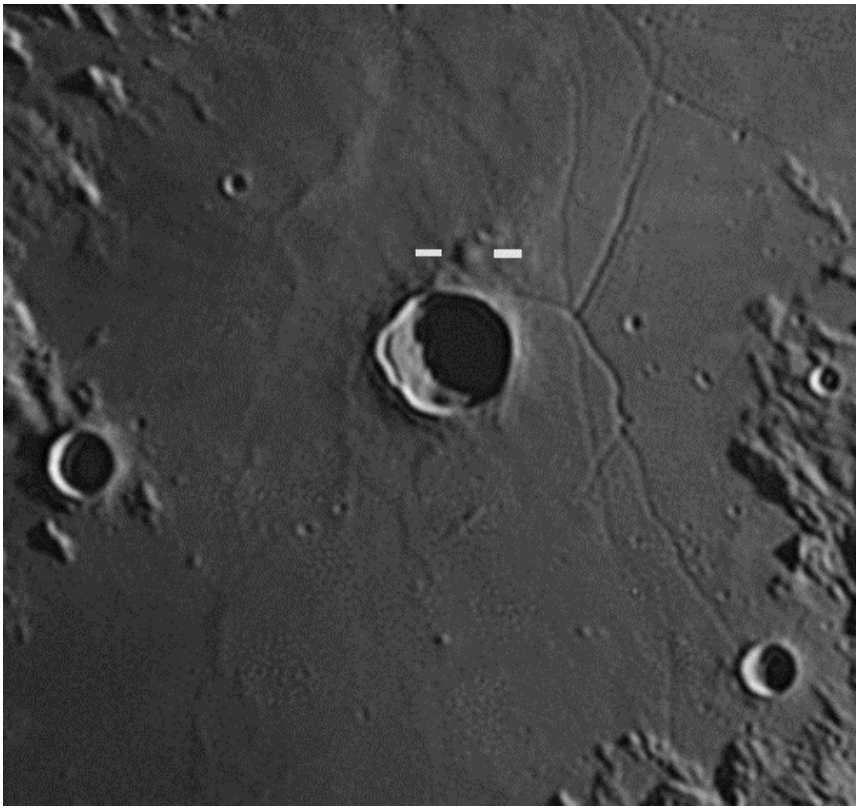


Figure 5. Lunar Dome Near Triesnecker, Rik Hill, Tucson, AZ, June 13, 2016 0236 UT, 35-cm C14 SCT, Wratten 21 filter, SPC900NC CCD camera, north/up, east/right.

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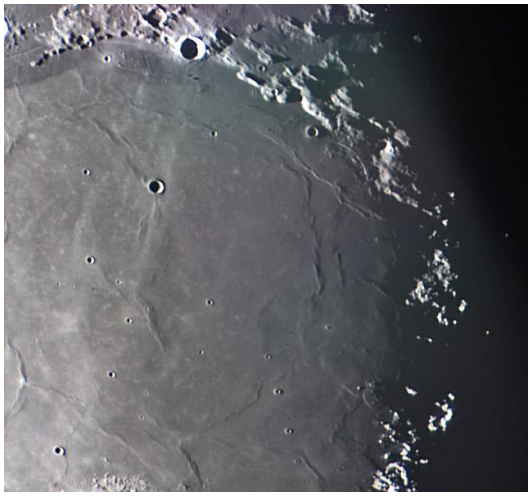
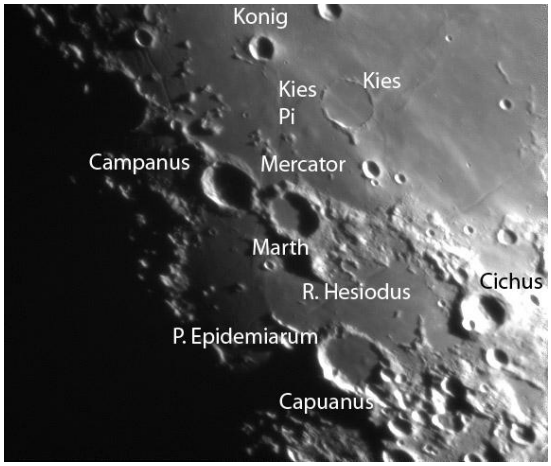
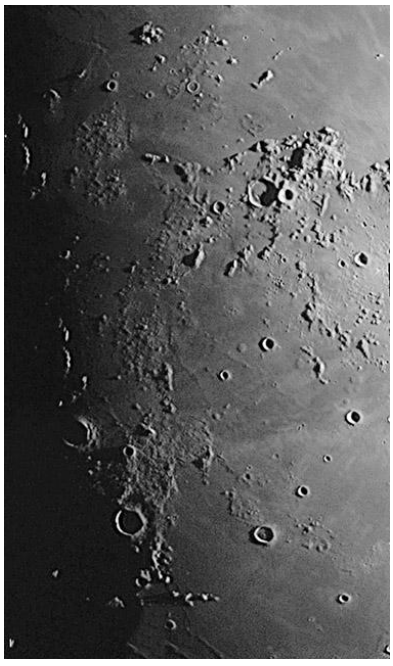
ADDITIONAL DOME IMAGES



VALENTINE DOME- Maurice Collins,- Palmerston North, New Zealand. July 30, 2017 07:23 UT. FLT-110 3x barlow, ASI120MC. North down.

KIES π – John Duchek - Carrizozo, New Mexico USA. May 06,2017:03:11 UT. 7" SkyWatcher Mak-Cas F/15. DMK21AUO4 , Orion green filter.

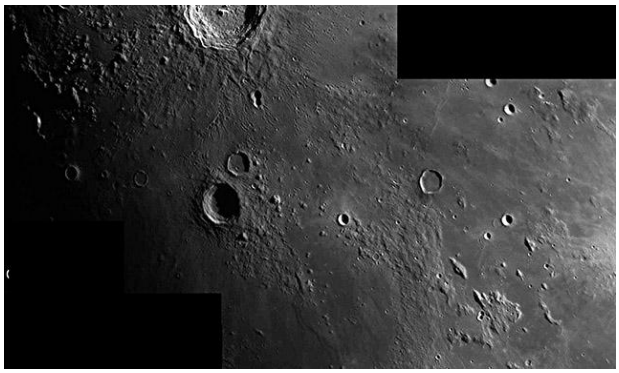


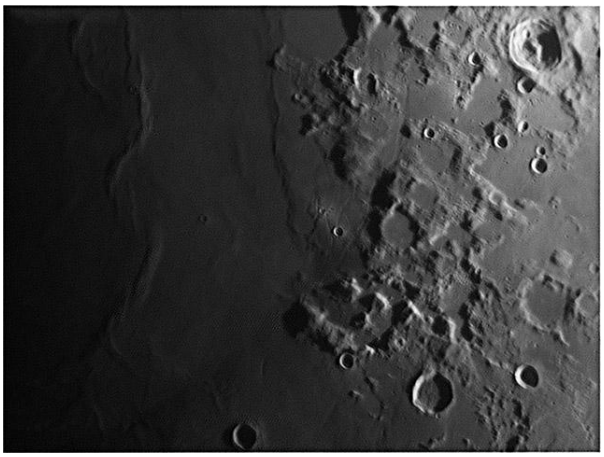


MARE INSULARUM DOMES - Richard Hill – Tucson, Arizona USA May 10, 2014 01:23 UT. Seeing 7/10. 8" Mak-Cass, f20, 656.3 nm filter, SKYRIS 445M.

