Acting Director: Anthony Cook.
Editor: Barry Fitz-Gerald.

LUNAR SECTION CIRCULAR

Vol. 58 No. 12 December 2021

From the Director:

We had a “nearly” total lunar eclipse on Friday 2021 Nov 19, and apparently the longest partial eclipse in six hundred years. As it was 97% partial it was a very close run thing to a total eclipse for those lucky enough to see it. Although I have received no reports from the UK, as it was barely into first contact before it set, we have been emailed some images from overseas, which I am pleased to include in this circular.

On another interesting note in 2022 we have been asked to provide a Lunar Section meeting at the BAA’s Winchester Weekend. A date for your diary is 2022 Apr 09. More details will be included in a later LSC, and especially look out for how to attend in the Feb BAA journal. For now we have speakers: Barry Fitzgerald on “Lunar Geology - Old Lunar Questions Revisited”, Tim Haymes on “Lunar Occultations from a Personal Perspective”, Nick James on “New Space Missions and the Prospect for Future Low Cost Lunar Exploration”, and myself on “Lunar Impact Flashes and How to Observe Them”. It has been a while since we held a Lunar Section meeting before and you can understand that factors may affect whether this is an in person meeting or not, but let us hold out hope as it would be really great to meet some of our readers.

Hope you enjoy the December edition of the circular and we wish all have a wonderful Christmas.

Tony.

…..

Correction:

The last LSC read "Vol. 59 No. 11 November 2021", it should have read "Vol. 58 No. 11 November 2021". (Thanks to Stuart Morris)

…..

Correspondence Received this month.

From John Fairweather:
A UK Lunar Rover.

I expect you have heard about the UK Lunar rover being launched in 2022, probably should have gone up in 2021, but they changed launchers - https://spacebit.com/ . (I see there are quite a lot of lunar landings in the pipeline - List of missions to the Moon - Wikipedia).

From Keith Burrell:
Will Future Lunar Satellites Interfere with Earth-Based Observations of the Moon?

I'm contacting you / Lunar Section to hopefully get your thoughts about the future Launch to provide the first stage deployment of a 'constellation' of Lunar orbiting communication micro cube satellites. The aim is to eventually have 24 in orbit, 4 different orbits used with 6 microsatellites in each orbit to provide communications coverage. See: https://www.argotec.it/online/what-we-do/small-satellite-unit/#tab-5

Description :- ANDROMEDA is a microsatellite constellation that will provide continuous real-time data access for third-party users in the lunar environment. The high-speed communication solution will be compatible with current and future missions and will be able to offer a multi-user service with global coverage of the Moon and 24/7 coverage of high-interest areas, such as the south pole. This constellation will greatly simplify the communication with the lunar users, proving seamless end-to-end connectivity with different users, such as small satellites, surface assets, and astronauts/space explorers. ANDROMEDA will make easier the exploration and the exploitation of the Moon.

As I'm also a Fellow of the British Interplanetary Society (BIS) I attended a virtual event organised by the BIS Italia Branch and the Member who is the Project Manager in Argotec for the Andromeda Constellation Project. As we have serious issues with thousands of Constellation Satellites in LEO (e.g Space X's Starlink) I raised the question about the Andromeda Constellation microsatellites albedo / reflectivity and whether any design criteria was employed to reduce this issue for Astronomers. Informed that their first batch design did not include this aspect but initial thinking was that their satellites would be too small to be noticed they may look at this aspect. My view was that they were thinking of the physical size of the microsatellites (3m across solar panels) not their reflectivity impact (especially with astrophotography). As a follow up to this answer I would like to provide some additional feedback about possible impact on Lunar Observation, especially involving astrophotography, looking for TLPs etc. with a Lunar Orbiting satellite and its solar panels reflectivity crossing the image. It will be bad enough with the LEO Constellations crossing the FOV!

Appreciate any thoughts the Section may have which I can pass on to stimulate thinking about this matter of 'Reflectivity' affecting Lunar Observing from Earth.

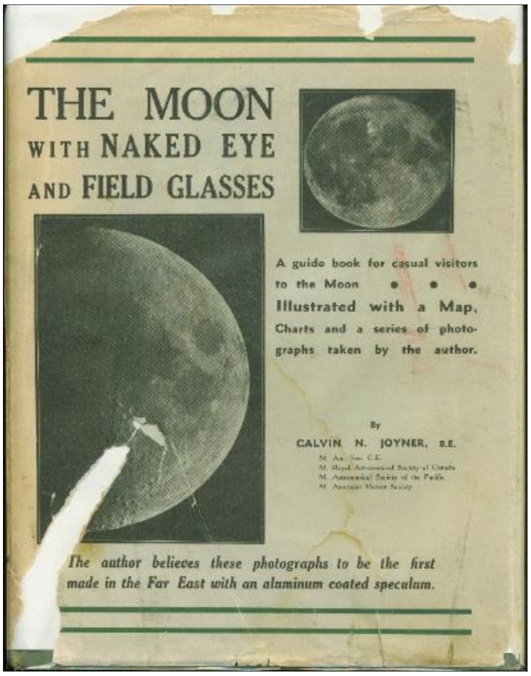
From: James Dawson:
Old books on the Moon…

WorldCat lists over 9,000, English language, non-fiction, non-juvenile, printed books on our natural satellite. I thought I had a lot of books on the Moon, but clearly I'm missing a few…

Last year whilst searching online for a book I stumbled on *The Moon with Naked Eye and Field Glasses* by a Calvin N Joyner. The book was under £30 and I couldn't see much reference to the book or the author online so I ordered it.

This hardback book is 135 pages long, and my copy came with a dustjacket, albeit a tatty one. It was self-published by the author in November 1936 in Tientsin, China and carries the subtitle *A guide book for casual visitors to the Moon. Illustrated with a Map, Charts, and a series of photographs taken by the author. A*nother eye catching statement on the cover is that *The author believes these photographs to be the first made in the Far East with an aluminum [sic] coated speculum.*

There are eleven photographs of the Moon at different phases of illumination, each accompanied by a sketch to identify the salient features on display during the phase in question. The photographs are adequate but not as clear or as well reproduced as the ones in Walter Goodacre's book which was also published in the 1930s. The text describes the more prominent lunar features which can be seen with the naked eye and with *field glasses*. There is discussion on how the topography of the lunar surface likely came about, with much mention of volcanic activity, but the emphasis of the text is mostly to describe the features and their relationship to one another for the casual observer.



The author clearly has a sense of humour which isn't commonly revealed in non-fiction astronomy books of this era. After a comprehensive bibliography, Joyner writes "*The last mentioned [Amateur Telescope Making by Ingalls] is a dangerous volume. The amateur astronomer who turns amateur telescope-maker is lost indeed. There is no turning back. But the true devotee this is the book, and rich are his rewards."* A pocket on the inside of the back board of the book contains a 30" x 30" printed map of the Moon. The map is coarsely drawn and has a naïve appearance, but the major features are shown and the labels are big and clear. A grid pattern is overlain allowing features to be looked up in a legend in the book and system of letters and numbers allow the reader to find any of 300 listed objects. I can't see another copy of this book in a library, but I presume there must be others out there despite there being no indication of how many copies were originally printed. There are two copies for sale on the internet as of today (24th November 2021) and one of these has a very similar inscription on the inside cover by the author. My copy was signed by the author on December 1st 1936 in Tientsin, China.

I've done some research online to learn more about Calvin N Joyner and it is not one which I can find mentioned in the JBAA or MNRAS. Most of the information I've learnt about Calvin Joyner was from his obituary which appeared in the *Washington Post*, 26th August 1979. Calvin Nicholas Joyner was born on 11th February 1899 in Monterrey, Nuevo Leon, Mexico. He studied and graduated from Tulane University in New Orleans after serving in the Army Corps of Engineers in World War I. He moved to China in 1921 (presumably after he graduated) and worked as a civil engineer until he left China in 1939 to work in Ruston, Louisiana. In 1943 he was back in China and in 1946 moved to Korea and in 1947 represented Korea in the US-Soviet negotiations on the future of Korea. He was in Washington in 1949 working with the Air Force in strategy. Between 1953 and 1963 Calvin was a consultant on strategic targeting in the office of the Army's Chief of Staff for Intelligence. I presume he retired in 1963, and he passed away in 1979 aged 80 at his home in McLean, Virginia. Calvin met his first wife, Isabel Francis Joyner, whilst in China and had three sons with her, all born in China, but sadly she died in 1946. He was survived by his second wife, Ruth Newcomer, and his sons. Calvin Joyner was a life-long Mason and a member of the Rotary Club, both of which he was a prominent figure in, both in America and in China whilst living there.

I've been unable to find out any further information about his astronomical pursuits, but it is clear he had the skills and the equipment to take lunar photographs through a reflecting telescope, though I'm unsure about his claim about being the first to photograph the Moon with an aluminum [sic] coated speculum in the Far East.

My copy of the book has some water damage, and the dust jacket is torn, but it is a fascinating book. My copy seems to have originally been given to one of Joyner's former teachers based on the inscription and some letters and Christmas cards inside from Joyner. Part of the pleasure of old books are the fragments of history left inside from previous owners, and the stories they turn up on a big of digging.

…...

OBSERVATIONS RECEIVED:

Observations have been received from the following:

Leo Aerts (Belgium), Peter Anderson (Australia), Maurice Collins (New Zealand), James Dawson (UK), Dave Finnigan (UK), Rik Hill (USA), Rod Lyon (UK), Manolo Rodriguez (Spain), John Tipping (UK), and Alexander Vandenbohede (Belgium).

Clavius.

Image (Fig.1) taken by taken by Leo Aerts on 2021 Nov 29 UT 05:13.

Leo says that this was his best ever Clavius image, taken with his C14, using a red filter and webcam ASI 290MM.

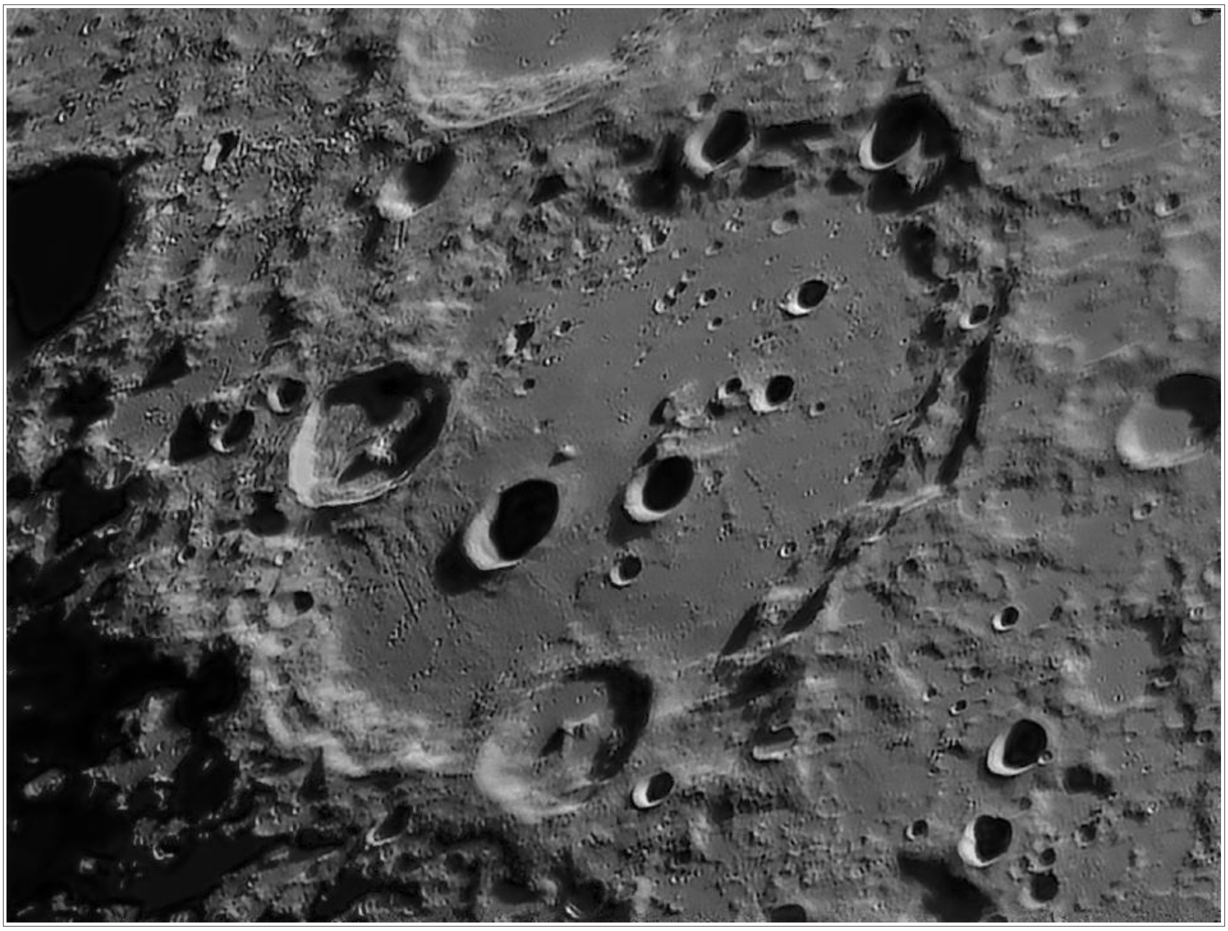


Fig.1 Clavius by Leo Aerts

Mare Smythii.

