ASSOCIATION OF LUNAR & PLANETARY OBSERVERS
ALPO
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THE LUNAR OBSERVER

A PUBLICATION OF THE LUNAR SECTION OF THE A.L.P.O.
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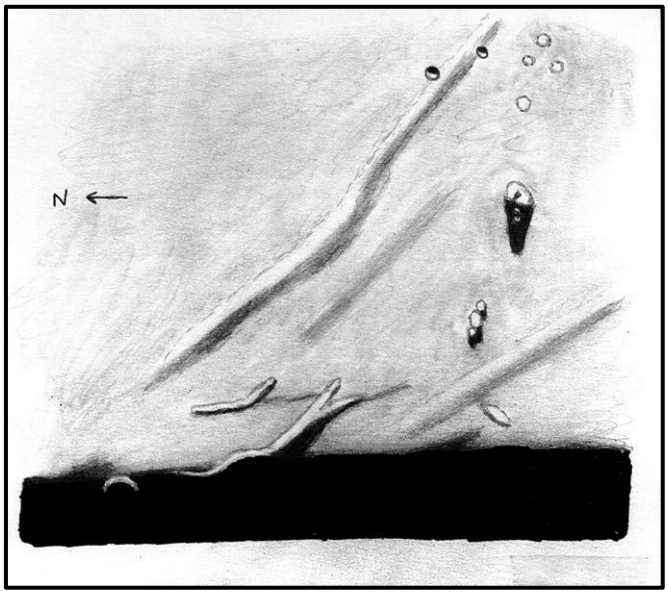
17 Autumn Lane, Sewell, NJ 08080
RECENT BACK ISSUES: http://moon.scopesandscapes.com/tlo_back.html

FEATURE OF THE MONTH – JULY 2016

Mons La Hire



Sketch and text by Robert H. Hays, Jr. - Worth, Illinois, USA
February 18, 2016 01:40-02:14 UT, 15 cm refl, 170x, seeing 8-6/10, transparency 6/6

I observed this area on the evening of Feb. 17/18, 2016 after the moon hid ZC 944. La Hire is a conspicuous isolated peak in central Mare Imbrium. This triangular shaped peak cast much shadow at this time, and itself was split by shadowing. La Hire alpha is northwest of La Hire, and consists of three lobes; the middle one being the largest one. La Hire A and B are the two small craters east of La Hire; A is the northern one and slightly larger than B. Four shadowless bright spots are south of La Hire B. Several conspicuous wrinkles dominate this area, generally oriented southeast-to-northwest. The longest one begins north of the bright spots, grazes both La Hire B and A, and continues northwestward, ending east of the crater C. Herschel. This crater was a partly lit ring just beyond the terminator at this time. A crisp wrinkle or ridge begins well north of La Hire alpha, and goes northwest, then north with some bends, ending at the terminator south of C. Herschel. This wrinkle/ridge is forked at its southeast end, and cast substantial shadow at this time. A short but still crisp wrinkle is east of and parallel to, the one along the terminator. There is a vague wrinkle between the two main peaks and the longest wrinkle, and another vague wrinkle west of La Hire alpha. A short low ridge is close to the terminator, and is nearly perpendicular to the wrinkle passing by La Hire alpha.

LUNAR CALENDAR

JULY-AUGUST 2016 (UT)

2016		UT	EVENT
Jul	01	06:45	Moon Perigee: 366000 km
	02	03:58	Moon-Aldebaran: 0.4° S
	03	20:06	Moon Extreme North Dec.: 18.6° N
	04	11:01	New Moon
	07	23:33	Moon-Regulus: 1.9° N
	09	01:42	Moon Ascending Node
	09	10:08	Moon-Jupiter: 0.9° N
	12	00:52	First Quarter
	13	05:24	Moon Apogee: 404300 km
	16	05:11	Moon-Saturn: 3.8° S
	18	03:41	Moon Extreme South Dec.: 18.6° S
	19	22:57	Full Moon
	23	07:49	Moon Descending Node
	26	23:00	Last Quarter
	27	11:25	Moon Perigee: 369700 km
	29	10:53	Moon-Aldebaran: 0.3° S
	31	04:52	Moon Extreme North Dec.: 18.5° N
Aug	02	20:45	New Moon
	04	06:19	Moon-Venus: 3.1° N
	04	22:12	Moon-Mercury: 0.6° N
	05	07:48	Moon Ascending Node
	06	03:28	Moon-Jupiter: 0.2° N
	10	00:05	Moon Apogee: 404300 km
	10	18:21	First Quarter
	12	12:10	Moon-Saturn: 4° S
	14	13:05	Moon Extreme South Dec.: 18.5° S
	18	09:27	Full Moon
	19	14:14	Moon Descending Node
	22	01:20	Moon Perigee: 367000 km
	25	03:41	Last Quarter
	25	16:21	Moon-Aldebaran: 0.2° S
	27	11:17	Moon Extreme North Dec.: 18.5° N

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

CALL FOR OBSERVATIONS:

FOCUS ON: Montes Apennines-Palus Putredinis

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 **September 2016** edition will be **the Montes Apennines-Palus Putredinis area.** 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 this 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 Montes Apennines-Palus Putredinis article is August 20, 2016

FUTURE FOCUS ON ARTICLES:

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

Subject	TLO Issue	Deadline
Schiller-Zuchius Basin	November 2016	October 20, 2016

ALCON 2016 & ALPO CONVENTION

This year, the ALPO annual meeting will again be in conjunction with the Astronomical League's ALCON 2016, August 10-13, 2016 in Arrlington, VA (Washington, DC area). Additional information is on the Astronomical League ALCON website (https://alcon2016.astroleague.org/) and in the JALPO. Registration and accommodation information is on the AL website.

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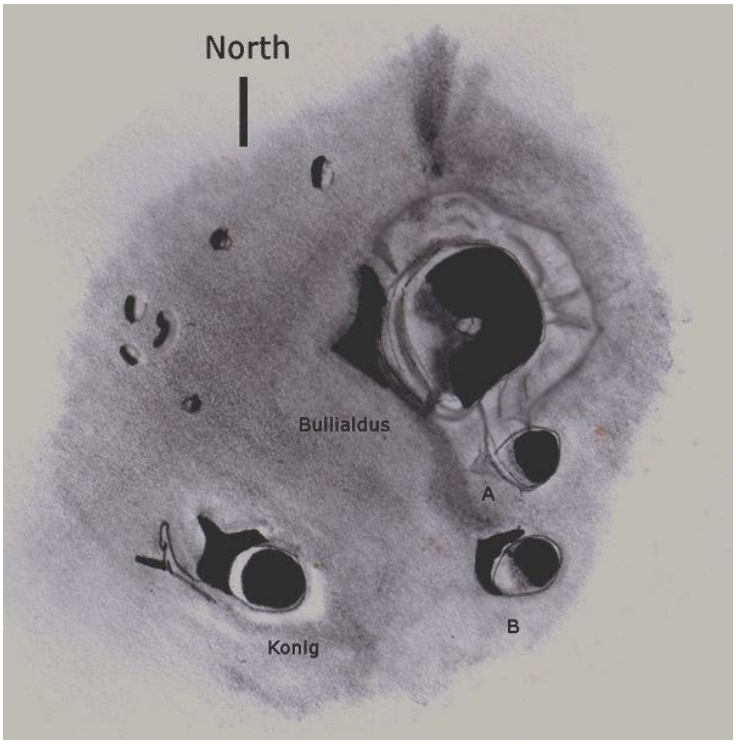
BULLIALDUS CRATER & ITS CENTRAL PEAK

Charles Galdies



The relatively isolated impact lunar crater Bullialdus is found in the western portion of Mare Nubium. This crater has a high outer rim that is circular with the usual subtle polygonal appearance. The inner terraced walls for which this crater is famous for are hidden in darkness. On the other hand the outer ramparts are conspicuous, and highlight a radial pattern of low ridges and valleys.

The illuminated part of the floor of the crater is generally rough with many low rises. In the center of the crater is a formation of several peaks and rises that climb to over a kilometer in height. The sketch shows this prominent peak that comes out of the surrounding shadow simply because of its height.

Klima et al., (2013) showed how the central peak of Bullialdus Crater is significantly enhanced in hydroxyl relative to its surroundings. This is indicative that the peak originated from deep down below the crater as result of the immense impact pressure and heat.

Two smaller but notable craters lie just to the south of the main crater. **Bullialdus A** lies just to the south-west of Bullialdus, within its ramparts. To the south of **Bullialdus A** is the slightly smaller **Bullialdus B**.To the Southwest is the conspicuous but smaller lunar crater Konig. Its shadow suggests a tapering side wall towards the northwest.

REFERENCES

R. Klima, J. Cahill, J. Hagerty, D. Lawrence (2013). Remote detection of magmatic water in Bullialdus Crater on the Moon. Nature Geoscience 6, 737–741 (2013) doi:10.1038/ngeo1909

FOCUS ON: PALUS EPIDEMIARUM and CAPUANUS

By Jerry Hubbell
Assistant Coordinator, Lunar Topographical Studies

Palus Epidemiarum (fig. 1), aka "Marsh of Epidemics" is a lunar mare located in the southwest at selenographic coordinates 32 .0° S, 28.2° W. The "Marsh" encompasses an area of approximately 175 miles (280 km) with several distinguishing features of note, not the least of which is the large crater Capuanus.

Figure 1. **PALUS** EPIDEMIARUM – G. Grassmann – SP, Brazil, May 17, 2016 2146 UT. Seeing 5/10 Transparency 3/6, North/Up, East/Right, 10" SCT, ZWO 127 CCD Video Camera.