ADDITIONAL DOME IMAGES

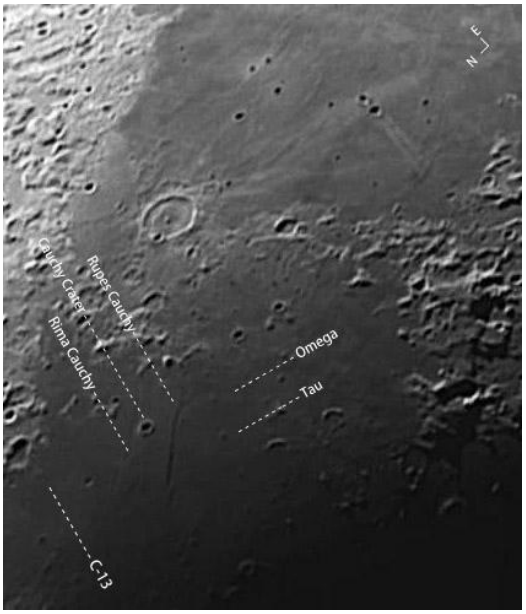
GAMBART DOMES - Richard Hill – Tucson, Arizona USA June 15, 2016 02:55 UT. Seeing 8/10. 8" Mak-Cass, f20, 656.3 nm filter, SKYRIS 445M.





TAURUS-LITTROW - Richard Hill – Tucson, Arizona USA April 13, 2016 02:37 UT. Seeing 7/10. 8" Mak-Cass, f20, 656.3 nm filter, SKYRIS 445M.

CAUCHY – Michael Sweetman – Tucson, Arizona USA. March 3, 2017 04:55 UT. Unitron 60mm f/15 refractor. Skyris 132M, Baader fringe killer filter. Seeing 4-5/10 transparency 3/6.



IN THE SHADOW OF PETAVIUS

Richard Hill

Sharing a favorable colongitudes with the great Petavius, poor old Langrenus (136km dia.) (fig. 1) is often overlooked while its bigger brother is over-looked. It's a magnificent crater with dome-like structures on its floor and spectacularly terraced walls surrounded by radially splattered ejecta. To the northwest is a trio of smaller craters arranged in a tight triangle. the one closest to Langrenus is Atwood (31km) above it is Naonobu (36km) and below it the largest of the trio, Bilharz (44km). All three are about half a billion years older than Langrenus, possibly as old as 3.8 billion years old. Note the collection of secondary cratering between Bilharz and Naonobu. This was likely cause during the Langrenus impact event. In the upper left of this image is a flooded crater Webb (22km). In between Naonobu and Webb is a small crater Webb D (7km). Notice to the left of that crater is a nice neat dome for which I cannot find a designation. In the lower left corner can be seen a good portion of the dramatic Dorsa Deikie a huge wrinkle ridge.

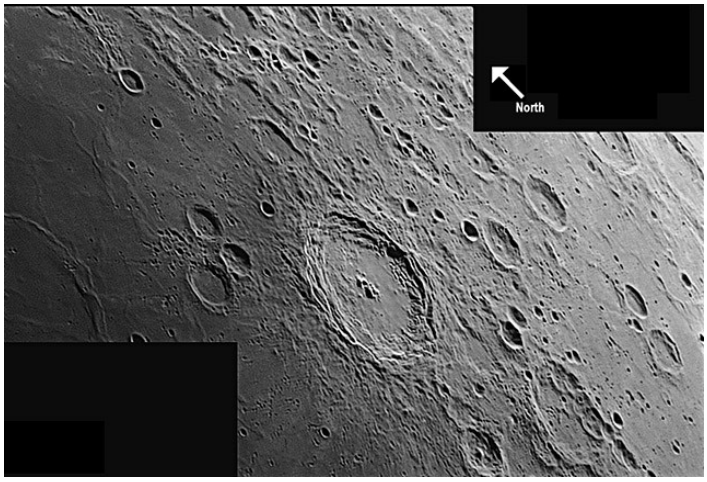


Figure 1. ***LANGRENUS*** *Tucson, AZ USA. June 28, 2017 03:05UT.* Seeing 8/10. Tec 8" Mak-Cass, f/20, 656.3nm filter, Skyris 445.

Moving away from Langrenus to the right in this image we come across two similar craters Barkla (44km) and Kapteyn (51km). Then below and a little right of Langrenus is Lohse (43km). All these craters are the same age as our former trio and older than Langrenus. If the competition from Petavius were not so great this crater would be more lauded among lunar observers!

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Red Moon over Russia

Anthony Cook

Being married to a former Russian Planetary Geomorphologist, the family once a year takes a trip out to Russia, to stay in a country dacha (a kind of cottage people live in over the summer vacation, but abandon outside of summer due to the low temperatures). Being away from home is not good though as I cannot observe, so I have attempted to build a crude, low cost, experimental 6" prime focus telescope out there (fig. 1). Not knowing where to source a primary mirror from in Russia I bought one on E-Bay and took it with me from the UK, along with a few parts to make a crude Dobsonian. The remainder I found on scrap heaps or bought from Russian building supplies stores. Bread chopping boards were used for the stationary base, rotating base and sides, all held together with bookshelf brackets. A large rotating ring with ball bearings (akin to a cake stand, or what one find inside a rotating table) served as an azimuth mechanism, and I utilised old 3D printer bearings for altitude motion. The mirror was placed into a baking dish with springs and screws to adjust the alignment. A couple of aluminium girders were used to support a

cheap USB microscope camera at the other end at prime focus. As the back end of the telescope was top heavy, some string was attached to the front of the girder and a shaft at the base of the back of the Dobsonian mount was used to wind up the string and change the altitude of the telescope.

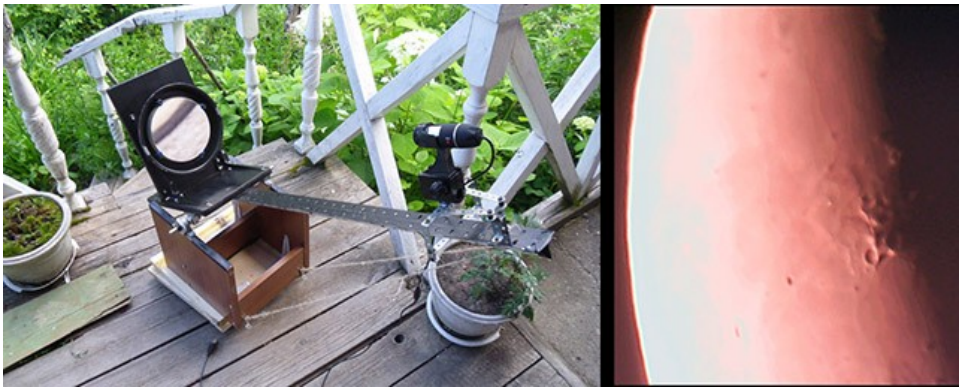

Figure 1. Telescope and lunar image

I have to say that the video and imagery captured so far have been inferior for several reasons. Firstly the Moon is pretty low at that time of the year near to Sergiyev Posad at 56˚ N, so I had to move the scope's physical position every ten minutes or so, as coniferous trees would block the view. Secondly because the summer was colder than usual, some neighbours would be burning wood in stoves or heating bath houses, and so wafts of smoke or steam would often drift past the Moon. Twilight was another problem at that time of the year, and so because the scope had no tube, there were issues with scattered light entering the microscope. Finally I was at the mercy of some hungry Russian mosquitoes. Anyway I have enclosed a picture of the scope, and a crude image that was obtained of the Aristarchus region just before lunar sunset.