Image (Fig.2) taken by John Tipping. Details in caption below.

Mare Smythii is a 373km diameter pre-Nectarian impact basin on the SE limb of the Moon. Pre-Nectarian is one of the earlier era basins and they are often highly degraded.

Fig.2. Mare Smythii taken by John Tipping on 2021 Nov 13 UT 21:11 using a SkyWatcher 180mm Mak/Cass telescope and ZWO 120mm colour camera

Gassendi.

Image (Fig.3) by Dave Finnigan. Date, UT, etc as given in the image.

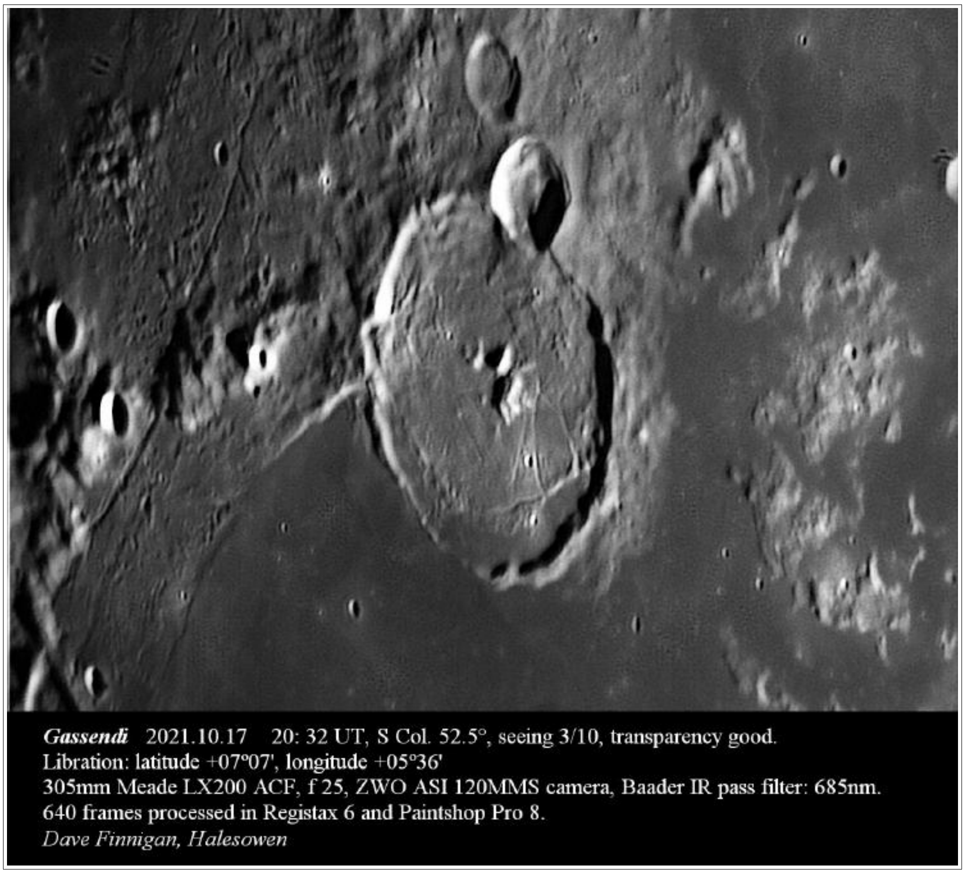


Fig.3 Gassendi by Dave Finnigan

Gassendi is a 100 km diameter crater on the NW shoreline of Mare Humorum, well known for its fractured floor and was a very popular TLP site in the 1960's through observations made by Patrick Moore from Armagh, Northern Ireland. You can also see Rimae Mersenius to the west.

Rupes Recta.

An image by Alexander Vandenbohede (Fig.4) taken on the date and UT given in the image.

Rupes Recta is a nearly 300m high linear fault (actually 5 segments) that lies on the SE interior edge of Mare Nubium. It is 110 km in length, but the slope is a lot shallower than it looks. The southern end of the fault ends in the Stagg's Horn Mountain.

Fig.4 Rupes Recta by Alexander Vandenbohede

The Gibbous Moon.

A natural colour image of the Moon (Fig.5) taken by Manolo Rodriguez on 2021 Nov 15.

Manolo comments: *"I am sending you the link to my recent moon image, posted in the member community gallery. I wanted to make a good size mosaic and although the seeing was not optimal I did not dislike it."*

Fig.5. Gibbous Moon by Manolo Rodriguez

Schiller.

An image by Rod Lyon (Fig.6). See image for date, UT, etc.

Schiller is a large oblique impact crater (179x71 km) in the SW quadrant of the Moon. It is a complex crater, but instead of a central peak has an offset central ridge on its northern floor and a break in its southern rim.

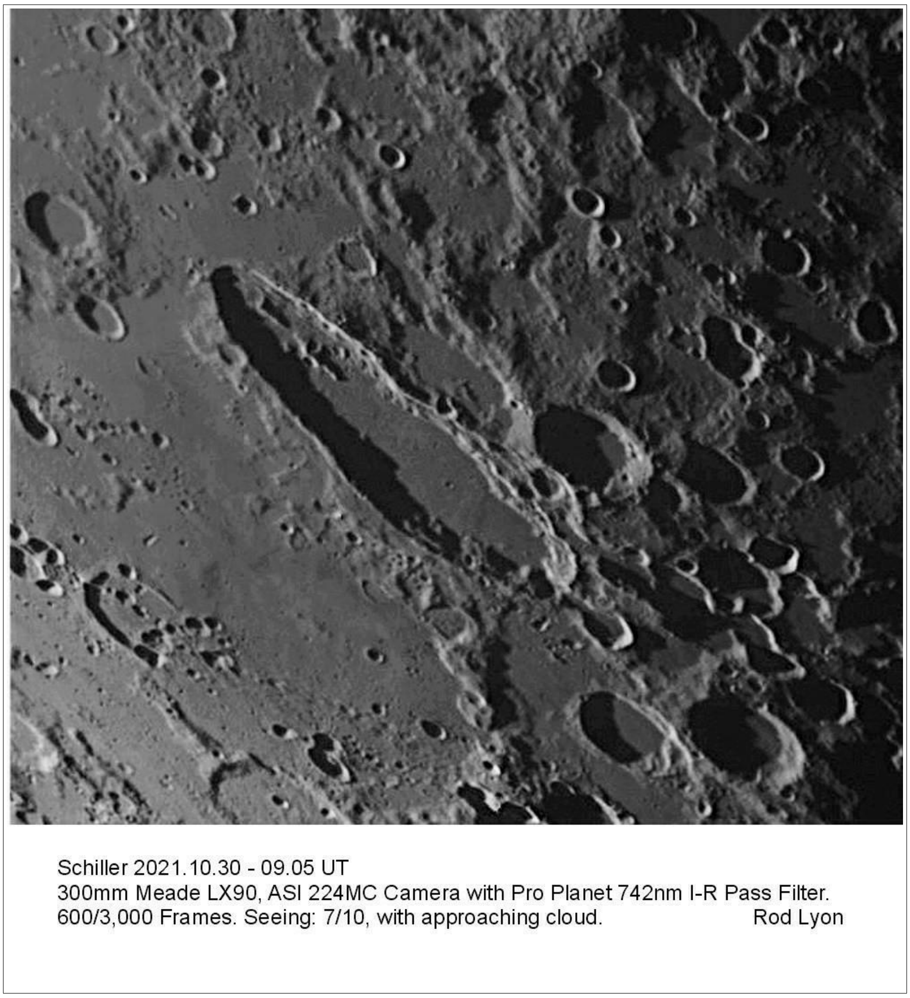


Fig.6 Schiller by Rod Lyon

Albategnius and Hippachus.

Images taken by James Dawson (Fig.7) using a Celestron C14 SCT with a ZWO ASI 224 MC camera. Originally from an animated GIFF, the two images have been extracted and placed side by side for comparison. (Left) on 2020 Nov 07. (Right) on 2020 Nov 28.

Fig.7 Albategnius and Hippachus by James Dawson

Partial Lunar Eclipse : 2021 Nov 19th.

Image sequence by Rik Hill, Tucson, Arizona (Fig.8), USA.

Fig.8 by Rik Hill

Partial Lunar Eclipse

Image (Fig.9) by Maurice Collins, Palmerston North, New Zealand, at 09:51UT.

Fig.9 by Maurice Collins

Partial Lunar Eclipse

Image (Fig.10) by Peter Anderson at 09:12UT from The Gap, Brisbane, Australia.

Fig.10 by Peter Anderson

All observers complained about not being able to capture the eclipse with their main telescope or having problems with clouds, but at least they caught it unlike from the UK.

…..

Lunar Occultations December 2021

by Tim Haymes

Time capsule: 50 year ago in the December 1971 issue:
[*With thanks to Stuart Morris for the LSC archives.* https://britastro.org/downloads/10167]

1. Water Detected on the Moon: Dr.J.W.Freeman announced on Oct 15th that a water cloud that erupted like a geyser from a crack in the surface was detected by Apollo instruments.
2. G W Amery (Reading) and D Hall, report Occultation Observations for 1970 and 1971 with O-C values for comparison.

An Apology.
Apologies for the lack of discussion points in this edition, but I was caught napping. I hope to redress this in January. May I wish all observers a good Christmas and some clear skies. I've not managed to obtain a single Lunar Occ in the second half of 2021. The weather has simply not cooperated. I hope I can report a modicum of success before the year ends.

Best wishes, Tim.

Eta Leonis Dec 24th
I draw observers' attention to eta Leo on December 24.
http://www.lunar-occultations.com/iota/bstar/1224zc1484.htm It would be very nice to see an observation from the UK if possible.

