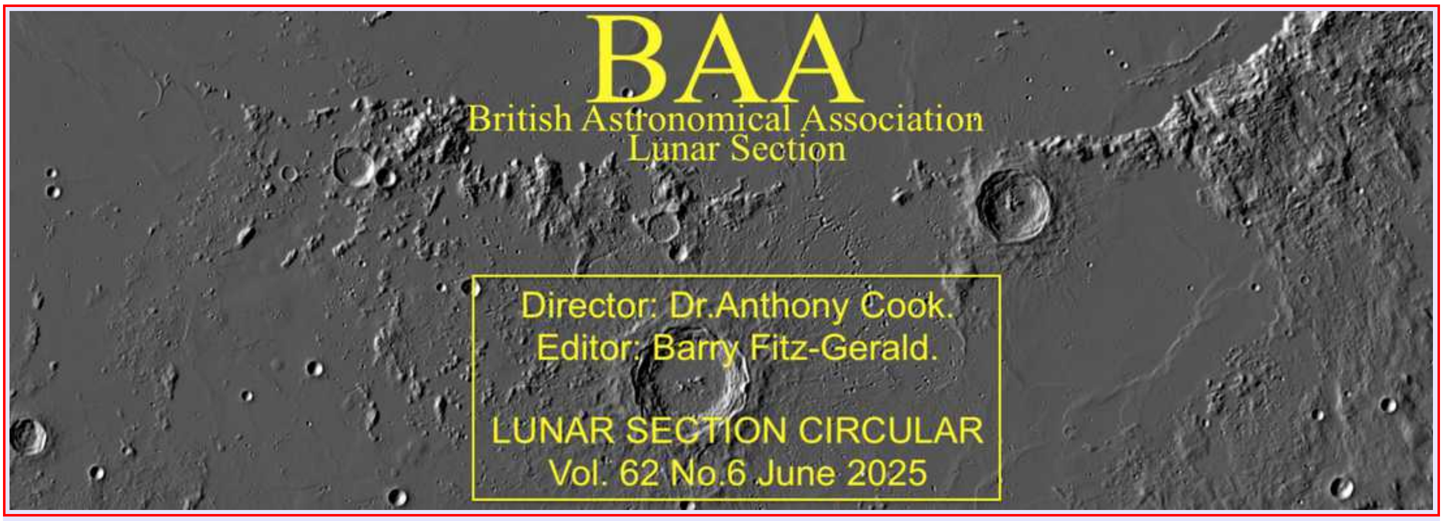
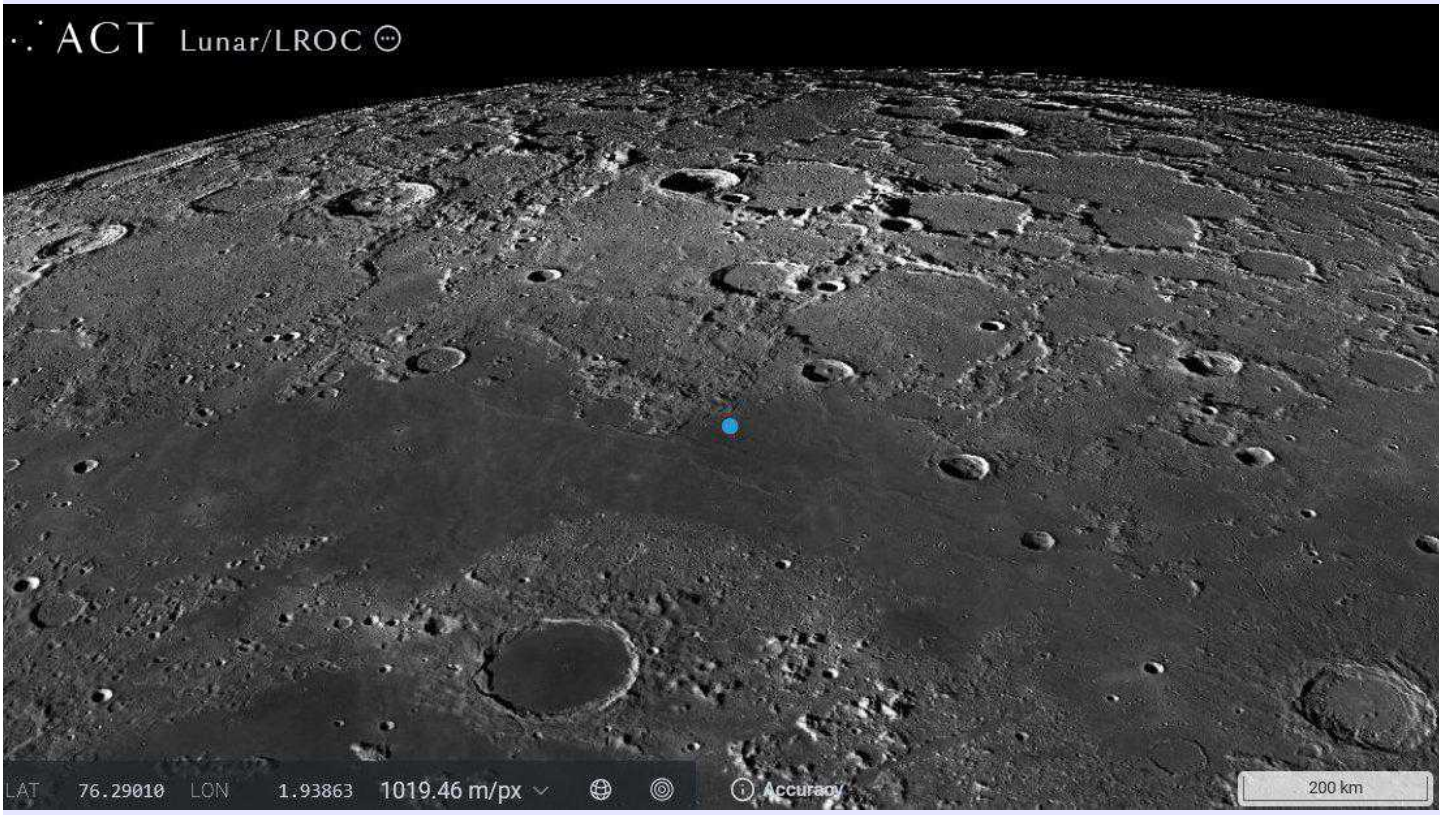


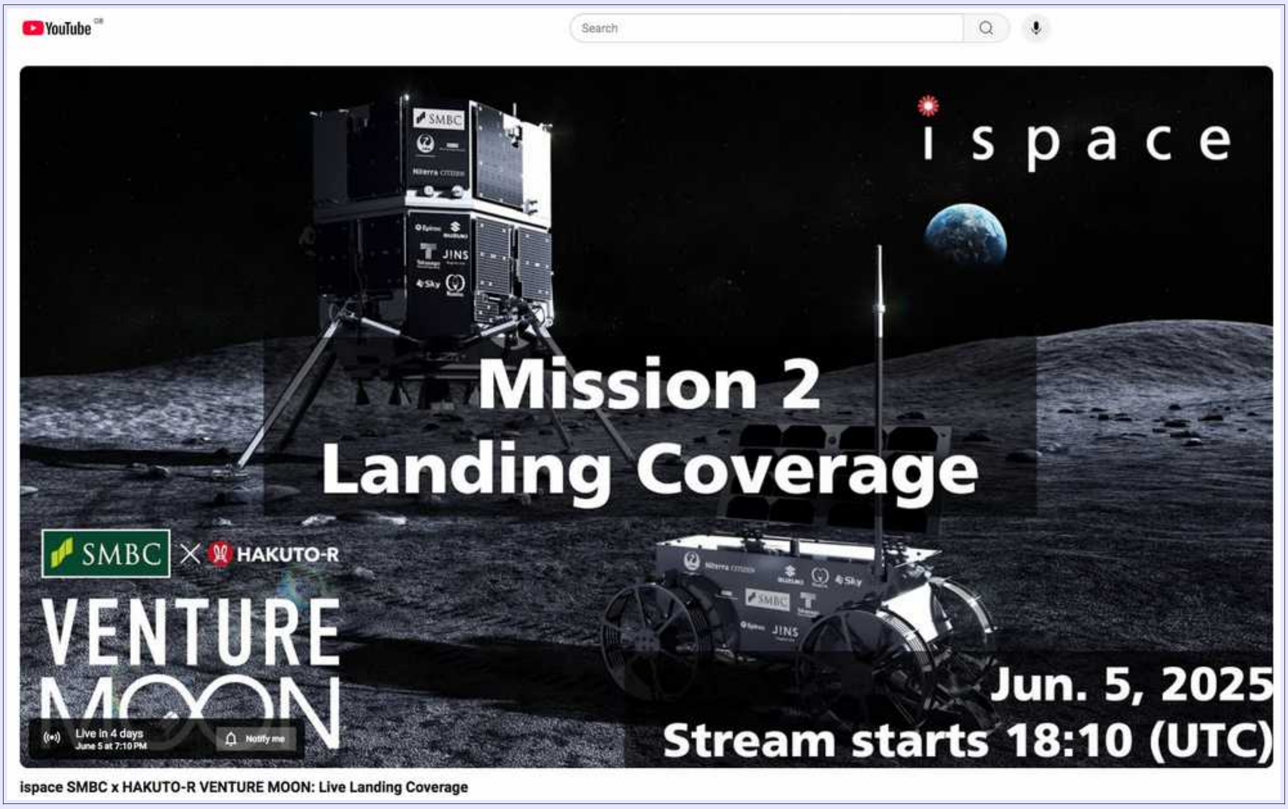
FROM THE DIRECTOR



The blue spot marks the landing site of the Resilience lander using NASA's Quickmap website as a backdrop.

On 2025 Jun 05 at 19:24UT the Japanese ispace resilience lander will attempt a landing in north Mare Frigoris. You can watch the live video on: www.ispace-inc.com/landing with video coverage due to start at 18:10UT (see image below). As this is a technology demonstration mission, it has relatively little payload, only three life science packages: water electrolysis, algae production and a radiation monitor. It does however carry a rover built in Luxembourg, called TENACIOUS, which will explore the area around the lander and maybe do some digging, though it cannot analyse the soil, just examine it with the camera.

Although we are unlikely to be able to see anything of dust being kicked up by the landing, through a scope, if you do want to attempt some context image capture, from the UK the Moon will be visible in the evening before sunset at about 28° above the horizon and almost due south (depending upon where you live). A red or IR transmitting filter may be helpful to cut out stray light from the sky. In the unlikely event that any dust kicked up by the landing might be visible, then high angular resolution imaging of at least 1km/pixel or better would be needed and one would have to subtract an average of pre-landing imagery from imagery of the region around the lander during the final moments of the landing. So, in effect you have a series of difference images which could be contrast stretched to see if there is any light scattering from high velocity dust kicked up by the landing exhaust.



https://www.youtube.com/live/BVSMXQPeTcw

James Dawson, our media coordinator, has told me that of the 26th May there had been an amazing total of 80 responses so far to the on-line survey out of 237 members registered in the Lunar Section, or about a third of our membership. I was going to give a brief summary of the findings in this circular, but James said that Philip Jennings had wanted to mention it in the June BAA Journal in case this enticed further people to do the survey. I will therefore wait a further month before summarizing what we have learnt. If you haven't taken part in the survey yet, please do so as it's a helpful way to know what we are doing right, or wrong, and what people would like to see. We are especially keen to find ways to make members feel that they would like to participate more in the section. Again, a reminder that the survey is entirely anonymous and is available from this web site: https://forms.office.com/r/mcVUXZiyhv

Tony.

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Lunar Occultations June 2025 by Tim Haymes

Time capsule: 50 year ago: in Vol 10 No.6
[With thanks to *Stuart Morris* for the LSC archives.]

*Report of the Section meeting at the Swedenborg Hall on May 11, 1975
*List of TLP Network observers
*Occultation observations received.

An interesting occultation.
Brian Mills (Kent) has been in contact regarding the reporting of timings using Occult4 software. One of the observations on 2025 May 4, was particularly unusual on two accounts.

1) The star ZC1392 was a double and detected by video as a long step event at the dark limb (DD).
2) The step egress appeared at the dark limb (RD) close to the cusp. On the video, the reappearance is almost on top of an illuminated peak.

Light curve of the disappearance: Step duration 4.0sec. (Tangra software)

Tangra Light Curve | Double star at full brightness | Half occulted (Comes in mag 9)

Reappearance of 7th magnitude ZC 1392 (SAO 98552) at CA 2N on 2025 May 4th (Brian Mills)

Before egress | one component | both components.

Full credit to Mr Mills for planning ahead for the reappearance which I doubt would have been recorded clearly without the use of a video recording.

Equipment used: 30cm RC, WATEC-910HX, Blackboxcamera GPS_SPRITE3 video time inserter, recorded as AVI. An Occult4 prediction shows the event was near grazing incidence with the observer 29 miles from the path which passed over Chelmsford, Southend-on-sea and Folkestone.

The graze is listed in the Handbook on page 45.

From Mr Mills' observatory, ZC1392 DD was at 25N, and the RD 13minutes later at 2N. The star was magnitude 7.3, separation 0.43 arcsec. A more complete analysis of the light curve will follow.

Occultations this month:

There is a Pleiades passage on the morning of June 23. The crescent Moon is low in the East with Venus nearby, and the Sun at -10.

