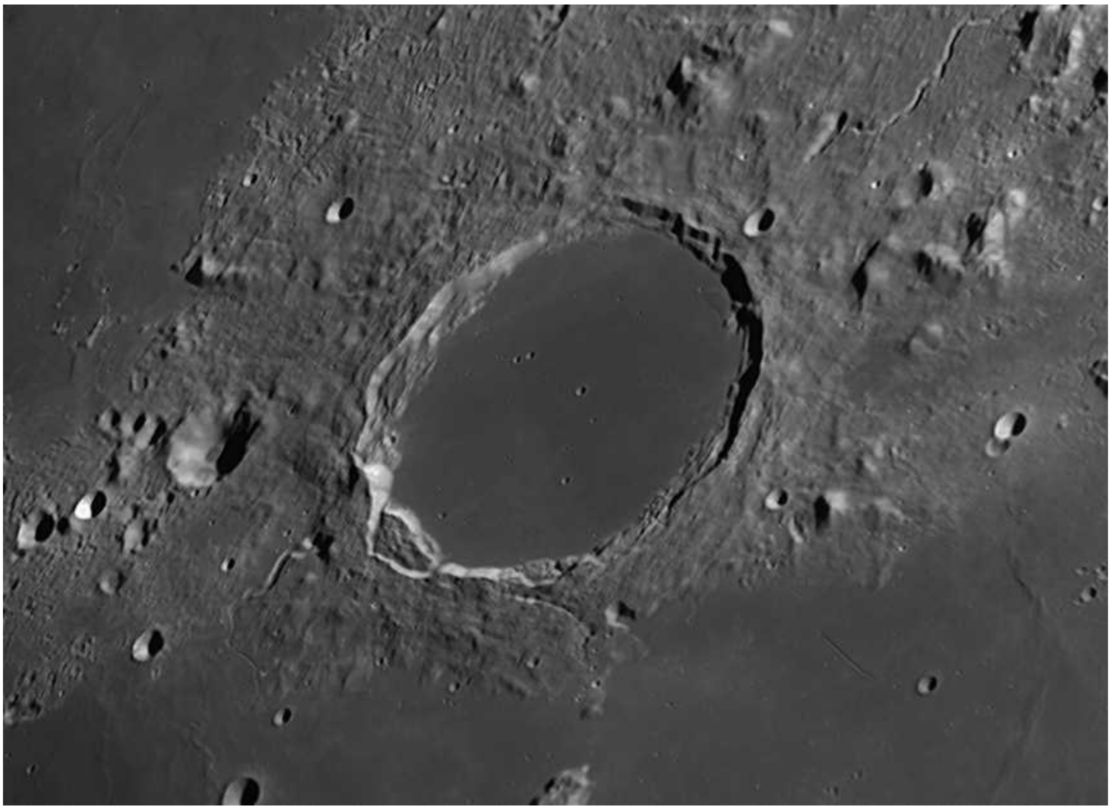
BAA Lunar Section
British Astronomical Association
Director: Bill Leatherbarrow

LUNAR SECTION CIRCULAR

Vol. 56 No. 12 December 2019

FROM THE DIRECTOR



Plato, imaged by Damian Peach 6 November 2019 with a 1m telescope from Chile

A combination of some of the worst weather I have ever encountered in Sheffield (and that is saying something!), flooding in my observatory, and the usual seasonal illnesses has effectively curtailed my observational activities throughout this autumn. Others have been more fortunate, as the selection of fine images in this issue testifies.

However, few were able to take up my challenge last month to observe the limb crater Einstein on the early morning of 12th November. Much of the UK was clouded out and no high-resolution images were obtained, although Maurice Collins (New Zealand) did manage to capture the crater under poor seeing conditions. We shall have to repeat this campaign on a future occasion, when hopefully conditions will be better.

When the weather is as bad as it has been in the UK it is good to go abroad, and this is effectively what Damian Peach has been doing by availing himself of the Chilescope one-metre Richey-Chretien remote telescope near La Serena in the Chilean Andes. His outstanding image of Plato, taken on 6 November using an ASI174MM camera, is reproduced as the frontispiece to this issue.

It is still raining in Sheffield as I write these words, with more to come according to the weather forecasts. Better conditions are surely around the corner, but meanwhile may I wish you all very best for the festive season and the New Year.

Bill Leatherbarrow

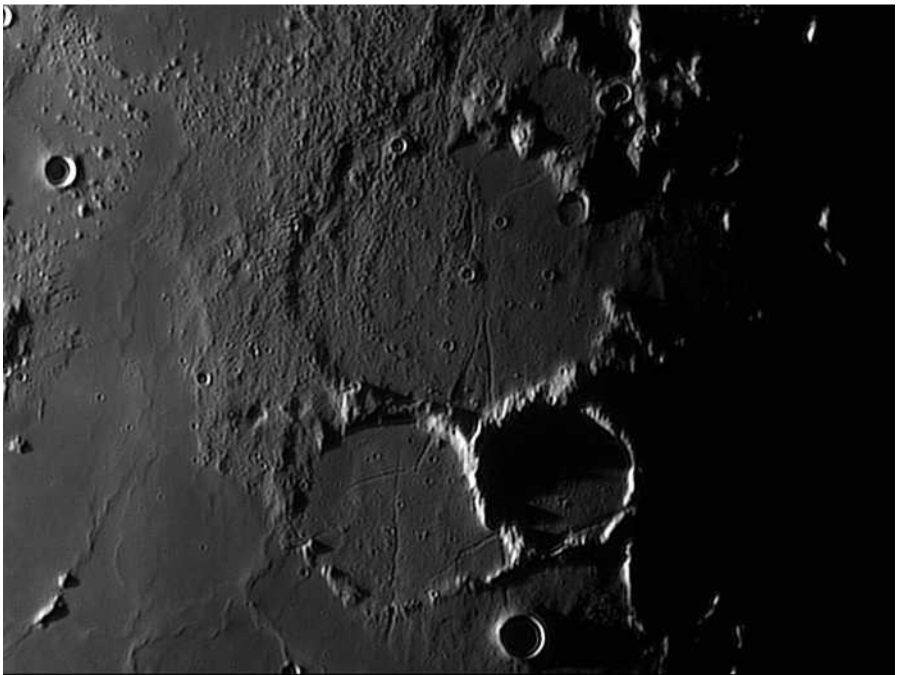
OBSERVATIONS RECEIVED

Images have been received from the following observers: Leo Aerts (Belgium), Maurice Collins (New Zealand), Dave Eagle, Dave Finnigan, Rik Hill (USA), Rod Lyon, Damian Peach, Mark Radice, Bob Stuart, and John Tipping.

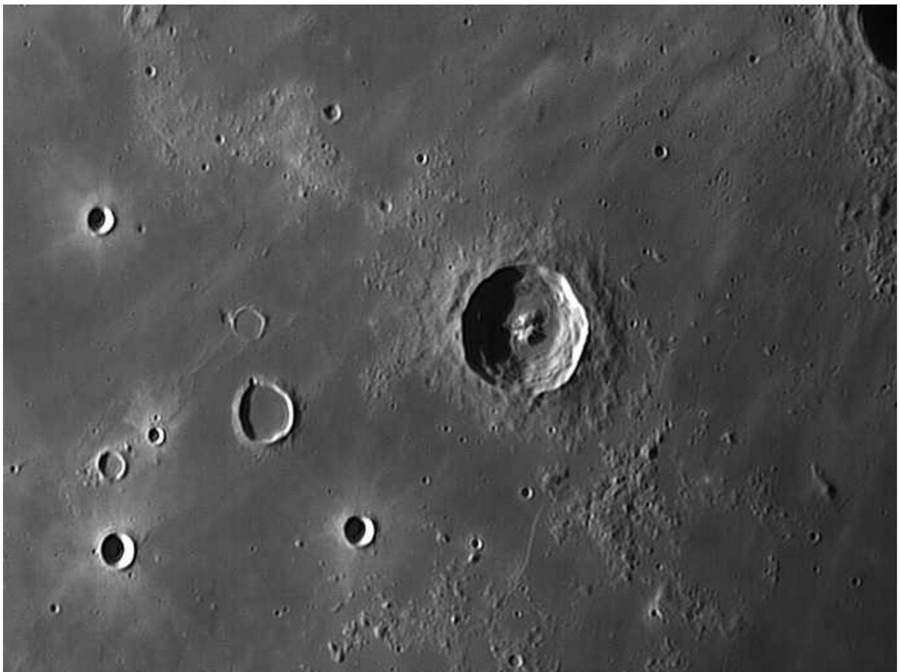
A selection is reproduced below.

Leo Aerts in Belgium has also been troubled by the recent poor weather, but he has sent in this earlier, highly detailed study of the South Polar Regions, taken on 2 July 2019 at 19h18m UT, using his C14 SCT. The crater Schomberger lies above and to the right of centre.

Dave Finnigan has also submitted some fine observations from earlier months (see over page).



Fra Mauro, Bonpland, Parry 2019.08.24 04:42 UT, S Col. 194.1°, seeing 6/10, transparency good. Libration: latitude +04°47', longitude -07°26'
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



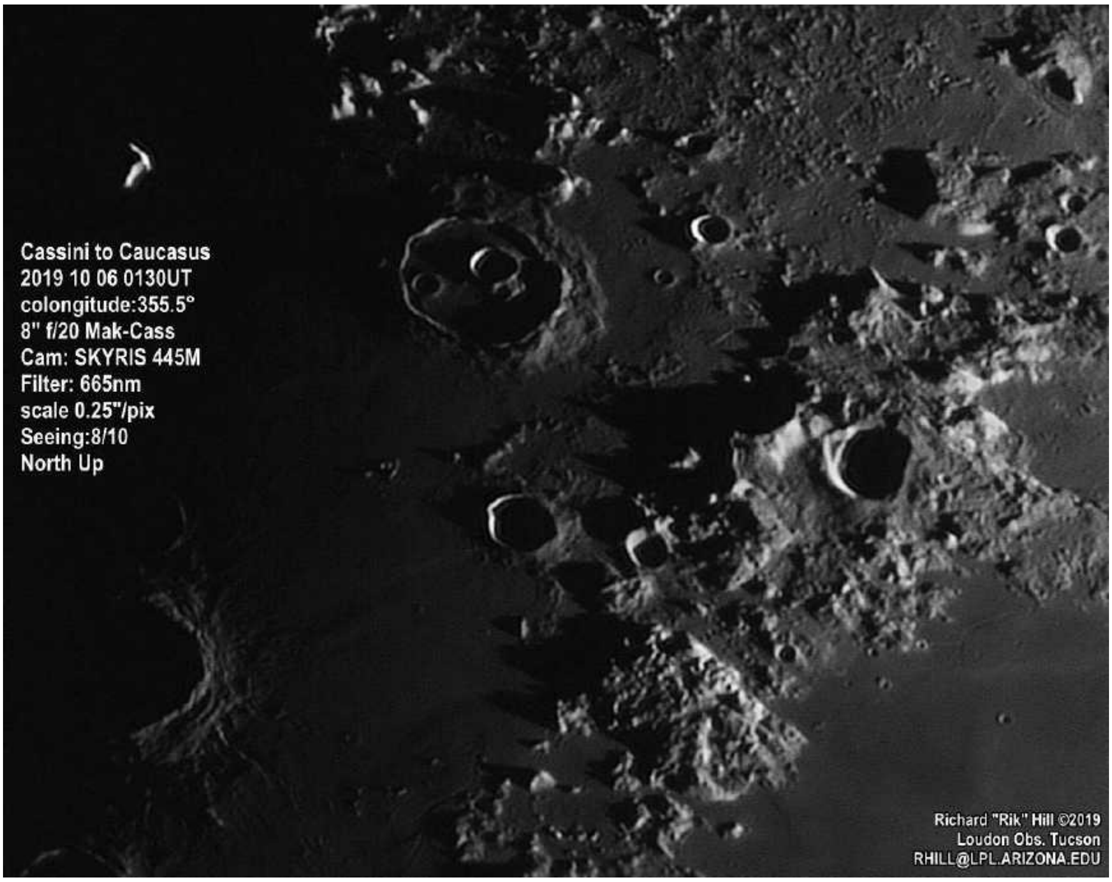
Lansberg 2019.08.24 04:44 UT, S Col. 194.1°, seeing 6/10, transparency good.
Libration: latitude +04°47', longitude -07°26'
305mm Meade LX200 ACF, f 25, ZWO ASI 120MMS camera, Baader IR pass filter: 685nm.
640 frames processed in Registax 6 and Paintshop Pro 8.
Dave Finnigan, Halesowen

Kepler 2019.08.24 04:50 UT, S Col. 194.1°, seeing 6/10, transparency good.
Libration: latitude +04°46', longitude -07°27'
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

Rik Hill has sent in another series of images and notes, including the following account of the area around Cassini and the Caucasus mountains under sunrise conditions:

'Trying to catch all the different colongitudes for various regions on the Moon always leads to discoveries. Here we see the region bounded by Cassini (60km dia.) at top, shadow filled Calippus (34km) to the right of it and Aristillus (56km) just coming into light in the lower left with the splash pattern of its ejecta. Directly below Calippus you can see shallow Rima Calippus, usually very difficult to see with higher sun angles. Calippus sits in the middle of a range of mountains that runs diagonally across the lower right of this image, the Montes Caucasus. I have a particular fondness for this range for the way the mountains just seem to rise up out of the surrounding plain. In the center of the image is another shadow filled crater, Theaetetus (26km). It sits at the head of an impressive unnamed valley that cuts through the Caucasus. What fun it would be to drive a rover the length of that valley! On the northwestern (upper left) flanks of these mountains are dramatic spiky shadows pointing back to Cassini. Note the fine cliff to the west of Calippus.