The area's smooth mare floor was most likely formed during the Imbrium period, approximately 3.5 billion years ago and slopes down nearly 2 km in altitude. To the west of Capuanus across the mare is the crater Ramsden 15 miles (25 km) where a number of rilles to the southeast cross. Namely Rima Ramsden I, II, III, IV, and V are very prominent and provide a wealth of detail worthy of extended study. Rima Ramsden VI is to the west of the rest of the rille complex and extends northeast of crater Lapaute a small crater 10 miles (17 km) in diameter. Lunar Aeronautical Chart LAC-111 Capuanus (fig. 2) shows the rilles in exquisite detail and is a good resource for comparative studies.

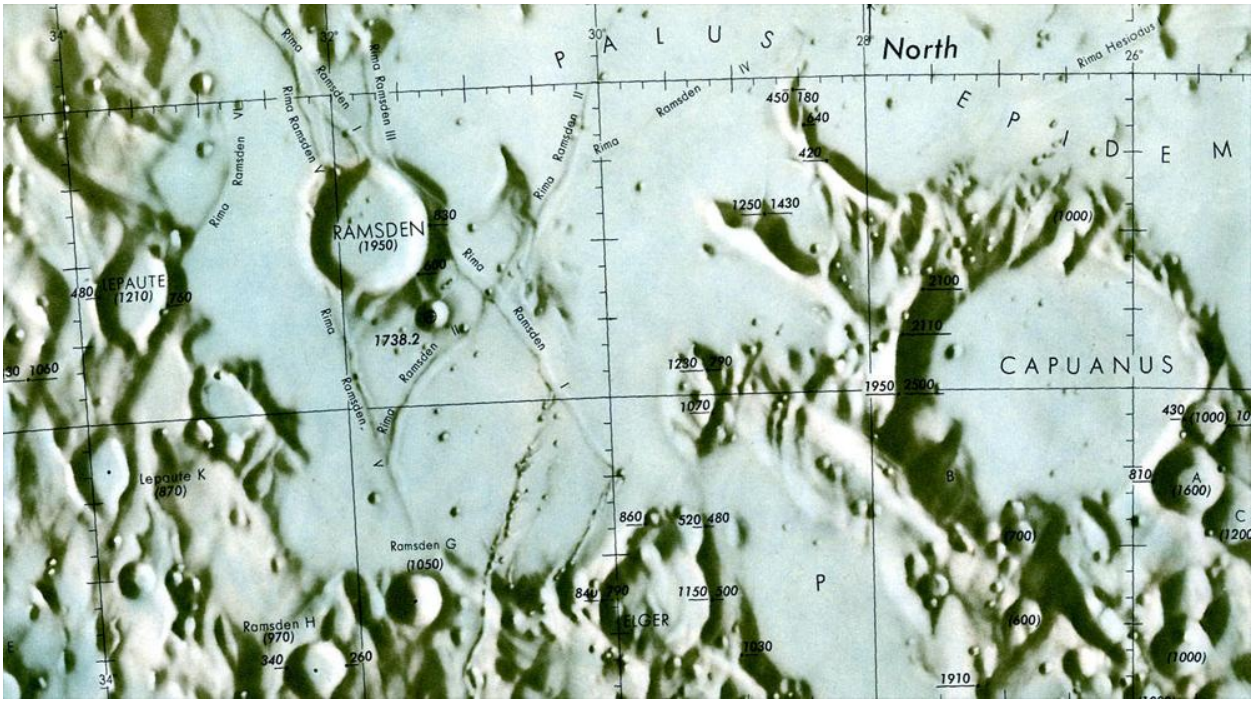


Figure 2. **Excerpt from LAC-111**- NASA, Air Force, Aeronautical Chart and Information Center, November, 1967.

Capuanus (fig. 3) is a partially flooded, ringed plain 34 miles (55 km) in diameter. On the western edge of Capuanus the crater wall rises some 8,000 feet above the surrounding terrain and is marked by a small silhouette of a crater, Capuanus B. This 6 mile (11 km) crater is deep in shadow late in the lunar day. When observing the moon during last quarter, you can spy a small rille, Rimae Hesiodus running NE/SW to the north of Capuanus all the way to Hesiodus. The rille's namesake crater Hesiodus is located nearly 180 miles (290 km) to the east. This is a very interesting feature to observe, and is possible with a scope of at least 4-inches (102 mm). Of note, the small satellite crater Capuanus L, 6 miles (11 km) in diameter, is on the ALPO list of banded craters and is worthy of observation during the lunation.

To the east of Capuanus is the relatively smooth mare all the way to the crater Chicus (fig. 4) 25 miles (41 km) in diameter located 100 miles (160 km) from the eastern wall of Capuanus to the western wall of Chicus. This area is interesting to observe because in between there is the hint of a flooded crater half-in and half-out of the frozen lava lake that looks more like a half ring mountain range that is not even worthy of a name on the LAC-111 Capuanus chart. Chicus C is also an interesting little crater 7 miles (12 km) in diameter. This diminutive crater is bisected by its larger brother's western rim.

Figure 3. <u>CAPUANUS</u> – David Teske, Starkville, Mississippi, June 16, 2016 0144 UT, Seeing 7/10, North/Up, East/Right, iOptron 150, Mallincam GMTm Video Camera. *Editor's Note: This is a crop of the original image provided by David.*

Figure 4. <u>CAPUANUS and CHICUS</u> – Francisco Alsina Cardinalli, Oro Verde, Argentina, June 19, 2016 0248 UT, Colongitude 78.2 degrees, Northwest/Up, Northeast/Right, 10" SCT, QHY5-II CCD, Astronomik ProPlanet 742 IR-pass.

To the northern edge of Palus Epidemiarum lie the twin craters Campanus, 29 miles (48 km), and Mercator 29 miles (48 km). This pair of craters (fig. 5) is a sight to see and beg to be observed closely and compared and contrasted. The rille, Rima Campanus I runs NE/SW bisecting the 2 craters to the southwest of where the craters come together. Of note is the fact that Campanus has several small craters in its floor, but Mercator is very smooth, notwithstanding the small craters that intersect Mercator's rim on the eastern and western sides. Mercator also appears to be "filled" to a higher level with lava as compared to Campanus which is probably the reason Mercator's floor is devoid of any distinguishing features. The crater Marth 4 miles (7 km) stands out in the vast wasteland between Ramsden and Campanus/Mercator, a distance of nearly 180 miles (290 km). This small concentric crater is a fascinating object to observe with larger telescopes.

Figure 5. CAMPANUS and MERCATOR – Alberto Martos, et al., September 4, 2014 0014 UT, North/UP, East/Right, *Editor's Note: The craters Campanus and Mercator are located in the lower left of the image.*

ADDITIONAL READING:

Bussey, Ben & Paul Spudis. 2004. The Clementine Atlas of the Moon. Cambridge University Press, New York.

Byrne, Charles. 2005. Lunar Orbiter Photographic Atlas of the Near Side of the Moon. Springer-Verlag, London.

Chong, S.M., Albert C.H. Lim, & P.S. Ang. 2002. Photographic Atlas of the Moon. Cambridge University Press, New York.

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Tudor Publishers, Greensboro Gillis, Jeffrey J. ed. 2004. Digital Lunar Orbiter Photographic Atlas of the Moon.. Lunar & Planetary Institute, Houston. Contribution #1205 (DVD). (http://www.lpi.usra.edu/resources/lunar_orbiter/).

Grego, Peter. 2005. The Moon and How to Observe It. Springer-Verlag, London. IAU/USGS/NASA. Gazetteer of Planetary Nomenclature. (http://planetarynames.wr.usgs.gov/Page/MOON/target).

North, Gerald. 2000. Observing the Moon, Cambridge University Press, Cambridge.

Rukl, Antonin. 2004. Atlas of the Moon, revised updated edition, ed. Gary Seronik, Sky Publishing Corp., Cambridge.

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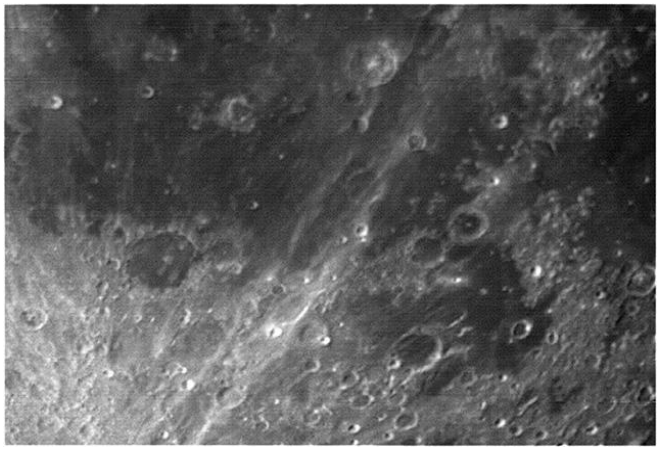
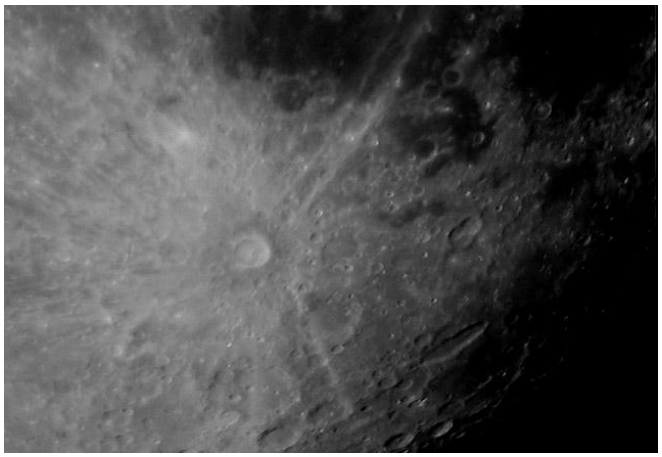
Wood, Charles. 2003. The Moon: A Personal View. Sky Publishing Corp. Cambridge.