Occultation predictions for 2025 June (Times at other locations will +/- a few minutes)
Oxford: E. Longitude -001 18 47, Latitude 51 55 40

```
  day          Time      Ph   Star  Sp  Mag  Mag    % Elon Sun  Moon   CA
yy mmm  d  h  m   s        No  D*    v    r   ill      Alt Alt Az   o   Notes

25 Jun  3 21 18 56.0 D  118879kF8  7.2  7.0   57+  98  -8 31 227  87N 110  83  88
25 Jun  4 22 16 23.4 D  138647pG4  7.4  7.1   67+ 110     24 228  54N  77  50  55
25 Jun 18  1 46 40.2 R  146591kG5  7.5  7.0   58-  99 -12 15 120  64N 273 305 294
25 Jun 20  1 51 39.8 R  109533 K0  7.4  6.8   35-  73 -11 12  94  39S 196 235 218
25 Jun 23  2 38 55.1 R     545SB6  4.1  4.2v   8-  32  -8  9  62  45N 309 346 321
   R545 = Merope = 23 Tauri
25 Jun 23  2 46 29   Gr    552SB7  2.9  2.9s   7-  32 -11  9 ** GRAZE: nearby
25 Jun 23  2 50 29   M     549SA0  6.3  6.3    7-  32  -7 10  64  12N 341  19 353
   R549 = 24 Tauri
25 Jun 23  2 52 46   M     552SB7  2.9  2.9s   7-  32  -7 11  64  13N 341  19 353
   R552 = Alcyone = eta Tauri
25 Jun 29 22 18 35.8 D   99153PF8  7.2  6.9   23+  57 -11  5 279  52N  73  35  53
25 Jun 30 22  8 39.0 D    1626 K2  8.0  7.4   32+  69 -11  9 266  75N  99  60  77
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Communications Recieved:

<u>Another Lunar Nomenclature Confusion Problem by Robert Garfinkle, FRAS</u>

An additional problem with the official lunar nomenclature is the confusion over whether the Roman numerals for depression features and the Greek alphabet used to designate elevations are still official nomenclature names. They are:

In the 1830s, German astronomer Johann Heinrich Mädler (1794–1874) and German banker Wilhelm Beer (1797–1850) published their 4-sheet lunar map *Mappa Selenographica*. Mädler introduced the system where he appended Roman numerals to the names where there were multiple depression features (rills) with the same name. He did the same thing for elevations, (peaks) using the Greek alphabet, and he introduced the use of Latin letters for satellite craters. This is known as the Mädler System.

In 1913, British astronomical researcher and amateur astronomer Mary Adela Blagg (1858–1944) and British astronomer and selenographer Samuel Arthur Saunders (1852–1912) published their 182-page *Collated List of Lunar Formations Named and Lettered in the Maps of Neison, Schmidt, and Mädler*. The catalogue listed the names of 4,789 lunar formations. This work was completed for the Lunar Nomenclature Committee of the International Association of Academies (IAA) in an effort to standardize the lunar nomenclature. Over the previous couple centuries, lunar mapmakers had used their own naming systems, which resulted in many single lunar features having been given different names. The Blagg/Saunders catalogue included the Mädler System.

The International Astronomical Union (IAU) adopted the first official lunar nomenclature list in 1932 and published the list in 1935 in *Named Lunar Formations*. This 196-page catalogue was compiled by Mary Blagg and Czech-born astronomer Karl Müller (1866–1942). It also included the Mädler System. The IAU adopted 681 features, slightly over 5,400 Latin-letter designated satellite formations, along with numerous Roman-numbered and Greek-lettered formations. These were listed in volume 1 of *Named Lunar Formations*. Volume 2 contained 14 hand-drawn charts. Any new names proposed for the Moon, since 1935, have to be approved by the IAU.

The confusion began in October 1982 with the publication of the *NASA Catalogue of Lunar Nomenclature*

(NASA Reference Publication 1097). The compilers of this catalogue, American astronomers Leif Erland Anderson (1943–79) and Ewen Adair Whitaker (1922–16) were tasked with computerizing the nomenclature list and correcting some misspelled foreign names. Ewen informed me, in the late 1990s, that they were not given enough funding to include the Roman numerals nor the Greek letter features. The former groups of rilles labeled with Roman numerals appended to the rille's names were gathered together to form rimae. The groups of elevations are now labeled as montes. These features are shown as either rimae or montes on some of the paper NASA lunar LAC (Lunar Astronautical/Aeronautical Chart) geology harts created in the 1960s and '70s for the Apollo missions. These charts were artists renderings of photographs taken by the Lunar Orbiters.

The current LAC charts are made from the digital images taken by the *Lunar Reconnaissance Orbiter* (LRO) and are part of the IAUs Solar System electronic database maintained by the United States Geological Survey (USGS) in Flagstaff, Arizonia (https://planetarynames.wr.usgs.gov). The database listings and these charts do not include the Roman numerals nor the Greek letters, only the terms "rimae" or "montes." Single rilles are known as "rima" and single elevations are "mons."

This is why many Moon observers think that the Roman numerals and Greek letters are no longer IAU valid. The IAU has NOT made them unofficial, they just will not give the USGS or NASA the funds to include them in the database nor plot them on the current official charts.

Because some lunar observers still use the paper LAC charts and other older luna reference materials, I included the Roman numeral and Greek letter features in my 3-volume Moon observers reference work *Luna Cognita* (Springer 2020). I give additional information on this matter in my book.

The following figures show the progression of the naming for the rilles of the crater Hippalus.

Figure 1. The Hippalus crater and rilles depicted on chart 14 of Edmund Neville Neison's (1849–1940) 1881 lunar atlas. He used Arabic numbers to designate the rilles. The IAU did not accept rille number 4. (South up)

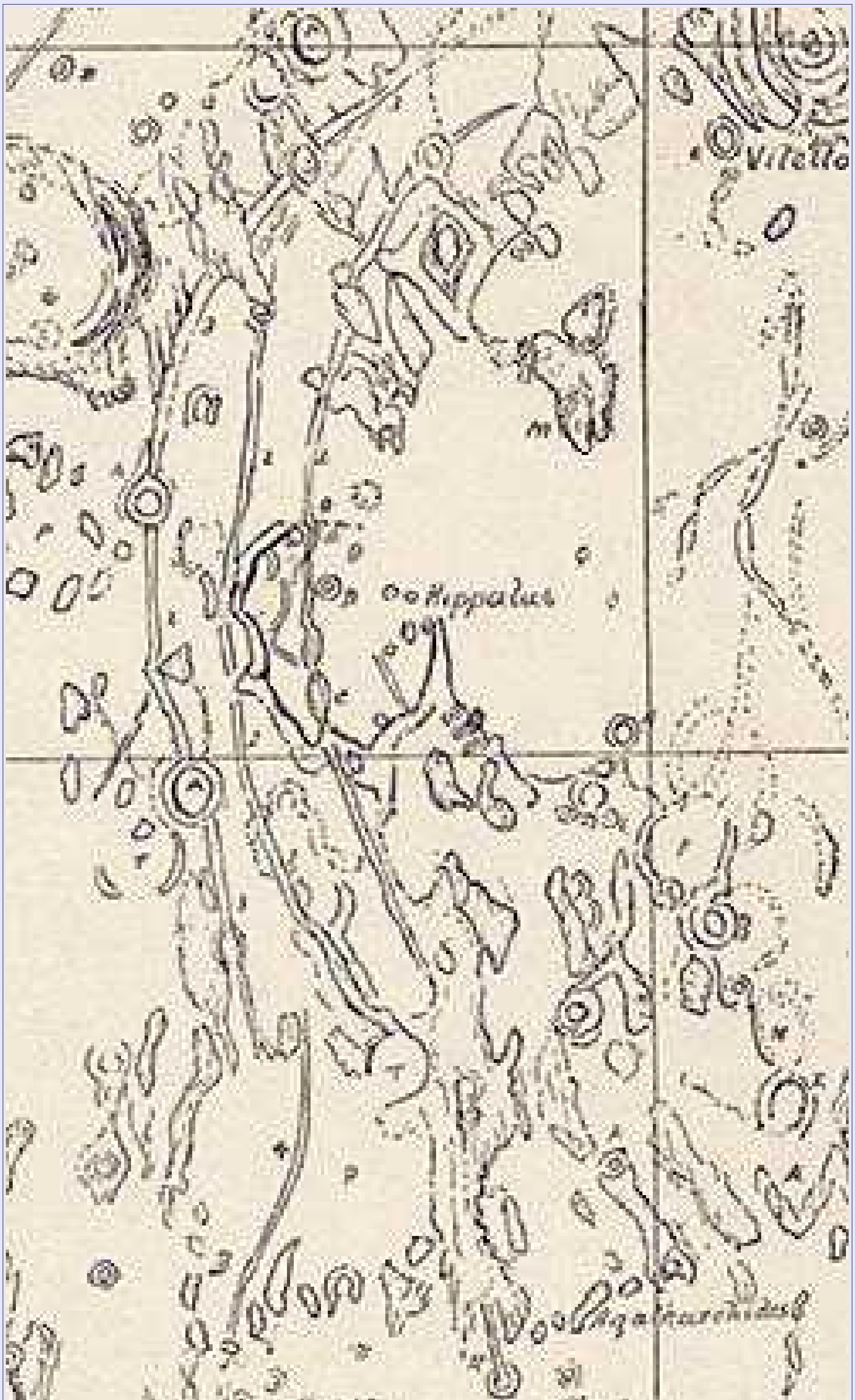


Figure 2. Walter Goodacre's (1856–1938) 1910 chart VII showing the Hippalus arcuate graben rilles numbered 1 to 4 with Arabic numbers instead of Roman numerals. Like Neison's rille number 4, Goodacre's number 4 was also not accepted by the IAU. (South up)

<u>2511</u>	Hippalus		-456 -420	φ 32	..	..	M
2512	Hipl.	I r	Thro' Sw	/	..	..	M(δ);N(ϕ_1)
2513	..	II r	fr 2526	|	..	..	M(ε);N(ϕ_3)
2514	..	III r	fr Sw 2491	|	..	..	S(r);N(ϕ_5)
2518	..	γ	-477 -458	ΛΛ	..	..	M
2519	..	ε	SE 2491	ΛΛ	..	..	N

Figure 3. Cropped from page 93 of volume 1 of *Named Lunar Formations* showing the list of adopted features named Hippalus (numbers 2511 through 2519.) The coordinates of (−456 −420) for the crater Hippalus are in the old orthographic system. The initials in the right-hand column indicate whose lunar map the name first appeared on. The "M" stands for Mädler, the "N" for Edmund Neison, and the "S" for Johann Friedrich Julius Schmidt (1825–84).

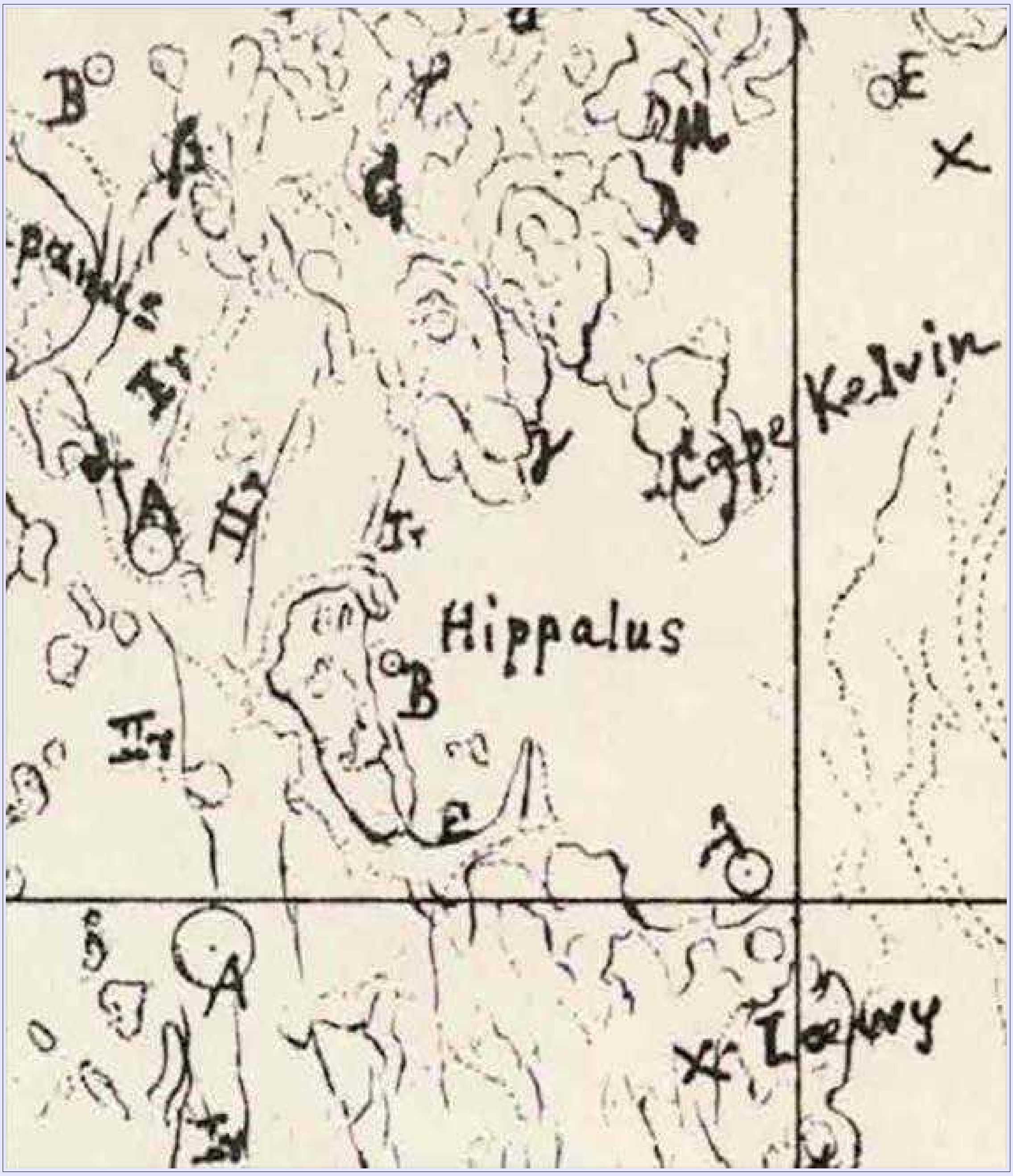


Figure 4. Shows the feature Hippalus and its rilles labeled with Roman numerals followed by a lower case "r". This is cropped from Section 12 of volume 2 of *Named Lunar Formations*. (South up)

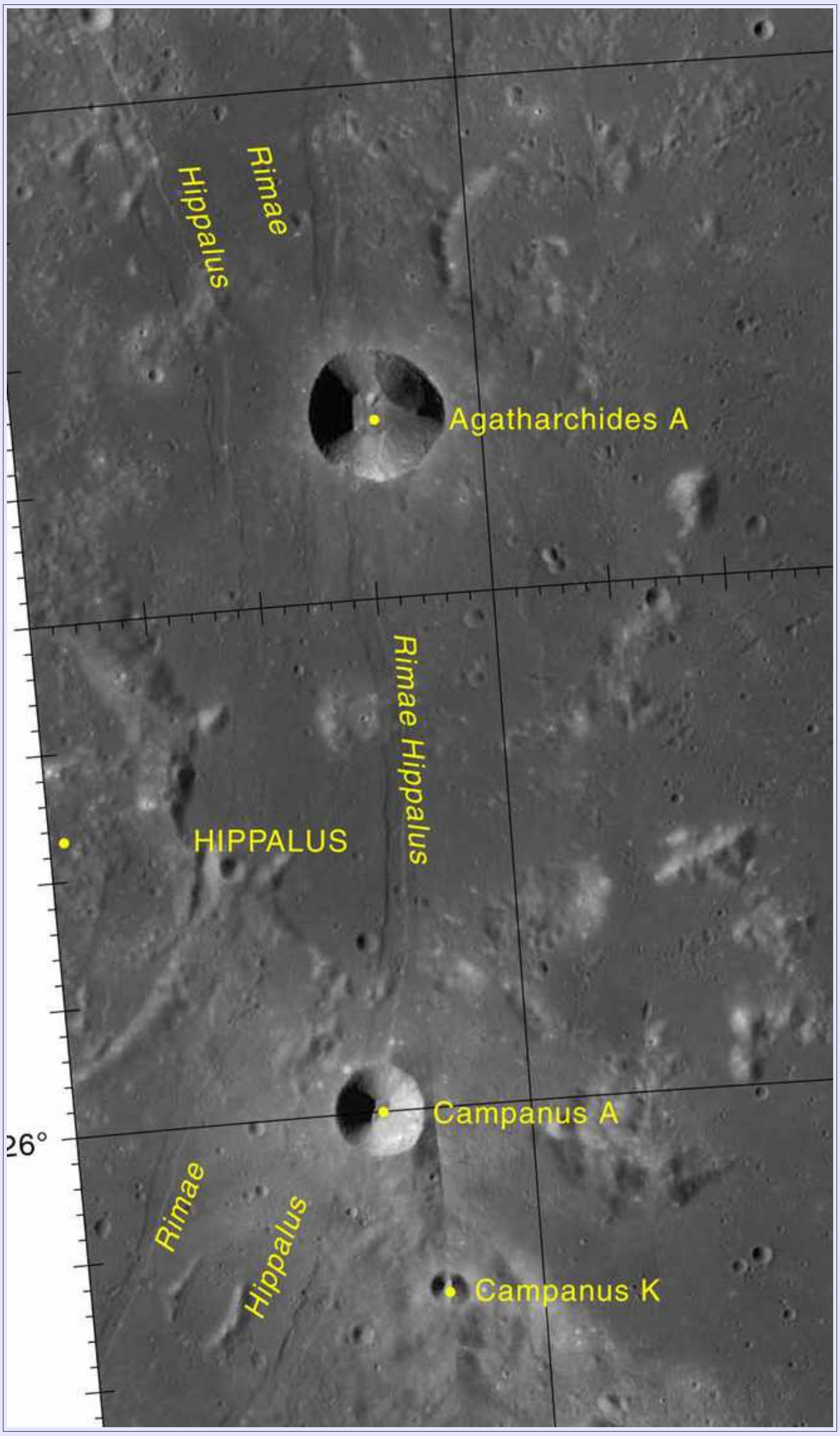


Figure 5. Image of the eastern half of crater Hippalus and the arcuate graben rima forming Rimae Hippalus. Cropped from the electronic LAC chart 94. The bowl-shaped satellite crater Agatharchides A (lat 19.85°South, long 31.11°West) and the bright cone satellite crater Campanus A (lat 25.99°South, long 28.67°West) are obviously younger than the rille Hippalus IIIr that they both bisect. (North up)

Robert Garfinkle, FRAS
32924 Monrovia Street
Union City, California USA

Response to Bill Leatherbarrow's Moretus observations in last months LSC.

Alexander Vandenbohede Sent in:

I*n response to an article "Moretus" appeared on P..32 of May 2025 LSC, I found an image that shows the long linear feature quite "clearly". from my archive. Enclosed is the image* (see below) *for your reference.*

I was intrigued by the the linear feature present on the Moretus image of Bill. It never caught my eye although it is clearly visible, once pointed out.

So I checked my images from March. I was able to observe the area on March 7, 8 and 9. The feature is not visible on the first image but it is on the March 8 and 9 images. I also rectified the March 9 image to have another view on the area. Doing so, the linear feature breaks up in a number of segments with different orientations. I tend to agree that it is a change alignment enhanced by the foreshortening.

Image courtesy of Alexander Vandenbohede.

Image courtesy of Alexander Vandenbohede

K.C.Pau sent in:

In response to an article "Moretus" appeared on P..32 of May 2025 LSC, I found an image that shows the long linear feature quite "clearly". from my archive. Enclosed is the image for your reference.

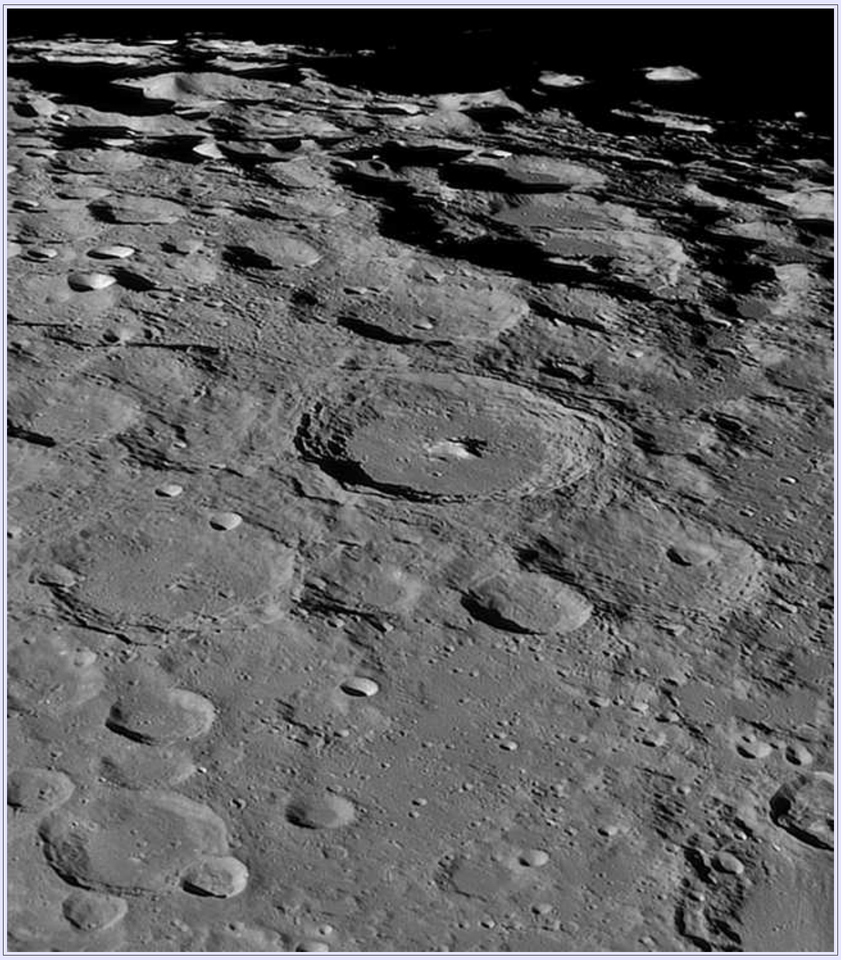


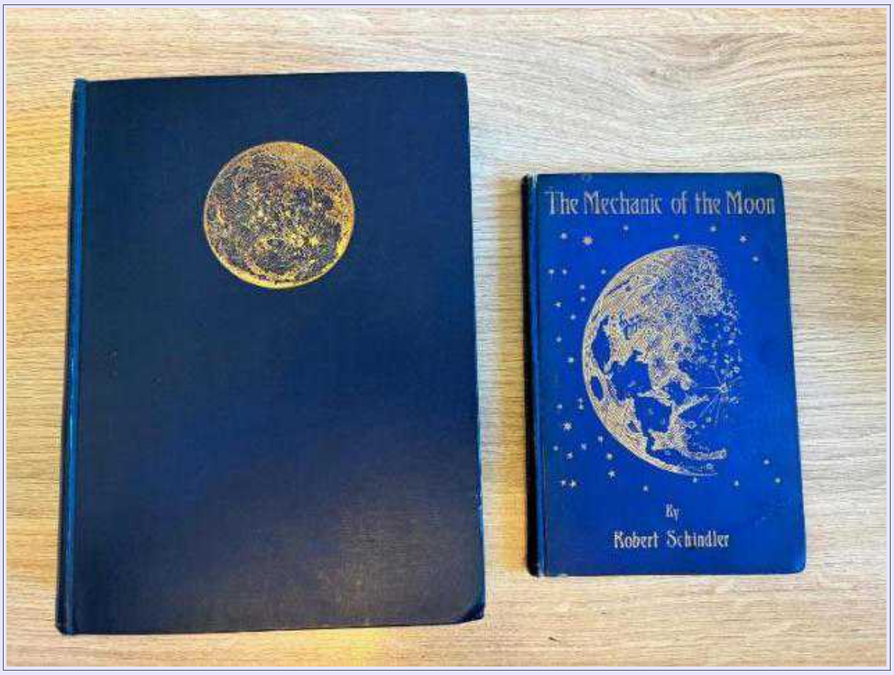
Image courtesy of K.C.Pau

Books for Sale!

1. The Moon considered as a planet, a world and a satellite, Nasmyth and Carpenter, 4th edition 1903. In good condition, but page edges roughcut, former library stamp inside, binding tight. £40. Buyer pays actual postage. UK only sorry.

2. The mechanic of the Moon, Schindler, 1906. Spine shocked and binding weakening and pages wobble but not loose [yet], some pencil scribbling inside presumably by a child but would rub out. £40. Buyer pays actual postage. UK only sorry.