On the floor of Cassini we see Cassini A (17km) and to the left of it, Cassini B (9km). The ejecta to the east of Cassini forms a wonderful rumpled apron. Lastly above the name plate we see the ramparts of Mons Piton (alt. 2250m) catching the first rays of the morning sun.'

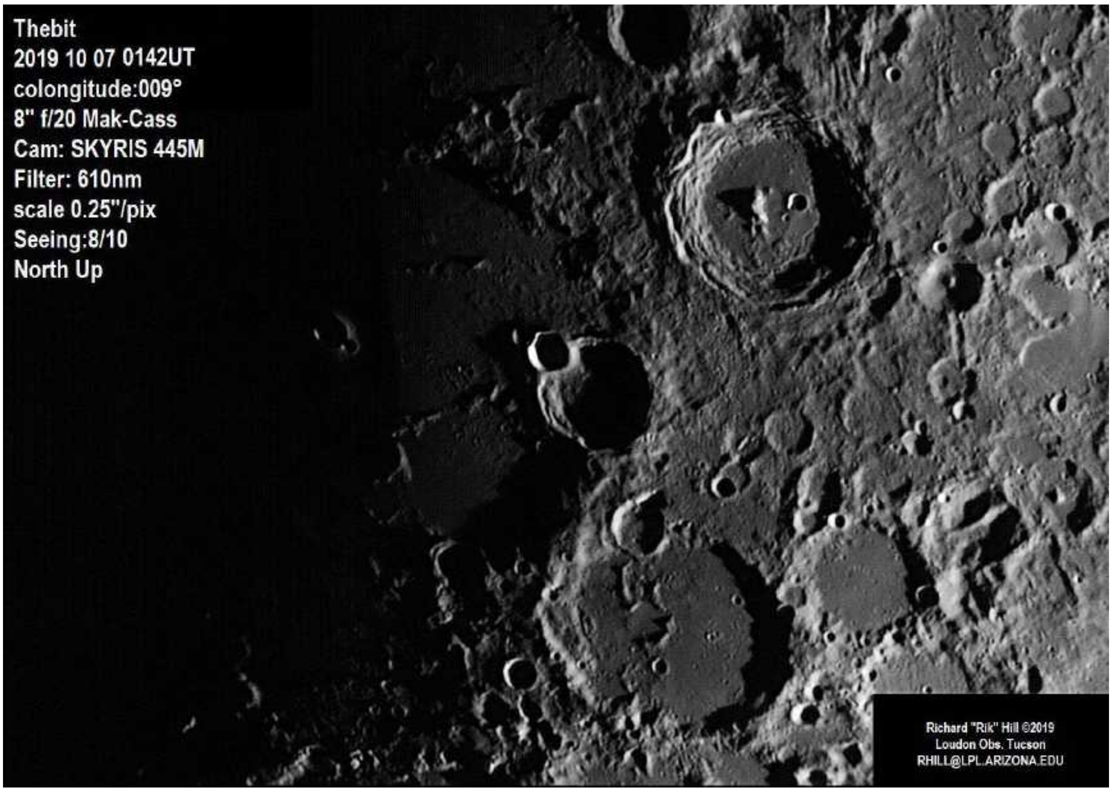


Rik has also sent in the following study of sunrise over the Thebit/Rupes Recta area:

'Here's another nice crater lost in the glory of all the surrounding spectacular landforms. In the center of this image can be seen the crater Thebit (60km dia.) with the smaller and much younger Thebit A (20km) on its northwest wall. Thebit is full of shadow here but is a shallow crater with an interesting polygonal rima on the flat floor. Below or south of Thebit is one of the major distractions, Purbach (121km) one of the older features on the moon with mauled walls to the west and north. the southeastern wall is part of the "Lunar X" seen best at a Colongitude of 359°, about a day earlier than this image. More of the X is made by La Caille (70km) just east of Purbach, and Blanchinus (also 70km) cut off by the nameplate of this image. I also enjoy Delaunay (48km?) to the immediate northeast of La Caille that looks like a giant cloven hoof print!

Above Thebit is the remarkable crater Arzachel (100km) with Rimae Arzachel on its floor. One of the larger of these rimae can be seen along the terminator shadow on the floor of this crater. This crater has wonderful terraced walls rivalling Copernicus. To the east are large north-south impact scars from "rocks" the size of cities that were ejected during the tremendous impacts that created the mare to the north.

To the west of Thebit a pair of craters can just be seen coming out of the shadows of the lunar night. The larger crater is Birt (17km) and the smaller, as you might expect is Birt A, best known as the craters just west of the Straight Wall or Rupes Recta, which can just barely be made out in the deep shadows here. Below these on the south end of the rupes, are what used to be called the Stag's Horn Mountains. Unfortunately for us that grew up in the 1960s knowing them as such, they no longer officially bear that name.'



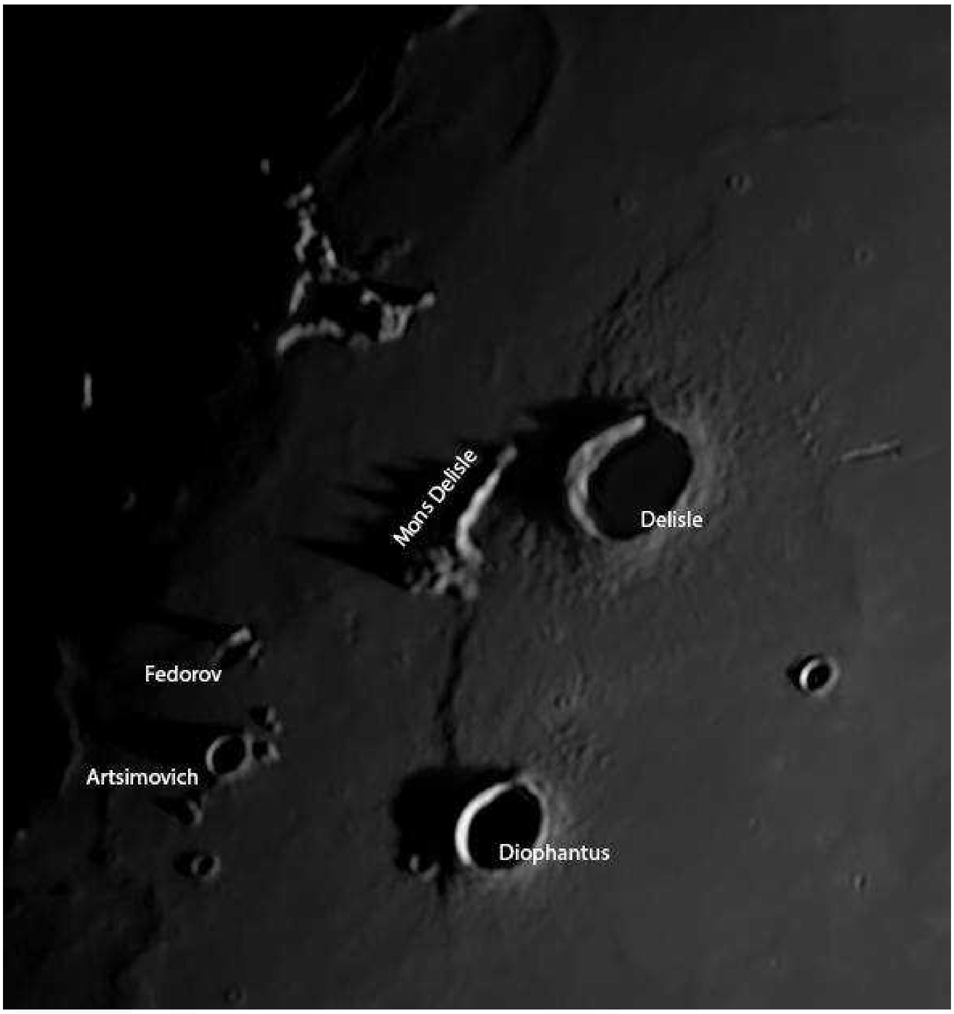
THE MOON: OCCASIONAL PAPERS OF THE BAA LUNAR SECTION

A further volume of *The Moon: Occasional Papers*, containing contributions by Raf Lena and Barry Fitz-Gerald, is currently in preparation. It is hoped that this will be circulated to Section members early in the New Year.

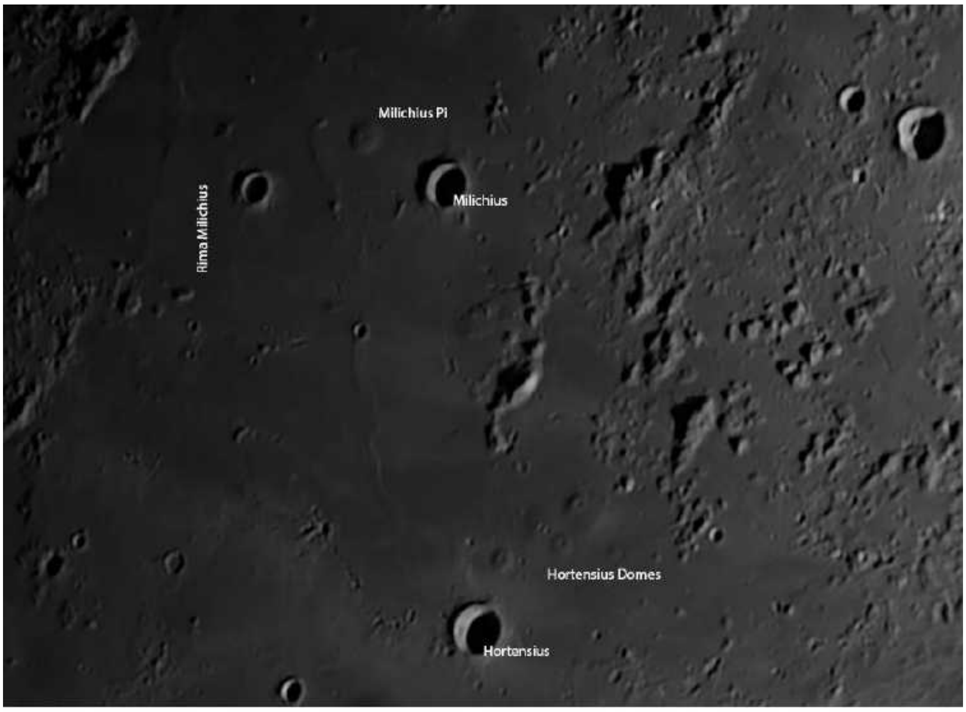
Maurice Collins has submitted a nice image of a lunar occultation of Saturn, visible from New Zealand on the night of 2 November 2019 (see below).

Dave Eagle has captured a nice three panel mosaic of the area around Mare Orientale. This was taken on the morning of the 23 October 2019. The three images used were obtained using a ZWO ASI120MC camera at the prime focus of a Celestron C11.

Mark Radice has submitted a series of images from 7 November 2019, taken using his C11 SCT. We feature here his studies of the Diophantus-Delisle region and the Milichius dome field.



Delisle
7 November 2019 2228Z
C11 f20 ASI224MC 685nm IR filter
Mark Radice RefreshingViews.com

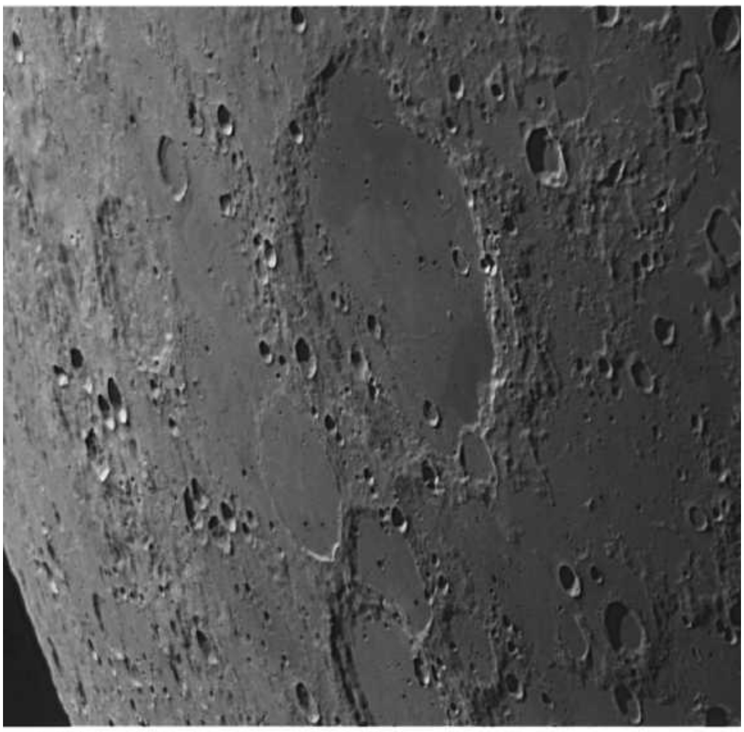


Milichius - Hortensius
7 November 2019 2208Z
C11 f20 ASI224MC 685nm IR filter

Mark Radice

RefreshingViews.com

Rod Lyon captured some nice detail on the floor of Schickard in broad daylight on the morning of 23 October 2019.