Although the image (fig. 1), taken on 2017 Jul 20 UT 00:47, is of poor resolution, and somewhat reddened due to the Moon's low altitude and local smoke and water vapour, it does at least show some nice wrinkle ridges in the vicinity of Aristarchus.

For next year I plan on making some improvements. Firstly some extra vibration dampening is needed on the mounting. Secondly I might add a low weight homemade black paper, or black polythene sheet, tube so that the scope is more light-tight. Thirdly I will bring out a better camera which can have lenses added to it in order to increase the magnification – though I might need to improvise a water cooling jacket (from a plastic pipe) to take any excess heat away. The present CMOS USB microscope does not seem to generate much heat, or produce thermal effects in the field of view.

Does anybody else have a story to tell about telescopes that they have built whilst on vacation away from home, or does everybody just pack portable scopes in their flight luggage these days? I would also be happy to hear of any suggestions of improvements to my unorthodox design.

THE RILLE IN THE VALLEY

Richard Hill

As the monsoons continue with night after night under clouds, though I did get a few minutes naked eye peak at the moon a few nights ago, I am still thrashing through 4 years of lunar observations getting ready to add them to my on-line database. I came across this image. The features are old familliar ones laid out diagonally from Plato (104km dia.) in the upper left to Cassini (60km) in the middle to Aristillis (56km), with the cluster central peaks, at bottom and Calippus (34km) in the northern end of the Montes Caucasus that stretch to the bottom of the image. The Montes Alpes runs between Plato and Cassini and conspicuous is the Vallis Alpes that runs perpendicular to them. There is a rille that runs up the middle of this valley that is well known to seasoned lunar observers. Seeing it is difficult unless you are blessed with a particularly steady atmosphere. Imaging it is a bit easier with today's high speed cameras that can take thousands of images in just a minute or so and software that can pick out the best and stack them. But even with that, it still requires things to be fairly calm, the lighting and sun angle (colongitude) to be just right and the libration to provide a good viewing angle. Otherwise you only capture pieces of the rille. I have managed to capture pieces of it with my Questar on the best of nights. Other observers have reported it partial with 6" apertures. But for the 5 years I have had the TEC 8" f/20 Mak-Cass I have made it a point to try and capture the entire rille. In this image that goal has been met. On this night and this time, the colongitude was 10.3deg, phase 72.8deg., illumination 64.8% and libration +06d 20' lat and +06d 50' long. I was thrilled to see the clear trace of the rima up the whole length of the Vallis Alpes shown best in the inset. I credit this to the good night, the best lunar parameters, a telescope of excellent quality and the Skyris camera with it's 3.74micron pixels.

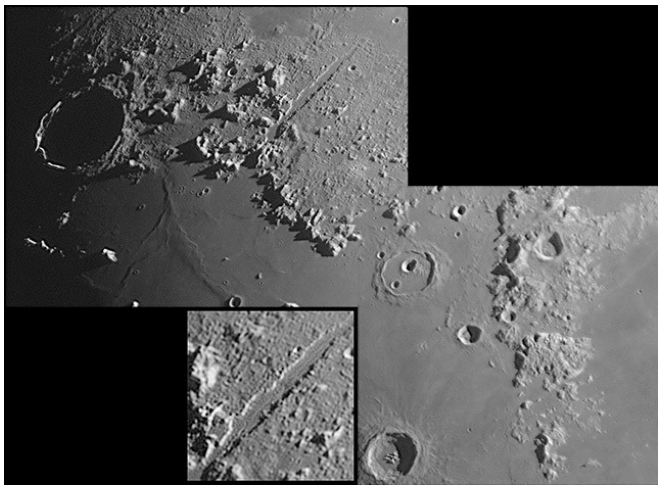

Figure 1. ***PLATO-MONTES CAUCASUS.*** *Tucson, AZ USA. March 17 2016 02:20UT.* Seeing 8-9/10. Tec 8" Mak-Cass, f/20, Colongitude 10.3º. 656.3nm filter, Skyris 445.

LUNAR TOPOGRAPHICAL STUDIES

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OBSERVATIONS RECEIVED

ALBERTO ANUNZIATO—PARANÁ,, ARGENTINA. Drawings of Arag α, Arago β, Cauchy, Kies π,& Luther domes.

MAURICE COLLINS - PALMERSTON NORTH, NEW ZEALAND. Digital images of 2, 4, 7, 12, 13(3) day moon, Ariadaeus, Aristarchus(2), Aristoteles, Bailly, Copernicus, earthshine(2), eastern Moon, Mare Humorum, Marius Hills, Mons Rumker, Plato, Schickard, Tycho & Valentine dome.

ROBERT HAYS - WORTH, ILLINOIS, USA. Drawings of Hortensius domes, Jansen B, & Messier G-Goclenius A.

RICHARD HILL – TUCSON, ARIZONA, USA. Digital images of Atlas-Hercules, Caucasus Mtns-Plato, Mare Insularum domes, Gambart,Hortensius, Taurus-Littrow, Theophilus & Triesnecker

DAVID TESKE - LOUISVILLE, MISSISSIPPI, USA. Digital image of Arogo domes

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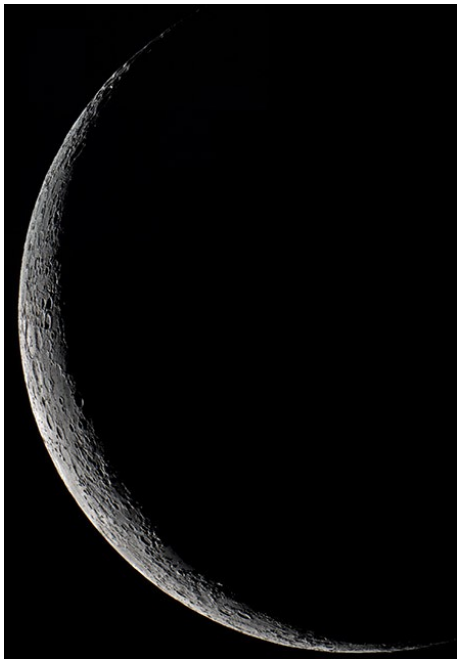
RECENT TOPOGRAPHICAL OBSERVATIONS



2-day Moon - Maurice Collins,- Palmerston North, New Zealand. August 24, 2017 06:12-06:18 UT. C-8 SCT, ASI120MC. North down,

RECENT TOPOGRAPHICAL OBSERVATIONS

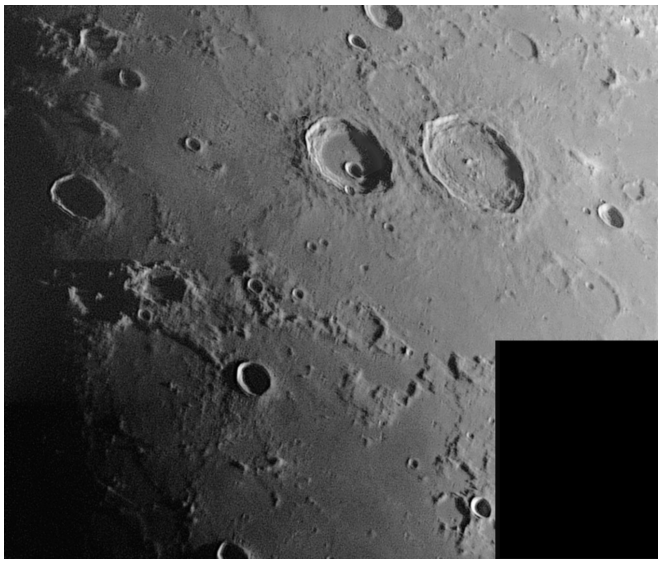
Earthshine - Maurice Collins,- Palmerston North, New Zealand. August 24, 2017 07:03 UT. C-8, Canon 1200D. North down.