Interested members please contact James Dawson james@dawson.me.uk



Lunar Images and drawings sent in and from the BAA Gallery.

Archimedes region.

Image from the BAA Gallery, and taken by John Arnold on 5th March 2025 at 20:15hrs using a Stellalyra 8" Classical Cassegrain, ASI178MM camera with 742 nm long-pass filter.

Aristarchus.

Image by Mark Radice with details as shown.

Mark sent the following remarks with the image: *Aristarchus Plateau colour enhanced 12th March - this region is always worth exploring. Not only do we have the outflow from the Cobra's Head, the plateau is littered with many more small rilles and outflows.I boosted the colour saturation to show the different surface-types and find that this highlights the contrast between the plateau and surrounding lava flows.*

Scott and Schomberger.

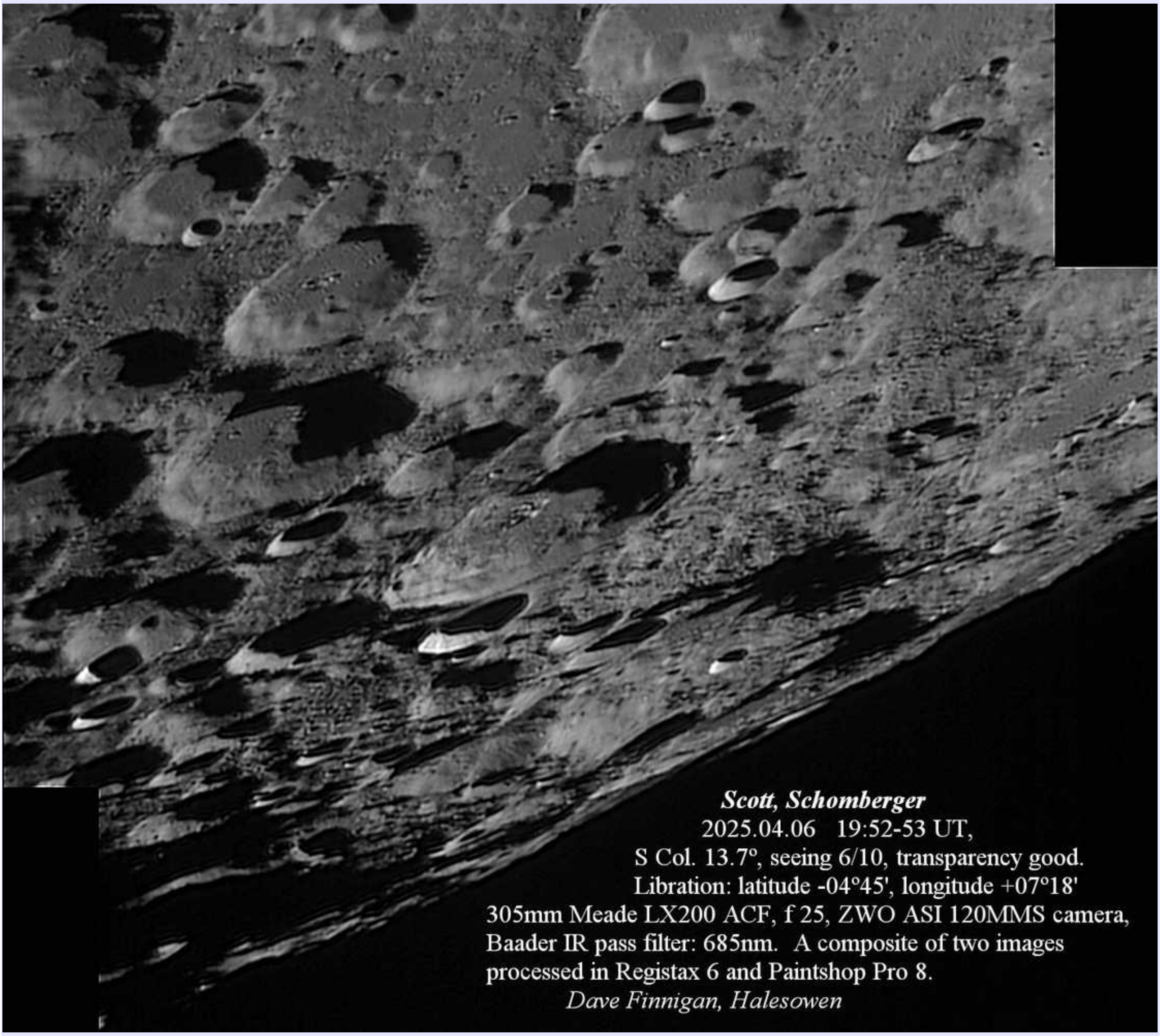
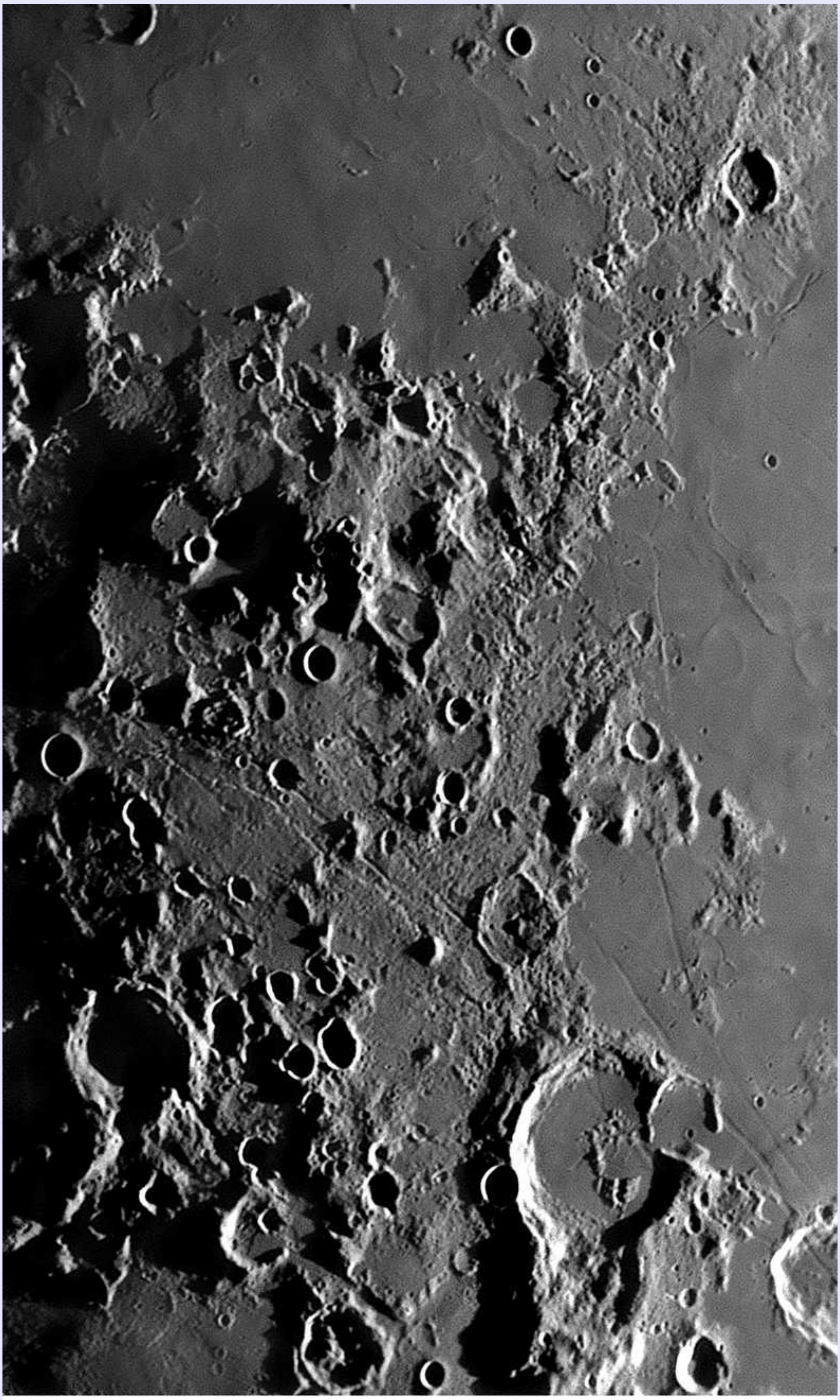


Image by Dave Finnigan with details as shown.

Montes Jura and craters in colour.

Image from the BAA Gallery, and taken by Peter Tickner on 9th May 2025 at 21:08 hrs using a Player One Uranus-C, Chroma luminance filter, ZWO ADC, 2.5x Televue PowerMate, 14inch f/10 LX200ACF SCT and Mesu E200 Mk II mount

Gutenberg.



Gutenberg
2 May 2025 11h52m UT with 250mm f/6
newtonian reflector + 2.5X barlow + QHYCCD 290M
Photo taken by KC PAU

Image by K.C.Pau with details as shown.

24 Hour Old Crescent Moon.

Image from the BAA Gallery, and taken by Andrew Paterson on 28th April 2025 at 16:26hrs using a Nikon Coolpix P900.

Mare Crisium.

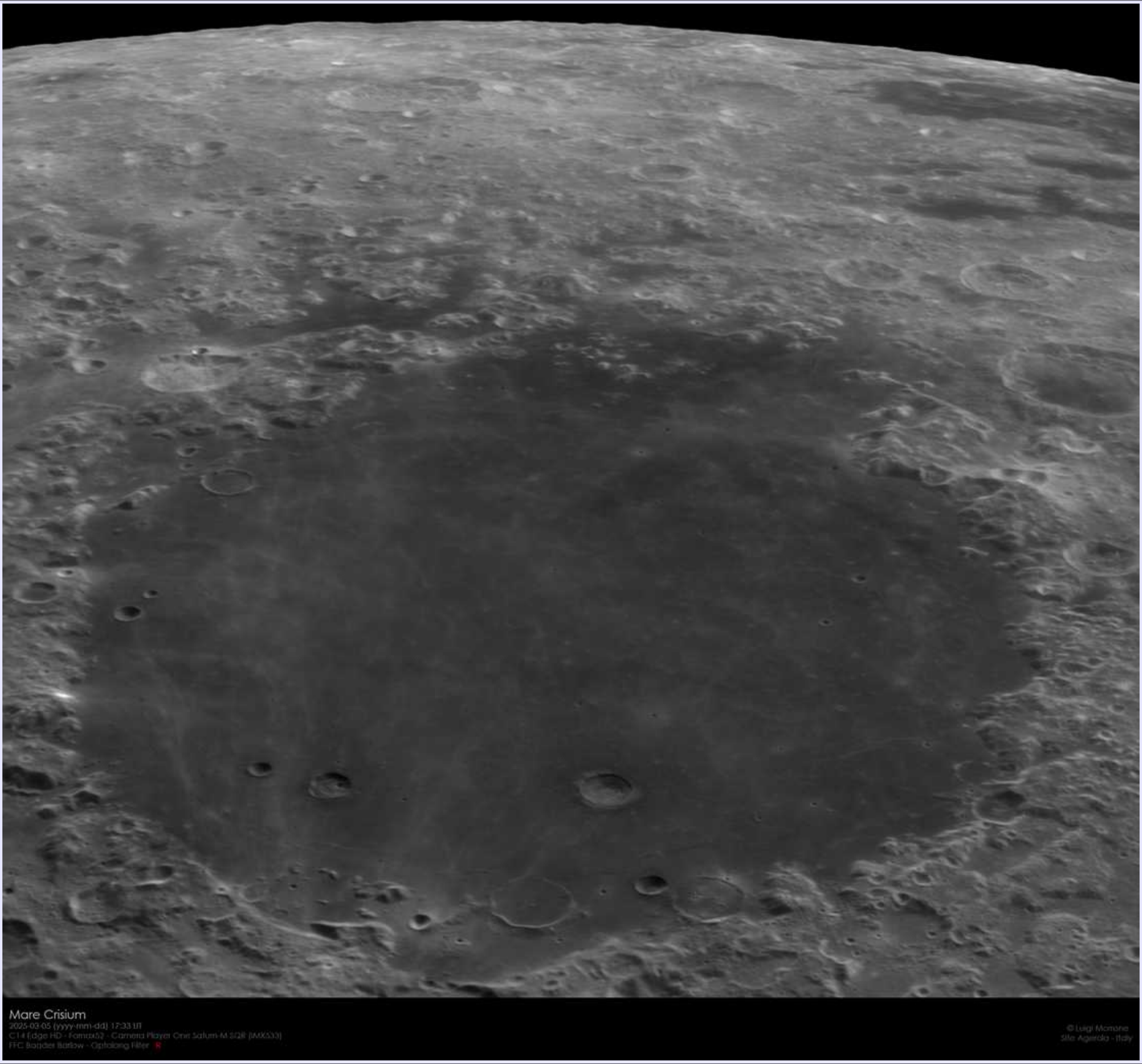


Image by Luigi Morrone with details as shown.

Editor Comments: The perspective in this image shows just how asymmetrical Mare Crisium is, being elongate along the E-W axis. This is of course the consequence of the low angle nature of the basin forming impact, with the impactor travelling from west to east – so this image is along that trajectory. The western rim is low compared to the northern and southern rims – whilst there is no real rim to the east. This is the characteristic 'saddle shape' produced in low angle impacts, with Messier being one of the best examples of this type of profile. At the eastern end of the basin you can see a range of hills projecting above the lavas that lie beyond Dorsa Tetyaev and Dorsa Harker, this mark the edge of a shelf like structure where the basin depth is lower than over the central part. This shelf is again another consequence of the low angle impact and where the basin was not excavated as deeply as the central part. This morphology was amusingly named a Tomahawk Basins in a paper on low angle impact basisn, with the far side Mare Moscoviense being another example.

* Schultz, P. & Stickle, Angela. (2011). Arrowhead Craters and Tomahawk Basins: Signatures of Oblique Impacts at Large Scales.

Micro Moon.

Image by Mazin Younis taken on the May 12th 2025 at 20:20hrs with a Personal Remote Telescope (Sky-watcher Quattro 8 f/4) in Morocco. Image from the BAA Gallery.

Mazin added the following notes: *Caught the Micro Moon Just as it cleared Aklim mountain in S Morocco. The image of the mountain was processed separately then joined for clarity.*

10.9 Day old Moon from New Zealand.

Image by Maurice Collins with details as shown.

Messier and Messier A

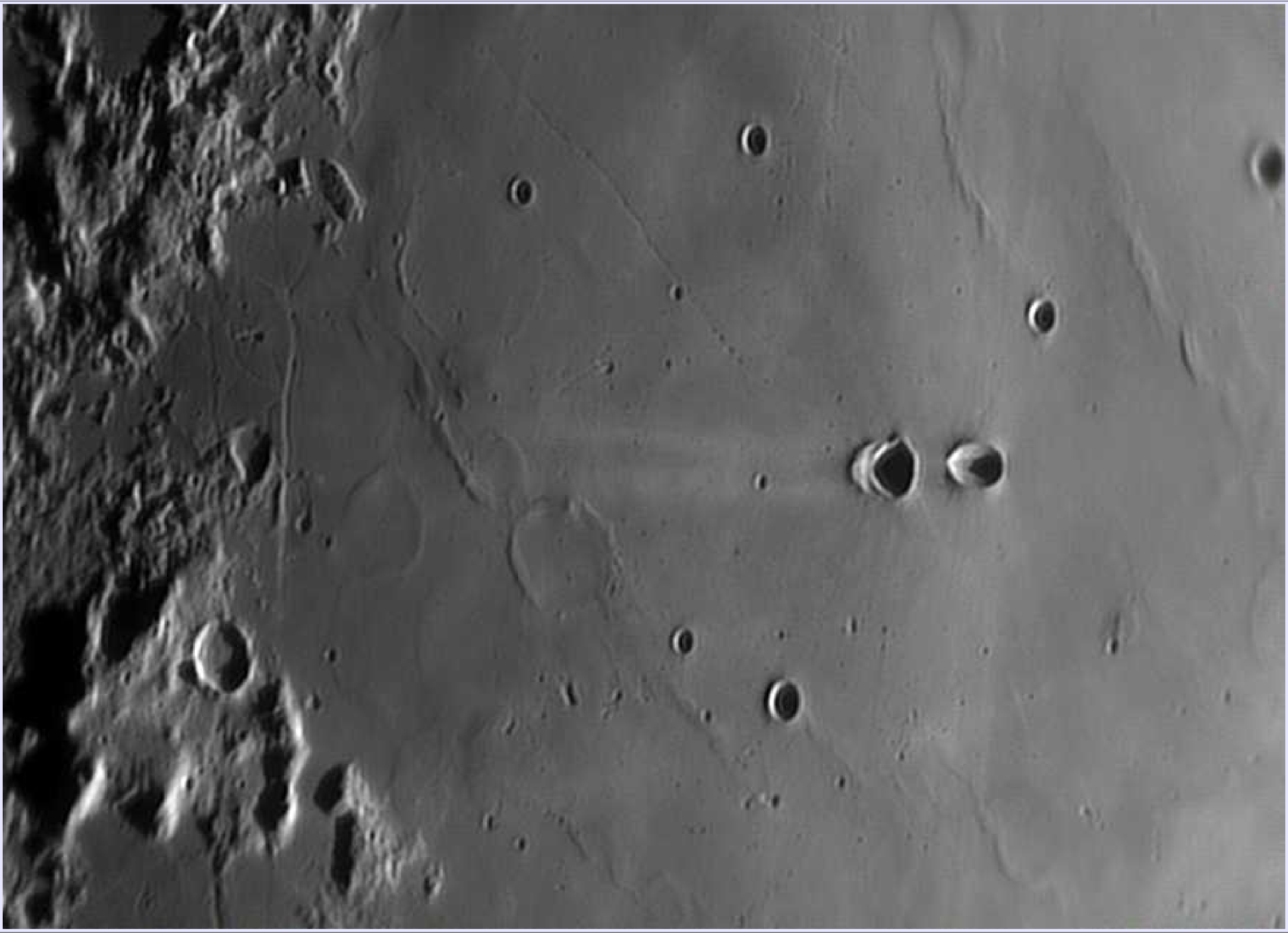


Image by Bill Leatherbarrow taken on 2nd April 2025 at 19:14hrs.

Pormortsev and environs.

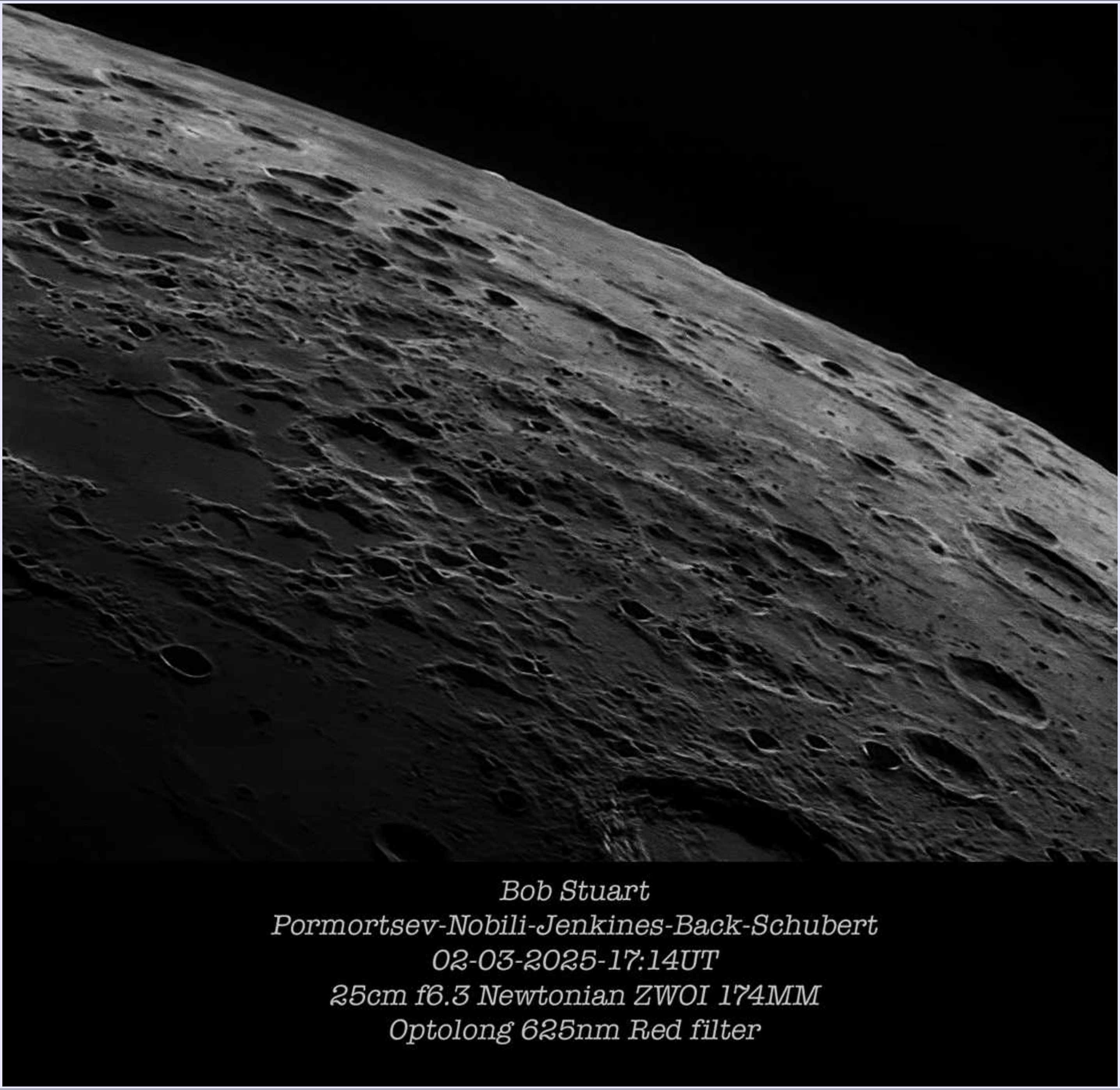


Image by Bob Stuart with details as shown.

Mare Nubium and surroundings.

Image from the BAA Gallery, and taken by James Dawson on 7th May 2025 at 22:11hrs using a Celestron C14 and ASI ZWO 585MC

James added the following notes: *Another delightful lava field, peppered with interesting features including the Straight Wall. Fra Mauro has passed me by, along with crater Parry next-door; Fra Mauro has very poorly defined walls on Quickmap but under this illumination was very clearly a prominent crater. Interesting rille system extending through Parry and into Fra Mauro which was nicely illuminated whilst observing. A region worthy of further observation at higher magnification.*

There is more to follow on this area – see below.

Southern Highlands in Colour

Image by Chris Longthorn and taken on November 11th 2024 ZWO using an ASI 585MC and 200mm F/8 RC Cassegrain at prime focus.

Mare Imbrium

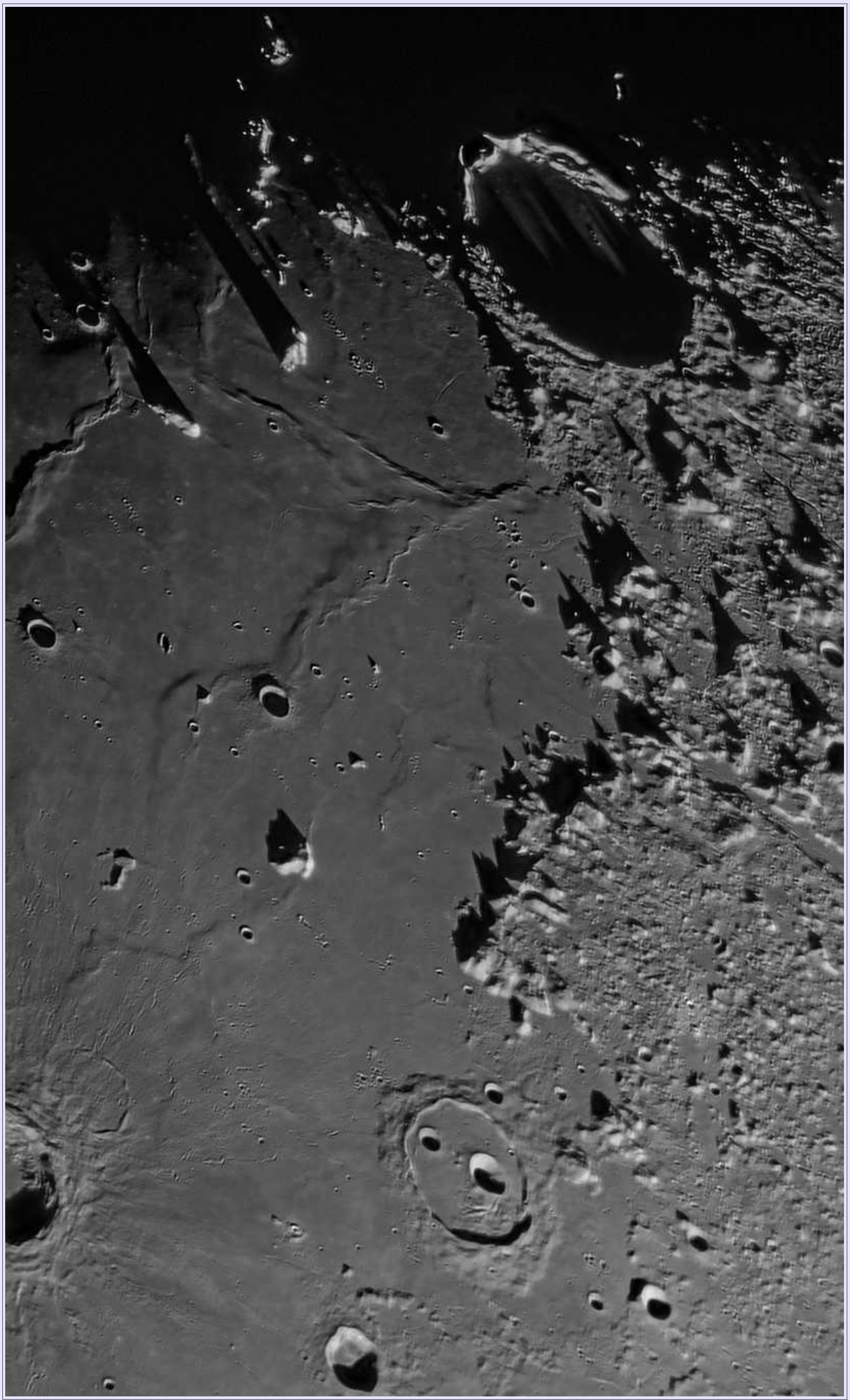


Image by Leo Aerts taken on March 18th 2024 at 18h11 UT using a Celestron 14 SCT and red filter.

Mare Humorum

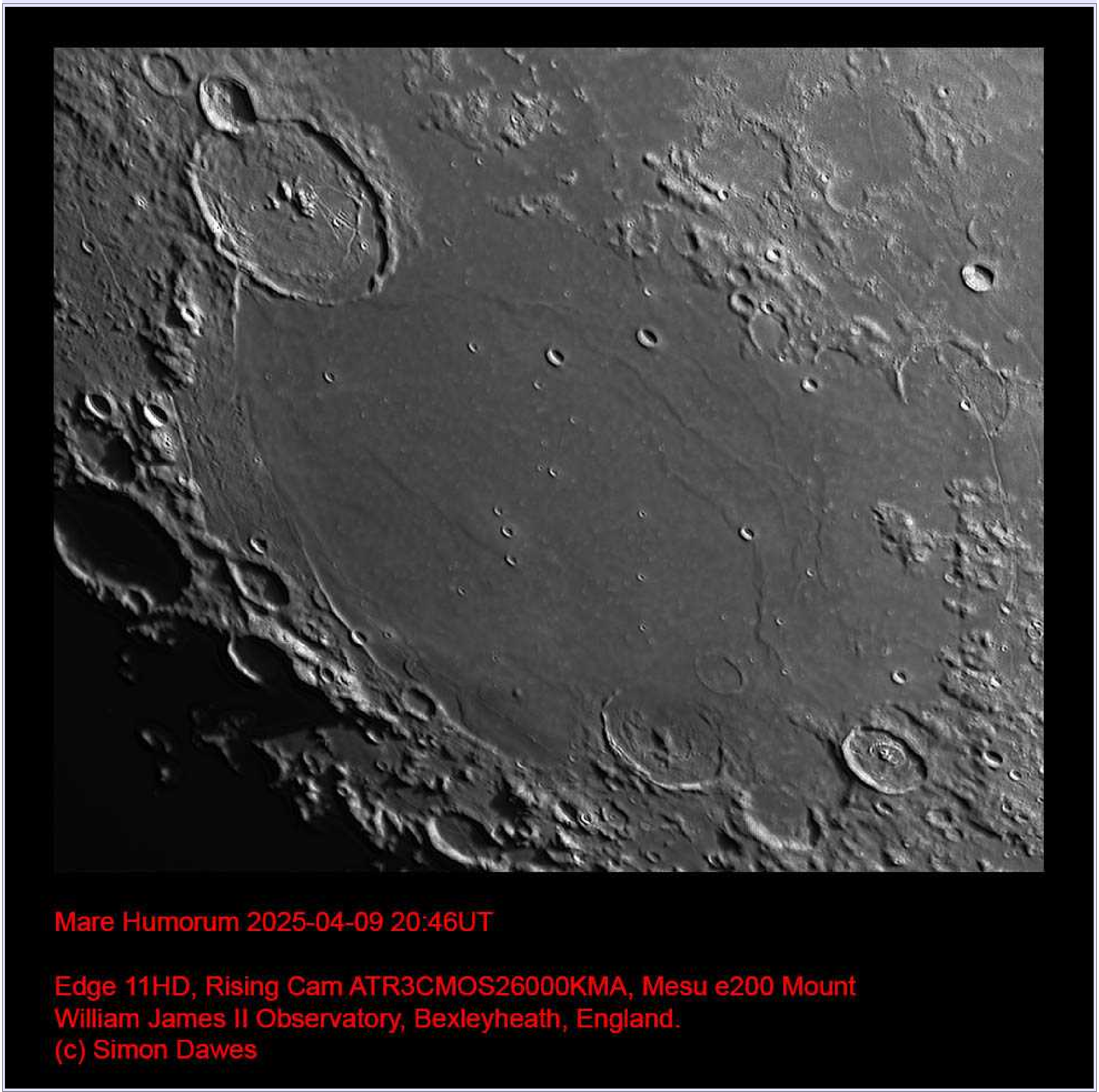


Image from the BAA Gallery, and taken by Simon Francis Dawes on 9th April 2025 at 2046hrs using a Celestron Edge11HD, Mesu e200 Mount and Rising Cam 26000.

Clavius.

Image from the BAA Gallery, and taken by Raf Lena with details as shown.

Bessel.

Image by Alexander Vandenbohede with details as shown.

Editor Comments. This image shows some really interesting geological structures – such as the Tacquet formation, that forms the dark band at the southern edge of Mare Serenitatis and to the north of Plinius and which is probably related to extensive pyroclastic deposits, as well as the odd Rima Dawes, which is not a rima but an ejecta feature from that crater. Another lunar feature that is here, but not visible due to being in deep shadow is the perplexing Bessel Ray – a bright ray that extends across the mare surface within close proximity to the crater Bessel (just left of centre frame and sitting on a wrinkle ridge) in a roughly NNE-SSW direction. The origin of the ray has been hotly debated – is it from the craters Hayne or Thales, or maybe from Menelaus? It is certainly not from Bessel though, as that is a much younger crater, but a 2004 LPOD[1] by Chuck Wood also suggested that Tycho could the ray source.

The ray is of a highland composition which would be consistent with Tycho being the parent, but Wood points out that "*Tycho's rays extend only about 1500 km, yet the centre of the Bessel ray is 2000 km*" adding that there is no trace of a ray over the intervening 500kms. This bought to mind some research that has proposed that a peculiar patch on the lunar far side and located at the to the Tycho antipode some 5,300kms away, is the result of ballistically emplaced ejecta from that crater which converged from various directions, and was deposited to form molten pools and rocky veneers over the surface[2].

Fig.1 LRO Colour Hapke-Norm overlay from Quickmap showing the Bessel Ray.

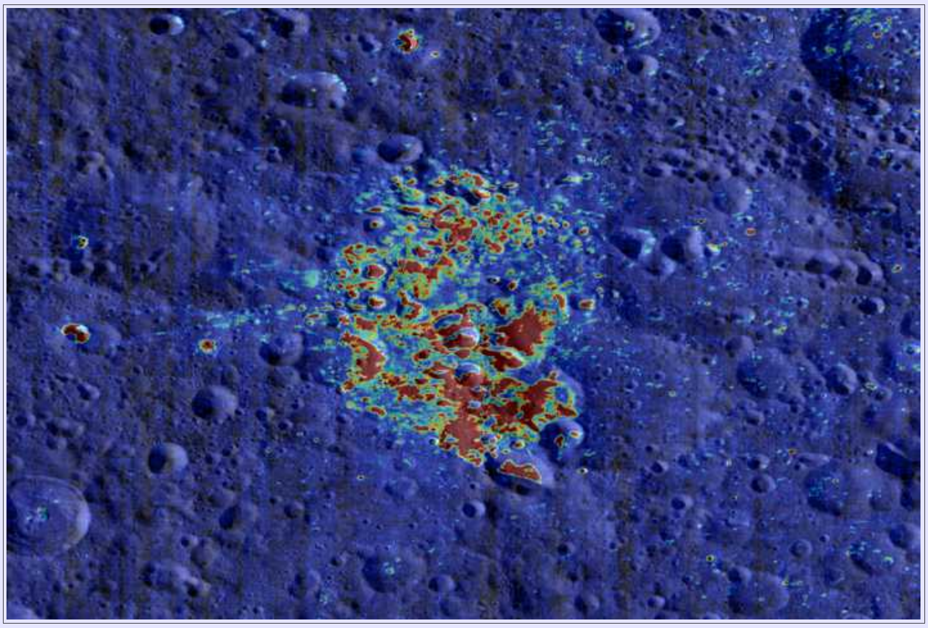


Fig.2 Diviner Rock Abundance overlay of the Tycho Antipode showing the rocky melt deposits (red and yellows) that are believed to be deposits of converging ejecta from Tycho some 5300kms away!

If this is a plausible hypothesis then it is also possible that the Bessel Ray does indeed originate from Tycho despite the apparent discontinuity between the most of Tycho's rays and central Mare Serenetatis, as many of these globe spanning trails of ejecta, failed to leave a surface ray but clearly traversed the lunar sky overhead en-route to to the far side. Maybe this is what happened with the Bessel ray, and a ballistic train of debris left the impact site as a discrete unit, not making landfall as it were until it reached Mare Serenetatis and leaving no trace of its passage on the ground it passed over.

To test this I used the LRO Path Tool with one end anchored on Tycho and the other on the antipode forming a Great Circle between them – this is shown in Fig.3 which is a 3D Globe rendition from Quickmap, and as can be seen the line traces the course of the Bessel Ray quite accurately. This correspondence is shown in more detail in Fig.4 providing a reasonably convincing argument for the parent crater being Tycho.

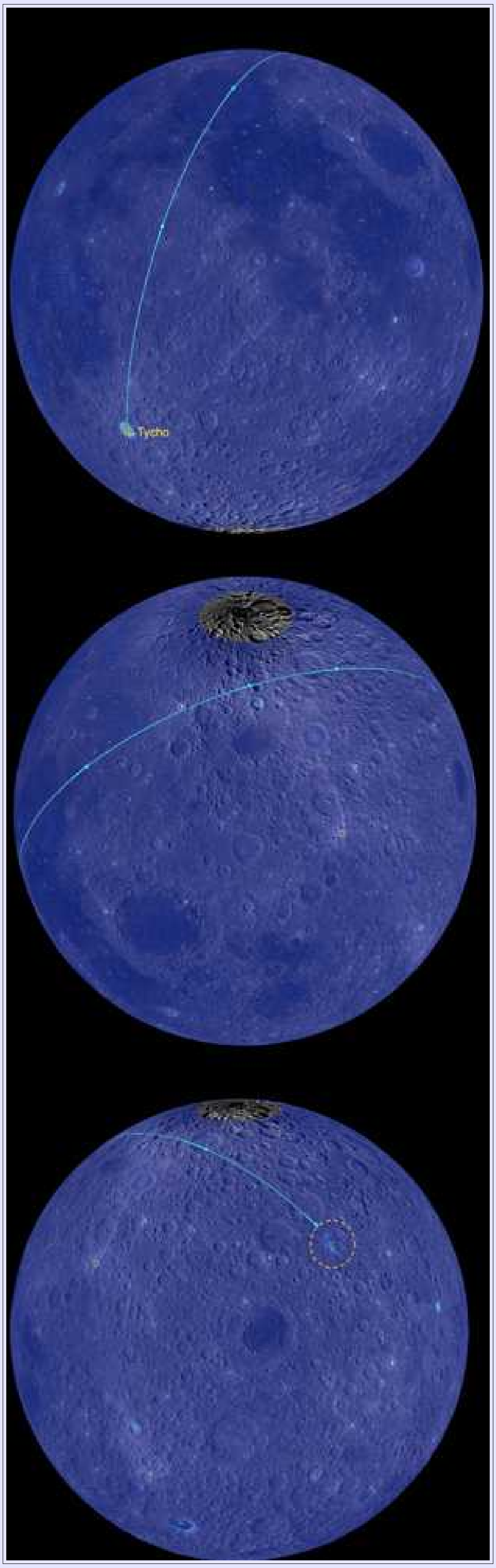


Fig.3 3D Lunar globe with the Diviner Rock Abundance overlay and a line from the LRO Path Tool in light blue which traces a Great Circle between the start and end points.

Now please bear in mind that this is not a totally scientific approach, and using the Line Tool might give you an *approximation* of a Great Circle – but I would stop short of suggesting that this gives you an accurate trajectory of ballistic ejecta, so we are dealing speculation and certainly nothing definitive, but it may be suggestive.

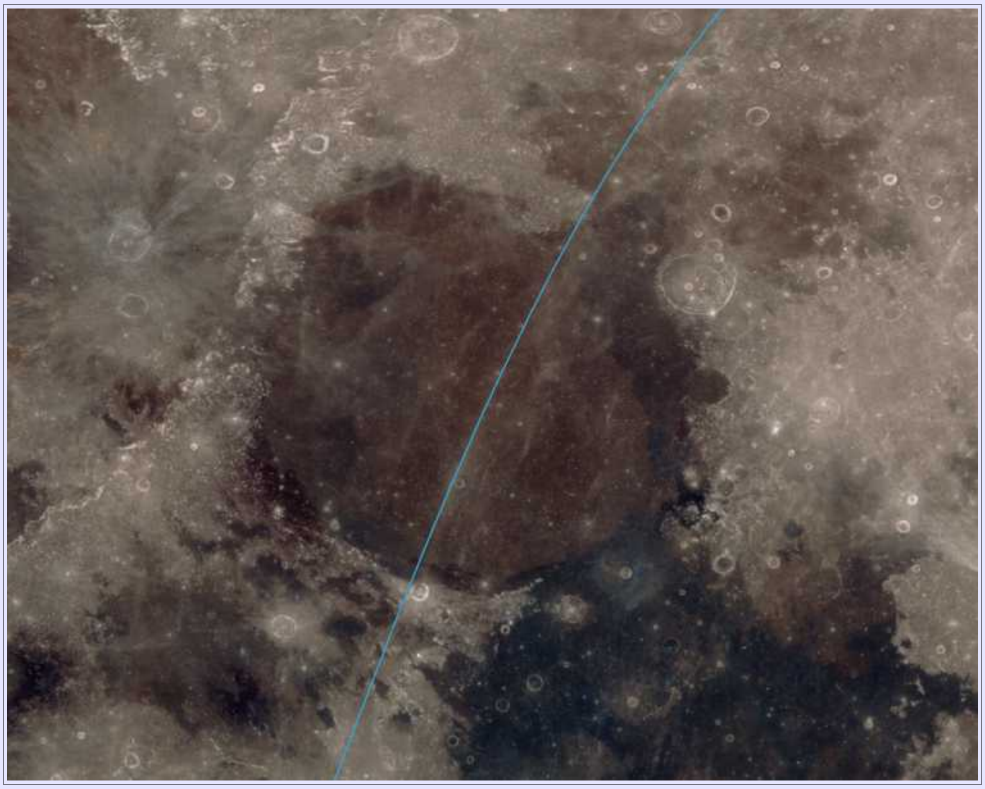


Fig.4 The blue line shows the Quickmap Path Tool line joining Tycho and its antipode – it passes over the Bessel Ray which might suggest that it originates from that crater.

Of course, not all crater rays are caused by the impact of ejecta that followed a ballistic trajectory from the parent crater along a Great Circle. So for instance the Cardioid Rays that define the edges of Zones of Avoidance (ZoA's) in low angle impact craters might not conform to this pattern as their final configuration is a result of interactions *within* the ejecta as it changes configuration during the impact process – despite individual ejecta particles following a ballistic trajectory.

