THE LUNAR OBSERVER

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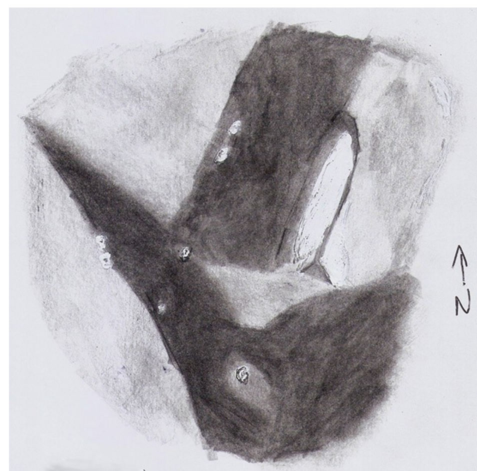
RECENT BACK ISSUES: http://moon.scopesandscapes.com/tlo_back.html

FEATURE OF THE MONTH – MARCH 2017
THE SHADOWS OF HADLEY



ALBERTO ANNUNZIATO—PARANÁ, ARGENTINA.—
February 4, 2017 00:30-01:10 UT. ETX-105 Mak-Cass, 105X.

The observation of the Montes Apenninus on the terminator-there is no lunar observer who deprives himself of that pleasure- in the early hours of February 4th led me to a personal discovery. For the first time I could observe the sublime landscape of the shadow of Mons Hadley Delta extending over Palus Putredinis, the lava plain adjacent to the Mare Imbrium. It looked like the cold shadow of a castle of legend. Lunar observers have the privilege of being able to grasp such wonderful details on the surface of a world that is not ours. I made a sketch with the intention of being able to later identify the illuminated areas in that kingdom of shadows with the help of a lunar atlas. The oblique light of the sun (colongitude 359.1) illuminates the highest peaks of the western Apenninus (the two bright spots at the base of the needle that forms the shadow of Mons Hadley Delta) that limit the strait through which the lava of Palus Putredinis entered the area known as Rima Hadley. I do not know the names of the two twin craters located in Palus Putredinis, which looked small but sharp. At the top of the sketch appear two bright spots in the shadows, which coincide with high areas of the Apennine mountain range. The shadows of Mons Hadley and Mons Hadley Delta erase almost completely the valley visited by the Apollo XV astronauts. Only the summit Mons Hadley Delta emerges from the shadows, at the bottom of the drawing. The shadows cover the western slope of Mons Hadley, while the east (higher) slope shows remarkable chiaroscuro by the incidence of sunlight on the different rock layers. Apollo XV commander David Scott "photographed and described intersecting sets of striations on all mountain slopes and commented that Mount Hadley was the best-organized mountain he had ever seen" (as Don E. Willhelms tells in "To a rocky Moon. A geologist's history of the lunar exploration). The central area of Mons Hadley (which rises 4.6 kms.) is undoubtedly the brightest area.

LUNAR CALENDAR

MARCH-APRIL 2017 (UT)

2017		UT	EVENT
Mar	01	18:58	Moon-Mars: 4.4° N
	03	07:24	Moon Perigee: 369100 km
	05	02:38	Moon-Aldebaran: 0.2° S
	05	11:32	First Quarter
	07	00:43	Moon Extreme North Dec.: 18.9° N
	10	22:20	Moon-Regulus: 0.9° N
	12	14:54	Full Moon
	14	20:04	Moon-Jupiter: 2.7° S
	18	17:25	Moon Apogee: 404700 km
	20	10:49	Moon-Saturn: 3.8° S
	20	15:58	Last Quarter
	21	05:22	Moon Extreme South Dec.: 18.9° S
	28	02:57	New Moon
	30	12:39	Moon Perigee: 363900 km
Apr	01	08:49	Moon-Aldebaran: 0.3° S
	03	06:12	Moon Extreme North Dec.: 19° N
	03	18:39	First Quarter
	07	04:30	Moon-Regulus: 0.8° N
	10	21:20	Moon-Jupiter: 2.4° S
	11	06:08	Full Moon
	15	10:05	Moon Apogee: 405500 km
	16	18:39	Moon-Saturn: 3.6° S
	17	13:12	Moon Extreme South Dec.: 19.1° S
	19	09:57	Last Quarter
	23	17:59	Moon-Venus: 5.3° N
	26	12:16	New Moon
	27	16:18	Moon Perigee: 359300 km
	28	17:20	Moon-Aldebaran: 0.5° S
	30	13:33	Moon Extreme North Dec.: 19.2° N

AN INVITATION TO JOIN THE A.L.P.O.

The Lunar Observer is a publication of the Association of Lunar and Planetary Observers that is available for access and participation by non-members free of charge, but there is more to the A.L.P.O. than a monthly lunar newsletter. If you are a nonmember you are invited to join our organization for its many other advantages.

We have sections devoted to the observation of all types of bodies found in our solar system. Section coordinators collect and study members' observations, correspond with observers, encourage beginners, and contribute reports to our Journal at appropriate intervals.

Our quarterly journal, **The Journal of the Association of Lunar and Planetary Observers-The Strolling Astronomer**, contains the results of the many observing programs which we sponsor including the drawings and images produced by individual amateurs. Additional information about the A.L.P.O. and its Journal is on-line at: **http://www.alpo-astronomy.org.** I invite you to spend a few minutes browsing the Section Pages to learn more about the fine work being done by your fellow amateur astronomers.

To learn more about membership in the A.L.P.O. go to: **http://www.alpo-astronomy.org/main/member.html** which now also provides links so that you can enroll and pay your membership dues online.

When submitting observations to the A.L.P.O. Lunar Section

In addition to information specifically related to the observing program being addressed, the following data should be included:

Name and location of observer
Name of feature
Date and time (UT) of observation (use month name or specify mm/dd/yyyy, dd/mm/yyyy)
Size and type of telescope used Magnification (for sketches)
Filter (if used)
Medium employed (for photos and electronic images)
Orientation of image: (North/South - East/West)
Seeing: 0 to 10 (0-Worst 10-Best)
Transparency: 1 to 6

Full resolution images are preferred-it is not necessary to compress, or reduce the size of images. *Additional commentary accompanying images is always welcome.* **Items in bold are required. Submissions lacking this basic information will be discarded.**

Digitally submitted images should be sent to both
Wayne Bailey – wayne.bailey@alpo-astronomy.org
and Jerry Hubbell –jerry.hubbell@alpo-astronomy.org

Hard copy submissions should be mailed to Wayne Bailey at the address on page one.

CALL FOR OBSERVATIONS: FOCUS ON: Concentric Craters

Focus on is a bi-monthly series of articles, which includes observations received for a specific feature or class of features. The subject for the **May 2017** edition will be **Concentric Craters**.
Observations at all phases and of all kinds (electronic or film based images, drawings, etc.) are welcomed and invited. Keep in mind that observations do not have to be recent ones, so search your files and/or add this to your observing list and send your favorites to (both):

Jerry Hubbell –jerry.hubbell@alpo-astronomy.org
Wayne Bailey - wayne.bailey@alpo-astronomy.org

Deadline for inclusion in the Concentric Craters article is April 20, 2017

FUTURE FOCUS ON ARTICLES:

In order to provide more lead time for potential contributors the following targets have been selected:

Subject	TLO Issue	Deadline
Messier & Messier A-Oblique Craters	**July 2017**	**June 20, 2017**
Lunar Domes	**September 2017**	**August 20, 2017**

FOCUS ON: The Straight Wall – Rupes Recta

By Jerry Hubbell

Assistant Coordinator: Lunar Topographical Studies

Object 15 on Chuck Wood's Lunar 100 list of lunar features to observe, The Straight Wall, aka. Rupes Recta or "straight cliff", is located at selenographic coordinates 22.1°S 7.8°W, the feature has a length of 85 mi (134 km) and a height of about 1600 ft. (0.49 km). In my younger days, no other feature captivated me more than this thin, linear scarp placed on a near perfect lava plain of a ghost crater. Crater Thebit lies 60 mi (100 km) to the east, and crater Birt lies only 15 mi (24 km) to the west. Placed almost directly 400 mi (650 km) north of the crater Tycho, the Straight Wall is very easy to spot a couple of days past first-quarter. (Figure 1.)