Wood, Charles & Maurice Collins. 2012. 21st Century Atlas of the Moon. Lunar Publishing, UIAI Inc., Wheeling.

ADDITIONAL CAPUANUS IMAGES



CAPUANUS-PALUS EPIDEMIARUM - Jay Albert, Lake Worth, Florida USA. June 18, 2016 04:45 UT. Seeing 3/10, transparency hazy. Nexstar 11 SCT, NextImage 5.



CAPUANUS-PALUS EPIDEMIARUM – Marcelo Gundlach, Cochabamba, Bolivia. June 18, 2016 00:53 UT. Seeing 9/10, transparency 5/6. 120mm f/8.3 refractor, Canon Power Shot A-620, V-block filter.

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THRONE OF DOMES

Richard Hill

South of Copernicus (at the top of this image) is the 95km crater Reinhold with the flooded 26km crater Gambart halfway to the right edge of this image. This region is peppered with domes. I remember my discovery of them when I first got my RV6 in 1965. This area was startling for someone that had been using a 2.4" refractor up to then. The sharp, fairly young crater between Reinhold and Gambart is Gambart A or just "A" here. You can see a number of these domes between Reinhold and "A". You can identify a lot of these domes on this image by going to the Lunar Dome Atlas at: http://lunardomeatlas.blogspot.com/ and comparing this to their spectacular images.

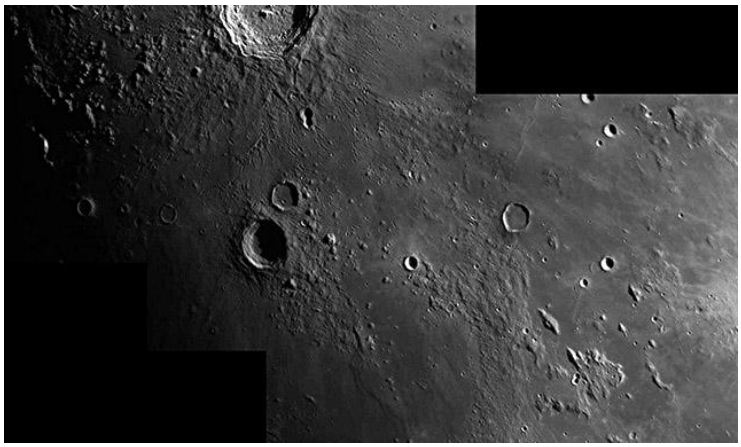


Figure 1. *Reinhold-Gambart Richard Hill – Tucson, Arizona, USA June 15, 2016 02:55 UT. Seeing 8/10. TEC 8" f/20 Mak-Cass, SKYRIS 445M, 656.3 nm filter.*

Before leaving this area note the elongate mountain south of Gambart with the craterlet in the summit. This is Fra Mauro R and thought to be of volcanic origin.

LUNAR TOPOGRAPHICAL STUDIES

Coordinator – Wayne Bailey - wayne.bailey@alpo-astronomy.org

Assistant Coordinator – William Dembowski - dembowski@zone-vx.com

Assistant Coordinator – Jerry Hubbell – jerry.hubbell@alpo-astronomy.org

Website: http://moon.scopesandscapes.com/

OBSERVATIONS RECEIVED

JAY ALBERT – LAKE WORTH, FLORIDA, USA. Digital image of Capuanus.

ALBERTO ANUNZIATO - ORO VERDE, ARGENTINA. Digital images of Aristarchus(4), drawing of Atlas A.

FRANCISCO ALSINA CARDINALI-ORO VERDE, ARGENTINA. Digital images of Aristarchus, Blancanus, Capuanus, Madler, Mare Humboldtianum(2), & Palus Putredinus.

MAURICE COLLINS - PALMERSTON NORTH, NEW ZEALAND. Digital images of 2 & 8 day moon, Alphonsus, Alpine Valley, Archimedes, Deslandres, Hyginus, Maginus, Mare Crisium, Mare Imbrium(2), Moretus & Triesnecker.

GUILHERME GRASSMAN - SP, BRAZIL. Digital images of Cleomedes-Macrobius, Endymion-Atlas, Gutenberg, Langrenus, Mare Crisium, Messier-Pickering Petavius & Santos-Dumont.

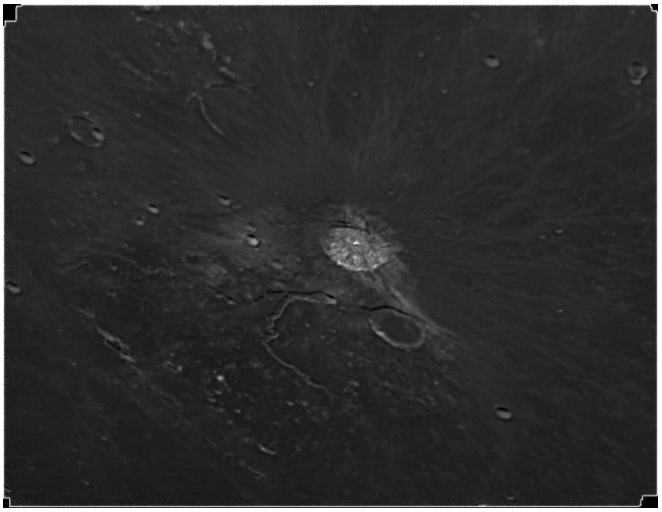
MARCELO GUNDLACH – COCHABAMBA, BOLIVIA. Digital images of Capuanus(2) & Tycho.

RICHARD HILL – TUCSON, ARIZONA, USA. Digital images of Atlas, Cassini, Bambart, Meton & Sirsalis..

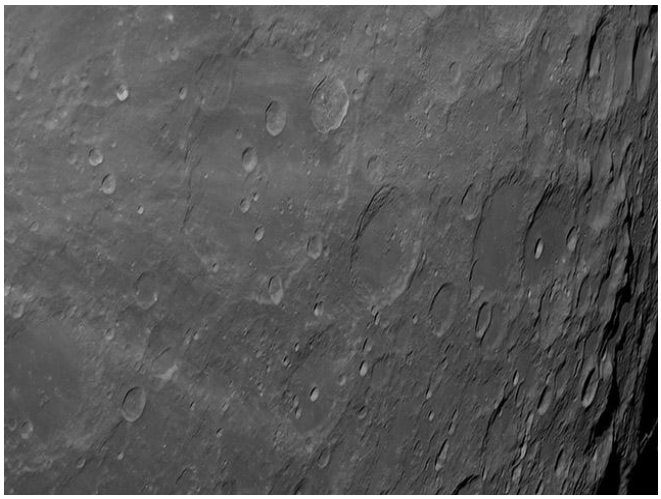
ALBERTO MARTOS, NIEVES del RÍO, JOSÉ CASTILLO, FERNANDO BERTRÁN, LUIS ALONSO & CARLOS de LUIS – MADRID, SPAIN. Digital images of Capuanus(3).

DAVID TESKE - STARKVILLE, MISSISSIPPI, USA. Digital image of Capuanus.

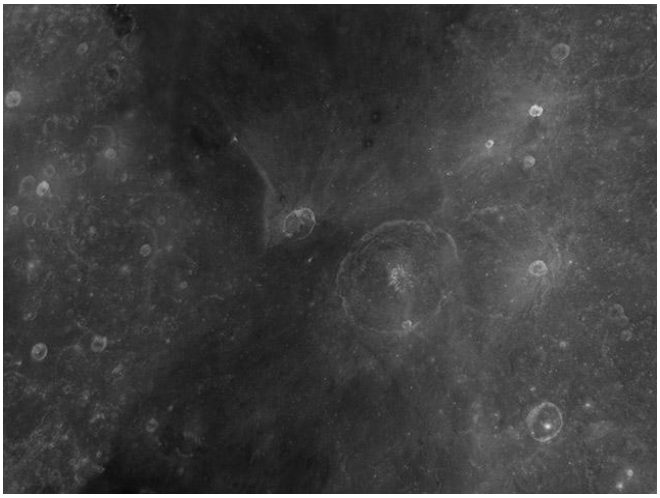
RECENT TOPOGRAPHICAL OBSERVATIONS



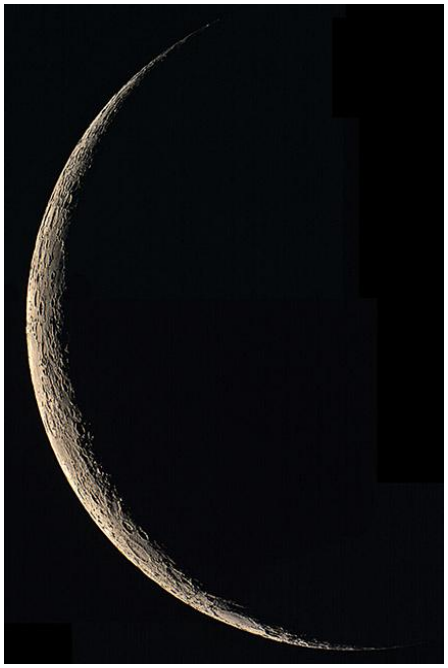
ARISTARCHUS- Alberto Anunziato-Oro Verde, Argentina. June 19, 2016 02:15 UT. 250mm LX200 SCT, QHY5-II.



BLANCANUS- Francisco Alsina Cardinali-Oro Verde, Argentina. June 19, 2016 02:31 UT. 250 mm LX200 SCT, QHY5-II, Astronomik ProPlanet 742 IR-pass filter.