Occultation predictions for North Oxfordshire, 2021 December:
Longitude 1 18 46 W , Latitude 51 55 41 N, Alt. 119m;
Some fainter predictions may be omitted near Full Moon. Mag Limit 9.0

y	m	day d	Time h	m	s	P	Star No	Sp	Mag v	Mag r	% ill	Elon	Sun Alt	Moon Alt	Az	CA	Notes
21	Dec	1	4	6	35.3	R	139460	G5	9.0	8.6	14-	43		3	107	50S	
21	Dec	1	5	10	19.8	R	139493	F5	8.0	7.8	13-	43		12	119	17N	
21	Dec	2	5	41	46.8	R	2087	K3	8.8	8.0	6-	29		4	119	73S	
21	Dec	2	12	47	44.2	DB	2118	A3	2.8	2.7	5-	25	15	14	219	-46S	Alpha Lib
21	Dec	2	13	38	48.6	RD	2118	A3	2.8	2.7	5-	25	13	9	230	57S	Alpha Lib
21	Dec	7	17	30	34.3	D	2978	A6	8.2	8.0	16+	47		9	208	73S	
21	Dec	7	18	5	15.1	D	189293	K0	8.9	8.3	16+	48		6	216	55N	
21	Dec	8	17	24	32	D	190325	F2	8.4	8.2	25+	61		15	195	18S	
21	Dec	8	17	29	56	Gr	190325	F2	8.4	8.2	25+	61		15	**	GRAZE:	nearby
21	Dec	8	17	35	38	R	190325	F2	8.4	8.2	25+	61		15	198	2S	
21	Dec	8	18	3	56.4	D	3141	K3	5.8	5.0	26+	61		14	204	79N	35 Cap
21	Dec	9	17	4	33.8	D	3276	G0	7.3	7.0	36+	73	-10	22	178	9N	
21	Dec	10	17	30	35	M	3408	G8	7.1	6.5	46+	86		26	172	10S	
21	Dec	10	17	30	38	M	X184943		7.8	7.3	46+	86		26	172	10S	
21	Dec	10	19	54	48.8	D	165594	F8	9.0	8.7	47+	87		23	210	85S	
21	Dec	11	17	41	17.6	DD	3529	G5	6.6*	6.0	57+	98		31	162	56N	Dbl*
		3529 is double: ** 7.6 7.6 0.10" 90.0, dT = +0.14sec															
21	Dec	11	18	25	18.5	D	147032	F5	7.8	7.6	57+	98		32	174	89N	
21	Dec	11	18	25	58.9	D	147033	K0	7.7	7.0	57+	98		32	174	81S	
21	Dec	11	18	51	57.7	RB	3529	G5	6.6*	6.0	57+	98		32	183	-78N	Dbl*
		3529 is double: ** 7.6 7.6 0.10" 90.0, dT = +0.27sec															

```
21 Dec 12 19 50 13   M  128962 G5  8.5  8.0   67+ 110      38 187  12S
21 Dec 12 20 31 29.3 D  109473 G0  8.2  7.8   67+ 110      37 200  44N
21 Dec 12 21 36 25.8 D  109496 K0  8.4  7.7   68+ 111      32 218  90S
21 Dec 12 22 46 37.0 D     110 G0  8.8* 8.5   68+ 111      25 236  33N
21 Dec 13 18 29 28.5 D  109931 G0  8.5  8.2   76+ 121      40 148  46N
21 Dec 13 19 58 43.9 D  109961 G5  8.9* 8.3   76+ 122      44 177  45S
21 Dec 14 20 16 40   M   92875 G0  8.7  8.4   84+ 133      48 168  12S
21 Dec 14 23 57  2.5 D   92910 G0  8.9  8.6   85+ 134      36 240  68N
21 Dec 15  0 49  7.2 D   92923 F0  8.5* 8.2   85+ 134      28 252  56S
21 Dec 15  1 53 42.3 D     355 F5  7.4  7.1   85+ 135      19 265  45N
21 Dec 15 18 10 47.2 D     445 F8  7.3  7.0   90+ 143      36 114  83N
21 Dec 15 18 22 37.7 D   93238 F2  7.8  7.4   90+ 143      38 117  75S
21 Dec 15 21 39 21.6 D     450 K3  6.4  5.6   91+ 144      54 183  11N
21 Dec 15 21 55 18   Gr    450 K3  6.4  5.6   91+ 144      52 ** GRAZE: Nearby
21 Dec 15 22  9 11.7 R     450 K3  6.4  5.6   91+ 144      53 195 -32N
21 Dec 16  1  7 33.4 R   93318 A5  7.9* 7.7   91+ 145      35 249  27S
21 Dec 16  1 55  3.3 D   93331 K5  7.5* 6.6   91+ 146      29 260  45S
21 Dec 16  2 19 36.5 D     466 A2  7.3  7.2   91+ 146      25 265  60N
21 Dec 16 19 33  4.5 D   93629 F0  8.5  8.3   95+ 155      45 121  81S
21 Dec 16 21  7  0.4 D   93645 K0  8.4  7.8   95+ 155      55 151  79N
21 Dec 17  0 11  3.4 D     583 A   8.8* 8.6   96+ 156      52 225  68N
21 Dec 17  2 37  0.6 D   76384 G4  8.7  8.3   96+ 157      32 262  58N
21 Dec 17  2 41 45.6 D   76386 A0  8.1  8.0   96+ 157      32 263  49N
21 Dec 17  2 42 32.8 D     595 K1  6.8  6.2   96+ 157      31 263  73S  Dbl*
       595 is double: ** 7.6 7.6 0.10"  90.0, dT = +0.25sec

21 Dec 20 21 23 25.3 R   79273 A2  8.6  8.5   97- 161      38  96  71N
21 Dec 20 22 35 50.3 R    1112 A2  8.8  8.6   97- 160      48 112  56N
21 Dec 21  0  6  0.8 R   79351 B9  8.9  8.9   97- 160      59 140  89S
21 Dec 21  3 29 51.5 R   79423 G5  8.8  8.4   97- 159      56 230  69S
21 Dec 21  4 17  6.0 R   79444 K2  8.5  7.8   96- 158      50 244  52N
21 Dec 21  6 44  4.1 R   79521 G2  7.4  7.0   96- 157      28 276  68S
21 Dec 21  7 15 22.2 R   79535 K0  8.3  7.8   96- 157   -8 23 281  71S
21 Dec 21 19 34 16.6 R    1225 K0  8.1  7.5   93- 150      13  68  73S
21 Dec 22  1 29  4.3 DB   1251 B9  5.9  5.9   92- 148      60 154 -26N  Lambda
Cnc
21 Dec 22  1 42 24   Gr   1251 B9  5.9  5.9   92- 148      61 ** GRAZE: Nearby
21 Dec 22  1 55 49.1 RD   1251 B9  5.9  5.9   92- 148      62 167  12N  Lambda
Cnc
21 Dec 22  2 12 46.5 R   80105 A0  7.9  7.9   92- 148      62 175  82N
21 Dec 22  4 28  1.1 R   80146 A2  8.0  7.9   92- 147      53 231  88N
21 Dec 22  5 22 57.9 R   80173 K0  8.3  7.8   92- 147      46 247  52N
21 Dec 22  6 24 12.7 R   80191 G0  8.9  8.7   92- 146      37 261  63N
21 Dec 22  6 42 55.4 R    1267 A0  8.1  8.0   92- 146      34 264  77S
21 Dec 22 20 58 15.8 R    1348 G5  8.1  7.6   88- 139      16  76  73N
21 Dec 22 23 24 30.0 R   80648 K0  8.7  8.2   87- 138      37 104  30S
21 Dec 23  2 33 35.8 R   80693 G0  8.4  8.1   86- 136      58 163  34S
21 Dec 23  5 11  5.6 R   80735 K0  8.7  8.1   86- 136      51 227  59N
21 Dec 23 22 31 24.9 R    1456 F2  8.4  8.2   80- 127      20  87  71S
21 Dec 24  4 22 27.0 DB   1484 A0  3.5  3.5   78- 124      55 188 -47N  eta leo
21 Dec 24  4 40  9   Gr   1484 A0  3.5  3.5   78- 124      50 ** GRAZE: Nearby
21 Dec 24  5  7 24.3 RD   1484 A0  3.5  3.5   78- 124      53 206  24N  eta Leo
21 Dec 24  6  0 33.0 R   98961 F8  8.6  8.3   78- 124      47 225  59S
21 Dec 24  7 11 15.1 R   98974 G5  8.6  8.1   78- 123   -9 38 244  36S
21 Dec 24  7 49 48.5 R   98983 K2  8.4  8.0   77- 123   -3 33 253  86N
21 Dec 24 23 24  8.3 R    1569 A2  6.9* 6.8   71- 115      17  91  50S
21 Dec 24 23 31 51.1 R   99287 K0  8.4* 7.9   71- 115      18  92  52N
21 Dec 25  0 43 29.2 R   99306 G5  9.0  8.5   70- 114      29 107  39N
21 Dec 25  0 58 54.6 R   99313 K0  8.5  8.0   70- 114      31 110  17N
21 Dec 25  2  1  7.5 R   99317 K0  8.1* 7.6   70- 114      39 126  48S
21 Dec 26  1 27 21.9 R  118969 K0  8.9  8.3   60- 102      24 110  17N
```

21	Dec	26	4	59	13.2	R	119008	F8	8.6	8.3	59-	101		44	169	76S	
21	Dec	26	7	32	41	Gr	119045	K0	8.9	8.4	58-	100	-5	39	** GRAZE: Nearby		
21	Dec	26	7	39	14.9	R	119045	K0	8.9	8.4	58-	100	-5	37	221	26S	
21	Dec	26	7	53	2.9	R	119056	F5	8.9	8.7	58-	99	-3	36	224	43N	
21	Dec	26	9	11	21.9	R	1709	K0	6.6	6.0	58-	99	6	26	243	35S	
21	Dec	27	1	4	12.6	R	1781	M*	7.6*	6.8	50-	90		10	100	52S	
21	Dec	27	3	15	22.6	R	119422	G5	8.7	8.4	49-	89		27	128	52N	
21	Dec	27	4	51	17.0	R	119442	G0	8.5	8.1	48-	88		36	154	80N	
21	Dec	28	5	33	28.0	R	139292	F5	8.5	8.2	37-	75		30	155	81S	
21	Dec	28	7	52	31.8	R	139323	K0	8.8	8.2	37-	74	-3	31	194	83N	
21	Dec	29	4	21	9.6	R	158397	F0	8.9	8.7	27-	63		13	128	73S	
21	Dec	29	6	11	22.3	R	2036	G5	7.0*	6.5	27-	62		23	154	81S	
21	Dec	29	7	11	58.8	R	158449	A5	8.0	7.8	26-	62	-9	25	170	49S	
21	Dec	29	7	33	40.4	R	158454	M0	8.0	7.1	26-	61	-6	26	175	80S	
21	Dec	30	5	33	1.3	R	159043	K0	8.2	7.6	17-	49		10	135	60N	
21	Dec	30	7	45	5	M	2173	K0	6.9	6.4	16-	48	-4	19	165	13S	
21	Dec	30	7	59	48.2	DB	2182	B9	6.2	6.2	16-	48	-2	20	169	-52N	26 Lib
21	Dec	30	8	44	50.3	RD	2182	B9	6.2	6.2	16-	47	3	20	180	27N	26 Lib
21	Dec	31	6	19	47	M	184181	A3	7.7	7.6	9-	35		4	135	15S	
21	Dec	31	6	20	7	Gr	184181	A3	7.7	7.6	9-	35		5	** GRAZE: Nearby		
21	Dec	31	6	48	9.4	R	2319	A0	7.1	7.0	9-	34		7	141	78N	
21	Dec	31	7	1	49.6	R	184195	G0	8.6	8.2	9-	34	-10	9	144	76N	
22	Jan	4	17	45	7.9	D	189912	F8	8.6	8.3	6+	27		2	228	53N	
22	Jan	5	17	24	59.9	D	164777	G0	9.0	8.7	12+	40	-11	13	214	76N	

Predictions up to Jan 5th, 2022
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. (-ve indicates bright limb)

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.
H denotes the HIPparchus 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. Ask the Occultation Subsection Coordinator: tvh dot observatory at btinternet dot com

…..

Lunar domes (Part LIII): A Lunar Dome north-east of the crater Schröter. Morphometric properties derived using terrestrial telescopic images.

by Raffaello Lena.

In previous work we have described a dome located to the north-east of the crater Schröter at latitude 3.52° N and longitude 6.27° W[1][2]. The dome, named as Schröter1 (Sc1), has a base diameter of 35 km and height determined using GLD100 dataset, amounts to 200 m and with an average slope angle (ξ) of 0.65°. It exhibits evidence of dark, probably pyroclastic volcanic deposits on its surface. The dome Sc1, is not recognized in the USGS lunar geologic map I-548, and is associated with a linear rille (a graben) traversing its northwestern summit, which would indicate structural control by subsurface geology [ibid]. Graben features are commonly interpreted as fractures that occur as a result of the flexural uplift. The goal of this study is to demonstrate that high resolution terrestrial imagery of the elusive lunar domes is useful for the recognition of non-cataloged domes. In this note two recent images made by Viladrich and Teodorescu are presented.