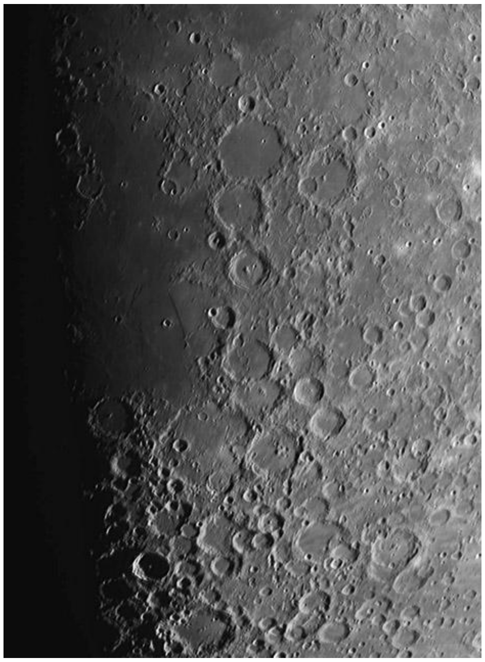


Figure 1. *RUPES RECTA, Starkville, MS, October 10, 2016 – David Teske, 00:19 UT. Questar 3.5" Maksutov, Mallincam GMTm CCD, Clear Sky, Seeing 6/10.*

the Straight Wall is on the eastern edge of Mare Nubium (Sea of Clouds) northwest of the southern lunar highlands.

One of the most studied aspects of the Straight Wall is how steep is the slope of the cliff. The LAC Chart 95 Purbach shows a good representation of the straight wall and lists a height of about 1300 ft. (400 m) above the surrounding lava plain. Figure 2 shows a Lunar Terminator Visualization Tool (LTVT) measurement of an image of Rupes Recta early in the morning.

The measured height of Rupes Recta directly east of Birt in Figure 2 is very close to that listed on the LAC chart, 1370 ft. (410 m). At a little over 1430 ft. (431 m), the measured value is about 5% higher, or around 60 feet. LTVT does a very accurate measurement based on the date and time of the observation, and the location of the observer. It is satisfying to be able to perform an independent measurement and repeat the prior work done to validate the technique. The measurements go from 1550 ft. (464 m) near the center of the cliff to around 920 ft. (275 m) near each end. To evaluate the error in these measurements several independent measurements at each point would need to be performed on several photographs at

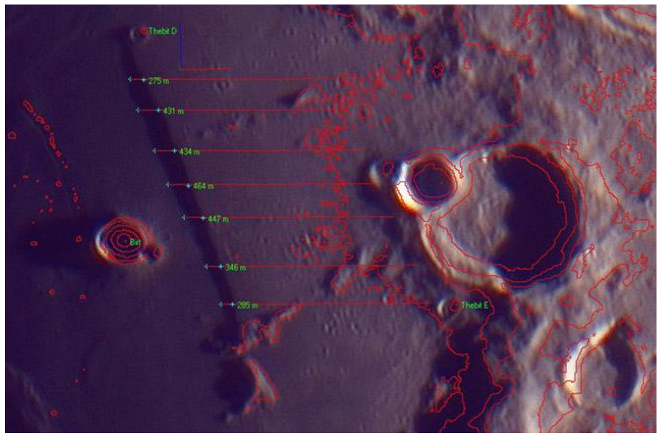


Figure 2. *RUPES RECTA, Carrizozo, NM, September 10, 2016 – John Duchek, 03:00 UT. Skywatcher Mak-Cas, ZWO-178MC CCD, Seeing 6/10, Transparency 5/6. LTVT Measurement by Jerry Hubbell.*

different lunations, but with the Colongitude near 11°, the shadow length provides an opportunity to obtain a high level of accuracy.

The image in Figure 3, provided by Alberto Martos, has described his image (referred to as photo 2) in the following way:

"Effectively, Rupes Recta (photo 2) is the most famous Moon cliff, although its true nature and physical form are far from the image that our eye catches and our brain represents. Its true nature is a fault scarp 110 km long, that runs approximately North-South across Eastern Mare Nubium. The slope is step down from East to West, a configuration that explains the darkness of the fault face under easterly illumination and its brightness under West illumination, when the slope is step up and the exposed foot of the scarp is lightened by Sun light. As far as the transversal and vertical measurements are concerned, officially 2.5 km wide and up to 300 m tall (A. van den Bohede, TLO Jan. 2005), the slope is far from that which typifies a steep abyss. Yet there exists a whole assortment of height data obtained by different authors (R. Lena et al. in Selenology Today, vol. 10, June 2008). Measurements in this publication range from a maximum of 495±20 m near the center of the scarp, to about 300±30 m near the tips, while the width is recurrently 1.28±0.07 km from beginning to end. The subsequent maximum slant is about 21 deg., a very gentle one. "

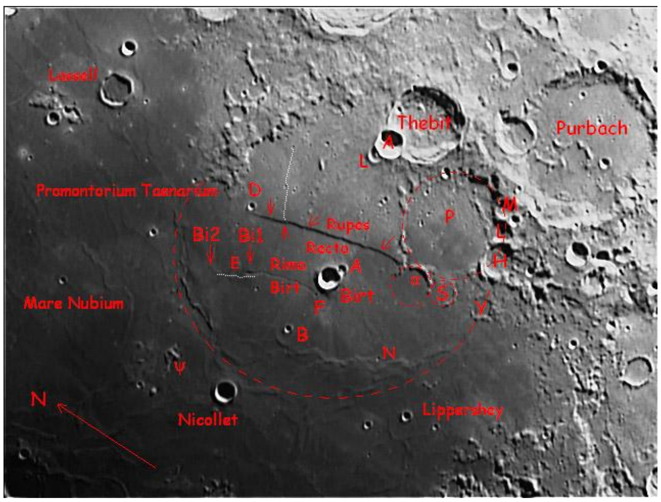


Figure 3. *RUPES RECTA, Madrid, Spain, January 13, 2011 – Alberto Martos, 02:59 UT. Newtonian 20 cm F/7.2 Barlow x2, Philips TouCam Pro CCD, Seeing 7/10, Transparency 4-5/6.*

This description is definitely in accordance with the value for the cliff listed in the LAC chart. This validates the measurements done on Figure 2, with a bias, or offset value of around -100 ft. (-30 m) for the measured values in Figure 2.

I think that it is important to keep in mind that being able to repeat topographical measurements that have been performed by the professionals is a way to gage your skills and knowledge and provide an independent check on your technique. This example shows that it is important to make sure you accurately record the date and time and location of your observations so that any measurements can be repeated by others.

REFERENCES:

Chuck Wood, *Lunar 100*, http://the-moon.wikispaces.com/Lunar+100 , retrieved 2017-FEB-27 *Lunar Aeronautical Charts (LAC)*, Lunar and Planetary Institute, LAC-95 Purbach, http://www.lpi.usra.edu/resources/mapcatalog/LAC/, retrieve 2017-FEB-28.

ADDITIONAL READING:

Bussey, Ben & Paul Spudis. 2004. The Clementine Atlas of the Moon. Cambridge University Press, New York.

Byrne, Charles. 2005. Lunar Orbiter Photographic Atlas of the Near Side of the Moon. Springer-Verlag, London.

Chong, S.M., Albert C.H. Lim, & P.S. Ang. 2002. Photographic Atlas of the Moon. Cambridge University Press, New York.

Chu, Alan, Wolfgang Paech, Mario Wigand & Storm Dunlop. 2012. The Cambridge Photographic Moon Atlas. Cambridge University Press, New York.

Cocks, E.E. & J.C. Cocks. 1995. Who's Who on the Moon: A biographical Dictionary of Lunar Nomenclature. Tudor Publishers, Greensboro

Gillis, Jeffrey J. ed. 2004. Digital Lunar Orbiter Photographic Atlas of the Moon.. Lunar & Planetary Institute, Houston. Contribution #1205 (DVD). (http://www.lpi.usra.edu/resources/lunar_orbiter/).

