Lunar Section

BAA

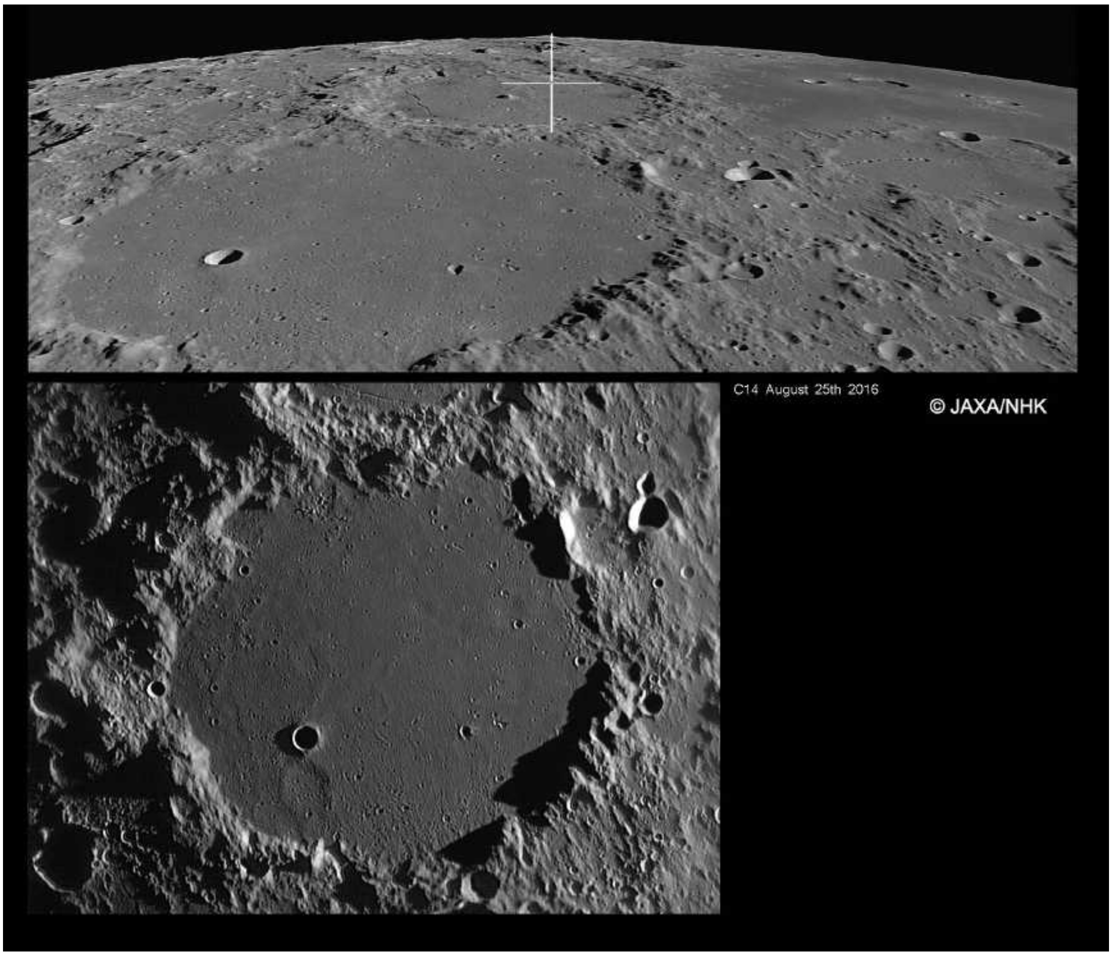
British Astronomical Association

Director: Bill Leatherbarrow

LUNAR SECTION CIRCULAR

Vol. 56 No. 3 March 2019

FROM THE DIRECTOR



Ptolemaeus, as seen from the Selene spacecraft and as imaged by Leo Aerts

When I first started out in lunar observation back in the early 1960s the human eye at the telescope was the best receptor for catching the finest lunar and planetary details in those moments when our turbulent atmosphere settled for a moment or two of calm. Pencil and paper the took care of recording those fleeting impressions. It was a long and inefficient process, particularly for those of us not gifted with the artistic skills needed to depict our Moon's rugged topography. More often than not a single observation would require most, if not all, of an evening's observing session. Photography in those days simply could not compete, even when used with the world's largest telescopes.

In the December 2018 issue of this Circular Klaus Brasch gave a personal account of how lunar imaging techniques have evolved over his own career as an observer. He provided an excellent illustration of how modern high-speed planetary cameras can produce results undreamt of during the days of film photography. However, a montage submitted by Leo Aerts (*above*) has brought home to me just how far we have come since those days of the visual observer and early photography. Not only does Leo's image of Ptolemaeus, taken with a C14 SCT under the skies of Belgium, show much more detail than can ever be seen by the eye at the telescope, but it more than stands comparison with an oblique image taken from the orbiting Jaxa/Selene spacecraft launched by Japan.

After a winter of poor seeing from the UK it is easy to lose heart, but Leo's image reminds us of the powerful techniques we have at our disposal for the (hopefully) better skies ahead as Spring approaches.

Good observing!

Bill Leatherbarrow

OBSERVATIONS RECEIVED

This month images have been received from the following observers: Leo Aerts (Belgium), Paul Brierley, Maurice Collins (New Zealand), Jamie Cooper*, Dave Finnigan, Rik Hill (USA), Thomas Jones*, Tom Moran*, Mark Radice, Bob Stuart, Alan Tough*, Alex Vincent*, Geoff White, and the Director.

Several observers (marked *) submitted further images of the total lunar eclipse of 21 January 2019, including the following fine compilation by **Alan Tough**, who writes:

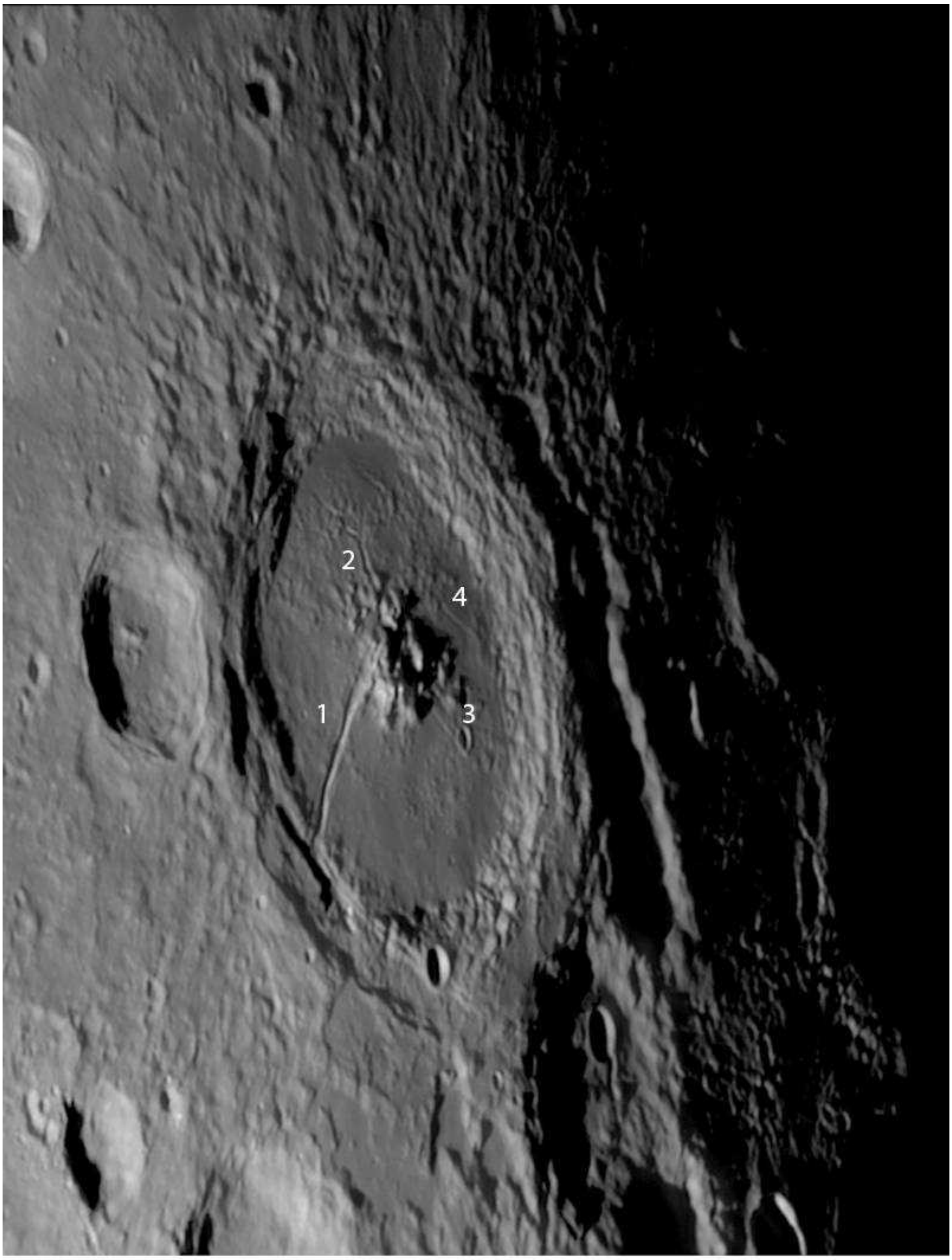
'This sequence shows the progress of the January 21st Lunar Eclipse from just before the start of the Umbral phase (03:29 UT) until two minutes before the start of totality (04:39 UT). The Moon then sank into thicker cloud! I packed up and went home at 5 a.m.

Location: Duffus Castle, Moray, Scotland. Equipment details: Celestron 9.25", f/10 Schmidt-Cassegrain telescope and a Canon EOS 5D Mark III DSLR. Exposure times ranging from 1/320th second to 15 seconds.'

Mark Radice has sent in a detailed study of the crater Petavius, imaged on 22 January 2019. Mark writes as follows:

‘I love the fact that we can witness planetary geology from the garden. The lunar crater Petavius (dia 177km) is a beauty through the C11. It has 4 rilles (see labels) on its floor that hint at a pool of magma that is trapped below the surface and, in addition to the rilles, caused the southern rim to collapse leading to its double rampart. Note that the southern part of the crater floor is relatively smooth compared to the northern floor, again hinting that it has suffered from a volcanic outflow, albeit limited.

All this with a cup of tea in hand and the radio on!’