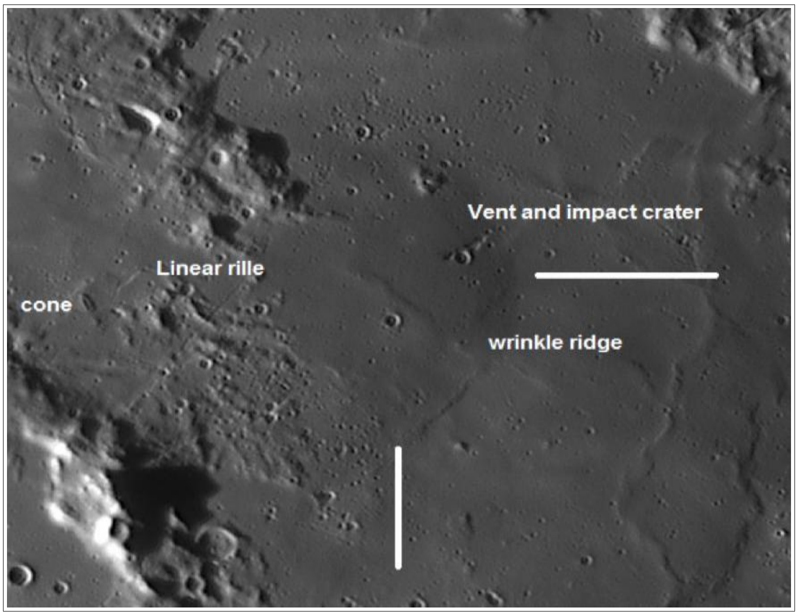


Figure 1: The dome Sc1 imaged by Viladrich on October 28, 2021 at 5:19 UT.

Terrestrial telescopic images.
Christian Viladrich has imaged the dome Sc1 on October 28, 2021 at 5:19 UT (Fig. 1), using a 500 mm Ritchey-Chrétien telescope.

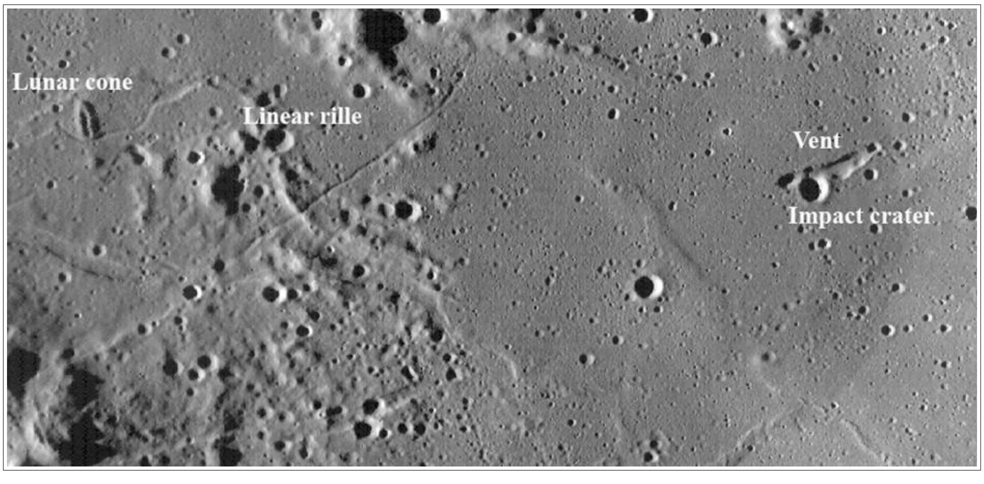


Fig.2 The dome Sc1 displayed in the WAC imagery for comparison with the telescopic terrestrial image.

On the same night, but at 4:09 UT, Teodorescu has imaged the same region using a 355 mm Newtonian telescope (Fig. 3).

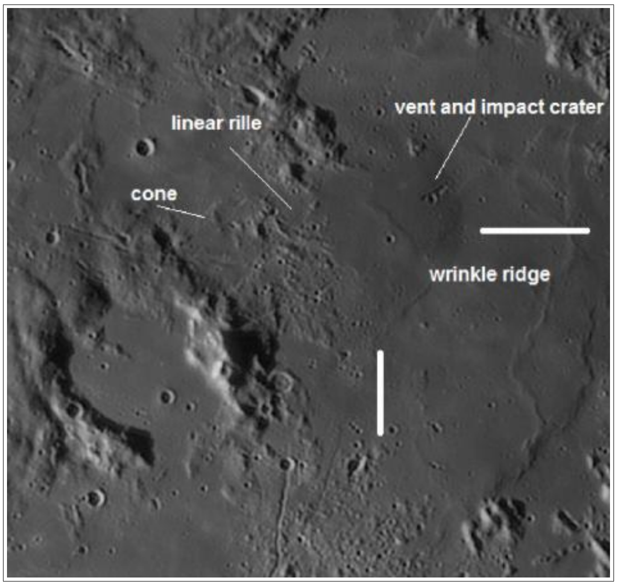


Figure 3: The dome Sc1 imaged by Teodorescu on October 28, 2021 at 4:09 UT.

Digital elevation model (DEM).
Generating a DEM of a part of the lunar surface requires its three-dimensional reconstruction. Well-known image-based methods for three-dimensional surface reconstruction are photoclinometry and shape from shading (SFS). They make use of the fact that surface parts inclined towards the light source appear brighter than surface parts inclined away from it. Both methods aim at deriving the orientation of the surface at each image location by using a model of the reflectance properties of the surface and knowledge about the illumination conditions.

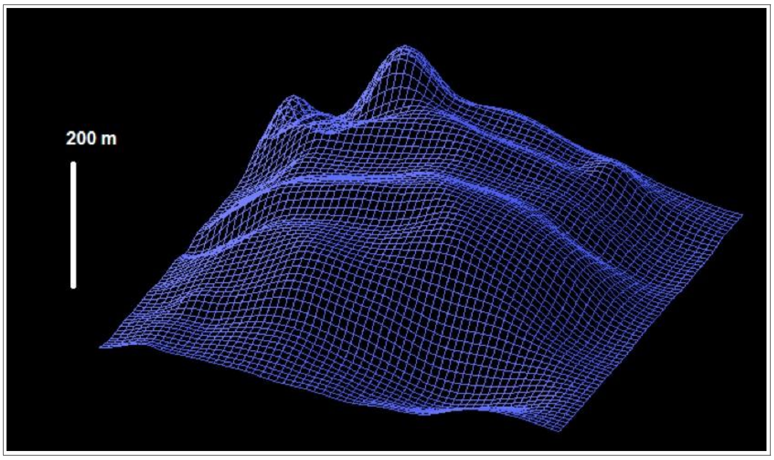


Figure 4: DEM of Sc1 derived using the image of Fig 1.The lunar curvature was subtracted. The vertical axis is thirty times exaggerated.

The photoclinometric approach performs a 3D reconstruction of the surface along one-dimensional profiles, while the SFS technique yields an elevation value for each image pixel[3]. The iterative scheme used for photoclinometry and SfS approach is described in preceding articles[4][5][6][7].

Using the Lunar Terminator Visualization Tool (LTVT) software package[8] I have determined the selenographic positions of the examined dome. LTVT is a freeware program that displays a wide range of lunar imagery and permits a variety of highly accurate measurements in these images. Selenographic coordinates, sizes, and shadow lengths of features can be estimated based on a calibration procedure. This calibration allows LTVT to make the spatial adjustments necessary to bring the observed positions of lunar features into conformity with those expected from the Unified Lunar Control Network (ULCN, 1994). The ULCN is a set of points on the lunar surface whose three-dimensional selenodetic coordinates (latitude, longitude, and radial distance from the lunar centre) have been determined by careful measurement. Typically these points consist of very small craters. The image shown in Fig. 1 was transformed in cylindrical projection. The 3D reconstruction obtained using photoclinometry and Shape from Shading (SfS) is reported in Fig. 4.

The height h of Sc 1 is thus obtained by measuring the altitude difference in the reconstructed 3D profile between the dome summit and the surrounding surface, considering the curvature of the lunar surface. The average flank slope was determined according to: slope = arctan 2h/D, with D the diameter in km. The dome has a base diameter of 35 ± 0.2km. Its height amounts to 198m ± 20 m, while the average slope angle ξ corresponds to 0.64° ± 0.06° in accord with the measurements obtained using GLD100 dataset.

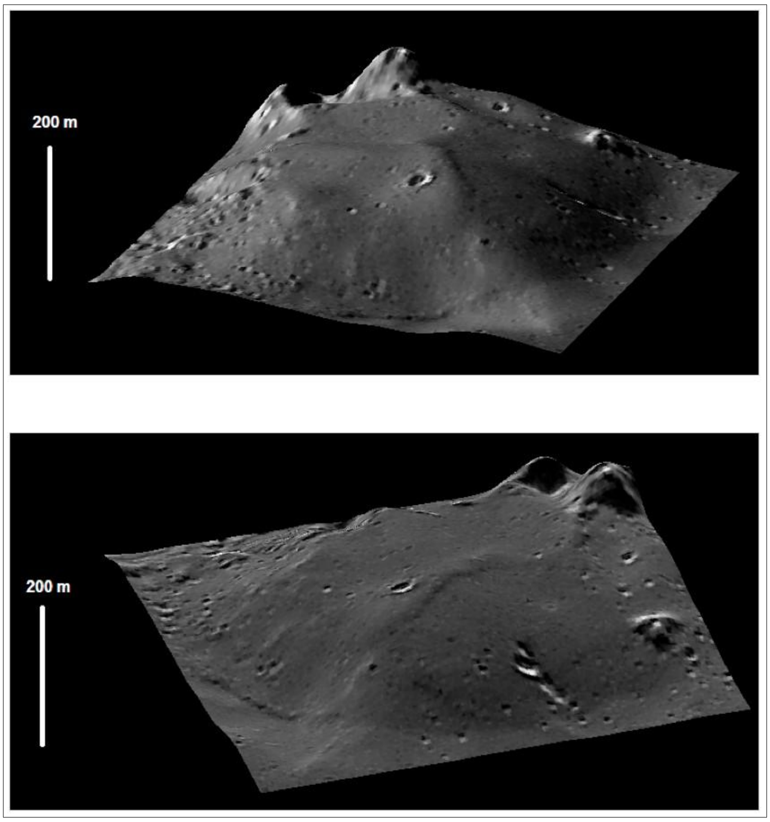


Figure 5: The dome Sc1 as viewed from the south (top) and the south-east direction (bottom).

A refined approach was then used to construct a rendered view using the telescopic image superimposed onto the corresponding DEM of Fig. 4. Figure 5 attempts to give a realistic 3D impression of the dome as viewed from the south and the south-east direction. Moreover the data obtained with terrestrial telescopic image shown evidence of extensional forces in the form of graben, compression in the form of wrinkled ridges and the elongated fissure, likely a vent, located on the dome flank (Figs. 1-2 and 5).

Analysis carried out on the image of Fig. 2 gives similar results, shown in Fig. 6. Its height, based on the analysis carried out on the image of Fig. 3, amounts to 202m ± 20 m, while the average slope angle ξ corresponds to 0.64° ± 0.06°

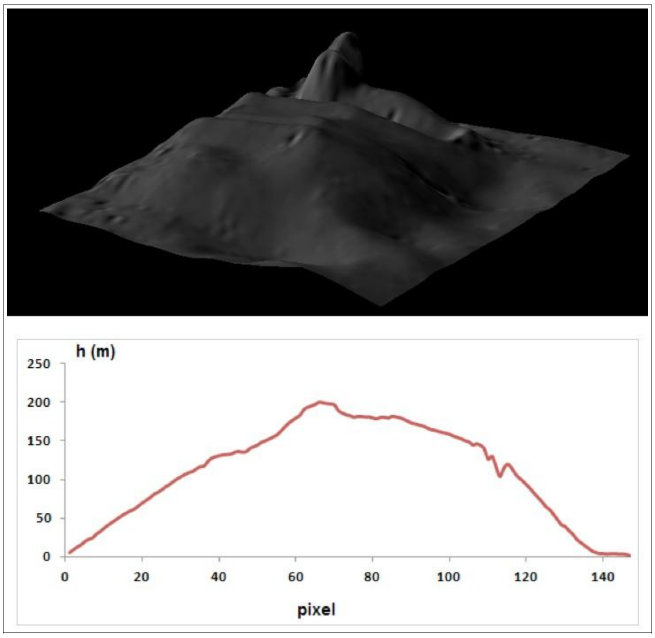


Figure 6: The dome Sc1 as viewed from the south (top) and the profile in E-W direction (bottom). The vertical axis is thirty times exaggerated.

As further comparison, Fig. 7 displays the 3D reconstruction obtained with the WAC image draped on top of the global LROC WAC-derived elevation model (GLD100). The elevation of the dome corresponds to 200 m.