Grego, Peter. 2005. The Moon and How to Observe It. Springer-Verlag, London.

IAU/USGS/NASA. Gazetteer of Planetary Nomenclature. (http://planetarynames.wr.usgs.gov/Page/MOON/target).

North, Gerald. 2000. Observing the Moon, Cambridge University Press, Cambridge.

Rukl, Antonin. 2004. Atlas of the Moon, revised updated edition, ed. Gary Seronik, Sky Publishing Corp., Cambridge.

Schultz, Peter. 1972. Moon Morphology. University of Texas Press, Austin. The-Moon Wiki. http://the-moon.wikispaces.com/Introduction

Wlasuk, Peter. 2000. Observing the Moon. Springer-Verlag, London.

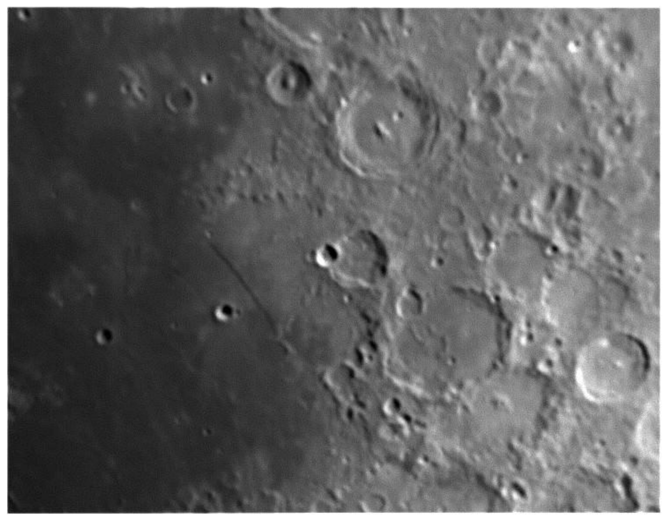
Wood, Charles. 2003. The Moon: A Personal View. Sky Publishing Corp. Cambridge.

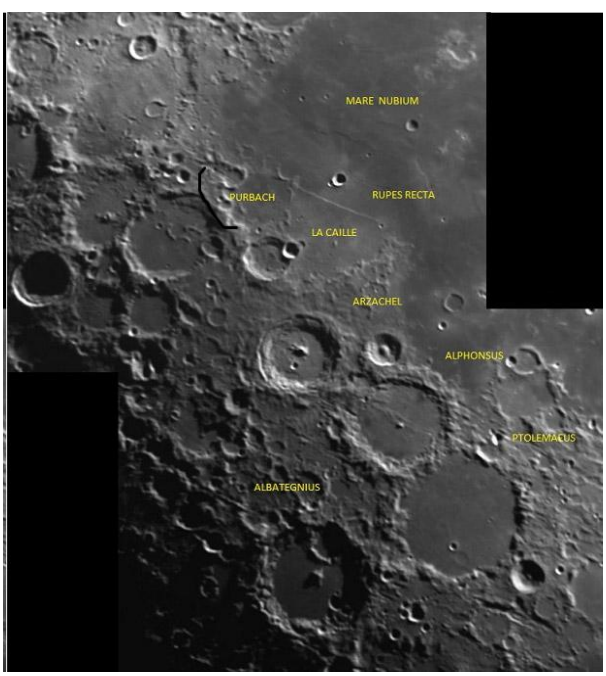
Wood, Charles & Maurice Collins. 2012. 21st Century Atlas of the Moon. Lunar Publishing, UIAI Inc., Wheeling.

ADDITIONAL OBSERVATIONS

PURBACH, THEBIT & STRAIGHT WALL - Jay Albert, Lake Worth, Florida USA. September 3, 2015 06:05 UT. Seeing 7-8/10, transparency 2/6. C-11 SCT, Neximage 5.

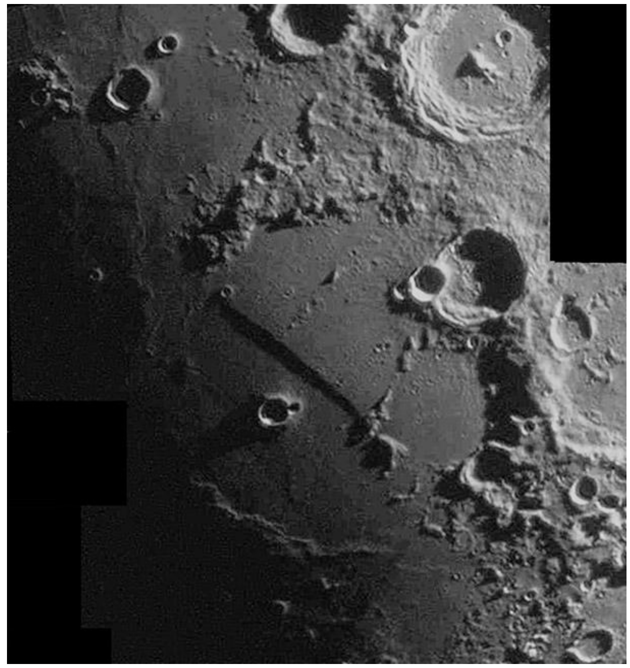
RUPES RECTA - Francisco Alsina Cardinali-Oro Verde, Argentina. December 9, 2016 04:06 UT. 8” LX-200 SCT, Astronomik 742 IR-pass filter.

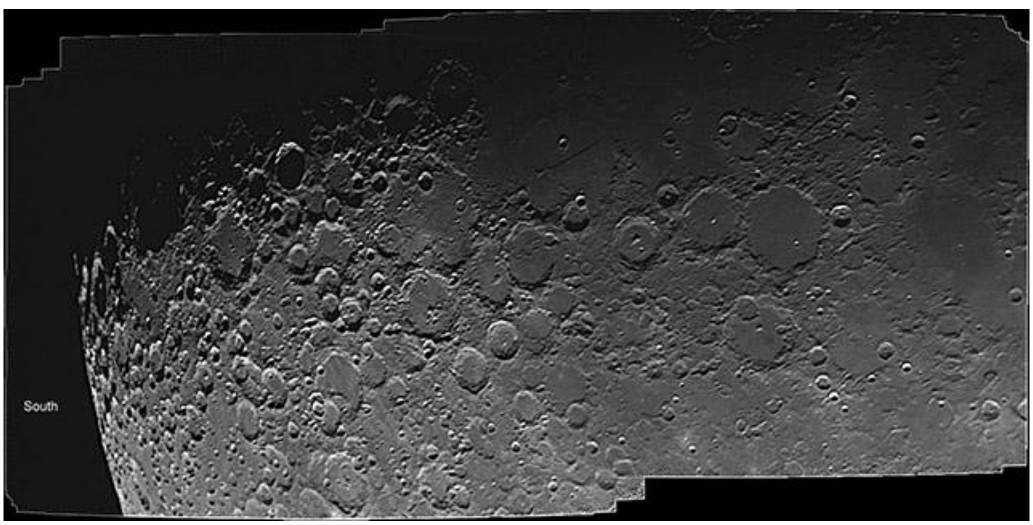




MARE NUBIUM- Guilherme Grassman - Americana, Brazil. November 21, 2016 06:51 UT. 10” SCT, f/25. Seeing 6/10, Transparency 5/6.

RUPES RECTA– Richard Hill – Tucson, Arizona, USA May 29, 2012 02:45 UT. Seeing 8/10. 8" Mak-Cass, f20, DMK21AU04, Wratten 23 filter..

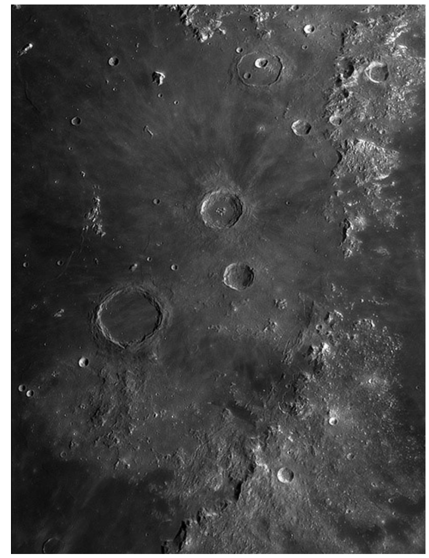




RUPES RECTA PANORAMA. Michael Sweetman - Tucson, Arizona, USA, February 5, 2017 0608 UT. Seeing 3/10, transparency very poor. Unitron 60mm refractor, f/15. Skyris 132M, Baader IR-cut filter.