Schickard 2019.10.23 - 10.04 UT
300mm Meade LX90, ASI 224MC Camera, with Pro Planet
742nm I-R Pass Filter. 1,000/5,000 Frames. Seeing: 7/10

Bob Stuart has sent in the following colour image, taken by his 10-year-old granddaughter Sophie from scratch, setting up scope, aligning, targeting the Moon, setting up camera and imaging run, and pressing go. Bob comments that ‘she is very chuffed with her first solo efforts’. The Director is equally chuffed, since this reduces by a significant amount the average age of contributors to this Circular!

20cm CN-8 f5 Baader Mk 3 coma corrector, Altair Astro 183C camera, best 10% of 400 frames in AS3! and Registax 8/11/2019 19:34 UT

Bob also submitted several of his own images from the same night, including this capture of the North Polar Regions around Fontenelle and Philolaus.

FUN WITH BOULDERS (AND TRAILS) Barry Fitz-Gerald

In the October 2019 LSC Tony Cook bought our attention to an interesting observation made by Kevin Kilburn on the 13th September this year of an anomalous optical phenomenon captured in a series of images made with a small refractor and a DSLR [1]. The images show a transient bright-green spot on the western rim of Galvani B, but what exactly was recorded is a mystery. Tony mentioned a number of possible explanations for Kevin's observations including effects produced by the physical movement of rocks such as moonquakes and/or landslides. The apparent location of this phenomenon appears to correspond to the western wall of Galvani B, and as Tony points out this is also the location of a small crater which shows evidence of landslides and is therefore worthy of consideration as a possible factor in the observation made.

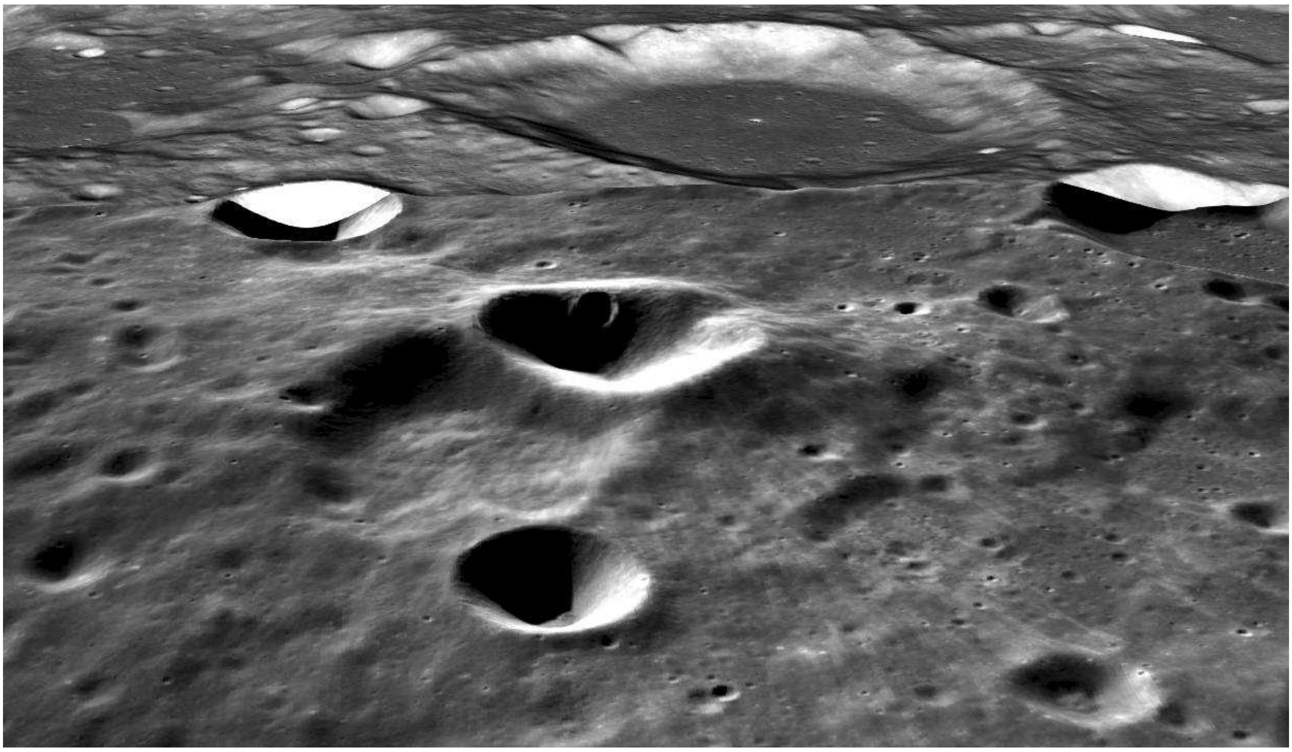


Fig. 1 3-D rendition of Galvani B viewed from the east. Note the flat aspect of the western wall facing the observer and the smaller crater superimposed on it.

Galvani B itself is an odd 'D'-shaped crater, measuring about 12kms east-west and 14kms north-south. As in the letter D, the straight section of the crater rim is to the west, and so the western inner wall, facing the observer, forms a flat slab as opposed to a gently curving surface as you would get with a circular crater (Fig. 1). The crater wall slopes are about the average for most lunar craters at about 26°, so not especially steep.

Superimposed on the western wall is a small impact crater, with its upper rim almost level with the western rim of Galvani B. The upper rim is sharp and well defined but the lower rim is completely obscured by debris that has collapsed downwards and overshot the lower rim in the form of a bouldery tongue that extends down the slope for about 1km. The side walls of the crater are sharp and well defined, and when measured from rim to rim in this direction, we get a distance of about 2kms.

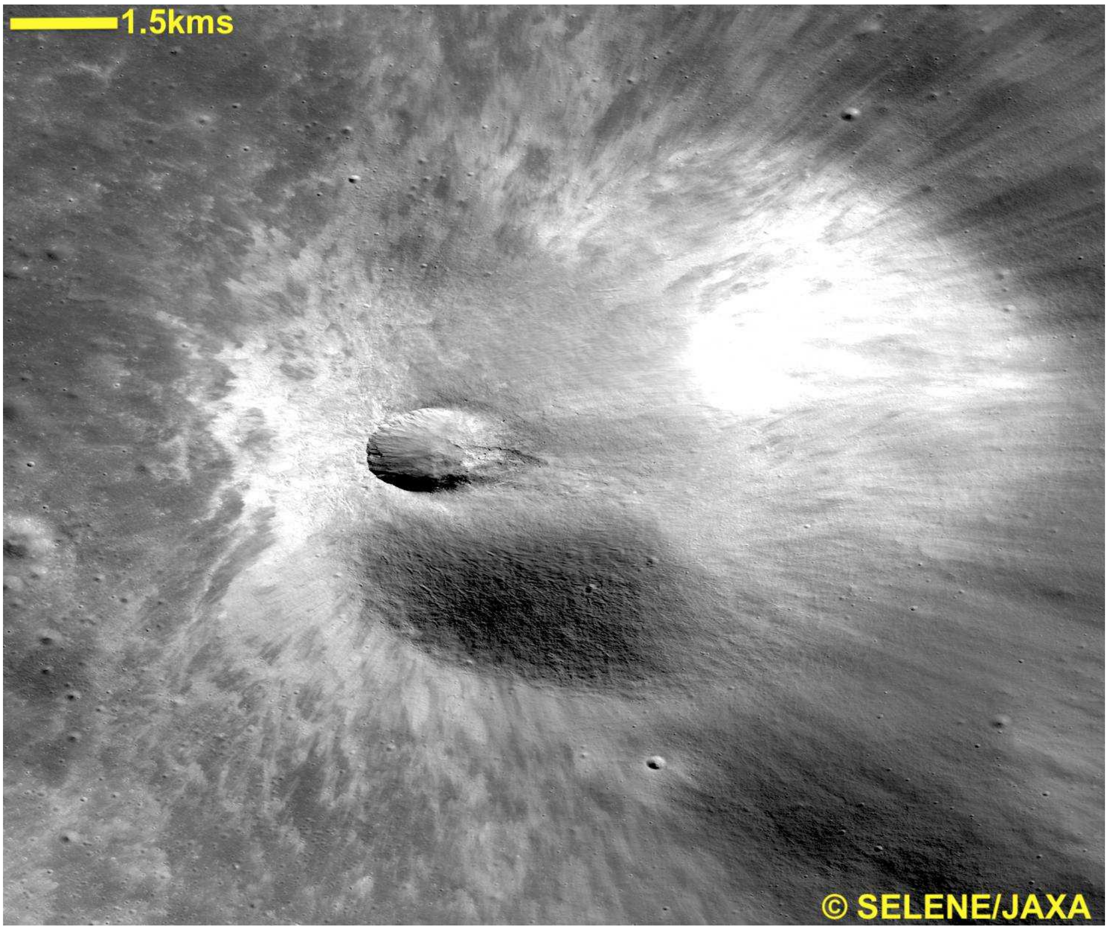


Fig.2 SELENE image of Galvani B and crater on western wall.

Craters that form on slopes, such as the rims or walls of pre-existing craters have a distinct form which is apparent in this case. For starters, as far as the impactor is concerned it is striking a surface at an oblique angle, so as with low-angle impacts on level surfaces, the ejecta pattern is quite asymmetric. This is quite apparent in Fig. 2 with the bulk of the bright ejecta off to the east, or downslope; this does not imply that the impactor came from the west as a vertical impact here would have produced the observed distribution. The ejecta to the west is less extensive and does not extend far beyond the rim of Galvani B. The secondary craters, sinusoidal dunes and troughs that are found concentrically arranged around circular craters are here arranged in a wavy-linear pattern tangential to the crater rim, mirroring the situation seen in the uprange ejecta pattern of some low-angle impact craters. The ejecta blanket is extremely bright and optically immature, showing that this small crater is in lunar terms extremely young. The crater is extremely shallow, somewhere in the region of 300m and its floor slopes at the same angle (26°) as the wall of Galvani B on which it rests (Fig. 3). This is the result of modification following the actual impact when material from upslope has slumped downslope and effectively filled up the crater. Around the crater, the rim can be seen to be ringed by concentric cracks and fractures and is probably quite unstable.

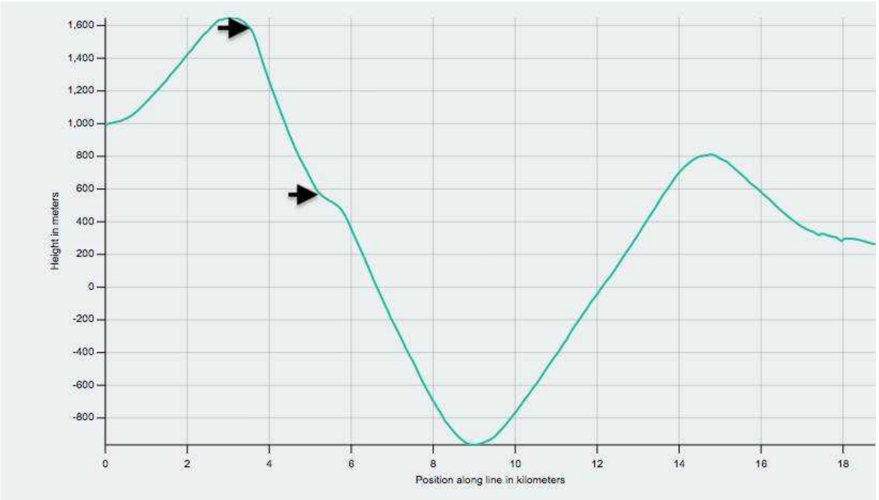


Fig. 3 SLDEM2015+LOLA(m) profile across Galvani B

The lower rim of the crater is obscured by very rocky deposits which, as noted above, extend down the slope in the form of a narrow triangular tongue (Fig. 4). Some of the boulders here are in excess of 50m across, and these deposits would in a conventional crater be the rubble found on the crater floor as the breccia lens. In all probability there is an impact melt component in with this material, but it is not visually apparent – probably buried beneath the rocky component.

Fig. 4 LROC NAC image of the crater on the western wall of Galvani B. Note the tongue of rocky material over the lower rim.