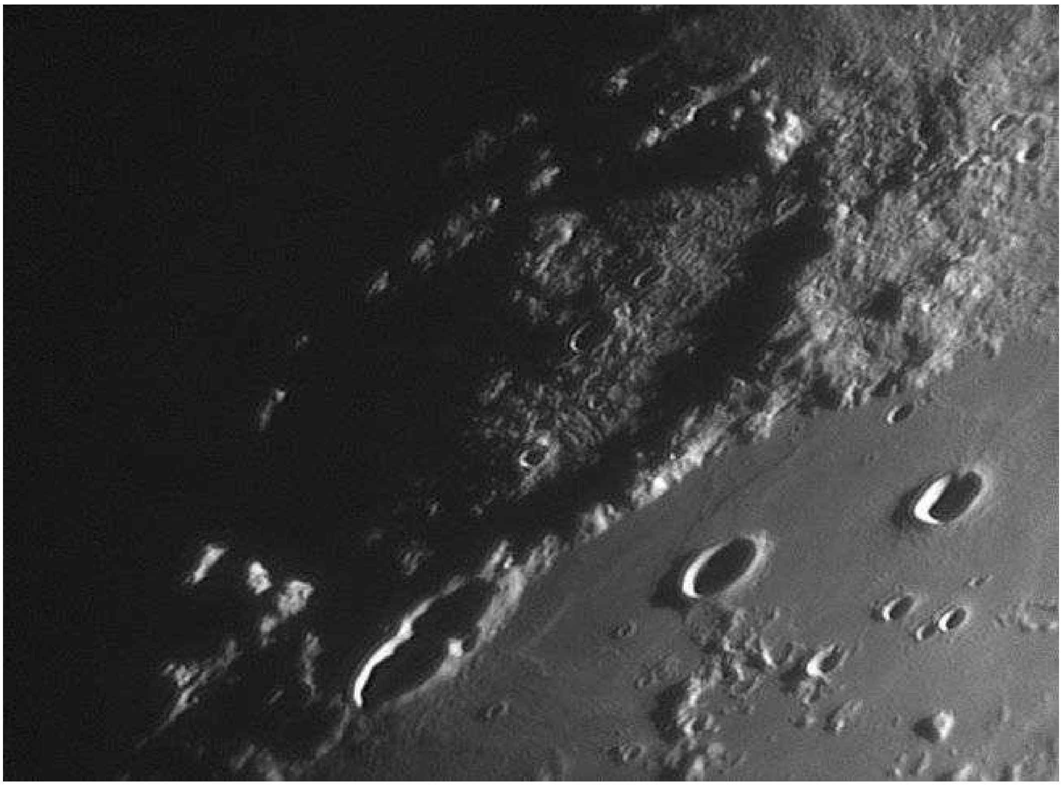


Petavius
22 January 2019 2235Z
C11 f20 ASI224MC 685nm IR Filter

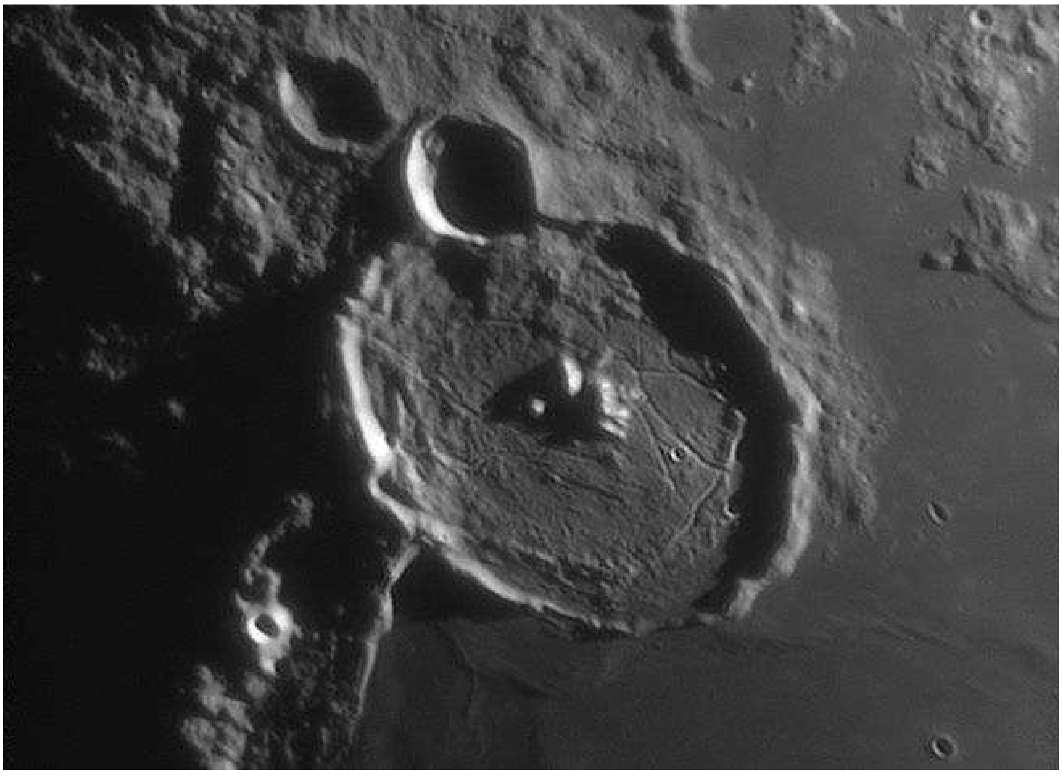
Mark Radice

RefreshingViews.com

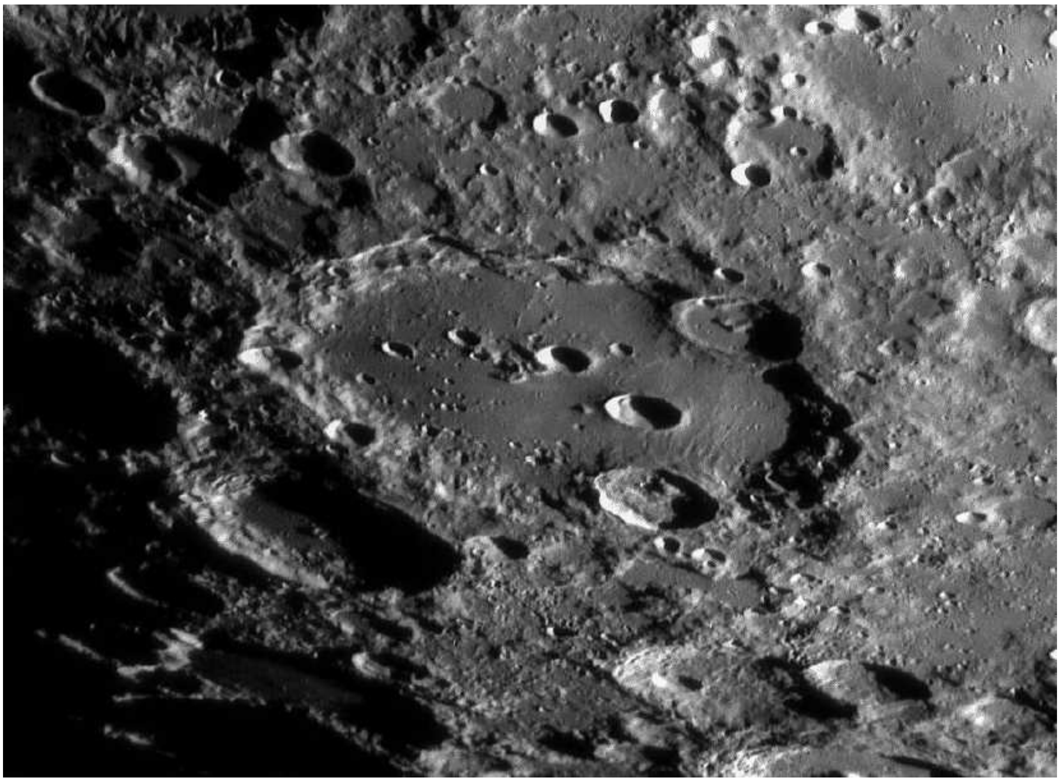
The Director had a fine view of sunrise over the ruined crater J. Herschel on the evening of 15 February 2019 at 21.28 UT. The low solar angle really brought out just how the original crater floor has been smothered with later ejecta debris.



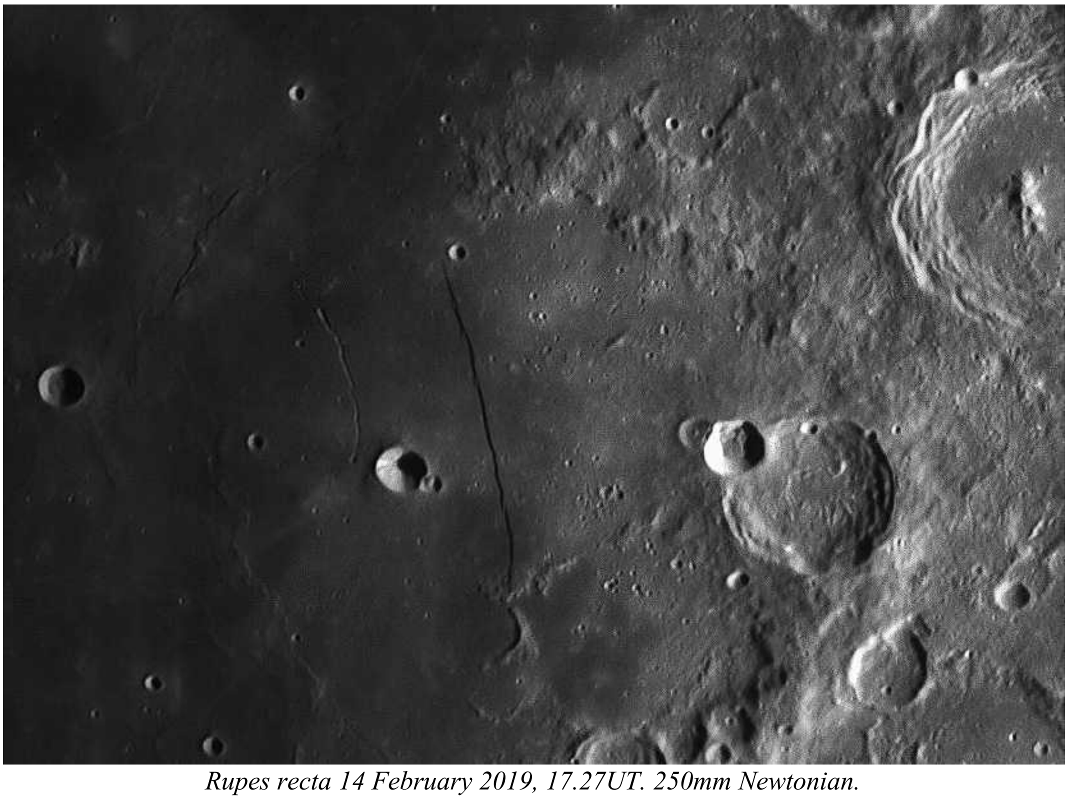
The same evening also allowed a fine view of the interior rilles of Gassendi (21.40 UT).