ARCHIMEDES, ARISTILLUS, AND AUTOLYCUS

Howard Eskildsen



The image (fig. 1) is processed to accentuate the contrast of rays against dark regions of the Moon. Archimedes, the largest crater on the image has ray markings across its basalt-filled floor. A few small craterlets are also visible. The rays seem to point towards the smaller crater Autolycus to its upper right. Notice the absence of a central peak in Autolycus as well as its rough, chaotic interior.

Figure 1. *Howard Eskildsen, Ocala, Florida, USA. February 7, 2017 00:45 UT. Seeing 9/10, Transparency 5/6. 6" Refractor, f/8,. 2x barlow, V-block filter, DMK 41AU02.AS.*

Above Autolycus, the larger crater Aristillus spews rays that dominate the upper half of the image, and has a central peak complex typical of craters its size. Archimedes does not since it was flooded with lava which buried its central peaks. But what about Autolycus, could it have formed central peaks that were buried in rubble from the later Aristillus impact?

Depth to diameter (d/D) ratios reveal the answer: (diameters in kilometers, depths in meter)

Crater	Diameter (From VMA)	Depth	Depth/Diameter
Aristillus	55	-3432.5	0.0624
Autolycus	39.5	-3559.5	0.0901
Archimedes	83	-1763.5	0.0212
Timocharis	35	-3328	0.0951
Triesnecker	27	-2418	0.0896

If Autolycus were filled with debris, it should have a shallower depth from the fill covering the peaks as seen in the crater Archimedes. On the contrary, its d/D ratio is much greater than Archimedes, and even grater than Aristillus, meaning that it is deeper relative to its size than either of the other two craters. It never formed central peaks in the first place. The d/D ratio for Autolycus is similar to nearby Timocharis (not on image), which has a central peak, and well-known Triesnecker, which has no obvious central peak, and fits into the d/D range expected for craters its size.

I can't help but wonder why some craters form central peaks while others of similar size do not.

Crater diameters were taken from The Virtual Moon Atlas, and depths and diameters were estimated using the LROC QuickMap for the mean rim elevation and crater floor elevation along a line running from west to east along the center of the craters measured.

OLD CRATERS, YOUNG CRATERS

Rik Hill

Sitting exactly on the terminator here (fig. 1), just above center, with half the crater in light and half in dark, is the 88km diameter crater Tycho. It's a young crater has craters go on the moon, being less than a billion years old. This is why it looks so crisp with a sharp rim not yet eroded by smaller meteorite impacts. Just below it is the larger and much older crater Maginus (168km diameter) whose age may stretch back as far as 4.5 billion years. Note how the walls are heavily eroded by smaller impacts over the thousands of millennia. At the very bottom of the image we see most of the monster crater Clavius (231km) with an age between these first two craters. To the right of Maginus, halfway to the edge of this image is the oddball crater Heraclitus, an oblong feature with a crater at the lower end and a larger one at the other end to the upper right. This latter crater is Licetus (77km). You will see that this crater too is rather weather beaten being about the same age as Maginus. Above Licetus is a large flat floored crater Stofler (129km). Notice the delicate striated shadings on its floor.

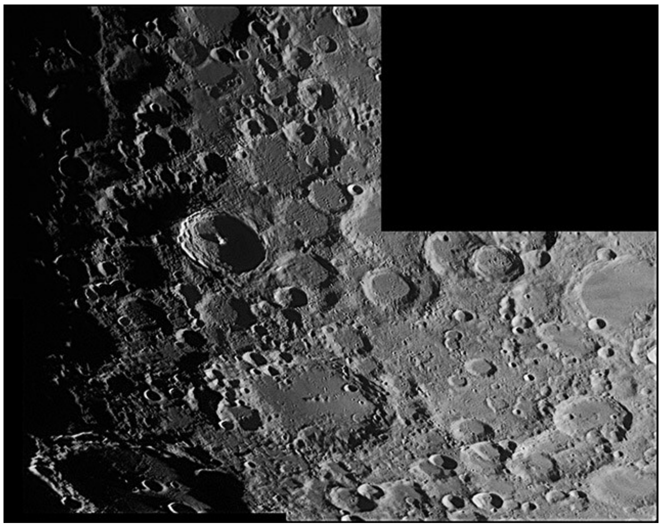


Figure 1*. *Tycho. – Richard Hill – Tucson, Arizona, USA Jan. 7, 2017 01:02 UT. Seeing 8/10. TEC 8" Mak-Cass, f20, SKYRIS 445M.

Zoom in on Tycho and you'll see that some of the features about the crater are soft and not crisp in detail like Tycho. These features were covered by the "ejecta blanket" of material expelled from Tycho during the few minutes of it's formation. There are also gouges and valleys carved out in those few minutes and chains of secondary craters formed from the larger material that was excavated during the impact. The density of these secondary craters falls off as you move radially away from the center of Tycho, a clear indication of origin. Lastly, notice the smaller crater to the upper right of Tycho with the clear central peak. This is Ball (44km) with high terraced walls very evident in this image.

RUPES RECTA: CLEAVAGE THROUGH A WEIRD AREA

Alberto Martos, Antonio Noya, Eduardo Adarve, Carlos de Luis and Jaime Izquierdo,

members of Madrid Amateur Astronomical Society

For an amateur astronomer (or for a professional astronomer who took his first steps as an amateur), a look through the telescope at Rupes Recta (the Straight Wall) embodies a lovely return to his or her youthhood experiences in astronomy, usually with a 6 cm refractor;. to the magnificent emotion felt in the discovery of the Moon dark sword, illuminated by the morning Sun light, before even having heard of it. Sometime later would take place the discovery of the Moon bright sword, when a better telescope, normally a reflector, would provide a sufficient resoluting power to catch the narrow bright line of the sword blade, illuminated by the evening Sun light. Certainly, the reason for the failure to see the bright blade of the lunar sword, must not be attributed to laziness at the time to get up early in the morning, but to the low resolving power of the 6 cm scope. As a matter of fact, the dark sword (see photo 1, inset) is a lot easier to see than the bright sword (photo 1), for the width of the scarp shadow can be several times wider than the true aspect of the scarp face, as seen from the Earth.

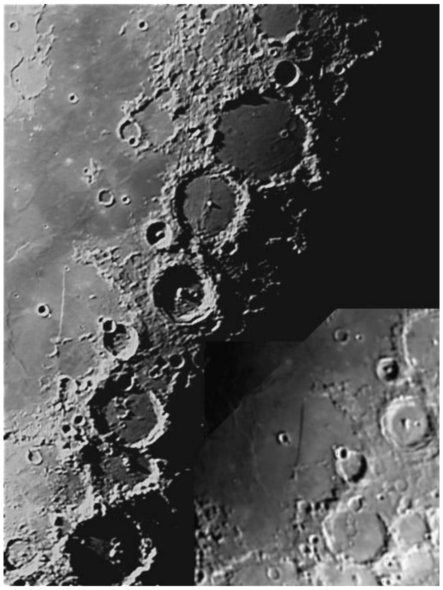


***Photo 1**. Oct. 11, 2009, 05:15 UT, 20cm Newt. f/7.2, ToUcam Pro, Seeing 4, Transparency 3-5, colongitude 155.3º.*

Effectively, Rupes Recta (photo 2) is the most famous Moon cliff, although its true nature and physical form are far from the image that our eye catches and our brain interprets. Its true nature is a fault scarp 110 km long, that runs approximately North-South across Eastern Mare Nubium. The slope is step down from East to West, a configuration that explains the darkness of the fault face under easterly illumination and its brightness under West illumination, when the slope is step up and the exposed foot of the scarp is lightened by Sun light. As far as the transversal and vertical measurements are concerned, officially 2.5 km wide and up to 300 m tall (A. van den Bohede, TLO Jan. 2005), the slope is far from that which typifies a steep abyss. Yet there exists a whole assortment of height data obtained by different authors (R. Lena *et al*. in Selenology Today, vol. 10, June 2008). Measurements in this publication range from a maximum of 495±20 m near the center of the scarp, to about 300±30 m near the tips, while the width is recurrently 1.28±0.07 km from beginning to end. The subsequent maximum slant is about 21 deg., a very gentle one.