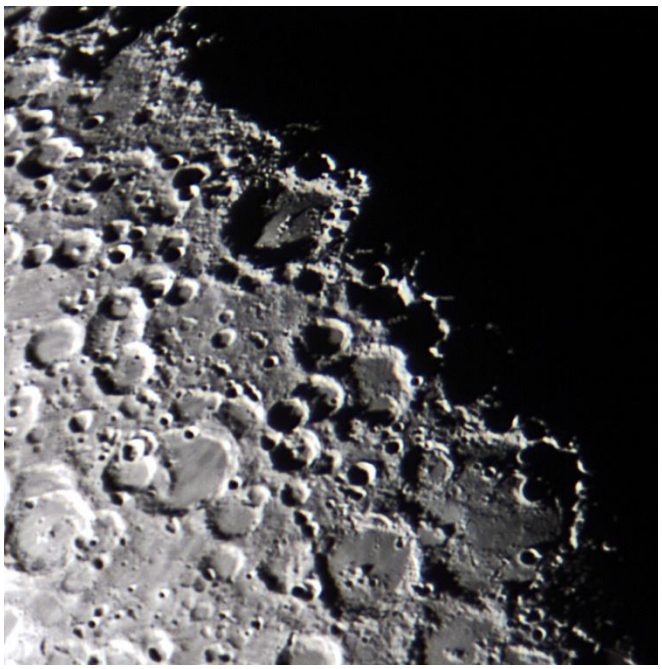


MÄDLER- Francisco Alsina Cardinali-Oro Verde, Argentina. June 19, 2016 03:23 UT. 250 mm LX200 SCT, QHY5-II, Astronomik ProPlanet 742 IR-pass filter



2-day MOON - Maurice Collins, Palmerston North, New Zealand. June 7, 2016 05:29 UT. FLT-110, ASI120MC (South up).

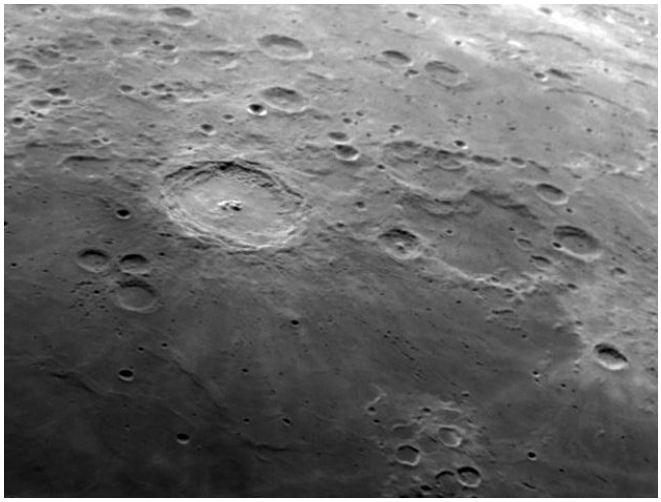
DESLANDRES - Maurice Collins, Palmerston North, New Zealand. June 13, 2016 08:10 UT. FLT-110, f/14, ASI120MC (South up).



MAGINUS - Maurice Collins, Palmerston North, New Zealand. June 13, 2016 08:10 UT. FLT-110, f/14, ASI120MC (South up).

MARE IMBRIUM-peaks & ridges - Maurice Collins, Palmerston North, New Zealand. June 13, 2016 08:14 UT. FLT-110, f/14, ASI120MC (South up).

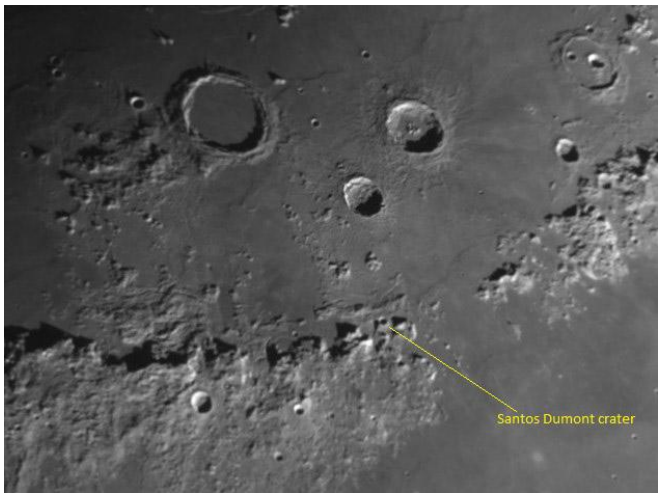
GUTENBERG – Guilherme Grassman, SP, Brazil. June 9, 2016 18:31 UT. 10" SCT. Seeing 7/10, transparency 4/6. Lumenera Skynyx

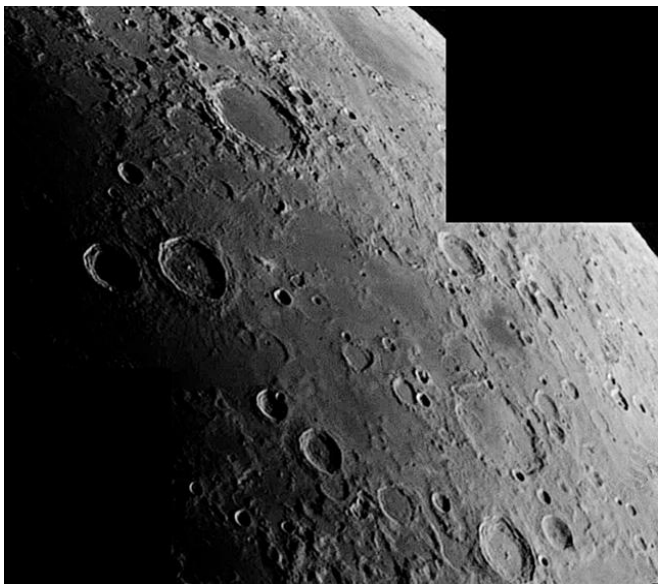


LANGRENUS – Guilherme Grassman, SP, Brazil. June 9, 2016 18:24 UT. 10" SCT. Seeing 7/10, transparency 4/6. Lumenera Skynyx

SANTOS-DUMONT – Guilherme Grassman, SP, Brazil. June 13, 2016 20:37 UT. 10" SCT. Seeing 7/10, transparency 6/6. Lumenera Skynyx

The only Brazilian on the moon.





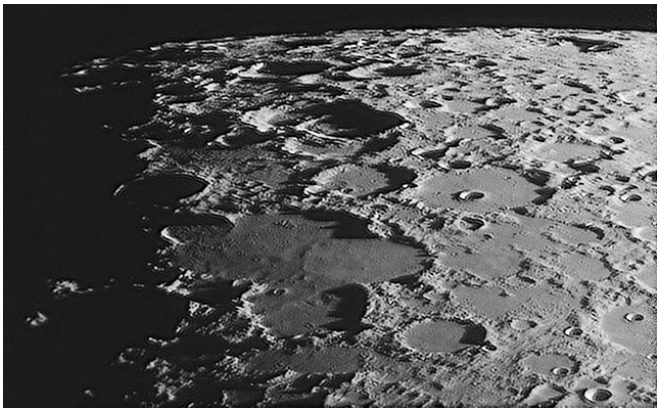
LACUS TEMPORIS – Richard Hill – Tucson, Arizona, USA April 12, 2016 03:26 UT. Seeing 8/10. Questar 3.5" Mak-Cass, SKYRIS 445M, 656.3 nm filter.

I was out observing a 3.8 day old moon back in April and got this image centered on Lacus Temporis under pretty good seeing conditions using the Questar. The two craters on the terminator are Hercules (71km and mostly in shadow) and the larger 90km Atlas. Up above them is Endymion at 129km diameter and older flooded crater. In the upper right corner is the large flat expanse of Mare Humboldtiaum. It is well seen here thanks to a favorable libration.

The nice clear and obviously young crater just below the corner of the title box is the 70km Mercurius. Below that is the large shallow crater Messala (128km) and further on at the bottom of the image is Geminus a beautifully terraced 88km crater. Heading back to Atlas from Geminus we encounter two craters. The first with a tiny central peak is Franklin at 58km diameter and above it the smaller Cepheus (48km). These craters I have pointed out enclose the flat region called Lacus Temporis a largely overlooked region...except here.

METON – Richard Hill – Tucson, Arizona, USA April 14, 2016 03:15 UT. Seeing 8/10. TEC 8" Mak-Cass, f/20, SKYRIS 445M, 656.3 nm filter.

When the moon is between 6 and 7 days old (colongitude of about 350°), half illuminated or known more popularly as First Quarter, we find the large expanse of Meton spread out on the terminator like a cloverleaf. It is seen here just below center with the identifiable flat expanse of the floor. Meton itself, technically 126km diameter, is the upper middle area of this expanse. There are three lobes to this cloverleaf. The one below or to the south is Meton C at 77km diameter, to the right is the



78km Meton D and opposite is the much smaller Meton E, a 48km cirque off of Meton itself. These are ancient large craters that were flooded with lava at the same time. Note the outline of the ruined walls of Meton D in the interior mare. Also notice the beautiful shadows on the floor of this complex.

Just to the lower right of this cloverleaf is another flat bottom, flooded crater, Neison with and excellent shadow cast by part of the crater wall, on it's floor. To the upper right is the 65km crater Euctemon and to the right of that the larger Baillaud with a smaller 14km crater, Baillaud E, nearly dead center.

Now we're going to take a journey so bear with me. Above Euctemon is the 72km crater DeSitter which sits on top of a similarly sized crater DeSitter M to its north. Moving our gaze further north you can see the mostly shadow filled, 62km Nansen F with its namesake crater being the large 126km crater to its right. From Nansen F you go to the left to a completely shadow filled oval on the limb. This is the 77km crater Peary. On its farthest edge is the much smaller crater Whipple which cannot be seen here. This was taken on a good libration for the lunar north pole but not the best. On favorable librations you can just make out Whipple. This crater marks the north pole of the moon and is a landmark well worth catching if you can.