Bob Stuart also had some good seeing on the evening of 14 February, allowing the following captures of Clavius and the Birt/Rupes recta region.



Clavius 14 February 2019, 17.25UT. 250mm Newtonian.



Rupes recta 14 February 2019, 17.27UT. 250mm Newtonian.

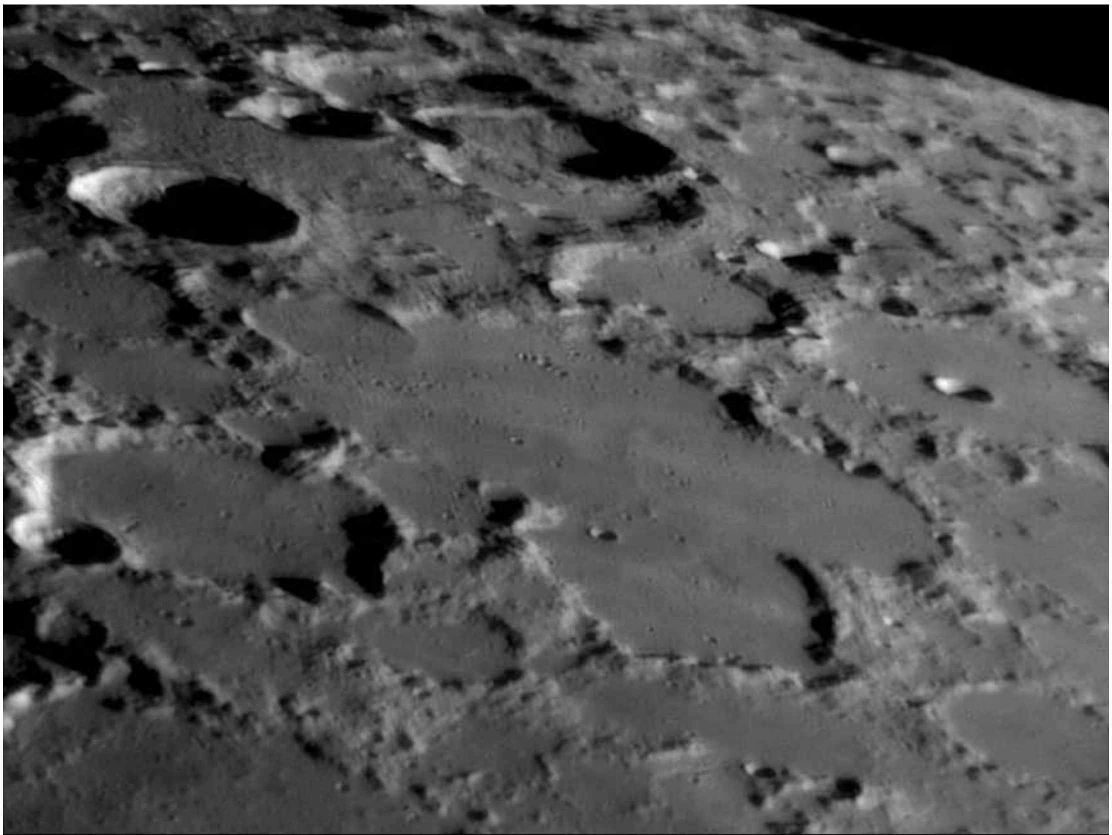
Rik Hill has submitted an image from last year of the Sinus Medii region.

Rik writes the following:

'This is a familiar area to the lunar aficionado. The large flat plain in the middle of this image is Sinus Medii with the 27km diameter Triesnecker in the middle of that. To the right is the intricate system of Rimae Triesnecker. Above is another crack in the moon the Hyginus crater cleft as we called it in the old days, now Rima Hyginus with the crater Hyginus (10km) in the center. Below and right are two craters Agrippa (48km) above and Godin (36km) below. At bottom you can see most of the flat floored crater Rhaeticus (51km).

To the left of Triesnecker Chladni (14km) and beyond it the larger Murchison (60km) and further Pallas (51km). Above these you can see Ukert (24km) with its tiny central peak. In the southern part of Sinus Medii are two similar sized craters, Blagg (5km) to the right and Bruce (7km) on the left. These two lead to several interesting places on the lunar surface. Shown here with the "+" is the point where the latitude and longitude are both zero, **right smack dab in the middle**. This was also the target area for three Surveyor spacecraft. The first, Surveyor 2 had an engine misfire that sent it off towards Copernicus where it crashed on Sept. 23, 1966. The second was Surveyor 4 that arrived in July, 1967 but ceased sending radio signals when it was landing and was not heard from again. The third time is a charm, at least in this case when Surveyor 6 landed just to the east of Surveyor 4 and sent back data successfully in Nov. 1967. The sites of Surveyor 4 and 6 are shown by the appropriate numbers on the image.'

Dave Finnigan captured the much-degraded crater Meton under a favourable libration on the evening of 13 February 2019



Meton 2019.02.13 20:50 UT, S Col. 19.4°, seeing 5/10, transparency fair.
Libration: latitude +5°43', longitude -8°16'.
305mm Meade LX200 ACF, f 25, ZWO ASI 120MMS camera, Baader IR pass filter: 685nm.
640 frames processed in Registax 6 and Paintshop Pro 8.
Dave Finnigan, Halesowen

LUNAR DOMES (part XXVII): A dome in Grimaldi Raffaello Lena

In this issue I examine a lunar dome in Grimaldi, located at latitude 4.5°S and longitude 68.7° W.

Grimaldi is a small impact basin of Pre-Nectarian age [1]. The main ring has a diameter of 440km and an average depth of 3.2km. The inner ring has a diameter of about 140km [1]. Orbiting spacecraft have also detected a mascon (mass concentration) below Grimaldi [2]. Lunar mascons are regions of positive gravity anomalies over topographic basins. Mascons are found at many of the near-side, circular mare basins, including Crisium, Humorum, Imbrium, Nectaris, Orientale, and Serenitatis [2].

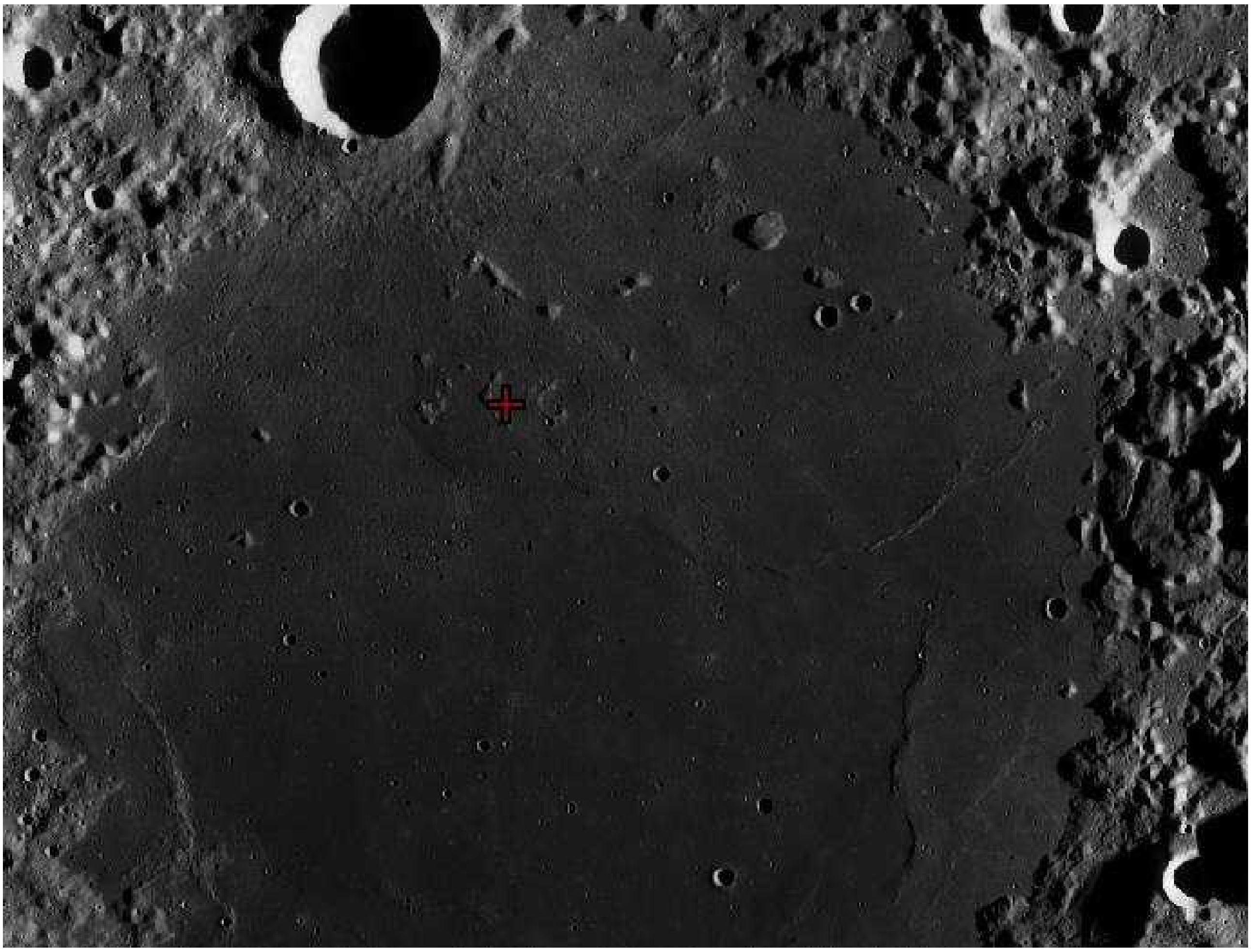


Figure 1. Grimaldi and its large dome, termed Grimaldi 1 (Gr1). WAC imagery from ACT-React Quickmap.

The inner wall of Grimaldi has been eroded by subsequent impacts that it forms a low, irregular ring of hills, ridges and peaks, rather than a typical crater rim. The floor of the basin, relatively smooth, has a low albedo. A large and flat dome of 30x22km is located to the north centre of the basin. Some non volcanic hills protrude above the dome and a small flat-floored depression occur off-center (Fig. 1).