Ed. Note: Compare this image to the next image of the 13-day moon. Earthshine is high angle illumination.

13-day Moon - Maurice Collins,- Palmerston North, New Zealand. August 5, 2017 05:40 UT. FLT-110, ASI120MC. North down,

MARE HUMORUM—Maurice Collins,- Palmerston North, New Zealand. August 5, 2017 06:33 UT. FLT-110, f/14, ASI120MC. North down,

RECENT TOPOGRAPHICAL OBSERVATIONS



ATLAS-HERCULES - Richard Hill – Tucson, Arizona, USA March 14, 2016 01:10 UT. Seeing 8/10. 8" Mak-Cass, f20, 656.3 nm filter, SKYRIS 445M.

Two craters can be seen staring out from the northern cusp of the five day old moon like a couple searching eyes south of Endymion. These two are Atlas (90km dia.) on the right (east) and Hercules (71km) on the left (west) with a nice 13km crater Hercules G, on its floor. On the floor of Atlas can be seen a wonderful system of fine rilles, Rimae Atlas. These rilles seem to have several different origins with the "V" of them straddling the remnants of the central peak looking on LROC like graben. Directly above these two is the crater Keldysh (34km) partly cut off by the image edge. A line from Keldysh through Hercules points to the shadow filled crater Grove (29km). Between Grove and Atlas is the ruined ancient crater Williams (37km) at 3.9-4.5 billion years age. Above and to the west of Grove are two side by side craters that I find very interesting. The very ancient looking one on the right is Mason (44km) and it's actually about a billion years younger than Williams. Next to it, deep in shadow with just the west wall and central peak showing is Plana (46km) of the same age. Note the curious apron that extends to the southeast from Mason pointing back to Grove. We can see Burg (41km) just coming out of shadow above Plana, at the center of Lacus Mortis and lastly in the upper left corner is Baily (27km) not to be confused with Bailly, a much larger feature.

THEOPHILUS - Richard Hill – Tucson, Arizona, USA April 13, 2015 02:46 UT. Seeing 7/10. 8" Mak-Cass, f20, 656.3 nm filter, SKYRIS 445M.

Who doesn't love Theophilus crater ("the awfulest crater")? It's 104km diameter encloses a wonderful central peak that sparkles in the morning sunlight and fantastic terraced walls. Surrounding its northern half is the splash of the ejecta blanket. Below and overlapped by Theophilus is the 100km crater Cyrillus almost a billion years older. Notice how its central peaks were deformed by the Theophilus impact. To the right of Theophilus is Madler (29km). It has an odd ray system partially seen here as a white ray extends from the northern wall to the right. The crater in the upper right with a smaller crater on its floor is Isidorus (43km).

LUNAR GEOLOGICAL CHANGE DETECTION PROGRAM

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Observations for July were received from the following observers: Jay Albert (Lake Worth, FL, USA - ALPO) observed: Aristarchus, Atlas, Censorinus, Curtis, Lambert, Moltke, Plato, Proclus, Promontorium Laplace, Ross D, Timocharis, and Vallis Schroteri. Alberto Anunziato (Argentina, AEA) sketched/observed: Alphonsus, Archimedes, Aristarchus, Censorinus, Curtis, Dawes, Julius Caesar, Messier, Picard, Proclus, Theaetetus, Theophilus and several other features. Maurice Collins (Palmerston North, New Zealand – ALPO/BAA/RASNZ) imaged: Alphonsus, Ariadaeus, Aristarchus, Atlas, Bailly, Clavius, Copernicus, earthshine, Gassendi, Grimaldi, Harpalus, Langrenus, Mare Australe, Mare Serenitatis, Plato, Posidonius, Proclus, Schickard, Schiller, Sinus Iridum, Theophilus, Torricelli, Tycho, and generated some whole Moon mosaics. Anthony Cook (Newtown, UK, & E of Sergiyev Posad, Russia, ALPO/BAA) imaged Maurolycus, Pitiscus, Rima Ariadaeus, and the South Pole area. Valerio Fontani (Italy, UAI) imaged Eratothenes, Gassendi, and Pallas. Rik Hill (Tucson, AZ – ALPO/BAA) imaged: imaged Rima Ariadaeus, Maurolycus, and the south pole area. Camilo Satler (Argentina, AEA) imaged Several Features. Franco Taccogna (Italy – UAI) imaged Gassendi, Schickard, Herodotus, Mons Gruithuisen, Pythagoras, Reiner Gamma, Schiller, and the Full Moon. Aldo Tonon (Italy, UAI) imaged Eratosthenes.

News: This month our newsletter differs to its usually nearly identical twin sister article, in the BAA Lunar Section Circular, in that the previous BAA LSC article was a combined Aug/Sep edition, whereas here in ALPO we have continued with separate Aug and Sep editions. As the deadline for the BAA LSC was earlier than normal, we did not include all the July observations. So I am pleased to present July in its entirety here.

In the October 2017 edition of Sky and Telescope, there will be an interesting article offering a neat explanation for bright star-like point, apparently seen on the night side of the Moon in 1794 and analyzed by the then Astronomer Royal: Maskelyne. More about this next month, after the article has been published.

Finally, I have been sent a couple of small Russian Monoculars by Jason Wentworth, that he found on E-Bay. Although these are only x2 magnification, they are able to augment naked eye views of the lunar earthshine, or lunar eclipses, in that the Moon is twice as big, Furthermore they fit on a key ring and are rather inexpensive. They could be useful in our program of monitoring the brightness of earthshine and features within it, though I have found they do suffer a little from chromatic aberration.

LTP Reports: No LTP reports have been received for July.

Routine Reports: Below is a selection of reports received for July that can help us to re-assess unusual past lunar observations.

Eratosthenes: On 2017 Jul 01 UT 21:30-21:33 Valerio Fontani (UAI) and Aldo Tonon (UAI) imaged this crater under a similar range of selenographic colongitudes (14.3˚-15.5˚) to two earlier observational reports of color:

On 2009 Nov 25 UT18:42-21:03 P.Abel, T.Little and C.North (Selsey, UK, 15" reflector, seeing II-III, transparency very good), all saw visually a brownish tinge on the north west rim of Eratosthenes crater. P.Abel made a sketch and T.Little took some high resolution CCD images, some of which were through colored filters. Checks were made for spurious color, but none was seen elsewhere on the Moon. The eyepiece was changed but this made no difference. M.C.Cook (Mundesley) was observing with a smaller scope at the same time, but saw no color, however observing conditions were worse. W.Leatherbarrow (Sheffield, UK) was observing with an instrument mid way in size, and saw a brownish tinge in the NW rim area, but saw a similar color elsewhere and put this down to spurious color. Normally multiple observers seeing the same thing would result in a weight of 4, however as

only the Selsey came to the conclusion that it was not colour from our atmosphere, I am allocating an ALPO/BAA weight=3.