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BRIGHT LUNAR RAYS PROJECT

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Bright Lunar Rays Website: http://moon.scopesandscapes.com/alpo-rays.html

RECENT RAY OBSERVATIONS

TYCHO – Marcelo Gundlach, Cochabamba, Bolivia. May 22, 2016 04:06 UT. 120mm refractor, f/8.3. Seeing 8/10, transparency 5/6. Nikon D3100, ISO 1600

Some time ago I noticed two parallel rays of Tycho unlike others that open radially. In May 22th, 2016 at 4:06 U.T., I took several photos of the region of Tycho, near full moon. After processing with Registax and using the "gamma" function of the software, I was able to get this image in which can be seen some remarkable features:

1. A halo surrounding the main crater is noted, the same one that has different shades concentrically
2. A kind of darker "feather" between the parallel (3) rays that contain it, which start in the crater and goes north
3. They are the only two parallel rays unlike others that are radial

What I think is that the impactor came from north to south (right to the left in the image) and the parallel rays mark the trajectory of it. Probably it was not completely destroyed and traveled some distance.

LUNAR GEOLOGICAL CHANGE DETECTION PROGRAM

Coordinator – Dr. Anthony Cook – atc@aber.ac.uk
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Observations/Studies for May were received from: Jay Albert (Lake Worth, FL, USA - ALPO) observed: Aristarchus, Atlas, Copernicus, Littrow, Plato and Tycho. Alberto Anunziato (Argentina – AEA) imaged: Censorinus, Linne, and Proclus. Kevin Berwick (Ireland - ALPO) observed Aristarchus and Messier. Maurice Collins (New Zealand, ALPO) imaged: several features. Anthony Cook (Newtown, UK – BAA) imaged several features. Marie Cook (Mundesley, UK – BAA) observed Mare Crisium and Proclus. Valerio Fontani (Italy – UAI) imaged Gassendi. Marcelo Mojica Gundlach (Bolivia – IACCB) imaged several features. Rik Hill (Tucson, AZ, USA – ALPO) imaged: Apianus. Derrick Ward (Swindon, UK – BAA) imaged Alphonsus, Bullialdus, Daniell, Mare Crisium, Plato, Proclus, Ross D, and Sinus Iridum.

News: I would like to congratulate UAI observers: Bruno Cantarella and Luigi Zanatta for their first independently confirmed lunar impact flash from 2016 Mar 02 UT 18:33:02. Further details can be found on: http://luna.uai.it/index.php/Lunar_Impacts_Research and you can now look this up also on the NASA web page: http://www.nasa.gov/centers/marshall/news/lunar/independent_impact_candidates.html).
So if anyone else was observing earthshine on this day and time, please get in contact.

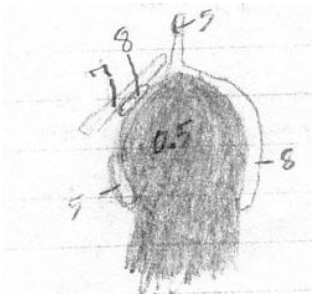

Figure 1. Walter Haas' observation of the floor of Herodotus from 2002 Feb 24 UT 05:15-05:25, orientated with north towards the top. Seeing =3 and Transparency=4.5.

One thing I forgot to mention in the last newsletter, concerning Jay Albert's observation of the Aristarchus region on 2016 April 19th, was that at 02:15-02:40 UT he checked on the appearance of Herodotus during a repeat illumination (to within ±˚0.5) prediction of a Walter Haas LTP from 2002 Feb 24, where Walter noticed that the shadow was almost, but not quite, black (See Fig 1). In the 2016 Apr repeat illumination window Jay also saw that the floor shadow was mostly black, but it did not seem completely black near the west wall, perhaps because of the glare from this brightly illuminated area? This effect did not show up on Jay's image taken at 03:35 UT (shown in the last month's newsletter), although the focus was non-optimal.

Jill Scambler (BAA) has sent in some plots of a statistical analysis of LTPs on the Moon, which deals with amongst other things: frequency of LTP occurrence in different eras, and proximity to rilles and rays etc. Just as an example of some of the sheets she has sent me of her studies, I enclose a color coded map (Fig 2) of the area spanning from Theophilus to Alphonsus in the E-W direction, and between Walther and Sinus Medii in the S-N direction. This illustrates the eras in which observers started reporting LTP in certain areas of the Moon. Although quite informative about LTP distribution/observational chronology, I think we have to be a little careful in interpretation as we need to take into account observational bias effects, and the weights of the observations involved. It might be interesting to see where people are generally observing anyway (without

seeing LTP) on the Moon, in different eras as a comparison. Nevertheless it is a good start and I may include some other examples of her studies in the next few months.

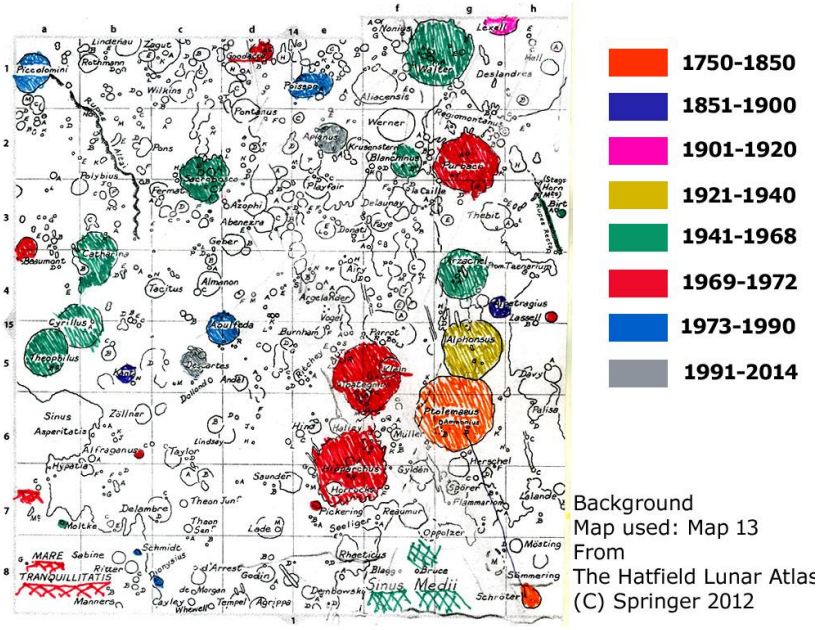

Figure 2. An example hand colored illustration, by Jill Scambler, depicting lunar features, color coded according to eras in which LTP were first seen in them. The map is orientated with north towards the top. Non-craters, where LTP have been seen, are indicated by a cross-hatch texture. A color legend has been added, on the right hand side, by myself. The background map used is from the Hatfield Lunar Atlas which has useful outline maps for adding detail to if studying large areas. (See: http://www.springer.com/us/book/9781461454984),

Finally the last item of topical news: an Internet You Tube trending craze, referred to as the "The Lunar Wave (Hologram) effect" was pointed out to me in an email I received from Robert Brown. Although these lines moving across the lunar surface look pretty spectacular, the opinions expressed on these videos are highly speculative indeed! As far as I can make out all of these videos are of cylindrical lens effects from when the Moon passes through a stable rotational vortex (i.e. a horizontal tornado) left behind by an aircraft wing tips, or its contrail. Usually these lunar wave effects come in pairs, as aircraft have two wings! The alignment and approach rate to the Moon in the stratosphere has to be just right else it will pass across too quickly to be noticed. Also the atmospheric conditions have to be optimal as well, else too much turbulence destroys the vortices. So there might actually be some interesting atmospheric, or aerodynamic, science that can be done by studying such videos. This effect is also mentioned and explained in a more sensible way in the book I described last month which attempts to debunk a lot of these Internet Hoax images: "Anomalies lunaires - Une étude photographique sur les conspirations et canulars lunaires", see page 443.

LTP Reports: No LTP reports were received during May.

Routine Reports: Below is a selection of reports received for May that can help us to re-assess unusual past lunar observations. This month we have managed to eliminate some past LTPs, reduce the weights of others, and have also found some possible errors present in past LTP catalogs.

South Pole Area: On 2016 May 9 Gary Varney (ALPO) imaged the whole Moon and this just happened to coincide with the same illumination and topocentric libration (to within ±1˚ for both) to a 1997 LTP reported by Scottish observer Ron Livesey (BAA):

South Pole 1997 Apr 10 UT 20:45 Observed by Livesey (Scotland, 65x33, Seeing Antioniadi II, Transparency : Thick Haze Alto Stratus, windy) "Two bright spots seen - one on southern tip of crescent and 2nd way over

on the dark side of the S. limb. Earthshine seen, but no features". Probably these are just peaks making it into sunlight - though one of them was of considerable distance from the tip of the crescent (was this the peak of eternal light?). So therefore the ALPO/BAA weight=2 i.e. it is worth checking out - however we may not be able to tell for sure until the libration matches up too.