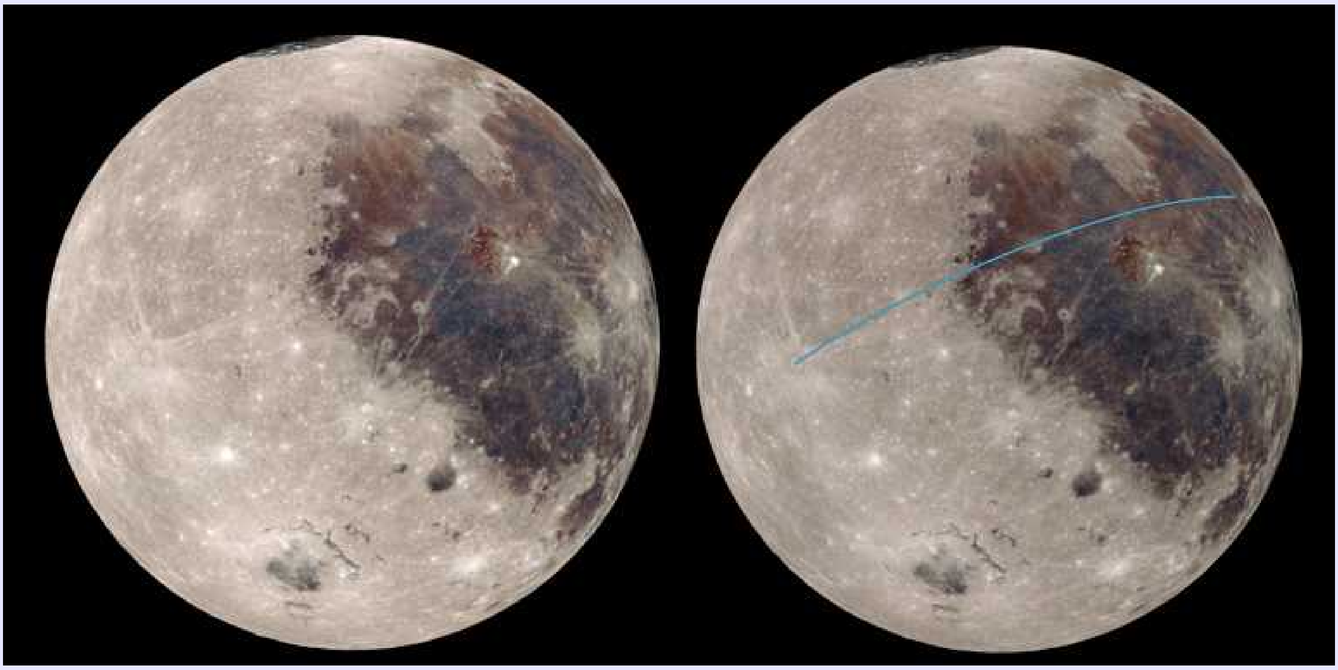


Fig.5 The Cardioid ray from Ohm that crosses over on to the near side – note that it does not correspond to the the blue Path Tool line marking a Great Circle.

An example of this is shown in Fig.5 which shows the Cardioid Ray from the far side crater Ohm, that reaches on to the near side, and as you can see its course does not correspond to a Great Circle, so something more complex than ballistically ejected debris is responsible for the course of the surface ray we see.

Try your hand at this Line Tool/Ray exercise and see if you can come up with any interesting results or even better find an alternative origin for the Bessel Ray.

1. https://www2.lpod.org/wiki/May_28,_2004

2. J. B. Adler et:al Tycho ejecta deposits near the ballistic antipode: new modelling methods. 50th Lunar and Planetary Science Conference 2019 (LPI Contrib. No. 2132)

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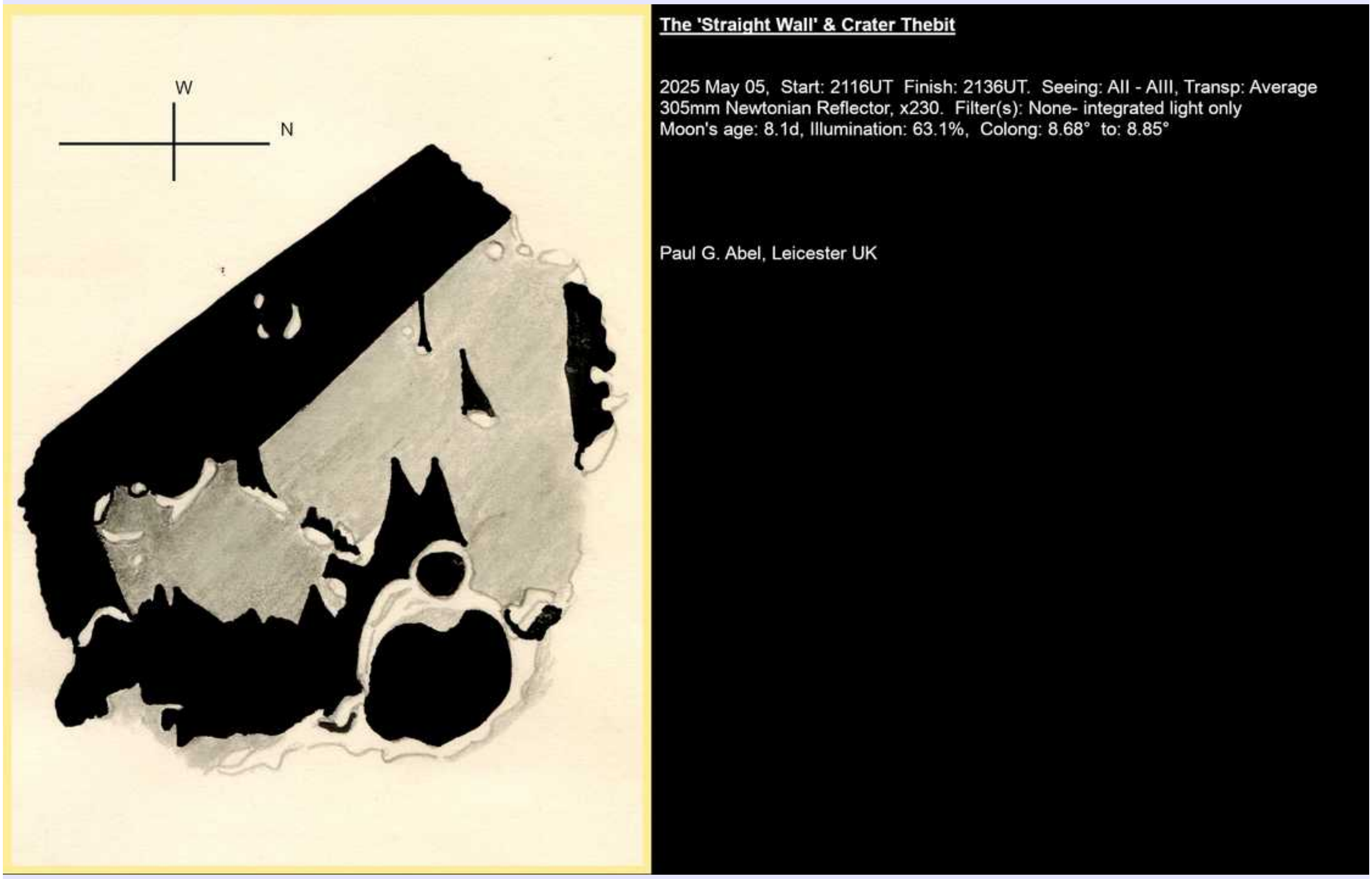
The Straight Wall and Thebit.



Drawing by Paul Abel with details as shown

Mineral Moon.

Image from the BAA Gallery by Alun Halsey taken on 10th May 2025 at 22:24 using a OOUK VX8L 200mm f/6 Solar Newtonian (uncoated primary), P1 Neptune-M mono planetary camera, Astronomik RGB filter set, ZWO filter drawer and Mesu-200 Mk1

Alun added the following remarks: *After having carried out star test on the solar converted 8" Newtonian I decided to have a go at the Moon after having watched the video posted on the Lunar section regarding capturing the Moon in colour representing the minerals. Captured six panes in Red same again in the Green and then Blue to cover the lunar surface in each filter. Stacked in Astrosurface, the three mosaics stitched in Microsoft ICE and aligned in IMPPG then back to Astrosurface to combine RGB. Final processing in GIMP to bring out the colouring and resize the image.*

An observation of Rima Parry by James Dawson and Barry Fitz-Gerald.

James sent in the following account which describes an interesting observation made during an astronomical outreach session at his local society:

My local society has two sit-down meetings per month, one usually by a professional astronomer, and a less formal meeting which I arrange and invariably deliver on practical aspects of amateur astronomy and related topics. For the May meeting, I'd asked everyone to make a drawing or sketch of something related to astronomy; I had imagined it would be like drawing blood from a stone, but I managed to get 20 drawings in all of a range of items, so it was a real success. In preparing for the meeting, a friend asked if he could use the society's Celestron C14 telescope to look at the Moon so he could make his drawing. Before he arrived, I'd set up a pair of William Optics Binoviewers on the C14 as I thought this would give him a better opportunity to get an immersive view of the Moon. I scanned the terminator of a 9.5-day-old waxing gibbous Moon (72.3% illuminated), past Copernicus, whose western wall was in sunlight, and south towards Mare Nubium. Just before the smooth lava plain of Nubium, a number of closely packed crater rims popped out and caught my eye. My friend liked the group and made his sketch of it. Whilst he was sketching, I used QuickMap to identify the group. When I had a closer look, and could just spend a little longer with the binoviewers, I thought there was a hair on the optics, but soon realised it was a rille crossing Parry and into the adjacent crater, Fra Mauro. He hadn't noticed this whilst sketching. After he'd gone, I decided to image the group and whilst the seeing was only mediocre the linear geological feature was clearly evident on the live recording and has come out clearly in the stacked image. Studying the image in higher magnification revealed that the rille crossed the floor of Parry, and both the northern and southern crater ridge lines, and into Fra Mauro to the north. Going south, the feature was interrupted by the crisp, younger crater Tolansky, but continued south, seemingly into the horseshoe-shaped Guericke F. The most interesting aspect of this for me was the feature appearing to be draped over the crater rim of Parry. It just goes to show what spending a bit of time at a single site can reveal and how blaming artefacts on grubby optics isn't always wise."

The linear feature that James spotted, and which is clearly a bit of a difficult target is Rima Parry I, one of a complex of *rimae* crossing the craters Fra Mauro, Parry and Bonpland. In geological parlance it is a *graben*, a tectonic feature consisting of two steeply dipping parallel faults where the terrain between has subsided to produce an elongate trough. These can be spectacular structures, with Rima Ariadaeus being a prominent lunar example. His image shown in Fig.1 picks out the hair line Rima Parry I as well as a surprising amount of other detail, some of it quite subtle and virtually invisible in most of the spacecraft data – but more of that later.

Rima Parry I can be traced from the northern part of Fra Mauro, southwards across the northern rim and western floor of Parry and then continuing towards the younger crater Tolansky which it interrupts before fizzling out somewhere to the west of Guericke – a total distance of over 190kms. This last section south of Tolansk which was also spotted by James involves a change in nature from a *rima* in to a *rupes* – a west facing scarp about 50m high but with no trace of an east facing one. You can see this clearly in the Apollo 16 image below (Fig.2) and which suggests a change in the configuration of the faults bounding Rima Parry I.

Fig.3 shows the different components of the Rimae Parry complex, with the numbering going from I to VI and no doubt if you searched the imagery you could find smaller offshoots and branches that have no designation but are part of the overall complex. Of course Fra Mauro's claim to fame is that it was the landing site of Apollo 14, a mission that targeted this area as it was believed to be covered in Imbrium Basin ejecta (the Fra-Mauro Formation) the dating of which, it was hoped, could provide an absolute age for Imbrium event. Though one of the most conspicuous of the complex, Rima Parry I is relatively modest in scale as lunar graben go, being at its most well developed somewhere between 50 and 60m deep and about 1.5kms across. You can see how close the area is to the terminator in James's image, and despite this it was clearly a difficult target for his fellow observers.

Image by James Dawson and taken on 6th May 2025 at 22:09 using a Celestron C14 and ASI 585MC camera.

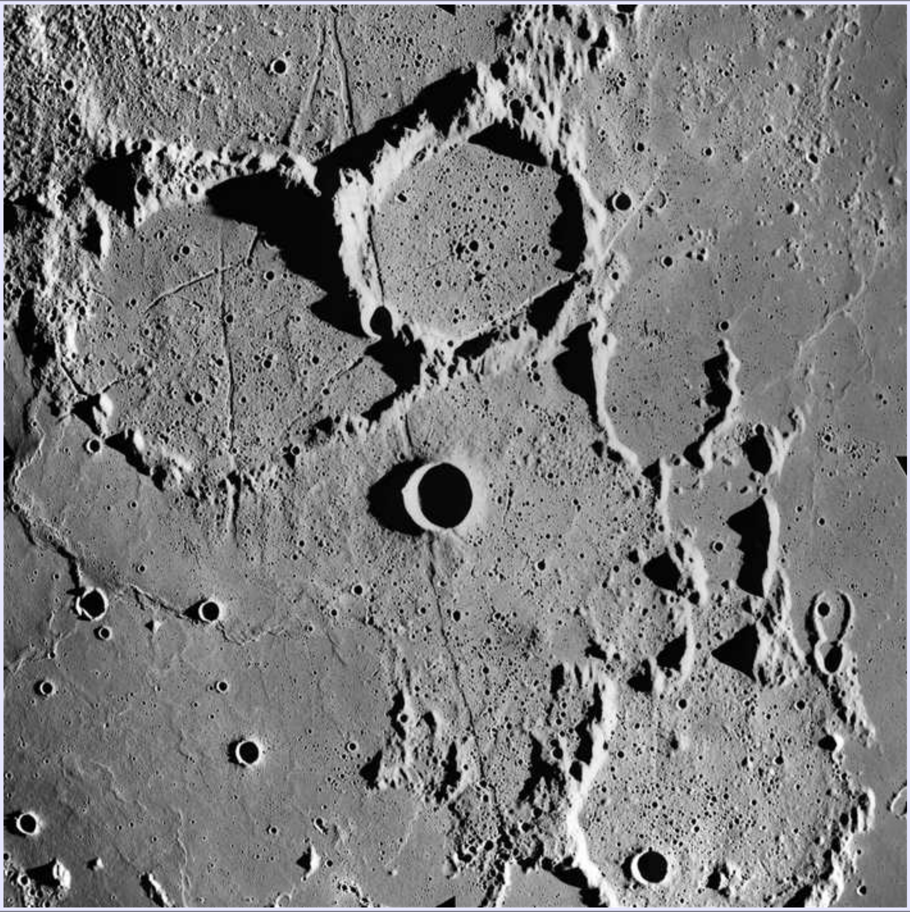


Fig.2 Apollo 16 image of Parry and Bonpland and the southern rupes configuration of Rima Parry I

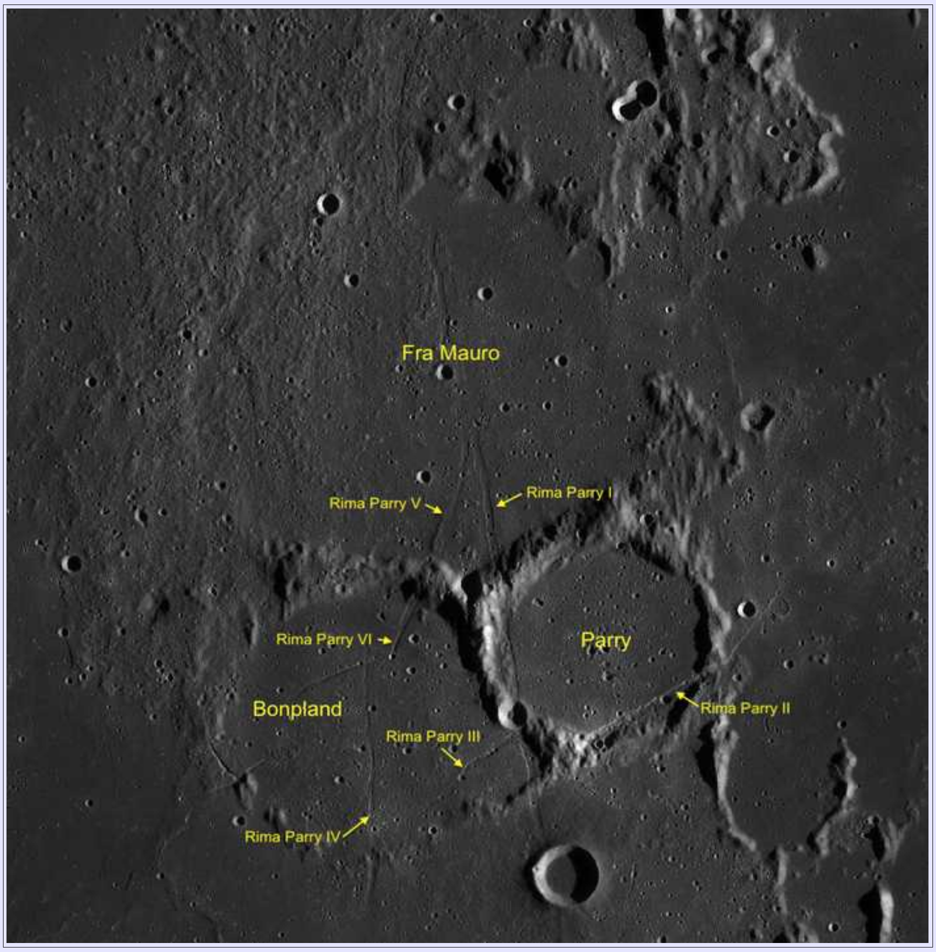


Fig.3 LROC WAC image of the Rima Parry complex

Graben form when the lunar crust is subject to tensional forces – that is, being pulled apart – with a frequent manifestation being pairs of parallel faults that form at right angles to those tensional forces. The strip of terrain between them can then subside downwards to produce an elongate trough or *horst*. This is a common terrestrial landform, and can result in colossal structures such as the East African Rift Valley where plate tectonics is pulling the region apart with the Somalian plate pulling eastwards and the Nubian plate westwards. As for lunar examples, observers and imagers will be familiar with the curving graben around some maria, such as Rimae Hippalus bordering eastern Mare Humorum. These formed as great piles of basal lava filled the central part of the basin, the great weight causing it to subsided and exert tensional forces around the mare edges. The more linear Rima Cauchy formed as the surface bulged upwards when magma was injected into the underlying crust producing a subtle regional up-arching of the crust. In both cases tensional forces resulted from vertical movements, downwards in the case of Rimae Hippalus and upwards in the case of Rima Cauchy, and whilst the Rima Parry complex was similarly formed by vertical movement it is not an example of either of these particular categories.

Fig.4 Chandrayaan-1 1489nm Reflectance overlay from Quickmap showing the dark areas around Rima Parry V amongst others that indicate volcanic activity in the form of volcanic cones, collapse pits and pyroclastic deposits.

A clue to what may be going on with the various rimae Parry is the presence of volcanic cones and apparent pyroclastic deposits associated with Rima Parry V where it crosses the northern rim of Bonpland. Jim Head and Lionel Wilson* proposed that this evidence of volcanism indicates the presence, beneath the surface, of a steeply dipping dike, a sheet of lava that forced its way up from a molten reservoir deeper within the crust. As it did so it exerted an extensional force within the crust – literally pushing it apart and opening up parallel faults that extended to the surface, resulting in the formation of a graben along its path. They calculated that the dike width was ~150m and the ascent of the magma stalled at a depth of ~650m, apart presumably from the places where it ascended via smaller conduits to erupt at the surface.