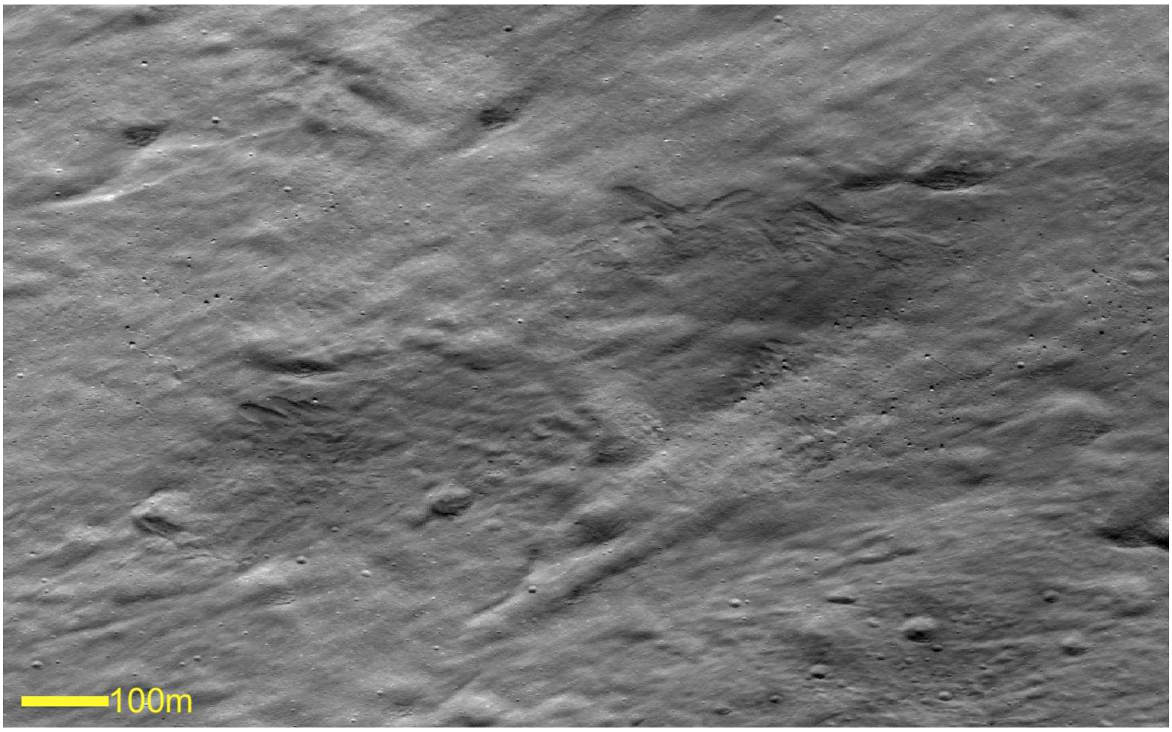


Fig. 5 LROC WAC image of the eastern wall of Galvani B showing glob of impact melt ejected from the crater on the opposite wall during its formation. Note the short stubby flows where the molten material flowed s short distance downslope.

The ‘floor’ of the crater is covered in a high-albedo extremely fine regolith and darker granular flows and is sculpted by innumerable slumps and scars marking small scale collapses. There are a few boulder trails crossing this ‘floor’ and their presence here suggests very recent falls, as on such a surface they would quite rapidly be filled in with loose debris. The presence of a few small impact craters on the crater ‘floor’ does however demonstrate that in Earth terms it is a fairly ancient surface, but in terms of lunar age – extremely young.

As noted above there is little trace of impact melt in the crater itself, but a small elongate glob can be seen on the opposite (eastern) wall of Galvani B, which appears to be the result of a jet of melt ejected from the crater during the impact process (Fig. 5).

Boulder trails provide pretty good evidence of seismic shaking as boulders become detached from rocky exposures and roll down slope away from their point of origin. Numerous fresh boulder trails are a good indication of relatively recent shaking, and have been interpreted to indicate activity within the last few million years [2] or even within the last few decades! [3] Remarkably fresh looking boulder trails occur in abundance downslope of the crater, with a large number apparently derived from the rocky tongue of debris that overlies the downslope rim (Fig. 6). Many trails cross over older trails here indicating many successive boulder falls.

Fig. 6 LROC NAC image of boulder trails leading away from the rocky tongue of debris overlying the crater lower rim. Note many trails cross over pre existing and therefore older trails.

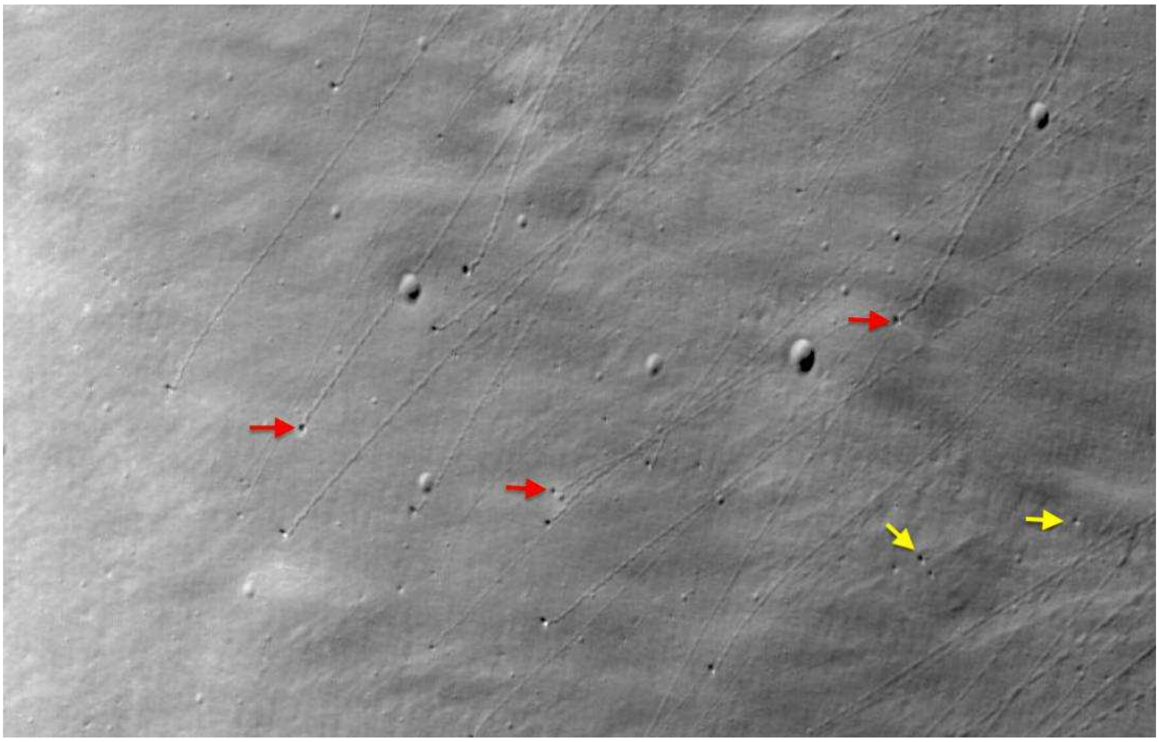


Fig. 7 LROC NAC image showing boulders trails on the wall of Galvani B. Boulders marked with yellow arrows lack trails and are probably the result of boulder falls several tens of millions of years ago. The boulders marked with red arrows have trails and are therefore younger, but the trails are cut by later small impact craters indicating that they are not particularly young features. This indicates at least two separate seismic events.

The western wall of Galvani B is a super canvas on which to look at these trails, as it is coated in fine-grained high-albedo ejecta against which the trails stand out remarkably well. Against this background it is possible to identify boulders derived from different seismic events. In places isolated boulders can be seen with no associated trails (Fig. 7 yellow arrows). Boulder trails at the Apollo 17 landing site had exposure ages of between 35 million years and 20 million years [4], so it would be reasonable to assume that boulders without trails ended up where we see them today well in excess of 35 million years ago to allow for the complete erosion of their trails. Other boulders have trails, but these are cut by small impact craters (Fig. 7 red arrows) which suggest an age comparable to the Apollo 17 age range, but sufficiently old to have been cut by later small impacts. So we have at *least* two seismic events recorded in these trails.

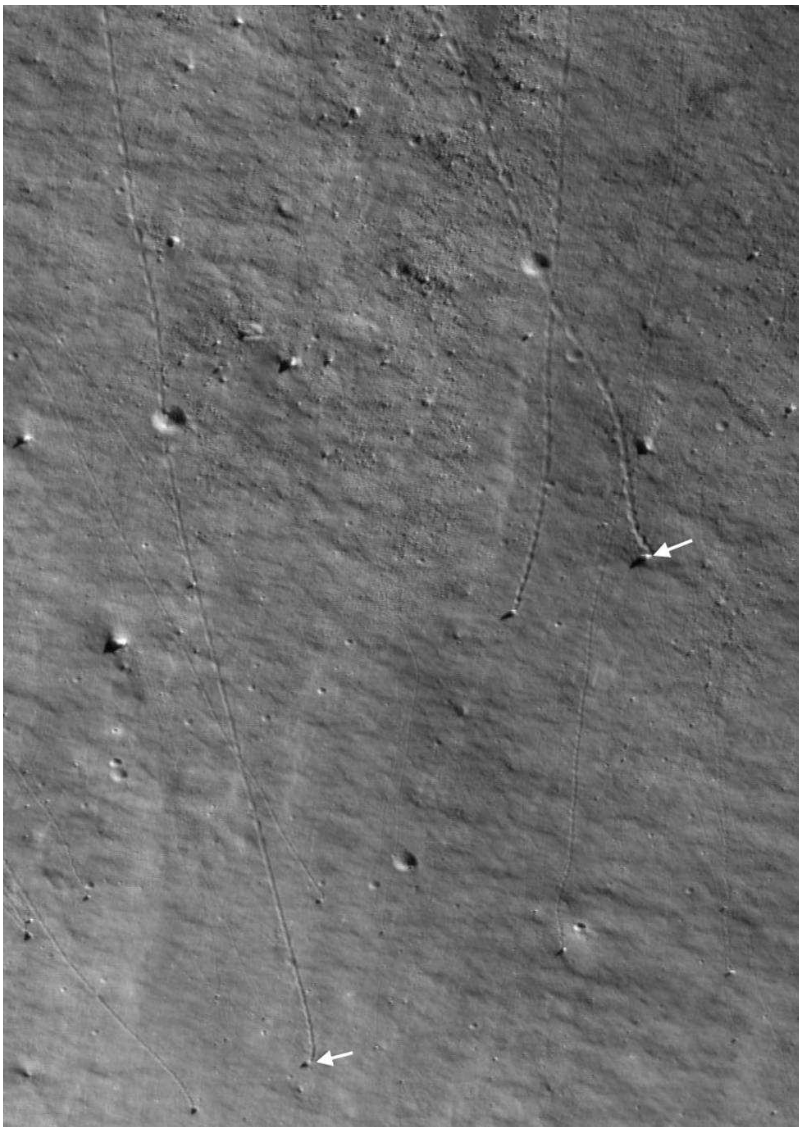


Fig. 8 LROC NAC image showing boulders trails on the wall of Galvani B with white arrows showing boulders whose trails cut small impact craters. These trails probably represent relatively recent boulder falls.

Examples can also be found where small craters have their rims and floors crossed by boulder trails (Fig. 8 white arrows) suggesting that the falls that caused them are probably relatively recent events. None of these observations give much of a clue as to the actual ages of these trails, but it is all evidence that rock falls have happened several times in the geological past and are not one-off events.

Fig. 9 shows three boulder trails, A, B and C that start abruptly on the lower slopes of Galvani B's southern wall. The boulders that formed these trails probably rolled down and came to rest at the start of the present trails some considerable time ago. As there are no trails leading from higher up to the start of the present trails, it is possible to conclude that enough time has elapsed for the first set of trails to erode away completely, whilst the boulders that caused them remained in situ for this period of time. The boulder that gave rise to trail A was then dislodged by a recent seismic event and continued its interrupted roll downhill for a further 2.2km before coming to rest again.

