THE LUNAR OBSERVER

A PUBLICATION OF THE LUNAR SECTION OF
THE ASSOCIATION OF LUNAR AND PLANETARY OBSERVERS
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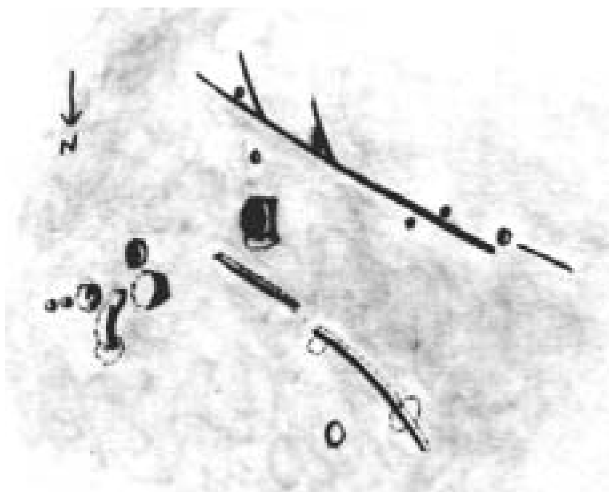
FEATURE OF THE MONTH - AUGUST 2004



CAUCHY & ENVIRONS

Sketch and Text by Robert H. Hays, Jr. - Worth, Illinois, USA
February 26, 2004 - 01:06 UT
15cm Newtonian - 170x - Seeing 8/10

I sketched this area on the evening of February 25/26, 2004 while watching two occultations. Cauchy itself is a rather ordinary crater except that it cast shadows that were considerably longer at its north and south ends than in its middle. The surrounding area was more interesting. The fault Rupes Cauchy lies south and west of Cauchy. This fault cast a conspicuous shadow that was wider toward the west. The crater Cauchy B interrupted it to the west, and it continued beyond that crater, but the shadow was not nearly as wide west of Cauchy B as it was east of that crater. There were two strips of shadow south of the fault; perhaps these were from branches of Rupes Cauchy. I saw a few small crater pits near the fault. Cauchy F appears to be one of two pits between Cauchy and Cauchy B. Cauchy E is just south of Cauchy, and further south is Cauchy C. The Lunar Quadrant Map shows Cauchy C north of Rupes Cauchy but I saw it south of the main fault.

Rima Cauchy lies to the north and northwest. This rille is split into two parts. One segment is straight and lies north of Cauchy while the other segment makes a gentle curve around Cauchy A. This segment appears to be more curved than is shown on the Lunar Quadrant Map. The gap between the segments looks larger than shown there also. Cauchy D lies east of Cauchy; these two craters both have substantial interior shadows. Cauchy A, however, appears to be much shallower. Its interior shadow is much less than that of Cauchy D, though these craters are about the same size. An assortment of hills was noted north of Cauchy D. I also saw four diffuse bright spots in this area. Two were along Rima Cauchy, one was at the north end of Cauchy, and one was at the north end of an elongated hill north of Cauchy D. I couldn't see any shadowing associated with these bright spots.

LUNAR TOPOGRAPHICAL STUDIES

Acting Assistant Coordinator – William M. Dembowski, FRAS
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OBSERVATIONS RECEIVED

MICHAEL AMATO - WEST HAVEN, CONNECTICUT, USA
Ray Maps of Proclus (3), Menelaus (3), Messier (3), Aristarchus (3), Kepler (3)

DANIEL DEL VALLE - AGUADILLA, PUERTO RICO
Sketches of Harpalus, Seleucus, Dome near Tobias Mayer
Digital images of Cleomedes, Endymion, Janssen, Proclus, Snellius

COLIN EBDON - COLCHESTER, ESSEX, ENGLAND
Sketches of Fabricus & Metius & Brenner, Schiller Annular Plain (2), Heraclitus, Sinus Iridum, Metius to Neander

HOWARD ESKILDSEN - OCALA, FLORIDA, USA
Digital image of Marius Hills & Reiner Gamma, Region from Rumker to Aristarchus, Ramsden to Mare Humorum, Gassendi and nearby rilles