In many cases however no volcanic material reaches the surface, and we only have a graben as evidence for the dikes presence, but in some cases, such as where we see in Rima Parry V magma does reach the surface and erupts. The Chandrayaan-1 overlay in Fig.4 shows some areas of probable volcanic deposits, with the dark patches indicating the presence of pyroclastic volcanic material. These include the dark patch to the north of Bonpland's rim which marks a line of cones along Rima Parry V, and other patches forming an arc along the inside of the crater rim. Also note the crater Tolansky and its surroundings, as well as patches to the SSE of this crater and one on the northern floor of Guericke. There is also a small crater on Rima Parry II that has a dark halo (just to the left of the yellow arrow marking Rima Parry II in Fig.2) apparently enriched in the mineral olivine, and whilst this might be a simple impact crater that has excavated volcanic rocks from the dike underlying the rima, it is also possible that this is a vent which erupted as molten rock ascended towards the surface. There is no indication of surface lavas however, so the eruptions would have been of the fire fountain type, building up ashy deposits and low cone like structures.

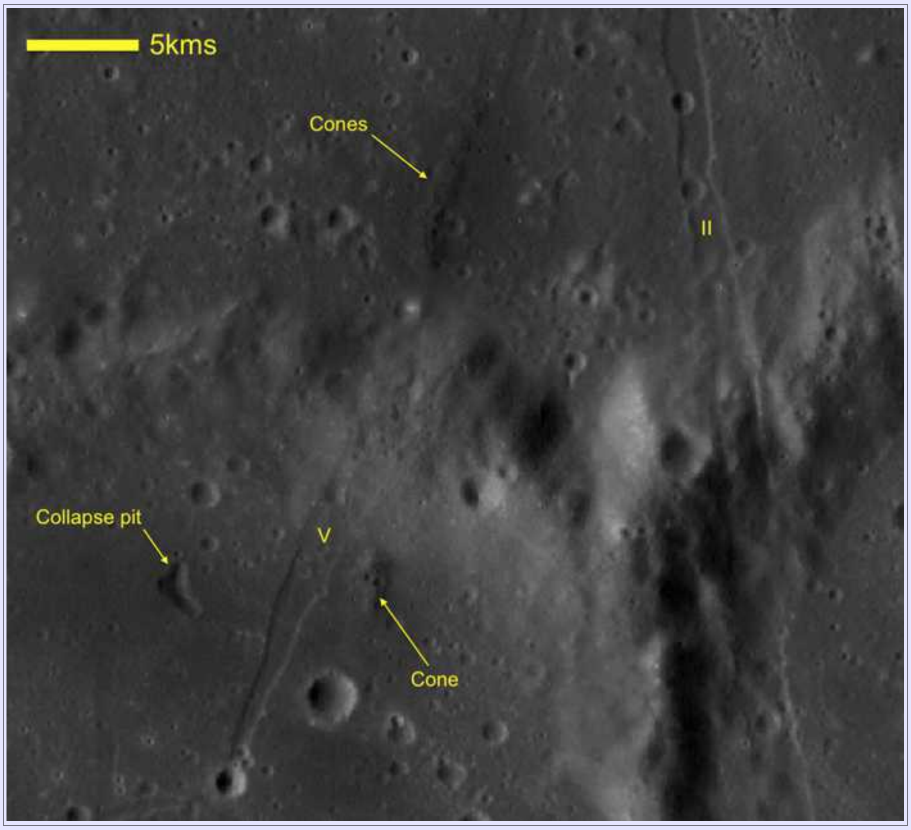


Fig.5 shows the northern rim of Bonpland in more detail, with various volcanic features marked – the most incriminating being the line of cones along the western edge of Rima Parry V.

Fig. 5 shows a more detailed view of the northern rim of Bonpland with some volcanic features marked – the line of cones hugging the western rim of Rima Parry V are set within their own little aureole of dark pyroclastic material, but other cones and collapse pits are also present – clear indicators of a volcanic association with the graben as suggested by Head and Wilson. There is disappointingly nothing similar associated with Rima Parry I, but as I mentioned this is not unusual if the dike fails to reach the surface, and there are many similar examples across the lunar surface – leaving their origin uncertain.

In some cases however hints of volcanism can be found if you scrabble around in the imagery, a good example being the incorrectly named Catena Taruntius (it should be a *rima*) where the origin could be a mystery if it were not for some small Irregular Mare Patches along its length (Fig.6), and as these are believed to be the result of volcanic outgassing it suggests the presence of underlying volcanism even if no actual lava eruption has occurred.

Despite there being no obvious signs of volcanism associated with Rima Parry I it appears that the crater Tolansky, which has obliterated part of the rima, is surrounded by a dark halo of material with a higher FeO content than its surroundings. This possibly indicates that the impact penetrated down to the dike responsible for the rima, and excavated these more iron rich volcanic rocks which ended up in its proximal ejecta. In addition the crater floor appears to be flooded with mare like material, so a magma source must have existed beneath this area, and active volcanism may well have occurred within and around Tolansky at some stage. Whether this involved the dikes responsible for the rima or magma from another source is another matter.

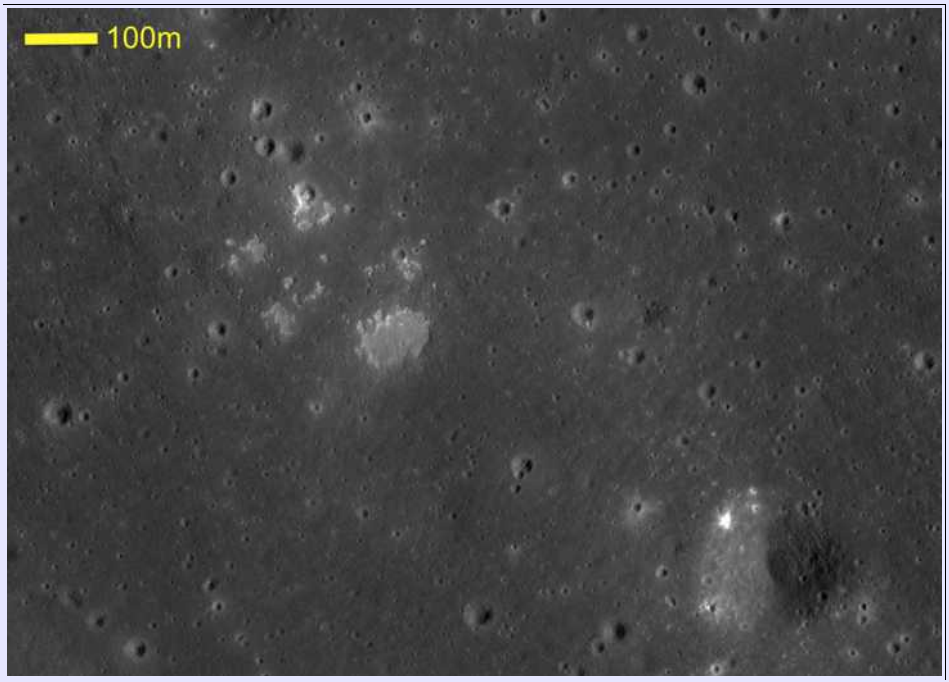


Fig.6 Small Irregular Mare Patches within Catena Taruntius which provide evidence for the presence of otherwise invisible volcanic activity below.

27kms to the SSE of Tolansky we see a small volcanic cone, about 120m high and about 5kms across with a rugged surface and set within a dark area of probable volcanic deposits, whilst a more impressive cone can be seen on the northern floor of Guericke, with a diameter of some 7kms and height of about 250m, also set within a field of low-albedo, probably volcanic deposits. Fig.7 shows SELENE images of both of these cones, they are visible in the Chandrayaan-1 image in Fig.4, and both are visible in James's image in Fig.1. Though neither are obviously associated with any of the Rima Parry graben their presence indicates the presence of magma bodies beneath the area, probably much later geologically speaking, as they appear to be some of the youngest features in this area. They are in effect small lunar domes but do not appear to be shown as such on the geological maps of the area.

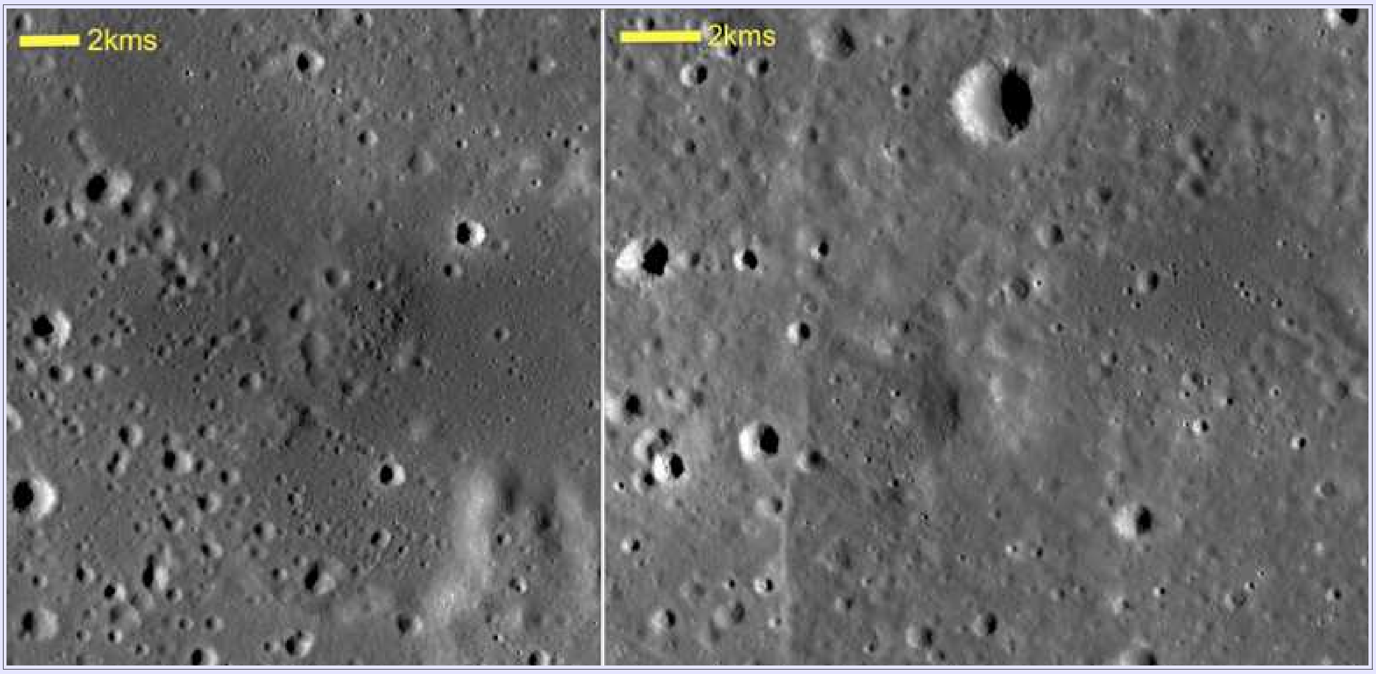


Fig.7 Small volcanic cones to the SSE of Tolansky (left) and on the northern floor of Guericke (right). Both are set in areas of low albedo probable volcanic deposits which may have erupted from or at the same time as the cones. Both images from JAXA/SELENE.

So even though we can see no obvious signs of volcanism associated with Rima Parry I, there is sufficient indication that a network of dikes, other volcanic conduits or magma bodies underlie this area, and that the forces responsible for the graben complex are ultimately volcanic in origin.

The Moon, Vol.7 No.2 January 1959 has a couple of nice drawings of the Rima Parry system by A.Ford and Alika Herring which are reproduced in Fig.8. As you can see by comparing Herring's drawing with Fig.2 this observer has captured some quite accurate detail with his 12.5" reflector. Herring, a leading lunar observer and ALPO's Lunar Recorder during the late 50's and early 60's, was however blessed with exceptional seeing conditions where he lived in Hawaii, and this and his exceptional skills as an observer resulted in many highly accurate lunar drawings during this period. In his commentary accompanying the drawings the then editor, Frank Thornton remarked on the curving 'cleft' which almost encircles the floor of Parry shown in Ford's drawing, commenting that he had never seen any trace of it despite extensive observations of the area.

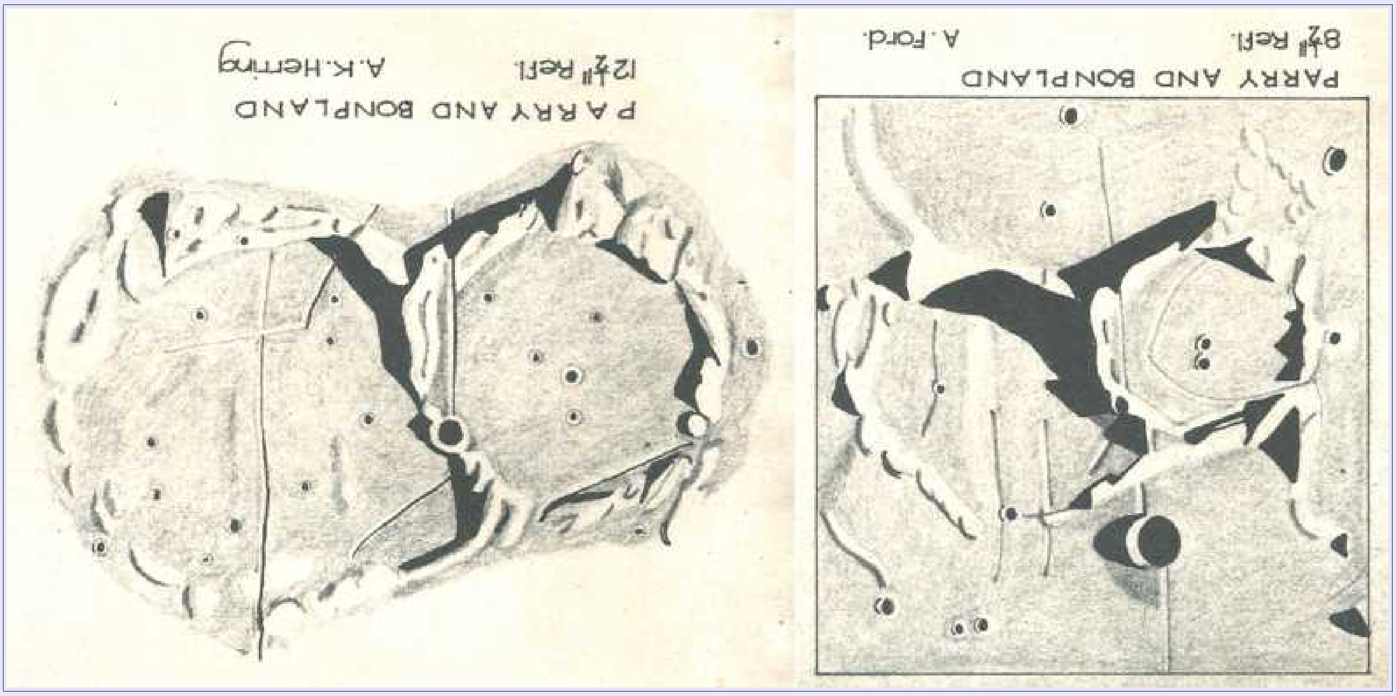


Fig.8 Drawings by Alika K. Herring (left) and A.Ford (right) taken from The Moon, Vol.7 No.2 January 1959 – the drawings are shown inverted to save the reader straining their necks to compare them to the photos above!
Herring's drawing was made using a 12.5'' Newtonian at x228 at 04:50UT on June 26th 1958 and Ford's using a 8.5'' Newtonian at x280 on 30th December 1957 at 19:00hrs.

Well, the spacecraft data does not show anything like a curving 'cleft' as shown in Ford's drawing, but if you look very carefully at James's image you can actually see some very slight tonal difference over the surface of Parry the edge of which corresponds to Ford's drawing.

If this were not convincing enough, a 1988 drawing by Harold Hill shown on page 109 of his Portfolio of Lunar Drawings shows this feature extremely clearly, so there is no doubt about its existence. As noted above there is barely any indication of this difference in the spacecraft images across the Parry crater floor, but there is a higher density of craters within the area to the east of the curving 'cleft' as compared to that on the crescentic part of the floor to the west of the curving 'cleft' as can be seen in Fig.10. This immediately suggests that the eastern floor is older and probably slightly more elevated than the western floor, and that the line of the 'cleft' corresponds to the slight break in slope over this boundary. The tonal difference would therefore probably be a result of the older higher eastern floor being embayed by younger darker lavas that cover the western crater floor.

Fig.9 Enlargement of part of James's image of Parry showing a slight tonal difference over the crater floor corresponding to the drawing by Ford shown in Fig.8.

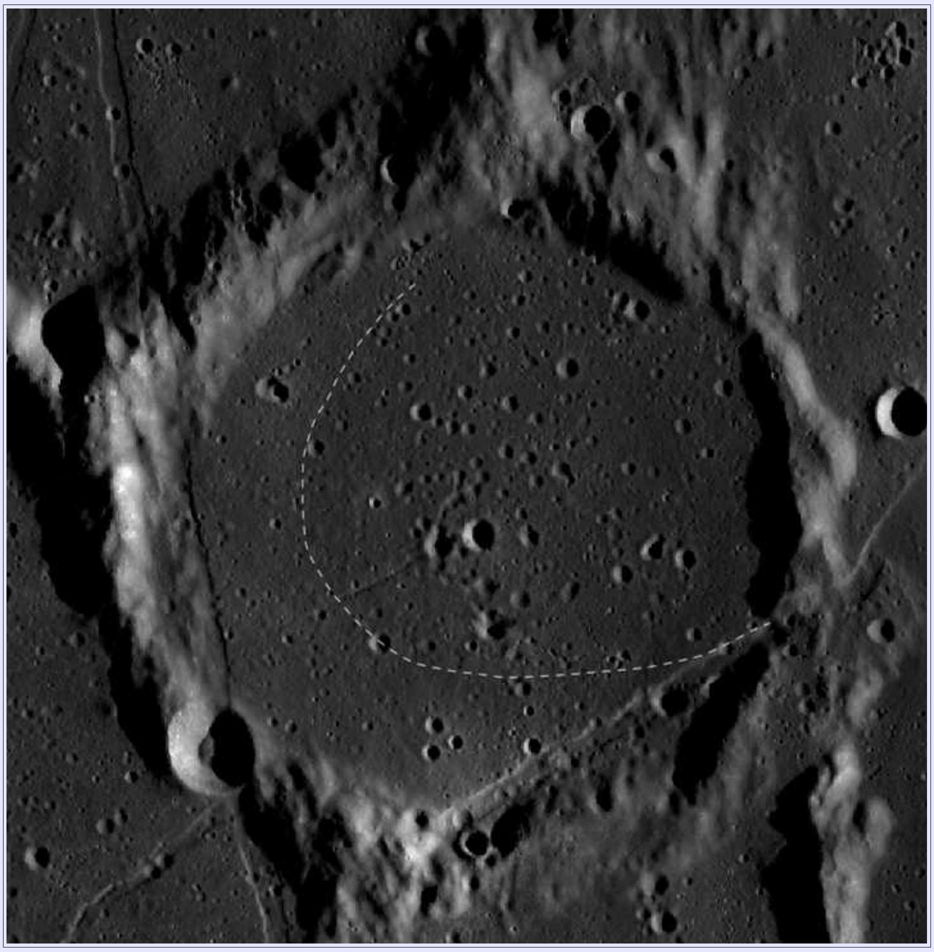


Fig.10 LRO WAC image of Parry showing the approximate line of Ford's 'cleft' with the white dotted line. To the east of the line the surface is more heavily cratered than to the west indicating an age difference which is probably the result of the eastern floor being slightly elevated, and embayed by younger lavas to the west of the dotted line.

The topographic profile shown in Fig.11 shows that this is indeed the case and that the eastern floor is elevated relative to the western, therefore preserving an older surface with its darker tone and more heavily cratered surface. The Bouguer gravity overlays in Quickmap do suggest the possibility of a magma body beneath this eastern part of the floor which could account for this uplift, and maybe even suggest the presence of a parent magma body beneath the crater that fuelled some of the surface volcanism we see.

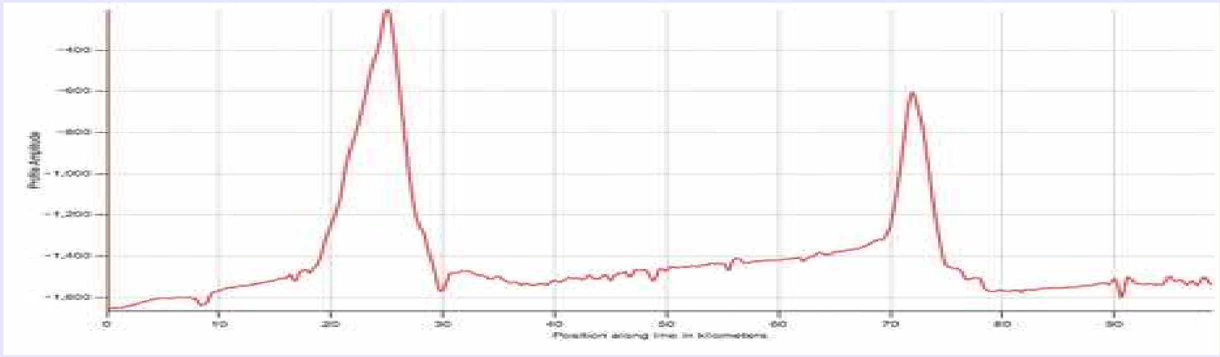


Fig.11 Topographic profile west-east across Parry showing the more elevated eastern floor. The cleft seen by Ford probably corresponds to the break in slope between the lower western and higher eastern parts of the floor, whilst the tonal differences recored by Hill are a result of the differing surface geology both in terms of age and composition.

So maybe the moral of the story is yet again that visual observations can and do reveal features that the fanciest of spacecraft cannot, and that the art of visual observing (and imaging) still has something to offer!