On 2012 Aug 25 UT1944-1952 Eratosthenes crater was imaged by C. Galdies (Malta, Nexstar 8SE, Philips SPC 900NC camera). 4 Registaxed images were produced covering 19:45, 19:48, 19:49, and 19:51. All but the first image, once first order spurious color had been removed, showed orange on the shaded terraces on the western illuminated rim (similar to what Paul Abel and others saw in 2009, albeit just confined to the NW rim), and the interior floor shadow was slightly smaller in red light. However orange color was also seen on the eastern side of mountains to the south of the crater, which infers that the spurious color removal did not fully accomplish its main goal. The effects were not caused by the registax software as the orange color is visible on individual images. Although probably the color is not lunar in origin, its explanation is not fully explained either, therefore an ALPO/BAA weight of 1 is being used for now.

In the report from 2009, the color was seen visually, and checks were made for atmospheric spectral dispersion by the observers concerned and not found elsewhere on the Moon – though an observer at a different site did claim to have seen colors induced by the atmosphere elsewhere. For the 2012 observation, color was imaged, but definitely seen elsewhere on the Moon, so most likely was not real. The two reports and past repeat illumination events are described in ALPO Newsletters 2009 Dec/2010 Jan, 2012 Sep and Oct, & 2016 Jun, for those who are interested? Aldo and Valerio's images in Fig 1 reveal no color present on the NW inner slopes on this occasion, though Aldo picked up a hint of color on 2015 Apr 15 (See p16 of 2016 Jun TLO), slightly earlier in lunar sunrise. We shall keep the weights as they are, but please continue monitoring the crater with high resolution color imagery, concentrating on the terraces on the NW inner slopes.

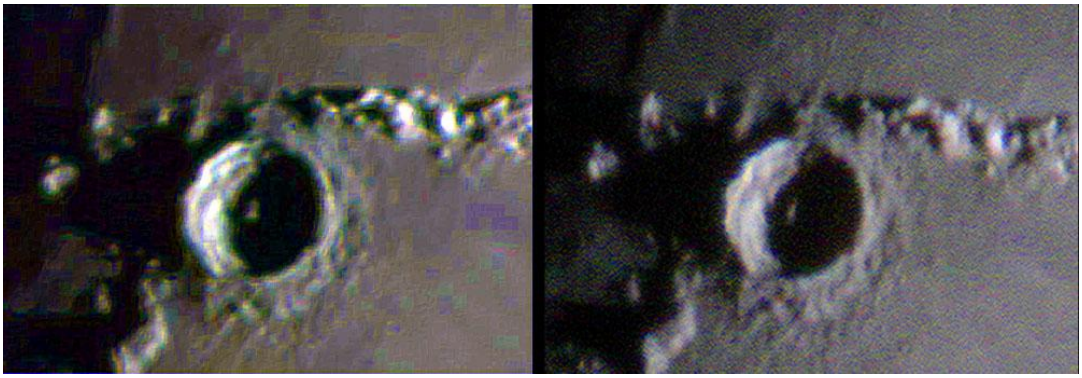

Figure 1. Color images of Eratosthenes taken on 2017 Jul 01 UT 20:31, orientated with north towards the top. These have both had atmospheric spectral dispersion removed, been color normalized, and then had their color saturation increased to 70%. **(Left)** Image taken by Aldo Tonon (UAI). **(Right)** Image taken by Valerio Fontani (UAI).

Curtis: On 2017 Jul 01 UT 22:48 Camilo Satler (AEA) imaged, and Alberto Anunziato 23:03-23:15UT, observed visually, this crater under the same illumination conditions (to within ±0.5˚) to a report of a brightness anomaly from 1882:

Williams of the UK, on 1882 Aug 21 at 19:30UT (Moon's age 7.9 days) noticed a spot at least half as bright, and as large as Picard, near to Picard crater. This observation was reported in the Astronomical Register of the Royal Astronomical Society and is not included in the Cameron catalogs. It is one of many measurements of the brightness of this spot for different illumination angles and is one of three outlying brightness points spotted on a graph by Williams. The ALPO/BAA weight=3.

Alberto comments that Curtis appeared like a fuzzy bright patch, perhaps 50% less bright than Picard, and in Carnilo's image, in Fig 2, it looks like it may be fainter still. However please bear in mind that Camilo's image was taken with a camera phone, and so has plenty of compression artifacts; but at least his image suggests that Alberto's description of Curtis being fuzzy is correct. We shall leave the weight of the 1882 observation at 3, as the crater should not have been brighter than Picard.

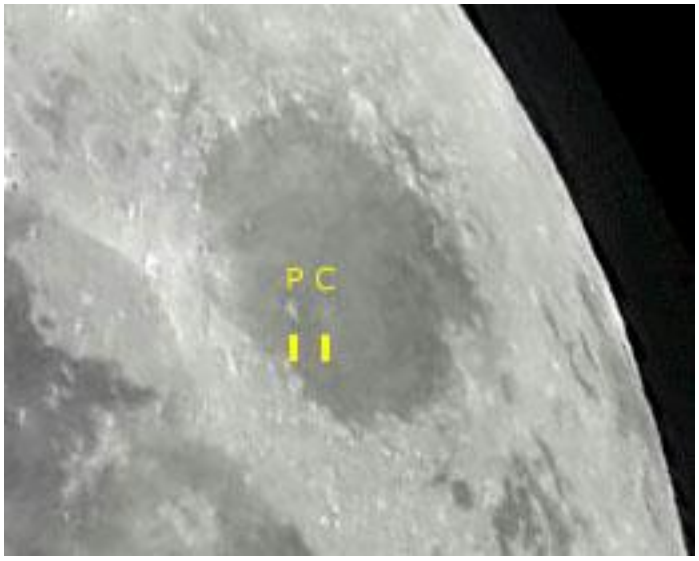

Figure 2. An image of Mare Crisium, taken by Camilo Satler (AEA), and orientated with north towards the top. The locations of the craters Picard and Curtis are indicated by the letters "P" and "C".

Thaetetus: On 2017 Jul 02 UT 04:26-04:40 Alberto Anunziato (AEA) sketched this crater under the same illumination & topocentric libration conditions (to within ±1˚) to a Patrick Moore observation from 1952:

Thaetetus 1952 Dec 24 UT 20:00? Observed by Moore (England?) "Bright spot, hazy line of light" NASA catalog weight=4. NASA catalog ID 556. ALPO/BAA weight=2.

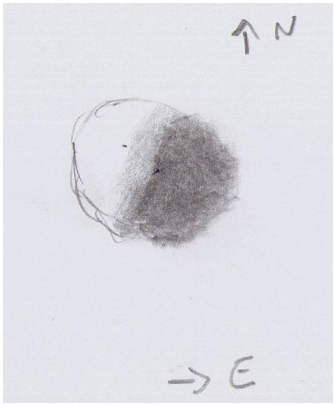

Figure 3. A sketch of Thaetetus by Alberto Anunziato (AEA) from 2017 Jul 02 UT 04:26-04:40, orientated with north towards the top.

In Alberto's sketch (Fig 3) he shows the normal appearance of the crater without a bright spot and hazy line of light effect. However although both the viewing angle and illumination are similar to what Patrick Moore would have seen, the tolerance used in the prediction was twice that what we use for repeat illumination. We use a lower tolerance for repeat viewing angle/illumination, otherwise these would occur to infrequently. Nevertheless we can possibly rule out specular effects present on the surface as these would have to take into account the Sun's diameter and no specular rock surface is optically flat, so there is always some extra scattering of light over several degrees around angles of equal incidence and reflectance. We shall therefore leave the weight of this report at 2.

