ASSOCIATION OF LUNAR & PLANETARY OBSERVERS
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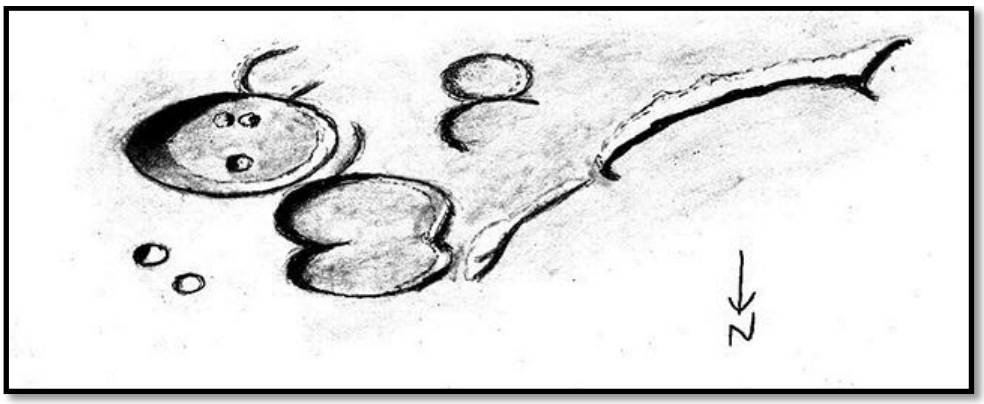
THE LUNAR OBSERVER

A PUBLICATION OF THE LUNAR SECTION OF THE A.L.P.O.
EDITED BY: Wayne Bailey wayne.bailey@alpo-astronomy.org
17 Autumn Lane, Sewell, NJ 08080
RECENT BACK ISSUES: http://moon.scopesandscapes.com/tlo_back.html

FEATURE OF THE MONTH – JUNE 2016

Scoresby-Challis-Main



Sketch and text by Robert H. Hays, Jr. - Worth, Illinois, USA
January 21, 2016 03:14-03:46 UT, 15 cm refl, 170x, seeing 7/10, transparency 6/6-clear.

I drew these three craters on the evening of Jan. 20/21, 2016. These craters are near the lunar north pole, but libration was favorable for them that night. Scoresby is the largest and deepest of this trio. There are two small peaks inside its south rim, and a conspicuous crater is within its north rim. Two low ridges extend out from its south side. At least one of them may be part of the ring Scoresby Q as shown on the Lunar Quadrant map. Two modest craters are north of Scoresby. The deeper one is probably Scoresby AA, judging from the map, and the shallow one northwest of AA would be Scoresby L. Challis and Main are similar-sized overlapping craters northwest of Scoresby. There isn't much of a common rim between these two craters except for a modest portion inside their east sides. Their featureless interiors were a darker gray than any non-shadowed area on this sketch. The west rim of Challis appeared straight~ er than that of Main, and Main's west side may have a high point since its exterior shadow was almost pinched out there. A curved bit of shading protrudes south from Challis, and is concentric with the west rim of Scoresby. A low, angular ridge begins just west of Main, and goes southwest from there. This feature is widest between its bend and Main. Immediately southwest of this ridge begins a longer one with darker shadow. These ridges do not quite touch. The longer ridge is gently curving, and has short hooks or branches at its east end and near its west end. There may or may not be ghost rings in that area. The Lunar Quadrant map does not show anything there. The partial ring south of Challis is probably Challis A, and the complete ring south of A would then be Challis K, according to the map. Challis A showed darker shadow than K, though A did not appear to be complete.

LUNAR CALENDAR

JUNE-JULY 2016 (UT)

2016		UT	EVENT
Jun	03	09:47	Moon-Mercury: 0.7° N
	03	10:55	Moon Perigee: 361100 km
	05	03:00	New Moon
	06	09:13	Moon North Dec.: 18.6° N
	10	14:47	Moon-Regulus: 2.2° N
	11	19:35	Moon-Jupiter: 1.6° N
	11	22:20	Moon Ascending Node
	12	08:10	First Quarter
	15	12:00	Moon Apogee: 405000 km
	19	00:40	Moon-Saturn: 3.6° S
	20	11:02	Full Moon
	20	18:52	Moon Extreme South Dec.: 18.6° S
	26	05:28	Moon Descending Node
	27	18:19	Last Quarter
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

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
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: Capuanus-Palus Epidemiarum

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 **July 2016** edition will be **the Capuanus-Palus Epiemiarum 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 Capuanus-Palus Epidemiarum article is June 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
Montes Apennines-Palus Putredinis	September 2016	August 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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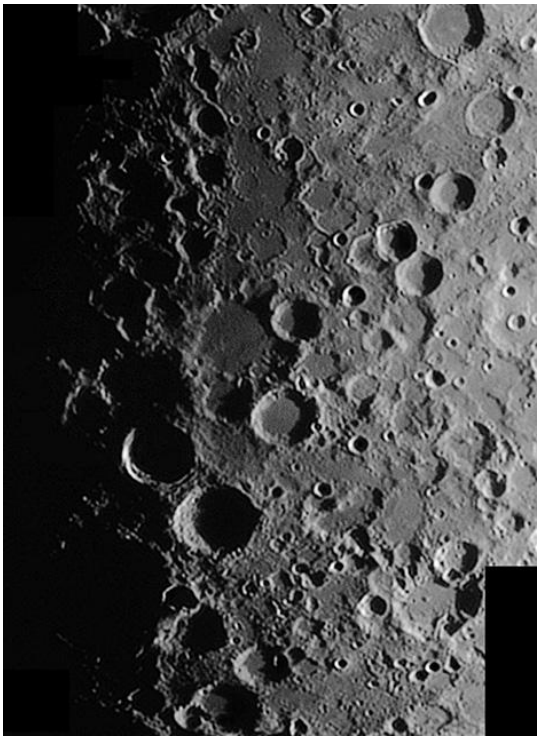
APIANUS & THE "X" AGAIN

RICHARD HILL

The seeing was not a great night so I worked with the Questar instead of the 8". We've had a lot of poor seeing and cirrus so far this year. As soon as I got on the first quarter moon I was treated to a wonderful sight. There on the terminator was the famous "X". If you don't see it, bear with me here. In the center of image is the flat bottomed 65km diameter crater Apianus. Just above it is the slightly smaller 49km crater Playfair, half in shadow here. Between them is a large 94km basin simply named Playfair G. To the lower left of Playfair are two large shadow filled craters. The lower one is the 82km Aliacensis, and to the upper left from that the 71km Werner. These two craters point right to the "X". This interesting feature is formed from the walls of Purbach and Blanchinus which are largely in shadow except for the higher parts of their walls. Blanchinus is directly above Werner and Purbach immediately to its left. Now I'm sure everyone can see the "X".



LUNAR "X" *– Richard Hill – Tucson, Arizona, USA May 14, 2016 02:17 UT. Seeing 7/10. Questar 3.5", 1.7x barlow, SKYRIS 445M, 656.3 nm filter.*

A few more landmarks in this image are seen in the triplet of craters to the upper right of Playfair. The clearer pair in the triplet of craters are the Azophi (49km) to the south and Abenezra (43km) adjacent to the north. The third crater is Abenezra C (44km). A crooked line of 3 clear craters can be seen to the top of the image. The first one above and right from the triplet is Geber (46km), further on to the upper right is Almanon (51km) and at the top of the image is Albulfeda (65km). Notice the line of craters that goes from the top of Almanon to the bottom of Albulfeda. This is Catena Albulfeda, a very interesting feature that bears magnification and study.

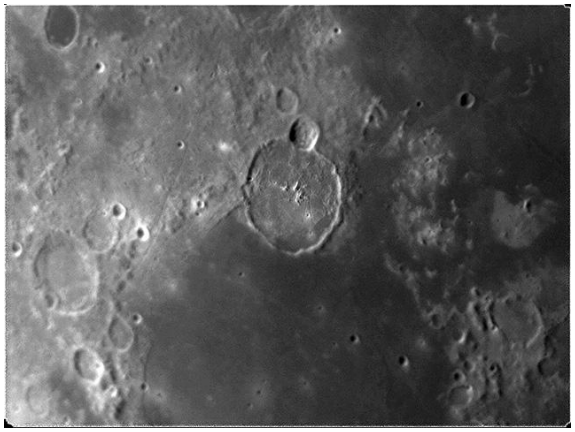
There's much more to explore in this image that should show how even a modest aperture can give you hours of enjoyable lunar treks.

The information in image capture is on the image itself. Stacking of the 600 frames from 3000 frame AVI was done with Registax6 and final processing was done using IrfanView and GIMP.