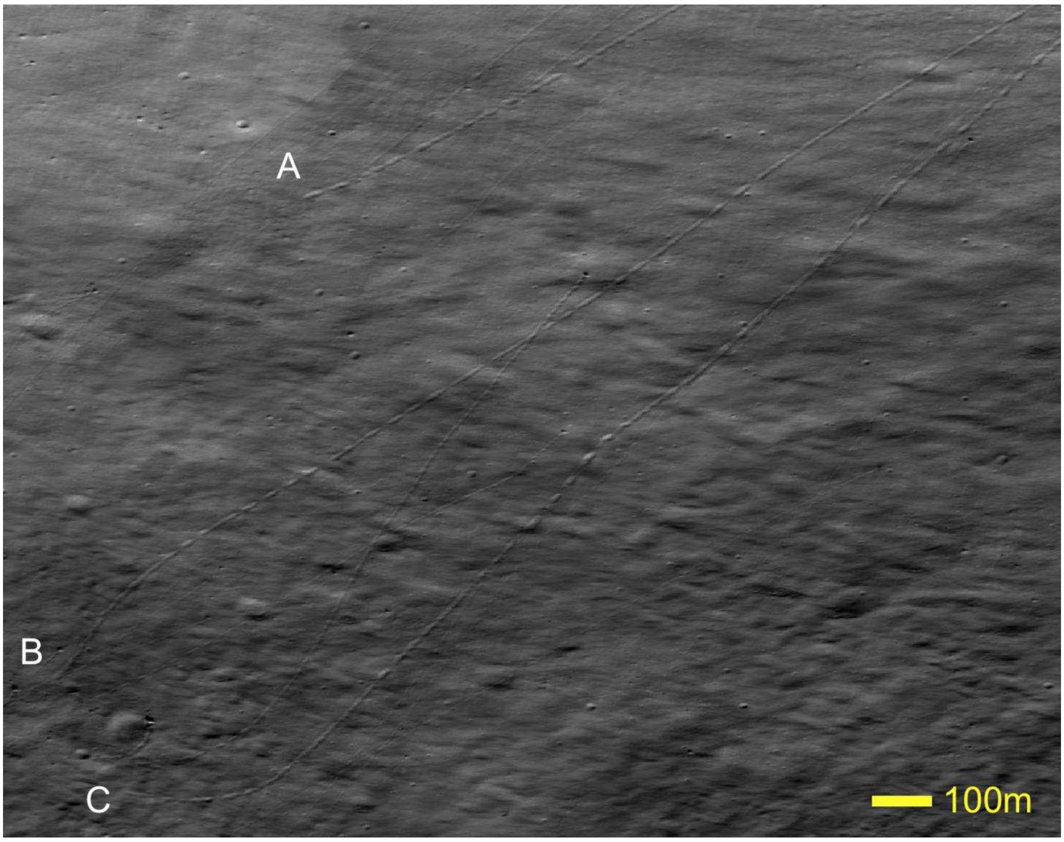


Fig. 9 Boulder trails A, B and C on the southern wall of Galvani B. This is the start of the journey which is continued in Fig. 10

Boulder trails B and C begin some 200m apart, and the boulders that made them may have resumed their downwards journey at the same time as boulder A, with their paths converging downhill. Remarkably, after 2kms the trails merge and continue downhill as a combined trail for another 1km before the boulders came to a halt side by side (Fig. 10). Apart from the sheer novelty, these trails also indicate the likelihood that all three boulders started moving at the same time as a result of the same seismic event, which imparted sufficient energy for them to roll about the same distance downhill.

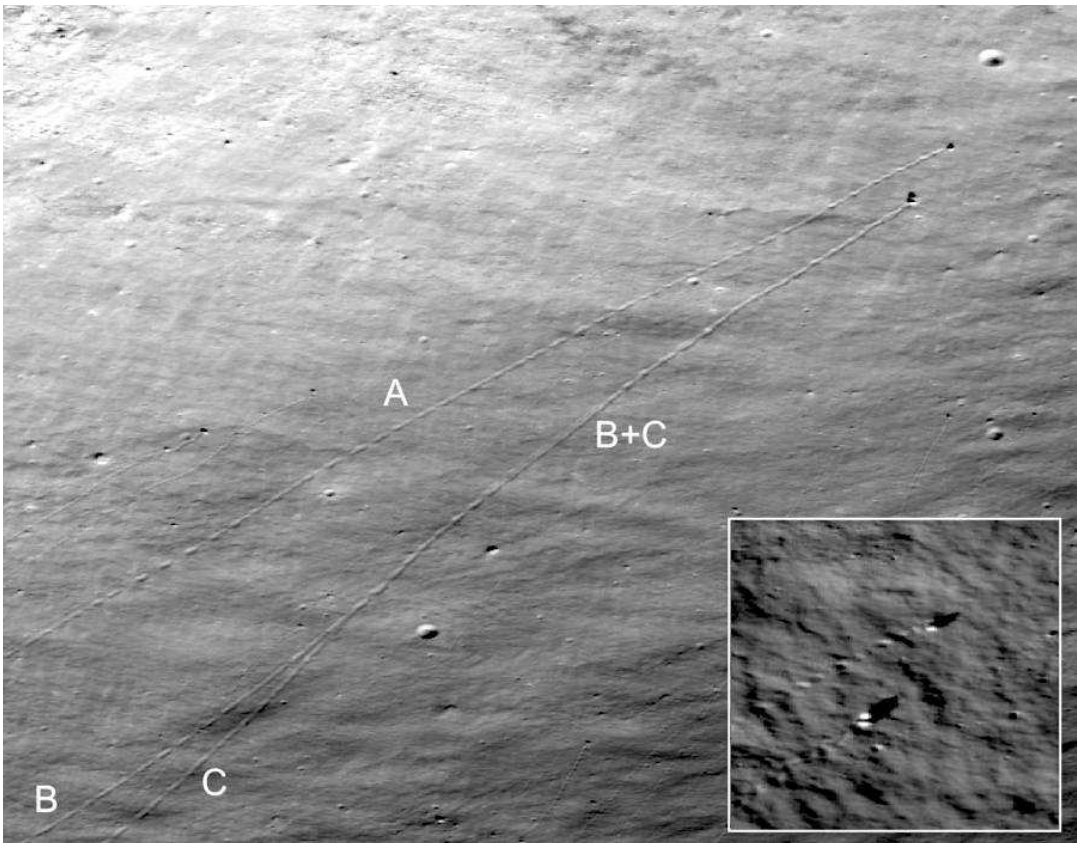


Fig. 10 The end of the journey started in Fig. 9. Inset shows the boulders that caused trails B and C lying side by side, and the boulder that formed trail A lying slightly downslope.

In summary what these trails show is that boulder falls are a common occurrence on the western wall of Galvani B, and have been taking place over a protracted period, possibly in separate episodes, producing many ‘generations’ of boulders and boulder trails. Along with these boulders it is also likely that finer material has been displaced with the potential to produce clouds of particulate matter that could be lofted above the lunar surface to produce a visible optical effect.

A flavour of the month explanation for boulder falls is movement along shallow angle thrust faults which show themselves on the surface as lobate scarps – low-relief, usually sinuous features which are often found in highland terrain. Movement along these faults is believed to be responsible for shallow moonquakes which shake boulders loose from rock exposures or steep sloping ground. The area around Galvani B does not contain any obvious prominent scarps of this type, but then again the nearby terrain is scoured and blanketed in fresh ejecta so any small features may well be obscured. There are one or two features, however, that may be lobate scarps in the area, but they are subtle and easily missed. Fig. 11 shows an area 16kms north-east of Galvani B which appears to show two lobate scarp type features of extremely low relief, with the scarp facing north. As this general surface is sloping towards the north at a shallow angle (~ 11°) it is always possible that these scarps are not fault related but represent downslope movement of regolith. The length of these features at over 2.5kms would however support a fault scarp interpretation more than a downslope movement one.

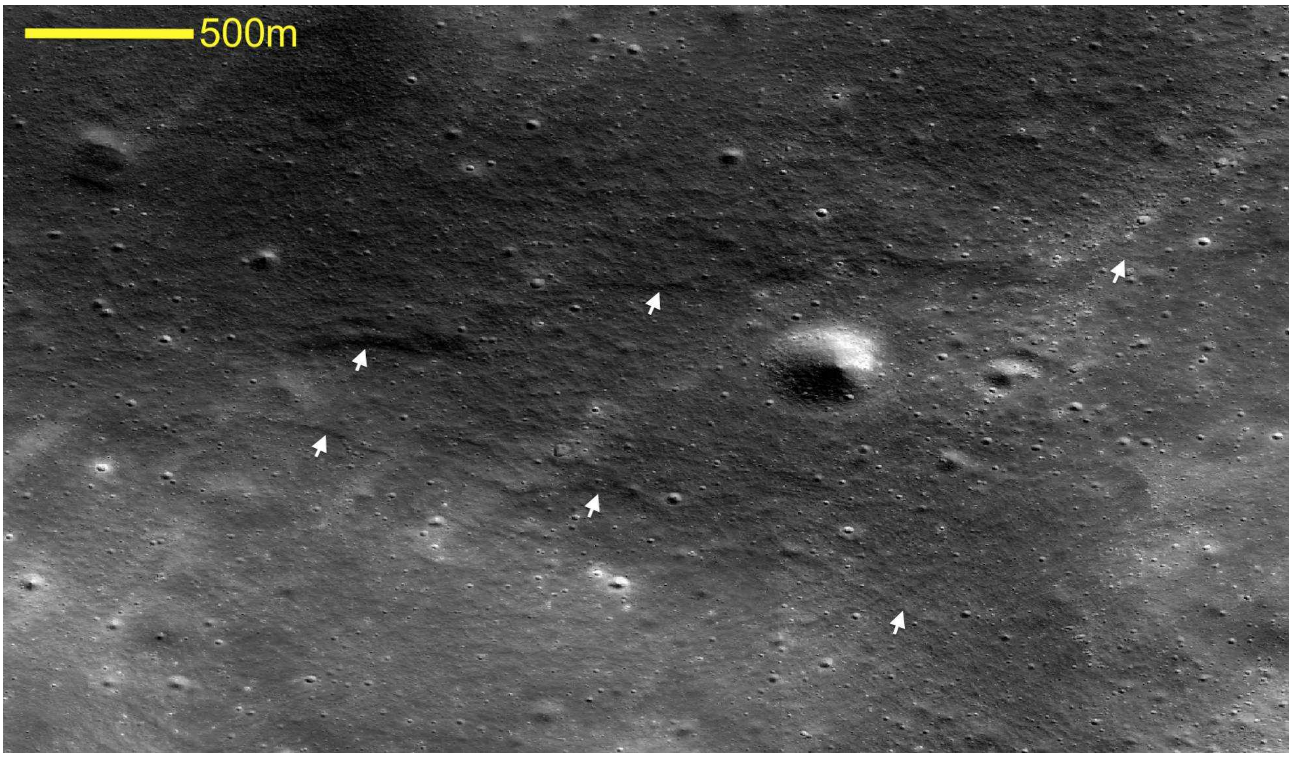


Fig. 11 LROC WAC image of possible lobate scarps (indicated with white arrows) located some 16kms to the north-east of Galvani B.

So to conclude, the western wall of Galvani B, the one facing Earth-based observers is covered with bright young ejecta, courtesy of the small impact crater on it, and is also subject to avalanche and repeated episodes of boulder falls due to the instability of the sloping terrain. The presence of several generations of boulder trails indicates that there has been several ground-shaking events, and the presence of suspected lobate scarps nearby supplies a source for seismic activity in the form of shallow moonquakes. Whether these factors contribute anything to the possible TLP observed is another matter, but there is at least a strong mechanism here to add to the list of possible causes.

Acknowledgements:

LROC images reproduced by courtesy of the LROC Website at http://lroc.sese.asu.edu/index.html, School of Earth and Space Exploration, University of Arizona.

Selene images courtesy of Japan Aerospace Exploration Agency (JAXA) at:
http://l2db.selene.darts.isas.jaxa.jp

References:

1. Tony Cook, BAA. Lunar Section Circular Vol. 56 No. 10 October 2019

2. Kumar, P.S., et al. (2016) 'Recent shallow moonquake and impact-triggered boulder falls on the Moon: New insights from the Schrödinger basin'. *Journal of Geophysical Research: Planets* 121,147–179.

3. Kumar p.s., et al. (2019) 'The Seismically Active Lobate Scarps and Coseismic Lunar Boulder Avalanches Triggered by 3 January 1975 (M W 4.1) Shallow Moonquake', Geophysical Research

Letters.

4. Hurwitz, D and Kring, D.A (2015) 'Identifying the Geologic Context of Apollo 17 Aphanitic and Poikilitic Impact Melt Breccias'. Abstract 46th Lunar and Planetary Science Conference.

LUNAR OCCULTATIONS December 2019

Tim Haymes

The Moon is in Capricorn at the start of this month, and might be glimpsed low in the SW after sunset. On Dec 5th 18h the 4th magnitude star 33 Piscum is occulted. The field of M44 is crossed on Dec 15th 16h but at our longitude no occultations are predicted due to twilight. A new Moon occurs over the Christmas holiday period.

Bright events are shown in the BAA Handbook, eta Gem on the 13th with DB and RD at 0644 and 0716, and nu Vir on Dec 18th 2337UT (Times at Greenwich). The Waning Moon is at high declination and a good time to observe reappearances at the dark limb (RD). Good luck.

Request for observation of ZC 1014 (HIP 31595)

This is a first call, and hopefully I will include a reminder in the Feb LSC; for observing ZC 1014 which was reported by a video observer to have a companion. The event is on 2020 March 4th. Details follow:

ZC1014 (HIP 31595) *is reported by Steve Messner (IOTA groups.io forum) as 'double' from a video recording made by Bob Sandy (IOTA-US) on April 20, 2010. Details here: https://occultationpages.com/events/ZC1014.html*

There are no previous reports of it being a double star. The components measured from the recording by LImovie are magnitude 7.4 and 8.3 Lunar occultations of this star finish at the end of 2020 and resume in 2028 AD.