*James W. Head, Lionel Wilson (1993) Lunar graben formation due to near-surface deformation accompanying dike emplacement, Planetary and Space Science, Volume 41, Issue 10.

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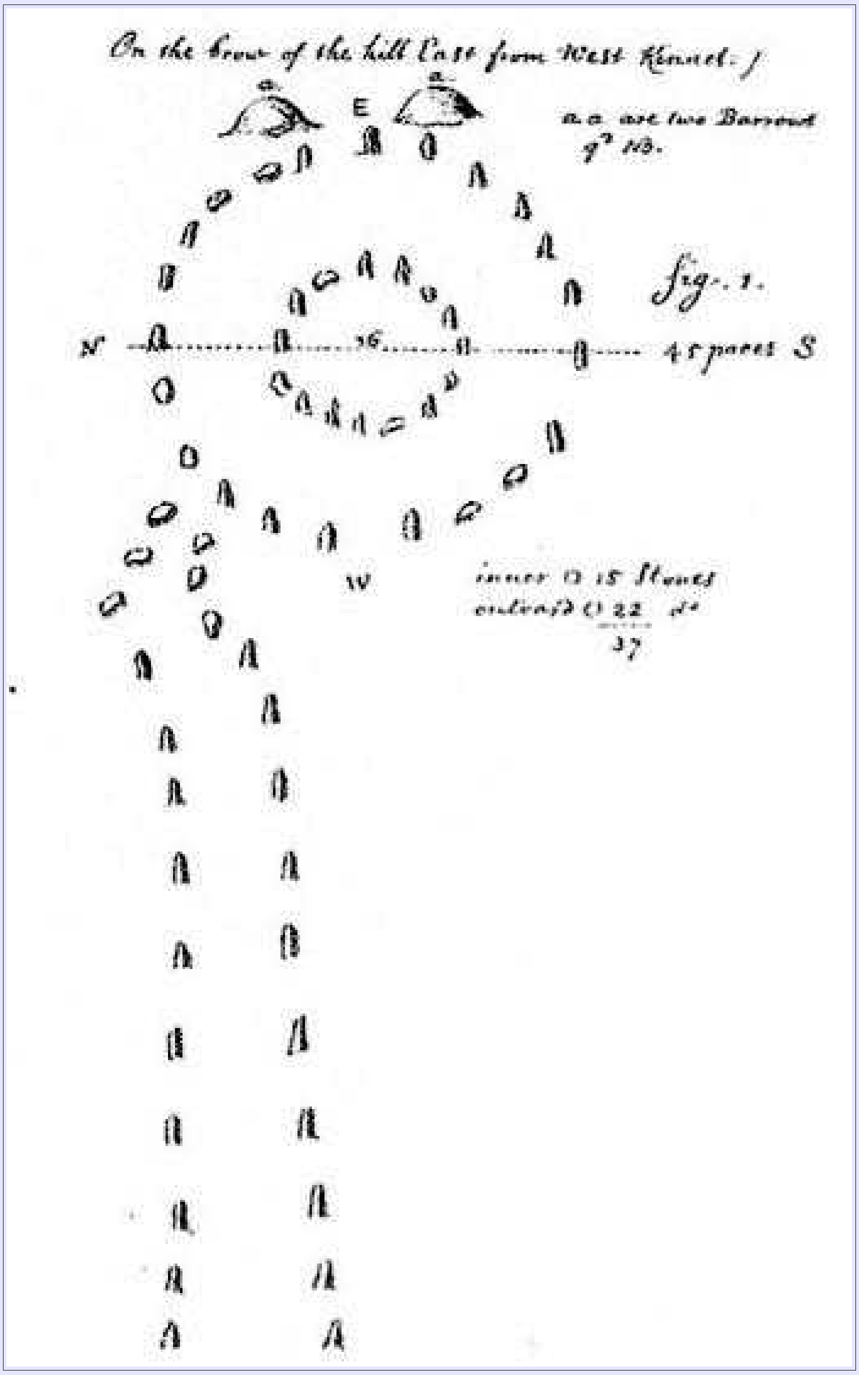
Elger's "Druidical Avenue." by Nigel Longshaw.

"*On the broken N flank…is a number of incomplete little rings all open to the N."* wrote T.G.E.Elger (1836-1897) in 1895. *"East of these"* he continued, *"… commences a linear group of isolated mountain masses extending towards the W. side of Parry, and prolonged for 30 miles or more towards the North"*. What intrigued Elger about this mountain group was their arrangement, *"…in parallel rows",* which reminded him of a *"Druidical Avenue of gigantic monoliths viewed from above*".

Elger was describing the region around the crater Guericke in his book "The Moon, a full description and map of its principal physical features", published in 1895. Unfortunately, the book carries no illustration of the area which Elger described and there appear to be no observational drawings contained in the notebooks of Elger held in the B.A.A archive to illustrate the appearance as Elger described.

Whilst the description is obviously somewhat fanciful to modern observers, we must bear in mind that Elger's interests were many and varied, not only did he devote his time and efforts to observing the Moon; his influence on the intellectual development of his hometown of Bedford cannot be overlooked. In addition to astronomical pursuits, it was said he was somewhat of an expert in archaeology and was "often consulted when objects of antiquity were discovered in the borough". He was consulted by the corporation in relation to the formation of a proposed Town Museum, the Old Priory was eventually adapted the for this purpose, unfortunately Elger did not live to see its completion. He formed connections with the local Archaeological Society, and compiled reports and drawings of his archaeological discoveries for the Society of Antiquities. His large collection of ancient flint tools, Celtic, Roman and Saxon pottery was displayed at Beaumont House, which was said to be "the best museum in town"!



John Aubrey's plan of The Sanctuary and West Kennet Avenue.

In 1857 William Long wrote a lengthy account of the neolithic monuments around Avebury in the Wiltshire Archaeological Magazine. In his paper Long discussed the work of two previous investigators, John Aubrey and William Stuckley, who both recorded the avenue of standing stones now known as West Kennet Avenue, originally of around 100 pairs of prehistoric standing stones, raised to form a winding one-and-a-half-mile ritual link between the pre-existing monuments of Avebury and The Sanctuary. Long's paper is generally considered one of the most important papers relating to these historical monuments and it is quite possible that T.G.Elger's interest in antiquities might have led him to this paper or perhaps William Stukeley's book, Avebury, a temple of the British Druids, published in 1743.

John Aubrey's plan of The Sanctuary and West Kennet Avenue.

There are striking similarities between John Aubrey's plan of The Sanctuary and West Kennet Avenue and Elger's description of the region North of Guericke, suggesting at least Aubery's drawing might have been at the forefront of Elger's mind when he observed the region. Clearly, he felt the best way to convey the appearance of the detached mountain masses was by reference to features which himself, and others, might have been well acquainted.

It is often necessary to wait some considerable time for lighting conditions over a particular area of the Moon to be repeated. However, without precise positioning or observational data under which Elger viewed the region it was somewhat difficult to know when a favourable opportunity may arise. I have looked on many occasions but recently the evening of April 6th, with sun rising over the area, seemed like it might provide favourable conditions. Initially seeing conditions were not too good, and I think lighting not sufficiently advanced. Whilst there was an indication of an alignment of peaks north of Guericke, the appearance was not at all as striking as Elger's description would have us believe. However as lighting advanced, yet only marginally, by 20:45 U.T., the appearance of two rows of detached peaks either side of what appeared to be a shallow valley became prominent in the eyepiece. Seeing had improved slightly by this time, and I was able to increase the magnification sufficient to detect some of the minor features within the limits of the aperture used. There seemed to be very little in the way of shadows thrown by the individual peaks, as one might expect if they were of some height. This seems to suggest therefore low-lying features, and therefore a short time frame in which the region appears as Elger described. And in fact, by the end of the session, around 21:30 U.T the effect had all but disappeared. My experience indicates that observations made between solar colongitude values of 14.19 – 15.50 degrees would be optimum for capturing Elger's Druidical Avenue.

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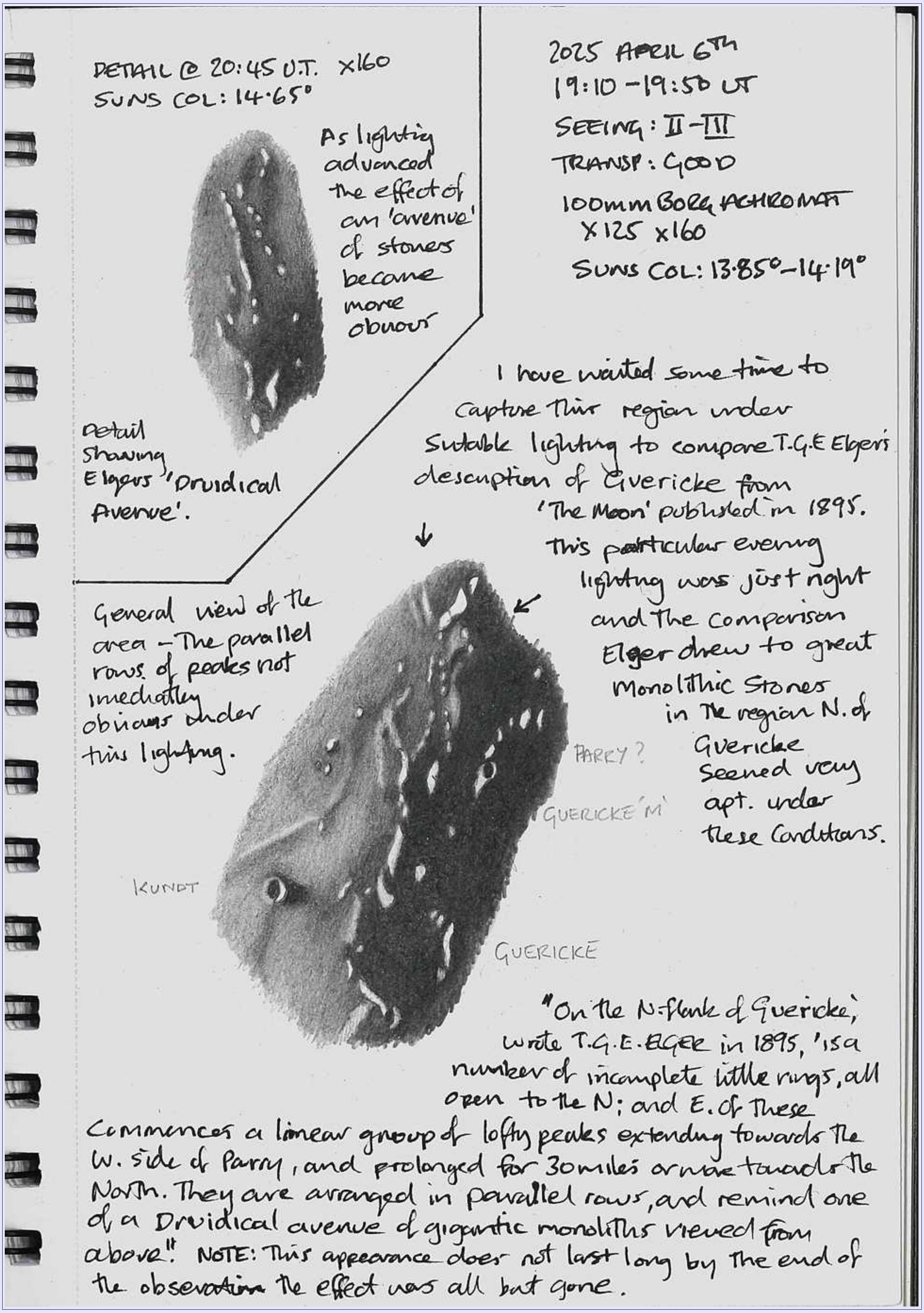
And to complement the above two articles a drawing by Nigel Longshaw of the Guericke area



Lunar Impact Flash Observing Programme

Video Observation of Earthshine in April: (Update)

Just an update to April's total – I was able to observe the earth-lit side of the Moon on Apr 30th from UT 20:32:12-22:23:45 in the H band in the SWIR i.e. for 1.86 hours. This brings April's total contact time with earthshine to 23.7h.

Video Observation of Earthshine in May:

2025 May 02 UT 16:26:55-18:29:00 (duration 1.41 hours) H band SWIR video – Observer A.C. Cook
2025 May 02 UT 18:34:53-18:59:38 (duration 1.18 hours) H band SWIR video – Observer A.C. Cook
2025 May 02 UT 19:39:38-20:45:10 (duration 0.65 hours) H band SWIR video – Observer A.C. Cook
2025 May 03 UT 20:49:43-22:21:56 (duration 1.84 hours) H band SWIR video – Observer A.C. Cook
2025 May 03 UT 16:06:29-17:10:24 (duration 1.09 hours) H band SWIR video – Observer A.C. Cook
2025 May 03 UT 17:12:59-17:53:39 (duration 0.78 hours) H band SWIR video – Observer A.C. Cook
2025 May 04 UT 18:01:24-18:25:20 (duration 1.41 hours) H band SWIR video – Observer A.C. Cook
2025 May 04 UT 18:40:07-18:42:58 (duration 1.82 hours) H band SWIR video – Observer A.C. Cook
2025 May 22 UT 18:47:56-19:48:09 (duration 0.11 hours) H band SWIR video – Observer A.C. Cook
2025 May 22 UT 20:04:28-21:57:46 (duration 0.25 hours) H band SWIR video – Observer A.C. Cook
2025 May 22 UT 19:12:34-19:13:52 (duration 0.84 hours) H band SWIR video – Observer A.C. Cook
2025 May 30 UT 19:32:17-21:56:24 (duration 0.22 hours) H band SWIR video – Observer A.C. Cook

Total Contact time with earthshine in May 2025 = 11.6 hours

I haven't had time to analyse the above yet due to university stuff – so am looking forward to research time over the Summer to churn through the processing of these. I do have an MSc student though, Pharthav Murukutla, doing a project with me over the Summer. He will be comparing the accuracy of the different impact flash software: Luanrscan, ALFI and FDS as well as using AI to help sort through the many detections that all these software come up with which might be real impact flashes, but much more likely due to: image noise, cosmic ray events, scintillating stars, sunlit peaks on the terminator, satellites, aircraft etc etc.

I attended a LUMIO Co-Investigator workshop, on Tue-Wed 27-28th May. It was held at the ESA centre in Frascati, Italy – though I attended on-line. The launch in currently in 2028 and they were pleased to hear about the different amateur groups in the USA (ALPO), UAI (Italy), BAA (UK) and another group in Germany. Also the ESA funded NELIOTA team in Greece have gotten funding to start observing again and French astronomers have set up some scopes to do observing starting later this year.

To learn how to observe impact flashes I have put together an instructional web site – this will be added to over time: https://users.aber.ac.uk/atc/lumio.htm . It's a lot simpler than you might think!

Two other useful lunar impact web sites are: https://www.pvamu.edu/pvso/cosmic-corner/lunar-meteor-watch/ and https://www.asg.ed.tum.de/en/lpe/research/lunar-impact-flashes/ .

You can find out when to look for impact flashes by checking on this web site:
https://users.aber.ac.uk/atc/lunar_schedule.htm , however visual observers are recommended to stick to meteor shower times to improve their chances of detection.

If you would like further details on how to observe impact flashes, please drop me an email. To learn more about the LUMIO mission, watch : https://www.youtube.com/@associationoflunarandplanetary/streams and select ALPO 2024 Conference Day 2 and wind on to about 4h8m into the video.

Tony (Email: atc @ aber.ac.uk)

Buried Basins & Craters (June 2025) by Skylar Rees