GASSENDI

Alberto Anunziato

Gassendi is an impresive crater (110 km of diameter) located on the northern shore of Mare Humorum. In this image we could see it's fractured floor with its collection of ridges and linear rilles, specially Rimae Gassendi to the east of the three large central mountains. Both fractured floor and central peaks are morphologies diagnostic of impact origin. The southern portion of the crater floor shows a marked constrast, with a dark plain that occupies the border with Mare Humorum. In the upper part of the image we see Gassendi A (a kind of "small Gassendi" with fractured floor and central peaks) and



TYCHO- *Alberto Anunziato-Oro Verde, Argentina. March 27, 2016 05:12 UT. C-11 HD edge SCT, Canon EOS Digital Rebel XS.*

Gassendi B. In the lower part we see the dark basaltic surface of Mare Humorum and a cluster of craterlets: Gassendi O, J, R, Y and L from right to left (and Puiseux F at the bottom). The west rim shows a notorius triangle formed by a landslide and if we travel through the Montes Percy we could see Gassendi E, Mersenius C and P in our way to Mersenius (at the left side of the image). The east rim, facing Oceanus Procellarum, is illuminated by the sun The most prominents accidents in the right part of the image are Agatharchides, very old crater partially submerged by the lava from Oceanus Procellarum, and Herigonius. Among the spots with high albedo, the most interesting are Gassendi N (in the floor, to the north of the central peaks) and two bright stains to the east-close to Gassendi E and to Mersenius C-, ressembling bright craters and presumably highland material.

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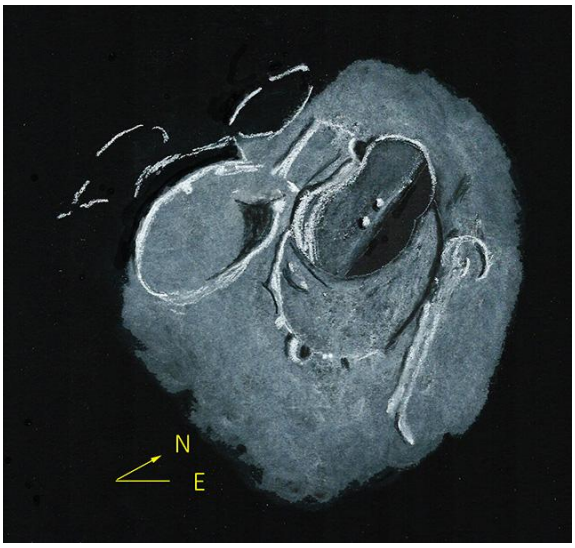
PHILOLAUS

DAVID TESKE

I made this sketch on the early evening of 20 February 2016 UT, Starkville, Mississippi, using a 60 mm f/16.7 fl 1000 mm Moon Raker refractor telescope. A 6 mm Burgess/TMB eyepiece was used with a magnification of 167. The telescope was mounted on a Losmandy GM8 mount. The observation was made between 0139 and 0242 UT. Seeing was 8/10 under clear skies. The moon was waxing gibbous phase. Medium was white and black pastel on black Strathmore Artagain drawing paper.



PHILOLAUS-*David Teske-Starkville, Mississippi USA. February 20, 2016 01:39-02:42 UT. 60mm, f/16.7 refractor. 167x. Seeing 8/10 clear.*

Philolaus is a remarkable double central peak crater far north of Plato. Its diameter is 71 km. The eastern wall of Philolaus was in shadow. The western interior wall of Philolaus was strongly terraced, especially to the northwest. The floor seemed rather smooth, but it stood out because of the two central peaks. Philolaus sits inside the northwestern edge of an older, larger, and much more degraded Philolaus C. Philolaus C with a diameter of 98 km has a hilly region on its floor just south of Philolaus. The walls of Philolaus C appear to be low. They have low shadows on the eastern side as indicated by the narrow shadow. The walls at the southern side are very thin and low. There are two brighter peaks on

the south wall. West of that is an unnamed small crater. The western walls of Philolaus C are the highest walls of the degraded crater with a couple of peaks.

East of Philolaus C was a bright partial ring that was open to the south. This ring had two parallel hills emanating from it to the south. The eastern hill had a hill at the end of it that resembled the toe of a boot. West southwest of Philolaus was the 81 km diameter crater Anaximenes.

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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

ALBERTO ANUNZIATO - ORO VERDE, ARGENTINA. Digital images of Byrgius, Gassendi & Philaus.

FRANCISCO ALSINA CARDINALI-ORO VERDE, ARGENTINA. Digital images of Aristarchus(5), Archimedes, Censorinus, Copernicus(2), Grimaldi, Mare Serenitatis, Montes Spitzbergen, Proclus & Grimald.

MAURICE COLLINS - PALMERSTON NORTH, NEW ZEALAND. Digital images of 5 & 6 day moon, Aristarchus, Mons Rumker & Southeast moon.

CHARLES GALDIES – NAXXAR, MALTA. Drawing of Bullialdus

GUILHERME GRASSMAN-SP, BRAZIL. Digital images of Clavius-Tycho, Palus Epidemiarum & waxing Gibbous moon.

RICHARD HILL – TUCSON, ARIZONA, USA. Digital images of Apianus & Piccolomini.

FRANCO TACCOGNA - GRAVINA IN PUGLIA (BA), ITALY. Digital images of Gassendi(6).

DAVID TESKE - STARKVILLE, MISSISSIPPI, USA. Drawing of Philolaus.

RECENT TOPOGRAPHICAL OBSERVATIONS

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PHILOLAUS- Alberto Anunziato-Oro Verde, Argentina. April 30, 2016 05:50 UT. 250mm LX200 SCT, QHY5-II.

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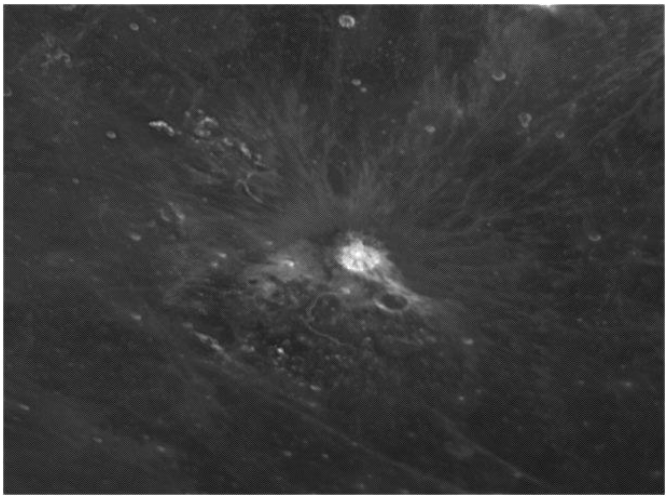
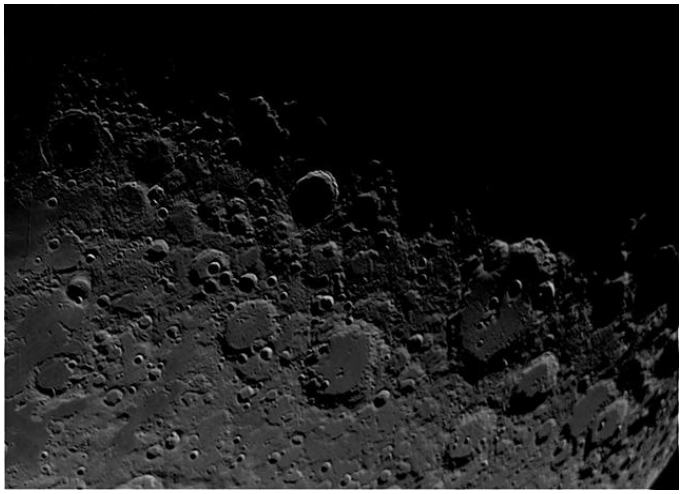


ARISTARCHUS- Francisco Alsina Cardinali-Oro Verde, Argentina. April 28, 2016 22:10 UT. 250 mm LX200 SCT, QHY5-II.

MONTES SPITZBERGEN- Francisco Alsina Cardinali-Oro Verde, Argentina. April 30, 2016 06:52 UT. 250 mm LX200 SCT, QHY5-II.

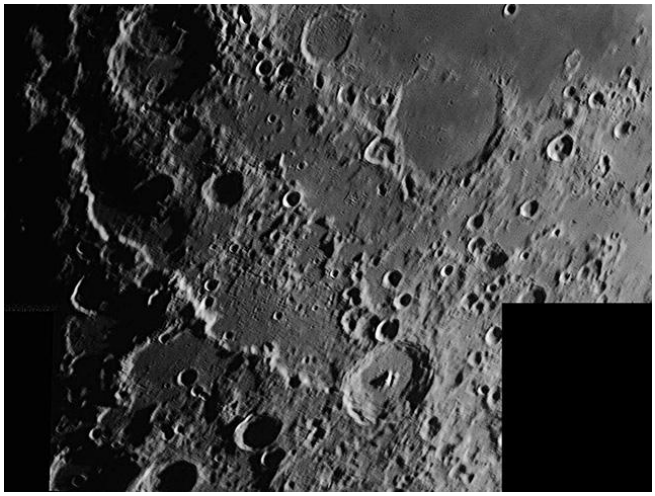
TYCHO- Francisco Alsina Cardinali-Oro Verde, Argentina. April 30, 2016 06:27 UT. 250 mm LX200 SCT, QHY5-II.



MONS RUMKER - Maurice Collins, Palmerston North, New Zealand. April 20, 2016 08:24 UT. FLT-110, f/21, ASI120MC (South up).

SOUTHEAST LIMB - Maurice Collins, Palmerston North, New Zealand. April 20, 2016 08:39 UT. FLT-110, f/21, ASI120MC (South up).