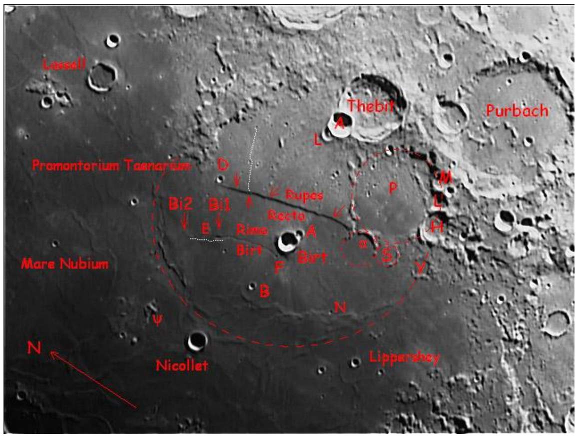


***Photo 2**. Jan. 13, 2011 02:59 UT. 20cm Newt.f/7.2, 2X barlow, ToUcam Pro, Seeing 7, Transparency 4-5, colongitude 21.3º.*

Paradoxically, Rupes Recta, Latin for “straight abyss” (better than wall), is said to be neither straight, nor an abyss, as we have already seen. It is not straight, as can be assessed in photo 1, because, as LROC pictures show, there are small offsets and slumps of materials in four points (at least) along the supposedly straight line. We have marked the positions of these four offsets and slumps in photo 2 by short arrows. A close observation under high power optics reveals that the true structure of Rupes Recta is that of a segmented fault, composed of five straight echelons stretched between two successive offsets. The first and last sections bend slightly westward. Just at the second northern offset, we were able to momentarily glimpse a very thin fault (announced by C. Wood in LPOD Jan. 2004) that runs perpendicular to the fault. (Although we can distinguish this feature in our print in glossy photographic paper as a slight scratch, it is not noticeable in photo 2, so we have had to pinpoint it in white). The question is if each other offset is produced by an invisible fault.

The southern end of the sword, the handle, is formed by what has been believed a cluster of mountains, the so-called the “Stag’s Horn Mountains”, and deserves an individual description that we will take care of a bit farther.

We observed Rupes Recta in several instances under the conviction -we believe every day more widely accepted- that it is a fault scarp produced by the subsidence of the west fault block, as a result of the central floor collapse of the Nubium basin. So far so good. The unorthodoxy showed up when one considered what and when triggered the floor fracture. The traditional explanation appeals to the huge impact that excavated the Imbrium basin, 3.85 billion years ago. The frightful shake that came up immediately after the impact, delivered enough energy to crack the lunar crust at thousands of kilometers away from point zero. A hint to uphold this hypothesis comes from one certainty: Rupes Recta is perfectly lined-up radially with the basin center. [If you dare to check this assertion by projeccting Rupes Recta on a map with the help of a ruler, you will blame Copernicus. But the Moon surface is not flat, so to deal with the truth, you better stretch a thin string with your finger tips along a great circle over a Moon globe, aligned on Rupes Recta (photo 3) and you’ll fly over the basin center].

Photo 3. *Alignment to Imbrium Basin.*

No matter how good this idea looked, it soon ran into trouble. The main obstacle to be overcome came from modern conceptual achievements in the light of the Apollo geology lessons: radial faults such as the Straight Wall, that cut mare materials, cannot be direct products of the Imbrium impact. If they were related to Imbrium, they should have formed by some sort of rejuvenation of [older] radial fractures (D. Wilhelms, The Geologic History of the Moon, p. 115). By such a sort of rejuvenation we understand a later repetition of the phenomenon that triggered the rupture of the crust in the first place.

We met the unorthodoxy not long ago, at some stage during a self-taught course on lunar geology we developed in the AAM classroom. We learnt from some well known authors (W. Dembowski, TLO May 2008 and C. Wood, Sky & Tel. Sep. 2000) that besides matching the nature of the above described fault scarp, Rupes Recta could be considered as a step fault, aligned diametrically within an anonymous half-ghost large crater (150 km diameter for Dembowski and 200 km for Wood), unofficially christened as Old Thebit (outlined in photo 2). The raised half rim of this crater is easily noticeable on the highlands, around crater Thebit (57 Km/3270 m), while the half lowered rim is subject to some conjectures under the lavas, as we’ll see below. Being this crater placed on the “shore” of Mare Nubium, it was affected by the stresses created by the collapse of the basin central floor, as the mare lavas cooled down and piled up on the basin center, so that the crater floor split and slid down from East to West, creating the Rupes Recta fault and being itself invaded by lavas which covered the floor and half of the rim. In other terms, Old Thebit turned out to be a floor fractured crater (FFC). But under this second account, the fault would be about 500 million years younger than the basin, since lavas came out from the lunar mantle that late.

If we were allowed to add something to this picture from our own, we would pick up fitting parts from both hypotheses (well established theories never are all the way wrong, even if they were superseded). We would suppose that Imbrium impact provided enough energy to nick the surface of Old Thebit, carving an old pre-fault and that the floor collapse, 500 million years later due to magma overloads, made the rest acting upon the scratches already set up by the impact shake and rejuvenated the fault. Remnants of ancient volcanism (magma flows escaping through crust clefts) could be the certainties needed to support this deduction.

As we looked at Rupes Recta through our telescopes under morning illumination on February 5th (photos 4 and 5 and drawing 1), in a preparation to comply with TLO's FOCUS ON request, we tried to identify those subtle details which best characterize an FFC crater, and make some comparison with standard FFC structures, searching for similarities. Soon we came upon a disagreement with the official statements. The supposed lowered rim of Old Thebit has been usually identified by an arcuate anonymous ridge (dorsum) located between craterlets Lippershey N (3 km) and Birt B (5 km/520 m). But to our own impression, the best fit for this rim is not denoted by the ridge, but by an arcuate trough whose only visible arc is located North-East of crater Nicollet (15.2 km/2030 m). Photo 2 (labeled) shows the good fit between this curved anonymous depression and the visible half rim in the highlands. Under this point of view, the curved ridge occupies the same position as the semi-circular ridge visible in the southern part of Gassendi and in other FFC structures.

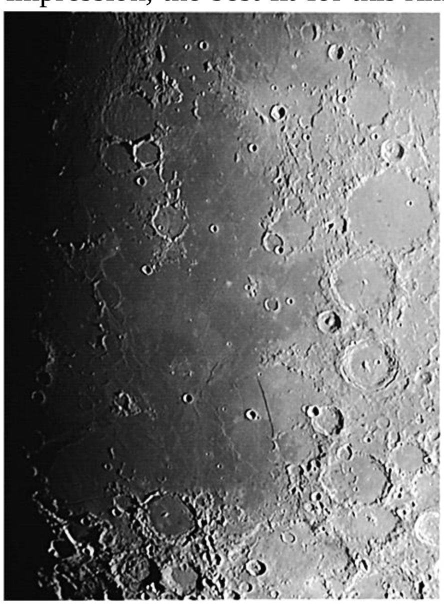


Photo 4. *Feb. 5, 20171 19:26 UT. Takahasi 130 f/23 3X barlow, QHY5LII, Seeing 4, Humid, colongitude 22.º2.*

Our attention was called to the raised rim of Old Thebit. It has been smashed at its central point by an array of three chained craters of decreasing size, which overlap one another. The largest one, Thebit (57 km/3270 m), is a flat floored crater with an almost circular rim, a central peak replaced by a horseshoe elevation, and massive ramparts and terraced walls, destroyed to the East by the younger and deeper Thebit A (20 km/2720 m), a banded crater with bowl shaped floor. In its turn, the rim of Thebit A is overlain by nested Thebit L (10 km), another bowl shaped crater with a small central mound, completing the chained array. However it is not all told about Thebit L, since it does not intrude Thebit A nor is intruded by it. As portrayed in photo 2, the junction of both craters runs in a straight line and this configuration poses a lot of ambiguity on the subject of ages. Which one is older? Clearly the superposition criterion does not help at all in this particular case. Fortunately there are two other criteria still available, those of degradation and decreasing sizes. Application of both criteria solves the problem: Thebit L is younger because it still conserves a central peak and is smaller.