The dome under examination imaged displays a flat shape (see Fig. 2 below).

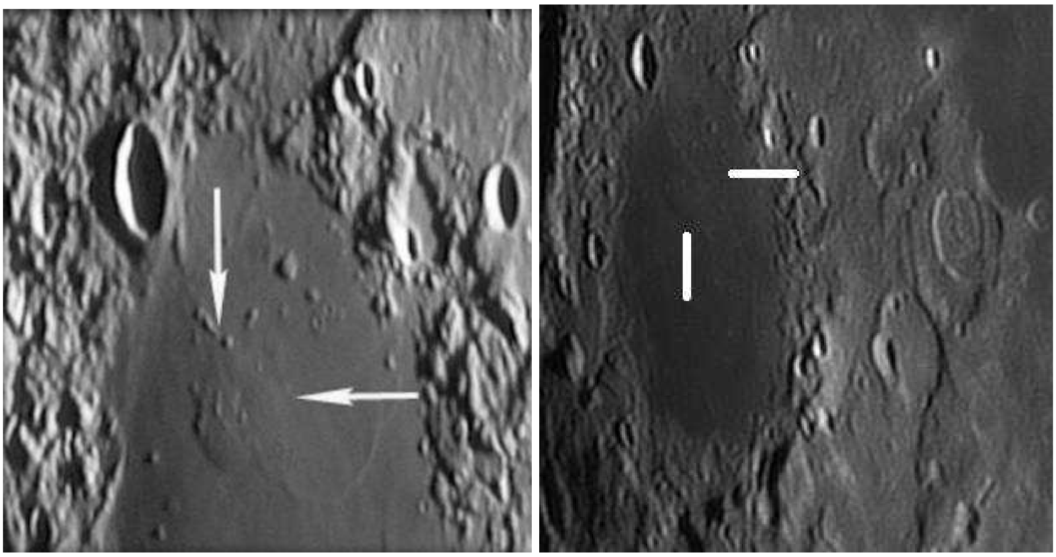


Figure 2. Grimaldi dome. (left) K.C. Pau November 11, 2008, at 13:23 UT; (right) Martin Stenke January 19, 2019 at 21:06 UT.

The adopted criteria for identification of possible intrusive domes is non-circular outline that can be described by a major axis **a** and a minor axis **b**; thus the dome diameter may be defined as the geometric mean:

$D = \sqrt{\mathbf{a\,b}}$ and its circularity as c = **b/a.**

The effusive domes always have circularity values higher than 0.9, having flank slopes below 0.9° and displaying effusive vents. On the other hand, I have identified domes, of possible intrusive origin, having circularity values well below 0.8 and flank slopes <0.9°.

The height of the Grimaldi dome is determined to 160 ± 20m, resulting in an average slope of 0.6° ± 0.10°. The dome volume V is estimated by assuming a form factor of f = 1/2, which yields an edifice volume of 41.2km³.

I have recently used a nearly global lunar DEM, the so-called GLD100 [3], comparing the results to old previous measurements based on CCD telescopic images [4].

This DEM has been constructed based on photogrammetric analysis of the LROC WAC image pairs. The ACT-REACT QuickMap tool is thus used to access the GLD100 dataset, allowing us to obtain the cross-sectional profiles (Fig. 3). The 3D reconstruction (Fig. 4) is obtained using WAC mosaic draped on top of the global WAC-derived elevation model (GLD100).

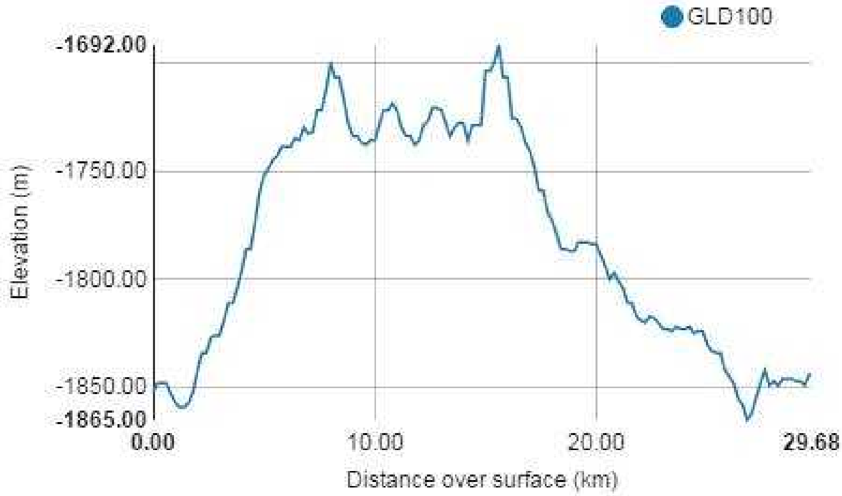


Figure 3. Sectional profile in E-W direction of the Grimaldi dome.

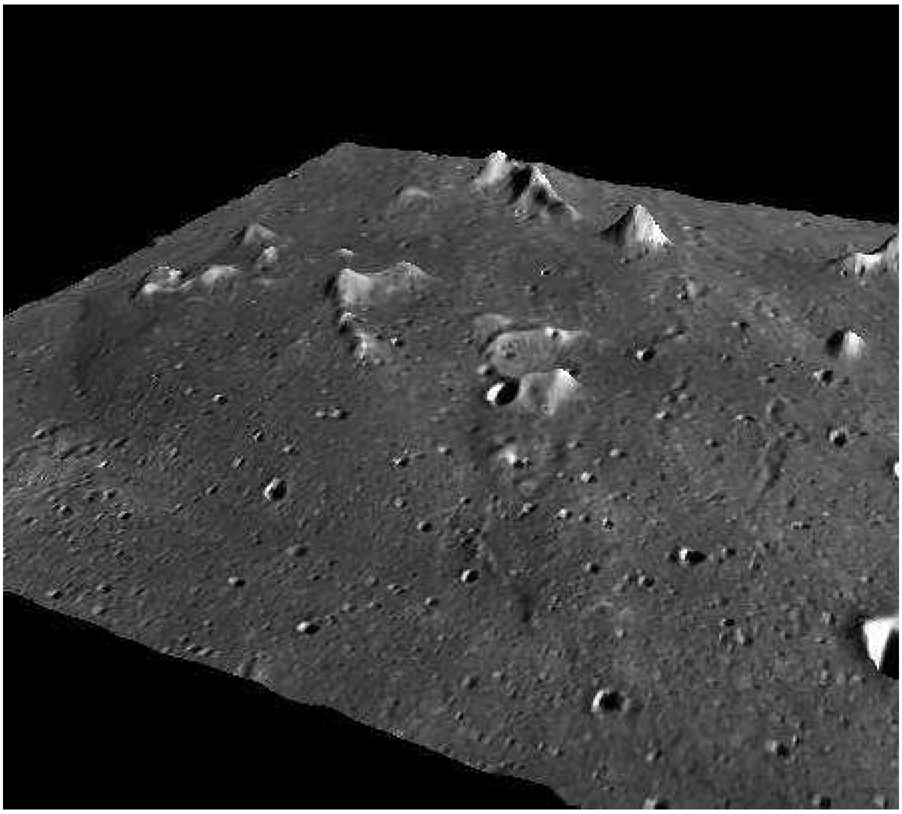


Figure 4. 3D reconstruction obtained with GLD 100 dataset. Grimaldi dome.

As visible in Fig. 1 some prominences, presumably non-volcanic hills, are situated on the summit of Grimaldi 1. The orbital image shows that the examined large dome displays linear structures on its surface that can be interpreted as the result of tensional stress (Fig. 5).

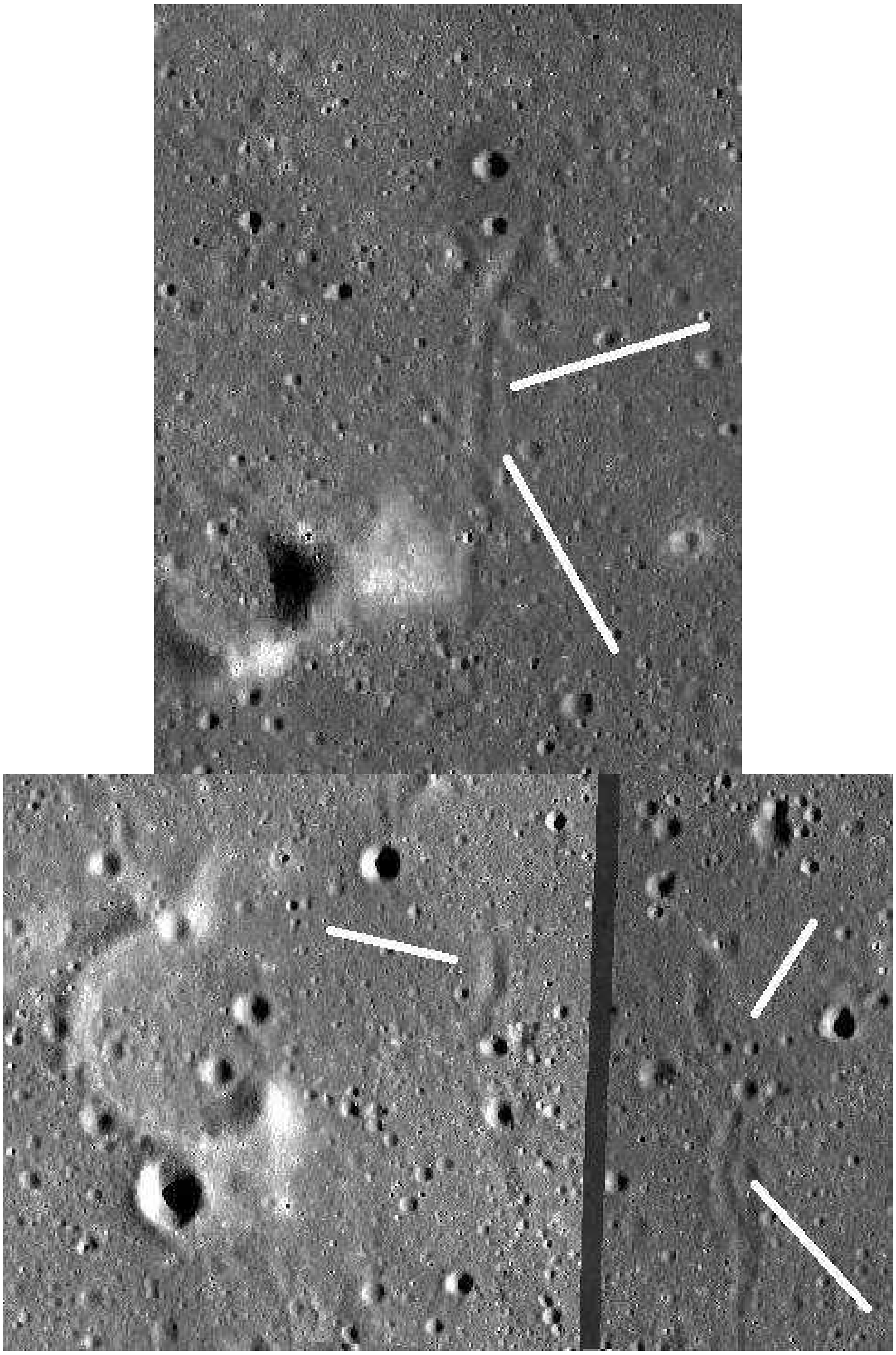


Figure 5. Sections of NAC image showing some short rilles on the surface of Gr1.