CLAVIUS-TYCHO – Guilherme Grasso, SP, Argentina. May 15, 2016 19:59 UT.



PICCOLOMINI – Richard Hill – Tucson, Arizona, USA April 13, 2016 02:54 UT. Seeing 7/10. TEC 8" f/20 Mak-Cass, SKYRIS 445M, 656.3 nm filter.

Easily visible twice in a lunation, even for the casual observer, only 5 days after new moon or 4 days after full moon, the 90km diameter Piccolomini and it's tail Rupes Altai. Both of these are visible even in 10x binoculars but are striking in a telescope of 4" or more aperture. The floor of Piccolomini is a good place to test the smallest craters visible to your eye as there is a good assortment of young, sharp edged craters on the floor. Don't be shy about using magnification. Unless you have bad seeing, lunar features bear magnification up to 60x the aperture in inches (24x the aperture in cm), quite well.

Above Piccolomini are twin craters that both are missing northern walls and flooded with lava. The largest one is the 128km Fracastorius. there are two small lettered craters on the floor, Fracastorius L to the north and Fracastorius M (Frac M) to the south. A small rima crosses from east to west just touching Fracastorius M. It is a good eye/seeing test. Can you see it? Just to the upper left is a smaller twin crater, flooded from the north, the 54km Beaumont. There is a ragged remnant of the north wall still there but it was clearly flooded from the north. A little farther to the left is the large 104km Catharina. It marks the end of the 495km long Rupes Altai just to its left.

Years ago there was an article in Sky and Telescope about an enigmatic elongated feature on the south side of Fracastorius, Fracastorius Y (Frac Y). This feature is about 10km wide and 20km long and in the LROC QuickMap appears to be the merge of about 3 impacts. . If you look across this image you will see a number of similar features. A quick look at QuickMap resolves the enigmae.

GASSENDI-Franco Taccogna-Gravina in Puglia (BA), Italy. May 17, 2016 18:58 UT. 10" LX200 ACF. ASI120mm. Seeing 5/10, Transparency 5/10

LUNAR GEOLOGICAL CHANGE DETECTION PROGRAM

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

Observations/Studies for April were received from: Jay Albert (Lake Worth, FL, USA - ALPO) observed: Aristarchus, Gassendi, Herodotus, Plato, Proclus, Vallis Schroteri and the western limb. Alberto Anunziato (Argentina – AEA) imaged: Archimedes, Aristarchus, Copernicus, Gassendi, Mersenius, Montes Spitzbergen, Philolaus, Riccioli, and Tycho. Kevin Berwick (Ireland - ALPO) observed Aristarchus and Daniell. Bruno Cantarella (Italy- UAI) imaged earthshine. Maurice Collins (New Zealand, ALPO) imaged: Aristarchus, Clavius, Copernicus, earthshine, Marius, Plato, Reinhold, Rumker, Schickard, Tycho, and produced some whole Moon mosaics. Anthony Cook (Newtown, UK – BAA) videoed several regions of the Moon with a color webcam. Marie Cook (Mundesley, UK – BAA) was not able to observe in April, due to a fall, but was back in operation again during May. Pasquale D'Ambrosio (Italy – UAI) imaged Rima Birt and Tycho. Valerio Fontani (Italy – UAI) imaged Mersenius and Tycho. Marcelo Mojica Gundlach (Bolivia – IACCB) imaged several features. Rik Hill (Tucson, AZ, USA – ALPO) imaged: Aristotles, Gemma Frisius and Piccolomini. Franco Taccogna (Italy – UAI) imaged Eratosthenes, Rima Birt, and Tycho. Aldo Tonon (Italy – UAI) imaged: earthshine, and Eratosthenes. Gary Varney (Pembroke Pines, FL, USA- ALPO) imaged Piccolomini, Theophilus, Vitruvius, and several other features. Derrick Ward (Swindon, UK – BAA) imaged Aristillus, Eratosthenes, and Mons Pico. Luigi Zanatta (Italy – UAI), imaged earthshine.

News: I was interested to come across Richard Baum's article in the 2016 May BAA Lunar Section Circular which had some information on the "line of light" effect which was seen by Trouvelot, in Eudoxus in 1878 Dec 3 and then again on 1881May 04. We attempted a repeat illumination observation of the latter as described in the April newsletter. Richard's article provides a little bit more information about these events and I will update the LTP descriptions, and details, in future accordingly.

Readers, who are able to read French, maybe interested in a new book: "Anomalies lunaires - Une étude photographique sur les conspirations et canulars lunaires" that has been produced by the artist Seb Janiak, with chapter contributions by planetary astronomer, David Baratoux (University of Toulouse), and myself. Despite the slightly disturbing title, the book provides an antidote to the many conspiracy theories that claim that Apollo Moon landings never happened, or that spacecraft Moon photos sometimes show: alien spaceships, buildings on the Moon, or even faces on the surface? I am sure that from time to time all of us have encountered people who believe in such things and it is very difficult to get them to see from a more reasonable viewpoint. This book fills this gap and provides us with lots of evidence and arguments for the fact that astronauts did go to the Moon, and highlights the kinds of pitfalls people sometimes make in putting 2 and 2 together to make 5, when interpreting spacecraft imagery. The contribution by David Baratoux deals with lunar geological formations which may look unusual to the non-geologists eye, but are due to underlying geology. As a comparison, another chapter shows similar geological appearances on Earth, some of which resemble human faces, but which clearly are just by chance. The final chapter, by myself, summarizes briefly the history of LTP, and then spends considerable time warning about the kinds of things that have tricked observers in the past into thinking that they have seen a LTP. It is likely that the book will be translated into English in the near future, and when it is, I will let you know.

I would like to correct a typo that crept into last month's newsletter: "Francesco Cecchini" should have read "Francesca Cecchini" - my apologies to our UAI colleagues.

LTP Reports: No LTP reports were received during April.

Routine Reports: Below is a selection of reports received for April that can help us to re-assess unusual past lunar observations. Although we have not eliminated quite as many past LTP reports as we did in last month's newsletter, you will get a good impression this month of some of the major LTP reports from the past, and what to look out for visually and image, when observing the Moon.

Earthshine: On 2016 Apr 10 UT 19:10-20:33 Luigi Zanatta and Bruno Cantarella (UAI) simultaneously videoed earthshine under a similar lunar phase (to within +/-0.5˚) to the following LTP reports:

On 1987 May 03 at UT 19:00-19:30 H. Miles (Cornwall, UK, 5" refractor, x30) found the earthshine to be both pink and bright with prominent features clearly visible. A "brilliant" star-like point was seen in Aristarchus crater. A bright spot was seen near Darney-Agatharides. Foley also confirmed that the Moon looked pink to him as well. The Cameron 2006 catalog ID=298 and weight=1. The ALPO/BAA weight=1.

On 1983 May 15 at UT20:30-21:05 P.W. Foley (Kent, UK, 12" reflector) was unable to see Aristarchus in earthshine, though other craters were clearly visible. However by 21:30 the Cooks could clearly see Aristarchus. The Cameron 2006 catalog ID=215 and the weight=0. The ALPO/BAA weight=2.

From Fig 1 we can clearly see Aristarchus and other craters, and it is interesting to attempt to compare Aristarchus to the 10th magnitude star, though of course Aristarchus is an extended object whereas a star is point like. So in practice this makes comparisons difficult. Aristarchus is neither faint, nor exceptionally bright in these two images. There is no sign of any bright spot near the Darney-Agatharides region either. Therefore I shall keep the weights of the 1987 and 1983 LTP reports as they are.