Quasi-Circular Mass Anomalies (QCMAs), posited by Evans *et al* (2016) and later Sood *et al* (2017), are potential buried craters identified by their anomalously high Bouguer and Free Air Gravity values. As they lie under the lunar maria, it is thought that they arise from dense mare lava infill as opposed to impact-related crustal deformation as in basin mascons. While gravitational data typically preserves the signs of impact better than the visual topography, it is still uncertain if these QCMAs are actually craters or originate from another source. This month, we look at QCMA 37 from the catalogue. This is a ~130km diameter structure located west of the *Wallace* crater at longitude 10.2W and latitude 19.9N on the Nearside, first proposed in the catalogue of Evans *et al* (2016).

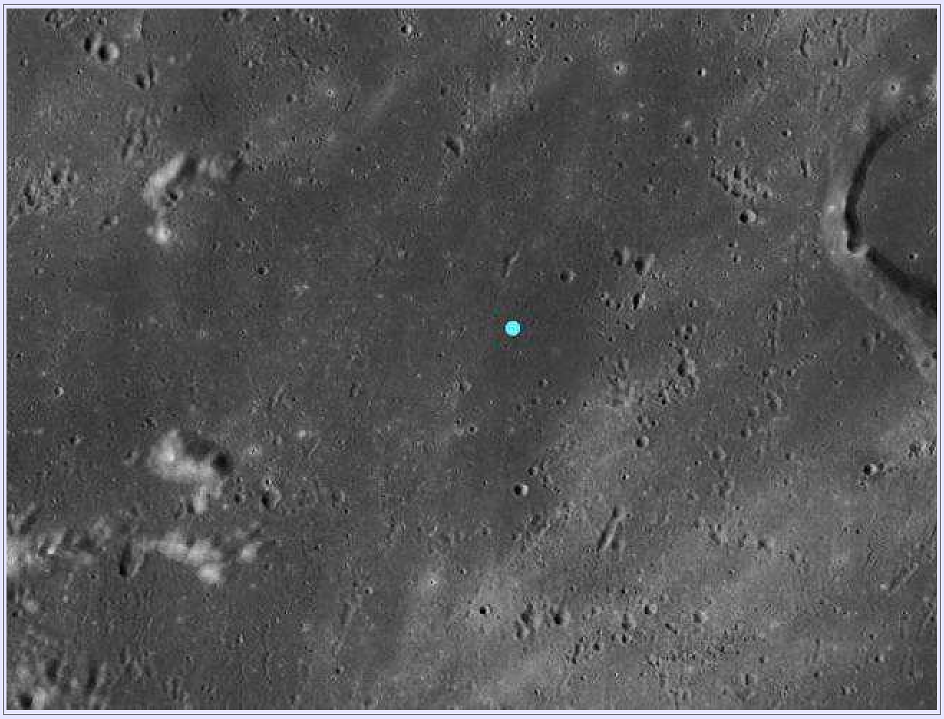


Fig.1: Location of QCMA 37 (centre blue dot). Brightness/contrast increased by 30% for visibility.

No conclusive topographic signs such as a rim or central peak remain, presumably degraded by mare emplacement, and the boundaries are also difficult to determine. There are arcing crater trails directly east of the central blue dot and next to *Wallace* which could indicate secondary ejecta, although these would more likely be degraded and buried than their source crater if so and could be entirely unrelated. Overall, QCMAs would be highly uncertain without the gravitational data (GRAIL) utilised by Evans *et al* (2016).

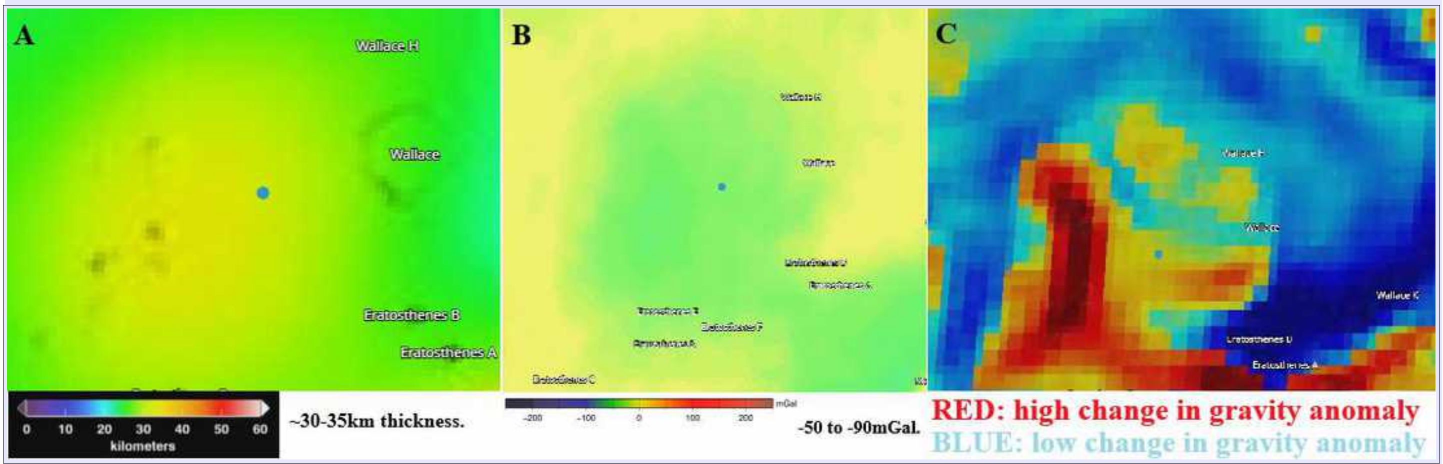


Fig.2 GRAIL gravity data in *QuickMap*. (a) Crustal thickness. (b) Bouguer Anomaly. (c) Bouguer Gradient. The red (high-gradient) lines in Fig.2(c) are the *Montes Appeninus* and *Mons Wolff* regions.

GRAIL shows a region distinct from its surroundings, with around a 10km thicker crust, ~100mGal more negative anomaly and a mixed, non-uniform gradient. The higher crustal thickness could be justified as solidified infill material, and the *Wallace* crater nearby being of comparable gravitational properties to the mare sheet suggests it to be post-mare; QCMA 37 may then represent the fate of pre-mare impact structures. This said, it is the only structure to display this higher crustal thickness anywhere between *Montes Carpatus* and *Mons Wolff*, or within approximately 300km diameter. The fact that a corresponding negative Bouguer Anomaly exists in the same location does imply a depression, or at minimum more 'missing' terrain than expected. The gravity gradient in 2(c) is rather nonuniform compared to much of the mare flow in continuous blue and also suggests some underlying structure that did not perfectly submerge under the mare, although the red gradient connected to *Montes Appeninus* might imply tectonic upheaval has occurred locally as well.

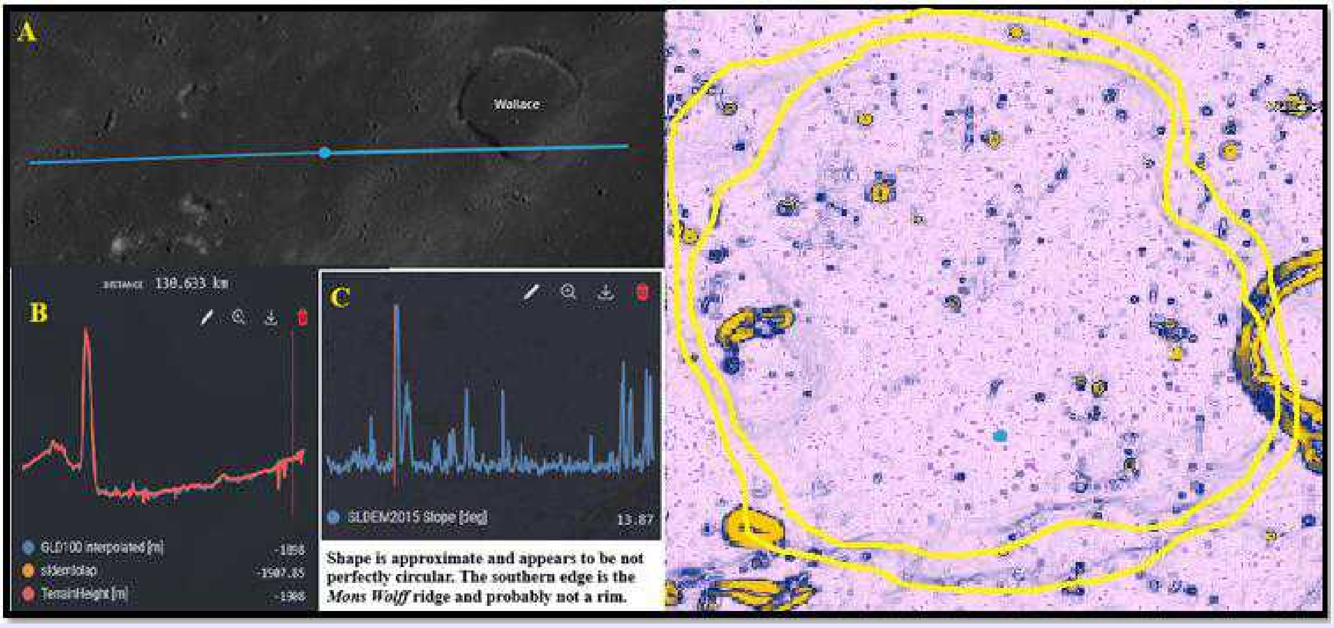


Fig.3 Height and Slope filters in *QuickMap*. (a) With the boundaries unknown but estimated 130km diameter, a 65km diameter slice in both directions is used. (b) Height plot across the slice. (c) Slope plot across the slice. (d) Slope filter and very approximate outline in yellow. Values in absolute height.

Height data as in Fig.3(a) and 3(b) confirms the terrain is uneven; plotted right to left, there is an initial spike at the rim of *Wallace* before a shallow ~100m downward slope. In the same region, Fig.3(c) read right-to-left demonstrates several ~6-10 spikes in slope, and two ~18 slopes to the left that do not visibly correlate to anything. Height and Slope data therefore both reaffirm a nonuniform terrain, but not enough to distinguish QCMA 37 as an impact site.

Overall, QCMAs prove significantly trickier to confirm the existence of due to a lack of appreciable boundaries with the overlaying maria or subsequent modification of the terrain. It may not be coincidental that they were first discovered with GRAIL's gravitational data, as the evidence for their existence is very weak – with only around 100m difference in absolute height separating the QCMA from the rest of the terrain, it is borderline indistinguishable from the continuous mare sheet. At best, we can infer it is a site of condensed mare infill.

References:

[1] Evans, A. J. et al (2016), "Identification of buried lunar impact craters from GRAIL data and implications for the nearside maria",Geophys. Res. Lett., 43, 2445–2455, https://doi.org/10.1002/2015GL067394

[2] Sood, R. et al (2017), "Detection and characterization of buried lunar craters with GRAIL data", Icarus, 289, 157-172, https://doi.org/10.1016/j.icarus.2017.02.013

Lunar domes (part XCI): The Phlegraean Fields caldera
By Raffaello Lena

The Phlegraean Fields (Campi Flegrei) is a large area of volcanic origin located in the north-west of the city of Naples (Italy). It is an area with a singular structure: not a truncated cone-shaped volcano but a vast depression or caldera, about 12x15 km wide. In this ninety-first note I will describe the terrestrial volcanic region of the Phlegraean fields. The process of *bradyseism* is associated with the volcanic activity of a caldera. Uplift occurs due to pressure from beneath the surface, which causes the rocks above to deform and rise. As the rocks deform, they may reach a point of breaking, resulting in earthquakes.

The seismic activity in this area can damage both structural and nonstructural elements of buildings and affect the functioning of infrastructure such as water and gas networks and port docks. The maximum expected magnitude of the earthquakes is estimated to be between 4.5 and 5.0 on the Richter scale. There were bradyseismic crises during 1969-1972 and 1982-1984, which resulted in a total ground uplift of more than three meters and thousands of earthquakes. Recently further earthquakes have been recorded.

The eruptive history is dominated by the eruptions of Ignimbrite Campana and Neapolitan Yellow Tuff (see also https://en.wikipedia.org/wiki/Ignimbrite). These events were so violent that the volumes of magma produced and the speed with which they were emitted caused collapse and originated calderas. For this reason, the shape of the area is that of a semicircle bordered by numerous volcanic cones and craters.

In 1538 the last eruption occurred which, despite being among the more minor ones in the entire eruptive history of Phlegraean Fields, interrupted a period of quiescence of about 3,000 years and gave rise to the cone of Monte Nuovo, about 130 m high. Since then, the activity in the Phlegraean Fields is endowed with phenomena of bradyseism, fumarolic activity and hydrothermal activity localized in the *Solfatara* area. I will describe the *Solfatara* area including my images and the mineral of my private collection.

Solfatara of Pozzuoli
The *solfatara* of Pozzuoli is one of the forty volcanoes that make up the Phlegraean Fields; it is located about three kilometers from the city of Pozzuoli. It is an ancient volcanic crater still active but in a quiescent state that for about two millennia has retained an activity of sulfur dioxide fumaroles. The Solfatara today represents a relief valve for the magma present under the Phlegraean Fields (Figs. 1-2), thanks to which it is possible to maintain a constant pressure of the underground gases.

Figure 1: Solfatara di Pozzuoli.

The Bocca Grande is the main fumarole of the Solfatara with steam, with the characteristic smell of sulfur and H_2S, which reaches temperatures of about 160°. Named by the ancient Forum Volcanoes, in its vapors there are salts such as Realgar and Orpiment which, resting on the surrounding rocks, give a yellow-reddish color (Figs. 2-6).

Figure 2: Solfatara of Pozzuoli. Bocca Grande is the main fumarole of the Solfatara).

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Figure 4: Solfatara of Pozzuoli. Realgar and Orpiment, two arsenic sulfide minerals.

The Bocca Grande is the main fumarole of the Solfatara with steam, with the characteristic smell of sulfur and H_2S, which reaches temperatures of about 160°. Named by the ancient Forum Volcanoes, in its vapors there are salts such as Realgar and Orpiment which, resting on the surrounding rocks, give a yellow-reddish color (Figs. 2-6). Sulfur (Fig. 7) is found in paragenesis with Realgar, Alunogen (Fig. 8), Gypsum and Alotrichite.

Figure 5: Solfatara of Pozzuoli. Bocca Grande is the main fumarole of the Solfatara.

Realgar, As_4S_4, is an arsenic sulfide mineral, also known as "ruby sulphur". It is found in granular or powdery form, in association with the related mineral Orpiment (As_2S_3) yellow in color (Fig. 24). Realgar is orange-red in colour (Fig. 6).

Figure 6: Realgar found in the Solfatara of Pozzuoli.

Figure 7: Sulfur found in the Solfatara of Pozzuoli (Lena, private collection).

Figure 8: Alunogen found in the Solfatara of Pozzuoli (Lena, private collection). Alunogen is an Aluminium sulfate mineral $Al_2(SO_4)_3 \cdot 17H_2O$.

Conclusion:

Vesuvius is a particularly interesting volcano for its history and the frequency of its eruptions. It is a mainly explosive volcano. Several studies (e.g. Pappalardo and Marstrolorenzo, 2012)* suggest a relation between Vesuvius and the Phlegraean Fields (Campi Flegrei): there might be a unique long-lived magma pool beneath the whole Neapolitan area. Stratovolcanoes/Composite cones are steep sided due to more viscous lava and are explosive. These volcanoes have a higher proportion of silica minerals and more gas in the magma. In comparison the shield volcanoes, and also the lunar domes, have moderate or gentle slopes caused by highly fluid lava flows of basalt.