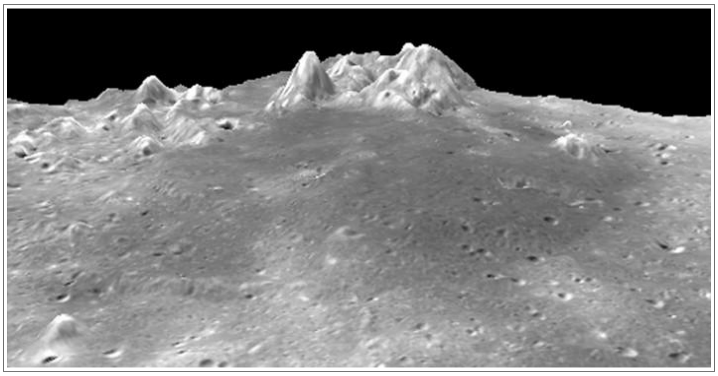


Figure 7: WAC draped on top of the global LROCWAC-derived elevation model (GLD100).The vertical axis is seven times exaggerated.

Conclusion:

High resolution CCD imagery of elusive lunar domes is the most difficult branch of astrophotography of the Moon. The recording of finer details will be obtained with telescopes optically of high quality, large diameter, and favorable observing sites in order to reduce the effect of the atmospheric turbulence. Using the described approach, based on the analysis of two excellent terrestrial telescopic images, it is possible to determine that this feature is clearly a low profile dome like structure, elevated above the mare surface. Consequently, ground-based images obtained using telescopes and CMOS cameras like those commonly used by well-equipped amateur astronomers are of great value for the morphologic and morphometric analysis of lunar domes.

References:

1. Lena, R., Fitz-Gerald, B., 2015. A Lunar Dome and associated Pyroclastic deposits north-east of the crater

Schröter. 46th Lunar and Planetary Science Conference.
https://www.hou.usra.edu/meetings/lpsc2015/pdf/1002.pdf

2. Lena, R. and Fitz-Gerald B. A lunar dome north-east of the crater Schröter. JBAA, 2016, 273-285.

3. Horn, B. K. P., 1989. Height and Gradient from Shading. MIT technical report 1105A. http://people.csail.mit.edu/people/bkph/AIM/AIM-1105A-TEX.pdf

4. Lena, R., Wöhler, C., Phillips, J., Chiocchetta, M.T., 2013. Lunar domes: Properties and Formation Processes, Springer Praxis Books.

5. Lena, R., Pau, KC, Phillips, J., Fattinnanzi, C., Wöhler, C., 2006. Lunar domes: a generic classification of the dome near Valentine, located at 10.26° E and 31.89° N, JBAA, vol 116, 1, pp. 34-39.

6. Wöhler, C., Lena, R., & Phillips, J., 2007. Formation of lunar mare domes along crustal fractures: Rheologic conditions, dimensions of feeder dikes, and the role of magma evolution. Icarus, 189 (2), 279–307.

7. Wöhler, C., Lena, R., Lazzarotti, P., Phillips, J., Wirths, M., & Pujic, Z., 2007. A combined spectrophotometric and morphometric study of the lunar mare dome fields near Cauchy, Arago, Hortensius, and Milichius. Icarus, 183, 237–264.

8. Mosher, J., & Bondo, H., 2006. Lunar Terminator Visualization Tool (LTVT)

……

Proclus, multiple impacts and pits (and a little bit of Glushko).

By Barry Fitz-Gerald.

The 28km diameter crater Proclus is one of the most conspicuous young craters on the lunar surface with its spectacular ray system showing it to be of Copernican age (~1.1 billion years). The ray system also shows that the crater was formed by an oblique impact, with the impactor having arrived from the south-west, having followed a descending trajectory over Mare Tranquillitatis and Palus Somni (Fig.1). Palus Somni stands out as a distinct topographic feature largely be virtue of it being in the Zone of Avoidance (ZoA) of the Proclus ejecta blanket, which is the wedge shaped zone in the up-range direction of a low angle impact that appears to be devoid of any ejecta. The extremely bright crater rays that edge this ZoA further emphasise the darker surface to the south-west of the crater.

The crater itself is sub-circular in outline with the somewhat scalloped appearance frequently seen in larger complex craters. It lacks a central peak which may be a consequence of the low angle trajectory of the impactor (Fig.2). The south-western rim has a particularly prominent scallop, but this has nothing to do with the collapse of the rim during the post impact modification stage. The ZoA provides a small clue as to what is going on in this south-western part of the crater, and particularly the rays that mark the edge of this zone.

Fig.3 show a SELENE evening image of Proclus with much of the western part in shadows. The rays that form the edge of the ZoA are marked with yellow arrows, and as can be seen they run up to the edge of the large scallop in the south-western rim. These particular rays are positive relief features taking the form of complicated ridges several hundred meters high which formed as debris in the ejecta curtain fell back onto the surface due to the low angle geometry of the impact.

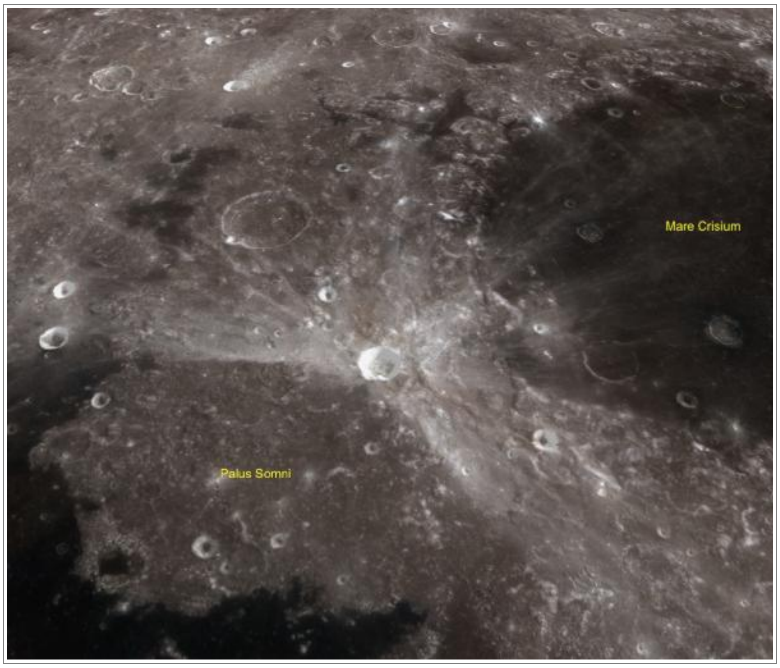


Fig.1 LRO 3D image of Proclus showing the asymmetric ejecta and the prominent ZoA over Palus Somni.

This suggests that the scallop is not in fact a scallop caused by rim collapse but is in fact part of the original crater rim that formed during the impact process. This part of the rim looks, on the face of it, to be less sharply defined than the rest of the rim, with a slightly subdued appearance. This can be explained by having a closer look at the part of the ZoA immediately outside the south-western rim (Fig.4). This shows a number of small craters with impact melt pools on their floors, showing that the ZoA was not really avoided by ejecta, and is in fact coated with a veneer of impact melt. This melt also coats the rim of the south-western 'scallop' giving it its more subdued appearance. There is also a 6km long chevron shaped ridge lying within the proximal part of the ZoA, quite subtle and only a few meters high, with the apex pointing towards the crater. This is a type of feature seen in many low angle impact craters[1] and supporting evidence if any were needed of the low angle credentials of the crater.

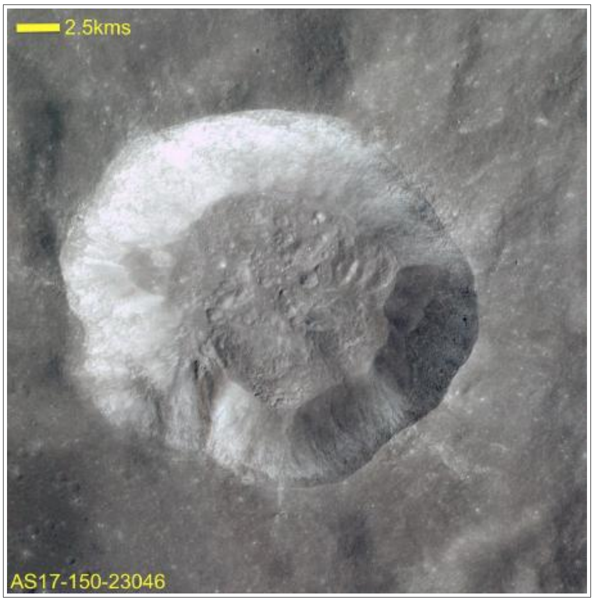


Fig.2 Apollo 17 image of Proclus showing scalloped rim and lack of a central peak. Note the impact melt rich deposits on the crater floor and the large scallop of the south-western rim.

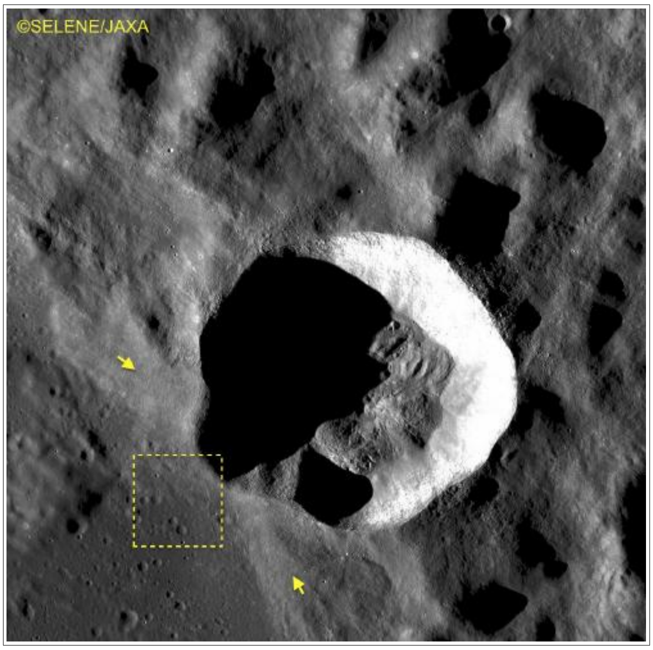


Fig.3 SELENE image showing the rays which form the edge of the ZoA (yellow arrows). Detailed view of area within yellow box shown in Fig.4

A closer look at the south-western 'scallop' shows that it appears to be something akin to half a small crater perched high up on the wall of the main crater, rather like a Cwm or Corrie on the side of a glaciated valley. A pool of impact melt can be seen occupying the space a lake would occur in such a landform, located on the shelf like floor of this small half a crater.

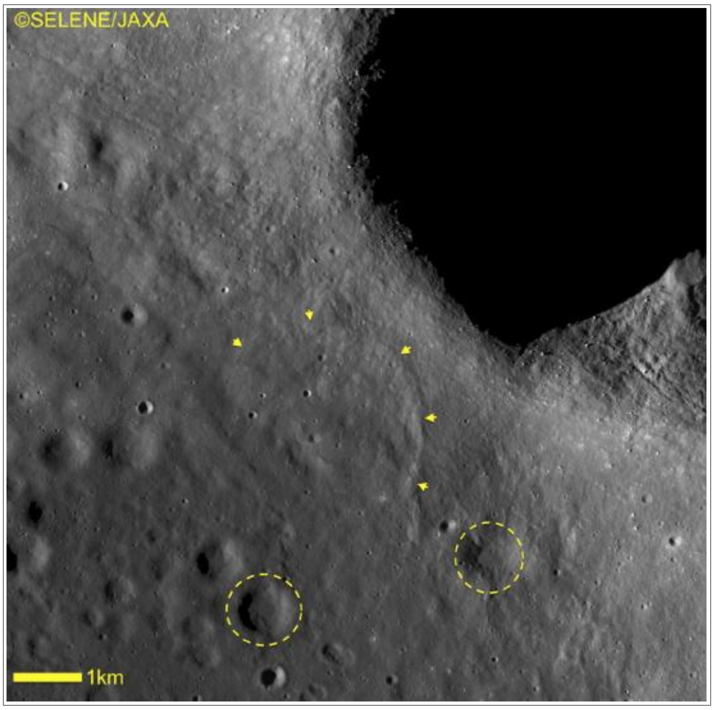


Fig.4 Detail of the south-western scallop in the rim of Proclus showing subdued nature of the rim itself, small craters with impact melt floors (yellow circles) and chevron shaped up-range ridge (yellow arrows).