Inside the large Old Thebit there are some other half-ghost small craters below the lava sheet, but easily identifiable by their raised rim and the discernible peaks of their lowered rims. Such craters are Thebit P (78 km), Thebit S (16 Km) and Purbach Y (16 km). All the three must have been

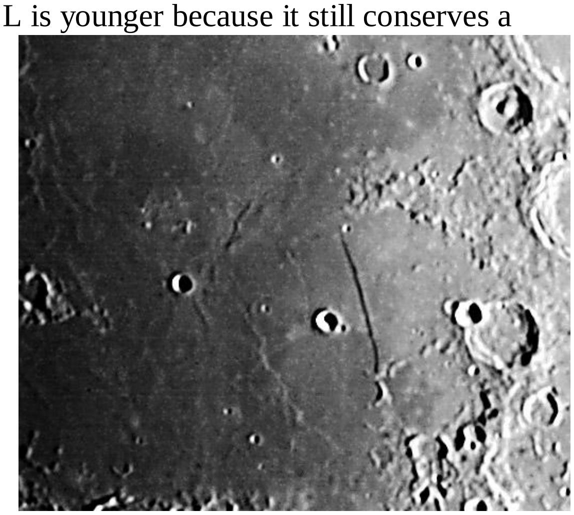
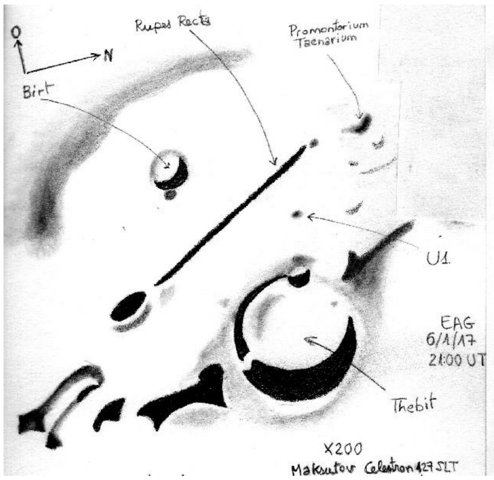


Photo 5. *Feb. 5, 20171 19:26 UT. Takahasi 130 f/23 3X barlow, QHY5LII, Seeing 4, Humid, colongitude 22.2º.*

formed before the volcanism epoch and so, they are examples of tilted structures with half a rim raised and the other half ring underneath the lavas. But again, it is not all told about Thebit P, because its western rim encloses one surprise for the observers. There is a peak (600 m) which occupies the position of the sword handle and that has been catalogued by IAU as a hill and named Thebit α. Ancient lunar cartographers called it the Stag's Horn because of the double branching that can be easily seen in the southern end. However, a close examination with high power optics, reveals that the curbed crest were not too different from the rim of Thebit S, but for the branch. And high optics shows as well that this branch could be part of the crater rampart, exposed by the general step-down tilt of the area. Consequently, we believe we have found enough material to raise a second disagreement report, because to our knowledge, Thebit α is actually the remnant of a 25 km crater, half-flooded by lavas.



Drawing 1. *Jan.6, 20171 21:00 UT. Celestron 127mm Mak-Cass , 85X, Seeing A-I, colongitude 18.5º*

Still inside Old Thebit and due west of *Rupes* Recta, lie two smaller, bowl shaped craters, Birt (17 km/3470 m) and Birt A (6.8 km/1040 m), nested as the Thebit cluster, but oriented contrary. The rim of Birt is notched to east due to the presence of Birt A, and as our photo 2 managed to catch, the western wall of Birt is terraced, a feature that was to be expected for its great depth (width/depth ratio ≈ 5).

Close to crater Birt lies Rima Birt, a 50 km long and 1500 m wide rille, that runs parallel to Rupes Recta, although it bends slightly westwards. This rille starts in craterlet Birt E (5 km/600 m), close to dome Bi-1 and ends in craterlet Birt F (3 km/470 m). It is commonly assumed that the lava flow ran from crater E to crater F. The rille splits two domes, Birt-1 as it undergoes an offset in the same point, and Bi-2. Because our picture failed to catch the stretch from craterlet Birt E to dome Bi-2, we have pinpointed this path in white. And although we could not even spot a second offset, which we have learnt that there exists at mid point down the rille, we have signaled the place by an arrow. What surprises lunar experts is that offsets never occur along lava channels, but rather along trenches or graben. This weird lava flow is the feature we were looking for, to support the Rupes Recta and Old Thebit hunch mentioned above.

With the aim of comparing the raised rim of Old Thebit with the rim of another well known FFC structure, Sinus Iridum (260 km), we paid attention to the way both end capes of the two structures "splash" into the lavas of Mare Nubium and Mare Imbrium, respectively. As it has been described (Wood, Sky & Tel. Dec. 1999) for Sinus Iridum, the northern cape (Promontorium Laplace) casts a conspicuous pointed shadow at sunrise and sunset, as a true cliff, while the southern cape (Promontorium Heraclides) casts a flatter blunt shadow at same phases, as a gentle ring wall, the cause being a supposedly hidden fault under the lavas, due East of Promontorium Laplace. In the case of Old Thebit, the northern cape (Promontorium Taenarium) casts a Herclides-like shadow, but unfortunately, an analogous analysis with the unnamed southern cape seems impossible, because the rim has been smashed by the small craters Purbach H, Purbach L and Purbach M. Nonetheless, if one contrasts these rim stretches immediately North and South of Thebit, it becomes clear that the southern part is a lot more massive than the northern one, attesting that the primeval end cape might have kept a strong resemblance with Laplace cliff, before it was smashed. Then, some similarity exists supporting our concern.

LUNAR TOPOGRAPHICAL STUDIES

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OBSERVATIONS RECEIVED

JAY ALBERT – LAKE WORTH, FLORIDA, USA. Digital images of Alphonsus-Walther, Ptolemaus -Pitatus & Straight Wall.

ALBERTO ANUNZIATO—PARANÁ,, ARGENTINA. Drawing of Mons Hadley.

HOWARD ESKILDSEN - OCALA, FLORIDA, USA. Digital images of Archimedes-Autolychus, Hyginus-Triesnecker, Montes Appeninus, Palus Epidemiarum, Plato, Sinus Iridum & Thales rays..

MARCELO GUNDLACH – COCHABAMBA, BOLIVIA. Digital images of Apennine Mountains-Palus Putredinus(3), Gassendi, Pythagoras & Schickard.

DESIREÈ GODOY - ORO VERDE, ARGENTINA. Digital images of Anaxagorus(2) & Plato(6).

RICHARD HILL – TUCSON, ARIZONA, USA. Digital images of Bullialdus, Clavius, Hyginus, Moretus & Rupes Recta(4).

JERRY HUBBELL – LOCUST GROVE, VIRGINIA, USA. Digital image of eastern Moon.

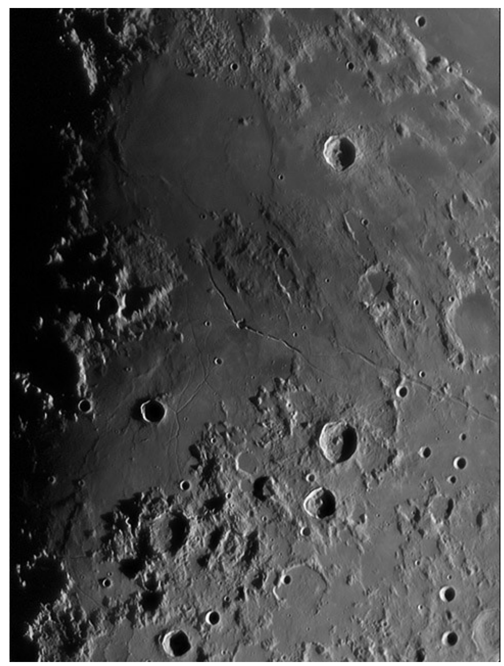
ALBERTO MARTOS, NIEVES del RÍO, JOSÉ CASTILLO, & ANTONIO NOYA – MADRID, SPAIN. Digital images of Rupes Recta (6). Drawing of Rupes Recta.