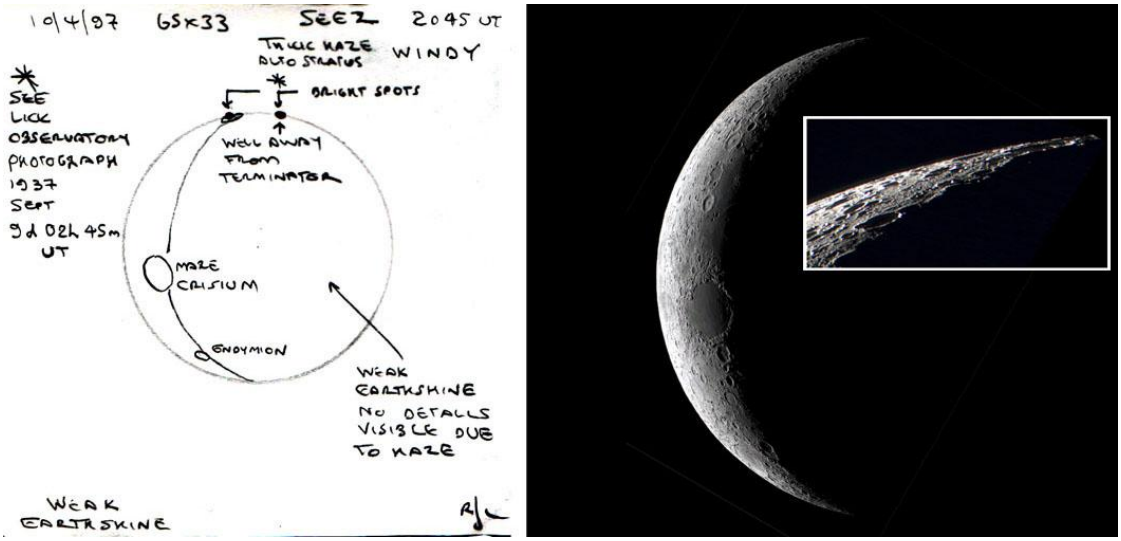

Figure 3. The crescent Moon orientated with south towards the top. **(Left)** A sketch by Ron Livesey from 1997. **(Right)** An image by Gary Varney (ALPO) taken on 2016 May 09 UT 01:10 with an inset enlargement of the south pole area

I have placed Gary's image next to Ron's sketch in Fig 3 for comparison. Now because both the phase and the viewing direction (topocentric libration) were very similar, sunlit peaks at the poles of the Moon should be nearly identical. Alas the edge of Gary's original image does not extend beyond the south cusp (I added some extra blank space to the right in Fig 3), so we cannot verify the furthest bright spot, as this would have been outside Gary's image, if it had been present. So was this a real LTP? One of the sunlit rims, on Gary's image, on the furthest craters visible on the crescent tip, might account for the inner most bright spot that Ron saw? Another possibility was to look for stars near the Moon which can sometimes look like sunlit peaks. I used WorldWide Telescope simulation program and stepped it back to 1997 Apr 10 at 20:45UT, and assumed that Ron was observing from Edinburgh at this time, as that was his postal address. Although there were no bright stars near the south pole of the Moon at precisely 20:45UT, some 45 minutes earlier, 48 Tauri was just south of the Moon and 1 hour later γ Tauri (mag 3.7) was occulted by the Moon – so the Moon was clearly going through the star rich area of the Hyades. So what if Ron had been observing away from Edinburgh? This certainly would displace any star and might have put it in the right place. I will lower the weight of this report to 1 as a star from the Hyades might be the simplest answer, and maybe a sunlit rim on a crater near the south pole might explain the second spot? However if this were to prove not to be the case then we would have to raise the weight to 3; it could even have been a large lunar impact event?

Mare Crisium: On 2016 May 12 UT 20:15-20:25 Marie Cook (BAA) observed this area under similar illumination (to within ±0.5˚) to the following report from 1983:

On 1983 Feb 18 at 19:00?UT P.W. Foley (Kent, UK) noted that the southern Mare Crisium appeared to be obscured by a pale grey haze. Cameron 2006 Catalog extension ID=205 and weight=3. ALPO/BAA weight=2.

Marie was using a 90mm aperture Questar scope, at x80 magnification under moderate transparency and Antoniadi III seeing conditions. She could not see any "pale grey haze" and the floor of Mare Crisium was the same overall shade with detail generally seen. As everything appeared normal in 2016 and differed in 1983, I will keep the ALPO/BAA weight at 2.

Censorinus: On 2016 May 13 UT 07:34-07:37 Maurice Collins (ALPO) imaged the Moon, including this crater, at the same illumination (to within ±0.5˚) to the following 1966 LTP report:

White spot near Censorinus 1966 Dec 18 UT 23:40-23:46 Observed by Enie (Pittsburgh, Pennsylvania, USA, 8" reflector x100, S=G) "Attention drawn to pink color in this usually white patch. Brightened to a light reddish tinge for 2 mins, then faded back to pink, then to white, Sketch." NASA catalog weight=4. NASA catalog ID #1002. ALPO/BAA weight=3.

Figure 4. A color image of Mare Nectaris, Mare Fecunditatis, and the southern Mare Tranquilitatis, taken by Maurice Collins on 2016 May 13 UT 07:34-07:37. The image is orientated with north towards the top and has had its color saturation increased to 70%. Censorinus can be seen as a blue spot near the top just to the left of center.

I have color enhanced Maurice's image in Fig 4, and it is very obvious that Censorinus should be a natural blue color, and not pink. I also checked the altitude of the Moon at the time that Enie observed in 1966 and it was a good 38˚ above the horizon, and so we cannot use atmospheric spectral dispersion, or even low altitude atmospheric absorption, as a possible cause of the pink color. Therefore I do really think that we need to keep the weight of this report at 3. We cannot give it a higher value though because nobody else was observing at the same time.

Alphonsus / Aristarchus / Linne / Hyginus N / Proclus: On 2016 May 14 Rik Hill (ALPO) and Alberto Anunziato (AEA) imaged parts of the lunar surface that coincided with similar illumination (to within +/-0.5˚) to an alleged multiple feature LTP report from Germany from 1965:

Alphonsus / Aristarchus / Hyginus N / Linne / Proclus 1965 Apr 08 UT 20:00? Observed by Hoffman (Germany?) "Saw variable shining lights in these features". NASA catalog weight=1. NASA catalog ID #873. ALPO/BAA weight=1.

To be honest, there are big doubts about several lunar features exhibiting variable shining lights, "all at the same time", as it is more likely to be atmospheric seeing related than lunar. But let us see what further details we can find out about this report? The Cameron catalog gives only an estimate on the UT and the observer's location, as these both have question marks. There was another observer, Hopmann, possibly from Czechoslovakia, who was observing the same night, but saw a LTP in Censorinus (Cameron Catalog ID #873a), so maybe there is some confusion over similar sounding surnames here? Unfortunately I do not have a copy of the reference that she gives either: *Classen, J. 1969, Veranderungen auf dem Mond, p. 15; Veroffentlichungen der Sternwarte Pulnitz (Saschen) Nr. 5.* – so if any of our colleagues in Germany have this publication, then I would be most delighted to see a scanned copy of page 15 – in order to understand what was happening? So at

this stage the only useful new information we have are the repeat illumination images (assuming the 20:00UT estimate is reliable) and you can see these in Fig 5. Neither of our observers attempted Aristarchus, as this was on the night side, but typically at this phase it can be seen sometimes as a bright patch in earthshine, and can vary in brightness due to a combination of atmospheric seeing, transparency, and the effects of several tens of minutes changes in the Earth's reflective cloud cover. If you look at Rik's image in Fig 5, which he was capturing primarily for the lunar "X" effect west of Apianus; just around the location of the text, you would normally expect to see Alphonsus (if it was illuminated), but like Aristarchus this crater was on the night side too when Hoffman observed back in 1965. Now what about the other features? For this we turn to Alberto's images in the right hand side of Fig 5. The two Proclus images show nothing unusual in terms of the appearance of the crater, and he took two other images (not shown) which also look similar and show no variability in brightness. They do happen to coincide (within +/-0.5˚ illumination) with another report about Proclus though:

1958 Aug 22 UT 00:05-00:29 Observed by Bartlett (Baltimore, MD, USA, 5" reflector, x180, S=6-0, T=3-0) "C.p. still looks abnormally large but has lost its dullness, now 5 deg". NASA catalog weight=4. NASA catalog ID #693. ALPO/BAA weight=1.

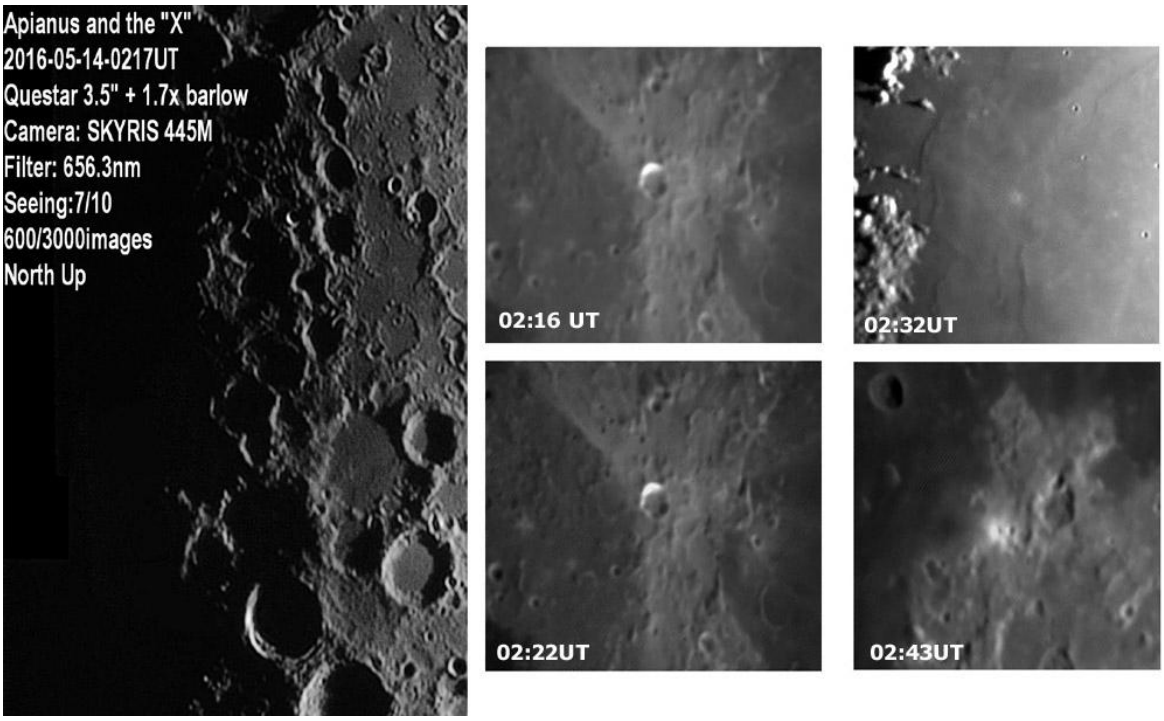

Figure 5. Images of the Moon taken on the same night of 2016 May 14, orientated with north towards the top. **(Left)** Apianus and the lunar "X" effect", as imaged by Rik Hill (ALPO). **(Right)** Four images of Proclus, Linne, and Censorinus taken by Alberto Anunziato (AEA).