The reason this structure looks like half a crater is that it *is* half a crater, showing that Proclus was formed by the impact of an asymmetrically sized binary asteroid, composed of a larger and a much smaller component. From the position of the smaller partial crater it looks like the two were lined up along their trajectory with the larger component leading and the smaller following. This might seem to be a rather contrived situation, but there are a number of craters formed by binary asteroid impacts that exhibit this phenomenon of *trajectory alignment*. Trajectory alignment occurs where the components of a binary system are affected tidally during close approach to a planetary body – which in this case was probably the Earth. Fig.6 shows two very good examples of this, Heis and Heis A and Birt and Birt A, both binary craters where the impactor(s) trajectory is indicated by a ZoA (as they were both low angle impacts) and along which both craters in the pair are aligned. In both of these cases the smaller component was leading and the larger following, a reversal of what we see in Proclus. Crater chains a such as Catena Davy are extreme examples of this phenomenon.

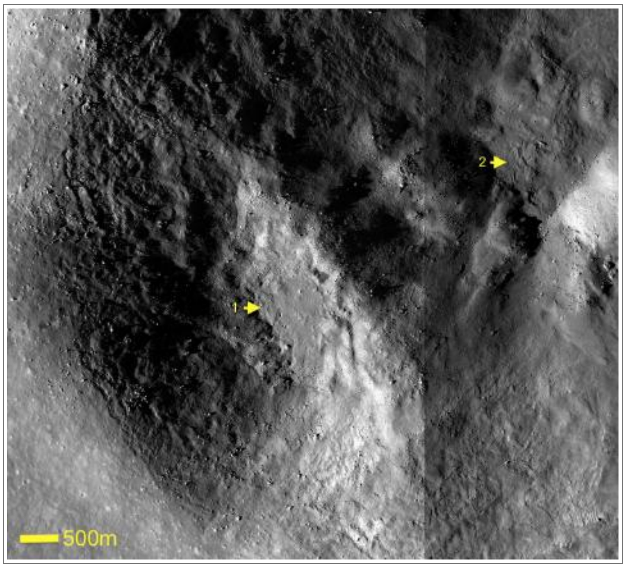


Fig.5 LROC WAC image of partial crater perched on the south-western rim of Proclus. Note the impact melt pool on the floor of this partial crater is shown by yellow arrow 1. A peculiar outflow feature in on the impact melt floor of the main crater is indicated by yellow arrow 2.

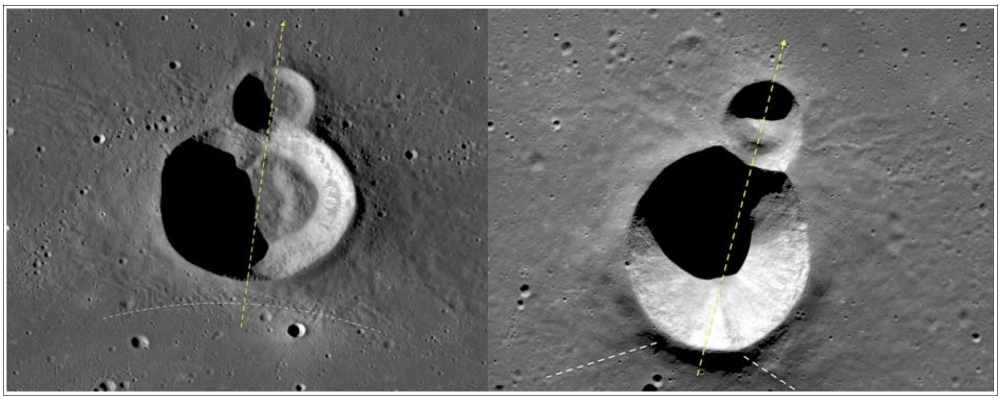


Fig.6 Heis and Heis A and Birt and Birt A showing ZoA's (white dashed lines) and trajectory of impactor (yellow dashed arrows). Note the craters are aligned with the trajectory.

A more comparable example to Proclus can be seen in Reiner A, another suspected binary impact where the main crater has a small companion perched on the north-eastern rim. Very subtle features in the ejecta in the form of a V shaped ridge extending away to the north-east from the rim of the smaller component define a

ZoA, and indicate an impactor trajectory from that direction. In this case the larger component was leading and the smaller trailing as is seen in Proclus. In all these examples the separation of the components varied, leading to the different morphologies we see, but it is likely that many binary impacts are effectively unrecognisable as the components were too close together on impact to produce individual craters.

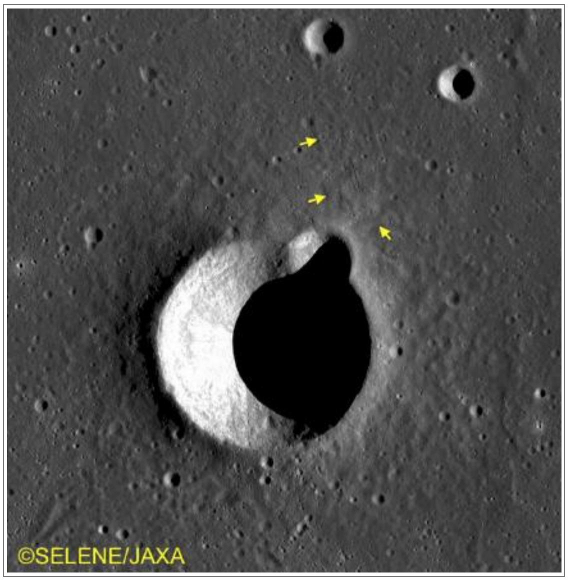


Fig.7 Reiner A a 9.8km diameter binary impact crater. Note the very subtle ridges to the north-east of the smaller component crater which define a ZoA showing that the impactor arrived from this direction, and the alignment of the two craters along the trajectory.

These apparent binary craters can sometimes hint at more complicated origins such as the crater Schiaparelli C shown in Fig.8, where a well preserved ejecta blanket allows the crater to be identified as a *triple* or possibly *quadruple* impact, with all the components aligned along the trajectory. The evidence for this can be seen in the form of ridges in the ejecta to the west of the smaller crater component. These ridges form where ejecta from separate but closely adjacent or overlapping craters interfere, such as in the individual craters in Catena Davy. In Schiaparelli C at least 3 are visible (Fig.8 yellow arrows) indicating 3 adjacent impacts, whilst the small crater itself has one prominent (Fig.8 white arrow) and one inconspicuous ridges orientated transverse to the trajectory of the impactor that represent the 'septa' separating each individual crater component.

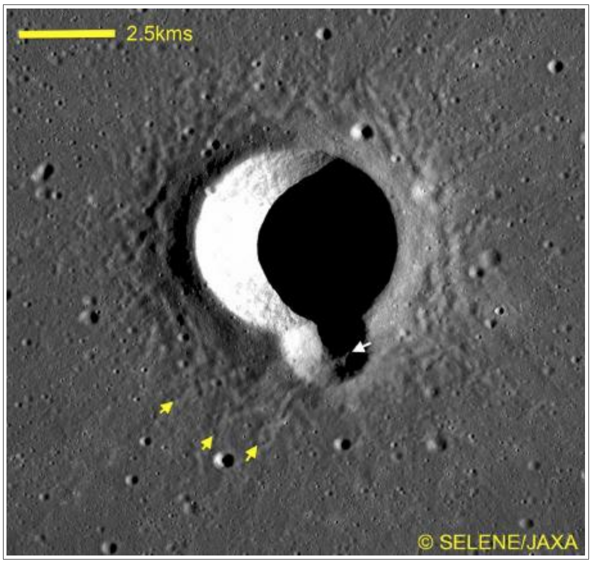


Fig.8 Schiaparelli C, showing an apparent binary crater, but the smaller component to the south-east sports 3 wavy ridges in the ejecta (yellow arrows) that show that it is composed of at least 3 overlapping craters. One of the septa separating these smaller component craters can be seen (white arrow) crossing the crater floor and aligned with one of the ridges.

Lunar pits have become something of a rage recently, with well over 200 identified [2] and even an overlay of pit locations available in the menu of the LRO Quickmap application. Two pits, Proclus A and B are located on the impact melt floor up against the northern crater wall, but another group can be seen on the small impact melt patch on the floor of the partial crater on Proclus's rim. These pits, rather than being vertical shafts appear to consist of ramps leading down beneath a solid surface crust into a void of unknown size beneath (Fig.9). These seem to have formed when the impact melt pool that formed on this small crater floor developed a solid crust whilst in contact with the chill of the vacuum. Beneath this crust the still molten melt could migrate or drain away elsewhere under gravity, leaving a void which would be revealed if the overlying crust collapsed due to a lack of support or as a consequence of local meteor impact or seismic shaking. Whether these ramps lead down into a single void or a number of smaller separate ones will probably remain unknown until explored by some lucky astronaut in the future.

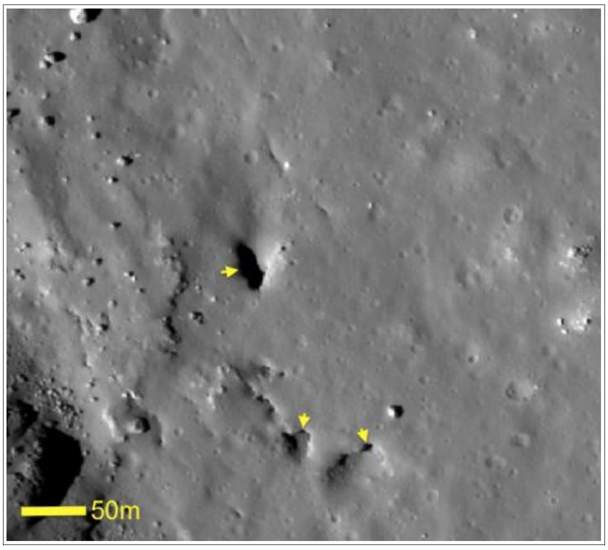


Fig.9 Lunar Pits (yellow arrows) on in the impact melt floor of the small partial crater on Proclus's south-western rim.

That impact melt migrates is shown by an 'outflow' feature on the main crater floor and below the smaller partial crater. As can be seen from Fig.5 large slumps have occurred off the edge of the partial crater and the rim either side, with the slumping having occurred immediately post impact, as the resulting deposits were saturated with still molten impact melt. The melt within these slumped masses would be able to drain and accumulate in the lower part of the debris mass, with the internal pressure eventually building up sufficiently to allow it to erupt from the solid material in a still molten stream. Fig.10 shows a vertical view of this feature, with the bottom of the frame showing the partially shadowed slumps which include some boulders of truly huge dimensions. An outflow feature consisting of a fan of incised channels can be seen, with the channels opening down-slope showing that the melt flowed in a lava like stream from the slump masses onto the crater floor. The fan appears to originate from a tunnel that opens into the base of the slump. This is better seen in a perspective view shown in Fig.11 which shows the channels of the fan converging towards the entrance of the partially infilled tunnel. In many ways this feature may mimmic a terrestrial lava tunnel, but whether it leads any distance back deeper into the slump will again have to remain unknown until visited by future lunar explorers.

There are a number of similar features elsewhere on the moon, particularly on the flanks of large fresh impact craters where melt rich ejecta was deposited and where the melt appears to have drained downwards to accumulate in a reservoir that eventually built up sufficient pressure to force its way out as a molten stream.

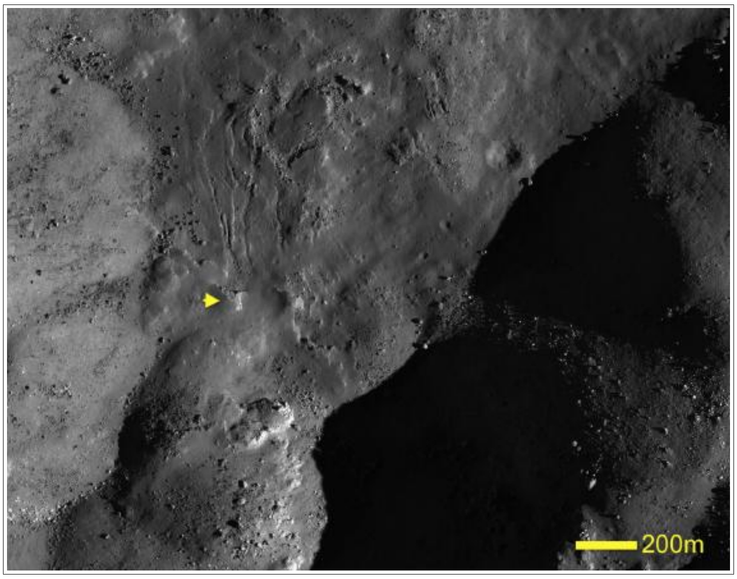


Fig.10 Proclus crater floor immediately to the east of the small partial crater showing the partially shadowed slump masses and a shall outflow feature emerging from the base of this feature. The channel emerges from an apparent tunnel in the slump (yellow arrow).