Grimaldi 1 is interpreted to be an intrusive structure due to the presence of short straight rille traversing the surface, suggesting tensional stress. It belongs to class In1 of possible lunar intrusive domes. We suggest that during the formation of the large intrusive domes of class In1 fracturing and faulting of the crust occurred, weakening the strength of the crust and thus facilitating the uplift of large volumes of crustal material visible as a large intrusive dome.

Intrusive domes of class In1 are characterised by uppermost basaltic layer thicknesses of 0.3-0.6 km and more, intrusion depths of 2.3-3.5km and magma pressures of 18-29MPa. For the smaller and steeper domes of class In2, the uppermost basaltic layer has a thickness of typically only 0.1-0.2 km, the magma intruded to shallow depths between 0.4 and 1.0km while the inferred magma pressures range from 3 to 8MPa. Class In3 domes are similar to those of class In1 with similar thicknesses of the uppermost basaltic layer ranging from 0.4 to 1.2km, intrusion depths of 1.8-2.7 km, and magma pressures of 15-23MPa.

We have inferred for the Grimaldi dome a thickness of the uppermost basaltic layer of 600m, an intrusion depth of 2400m, and a maximum magma pressure of 19MPa. It is an interesting object for lunar observers to improve their knowledge of volcanic domes.

References

[1] Wilhelms, D., 1987. The geologic history of the Moon. USGS Prof. Paper 1348.
[2] Kiefer, W. S., 1999. 'Lunar gravity models: large, near side impact basins'. *Lunar and Planetary Science* XXVIII.
[3] Scholten, F., Oberst, J., Matz, K.-D., Roatsch, T., Wählisch, M., Speyerer, E.J., Robinson, M.S., 2012. 'GLD100: the near-global lunar 100 m raster DTM from LROC WAC stereo image data'. *J. Geophys. Res.* 117(E00H17). Doi: 10.1029/2011JE003926.
[4] Lena, R., Wöhler, C., Phillips, J., Chiocchetta, M.T., 2013. *Lunar domes: Properties and Formation Processes*, Springer Praxis Books.

LETTERS

From Tim Haymes:

Dear Editor,

Trevor Smith describes conditions that deteriorate after observing commences (see February 2019 LSC). I have noticed a similar effect while imaging with video. My thought was that my presence in the dome was the cause of the increased turbulence as warmer air exited the slit, but I did not investigate any further. The observatory was a 3m with an observing slit of 75cm. The telescope was a 30cm F/4 Newtonian with Barlow.

Tim Haymes

OCCULTATION NEWS   March 2019   Tim Haymes

Observations

Mr T. Haymes has sent 21 observationS in the last half of 2018 to the European coordinator. Mr A. Pratt has submitted observations from the last quarter of 2018.

In retrospect

In the 1996 July/August LSC (V 32 No7/8) Alan Wells writes in the Subsection News 'What a useful item a GPS system would be on a graze track!' Dr. Eberhard Riedel (IOTA-ES) has included this tool in his graze prediction suite GRAZEPREP4 to enable an observer to reach the optimum coordinates. Good idea Alan! (Hope you are reading this.)

[The LSC can be selected from the downloads area with thanks to LS team]

Occultations last month

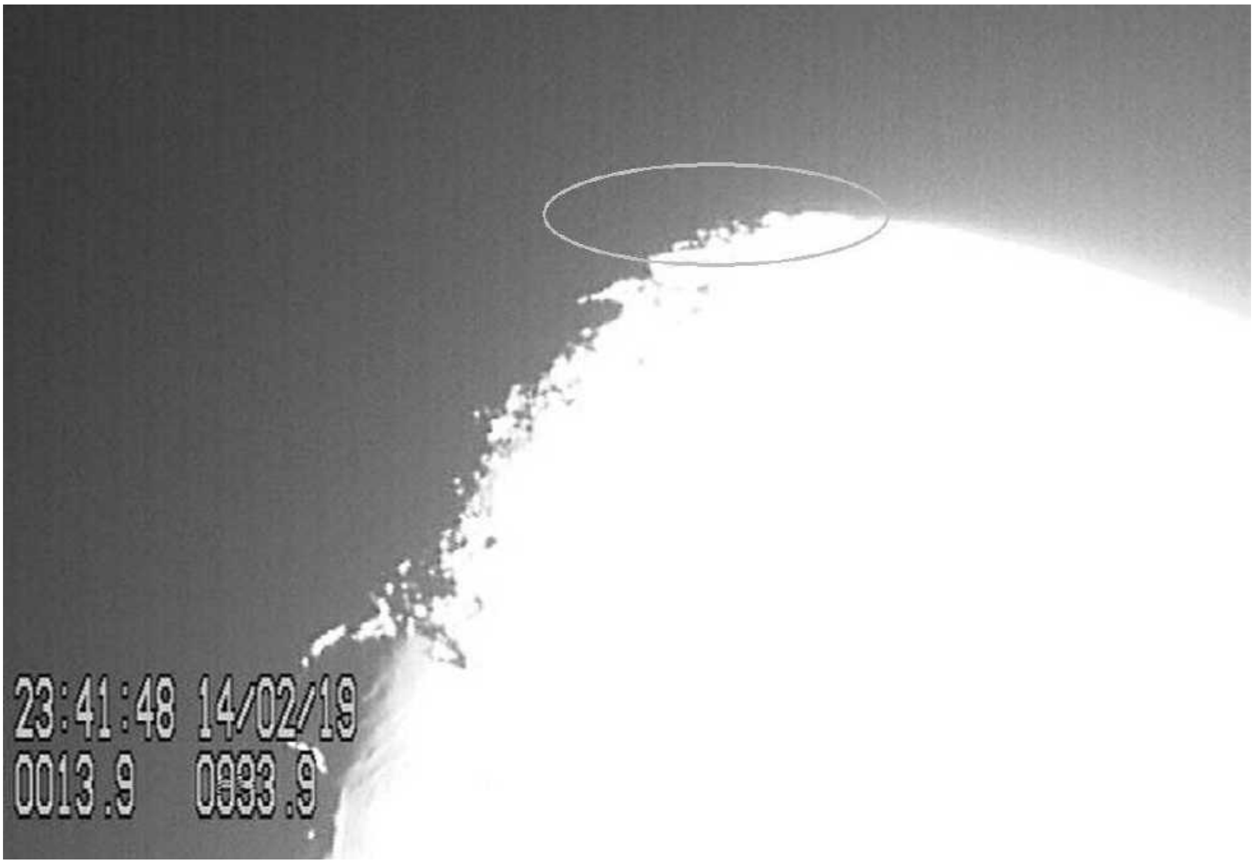
The Moon passed through the northern part of the Hyades cluster on Feb 13/14th and a number of disappearance events were predicted. Flamsteed 63 Tau (mag 5.6, HIP 20484) grazed between Bude and Exmouth, Devon on the 13th at about 2325UT although I doubt if anyone has observed this.

The star that was very shy – a strange non-event? (request for any other reports).

Interestingly, when I did the Occult4 predictions for my site on the evening of the Feb.14th, I discovered that ZC798 (mag 6.2, HIP 24977) was close to grazing incidence at the Northern limb near cusp angle +1.5. The actual graze path was on the bright limb running across the midlands and North of London some distance from me. The graze wasn't included in the 2019 BAAH because of the difficult circumstances.

Being curious, I set up my 8" F4 with 2x Barlow to record the occultation by video. This was predicted for 2345hr 32sec. The star was quite clear on the monitor screen at 2338UT, but when I came back to the instrument at 2341 the star had 'gone'. This was perplexing given the prediction is good to +/- 1 sec. Maybe some high cloud or optical dewing had masked the star. I recorded anyway, starting well before the predicted time.

Analysis of the recording showed no evidence of the 6.2 mag star on playback. I was expecting some intermittent visibility of the star – but nothing was seen on the monitor. So the fate of the star is a bit of mystery.



Caption1: Video frame of the cusp where HIP24977 was expected. The terminator formation lower left is the Sun rising over Sinus Iridum.

The instrument was a Meade SN8 on EQ6pro, with 2x Barlow (Magni-max) attached to the video camera nose piece (1.25”). The camera a WATEC 910HX/RC (setting 1/50th sec, gain 9 dB) and the output was passed through a BlackboxCamera GPSBOXSPRITE2 video time inserter, and then recorded on digital tape. The tape unit is a Sony TRV33E camcorder set up for external video input. The tape-recording can be transferred to a laptop for analysis. The alternative is to record onto a laptop directly using a USB video digitiser and software like Virtual Dub.