MICHAEL SWEETMAN – TUCSON, ARIZONA USA. Digital images of Montes Apenninus, Clavius & Rupes Recta.

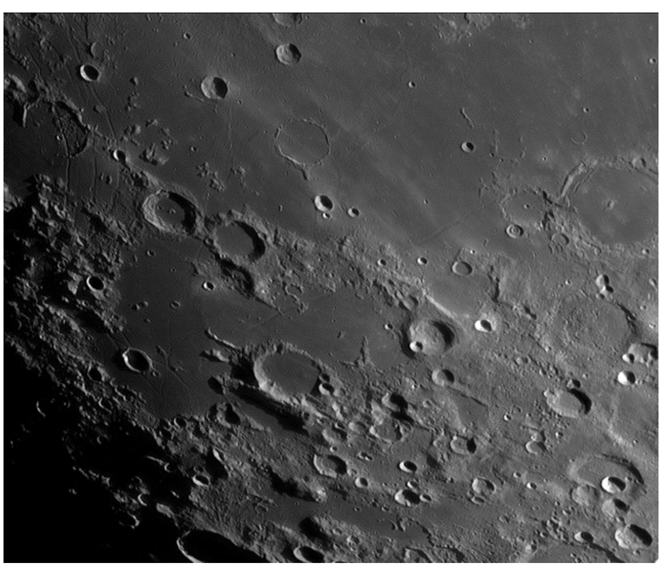
DAVID TESKE - STARKVILLE, MISSISSIPPI, USA. Digital images of Rupes Recta(3).

RECENT TOPOGRAPHICAL OBSERVATIONS

ALPHONSUS-WALTER - Jay Albert, Lake Worth, Florida USA. January 6, 2017 02:43 UT. Seeing 6-7/10, transparency 4/6. Nexstar 6" SCT, iPhone 6S..

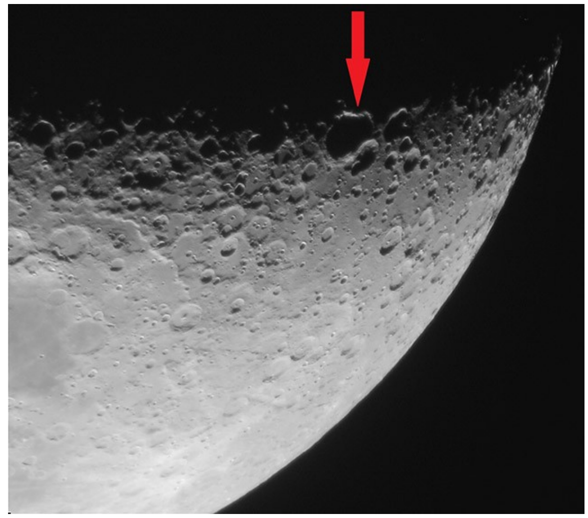


HYGINUS-TRIESNECKER - Howard Eskildsen, Ocala, Florida, USA. February 4, 2017 00:44 UT. Seeing 7/10, Transparency 6/6. 6" Refractor, f/8,. 1.5x barlow, W8 yellow filter, DMK 41AU02.AS.



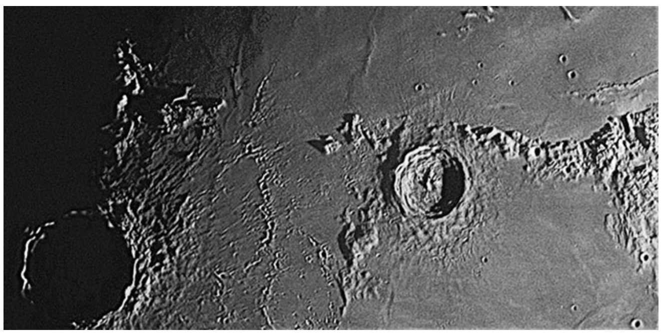
PALUS EPIDEMIARUM - Howard Eskildsen, Ocala, Florida, USA. February 7, 2017 00:51 UT. Seeing 9/10, Transparency 5/6. 6" Refractor, f/8,. 2x barlow, V-block filter, DMK 41AU02.AS.

RECENT TOPOGRAPHICAL OBSERVATIONS



MAUROLYCUS– Marcelo Gundlach, Cochabamba, Bolivia. February 3, 2017 00:57 UT. Seeing 9/10, transparency 6/6. 150mm f/8 refractor, Canon Power Shot A-620. V-block filter.

...the region of Maurolicus, my old friend, showing his bright spot. This bright spot looks fuzzy in small apertures, so one can be confused with LTP. With largers apertures a little crater in the wall can be seen



ERATOSTHENES – Richard Hill – Tucson, Arizona, USA January 7, 2017 01:21 UT. Seeing 8/10. 8" Mak-Cass, f20, SKYRIS 445M.

It must be a rough life for any features near Copernicus. To be lost in the shadow of the 95km giant means you will always be overlooked. Such is the case of Eratosthenes, a 60km crater that would shine on its own in lesser environs. From the wonderfully terraced walls to the splendid crisscrossed pattern in the hummocky terrain of the ejecta blanket it's a sight to behold. Beyond the immediate thick ejecta are radial streaks of a thinner layer of ejected material spreading into Sinus Aestuum below and Mare Imbrium above. To the right of Eratosthenes is the curve of peaks that is tail end of the Montes Apenninus. At the far right end of the curve is Mons Wolff with deep valleys on its flanks.

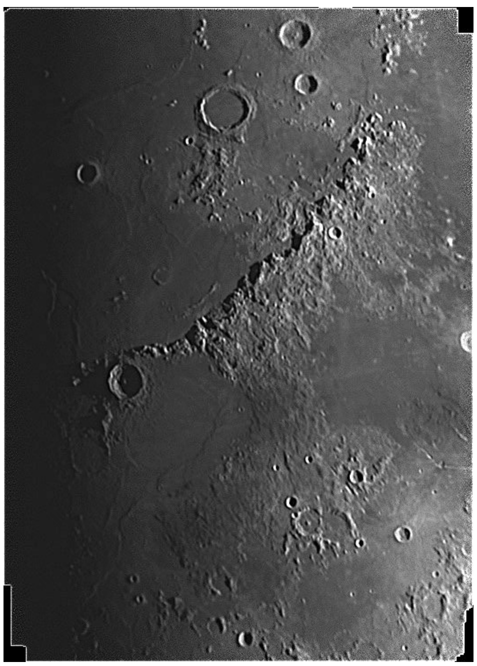
To the left of Eratosthenes is the ghost crater Stadius splattered with secondary craters from the Copernicus impact that stretch to the upper edge of this image. Back in the early 1960s I had to work to see these pits in my 60mm Tasco refractor. It was not until I had my RV6 6" f/9 reflector that they were clear to me.

HADLEY RILLE– Richard Hill – Tucson, Arizona, USA January 7, 2017 01:27 UT. Seeing 8/10. 8" Mak-Cass, f20, SKYRIS 445M.