Mountain near Lambert: On 2017 Jul 03 UT 01:50-02:20 Jay Albert (ALPO) observed visually this area under the same illumination conditions (to within ±0.5˚) to a report published in a 1902:

On 1902 Aug 13 at UT 00:50 Jones (Philadelphia, Penn, USA, 6" reflector, x250) observed a brilliant star-like point near Lambert (21W, 25N) on the dark side of the terminator. It was a magnitude 3-4 round spurious disk and had an interference or diffraction ring. Resolved into a very brilliant spot as the terminator neared it. Cameron says that this was too far from the terminator to be a sunlit peak?

The report is given as Aug 12 in Middlehursts's catalog. The Cameron 1978 catalog ID=312 and weight=1. The ALPO/BAA weight=1.

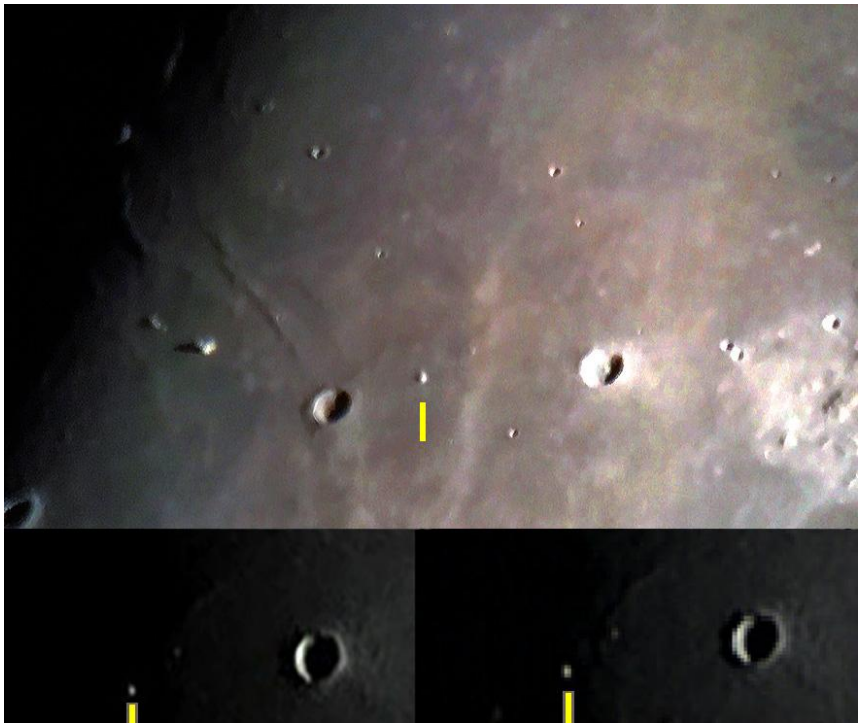

Figure 4. (Top) A color image of a mountain peak 1/3rd of the way between Lambert and Timocharis, taken by Jay Albert (ALPO) on 2017 Jul 07 UT 02:18, and orientated with north towards the top. **(Bottom Left)** The same mountain as imaged by Maurice Collins (RAS NZ) on 2015 Jul 25 UT 07:45-07:48. **(Bottom Right)** The same mountain as imaged by Maurice Collins (RAS NZ) on 2016 Apr 16 UT 07:52.

.Jay noticed that in fact Lambert was well west of the terminator, and not visible. Timocharis was however visible and its floor was in full shadow. At about the same latitude, and approximately 5-6˚ west of Timocharis, just beyond the terminator, was indeed a star-like point. Jay found that this bright point remained visible, and brightened over time. Jay took an image of the area on the next night (See Fig 4 - Top) and now thinks that the star-like point came from a mountain peak situated 1/3rd of the way from Lambert to Timocharis. It was worth looking up the original source of information for this LTP report, namely on p419 of the Journal: "Popular Astronomy" from 1902. The observation is mentioned in an article by Prof. William H. Pickering, in an article entitled: "Lunar Phenomena in October". In this we learn that the observer was "G.S. Jones" and the time was given as August 12^d 7.5^h E.S.T. – now that would be in an era when the day started at noon, and so after allowing for longitude west, this should read: 1902 Aug 13 UT 00:30. Pickering then goes onto say that as the terminator advanced towards it, 2 hours later, it resolved into a very brilliant spot, whose position coincided with Lambert. Interestingly Pickering goes onto say that Lambert is a relatively rare crater on the Moon in that both its interior and walls are dark; this I had not appreciated until I took a look at Full Moon illumination view on the LROC Quickmap web site. Pickering and Jones speculate about a polished surface, possibly ice, giving rise to such a strong reflection of sunlight and a diffraction ring effect – though with modern hindsight we know that this is completely the wrong interpretation! It also turns out that Pickering was incorrect too about the peak being the eastern rim of Lambert - because using the archives I found two images by Maurice Collins that match the illumination of the 1902 report, and these can be seen in Fig 4 (Bottom Left/Right). The bright point is simply a 9 km long, 1 km tall, mountain peak near to Dorsa Stille. We can therefore remove this from our LTP database by assigning this a weight of 0.

Gassendi: On 2017 Jul 04 Franco Taccogna (UAI) observed from 19:48-22:05 UT and Valeri Fontani (UAI) observed from 21:50-22:53 UT. Franco's images dealt with all of the following and Valerio the last two past LTP reports - under similar illumination conditions, to within ±0.5˚:

1967 Jan 21 UT 19:36-20:24 Observed initially by Moore & Moseley (Armagh, N.Ireland, 10"

refractor, x360, S=G), Ringsdore (England, 10" reflector), Sartory (Farnham, England, 15" reflector?), Duckworth (England), Kilburn (Ashton, England, 6" reflector), Farrant (England, 8" reflector) "Eng. moon blink at 1936 (no events from 1750-1815h) outside SE wall, brighter at 1939h, seen vis. at 1940h, faint at 1946h. Moved NW at 1950h. At 2000h, Moseley saw it farther W., lost it at 2008h. Seen again at 2026h further toward group of hills. Moore saw it faint at 2002h, lost it at 2005h, vis. & blink at 2007h. Checks again at 2010-50h, 2130-50, 2200-20, 2250-2300, 2325-0000h.Duckworth suspected blink in S.Iridum nr. Bianchini later, but clouds intervened, after clearing couldn't see it. Neg. obs. in 11 other features, inc. Alphonsus & Plato. Confirmed Gass blink 2018-2024h" NASA catalog weight=5. NASA catalog ID #1010. ALPO/BAA weight=4.

1971 Oct 29 UT 22:15-22:50 observed by J.Coates and A.R. Neville (Burnley, UK, 6" reflector, x192, slight fog, seeing jumpy but good at times). An in initial Moonblink search proved negative. However white light observations by Coates revealed a golden brown color between the black interior shadow and the base of the (bright W (IAU?) wall). Neville confirmed its appearance as a coppery hue and saw the color for 5 minutes before it vanished at 22:55UT. ALPO/BAA weight=2

1987 Nov 02 at UT 01:00-01:30 P. Jean (Outremont, Quebec, Canada) saw a blink from a bright spot south of the central peak of Gassendi. This was apparently the same spot seen by Foley and Moore on 1987 Sep 05. The Cameron 2006 catalog ID=312 and the weight=4. The ALPO/BAA weight=2.

On 1990 Sep 30 D. Darling (Sun Praire, WI, USA, 12.5" reflector, x150) observed a red spot on the west wall (bright in red filter and faint in the blue filter. No filter reactions were found elsewhere. Gassendi had much detail visible. A sketch was made. BAA observers in the UK were alerted but they could not observe due to cloud. Cameron 2006 extension catalog ID=411 and weight=5. ALPO/BAA weight=3.