The next one predicted for the UK and Europe is on 2020 Mar 4th when the Moon will be well placed in Gemini. The phase is 70% and the star is 7.0 magnitude. For Southern England the DD is early evening at about 1948 UT.

I'm proposing that anyone with video should record the occultation at 25 or 50 fps. Alternatively if you have a planetary web cam to use 200 fps (e.g.)

Please add this prediction to your observing calendar for next year.

Graze occultation planning https://britastro.org/downloads/17673

The graze predictions in BAAH 2020 page 42, are described by three files created by the software Occult 4. One is the kmz which is the mean limb limit-line displayed on

Google Earth. The second is the limb profile to help with selection of the best situation on the ground, and the third is a text file with further details like Alt/Az.

These files can be downloaded from the BAA as a zip archive (one per event). The path is: Observing Sections > Lunar Section, and a Section Page 'Lunar Occultations' and then the Link to 'Graze predictions for 2020'. This avoids the need to request the information. The Read Me.pdf is a useful guide for an observer.

Finding a good place to set up for a graze

Looking at the BAAH you will probably select a graze near you, or if you are well organized, find a good event and build a short holiday around it, or book some overnight accommodation.

The graze line is the starting point (kmz), and then we look at the limb profile (jpg). First note if the graze is North or South limit, then find a point on the limb histogram where a good number of graze contact can be seen. Suppose these are 1km inside the mean limb.

Referring to Google Earth, scan the line to find where it intersects roads (for access) and if those roads lead to an area 1km from the line.

What should I look for?

Public car park, NT carpark, side road, open space, sports field, camp site. If you are looking for overnight accommodation like Farm House B&B then it would be ideal if that location was also close to the observing site. A friend's garden is also an obvious location.

In the course of selection we need to be sure the view is OK, no obstructions in the direction of the Moon (See the Alt and Az information in the txt file), and also shielded from car headlamps. It doesn't have to be completely dark for a lunar graze so a bit of lighting will not interfere that much. There is quite a lot of planning involved, and wherever possible one should visit the observing location beforehand in daylight. Two reasons: familiarity with the journey which will look quite different at night (use sat nav); and the second to have an opportunity to speak to a resident or landowner. If you have the OK, or find the contact for private land (e.g, Church Hall /community hall) then this is desirable.

Making the observation.

Well I leave that to you, but what is required on the report is your location. The Long/lat to 0.1" arc is needed, so wherever you are, take a few photographs of the telescope in relation to nearby landmarks. From this you can get the long/lat from Google Earth. GE is preferred even if you are pretty close with a hand-held sat-nav. Observing with a friend is fun and can be helpful if approached by a curious passer bye. Be prepared to promote astronomy and explain what you are doing, and why.

Good luck, and don't leave anything behind: eyepieces, lens caps litter etc. Oh! And I nearly forgot: do send me a report – Thanks.

2019 December predictions for Manchester (Occult4 by D.Herald).
Please Note: Predicted times are in UT

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	Moon Az	CA o	Notes
19	Dec	1	16	52	52.8	D		189827	A3	8.0	7.9	26+	61	-8	16	187	36N	
19	Dec	2	17	22	54.5	D		164632	G5	8.5		35+	73		19	183	34N	
19	Dec	2	17	26	57.9	D	X	50839	G0	8.8	8.6	35+	73		19	184	87S	
19	Dec	2	17	49	16.0	D		164637	K2	7.5	6.8	35+	73		18	190	32N	
19	Dec	2	18	13	57.9	D		3191	A5	7.4	7.3	35+	73		17	195	46S	Dbl*
19	Dec	3	20	21	7.2	D		3323	A5	7.5	7.3	45+	85		16	216	84S	Dbl*
19	Dec	4	17	47	51.5	D		3433	G5	7.7	7.2	54+	95		25	166	49S	
19	Dec	4	23	33	52.8	D		3458	K0	6.2	5.5	56+	97		3	250	88S	
19	Dec	5	18	7	1.3	D		5	K1	4.6	4.1	63+	106		29	160	49N	33 Psc
19	Dec	5	21	30	58.8	D		18	K1	5.8	5.3	64+	107		26	216	71S	Dbl*
19	Dec	5	22	26	0.3	D		128632	K2	8.3	7.7	65+	107		20	229	70S	
19	Dec	7	18	13	12.2	D		227	F0	8.3*	8.1	81+	128		32	135	22N	
19	Dec	7	19	23	29.2	D		110007	A*	8.6	8.5	81+	128		38	155	70S	
19	Dec	8	0	57	56.4	D		110095	K0	7.8	7.0	82+	130		20	250	75N	
19	Dec	8	17	12	49.3	D		110464	K0	6.8	6.3	88+	139	-11	23	108	62N	
19	Dec	8	19	43	48.9	D		110502	F0	7.6*	7.4	88+	140		41	146	77S	
19	Dec	9	0	35	9.3	D		368	K2	6.2		89+	141		33	238	70N	
19	Dec	9	18	38	49.4	D		93301	G5	7.2	6.8	94+	151		33	114	61N	Dbl*
19	Dec	9	19	56	33.9	D		464	K0	6.1	5.6	94+	151		42	134	81N	
19	Dec	9	23	53	47.8	D		93367	K2	8.5	7.7	94+	153		46	217	25N	
19	Dec	10	0	21	41.5	D		475	A0	7.5*	7.5	94+	153		43	225	69N	
19	Dec	10	23	14	19.3	D		610	K5	6.1	5.1	98+	164		54	186	78S	
19	Dec	10	23	46	16.1	D		93781	A0	7.6*	7.6	98+	165		53	198	52S	
19	Dec	13	1	2	19.6	R		911	B8	6.4	6.4	99-	170		59	187	64N	141 Ori
19	Dec	13	5	6	32.9	R		928	K4	5.9	5.1	99-	168		33	263	55S	
19	Dec	13	7	12	54.6	R		946	M3	3.5	2.5	99-	167	-9	16	287	37N	eta Gem Dbl*
19	Dec	13	7	12	54.7	R	X	85102		6.1	5.5	99-	167	-9	16	287	37N	
19	Dec	13	21	46	35.0	R		78861	A2	7.7	7.5	96-	158		37	102	63S	
19	Dec	13	22	57	27.2	R		78912	G0	7.6	7.3	96-	158		47	119	52N	
19	Dec	13	23	2	46.6	R		1059	G5	6.9*	6.6	96-	158		47	121	24S	DBl*
19	Dec	14	3	5	31.2	R		1078	B8	6.0	6.0	96-	156		56	214	69S	44 Gem
19	Dec	14	3	37	17.4	R		79056	G0	8.3	7.9	96-	156		53	225	83S	
19	Dec	14	4	1	40.1	R		79067	M0	8.4	7.6	96-	156		50	233	47S	
19	Dec	14	4	9	50.9	R		79070	S3	7.5	6.4	96-	156		49	236	87N	
19	Dec	15	1	17	30.0	R		79884	K0	8.0	7.2	90-	144		55	146	79N	
19	Dec	15	2	7	4.7	R		79909	K0	7.6	7.0	90-	144		58	165	82S	
19	Dec	15	4	7	51.2	R		1224	G2	5.3*	5.0	90-	143		54	215	83S	mu Cnc Dbl*
19	Dec	15	21	10	47.0	R		1329	F8	6.8*		84-	133		13	75	39N	
19	Dec	16	2	0	43.3	R		98321	K2	8.6	8.0	82-	131		51	142	80S	
19	Dec	16	2	52	16.2	R		1352	F5	7.9	7.7	82-	130		55	161	58N	
19	Dec	16	5	59	54.9	R		1366	K2	8.1*	7.3	81-	129		47	231	86N	
19	Dec	17	1	30	56.2	R		98892	K0	7.7*	7.1	73-	118		39	120	88S	
19	Dec	17	1	57	47.0	R		98897	K0	7.6*	7.0	73-	117		42	127	60S	
19	Dec	17	5	34	39.1	R		1485	G0	7.1	6.8	72-	116		50	203	78S	
19	Dec	17	23	8	10.1	R		1578	K0	6.9	6.2	63-	105		8	82	51S	
19	Dec	18	23	39	56.2	R		1702	M0	4.0*	3.3	52-	92		1	81	84S	nu Vir
19	Dec	19	5	27	18.7	R		1725	K0	7.6*	7.1	49-	89		41	164	83N	Dbl*
19	Dec	19	6	46	26.0	R		119146	F5	8.4	8.2	49-	89		41	189	50S	
19	Dec	20	2	29	6.6	R		119565	M*	7.9	7.0	39-	77		13	108	64N	
19	Dec	20	4	25	26	Gr		1840	F8	8.0	7.7	38-	77		27	134	5S	
19	Dec	20	6	5	8	M		138992	M0	8.5	7.8	38-	76		34	161	7S	
19	Dec	20	7	12	42.1	R		1848	K5	7.7	7.0	37-	75	-9	36	181	32S	
19	Dec	21	6	55	19.5	R		139528	K0	7.2	6.7	27-	62	-12	29	162	29N	
19	Dec	21	7	14	39.5	R		139525	G5	8.8	8.5	27-	62	-9	30	168	71N	
19	Dec	22	4	13	56.4	R		2080	G5	8.4	7.9	18-	50		5	115	59S	
19	Dec	23	5	24	23.4	R		2210	K0	6.8	6.4	10-	37		3	122	83N	
19	Dec	23	5	57	25.5	R		159300	K5	8.4	7.4	10-	37		7	128	44N	
19	Dec	23	6	31	58.8	R		159310	A5	7.7	7.5	10-	36		10	135	58N	
19	Dec	29	17	12	57.5	D		164398	K0	8.2	7.6	12+	41	-10	13	211	76N	
19	Dec	29	18	48	47.7	D		3150	F3	6.6	6.4	12+	41		4	231	82S	
19	Dec	30	17	45	58.1	D		164982	K1	8.5	7.9	19+	52		17	209	54S	
19	Dec	30	17	47	28.6	D		164984	K0	7.1	6.6	19+	52		17	209	67S	
19	Dec	30	19	21	0.2	D		165002	K2	8.8	7.9	20+	53		8	230	72N	
20	Jan	2	18	12	31.5	D		128824	F0	8.7	8.6	46+	85		34	185	64N	
20	Jan	2	19	14	33.4	D		128840	K2	8.8	8.1	46+	85		32	203	54S	
20	Jan	3	17	47	30.1	D		109787	K0	7.6		55+	96		38	165	82N	
20	Jan	3	18	6	31.3	D		109783	G5	7.3	6.7	55+	96		39	171	40N	

20	Jan	3	20	32	12.7	D	109815	K2	8.7	7.9	56+	97		34	215	42N	
20	Jan	3	23	43	33.3	D	208	F0	7.0	6.8	57+	98		11	260	86N	
20	Jan	4	20	30	32.0	D	306	F0	6.8	6.6	65+	108		42	204	85N	
20	Jan	4	21	37	29.5	D	110349	F5	8.3	8.1	66+	108		36	224	66N	
20	Jan	5	19	58	10.1	D	93150	F0	8.4	8.1	74+	119		48	178	75S	
20	Jan	5	20	0	22.0	D	93151	G5	8.4	8.1	74+	119		48	179	88S	
20	Jan	6	17	34	30.3	D	93523	G0	8.2	8.0	82+	130		37	117	66N	
20	Jan	6	18	5	43.1	D	93527	G0	8.5	8.2	82+	130		41	125	72N	
20	Jan	6	18	8	44.3	D	93528	G5	7.4	6.7	82+	130		41	126	80N	
20	Jan	8	19	24	15.2	D	77202	F8	8.2	7.8	95+	155		43	114	69N	
20	Jan	8	22	54	11.9	D	77293	O7	7.6	7.5	96+	156		58	189	56S	
20	Jan	9	0	58	11.6	D	851	A1	6.4*	6.4	96+	157		49	234	68N	
20	Jan	9	17	10	40.4	D	976	M3	2.9	2.0	99+	166	-8	17	75	40N	mu Gem
20	Jan	9	18	4	44.7	D	78352	A3	7.2		99+	167		24	85	75N	
20	Jan	9	20	12	46.9	D	997	A0	7.0	7.0	99+	168		42	111	89S	
20	Jan	9	23	58	42.7	D	78561	K2	7.4	6.6	99+	170		59	192	85N	
20	Jan	10	3	49	58.0	D	1033	A2	6.8	6.7	99+	171		34	263	34N	

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:
1/2/3/4 digits = Zodiacal catalogue (ZC) referred to as the Robertson catalogue (R)
5/6 digits = Smithsonian Astrophysical Observatory catalogue (SAO)
X denotes a star in the eXtended ZC/XC catalogue.
The ZC/XC/SAO nomenclature is used for Lunar work. The positions and proper motions of the stars in these catalogues are updated by Gaia.