In Alberto's image we see no sign of the central spot (there is no central peak in actuality) but this maybe due to image resolution, or a different libration, or both?

Concerning Linne, Alberto's image was just outside the repeat illumination window, but this shows nothing unusual either – unfortunately the image is too far north to capture Hyginus N, but it is clear that that would have been on the night side of the Moon too, as with Aristarchus and Alphonsus.

With regards to the Censorinus image in Fig 5, although also just outside the repeat illumination window for the report below, this shows what the crater would have looked like to Hopmann on the same LTP night in 1965, if the crater had been normal in appearance:

Censorinus 1965 Apr 08 UT 20:00? Observed by Hopmann (Czechoslovakia?) "Green flash or brightening (date correct ? written 8-4-65. First taken as American convention, thus as Aug. 4, but now think it was in

European convention of day first then month)." NASA catalog weight=2. NASA catalog ID #873a. ALPO/BAA weight=2.

In deciding whether to change the weights of these past LTP reports, the 1958 Aug 22 observation by Bartlett, probably cannot be solved until we have repeat illumination/topocentric libration images of this at higher resolution, but it is nevertheless interesting to see its general appearance in this context image. I shall therefore keep the weight at 1. For the 1965 Apr 8 Alphonsus / Hyginus / Linne / Proclus events, I shall leave the weight at 1 too as we cannot solve these either until we have more details of the original observation. Finally for the Hopmann LTP, also from 1958 Apr 8, the description is a bit more specific, so I will leave the weight of this at 2 for now, though the date could of course have been 1985 Aug 04 – so again we desperately need the 1969 Classen article to find out more.

Messier & Messier A: On 2016 May 15 UT 21:45-22:36 Kevin Berwick (ALPO) did a visual check on these two craters under the same illumination conditions (to within ±0.5˚) to the following J-Hedley Robinson report from 1979:

On 1979 Jul 03 at UT 20:55-21:20 J-H. Robinson (Teighmouth, Devon, UK, 10" reflector, seeing II) observed that Messier was brighter than Messier A. No color was observed. The Cameron 2006 catalog ID is 58 and the weight=3. ALPO/BAA weight=1.

Just for the record, Kevin was using a C90 telescope, at a magnification of 125x, with seeing at Antoniadi I-II. Kevin noted that: "*Messier and Messier A about equal in brightness throughout, although, on occasion, it did appear that Messier was slightly brighter than Messier A. Finished due to sea mist rolling in*". Although Kevin's telescope had a smaller aperture than the one that Hedley Robinson was using, this should not make much difference in being able to monitor the relative brightness of these two craters. It is perhaps possible that seeing, being slightly worse for the 1979 report, might have contributed to variations in the brightness seen? However as Kevin found the two craters equal in brightness compared, to the Robinson observation, I think we should keep the weight of the 1979 report at 1 for now.

Plato: On 2016 May 16 UT 02:05-02:30 Jay Albert (ALPO) observed the Moon under the same illumination (to within ±0.5˚) to a Bartlett report from 1970, and to the same illumination and topocentric libration (to within ±1˚) to another Plato report, by Mackey:

Plato 1970 Nov 8 UT 01:31-01:47 Observed by Bartlett (Baltimore, MD, USA, 3" refractor x54-300, T=5, S=5) "Only crater A seen, all others obscured. Floor =3 deg albedo, very smooth. A had a minute shadow & no obscur. On Nov. 22 1966 at nearly same colong. 5 spots incl. A were vis." NASA catalog weight=4. NASA catalog ID #1278. ALPO/BAA weight=2.

Plato 1969 Nov 18 UT 19:00-19:30 Observed by A. Mackey (Scotland, 6" reflector x40, x96, x144) "Obs. shadings in crater at low power, but less apparent at higher power (less contrast). Not shadows as they were not uniform black (Apollo 12 watch)." NASA catalog weight=1. NASA catalog ID #1215. ALPO/BAA weight=1.

Jay was using a 6" Nexstar SCT, and comments for the repeat illumination of the Bartlett sighting, that the central craterlet was definitely seen. The southern craterlet, and northern pair of craterlets, were also seen at 214x, but with some difficulty, namely best seen during moments of steadier seeing. There were no obscurations visible anywhere that he could see. His seeing was never better than 6 or 7 out of 10 though, and his transparency was very variable. I will keep the Bartlett LTP at a weight of 2.

With regards to the repeat illumination/viewing angle 1969 LTP, Jay found that there indeed were some very subtle light and dark shadings (not shadows) that crossed the crater floor from east to west. However these were hard to detect with no clear demarcation, and indeed they seemed to blend from one to the other. Contrary to the LTP description, these tenuous shadings seemed more noticeable at 214x than at 88x, and were not seen at all at 36x. There was a sharply defined, black shadow on the floor along the base of the interior east wall though. Although there is an issue with magnification and viewability of these shadings, I am confident that

what was seen in 1969 and 2016 is normal. Therefore I shall reduce the weight to 0 and remove the 1969 observation from the LTP database.

Daniell: On 2016 May 16 UT 20:34 Derrick Ward (BAA) imaged this crater under identical illumination (to within ±0.5˚ to the following LTP report from 1979:

> *Daniell 1979 May 06 UT 20:30-20:46 Observed by Marcus Price (Camberley, England, Seeing III, Transparency: Poor, 6 inch reflector) "Obscuration seen, Whilst the NW interior was normal, the SE was somewhat fainter and less distinct." BAA Lunar Section Report. Cameron 2006 Extension Catalog ID=52 and weight=2. ALPO/BAA weight=2.*

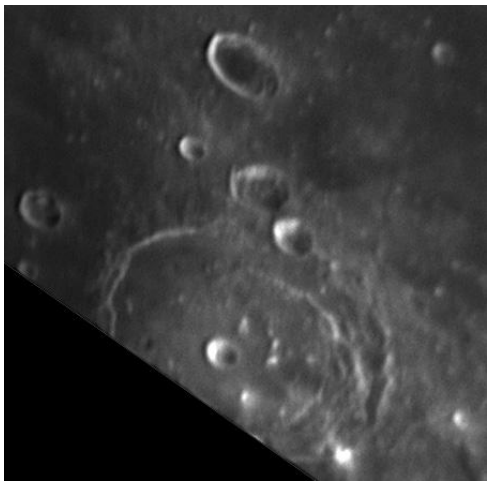

Figure 6. Daniell crater as imaged by Derrick Ward (BAA) on 2016 May 16 UT 20:34UT, and has been rotated so that north is orientated towards the top. Daniell is located near the top of the image and Posidonius beneath.

I decided to look up Marcus Prices's original report to help make the analysis easier: *"A new suspect. No interior detail seen due to bad conditions. However a curious thing was noticed. The north-west of the crater appeared normal. But the south-east of the crater appeared fainter, and less distinct."…."I do not know whether this is a usual feature of Daniell, as this is the first time I have observed it, or that it was due to the poor seeing and transparency conditions at the time. One thing is certain, I recommend all T.L.P. observers to monitor Daniell"*. Now although a sketch was provided, I have not included it here as it does not show much more than what is already in the verbal description, and the orientation and writing is different to the image in Fig 6.

Studying Derrick's image, in Fig 6, we can clearly see the south east rim is not so well defined, and indeed has some unusual terracing inside, compared to the brighter, and more contrasty, north west rim. There is some floor detail visible and the southern half of the floor is lighter in appearance than the northern half, but due to the poor observing conditions back in 1979, I am sure that these would not have been seen. In view of all of this newly deduced information, I will lower the weight from 2 to 0 and effectively remove the 1979 report from the LTP list. Marcus Price did the right thing at the time to consider the appearance of this crater as unusual, but as you can see from Fig 6, and also by examining this crater on the LROC web site: http://target.lroc.asu.edu/q3/, this lunar feature has some interesting extra terracing on its southern inner rim which has contributed to its slightly unusual telescopic appearance.

Gassendi: On 2016 May 17 UT 18:50-19:00 Valerio Fontani (UAI) imaged this crater just 24 minutes after the following repeat similar illumination (to within ±0.5˚) window for the following LTP report:

> *On 1977 Jul 26 at 21:00-23:50 P.W. Foley (Maidstone, UK, 4" refractor, x50-x360, seeing II, transparency good) saw a red spot on southern slope of northern most central peak, and red on the western rim. He was able to confirm that the western rim area was suspected of darkening in a blue filter, but the central red spot*

was too small to show up an effect in the same filter. Also 21:42-21:55UT A. Cook (of Frimley, UK) saw a possible red color on the west of the central peak of Gassendi and dark brick red color in the north west floor quadrant. The telescope used was a 12" reflector, x240 and the seeing was IV. P. Moore and D. Jewitt think the cause is atmospheric spectral dispersion. The ALPO/BAA weight=3.