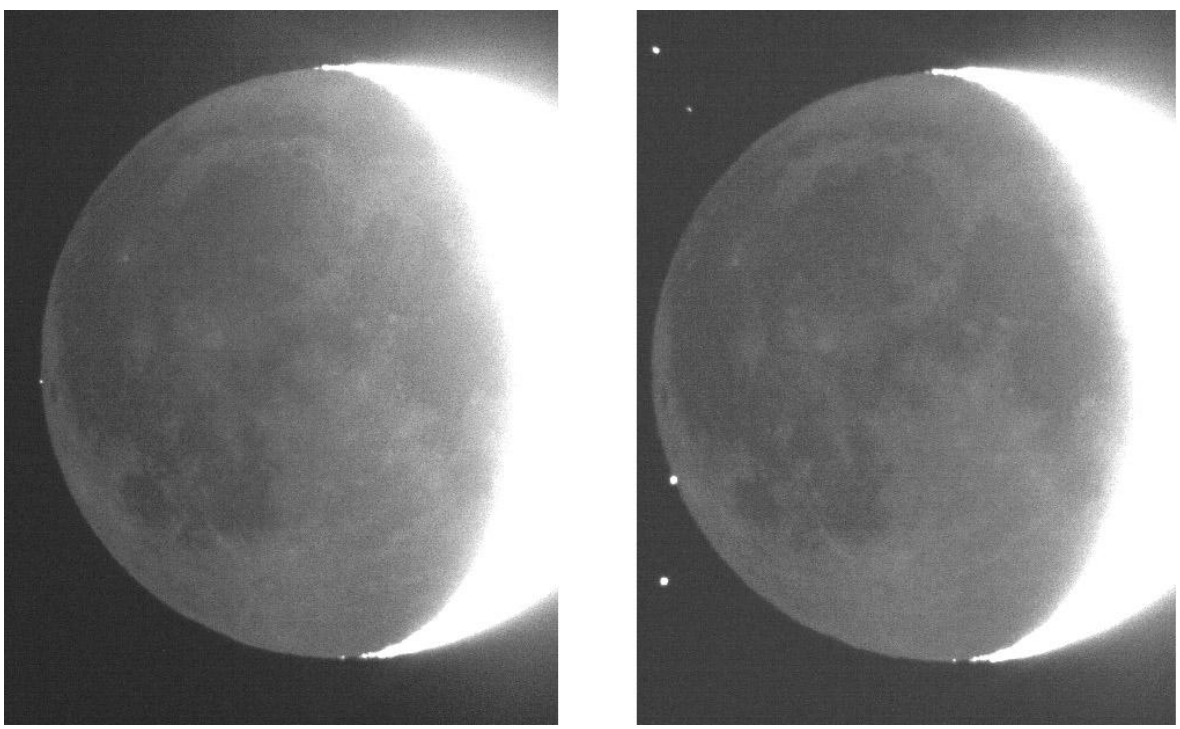


Figure 1. *Earthshine, orientated with north towards the top, taken on 2016 Apr 10.* ***(Left)*** *Image by Luigi Zanatta (UAI) at 19:59UT with 10th magnitude HD 28236 about to be occulted.* ***(Right)*** *Image by Bruno Cantarella (UAI) at 20:15 with 3rd magnitude θ^1 Tauri about to be occulted.*

Daniell: On 2016 Apr 12 UT 20:51-22:11 Kevin Berwick (ALPO) observed this crater under the same illumination (to within ±0.5˚) to the following LTP report from 1979:

Daniell 1979 Apr 02 UT 21:45-22:14 Observed by Madej (Huddersfield, UK, 158mm reflector, f/4.2, x36-110, seeing II-III) "Obscuration seen" BAA Lunar Section Report. Cameron says that this was a bright white cloud that covered three quarters of the crater. A yellow filter was used at 21:48, but the cloud was still white, albeit thinner (at x110). By

22:14UT the LTP was barely visible and again no color seen. Buczynski Lancaster, UK, seeing = poor) saw spurious color. Later (22:31-22:46UT?) Mellor obtained some photos, but these revealed no color. The Cameron 1978 catalog ID=48 and the weight=3. The ALPO/BAA weight=2.

Kevin made a visual observation and reported: *"I did notice that the base of the crater Daniell, where it meets the Lacus Somniorum is white when compared to the Mare. A bit of a stretch, but perhaps atmospheric conditions coupled with this might be responsible for the historical observation?? I saw no 'cloud' covering ¾ of the crater when I looked."* I think that we had better keep the weight at 2 as we have not replicated what was seen in 1979 and the crater has been reported for other similar obscuration type LTP in the past – though, like Kevin, I am not so convinced that these have not been atmospheric seeing related in origin.

Agrippa: On 2016 Apr 15 UT 00:36-00:40 Marcelo Gundlach (IACCB) and Gary Varney (ALPO) at UT 01:19 imaged this crater at the same illumination angle (to within ±0.5˚) to the following LTP report from 1962:

Agrippa 1962 Jul 10 UTC 01:14-01:48 Observed by Bartlett (Baltimore, MD, USA, 4" reflector x240, S=8, T=4) "Shadow of c.p. med. gray, wall shad. & landslip normal black. C.p. very dull, 4 deg bright." NASA catalog weight=4. NASA catalog ID #759. ALPO/BAA weight=1.

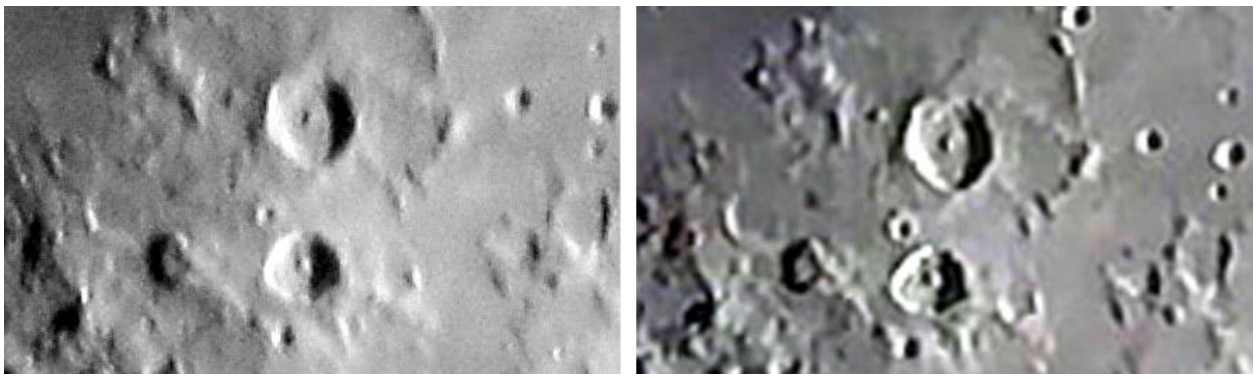


Figure 2. *Agrippa, located in the centre of this image, cut out from larger area images, and orientated with north towards the top.* ***(Left)*** *Imaged by Marcelo Gundlach (IACCB) on 2016 Apr 15 UT 00:36-00:40.* ***(Right)*** *Imaged by Gary Varney (ALPO) on 2016 Apr 15 UT 01:19 using an iPhone 5s camera on his telescope.*

So you can see from Fig 2, neither Marcello or Gary managed to capture any greyness in the central peak shadow, so presumably we had better leave the weight of this LTP at 1 for now, and if we obtain some higher resolution shots in the future, which still show a black central peak shadow, instead of grey, then it would be worth considering raising the weight.

Tycho: On 2016 Apr 15 UAI observers: Franco Taccogna, Pasquale D'Ambrosio, and Valerio Fontani took on the task of trying to catch the central peak of Tycho, perhaps before direct sunlight illumination reached it?

On 2003 Mar 09 UT 21:04 (See Fig 3 – top right) Brendan Shaw took an image of the apparently completely shadow filled interior of Tycho, which appeared (upon contrast stretching) to show the central peak, despite the Sun just being 1.2˚ above the horizon. Checks for direct illumination of the central peak, using ALVIS and LTVT visualization tools, revealed that the central peak should not be under direct illumination this early, even allowing for the 0.5˚ angular diameter of the Sun. So presumably the central peak was being illuminated in another way e.g. perhaps by being illuminated by scattered light from the sunlit western rim of Tycho lighting up the interior of the crater? If so then the effect should have been be repeatable. However after many attempts at repeat illumination observations (Fig 4 contains plotted points for the solar alt/az of all Tycho observations in the ALPO/BAA database) the central peak was never again seen, for certainty, to be illuminated this early. For this reason the observation was given a high LTP weight of 4. But could another explanation be a secondary source of illumination from a more mundane source, for example earthshine as this can vary in strength on different dates, or even a LTP?

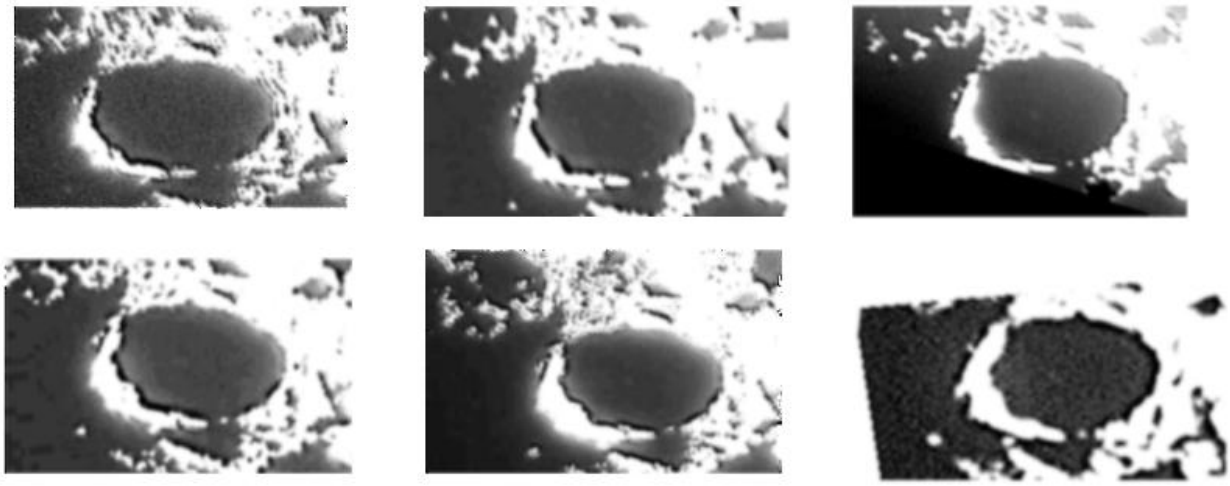


Figure 3 *Highly contrast stretched images of the shadow filled interior of Tycho, orientated with north towards the top. You can see a very weakly illuminated central peak in many of these, just to the left of the centre of the crater floor, and because it is consistently in the same position, it is not just image noise.* ***(Top Left)*** *Image taken by Franco Taccogna (UAI) on 2016 Apr 15 at 17:27 UT – central peak not visible at a solar altitude of 0.98˚.* ***(Top Centre)*** *Image taken by Pasquale D'Ambrosio on 2016 Apr 15 at 17:58 UT – central peak, or noise, visible(?) at a solar altitude of 1.18˚.* ***(Top Right)*** *Image taken by Brendan Shaw (BAA) on 2003 May 09 at 21:09 UT – central peak visible at a solar altitude of 1.24˚.* ***(Bottom Left)*** *Image taken by Pasquale D'Ambrosio on 2016 Apr 15 at 18:30 UT – central peak visible at a solar altitude of 1.37˚.* ***(Bottom Centre)*** *Image taken by Franco Taccogna on 2016 Apr 15 at 18:33 UT – central peak visible at a solar altitude of 1.38˚.* ***(Bottom Right)*** *Image taken by Maurice Collins (ALPO) taken on 2014 Aug 04 at 09:12 UT – central peak visible at a solar altitude of 1.51˚.*

Now with the successful observing campaign by UAI observers from 2016 Apr 15, we have gained a little bit more knowledge, and even a potential, albeit uncertain, earlier sighting of the central peak?