[21:46-22:54] Gassendi 1977 May 28/29 UT 20:45-21:15 Observed by D. Sims (Dawlish, Devon, UK) saw a hazy area on the south east floor that was normal in red and white light but darker in blue. This was partly confirmed by J-H Robinson (Devon, England, 10" reflector) 21:24-23:12 who saw the south east floor of Gassendi to have a loss of detail - but no color seen, although at 21:57-21:58 it was slightly brighter in red than in blue briefly. P. Doherty (22:45-23:15) did not see anything unusual. D. Jewitt (22:22-22:55) did not reveal anything unusual, apart from spurious color. The Cameron 1978 catalog weight=3 and ID=1463. The ALPO/BAA weight=3.

Franco's images were taken with a monochrome camera, and so it is difficult to verify the original moon blink reports as these used red and blue filters in order to eliminate chromatic aberration and/or atmospheric spectral dispersion effects. However we can at least confirm the descriptions of white light features in the reports, and for the 1971 report, simulate atmospheric spectral dispersion in order to see if that was the cause?

So for the 1967 report, Fig 5 (Top Left) is a good approximation on where the shadows would have been, and the red patch would have been located outside the south east rim. We shall leave the weight at 4 because of the fact that the observers used a moon blink, eliminates atmospheric/scope optical effects.

For the 1971 report, Fig 5 (Top Right) is the best that we can do with a simulation for atmospheric spectral dispersion. It does not simulate too well the golden color seen, though there is maybe a hint of yellow on the western rim, but so too on the eastern rim. So we do not have too much to go on to suggest a change of weight, and so we will keep this at 2.

For the 1987 report, there are actually 3 slightly bright spots south of the central peak as you can see in Fig 5 (Bottom Left). Pierrette Jean's sketch has some differences to the image which might suggest that it was made an hour earlier, and the spot referred to was actually the southern most of the central peaks. To checkout the color appearance of the crater see Valerio Fontani's image in Fig 6. There is no sign of natural color on the central peaks. In view of the suspected uncertainty in the Jean observational times, but also because of schematic inaccuracies in the sketch, I will lower the weight to1, but keep it on the ALPO/BAA LTP database for now as the description of a blink effect between red and blue filters is interesting, and we cannot tell from Franco's image as it was in monochrome.

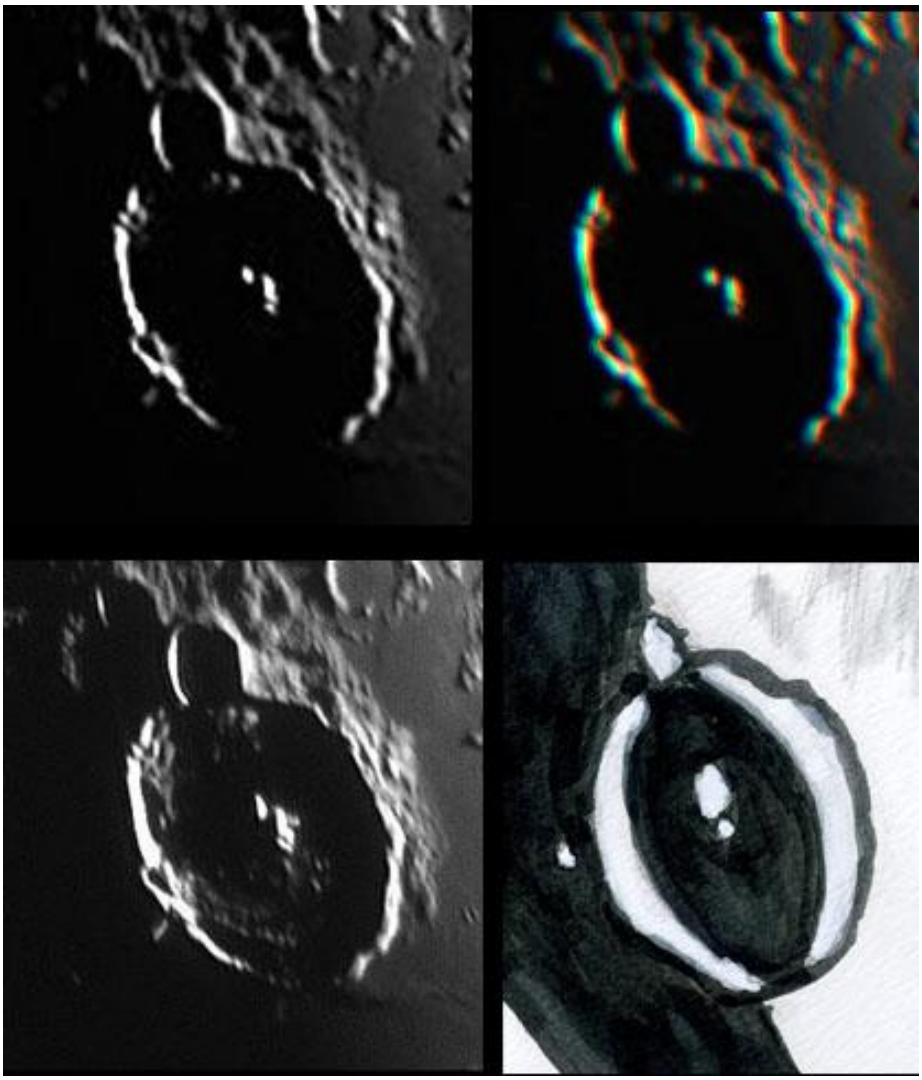

Figure 5. Gassendi as imaged by Franco Taccogna (UAI) 2017 Jul 04, orientated with north towards the top. **(Top Left)** A monochrome image taken at 21:28 UT. **(Top Right)** The 21:28 UT view but with simulated atmospheric spectral dispersion. **(Bottom Left)** A monochrome image taken at 22:05 UT. **(Bottom Right)** A sketch by Pierrette Jean made on 1987 Nov 02 UT 01:00-01:30.

For the 1990 David Darling observation, again Fig 5 (Bottom Left) is the closest similar illumination image, and you can see roughly where the spot on the western wall would have been, just beyond the most western part of the floor shadow – based upon a sketch not shown here. Valerio's image (Fig 6) is in color, albeit at lower resolution, and despite separating out red and blue components (to mimic the filters) we cannot see any excess redness on the western wall. We shall leave the weight at 3, as nobody else in 1990, was observing at the time to confirm David's report.

Finally for the 1977 report, again Fig 5 (Bottom Left) is the best quality repeat illumination representation of what the scene should have looked like. The South East floor is emerging from sunlight, and so could easily look hazy as detail breaks through shadow. A color image (Fig 6) by Valerio, has been split into red and blue components (akin to a visual Moon Blink device), and does not show that SE floor is darker in blue light – in fact it is slightly brighter in this color!. However before declaring this a LTP, note that other shaded areas are also slightly brighter in blue (you can see this visually in the centre row in Fig 6) – so this is undoubtedly either Rayleigh scattering effect in our atmosphere affecting shorter wavelengths, or some sort of chromatic aberration/internal blue scattering in Valerio's optics or camera. Referring back to the 1977 observation - as for the observers who did detect color with Moon Blink devices, neither of them overlapped in time, and the two additional observers studied the scene much later and did not see any color other than atmospheric spectral dispersion. We shall therefore leave the weight at 3.