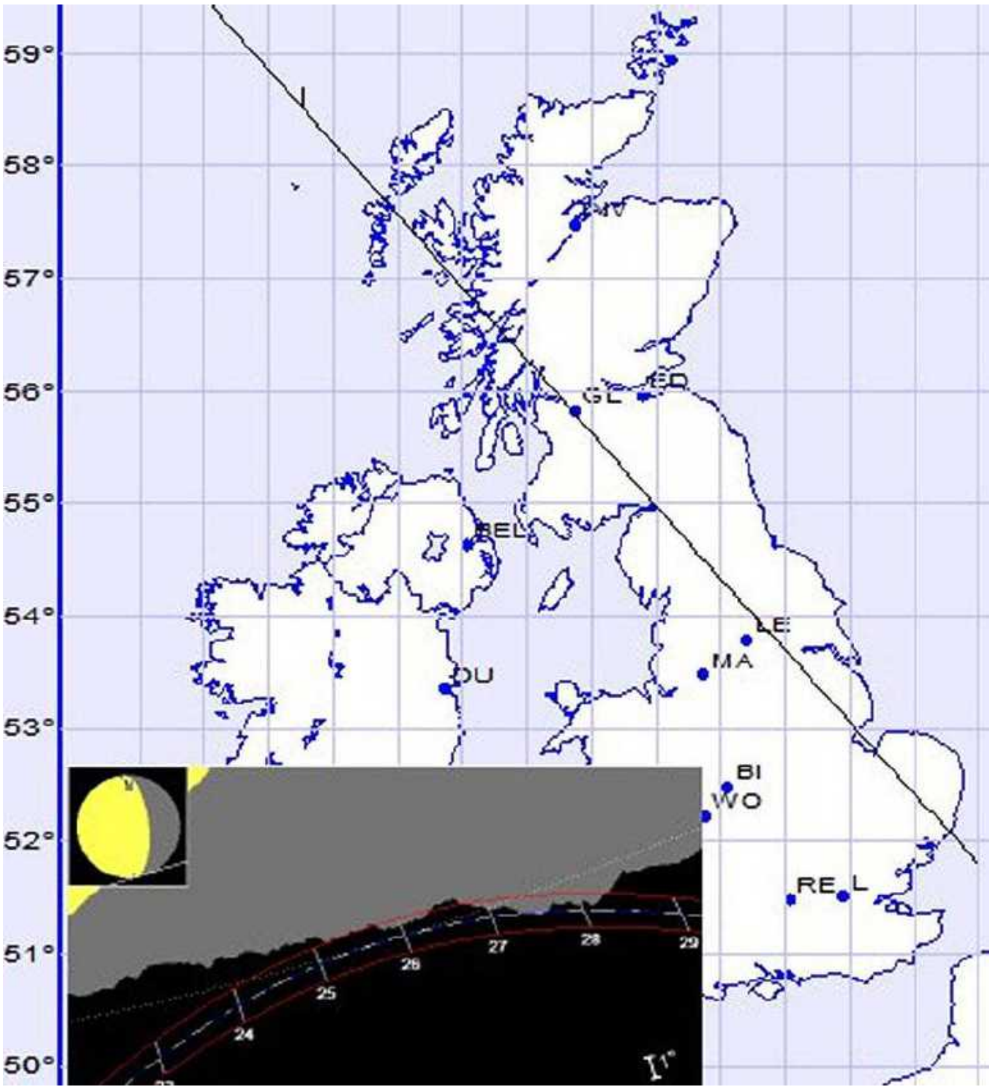
Occultations listed for 12 months

The coordinator will be pleased provide predictions to individual observers. Please send me your location to 1” arc and I will provide a file of prediction down to 9th magnitude.

I urge occultation observers to request a listing if you do not compute your own. It will include some events that don’t pass into the more general listings.

Graze Occultations in March.

SAO 160052 on March 26 at 0324 UT, v5.5. CA 10S, altitude 13 degrees. (Details from the coordinator via email). The star is in Ophiuchus.



Caption2: Southern limit graze of SAO 160052 (HIP 81754, WDS KUI73) from GRAZEPREP 4.14 software [E. Riedel (IOTA-ES)*]*

2019 March predictions for Manchester (Occult 4.6.1.0 by D Herald).
W. Longitude 002d 15', Latitude +53 25', Alt. 50m;

y	m	day d	Time h	m	s	P		Star No	Sp	Mag v	Mag r	% ill	Elon	Sun Alt	Moon Alt	Az	CA o	Notes
19	Mar	9	19	16	35.2	D		227	F0	8.3*	8.1	9+	35		15	256	87N	
19	Mar	10	20	42	37.0	D		110502	F0	7.6*	7.4	16+	47		12	268	54N	
19	Mar	12	23	13	57.6	D		609	B9	7.6	7.6	34+	71		11	283	14N	
19	Mar	13	20	46	23.1	D	X	6365	G5	8.7	8.4	43+	82		41	244	50N	
19	Mar	14	18	46	46.4	D		77654	B9	8.2*	8.2	54+	94	-6	57	185	72N	
19	Mar	14	19	8	18.5	D		77665	K0	8.8*	8.3	54+	94	-9	57	195	53N	
19	Mar	14	19	10	28.2	D		77667	B9	7.7*	7.7	54+	94	-10	57	195	58N	
19	Mar	14	19	18	2.7	D	X	79277		8.7*	7.9	54+	95	-11	56	198	40S	
19	Mar	14	20	34	54.1	D		77718	F2	8.4	8.2	54+	95		50	226	32S	
19	Mar	14	20	45	6.1	D		77726	K5	7.7	6.7	54+	95		49	229	37S	
19	Mar	14	20	56	2.0	D		77743	A0	8.9	8.9	55+	95		48	233	71S	
19	Mar	14	22	5	51.8	D		77796	G0	8.8	8.6	55+	96		39	251	81N	
19	Mar	14	22	11	18.1	D		903	G5	8.2	7.7	55+	96		38	252	84S	
19	Mar	15	0	7	55.9	D		77889	G5	6.9	6.4	56+	97		22	276	66S	
19	Mar	15	19	43	19.4	D		1051	K1	6.6		65+	108		58	185	73S	Dbl* dT = +0.45s
19	Mar	15	21	24	12.7	D		78896	B8	7.4	7.5	66+	108		51	224	21S	
19	Mar	15	21	36	51.7	D		78919	K2	8.3	7.7	66+	108		50	228	78N	

19	Mar	15	21	41	37.0	D	78920	A0	8.8	8.8	66+	109	50	229	71S	
19	Mar	15	22	7	30.9	D	78936	A5	8.4	8.3	66+	109	47	237	67S	
19	Mar	15	22	27	8.0	D	78953	A2	8.5	8.4	66+	109	44	242	61S	Dbl* dT = -0.2s
19	Mar	16	0	3	17.8	D	79005	G5	7.7	7.2	67+	110	31	264	68N	
19	Mar	16	0	3	40.3	D	78993	A2	7.8	7.8	67+	110	31	264	13S	
19	Mar	16	1	6	9.2	D	79047	B9	7.8		67+	110	22	276	89S	
19	Mar	16	21	8	3.0	D	79830	A0	8.6	8.5	76+	122	57	195	27N	
19	Mar	16	23	34	34.7	D	79899	G5	7.0	6.5	77+	123	43	243	35N	
19	Mar	16	23	44	4.0	D	79912	F5	8.6*	8.5	77+	123	41	246	85N	Dbl* dT = -0.18
19	Mar	17	0	16	47.0	D	97528	F0	8.3*	8.1	77+	123	36	253	22S	
19	Mar	17	1	14	37.9	D	1223	F8	7.7*	7.4	78+	124	28	265	72S	
19	Mar	17	19	41	33.0	D	1340	A0	6.6	6.6	85+	135	49	139	57N	
19	Mar	17	20	7	36.6	D	1343	M4	6.3	5.5	85+	135	51	148	84N	
19	Mar	17	20	10	40.5	D	98274	G5	8.8	8.3	85+	135	52	149	81S	
19	Mar	18	0	2	16.1	D	1353	A2	8.1	8.0	86+	137	44	233	26S	71 Cnc
19	Mar	18	1	7	49.2	D	1362	K3	7.2	6.6	87+	137	36	249	76N	78 Cnc
19	Mar	18	1	17	25.2	D	98388	F5	8.4	8.2	87+	137	34	251	54S	
19	Mar	18	21	19	16.2	D	98914	A1	8.0	7.9	93+	150	49	154	40N	
19	Mar	18	21	20	38.8	D	98917	A3	8.5	8.3	93+	150	49	155	85N	
19	Mar	19	2	9	11.1	D	1493	F7	6.5		94+	152	32	247	78S	34 Leo Dbl*
19	Mar	19	20	5	22.4	D	1596	A2	7.2*	7.1	98+	163	32	119	77N	
19	Mar	20	0	43	8.9	D	1613	F5	8.1	7.9	98+	165	43	206	67N	
19	Mar	20	4	3	52.1	D	1625	K3	5.8	5.2	99+	167	20	256	62S	Dbl* dT = 0.1s
19	Mar	23	4	2	24	M	2008	K0	6.6*	6.0	94-	151	24	211	13S	Dbl*
19	Mar	24	1	44	25.6	R	158835	F2	7.1	6.9	88-	139	23	161	38N	
19	Mar	24	3	20	19.1	R	158874	F2	7.7*	7.5	87-	138	24	186	61N	
19	Mar	24	3	31	12.4	R	2123	F5	8.0*	7.7	87-	138	24	189	67S	
19	Mar	25	0	50	13.8	R	159453	F7	6.9		80-	126	11	138	65N	
19	Mar	26	3	24	38	M	2401	F3	5.6	5.3	70-	113	15	162	11S	

Predictions made up to April 5th

Notes on the Double Star selection.

Doubles are selected from Occult 4, where the magnitudes of the pair are not more than 2 magnitudes different, the fainter companion is brighter than mag 9, and the time difference(dT) is between 0.1 and 5 seconds. Please report double star phenomena.

Key:

P = Phase (R or D), R = reappearance D = disappearance
M = Miss at this station, Gr = graze nearby (possible miss)
CA = Cusp angle measured from the North or South Cusp. Negative CA = bright limb
Dbl* = This is a double star worth monitoring.
Mag(v)* = asterisk indicates a light curve is available in Occult-4

Star No:

2/3/4 digits = Zodiacal catalogue (ZC) but referred to as the Robertson catalogue (R)
5/6 digits = Smithsonian Astrophysical Observatory catalogue (SAO)
X denotes a star in the eXtended ZC catalogue

Detailed predictions at your location for 1 year are available upon request.
Occultation Subsection Coordinator: Tim Haymes occultations@stargazer.me.uk

LUNAR GEOLOGICAL CHANGE DETECTION PROGRAMME - 2019 Mar

Tony Cook

Reports have been received from the following observers for January: Jay Albert (Lake Worth, FL, USA - ALPO) observed: Alphonsus, Aristarchus, Arzachel, Atlas, Eimmart, Gassendi, Herodotus, the lunar eclipse, Manilius, Picard and Tycho. Alberto Anunziato (Argentina – SLA/LIADA) observed Aristarchus, Atlas, Byrgius, Grimaldi, Kepler, and Tycho during the lunar eclipse. Simon Bell (Mid Wales, UK - NAS/Slooh) imaged several features. Juan Manuel Biagi (Argentina – SLA/LIADA) imaged the lunar eclipse. Jairo Andres Chavez (Columbia – LIADA) imaged: Aristarchus, Babbage, Billy, Copernicus, Longomontanus, the lunar eclipse, Philolaus, Plato and several features. Maurice Collins (New Zealand – ALPO/BAA/RASNZ) imaged earthshine and several features). Anthony Cook (Newtown, UK – ALPO/BAA) imaged several features and videoed the lunar eclipse. Marie Cook (Mundesley, UK – BAA) observed Alphonsus, Aristarchus, Censorinus, Grimaldi and Plato). Valerio Fontani (Italy – UAI) imaged Maurolycus. Les Fry (UK - NAS) imaged earthshine and the lunar eclipse. Brandon Lane (Welshpool, UK – NAS) imaged the lunar eclipse and watched it visually. Dr Heather McCreadie (Aberystwyth University) watched the lunar eclipse visually with and without binoculars. Paolo Moramarco (Italy – UAI) imaged the Full Moon just prior to the lunar eclipse. Franco Taccogna (Italy – UAI) imaged the lunar eclipse, the lunar north pole, Mare Humorum, and Torricelli B, Aldo Tonon (Italy-UAI) imaged the lunar eclipse. Gary Varney (Pembroke Pines, FL, USA – ALPO) imaged: Alphonsus, Lamont, the lunar eclipse and several features. Luigi Zanatta (Italy – UAI) imaged the lunar eclipse.