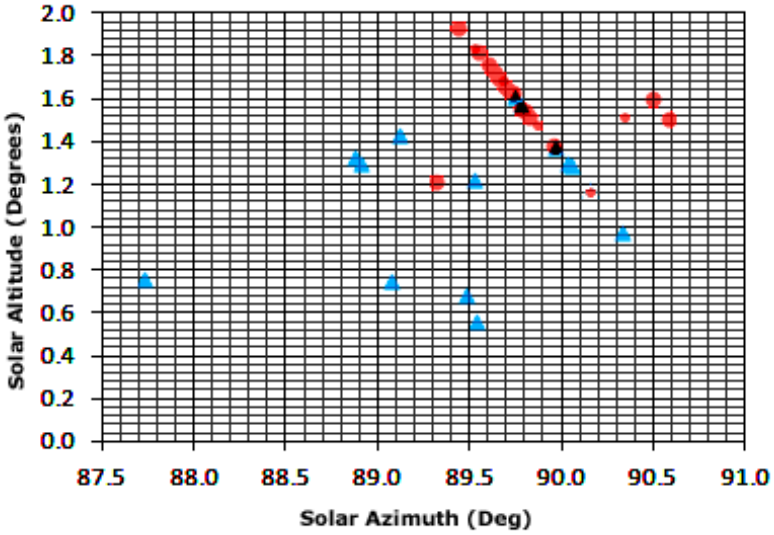


Figure 4 *An altitude versus azimuth plot of the Sun (at the centre of the crater) for Tycho observations. The large red dots are reliable sightings of the central peak. The smaller red dots are possible, albeit very uncertain, sightings of the central peak. The blue triangles are non-sightings of the central peak. Hence when the Sun is too low for potentially direct or indirect illumination, then you see more blue triangles on the plot.*

Fig. 3 shows a selection (six of the plotted points from Fig 4) of contrast stretched CCD images of the central peak, sequenced by the solar altitude at the centre of Tycho crater. Included are images by UAI and other observers, but not all taken on the same date. As you can see there may be a detection of the central peak in Pasquale D'Ambrosio's 17:58 UT image, which would be < 1/20th° in solar altitude lower than Brendan's, image, though it must be said that the central peak in Pasquale's image is so faint that it could be easily image noise, as two other similar points can be seen elsewhere on the shadowed interior. The next definite sighting of the central peak does not occur until the Sun has risen almost 1/8th° higher in altitude, as seen in Pasquale and Franco images from 18:30 and 18:33UT respectively on 2016 Apr 15. But why are there sometimes occasions at solar altitudes slightly above 1.2˚, that the central peak is not visible (See Fig 4)? Photometry of the images suggests that the weakly illuminated central peak is < 0.5% the brilliance (per pixel) of the brightest part of the illuminated rim and so can be quite difficult to see! Therefore it is quite likely that close to 1.2˚ the central peak it is just on the limits of detection. Now the 2016 Apr 15 series of UAI observations show up as a nice line that turns red (indicating the peak is illuminated) at an azimuth of about 90.0˚ and an altitude of ~1.4˚ (slightly less if we take Pasquale D'Ambrosio's tentative/less certain(?) detection of the central peak). The two other early detections from other nights are at an azimuth of 90.5˚ as imaged by Maurice Collins, and Brendan's observation at an azimuth of 89.1˚, but both of these are at higher altitudes above the horizon.

So is the central peak is being illuminated early due to scattered light of the western rim, or due to exceptionally bright earthshine, or indeed another explanation? If scattered light from the western rim was the cause then there should be a repeatable trend of first detection in terms of altitude and azimuth. If earthshine, or a LTP were the reason, than we would expect at a given azimuth we will get quite a lot of variation of when the central peak would first detected. Actually the earthshine idea itself has a major weakness in that earthshine is typically 8 magnitudes fainter (approximately 1/1600th) per sq arc sec, than the mean sunlit side of the Moon at this phase, though being near to the terminator (sunlit surfaces are fainter than the mean here), may make this more plausible. I think for now, as we are testing out these ideas, I will lower the LTP weight from 4 to 3, but would encourage strongly all observers with cameras to have a go at catching the central peak just after the terminator passes over the crater. More points on the graph would make a good case for proving one theory against another.

Rima Birt: On 2016 Apr 15 UT UAI observers: Franco Taccogna and Pasquale D'Ambrosio imaged this feature at similar illumination (within ±0.1˚ selenographic colongitude in Pasquale's image sequence) to the following 2005 LTP:

> *Rima Birt 2005 Sep 12 UT 00:40-01:01 Observed by Daniel del Valle Hernandez (Aguadilla, PR, 4.7" refractor, S=7, T=3.5) "Rima Birt not clearly visible, despite the other cleft near the dome being visible." An ALPO report. ALPO/BAA weight=2.*

Both Franco and Pasquale were able to obtain some sharp images (Fig 5 – Left and Right) which show that Rima Birt is normally visible, though obviously not as well defined as Rupes Recta. They both used 20 cm aperture telescopes and the latest modern day imaging technology. Daniel was using a telescope nearly half the diameter, and although his seeing conditions were good, upon reading his written description in the archives, it appears that the transparency was hazy, and he suspected that this was why Rima Birt was not so clearly visible (See Fig 5 – Centre). There are some differences between the images and the sketch, in particular Rima Birt seems to join Birt a little too far to the east in the sketch and the western rim shadow of Birt is more rounded in the images than in the sketch. However apart from these the sketch is fairly accurate. I am not sure how this report ended up in the ALPO/BAA LTP catalog, but I definitely think this should be removed from the database, and so will not appear in the predictions in future.

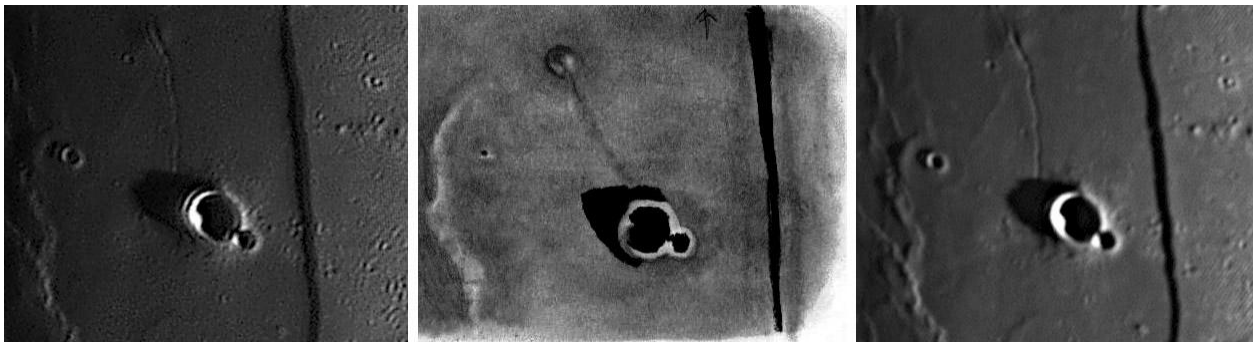


Figure 5. *Rima Birt, Birt and Rupes Recta, orientated with north towards the top.* ***(Left)*** *As imaged by Franco Taccogna (UAI) on 2016 Apr 15 UT 18:30. Image has been non-linearly contrast stretched to match the mare grey tones in the next sketch.* ***(Centre)*** *A sketch by Daniel del Valle Hernandez (ALPO) made on 2005 Sep 12 UT 00:40-01:02.* ***(Right)*** *As imaged by Pasquale D'Ambrosio (UAI) on 2016 Apr 15 UT 20:05. Image has been non-linearly contrast stretched to match the mare grey tones in the previous sketch.*

Eratosthenes: On 2016 Apr 15 UT 22:30 Aldo Tonon (UAI) attempted to take a color image of Eratosthenes crater to match the illumination (to within ±0.5˚) to a visual report of color on the inside NW rim of Eratosthenes:

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 a 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 this was only observers at Selsey and some of the evidence contradicts, I am allocating an ALPO/BAA weight=3.