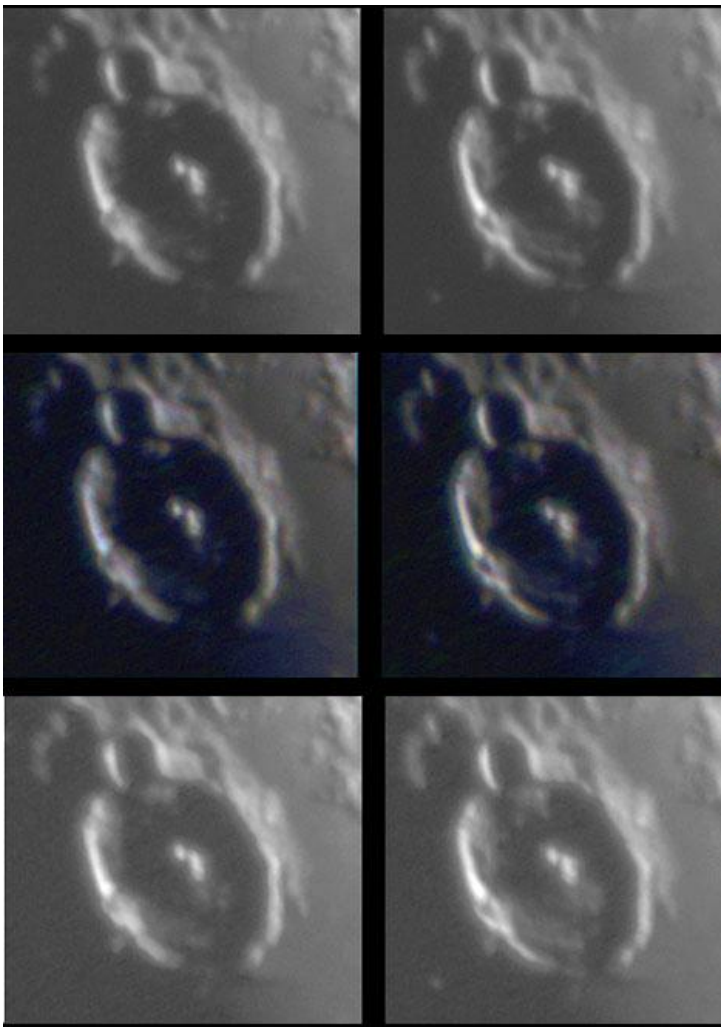

Figure 6. Gassendi as imaged by Valerio Fontani (UAI) 2017 Jul 04 at 21:50 UT (Left Side) and 22:22 (Right Side). **(Top)** Red light component of color image. **(Middle)** Color image, with atmospheric spectral dispersion removed, and color saturation increased to 70%. **(Bottom**) Blue component of color image.

Plato: On 2017 Jul 05 UT 07:56 Maurice Collins (RASNZ) imaged this crater under similar illumination conditions, to within ±0.5˚, to an observation from 1980:

> *Plato 1980 May 25 UT 21:33-22:54 Observed by North (Seaford, England, seeing III-IV, 460mm Newtonian) Definite strong reddish glow along NNW border, definitely much stronger than spurious coloration and always visible when telescope moved in RA and Dec to eliminate possible chromatic aberration effects in the eyepiece. Effect ended by 21:54 UT. BAA Lunar Section Report. ALPO/BAA weight=3.*

From Fig 7 (center) you can quite clearly see that there is no natural surface color on the NNW rim area that can produce the red that Gerald North saw here in 1980. In terms of the atmospheric spectral dispersion, this depends upon how one interprets "reddish glow along NNW border" – I am assuming it means between the floor and the NNW rim (Fig 7 – Left), rather than outside the NNW rim (Fig 7 – right)? Either way we can produce artificial color at either location – though as you can see from the figures (Fig 7 - left and right) it is much stronger still elsewhere e.g. Mons Pico. It is worth delving into this report in more detail from the archives. At around 21:33 UT the Moon was at an altitude of 34˚ from Seaford, and the sky was hazy and worsening. Over time, the effect lessened, it was more difficult to see at 22:00 UT, and was gone by 22:54, when the Moon was at slightly lower at an altitude of 30˚, and this is despite atmospheric spectral dispersion being seen elsewhere. Although not using red and blue filters, Gerald did use a strong yellow filter, but the effect was still visible, and perhaps a little more orange, where as the red part of obvious spectral dispersion elsewhere was unaffected. No LTP alert was issued by

the BAA alert telephone network because the BAA's LTP coordinator, Peter Foley, checked the crater and came to the conclusion that it was atmospheric spectral dispersion, however I have no written details of his specific observation. So the evidence presented by Gerald suggests a weight of 3, where as a short unsubstantiated note from Peter Foley suggests otherwise. I think I will play safe here and lower the weight to 2, at least we still keep it in our LTP catalog.

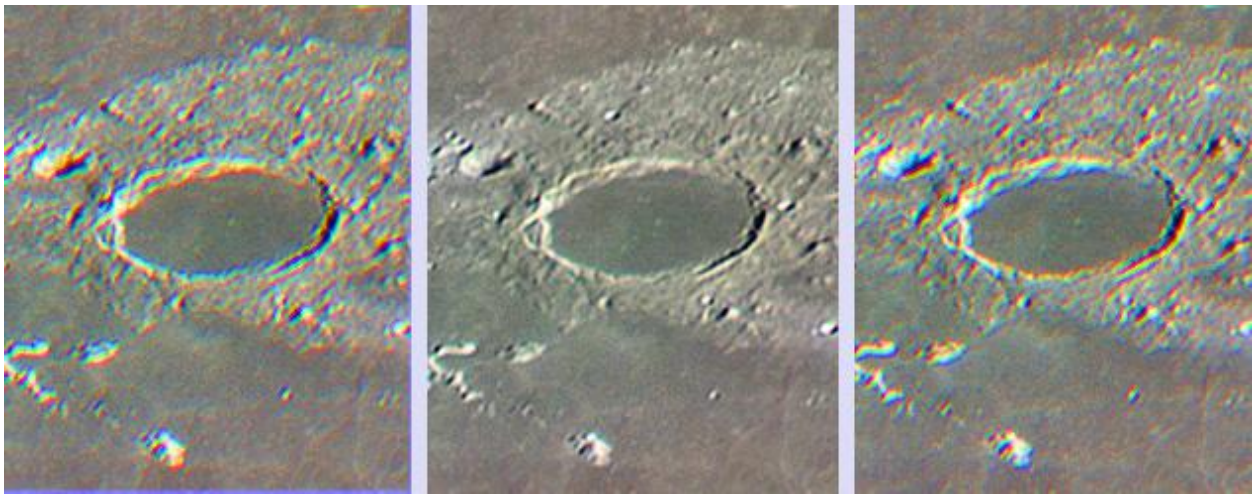

Figure 7. A color image of Plato taken by Maurice Collins on 2017 Jul 05 UT 07:56, orientated with north towards the top, with color saturation increased to 60%. **(Left)** NNW direction induced atmospheric spectral dispersion. **(Center)** No atmospheric spectral dispersion. **(Right)** SSW direction induced atmospheric spectral dispersion.

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. **Alpine Valley**
2. **Arago**
3. **Atlas**
4. **Cauchy**
5. **Eratosthenes**
6. **Gambart**
7. **Gassendi**
8. **Hortensius**
9. **Kies**
10. **Lambert**
11. **Littrow**
12. **Langrenus**
13. **Mare Crisium**
14. **Mare Humarum**
15. **Mare Insularum**
16. **Mons Rumker**
17. **Plato**
18. **Theaetetus**
19. **Theophilus**
20. **Triesnecker**
21. **Valentine Dome**