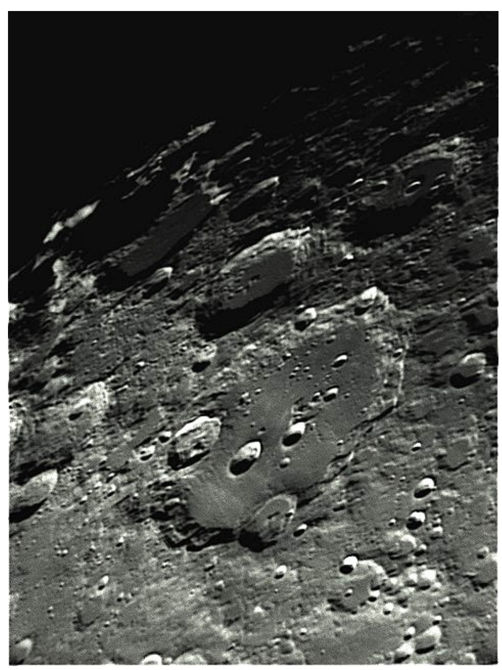
Here we have what is probably the most identifiable of all the Apollo landing sites. This is the region of Hadley Rille or Rima Hadley which was home for Apollo 15 from July 30 - Aug. 02, 1971. The landing site is marked with an "X" in this image. The full rima can be easily seen to the left of this marker as it snakes left around the mountainous projection named Bela. For gross orientation, the large crater at top, peeking into this field, is Archimedes. Above Rima Hadley on the other side of a low mountain chain is a system of rilles called Rimae Fresnel. They stretch 94km from Promontorium Fresnel to Palus Putredinis. Following further along the line of these rimae to the left, directly left of Rima Hadley is another great crack in the Moon, Rima Bradley this one 134km long stretching from Palus Putredinis to the shores of Mare Imbrium. Then running down the left side of Palus Putredinis are the broad Rimae Archimedes. Before leaving the area notice the field of mountains to the lower left of Archimedes are the Montes Archimedes, the remnants of once grand range that was overlain by the ejecta from surrounding impacts and flooded by the lavas of Mare Imbrium.

RECENT TOPOGRAPHICAL OBSERVATIONS

EASTERN MOON – Jerry Hubbell · Wilderness, Virginia USA.. February 7, 2017 00:31 UT. Meade 12” SCT, f/6.3. QHY163..

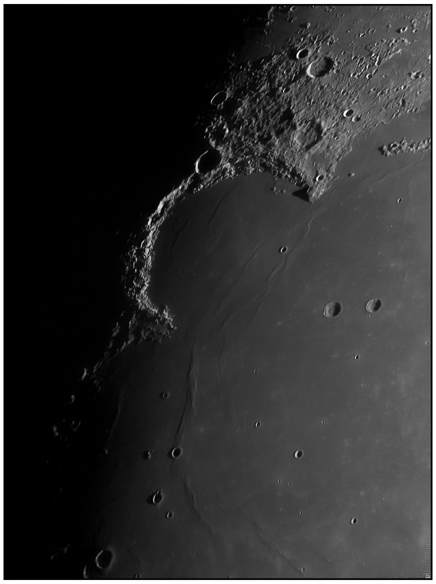


APPENINE MOUNTAINS. Michael Sweetman - Tucson, Arizona, USA, February 5, 2017 06:11 UT. Seeing 3/10, cloudy. Unitron 60mm refractor, f/15. Skyris 132M, Baader IR -cut filter.



CLAVIUS. Michael Sweetman - Tucson, Arizona, USA, November 22, 2015 06:19 UT. Seeing 6/10, transparency 3/6. 5” APO, f/22.5. DMK21, Baader IR-cut filter.

RECENT TOPOGRAPHICAL OBSERVATIONS



SINUS IRIDUM- Howard Eskildsen, Ocala, Florida, USA. February 7 2017 00:32 UT. Seeing 9/10, Transparency 5/6. 6" Refractor, f/8,. 2x barlow, V-block filter, DMK 41AU02.AS.

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BRIGHT LUNAR RAYS PROJECT

Coordinator – Wayne Bailey – wayne.bailey@alpo-astronomy.org

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Assistant Coordinator – William Dembowski – dembowski@zone-vx.com

Bright Lunar Rays Website: http://moon.scopesandscapes.com/alpo-rays.html

RECENT RAY OBSERVATIONS

THALES RAYS - Howard Eskildsen, Ocala, Florida, USA. January 9, 2017 00:25 UT. Seeing 7/10, Transparency 5/6. 6" Refractor, f/8,. 2x barlow, Orion V-block filter, DMK 41AU02.AS.

LUNAR GEOLOGICAL CHANGE DETECTION PROGRAM

Coordinator – Dr. Anthony Cook – atc@aber.ac.uk

Assistant Coordinator – David O. Darling - DOD121252@aol.com

Observations for January were received from the following observers: Jay Albert (Lake Worth, FL, USA - ALPO) observed: Alphonsus, Aristarchus, Atlas, Censorinus, Eimmart, Menelaus, Mons Pico, Plato, Promontorium Laplace, Purbach, Swift and several lunar features. Alberto Anunziato (Argentina – AEA) observed: Alphonsus, Aristarchus, Bessel, Mons Pico, Montes Apenninus, Plato, Proclus, Purbach, Sulpicius Gallus, and several lunar features. Maurice Collins (New Zealand – ALPO) observed Albateginius, Autolycus, Cassini, Heraclitus, Hipparchus, Janssen, Lacus Mortis, Manilius, Mare Tranquilitatis, Plato, Plinius, Posidonius, Proclus, Stoffler, Theophilus, Triesnecker, Vallis Alpes, W. Bond, Werner, and several lunar features. Marie Cook (BAA – Mundesley, UK) observed Plato, Torricelli B, and several lunar features. Pasquale D'Ambrosio (Italy – UAI) observed Descartes. Valerio Fontani (Italy – UAI) observed Archimedes. Brian Halls (UK – BAA) observed Picard. Rik Hill (Tucson, AZ – ALPO/BAA) observed Clavius, Eratosthenes, Moretus, Rima Hadley, and Tycho. Franco Taccogna (Italy – UAI) observed earthshine, Mare Crisium, and several lunar features. Aldo Tonon (Itlay – UAI) observed Alphonsus. Ivor Walton (UK – CADSAS) observed Promontorium Agarum and several lunar features.

News: Due to a European research grant proposal I am involved in helping to prepare, I regret that I do not have time to put together the usual 8+ page newsletter this month exhibiting the best of your observations. Although this may disappoint many readers – please be reassured that we will publish observations sent in for January and February in full next month – though this may run to many pages. It is the best that I can do in the available time at the moment – so please do not hesitate to continue sending in observations.

LTP Reports: Three reports were received for January/February – though two are impact flashes and maybe even the third too?

Sporadic Lunar Impact Flash NW of Wolf– 2017 Jan 01 UT 17:47 detected by Stefano Sposetti (from a GLR team of: Raffaello Lena, Iten Marco, and Steffano Sposetti) and much later confirmed in an Aberystwyth University, Department of Physics, Robotic Telescope video recording (Anthony Cook/Matthew Menzies) – See: See: http://www.pvamu.edu/physics/cosmic-corner/lunar-meteor-watch/. More about this next month.

Quadrantic Lunar Impact Flash – 2017 Jan 03 UT 19:19 the same GLR observers detected this from two observing stations – confirming the flash was lunar in origin, and in the correct part of the Moon for it to be a Quadrantid meteor. See: http://www.pvamu.edu/physics/cosmic-corner/lunar-meteor-watch/.

130 km west of the Centre of Herodotus: Alexandre Amorim (Brazil - REA) alerted me to the fact that Brazilian observer Antonio Martini Jr. (Botucatu Sao Paulo, Brazil) , whilst using a 10" SCT and ASI 120 MC IR filter camera, had noticed on the computer monitor a white flash at 54.5W, 23.5N, on 2017 Feb 08 UT 01:45. Unfortunately they were not recording at the time, however it does not sound like a cosmic ray air shower detection on the CCD because the flash lasted as long as 0.5 sec. Cosmic ray radiation events last a TV frame only. We shall assign a weight of 2 to this report. Was anyone else observing then?

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

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KEY TO IMAGES IN THIS ISSUE

1. **Alphonsus**
2. **Apennine Mountains**
3. **Archimedes**
4. **Clavius**
5. **Eratosthenes**
6. **Hadley Rille**
7. **Herodotus**
8. **Hyginus**
9. **Mare Nubium**
10. **Maurolycus**
11. **Mons Hadley**
12. **Palus Epidemiarum**
13. **Purbach**
14. **Sinus Iridum**
15. **Thales**
16. **Thebit**
17. **Triesnecker**
18. **Tycho**
19. **Walter**
20. **Wolf**

FOCUS ON targets

X = Rupes Recta
Y = Messier-Messier A