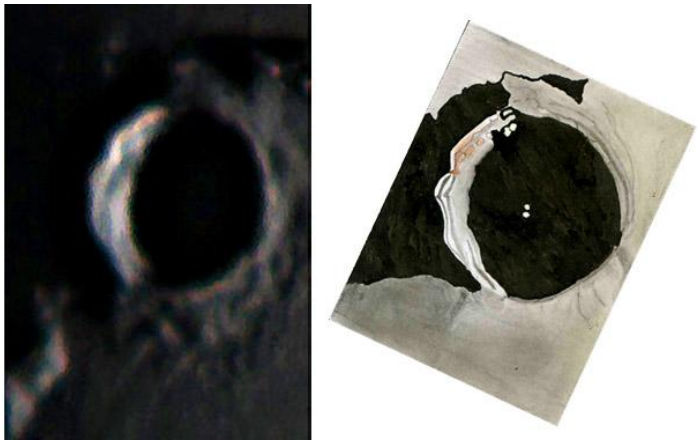


Figure 6. *A close up of Eratosthenes, orientated with north towards the top.* ***(Left)*** *A color saturation enhanced (50%) image by Aldo Tonon (UAI) from 2015 Apr 15 UT 22:30.* ***(Right)*** *A sketch made by Paul Abel (BAA) from 2009 Nov 25 which had been started earlier, but finished at 20:18UT*

Aldo's image (Fig 6 - Left) shows no sign of a brownish tinge on the same place on the inner NW rim, as in Paul Abel's sketch (Fig 6 – Right), though there is a small amount of red spectral dispersion on the NW outer rim. However the illumination is not quite right, as the central peak has not emerged from the shadow yet, despite being ±0.5˚ similar in illumination. So I think we had better keep this LTP at a weight of 3.

Mons Pico: On 2016 Apr 16 UT 20:39 Derrick Ward (BAA) imaged this mountain under the same illumination condition, to within 0.5 to a LTP alleged to have been videoed by former BAA president Martin Mobberley – though as you will see below this was just a comment in the BAA Lunar Section Circular at the time:

> *On 1987 Mar 09 at UT20:00 M. Mobberley (Sussex, UK) obtained some video of Mons Pico - apparently these show the mountain with a puzzling appearance (not sure whether it was the observer who claimed this or someone who analyzed the tape?). The Cameron 2006 catalog ID=300 and the weight=5. The ALPO/BAA weight=1.*

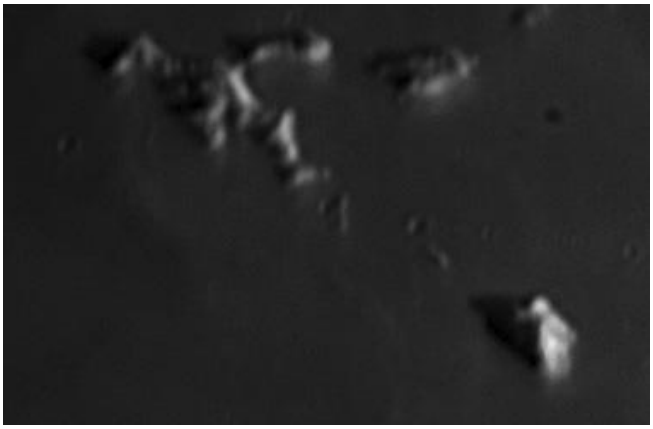


Figure 7. Mons Pico (bottom right corner) as imaged by Derrick Ward (BAA) on 2016 Apr 17UT 20:30.

Now unfortunately I cannot find a copy of the video in the Lunar Section archives, or any other record other than what was reported in the BAA Lunar Section Circular from p32 from the 1987 Apr edition: *"Martin Mobberley has written to advise that CCD video was obtained on 1987 March 9th and that Mt. Pico presented some slightly puzzling appearances. This tape is being forwarded onto me shortly"*. We do have some contents pages for about several video tapes that Martin took, No.s 1 to 9 and 11 to 12, but no tapes, and unfortunately the contents page for tape No. 10, which would have covered the above event, is missing. So I think that the weight given in the Cameron 2006 catalog of 5 was an overly optimistic, and the ALPO/BAA weight of 1 was more reliable. Anyway now kindly due to Derrick's image (Fig 7) we can see what the mountain should have looked like if it was normal back in 1987. As I have studied Mons Pico in great detail during the late 1970's to early 1980's, by making at least seventy sketches, I have to say that what I see in Fig 7 looks perfectly normal to me; though there is a bit of diffuseness on the southern corner, but as I see this on other mountains too, this could be due to seeing flare, or an artifact of the image stacking process used? Alas without Martin Mobberley's video tape resurfacing, we probably cannot make any further progress on working out if anything unusual was recorded in 1987, so the weight shall remain at 1, but I will remove it from the Lunar Schedule web site.

Mersenius C: On 2016 Apr 18 UT 21:09-22:46 Valerio Fontanni (UAI) imaged this crater under similar illumination and topocentric libration (to within ±1˚) to a visual report by Glen Ward from eleven years ago:

> *On 2005 Nov 13 G. Ward (a lunar observer for 15 years) observed an area just south west of Mersenius C to be blurred and in a greenish cloud. The green color was more like that of dead grass than one gets from a neon bulb. The effect was seen from 04:50-04:57UT, but could have been going on before it was first noted at 04:50-UT. Seeing was 6-7/10 4" Refractor (2 element). The refractor had been used hundreds of hours before (over a 10 year period) with no similar color being seen. The observer checked other areas but did not see any similar effects. They also rotated and changed eyepieces, but this made no difference to the LTP. The LTP site seen was picked up on an image taken earlier at 04:47UT by W. Bailley, from Sewell, NJ, USA. Unfortunately the area concerned, a mountain on the image, was saturated and so we cannot tell if a color was present there and anyway the seeing was poor. ALPO/BAA weight=3.*

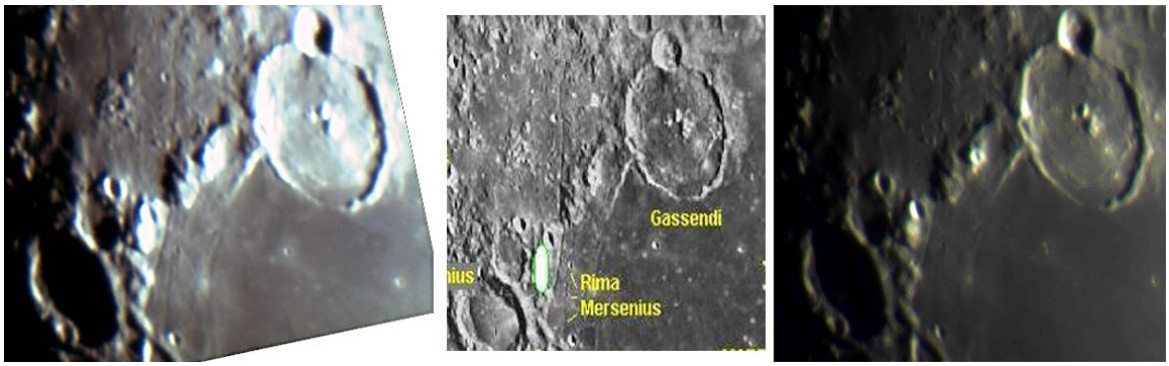


Figure 8. North West mare Humorum, orientated with north towards the top. **(Left)** A Color image by Wayne Bailly from 2005 Nov 13 UT 04:47. **(Centre)** A computer generated sketch by Glen Ward (ALPO) showing the location of a green glow, that they saw on 2005 Nov 13 UT 04:50-04:57. **(Right)** A color image by Valerio Fontanni (UAI) from 2016 Apr 18 UT 22:26

Well "green" LTP reports have always interested me. You often get reds and blues which can some time be explained away as atmospheric spectral dispersion, or chromatic aberration, but reports of green are quite rare and more difficult to account for. Back in 2005 Glen provided a computer generated sketch (Fig 8 – centre) showing where the green glow was seen. Just 3 minutes earlier, Wayne Bailly (ALPO) had taken a color image of the region (Fig 8 – Left) but unfortunately this was slightly over exposed, so alas we lose color information here in a vital place. However if you took Glen's sketch literally, then the green patch extended further than the bright sunlit slope, just south of Mersenius C in Wayne's image. Valerio's 2016 image (Fig 8 – Right) shows some color in the area of the 2005 report, but it is a very similar color to what we get on the western slopes of Gassendi, so would not normally be noticeable too much to visual observers. So it looks like Glen's 2005 green glow effect should not have been seen, but as there is no simultaneous confirmation of it, it must remain at a weight of 3.

Aristarchus and Herodotus: On 2016 Apr 19 UT 03:34 Jay Albert imaged this area under the same illumination conditions (to within ±0.5˚) to the following three LTP reports:

Herodotus 1954 Aug 11 UT 02:18-04:05 Observed by Haas (Las Cruces, NM, USA) "Temporary greyness seen in interior shadow." ALPO/BAA weight=3.

Herodotus 2002 Feb 24 UT 06:05-06:20 W. Haas (Las Cruces, NM, USA) observed that the shadow was, almost, but not completely black. This might have been related to the observing conditions. ALPO/BAA weight=2.