*Pappalardo, Lucia & Mastrolorenzo, Giuseppe. (2012). Rapid differentiation in a sill-like magma reservoir: A case study from the campi flegrei caldera. Scientific reports. 2. 712. 10.1038/srep00712.

LUNAR GEOLOGICAL CHANGE DETECTION PROGRAMME

TLP Reports: No TLP reports were received for May

Routine reports received for April included: Paul Abel (Leicester, UK - BAA) observed: Rimae Hippalus. Leo Aerts (Belgium) imaged: Deslandres, Mare Nubium, the south pole, Stofler and Walther. Alberto Anunziato (Argentina – ALPO/SLA) observed: Mare Vaporum, Proclus and Ptolemaeus. Bob Bowen (Ynyslas, UK – NAS) imaged: earthshine. Maurice Collins (ALPO/BAA/RASNZ) imaged: Archimedes, Aristarchus, Copernicus, Gassendi, Kepler, Montes Harbinger, Montes Riphaeus, Plato, Sinus Iridum, Triesnecker and several features. Anthony Cook (Newtown, UK – ALPO/BAA) imaged: earthshine in SWIR. Walter Elias (Argentina – AEA) imaged: Aristarchus, Hahn and Mare Crisium. Dave Finnigan (Halesowen, UK – BAA) imaged: Boussingault, Demonax, Deslandres, Maginus, Mare Australe, Orontius, the south pole, Scott and W. Bond. Valerio Fontani (Italy – UAI) imaged: Aristarchus, Maurolycus, Mutus F, Ptolemaeus, and Torricelli. Bill Leatherbarrow (Sheffield, UK – BAA) imaged: Bohnenbergerm, Cauchy, Janssen, Messier, Petavius and Sinus Amoris. Bob Bob Stuart (Rhayder, UK – BAA) imaged: Alphonsus, Archimedes, Archytas, Birt, Vonon, Curtius, Deluc, Deslandres, Heraclitus, Herschel, Mare Figoris, Pentand, Pictet, Plato Thebit, Ukert and Werner. Alan Tough (Elgin, UK – BAA) imaged: earthshine. Aldo Tonon (Italy – UAI) imaged: Aristarchus and Ptolemaeus. Alexander Vandenbohede (Belgium) imaged: Boussingault, Bugoslawsky, Humboldt, Julius Caesar, Rimae Theaetetus, and Walther. Alex Vincent (Worthing, UK – BAA) imaged: earthshine. Luigi Zanatta (Italy – UAI) imaged: Eratosthenes.

Analysis of Reports Received (April): Again, due to academic time constraints, I have not been able to do an analysis in full, so please just take a look at the images and the reports and make your own judgement as to whether what happened in the past and was regarded as a TLP is recurring under these repeat illumination windows or was something unique that was seen.

Figure 1. Earthshine and the Pleiades on 2025 Apr 01 as imaged from the UK. **(Top Left)** taken by Alan Tough at 20:43UT **(Top Right)** taken by Alex Vincent at 20:51UT **(Bottom Left)** taken by Alan Tough at 21:39UT. **(Bottom Right)** taken by Bob Bowen at 21:54UT.

Aristarchus: On 2025 Apr 01 Bob Bowen (NAS), Alan Tough (BAA), and Alex Vincent (BAA), imaged earthshine for the Pleiades occultation, but this was by chance under similar illumination to the following 1970's report from Chile – though of course the libration and reflectivity from cloud cover probably don't match:

On 1970 Aug 05 at UT 23:00-23:30 Celis (Paso Hondo, Chile, 3" refractor, x60, x100, x135, seeing=good?) saw the same characteristics in Aristarchus as had been seen the previous night, but of lower grade intensity. Somewhat difficult to see because of the small crescent. The Cameron 1978 catalog ID=1270 and weight=1. The ALPO/BAA weight=1.

Note that atmospheric conditions, and image resolution have a big effect on the visibility of features in earthshine. Also, as the images were taken from different parts of the UK and at different times, the star backgrounds change due to the position of the Moon in the sky and stereo parallax.

Proclus: On 2025 Apr 05 UT 07:19-07:24 Maurice Collins (New Zealand - ALPO/BAA/RASNZ) imaged the whole Moon and this included the Proclus region (Fig 2) under similar illumination to the following reported event:

Proclus 1877 Mar 21 UT 20:00? Observed by Barrett (England?) described in NASA catalog as: "Brilliant illum. -- not from sun". NASA catalog weight=2. NASA catalog event ID=#188. ALPO/BAA weight=1.

Figure 2. The Proclus region from a whole Moon mosaic captured by Maurice Collins (ALPO/BAA/RASNZ) on 2025 Apr 05 UT 07:19-07:24. North is towards the top.

Tip – compare the brightness of Proclus to neighbouring craters and Censorinus. Oddly if you view the image upside down, the NW rim looks brighter still?

Ptolemaeus: On 2025 Apr 05 (See Fig 3) Valerio Fontani (UAI), Aldo Tonon (UAI), and Alberto Anunziato (SLA) imaged and sketched this crater for the following Lunar Schedule request:

BAA Request: Examine the floor visually, sketch, or image to show the progression of the shadow spires across floor. If observing visually, how would you describe the appearance of the central lit area on the floor? If imaging, do a time lapse e.g. 1 image per minute to show the progression of the shadow spires. We are asking for these observations following an observation by N. Travnok (Brazil) on

2020 Jul 27 UT 23:00 who commented on an unusual appearance to the floor. It would be really useful to have visual observing of the appearance and please note down what the seeing conditions are like. If you want to image it at high resolution, please go ahead but remember that any image stacking should not be from sections of video of longer than 1 min duration as the shadows change in length rather quickly at sunrise. Any sketches, visual descriptions, or images taken, should be emailed to: a t c @ a b e r . a c. u k

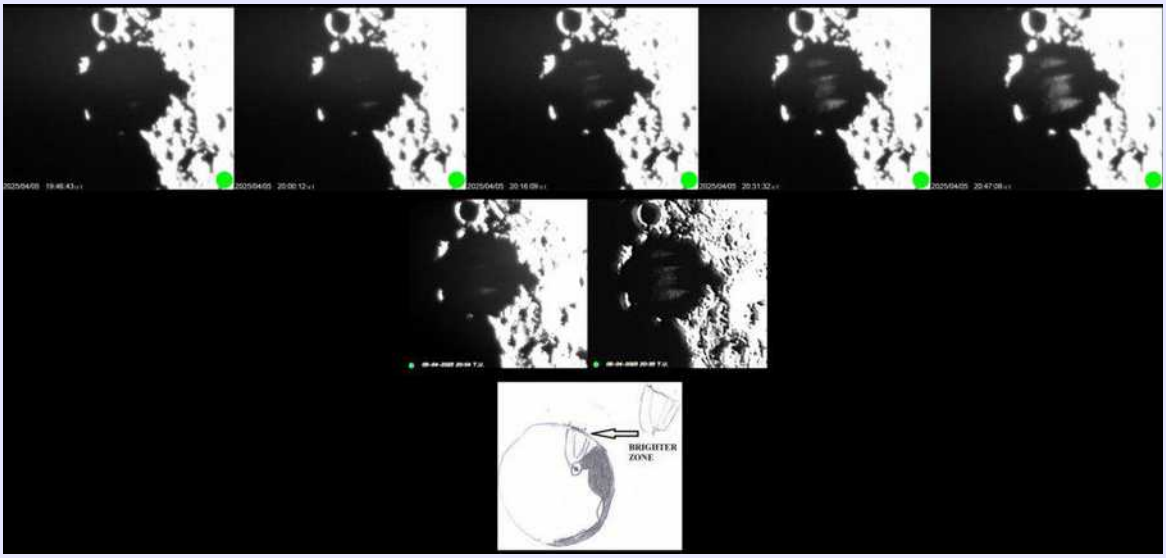

Figure 3. Ptolemeaus crater with north at the top on 2025 Apr 05. UTs are written on the images. **(Top)** Images by Valerio Fontanti (UAI). **(Centre)** Imaged by Aldo Tonon (UAI). **(Bottom)** A sketch by Alberto Anunziato (SLA) made at 23:00-23:20 – he noticed a bright zone (very subtle) in the northern part of the floor, with two brighter streaks inside. Craterlets were clearly visible on the floor.

Plato: On 2025 Apr 06 UT 19:46 was imaged (See Fig 4) by Bob Stuart (BAA) under similar illumination to the following report:

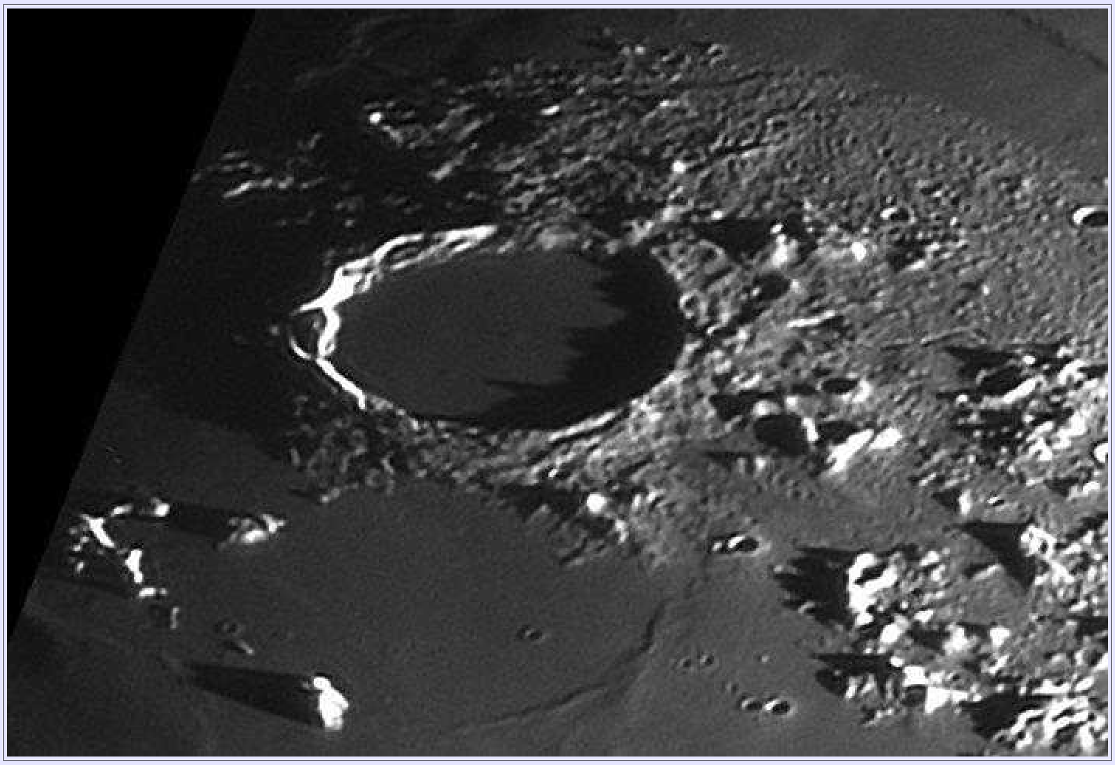

Figure 4. Plato with north towards the top as imaged by Bob Stuart, in monochrome, on 2025 Apr 06 UT 19:46.

1965 Jun 08 A dome-like feature, sketched by Herring and confirmed in a photograph by Larson (Univ of Arizona). This had not been seen before by Herring in hundreds of hours of observing. No other reports of this. The photograph was taken at 02:50h. Cameron 1978 catalog ID=878 and weight=5. ALPO/BAA weight=3.

Eratosthenes: On 2025 Apr 06 UT 20:24 and 20:55 Luigi Zanatta (UAI) imaged (See Fig 5) this crater for the following lunar schedule request:

ALPO Request: This request comes about because of two observations. Firstly, on 2009 Nov 25 Paul Abel and others detected some colour on the inner west illuminated slopes of this crater. No similar colour existed elsewhere. On 2012 Aug 25 Charles Galdies imaged this crater and detected a similar colour, approximately in the same location, though he also imaged colour elsewhere. It is important to replicate this observation to see if it was natural surface colour, atmospheric spectral dispersion, or some effect in the camera that Charles was using, namely a Philips SPC 900NC camera. The minimum sized telescope to be used would ideally an 8" reflector. Please send any high-resolution images, detailed sketches, or visual descriptions to: a t c @ a b e r . a c. u k .

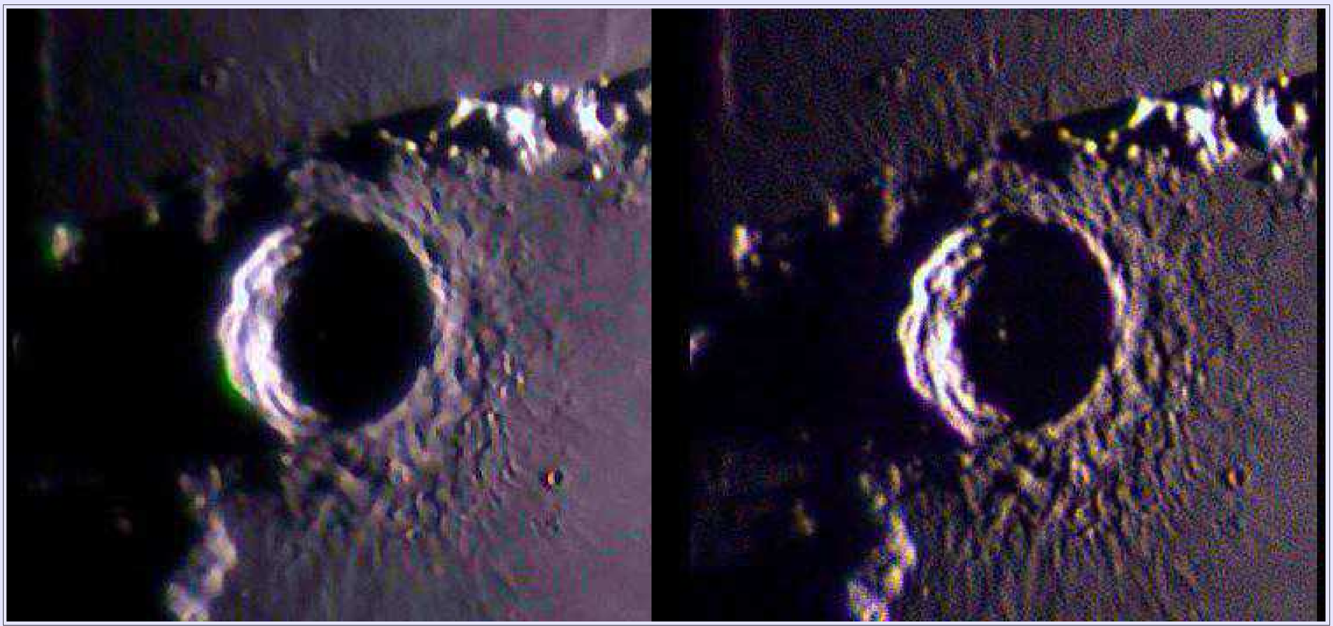

Figure 5. Eratosthenes with north towards the top as imaged by Luigio Zanatta on 2025 Apr 06. Both images have been colour normalized and then had their colour saturation increased. **(Left)** at UT 20:24, **(Right)** at UT 20:55.

Hahn: 2025 Apr 13 UT 23:58 Walter Elias (AEA) imaged (See Fig 6 – Left) this crater under similar illumination to the following report:

On 2012 Jan 09 UT 21:01-21:08 Hahn crater was imaged by N. Hazel (Beverley, Yorkshire, UK, Nikon D7000 with 70-300 zoom at max, with 2x teleconverter, at f9, 1/320 sec, ISO 400 - tripod mounted, mirror up), A series of images were taken. The 21:06 one showed a grey column cutting across the central floor of the crater from the west and then bisecting the eastern rim. All detail inside is completely invisible. Some (but not all) of the other images showed a more blurred view of this feature. It's possible that this was a seeing ripple effect, or just the natural appearance of shadings on the Moon at this time, however for now this will be given an ALPO/BAA weight of 1.

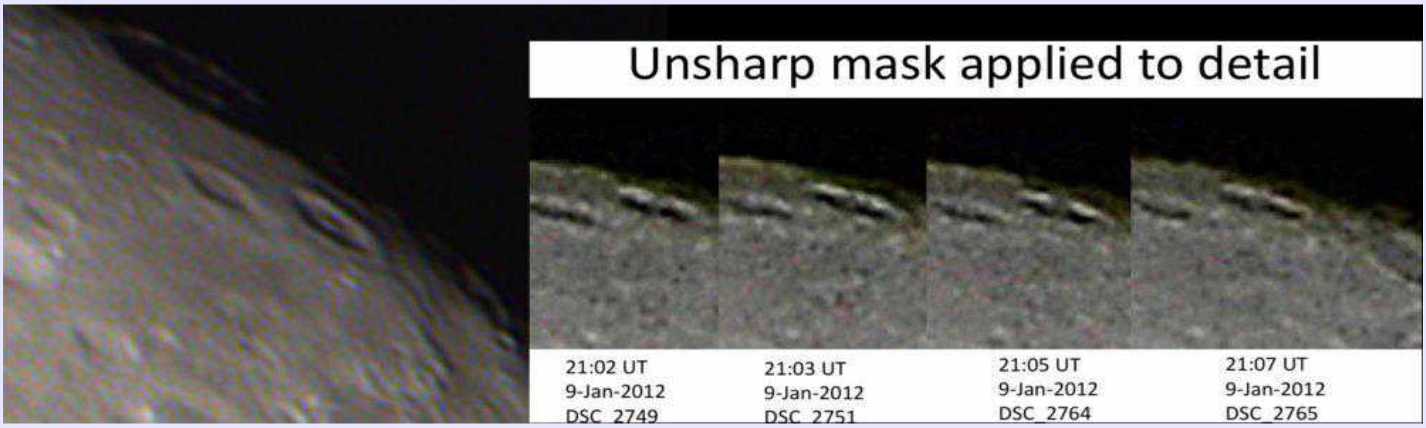

Figure 6 Hahn Crater. **(Left)** as imaged in colour by Walter Elias on 2025 Apr 13 UT 23:58. **(Right)** Unsharp masked version of the original TLP report from 2012 Jan 9 as provided by N. Hazel.

So, could the 1992 event really be a plume (visible at 21:05 and maybe at 21:07 UT?) or is it just image noise or a data compression artefact?

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. 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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