Detailed predictions at your location for 1 year are available upon request.
Occultation Subsection Coordinator: Tim Haymes
tvh.observatory@btinternet.com

LUNAR GEOLOGICAL CHANGE DETECTION PROGRAMME 2019 Dec

Tony Cook

Firstly, I would like to wish our readers a festive holiday over the Christmas period with plenty of clear sky. Reports have been received from the following observers for Oct: Jay Albert (Lake Worth, FL, USA - ALPO) observed: Cepheus A, Grimaldi, Kepler, Menelaus, Theophilus and imaged several features. Alberto Anunziato (Argentina – SLA) observed Alphonsus, Censorinus, Mons Piton, Swift, Plato and Ross D. Anthony Cook (Newtown, UK – ALPO/BAA) videoed several features. Maurice Collins (New Zealand – ALPO/BAA/RASNZ) imaged: Alphonsus, Aristarchus, Aristillus, Blanchinus, Copernicus, Darwin, Eddington, Gassendi, Grimaldi, Heraclitus, Plato, Pythagoras, Schickard, Triesnecker, Tycho, Vallis Alpes, and took some whole lunar disk images. John Duchek (Carrizozo, NM, USA - ALPO) imaged Copernicus, Valerio Fontani (Italy – UAI) imaged Briggs. Rik Hill (Tucson, USA – ALPO) imaged Aristoteles, Barrow, Rupes Altai, Thebit, Theophilus, and several features. Thierry Speth (France – BAA) imaged Aristarchus, Grimaldi, and Herodotus. Franco Taccogna (Italy – UAI) imaged the Full Moon. Aldo Tonon (Italy – UAI) imaged Briggs. Ivan Walton (Cranbrook, UK – BAA) imaged Alphonsus and Aristarchus.

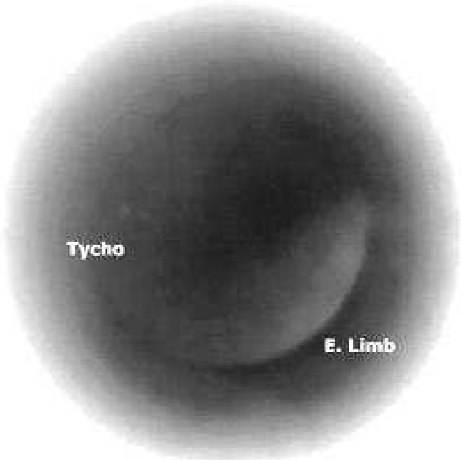


Figure 1. *Thermal IR image of the Moon captured by Anthony Cook during the 2007 Mar 03 lunar eclipse at 22:25 UT. White is hot and dark is cool.*

News: This newsletter is published both by ALPO's *The Lunar Observer* (TLO) and the BAA's Lunar Section Circular (LSC). BAA readers may be interested in some articles published in the TLO recently, namely thermal IR measurements from ALPO observer Daryl Williams in the Sep and Nov 2019 TLO. I wanted to highlight this as thermal imaging has come a long way since professional astronomers did this in the 1960s using scanning bolometers, and a brief experiment I mentioned in the April 2007 newsletter capturing the heat radiating away from large boulder-sized ejecta blocks outside Tycho during a lunar Eclipse (Fig. 1). Fig. 1 was made with an Indigo Omega (sometimes known as a ThermoVision™ A10) camera operating at Newtonian focus on an 8" reflector. The camera can in theory measure temperature differences as small as 0.1C, but in the unconventional way that I used it, the precise sensitivity is probably much poorer. The image size was only 160x128 pixels and the camera had a fixed focus lens that I could not remove. Such cameras cannot see through ordinary glass so I had to improvise and use a spare Germanium lens as an eyepiece for eyepiece projection. The set up was far from ideal as the telescope mirror was aluminium coated instead of the more traditional gold coating that one finds on professional scopes, and I had heat radiating off the telescope tube and the sides of the draw tube – hence why the image has the white border around it. Furthermore, I had to turn the automated calibration and flat fielding off once the Moon was well into the eclipse as the heat from the Moon was fading fast and the telescope heat started to dominate. Anyway, despite this I was able to detect the radiated heat from the Moon falling away quickly once the penumbra, and umbra started to cover. What was really fascinating for me was how Tycho sits there glowing hot, eventually becoming the hottest remaining object on the Moon – you can see it as a white blob just up from the 'o' in 'Tycho' in Fig. 1. Unfortunately, the experiment made back in 2007 was too poor resolution and wasn't really going anywhere, so further work was moth-balled.

Roll on twelve years and what is really exciting about Darryl's work is the amazing improvement in image resolution that he is achieving. The potential uses for looking for changes on the Moon are immense. Whilst thermal imaging of the Moon has been undertaken globally by missions such as Clementine in 1994 and the **Diviner** instrument on NASA's Lunar Reconnaissance Orbiter, these cover very small fields of view, fleetingly as the spacecraft orbit the Moon at 1 km/s. A system such that Darryl has set up could detect effects lasting many seconds, and cover very large regions of the nearside in one shot. Possible phenomena that could be detected (note the last two are speculative) could include:

The heat decay from impacts on the day and night side.

Ejecta from impacts on the night side, near the terminator, making it into sunlight and warming up, as was detected with the SMART-1 impact.

Heat generated from friction during localised shallow (violent) moonquakes – though these are rare as at around 5-6 per year, they are slightly more frequent during apogee and perigee and are sometimes associated with lobate scarps.

If gas were to be leaking, albeit perceptibly very, very, slowly (trickling) from the lunar surface, this might offer a means to cool the surface slightly below the temperature of the surrounds, during its release and hence could be detectable as transient cold spots.

So please keep an eye out for future article by Darryl in the TLO as this is very exciting work and he should be congratulated on these pioneering efforts in Earth-based lunar thermal IR imaging.

TLP reports: No TLP reports were received in October.

Routine Reports: Below are a selection of reports received for Oct 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. Note that some observations sent in have not been used in this newsletter because they do not cover repeat illumination predictions. However, they will be kept in our database and used as reference images should a TLP be reported under similar illumination in the future.

I am still in the throes of a heavy teaching workload at University, and so although trying to list as many observations as possible, I will not be providing, much in the way of analysis. Instead, readers of this newsletter, are invited to read the original TLP descriptions and judge for themselves whether these repeat illumination (or in some cases both repeat illumination and topocentric libration) observations explain what was originally seen. When I get some freedom, in a month's time, I will reassign weights, if necessary, to the original TLP reports.

Mons Piton: On 2019 Oct 06 UT 01:30 Rik Hill (ALPO/BAA) imaged the Cassini to Caucasus area under both similar illumination and topocentric libration (within ±1.0º), and within similar illumination (within ±0.5º), respectively, to the following two reports:

[REF 14] *Mt Piton 2001 Sep 24 UTC 19:25-19:55 Observed by Marie & Jeremy Cook (Frimley, Surrey, UK) described Mt as the brightest point on the terminator flaring seen on the southern end and red in colour. Observers really thought it was normal (not a TLP) to be this bright and the flaring was spurious colour. Worth checking out just in case, and also because it looks spectacular. ALPO/BAA weight=1.*

[REF 15] *On 1987 Jun 04 at UT02:26-03:26 D. Darling (Sun Praire, WI, USA, S=G and T=4) observed that Mons Piton was the brightest object on the Moon that he had ever noted before. Variations seen gave the mountain a "silvery" shine. The abnormal brightness was confirmed by another independent observer. The Cameron 2006 catalog ID=302 and the weight=5. the ALPO/BAA weight=2.*

Rik's image appears on page 4 of this issue.

Alphonsus: On 2019 Oct 06 UT 23:10-23:20 Alberto Anunziato observed this crater under similar illumination (within ±0.5º) to the following two reports:

[REF 16] *Alphonsus 1967 Aug 13 UT 18:40-18:55 Observed by Horowitz (Haifa, Israel, 8" reflector?) "Glow or hazy patch seen while using filters. Brighter than background. Not seen after 2055 or next nite" NASA catalog weight=3. NASA catalog ID #1041. ALPOP/BAA weight=2.*

[REF 17] *On 1990 May 03 at UT 02:03 D. Darling (Sun Praire, WI, USA, seeing steady) observed a point of light inside Alphonsus just to the north of the central peak, along the "center ridge". It was seen again, half way between the central peak and the noth west rim - along the ridge. All other features were normal. The Cameron 2006 catalog ID=403 and the weight=3. The ALPO/BAA weight=3.*

Alberto was using a 105 mm Maksutov-Cassegrain (Meade EX 105) at a magnification of 154x. He could see quite clearly, with detail, the central peak, but none of the other events reported.

Copernicus: On 2019 Oct 08 at various times from 01:42-05:22 John Duchek (ALPO) imaged this crater and some of his images covered the following repeat illumination (within ±0.5º) events:

On 2006 Jun 05 UT sometime during 21:00-22:00 G. Burt (SPA) made a drawing over a period of 30 minutes. Upon examining drawing, and comparing with photos made under similar illumination was struck by the abnormality of a small white blob in the north east corner of the shadowed floor. There should be no raised topography between the wall and the central peaks that could give rise to this. The making of the sketch overlapped with an earlier drawing made by Rony de Laet (Belgium) which did not show this blob. Subsequent attempts to find sketches/images at very similar illumination angles have failed to show the blob in the north east corner of the shadowed floor. ALPO/BAA weight=3.

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

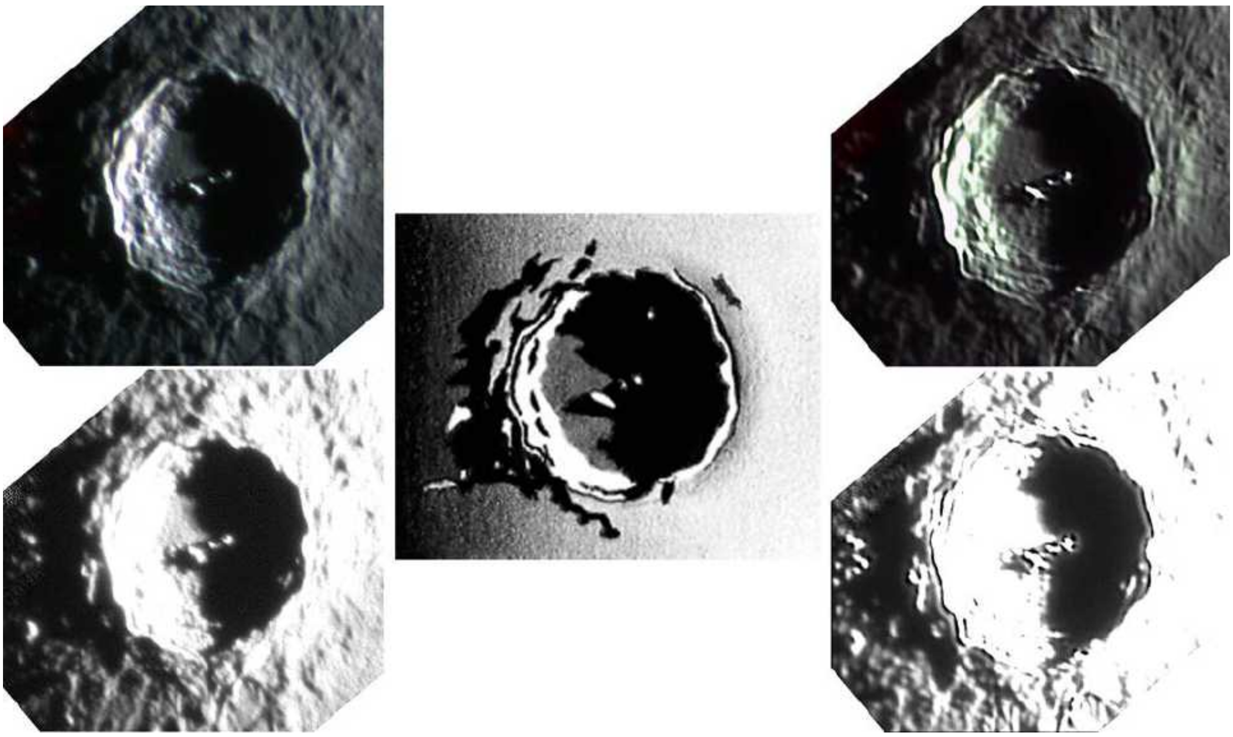


Figure 2. *Copernicus orientated with north towards the top.* ***(Top Left)*** *Colour image by John Duchek (ALPO) taken on 2019 Oct 08 UT 04:39 with colour saturation increased.* ***(Bottom Left)*** *Same image by John Duchek (ALPO) but colour removed and contrast stretched to bring out detail in the shadow.* ***(Top Right)*** *Colour image by John Duchek (ALPO) taken on 2019 Oct 08 UT 05:20-05:22 with colour saturation increased.* ***(Bottom Right)*** *Same image by John Duchek (ALPO) but colour removed and contrast stretched to bring out detail in the shadow.* ***(Centre)*** *A sketch by Geoff Burt (SPA) made on 2006 Jun 05 made in a 30-minute period sometime between 21:00 and 22:00.*

John took a number of high-quality colour images during the repeat illumination window. The two extremes of which are shown in Fig. 2 for the Geoff Burt TLP repeat illumination window. For the Le Franc TLP, Fig. 2 (Right) is the most similar in terms of illumination. Unfortunately, we appear to have no sketch for the 1990 event remaining in the ALPO/BAA archives - just the written description published in the BAA Lunar Section Circular.