TLP reports: No TLP were observed in January - other than the 21/1/2019 impact flash during the lunar eclipse.

Routine Reports: Below are a selection of reports received for January that can help us to re-assess unusual past lunar observations – if not eliminate some, then at least establish the normal appearance of the surface features in question. Due to pressure of work I won't have time to analyze these – but will go through them next month in summary form.

Earthshine: On 2019 Jan 09 UT 18:19 Les Fry (NAS) imaged earthshine, and although not during a repeat illumination, or lunar schedule prediction, it does exhibit a nice sunlit peak dethatched from the southern crescent in Fig 1.This effect has tricked some observes in the past into thinking they had seen a TLP here.

Figure 1. *The crescent Moon with earthshine taken by Les Fry (NAS) on 2019 Jan 09 UT 18:19 and orientated with north towards the top.*

Maurolycus: On 2019 Jan 12 UT 19:39-19:51 Valerio Fontani (UAI) and UT 19:41-22:02 Leonardo Mazzei (Gruppo Astrofili Montagno Pistoiese – UAI) imaged this crater (See Fig. 2) for a request by the Lunar Schedule web site:

ALPO Request: On 2012 Feb 28 Raffaello Braga noted that only the tip of the central peak was visible. Most of the crater was in darkness - this was normal at this stage in illumination. When viewed through a red filter, the central peak was visible, but however when viewed through a blue filter it was invisible. Please try to observe this crater visually with red and blue filters, to see if you can replicate this effect? If so, then check for similar effects on other craters on the terminator. Otherwise try to obtain some high-resolution colour images. This work is suitable for telescopes of 4" aperture or larger - if you have a choice of a refractor or a reflector, please try the refractor. Please send any observations you make to: a t c @ a b e r . a c . u k

Figure 2. *Maurolycus orientated with north towards the top.* ***(Left)*** *An image by Valerio Fontani (UAI) taken at 19:47 UT, taken with a reflector.* ***(Right)*** *An image by Leonardo Mazzei (Gruppo Astrofili Montagno Pistoiese – UAI) taken with a refractor at 19:52UT.*

Plato: On 2019 Jan 15 UT 23:55 Jairo Andres Chavez (LIADA) imaged (Fig. 3) the crater under similar illumination (to within ±0.5°) to the following report:

Plato 1937 Dec 12 UT 16:45-21:00 Observed by Barker (Chestnut, England, 12.5" reflector x420) and Fox (Newark, England, 6.5" reflector, 24?x) "Strong streak of orange-brown on E. wall. Floor *nearly clear of shad. composed of many veins & thin streaks interwoven. At 21h irreg. extension seen spreading eastward down wall. Confirmed by Barker's younger son. NASA catalog weight=5. ALPO/BAA weight=4. NASA catalog ID #428.*

Figure 3. *Plato as imaged by Jairo Andres Chavez (LIADA) on 2019 Jan 15 UT 23:55 and orientated with north towards the top.*

Torricelli B: On 2019 Jan 17 Franco Taccogna (UAI) imaged this area (See Fig. 4) under similar illumination & topocentric libration (to within ±1°) to the following report:

Torricelli B 1995 Apr 11 UT 20:15 Observed by North (UK). "Colour moonblink reaction, and crater dull". BAA Lunar Section report. ALP\BAA weight=3.

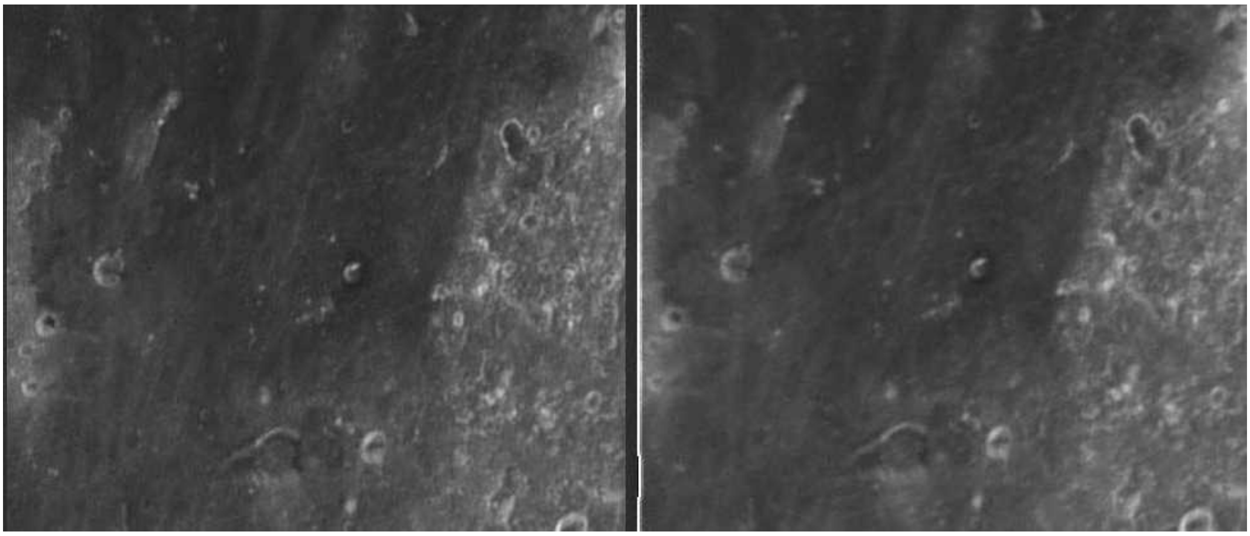


Figure 4*. Torricelli B - the small crater close the image centre, as captured by Franco Taccogna (UAI) on 2019 Jan 19 UT17:49, with north towards the top.* ***(Left)*** *A red image.* ***(Right)*** *A blue image.*

I contacted Gerald North over this report and he provided me with a little more detail over what he saw – though he did not regard it as a TLP at the time due to the seeing conditions:

- *19h 16m - 19h 23m UT, X104: "Torricelli B strikes me as unusually prominent, though I am unfamiliar with the view at this power (first night of trying a 25 mm Kellner eyepiece)."*
- *19h 23m - 19h 28m: UT "Examine Torricelli B at X144 and X207. Decide that it looks fairly normal, after all. However, the boiling and blurry image makes a proper assessment difficult. The image is generally very fuzzy at X207".*
- *A couple of raster-scans then made, first in integrated light, then in green light - both normal for the entirety of the sunlit Moon.*
- *20h 00m - 20h 10m UT. Raster-scan, X144. Deep red filter.: "All seems normal, - except perhaps Torricelli B which is practically invisible in the red filter!".*
- *Further raster scans in integrated light. All seems normal, as far as could be ascertained in the very poor seeing.*

I believe that I was probably videoing the Moon at the time in 1995 - so between now and next month will look this up, feed it through Registax and see what I can come up with in comparison to Franco's image.

Herodotus: On 2019 Jan 18 UT 02:30-03:15 Jay Albert (ALPO) observed and imaged (See Fig 5) this crater under similar illumination (to within ±0.5°) to the following 2 reports:

On 2003 May 13 at UT06:40-07:26 W. Haas (Las Cruces, NM, USA, 12.5" reflector, x321 and x202, S=2, T=3.5) suspected (06:40-06:55UT) that he saw an oval bright feature (intensity 5.5) near the centre of the floor of Herodotus crater indenting into the shadow - however the seeing was none too good, so it is more of a suspicion than a definite sighting. At 07:14-07:26UT he re-examined the region (x202 and x321, S=1-2 and T=3.5) and had better glimpses that conformed his initial suspicions of there being an oval indentation bright spot (now intensity 6) into the shadow in the centre of the floor. Of course, Herodotus does not have a central peak! There was also a very bright spot on the NW> sunlit rim of Herodotus crater. The ALPO/BAA weight=2.

On 2017 Sep 02/03 UT 23:55-00:30 A. Anunziato (Parana, Argentina, 105 mm Maksutov-Cassegrain, x154, seeing 6/10, some interruption from clouds) observed a light spot SE of the centre of the floor of the crater, which came and went in visibility. There is a light spot here, but what was unusual was that the visibility decreased over time. ALPO/BAA weight=1.