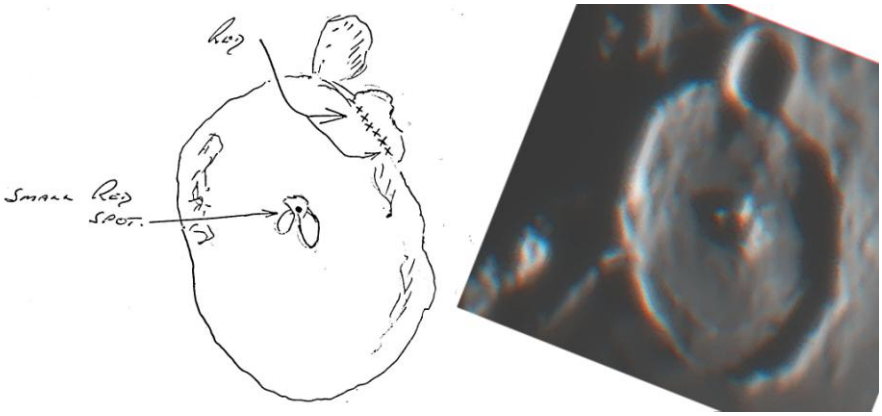

Figure 7. Gassendi orientated with north towards the top. **(Left)** A sketch by Peter Foley (BAA) made on 1997 Jul 26 UT 21:00-23:50 orientated with north towards the top, however the text has been rotated as the original sketch orientation was with south at the top. **(Right)** An image by Valerio Fontani (UAI) taken on 2016 May 17 UT 18:50 – please note that artificial spectral dispersion has been added to this.

Although not perfect, the atmospheric spectral dispersion effect added to Valerio's image (Fig 7) does put a nice red spot in the center of the central peaks, and there is also some artificial red on the NW rim. However there is some spectral dispersion color elsewhere in Gassendi which is not mentioned by any of the observers on that night. Checking my own observation from the same night in 1977, but from 21:42-21:55UT, I also saw a possible red spot on the central peak, but differed to Peter Foley in that I saw some redness (brick red) on the NW floor of Gassendi, however despite using a 12 inch reflector, my atmospheric seeing conditions were Antoniadi IV (poor) and the Moon was too dark (poor transparency) to be able to use a Moon Blink filter device to check the colors out properly. Knowing what my local horizon was like at Frimley, it is quite likely that part of the telescope aperture was obstructed by bushes. We should therefore disregard any significance in my account. A third observer, David Jewitt (The co-discoverer of the first Kuiper Belt object – *other than Pluto*) started to observe at 21:50UT using a 12 inch reflector, with filters, under II seeing conditions, and by 21:53 he was able to show that there were no blink reactions in the filters, hence the colors were not lunar in origin, but visually (no filters) he saw a red spot on the south of the northern most central peak, and red on the eastern rim of Gassendi. He also saw visually color on other contrasty lunar features with shadow present e.g. Kepler and Promontorium Heraclides. Because the Moon was low in altitude 19˚ to 8˚over the duration of the entire LTP event, David concluded that the effects were due to atmospheric spectral dispersion. A call from Patrick Moore to Peter Foley came to a similar conclusion. Despite this, by 22:45 Peter Foley did a check himself for color elsewhere on the Moon, but could see only color in Gassendi. So to sum up we have four observers, and all four saw colors visually, but two saw color elsewhere on the Moon. Two observers tried filters, one suspected a blink reaction, where as the other, who was using a larger telescope did not. So although we do not have unanimous agreement, and the repeat illumination is slightly outside the ±0.5˚ window, in view of the low altitude, of the Moon in 1977, I will lower the weight from 3 to 1, but keep it on record in the LTP database, just in case?

On another issue, the main reason why Valerio was imaging was because the Lunar Schedule website http://users.aber.ac.uk/atc/lunar_schedule.htm had suggested it was a good time to observe, to check out similar Selenographic Colongitudes to Tony Deyes' report of 2003 Jan 22, of a white streak on the floor of Gassendi, extending from the central peak to the north east at > 10% of the brightness of the central peak. I think Valerio's image confirms nicely the line of hills here that were discussed in the May newsletter, from which we deduced the effect was not a LTP.

Hyginus N: On 2016 May 17 UT 23:31Marcelo Gundlach (IACCB) took an image that was about 1.5 hours before a repeat illumination/topocentric libration (to with ±1˚ for both) observing window for a H.P. Wilkins 1944 observation:

Hyginus N 1944 Apr 04 UT 20:00? Observed by Wilkins (Kent, England, 15" reflector) "Darker than usual. S. edge of great crater valley was bordered by a narrow dark band for 13km along its length" NASA catalog weight=4. NASA catalog ID #490. ALPO/BAA weight=3.

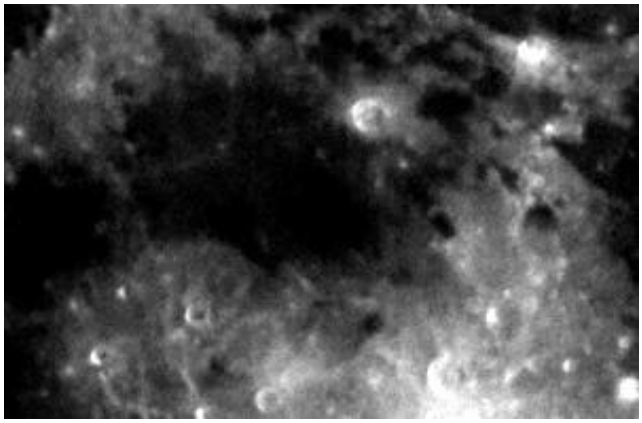

Figure 8. The Mare Vaporum area as imaged by Marcelo Gundlach (IACCB) on 2016 May 17 at 23:31UT. Observing conditions were poor, with the image being taken through cloud. Rima Hyginus is located just south of the center of the image and the image is orientated with north towards the top.

Alas Marcello has been suffering from really quite poor weather during May, and this 17th May observing opportunity was the only night he could capture the Moon on, and even then had to make do with imaging through cloud. So unfortunately we cannot really learn too much from this image (Fig 8) except that we know that the region was illuminated under a fairly high sun angle, and we have at least now a context image which shows the position of ray material passing through this region. I shall keep the 1944 observational weight at 3 for now.

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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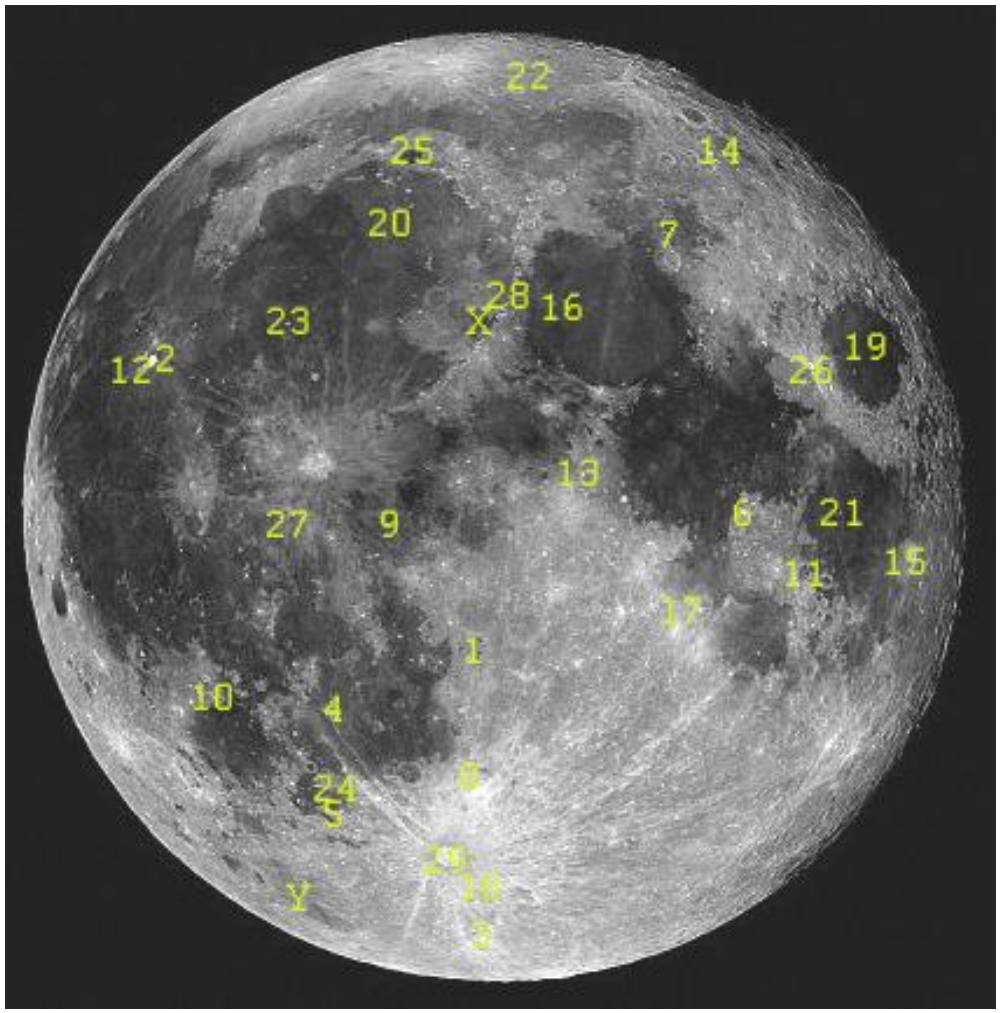
KEY TO IMAGES IN THIS ISSUE

1. .Alphonsus
2. Aristarchus
3. Blancanus
4. Bullialdus
5. Capuanus
6. Censorinus
7. Daniell
8. Deslandres
9. Gambart
10. Gassendi
11. Gutenberg
12. Herodotus
13. Hyginus
14. Lacus Temporis
15. Langrenus
16. Linné
17. Mädler
18. Maginus
19. Mare Crisium
20. Mare Imbrium
21. Messier
22. Meton
23. Mons La Hire
24. Palus Epidemiarum
25. Plato
26. Proclus
27. Reinhold
28. Sonto-Dumont
29. Tycho



FOCUS ON targets

X = Montes Apennines-Palus Putredinus
Y = Schiller-Zuchius Basin