Briggs: On 2011 Oct 11 UT Valerio Fontani (UAI) and Aldo Tonon (UAI) imaged this crater under similar illumination (selenographic colongitude in the range: 67.1ºto 68.0º) to the following Perter Grego report:

On 2010 Apr 27 at UT 00:10-00:30 and 01:45-02:00 P. Grego (St Dennis, UK, 20 and 30cm reflectors) noticed a craterlet just to the east of Briggs and an E-W trending lineament or wrinkle ridge that did not show on NASA LAC charts. Further checks did not reveal it on Lunar Orbiter mosaics, or on very recent LROC images of the area. Possibly these are very low relief features that show only under very shallow illumination conditions. The ALPO/BAA weight=1 until we get confirmation at repeat illumination.

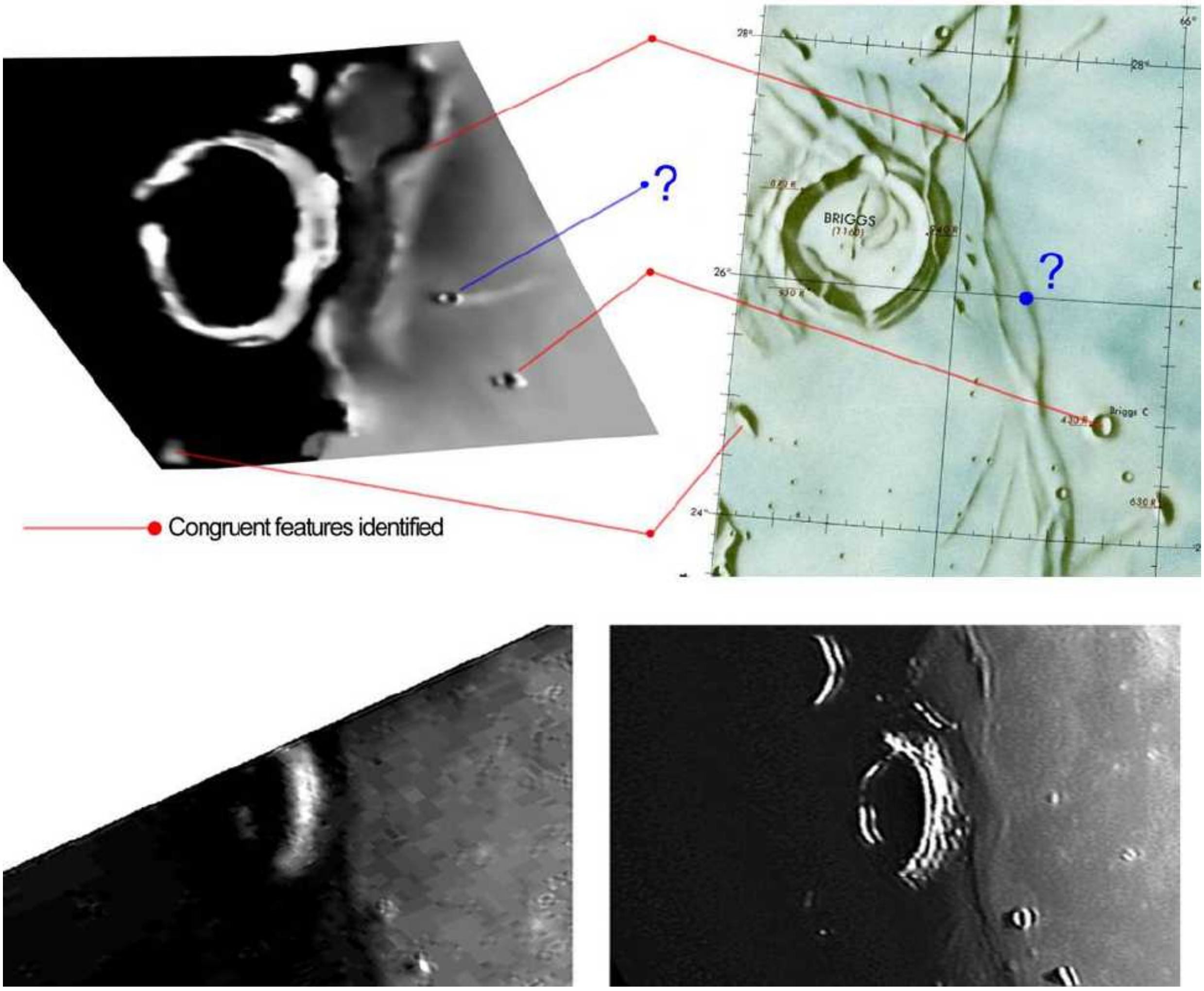


Figure 3. *Briggs orientated with north to the top right.* ***(Top Left)*** *A sketch by Peter Grego based upon PDA sketches made on 2010 Apr 27 at UT 00:10-00:30 and 01:45-02:00.* ***(Top Right)*** *A portion of p23 from the Times Atlas of the Moon that Peter Grego had labelled. The red lines show features that are common to his sketch and the map. The blue refers to a crater that he saw but the map does not show.* ***(Bottom Left)*** *An image by Valerio Fontani (UAI) taken on 2019 Oct 11 at UT 20:11 – this has been subtracted from a much larger image and rescaled and re-orientated.* ***(Bottom Right)*** *An image by Aldo Tonon (UAI) taken on 2019 Oct 11 at UT 20:39. This too has been cut out from a larger image, rescaled and re-orientated.*

Fig. 3 is a good comparison between modern day images and Peter Grego's sketch. It is certainly clear on all of these where the wrinkle-ridges lie to the east of Briggs. Briggs C is clearly visible on both the UAI images. It is not certain where the crater with a blue question mark (Fig. 3 Top right) lies on the UAI images, unless it is either a piece of highland visible in Fig. 3 (Bottom right) on the wrinkle-ridge, or a mis-identification of the northernmost of a couple of craterlets NE of Briggs C.

Aristarchus: On 2019 Oct 11 UT Thierry Speth (BAA) imaged the crater in red and blue filters under similar illumination and topocentric libration to the following two events

On 1975 Mar 25 at UT18:50-20:50 P.W. Foley (Kent, UK) observed blue/grey in Aristarchus. The ALPO/BAA weight=1.

On 1983 Sep 20 at UT 05:08-06:13 Louderback (South Bend, WA, USA, 3" refractor, x150, seeing poor and chromatic aberration on the limb) detected "purple" in the vicinity of Aristarchus crater and this was strongest on the north and north west external rims, however there was no "violet glare" from inside the crater. However, the region of the central peak was very bright - though he could not detect the central peak. The brightness of the TLP was 4.5 and it should normally be 3 (nimbus area). Near the "big plain" it was 7. The chromatic aberration seen on the crater. There was also violet on the northern wall of Herodotus crater and the Cobra Head. It appeared dark blue in the blue filter"; the surrounds remained gray". Apparently on the 26th the "ring was still dark with faint violet - nearly normal". Cameron comments that the TLP was due to spurious colour. The Cameron 2006 catalog ID=229 and the weight=3. The ALPO/BAA weight=2.

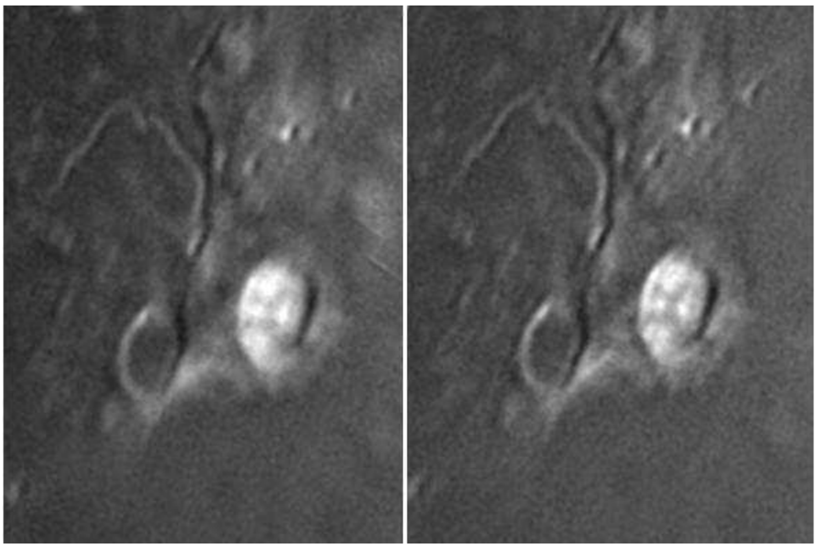


Figure 4. *Aristarchus as imaged by Thierry Speth on 2019 Oct 11 and orientated with north towards the top.* ***(Left)*** *Blue filter image taken at 21:21UT.* ***(Right)*** *Red filter image taken at 21:22UT.*

The images that Thierry took (Fig. 4) give us a good indication of what Foley and Louderback should have seen in respective blue and red components of the spectrum – if they had used filters. Remember that blue should show up brighter in a blue filter image and red brighter in a red filter image. Of course, Rayleigh scattering complicates things as it loses some definition down the blue end of the spectrum by yielding more scattered light or diffuseness in normally dark areas as well as some image flare from bright areas.

Darwin: On 2019 Oct 12 UT 09:38 Maurice Collins imaged Darwin under similar illumination (within ±0.5º) to the following report:

Darwin 1945 Oct 19 UT 23:23 - P. Moore (UK) saw 3 brilliant points of light on wall. 12" reflector used. NASA catalog ID #495, NASA weight=3. ALPO/BAA weight=3.

Figure 5. *Darwin, located in the centre of the image, as captured by Maurice Collins on 2019 Oct 12 UT 09:38 and orientated with north towards the top. Image has been colour normalised and had the colour saturation increased to 40%.*

In the image that Maurice took (Fig. 5), it is uncertain on which wall, east or west, Patrick Moore saw three brilliant points of light. But if it was on the south west wall (over exposed in this image), then maybe they refer the west rims of the three small craterlets here?

Aristarchus: On 2019 Oct 13 UT 18:56 Franco Taccogna (UAI) imaged the Full Moon when the crater Aristarchus was similar illumination (within ±0.5º) to the following report:

Aristarchus 1976 Jan 16 UT 22:00-23:15 Observed by P.W. Foley (Wilmington, Kent, UK, seeing II) - Aristarchus was tremendously bright. No colour seen. ALPO/BAA weight=1.

Figure 6. *The Full Moon as imaged by Franco Taccogna (UAI) on 2019 Oct 13 UT 18:56, and orientated with north towards the top right.*

In terms of relative brightness, against an immediately adjacent dark mare background, one can say that visually Aristarchus looks stunningly bright, in Fig. 6, compared to other features on the Moon. But in terms of absolute brightness, just by measuring digital number values in the image, we get in order of brightness: Censorinus (255), Proclus (252), bright spot near Hell (240), Aristarchus (236), Tycho (198) – so in an absolute sense Aristarchus is not the brightest feature on the Moon at this time.

Alphonsus: On 2019 Oct 18 UT 22:48 Ivan Walton (BAA) imaged this are under similar illumination (within ±0.5º) to the following report:

Alphonsus 2002 Sep 27 UT 00:00-02:15 Observed by Clive Brook (Plymouth, UK) "Central peak was bright 00:00 UT but had faded by at least 2 deg on the Schroter scale - no colour seen. Observer continued observing until 02:15 UT but central peak had dimmed considerably by then". ALPO/BAA weight=2.

Figure 7. *Alphonsus as located at the centre of the image and orientated with north towards the top. Image taken by Ivan Walton (BAA) on 2019 Oct 22:48.*

Although Ivan's image covers a large area of the Moon, you can at least just see the location of the central peak in Alphonsus in Fig. 7, as well as three of the dark spots on the floor.

Grimaldi: On 2019 Oct 25 UT 10:30-10:50 Jay Albert (ALPO) observed visually this area under similar illumination (within ±0.5º) to the following report:

Grimaldi 1938 Mar 28 UT 09:30 Observer: Firsoff (Glastonbury, UK - 6" reflector) - Slight greenish colour - {Note the UTC given in the NASA catalog is 09:30 which is in daylight here in the UK - possibly the catalog is wrong, else the observer was observing in daylight, but worth checking out just in case}. NASA catalog ID No. #433 and NASA weight=4. ALPO/BAA weight = 3.

Jay was using just Celestron 7-21x50mm tripod mounted binoculars, but at a magnification of x21. He saw, through these binoculars, a strong green fringe along the lit edge of the crescent. This gave the impression of the dark floor of Grimaldi a having slight greenish tint, in contrast to the bright sunlit west limb of the Moon. He goes onto say that in his view that the green color was due to the optics of the binoculars and nothing to do with the Moon. We have covered this TLP before in the 2018 Feb edition of this newsletter.

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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