Figure 5. *Aristarchus and Herodotus, taken by Jay Albert (ALPO) on 2019 Jan 18 UT 03:01 and orientated with north towards the top.*

Jay commented that: *'More than half the crater floor was in shadow with one prominent dome-shaped shadow just S of center stretched all the way to the base of the interior W wall, which was well lit. I saw no bright oval protruding into the shadow on the central part of the floor. I did, however, easily see the bright spot on the NW crater wall as per the TLP description. This spot was clearly seen to be a craterlet on the NW rim and is labeled "N" on Rukl chart 18. I observed visually from 02:30 to 02:50 at 290x. I then noticed that my optical tube was dewing up (fortunately, not my corrector plate) and more thin clouds were approaching, so I quickly attempted a few quick cellphone photos before shutting down.'*

Archimedes: On 2019 Jan 19 UT 00:11 Gary Varney (ALPO) imaged (Fig. 6) the whole Moon, but this covered the following region to within ±0.5°:

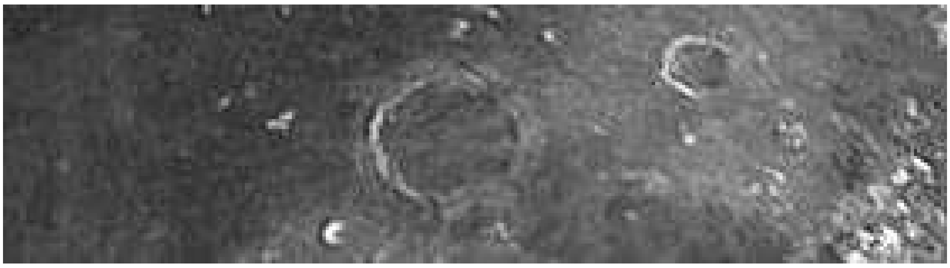


Figure 6. *Archimedes from a larger image taken by Gary Varney (ALPO) on 2019 Jan 19 UT 00:11 and orientated with north towards the top.*

On 1988 Sep 23 at 19:40-19:55 & 20:36-20:41 G. North (760mm Coude Refractor, x250, Royal Greenwich Observatory, Herstmonceux, UK, seeing V, Transparency: Fair). 19:40-19:55 image very unsteady. All seems normal in other craters with the exception of Archimedes. Much of the rim seems indistinct apart from a 1/4 length of the west rim. Strongly suspected that this was due to a combination of seeing and illumination. UT 20:02-20:06 - checked the area with a lower magnification 10" Astrographic Refractor - the crater seems more normal, so suggesting that the theory was correct. 20:36-20:41 returned to the 30" reflector, and the crater appeared similar to the start of the session. This is almost certainly not a TLP, but it would be helpful to have some images or sketches to check this theory out. Weight=1.

Unknown: On 2019 Jan 19 UT 05:49 Simon Bell (Mid Wales, UK – NAS/Slooh) imaged (See Fig. 7) a large area of the Moon remotely using the Slooh Chile 1 robotic scope to with ±0.5°in terms of illumination to the following report:

On 1960 Sep 04 at UT00:00? Miranova (Russia or Israel) observed a TLP at an unnamed lunar feature: "Spectral photom. of some lunar obj. in 4250, > 5000A bands. Spectral plates". Cameron suspects luminescence? The Cameron 1978 catalog ID=730 and weight=5. The ALPO/BAA weight=1.

***Figure** 7 Image of the Moon captured by Simon Bell (NAS) via the Slooh Chile 1 scope, taken on 2019 Jan 19 UT 05:49 and orientated with north towards the top.*

Censorinus: On 2019 Jan 20 UT 20:10-20:15 Marie Cook (BAA) observed this crater under similar illumination (to within ±0.5°) of the following report:

On 1982 Jan 09 at UT 18:46-21:42 P. Moore (Selsey, UK) and other observers noted Censorinus was exceptionally bright. Cameron 2006 catalog ID=162 and weight=5. ALPO/BAA weight=2.

Marie, observing under Antoniadi III seeing conditions, found the crater to be what she regarded as normal in brightness.

Grimaldi: On 2019 Jan 20 UT 22:54 Paolo Moramarco (UAI) imaged (See Fig. 8) the whole Moon that matched to within ±0.5° to this binocular report from a penumbral eclipse from 1976:

On 1976 Nov 06 at UT 18:26 M. Herbert (10x50 binoculars, Western Super Mare, UK) noticed a thin line that appeared to be dark red (almost black) around the Gassendi area. This is BAA Lunar Section report. The ALPO/BAA weight=1.

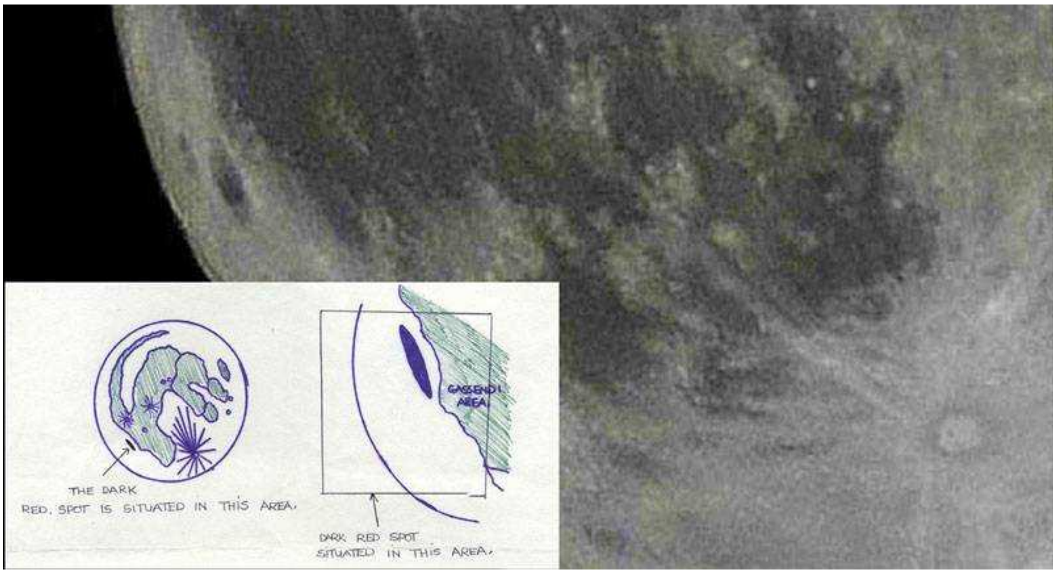


Figure 8 *Image by Paolo Moramarco (UAI) on 2019 Jan 20 UT 20:54 with colour saturation increased to 50% and orientated with north towards the top. Inset is the sketches made by Mark Herbert, in a letter sent to Patrick Moore concerning an observation on 1976 Nov 06.*

It is very obvious from Fig. 8 (Inset) that the thin almost black line is simply Grimaldi. Not sure why it would have appeared red – perhaps chromatic aberration in the binoculars or atmospheric spectral dispersion as the Moon was at a low altitude of 16°. There was a penumbral eclipse on that date but it did not start until 20:48UT, so this could not have contributed any colour. There is no natural colour here as seen in Fig. 5. Because the instrument had a small aperture and small magnification, I have decided to take this off the TLP database, as the observer did not even know the name of the crater in their report was Grimaldi. I shall assign a weight of 0.

Tycho: On 2019 Jan 21 Alberto Anunziato (SLA/LIADA) observed the lunar eclipse to within ±0.5° of illumination of the following Tycho reports:

Tycho 1956 Nov 17/18 UTC 23:30-00:30 Observed by Argentiere et al. (France?) "Crater was extra-ordinarily bright". NASA catalog weight=3. NASA catalog ID #658.

On 1919 Nov 27 at UT 23:00-01:00 Fock (Germany) observed in the vicinity of Tycho, during an eclipse (mid eclipse at 23:56UT) a long ray in the direction of Longomontanus that remained visible. It was glowing in weak gray-green colour for the whole of the eclipse. The Cameron 1978 catalog ID=373 and weight=2. The ALPO/BAA weight=1.

At 04:06-04:12 UT Alberto commented that: *'Tycho was in the umbra but you could clearly discern 5 rays. One of them was brighter than the others, the one heading to Longomontanus (marked with an arrow in the sketch in Fig. 9.'*

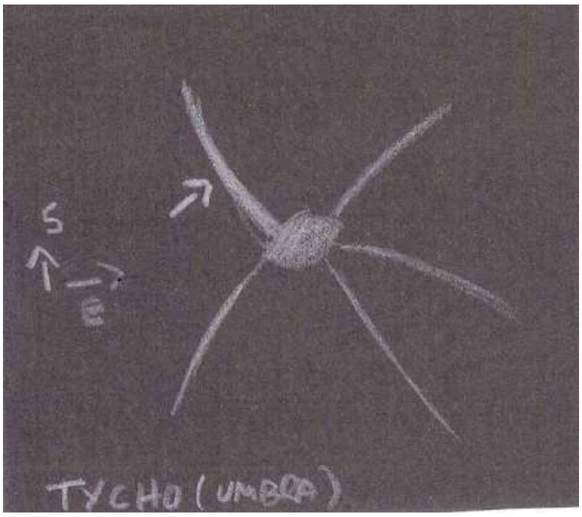


Figure 9 *A sketch of Tycho by Alberto Anuziato (SLA/LIADA) on 2019 Jan 19 UT 04:06-04:12*

Lunar Eclipse: On 2019 Jan 30 UT at approximately 04:30 Brandon Lane (NAS – Welshpool, UK) observed a shooting star near to the Moon (See Fig. 10).

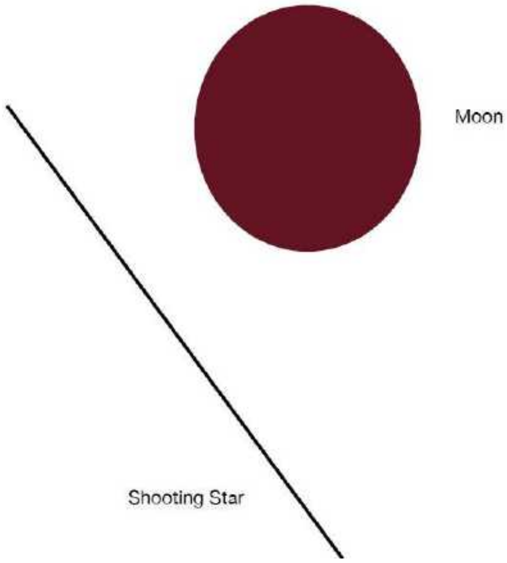


Figure 10. *A naked eye sketch by Brandon Lane (NAS)*

Shooting stars in our atmosphere do occasionally appear close to the line of sight with the Moon – just by chance, though this was not the same one which caused an impact flash as mentioned in the last newsletter as that was at 04:42, but what Brandon saw may have been part of the streak effect seen by Dr Heather McCredie from Aberystwyth, also mentioned last month. There were no predicted showers that night so it must have been a sporadic.

We have received lots of other lunar eclipse images (not of the meteor or the impact flash) and these will be discussed in next month's newsletter – due to time and page constraints this month.

Unknown: On 2019 Jan 30 UT 15:38 Maurice Collins (ALPO/BAA/RASNZ) imaged (See Fig. 11) the Moon in earthshine during a requested observing time on the Lunar Schedule web site:

Figure 11 *Image of earthshine as captured by Maurice Collins on 2019 Jan 30 UT 15:38 and orientated with north towards the top.*

Maurice's image (Fig. 11) is just a reminder that like the evening, the early morning is a good time to look for lunar impact flashes, i.e. before local sunrise

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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 . Only by re-observing and submitting your observations 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 TLP, firstly read the TLP 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 TLP alerts can be accessed on https://twitter.com/lunarnaut .

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