Aristarchus 1955 Oct 28 at UT00:00? Kozyrev (Crimea, Soviet Union, 50" reflector) detected in Aristarchus Fraunhofer lines in UV spectra that were much narrower than in the solar spectrum. This indicated luminescent glow which overlapped contour(?) lines. Greatest after Full Moon, but fluctuated monthly with no indication of solar activity effect. The Cameron 1978 catalog ID=621 and the weight=5. The ALPO/BAA weight=5.

Now the image taken by Jay (Fig 9 – Centre) cannot help us with the Kozyrev LTP as that was concerned with thinning of the Fraunhofer absorption lines, but at least it shows us what Aristarchus would have looked like, assuming that the UT given for the spectra is correct. The two sketches either side in Fig 9 relate to transient gray shadows that were seen inside Herodotus crater by Walter Haas, however in Jay's image (Fig 9 – centre) which shows the normal appearance, there clearly is no sign of any grey shadow. So whatever Walter saw in 1954 is difficult to explain, though in his 2002 report, where the grayness effect was much weaker, he does give some probability to it being due to atmospheric conditions. For now I will leave the Herodotus LTPs at 3 and 2 respectively, but concerning the Kozyrev report, the finding that the Faunhofer lines are shallowed towards Full Moon, reminded me about a paper which suggested that this is probably caused by the photon-phonon scattering (See: "Lunar Luminescence and the Filling-in of Fraunhofer Lines in Moonlight", by Potter, A. E., Mendel, W., & Morgan, T., 1984). I will therefore lower the weight of the Kozyrev LTP to 4, as although the theory maybe correct, I would like to find out more about the dates and UTs when Kozyrev was observing, but not seeing this effect.

Figure 9. *The Aristarchus region orientated with north towards the bottom.* ***(Left)*** *A sketch by Walter Haas of Herodotus crater from 2002 Feb 24 UT 06:05-06:20.* ***(Centre)*** *A color image of the Aristarchus area by Jay Albert (ALPO) taken on 2016 Apr 19 UT 03:34 – the rectangle outlines Herodotus crater which is depicted in the side panels.* ***(Right)*** *A sketch by Walter Haas (ALPO) from 1954 Aug 11 UT 02:18-04:05, when a grey shadow was noted in the interior of Herodotus, despite the shadow in Aristarchus being completely black.*

Aristarchus: On 2016 Apr 24 UT 08:11 Maurice Collins obtained an image of this crater that was under similar illumination (to within ±0.5˚) to no less than three LTP reports:

> *Aristarchus-Cobra Head, 1967 Nov 15 UT 05:40-06:00 Observed by Cross, Tombaugh (Las Cruces, NM, 12" reflector x800) and Harris (Tucson, AZ), and Dunlap (Organ Pass, NM, 24" reflector with Moonblink). "Obs. reddish color N. & E. of Aris. & more intense color nr. E.(IAU?) rim of Cobra Head. Red color nr.C.H. confirmed by Tombaugh. Obtained 10 photos between 0543-0549h in 3 spectral bands (blue, yellow, red, & integ. light). No change dur. obs. per. but spot got smaller at moments of good seeing. Isodensitometry of photos. At Corralitos 0152-0155 on 24-in image intensifier & filter sys. photos at 0320-0330h. Harris at Tucson got spectra. Neither of latter 2 show anything unusual. Its edges were nebulous even at best seeing. Size @ that of Cobra's Head." NASA catalog weight=5. NASA catalog ID #1053. ALPO/BAA weight=4.*
>
> *On 1980 Apr 28, Louderback (South Bend, WA, USA using a 8" reflector and a 2.5" refractor) observed a very bright reg region on top of the south west rim of Aristarchus crater. This was on the same side as the ray system between Aristarchus and Herodotus. Louderback noticed some chromatic aberration - blue where he had seen the red patch before. Louderback suspects chromatic aberration was the cause although did not see red in that region ever again. "Patch was between his observation points A and C. Point C was 5 points brighter in the red filter than in the blue." A sketch was made. Cameron suspects that the LTP was real. Cameron 2006 LTP catalog extension ID=92 and weight=3. ALPO/BAA weight=2.*
>
> *Aristarchus 1985 Dec 25 UT Louderback observed that the south west wall was a creamy deep yellow. There was also strong fluorescent blue on the west wall of the Cobra Head - Schroter's Valley area and this was similar to the violet glare seen on Aristarchus at times. Violet was seen between Aristarchus and the Cobra Head. Seeing conditions were poor. Brightening of a point near C occurred roughly every 10-15 seconds and lasted 0.5 sec - (Cameron concludes that this was not due to the Earth's atmosphere). A 0.2 step drop in brightness was seen on point A (twin spots). Point C had reduced by 0.6 steps. Elsewhere was stable in brightness. Cameron 2006 catalog ID=281 and weight=4. ALPO/BAA weight=3.*

Now concerning the color effects mentioned in these three LTP reports, does the "red to the N & E of Aris" mean on the rim or beyond in the 1967 report? If the former, then the bottom left image in Fig 10 might suffice, but if the latter then the top right has some hint of red beyond Aristarchus. In order to get some red near the E. of the Cobra Head, any of the images on the left of Fig 10 might do? For the 1980 report, it is difficult to tell from Maurice's image whether the bright area on the SW rim is very bright as it looks similar in brightness to other parts of the W. Rim, this is because these areas are saturated. I cannot comment on the other details in this report as I do not believe we have these in our archive. Concerning the 1985 report the only image in Fig 10

which has any resemblance of what might be described as violet between the Cobra's Head and Aristarchus is perhaps the top left figure, but the effect is not as strong as other atmospheric spectral dispersion effects present. In view of the overall poor agreement between colors described in the reports and what is shown in the simulations in Fig 10, I will leave these reports at their present weights.

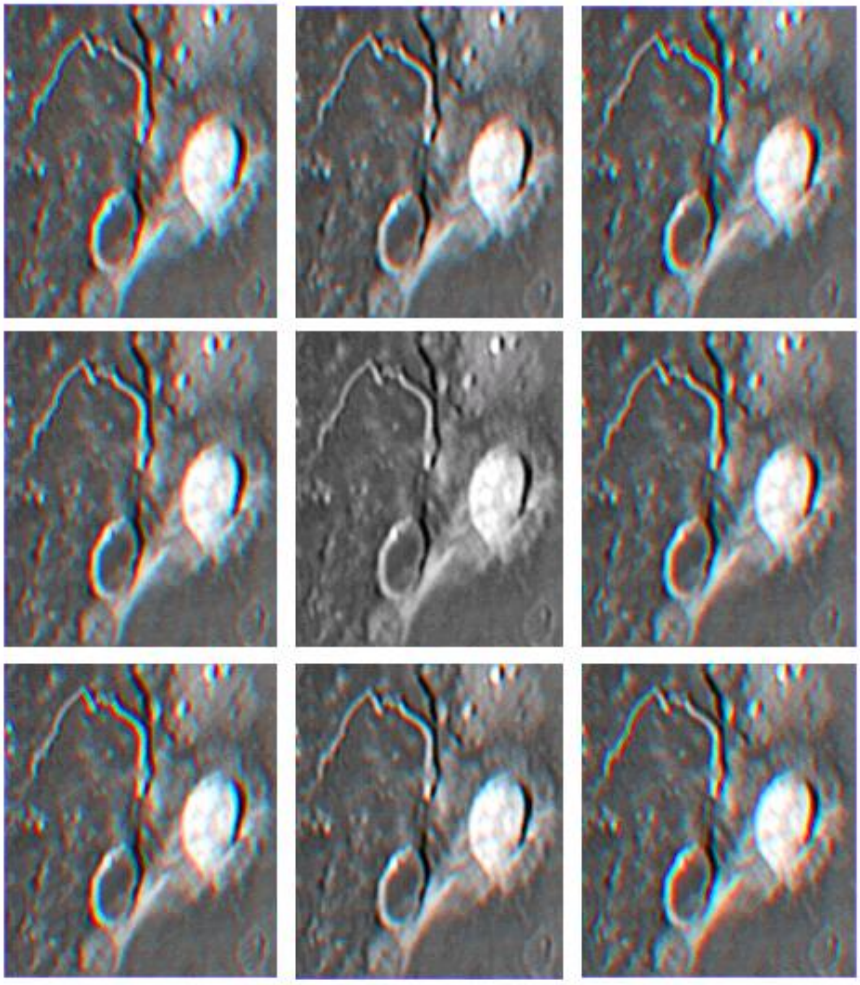


Figure 10 (Centre) *Aristarchus as imaged by Maurice Collins in monochrome of 2016 Apr 20 UT 08:11, orientated with north towards the top. Around the centre image are modeled (artificial) exaggerated spectral dispersion images, where the red component has been shifted away from the central image and blue towards.*

Aristarchus: On 2016 Apr 21 UT 22:09-22:46 Alberto Anunziato (AEA) imaged Aristarchus under the same illumination and topocentric libration (to within ±1˚) to the following LTP report from 1990.