Fig.12 shows the glacis of Glushko, a crater with extensive impact melt deposits to the north. The slope from the rim of the crater at the bottom of the frame, across the glacis towards the top is some 5°. The feature in the yellow box is on this sloping terrain, and surrounded by extensive smooth deposits of impact melt, much of it forming 'lakes' within topographic lows. The feature itself (which looks rather like an octopus) is another fan of channels as seen in Proclus, apparently emerging from a pit like depression (Fig.13 arrow 2) about 70m deep and between 500 and 600m across. The outflow feature (Fig.13 arrow 3) emerging from it is a complex interconnected network of channels, many with raised 'levees', all flowing down slope towards the north.

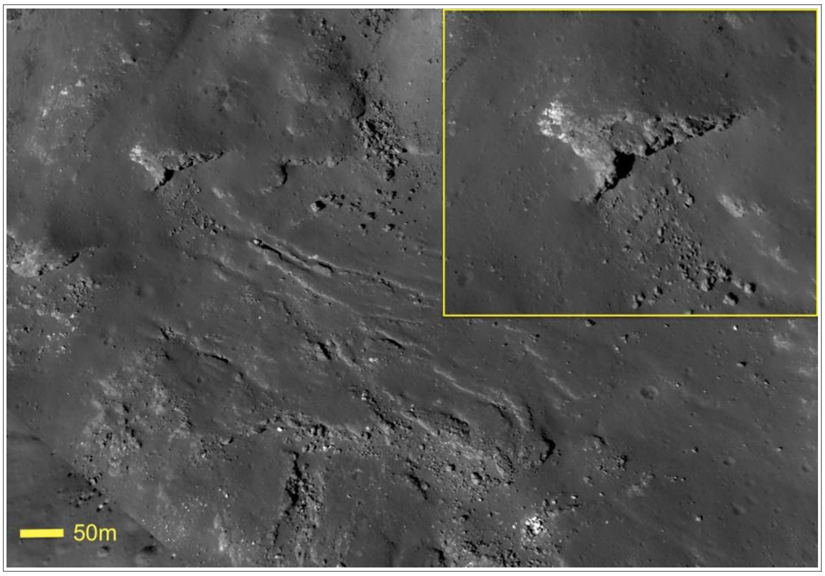


Fig.11 3 D view of the outflow channel showing the channels converging up-slope towards a partially obscured tunnel entrance emerging from the slump. Inset shows detail of the tunnel entrance.

The morphology suggests a rather chaotic and energetic initial flow of molten impact melt, with different channels being dominant but then being abandoned as the bulk of the flow diverted into another channel. The levees indicate that the molten melt frequent overtopped the channels as the 'eruption' rate at times surged (of course nothing was being erupted in the volcanic sense). The final and apparently dominant channel can be traced downslope for some 4kms. Up-slope of the apparent source pit are a pair of crater like pits (Fig.13 arrow 1) that open down-slope and are occupied by a number of small rounded hills which appear to be the result of collapse. A small melt channel also emerges from this pair.

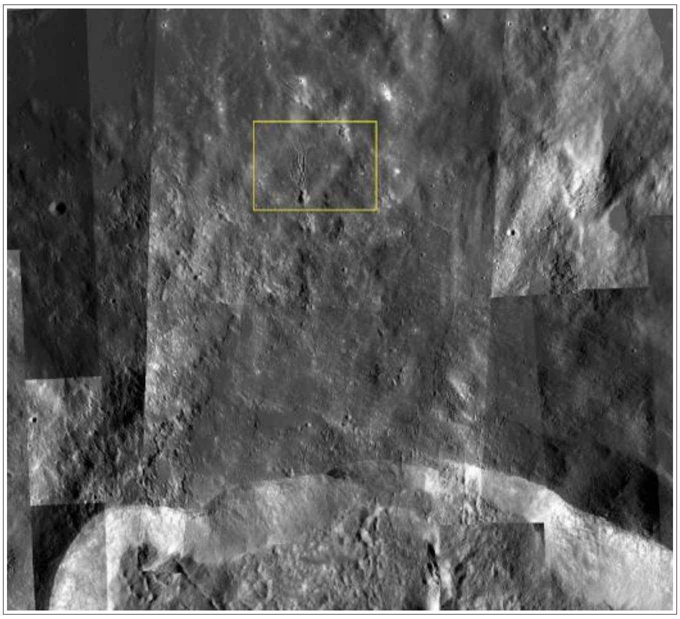


Fig.12 Northern rim of Glushko with the impact melt draped glacis to the north. The feature in the yellow box is shown in detail in Fig.11.

One explanation for this suite of features is that immediately post impact, this part of the glacis was draped in thick deposits of melt rich rocky ejecta, as well as surface deposits of impact melt in the topographic lows. The melt held within the ejecta could drain downwards under gravity and accumulate as a reservoir within the glacis, but eventually the hydrostatic pressure within overcame the pressure of the rocky overburden, and the melt forced its way out to the surface.

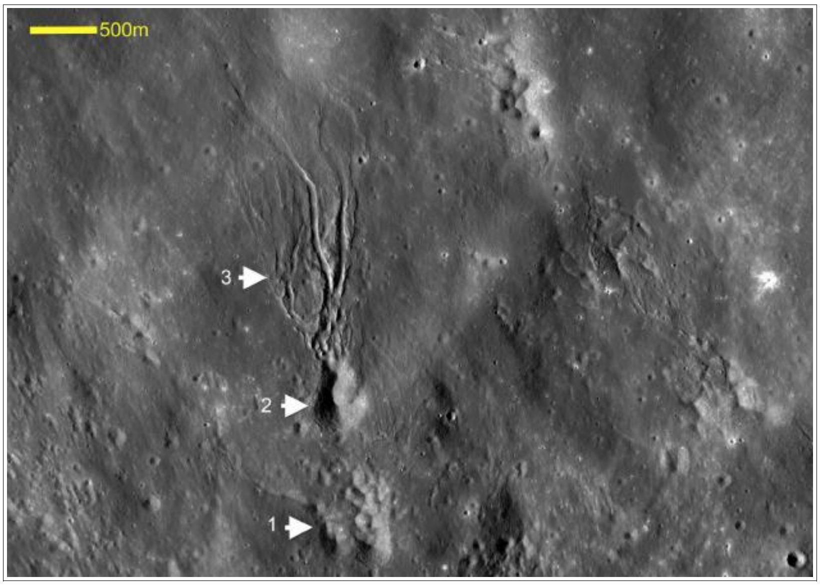


Fig.13 Possible impact melt outflow channels (3) emerging from a source pit (2) on the impact melt rich glacis of Glushko. A pair of pits further up-slope containing collapse mounds may be the collapsed roof of the impact melt reservoir (1). Note the complex overlapping channels many of which have levees along their margins.

This may have occurred in something of a catastrophic event, with the sudden draining of the reservoir removing the support from the overlying ejecta which had effectively formed a roof, and this then collapsed into the growing void below to form the most upslope group of pits (Fig.13 arrow 1). The escaping melt 'ate' backward into the slope in a process similar to terrestrial 'spring sapping' where an emerging spring erodes backwards to produce an amphitheatre shaped hollow, and in this case the apparent source pit (Fig.13 arrow 2). A catastrophic outflow event would account for the chaotic nature of the outflow, whist the apparent surges in flow rate as indicated by the channel levees could be the result of additional pulses of melt entering and draining from the former reservoir from the surrounding ejecta.

There are no visible pits or tunnels associated with this feature, but the hypothesised draining of a reservoir might leave the possibility of a 'subterranean' void space open. All of the features discussed above are only visible in the youngest of lunar formations as melt deposits and ejecta blankets appear to erode rapidly in the lunar environment, making their location and identification in older terrain very difficult.

Barry Fitz-Gerald.
(barryfitzgerald@hotmail.com)

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.Fitz-Gerald, B. (2014) Up-range ejecta features in oblique lunar impact craters. British Astronomical Association, Lunar Sections, Circular,Vol. 51 No. 2.

2. R. V. Wagner and M. S. Robinson (2021) Occurrence and origin of Lunar Pits: Observations from a new catalog. 52nd Lunar and Planetary Science Conference (LPI Contrib. No. 2548)

…..

LUNAR GEOLOGICAL CHANGE DETECTION PROGRAMME

by Tony Cook.

TLP reports: No TLP reports have been received, since the last newsletter. However, I have a correction from Massimo Giuntoli in that his drawing of Cavendish E feature in the last newsletter (Nov. 2021) was incorrectly dated. The correct date is 2021 September 18 at 21.15 UT, seeing IV - 200mm Newtonian, x 200, col. 60.6°, libration: lat. +7°14' long. +4°15', solar lat. +1.4°. The date 2021 June 22 referred to in his previous drawing of this crater was when it appeared "normal". The brightness of the northern floor of this crater, when he observed it on the two dates in October, was was the same as it was on September 18, but it was less eye-catching because the lunar terminator was further away from it.

BAA Reports received for October included: Alberto Anunziato (Argentina - SLA) observed: Aristarchus, Daniel, Gassendi, Mare Crisium and Plato. Massimo Alessandro Bianchi (Italy - UAI) imaged: Bullialdus, and Eratosthenes. Maurice Collins (New Zealand – ALPO/BAA/RASNZ) imaged: Clavius, Copernicus, Langrenus, and several features. Walter Elias (Argentina – AEA) imaged: Aristarchus, Atlas, Endymion, Langrenus, Mare Crisium, Petavius and Plato. Don Estep (USA) imaged: the whole Moon. Valerio Fontani (Italy – UAI) imaged: Aristarchus, Eratosthenes and Mare Tranquilatis. Les Fry (West Wales – NAS) imaged: Aristotles, Isidoris, Janssen, Montes Pyrenaeus and Posidonius. Massimo Giuntoli (Italy - BAA) sketched: Cavendish E. Leandro Sid (Argentina – AEA) imaged: Gassendi, Plato and Proclus. Rik Hill (Tucson, AZ, USA – ALPO/BAA) imaged: Plato and Sinus Iridum. Aldo Tonon (UAI – Italy) imaged: Aristarchus, Bullialdus and Sirsallis. Fabio Verza (Italy – UAI) imaged: Bullialdus, Eratosthenes, and

Herodotus. Luigi Zanatta (Italy - UAI) imaged: Eratosthenes. Paul Zeller (Indianapolis, IN, USA - ALPO): observed Aristarchus and imaged several features.

Mare Crisium was imaged by Walter Elias (AEA) under similar illumination to the following report:

Mare Crisium 1998 Jan 31 UT 17:15-17:35 R. Braga (Corsica (MI), Italy, 102mm f8.8 refractor, x180, with no diagonal, seeing II, Transparency poor). A very bright point located at 23N 54.5E this was normal! - what was unusual was that it vanished when viewed through a blue Wratten 38A filter (this filter absorbs red, UV, and some green light). The ALPO/BAA weight=2.