> *1990 Dec 02 F. Graham took some photos of the Cobras Head and found a blue cloud about 50 km in diameter and scattering light - Cameron says that this indicates high density. Darling found the Cobra's Head obscure and variable "clear and bright to diffused". Cameron was alerted observed (02:40UT) variations with periods of approximately 30 seconds, and thought that she could see a red tinge on the east rim of Aristarchus - checks elsewhere found no other colors. Darling found that a blue filter enhanced the effect and a red filter made it disappear. There was a blink at 02:55UT but no blink in the Cobra's Head, which looked fuzzy and lacking in detail. The effect was confirmed by Weier, who also saw two dark spots in the Cobra Head in blue but not in red light. The brightness of the Cobras Head was 6.0, Herodotus floor 5.5, NW wall 7.5, South wall, 7.0, Aristarchus south wall 9.0, west wall 9.0, south wall 7.0, East wall 8.0, and the central peak 10.0. Observer details were as follows: Darling (Sun Prairie, WI, USA, 12.5" reflector, x159, S=9/10). D. Weier (Sun Prairie, WI, USA, 12.5" reflector, x159, S=9/10), W. Cameron (Sedona, AZ, USA, 8" reflector x110 and x220, T=6 and S=6) F. Graham (E.Pittsburgh, PA, USA, 7" refractor, thin haze). Cameron 2006 catalog ID=415 and weight=5. ALPO/BAA weight=4.*

Alas I cannot find any of Francis Graham's photographs in the archives, but I did manage to find a copy of David Darling's sketch that he made showing the relative visual intensities and you can compare these with the sequence of Alberto's images in Fig 11. All looks reasonably normal, although there are some slight differences in the intensity values e.g. the Cobra's head in David's sketch says 6.0, where as it looks more like 7.0 in Alberto's image (a difference of only 1), but this could be down to differences in sensitivity and resolution between the human eye and Alberto's camera. Also there is no third band in David's sketch which is revealed in the SSW part of the rim of Aristarchus in Alberto's images –but the reason for this might be due to seeing conditions. As to what to do about the high weight of 4 for this LTP, well David's sketch is not too different to what Alberto imaged, so the main evidence for the 1990 LTP relies upon the huge cloud effect photographed by Francis Graham, and visual confirmation of haziness and changes in appearance by visual observers of the Cobra's Head. However without the photographs, how do we know that it was not some sort of optical flare effect that one sometimes gets if for example a Barlow lens had been used? Could the variation in visual appearance of the Cobra's Head by visual observers be due to atmospheric seeing effects? Although I am tempted to lower the weight to 3 because of this, and the fact that widely geographically separated observers saw changes in the appearance of the Cobra's Head, this suggests that we should stick to a weight of 4.

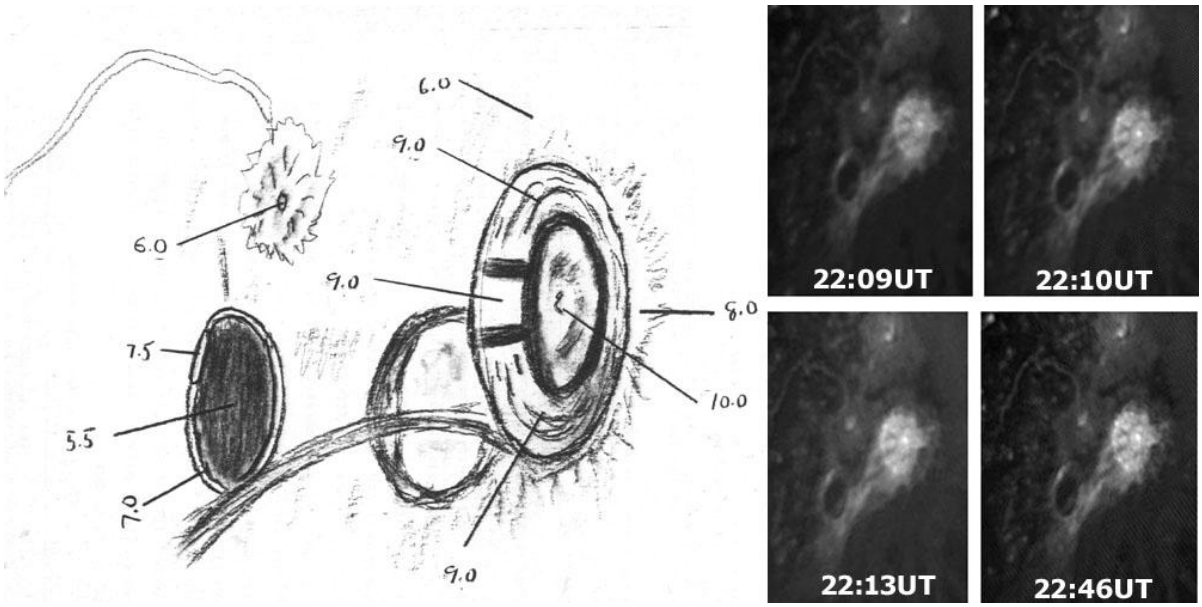


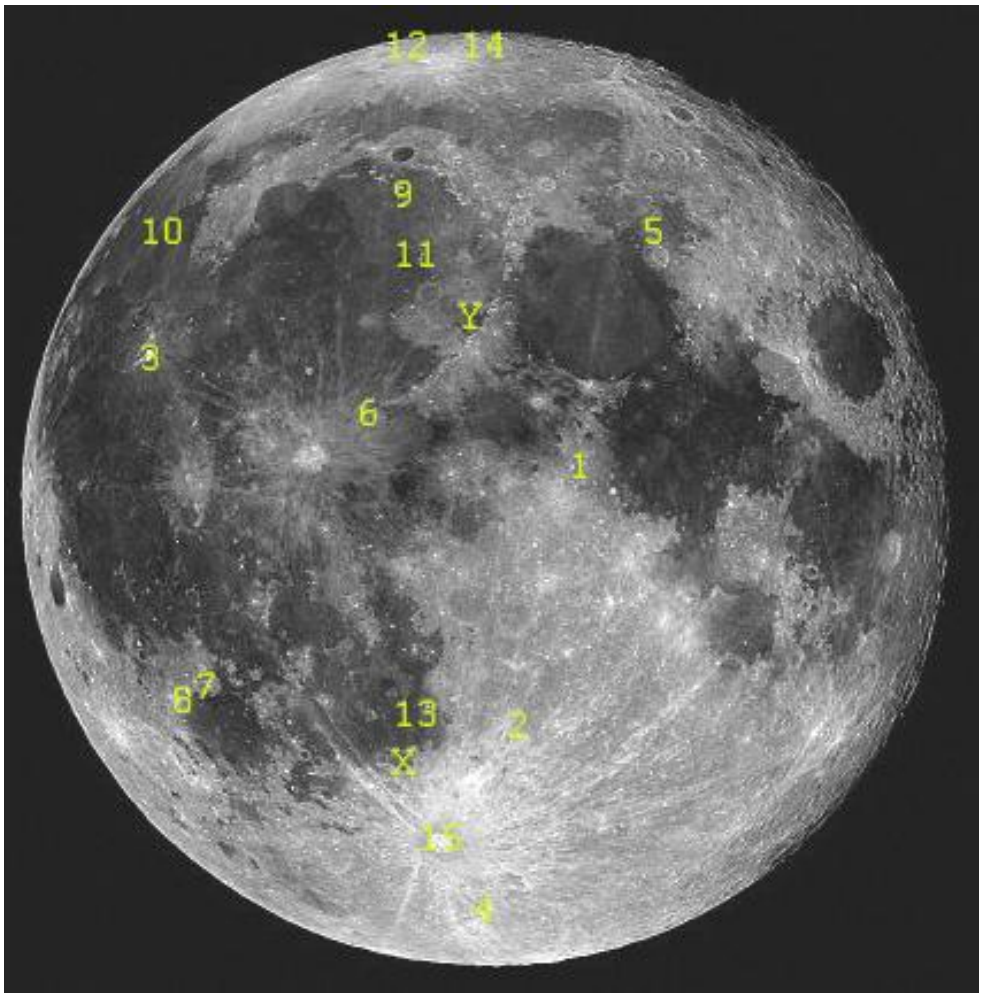
Figure 11. *A comparison of a sketch and images of Aristarchus, all orientated with north towards the top, made under similar illumination and viewing angles.* ***(Left)*** *A sketch by David Darling from 1990 Dec 02 UT 03:30* ***(Right)*** *Images by Alberto Anunziato (AEA) from 2016 Apr 21.*

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

Dr Anthony Cook, Institute of Mathematical and Physical Sciences, University of Wales Aberystwyth, Penglais, Aberystwyth, Ceredigion, SY23 3BZ, WALES, UNITED KINGDOM. Email: atc @ aber.ac.uk.

KEY TO IMAGES IN THIS ISSUE

1. **Agrippa**
2. **Apianus**
3. **Aristarchus**
4. **Clavius**
5. **Daniell**
6. **Eratosthenes**
7. **Gassendi**
8. **Mersenius**
9. **Mons Pico**
10. **Mons Rumker**
11. **Montes Spitzbergen**
12. **Philolaus**
13. **Rima Birt**
14. **Scoresby**
15. **Tycho**



FOCUS ON targets

X = Capuanus
Y = Montes Apennines