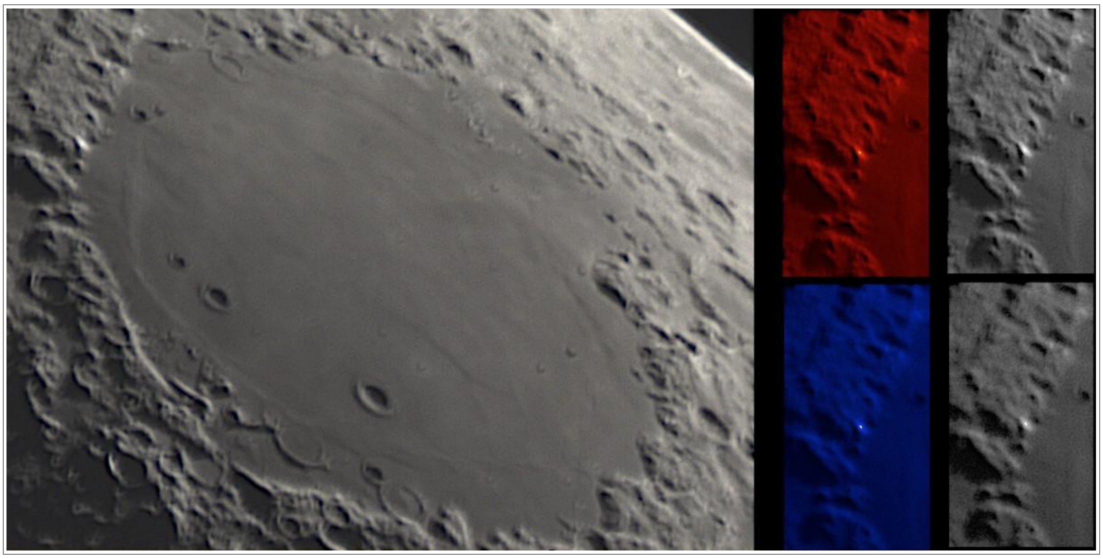


Fig.1. Mare Crisium orientated with north towards the top left. (left) Original colour image by Walter Elias from 2021 Oct 9 UT 22:36 as imaged by Walter Elias (AEA). (Right) Red and Blue filter components in colour and monochrome. Note the white dot is a bright area of the image that appears saturated when I removed the corresponding colour channels in Adobe Photoshop.

It is difficult to tell for sure from Fig 1 if the bright point on the NW rim of Mare Crisium is indeed brighter in red than in blue. It is hinted at perhaps? But the problem is one of image resolution and focus. It is often the case that in blue light, light scattering inside the scope/atmosphere lowers contrast at shorter wavelengths making the background brighter. Also, the focal length of the scope is marginally different between red and blue light if there are any pieces of glass in the way (even the CCD window) so red maybe more in focus than blue or visa versa. Clearly, we need a few more colour images of this area before we can come to a definitive conclusion about the 1998 visual observation.

Daniel was observed by Alberto Anunziato under similar illumination to the following report:

M. Price of Camberley, UK noticed that an area in relation to the central area of the floor could not be resolved. Averted vision was used, but this did not help to resolve detail. The crater was close to the terminator and was in general sharply in focus apart from the suspect area. No spurious colour seen. Sketch supplied. P. Foley wonders if the effect was due to the resolution limit of Price's scope? Cameron 2006 extension catalog ID=78 and weight=2. ALPO/BAA weight=2. 6" reflector x64 and x120. Seeing=III-IV and Transparency=good.

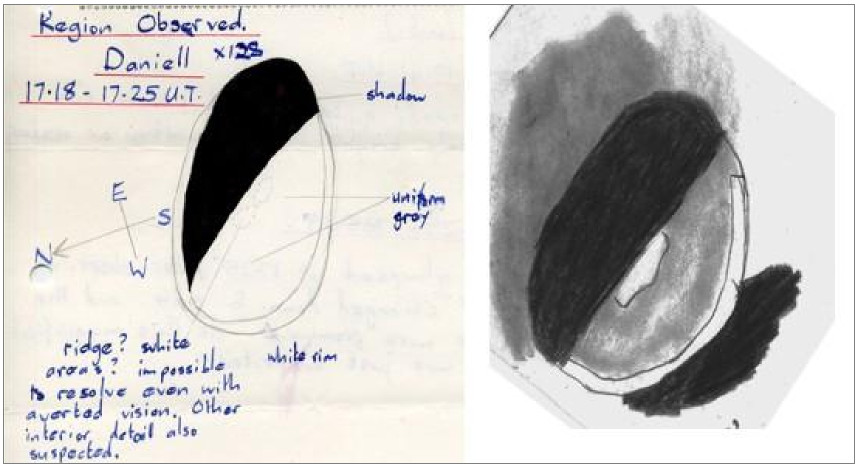


Fig.2. Daniell orientated with north towards the bottom left. (Left) A sketch by Marcus Price (BAA) from 1979 Dec 24 with UT given in the image. (Right) A sketch by Alberto Anunziato (SLA) from 2021 Oct 11 UT 23:10-23:20.

It is curious that Alberto could see the light patch on the floor of Daniel but Marcus price could not. Alberto was using a 105 mm Meade Maksutov-Cassegrain, a smaller telescope than was used back in 1979. Clearly, we need a few more observations, under different observing conditions to see how this affects the visibility of floor detail.

Clavius was observed by Maurice Collins under very similar illumination (±0.5°) to the following report:

Clavius 1915 Apr 23 UT 20:00 Observed by Miss A.G. Cook (England?) "Narrow straight beam of light from crater A to B" NASA catalog weight=1. NASA catalog ID #352. ALPO/BAA weight=1.

Now Clavius A does not exist on the IAU name list, but back in 1915 it would have been the largest crater on the floor of Clavius, and what we now refer to as Rutherfurd. Clavius B, according to the Times Atlas of the Moon, is the nearly shadow-filled crater on the NE rim of Clavius, however it is now called Porter. Looking at Fig 3, there is a hint of a faint wrinkle ridge from Rutherfurd to Porter that is just visible in Maurice's image – I wonder if this is what Miss Cook saw? It certainly is not straight though?

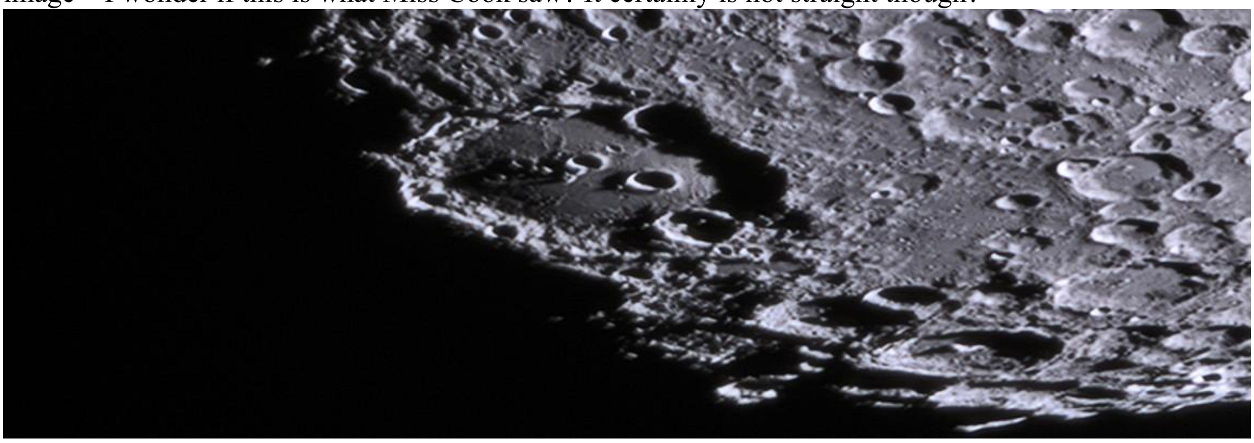


Fig.3. Clavius as imaged by Maurice Collins on 2021 Oct15 UT 07:33 and orientated with north towards the top.

Checking Winnie Cameron's card catalog, she has written down April 23, 1915 GMT 20:00? The 20:00 is a default time she would use if the observer did not write down the time as it is a reasonable time of the night for most people to observe at. The reference to this observation comes from a private communication with Patrick Moore. I do not know much about A.G. Cook, but she is listed in the BAA Meteor memoir from the 1936 as Miss A. Grace Cook from Combs in Suffolk in England. Assuming that she was at the same location in 1915, then after sunset, the Moon would have been at an altitude of 54° and due south, and eventually setting at 02:40 on 2021 Apr 24. So, the Cameron time of 20:00 is quite reasonable. I may add a wider range of colongitudes to the Lunar Schedule web page to encompass more potential observing opportunities on the night of 1915 Apr 23.

Bullialdus was imaged by three UAI members under similar colongitudes to the following lunar schedule request:

ALPO Request: Can you detect any colour, inside the crater, on the floor and elsewhere? Can you image any colour? Minimum telescope aperture needed: 6", and if possible, try using a refractor. All images or sketches should be sent to me on this email address: a t c @ a b e r . a c. u k

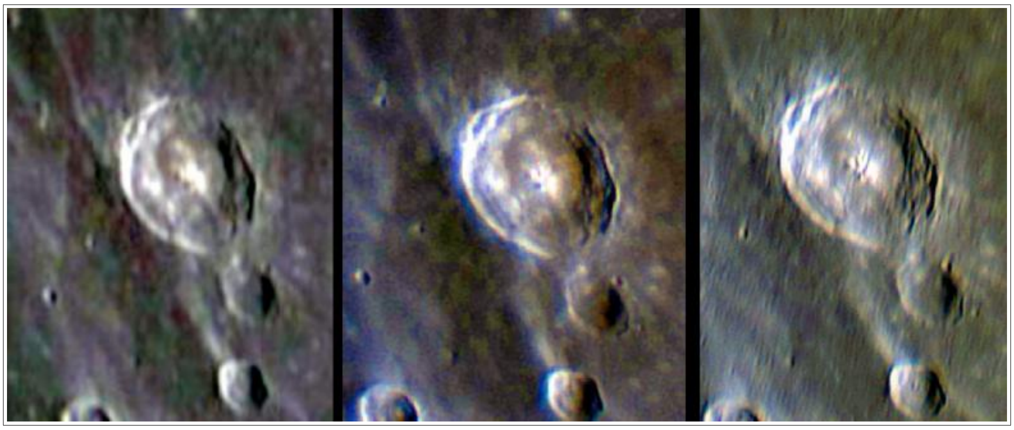


Fig.4. Bullialdus orientated with north towards the top, colour normalized and taken by UAI observers on 2021 Oct 17. (Left) Image by Fabio Verza at 18:15 UT with colour saturation increased to 60%. (Centre) Image by Massimo Alessandro Bianchi at 18:31 UT with colour saturation increased to 50%. %. (Right) Image by Aldo Tonon at 18:58 UT with colour saturation increased to 50%.

There have been several reports of colour inside this crater, sometimes on the rim, but often a yellow or orange colour on the floor. Fig 4 shows some different resolution views of the crater. Fig 4 (Right) is just outside the lunar schedule window but has been included as a reference. There is quite a bit of consistent blue ray material visible in all observations - to the bottom left to mid left in each image. The The left and centre images show some orange colour on the N and W of the central peak and a bit on the floor, especially in the centre image. By contrast Fig 4 (Right) is a lot higher resolution and exhibits less colour – something I have noticed in higher resolution colour images. All images exhibit some atmospheric spectral dispersion, especially the middle one. It is possible that we are pushing the colour sensitivity of the cameras concerned to their limits here. But we shall certainly continue to monitor this crater.

General Information: For repeat illumination (and a few repeat libration) observations for the coming month - these can be found on the following web site: http://users.aber.ac.uk/atc/lunar_schedule.htm . By re-observing and submitting your observations, only this way can we fully resolve past observational puzzles. To keep yourself busy on cloudy nights, why not try “Spot the Difference” between spacecraft imagery taken on different dates? If you would like your observations to be considered for mention in the next newsletter, then they should be submitted by 17:00UT on the 24th of July, covering observations for June. Please send observations in, even if older than this as they are still very useful for future repeat illumination studies. 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 .

Dr Anthony Cook, Department of Physics, Aberystwyth University, Penglais, Aberystwyth, Ceredigion, SY23 3BZ, WALES, UNITED KINGDOM. Email: atc @ aber.ac.uk

BAA LUNAR SECTION CONTACTS

Acting Director: Tony Cook (atc @ aber.ac.uk)

Lunar Section Circular Editor: Barry Fitz-Gerald (barryfitzgerald@hotmail.com)

Website Manager: Stuart Morris [contact link via the Section website at https://britastro.org/section_front/16]

Committee members:
Tony Cook (Coordinator, Lunar Change project) (atc @ aber.ac.uk)
Tim Haymes (Coordinator, Lunar Occultations) (occultations @ stargazer.me.uk)
Robert Garfinkle (Historical) (ragarf @ earthlink.net)
Raffaello Lena (Coordinator, Lunar Domes project) (raffaello.lena59 @ gmail.com)
Nigel Longshaw