RAFFAELLO LENA - ROME, ITALY
Digital image of Clavius & Tycho & environs

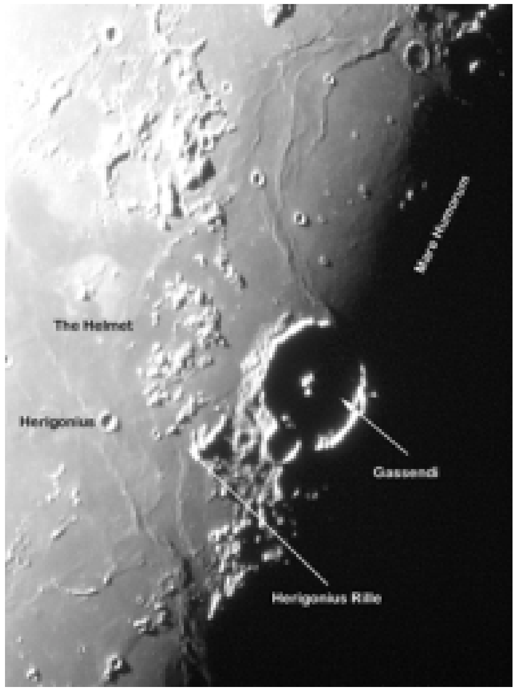
GUIDO SANTACANA - SAN JOSE, PUERTO RICO
Digital images of Copernicus, Tycho

ROBERT WLODARCZYK - CZESTOCHOWA, POLAND
Sketches of Plateau and Rays of Gambart A, Region from Piccolomini to Fracastorius

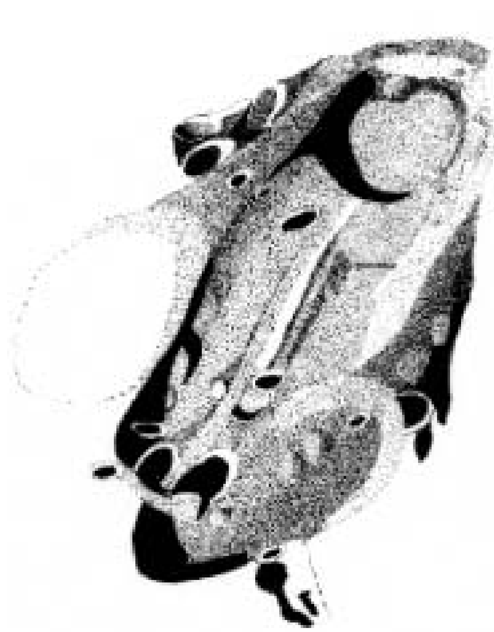
Observations submitted should include the following:

Name and location of observer
Name of feature
Date and time (UT) of observation
Size and type of telescope used
Magnification (for sketches)
Medium employed (for photos and electronic images)

RECENT TOPOGRAPHICAL OBSERVATIONS

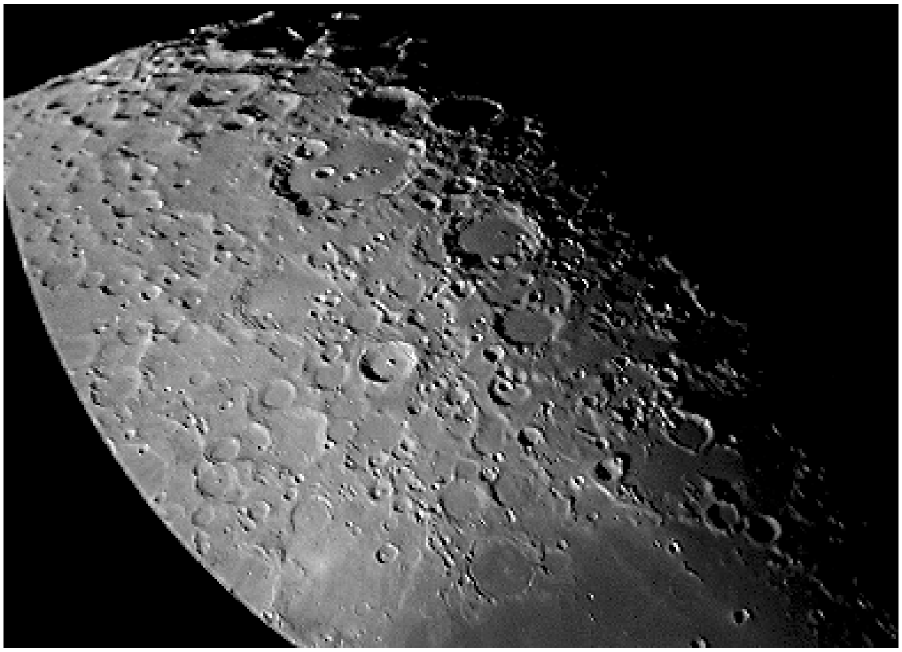


GASSENDI & ENVIRONS
Digital image by Howard Eskildsen - Ocala, Florida, USA
May 30, 2004 - 01:04 UT
10 inch Refractor - 2x Barlow - Nikon Coolpix 4300

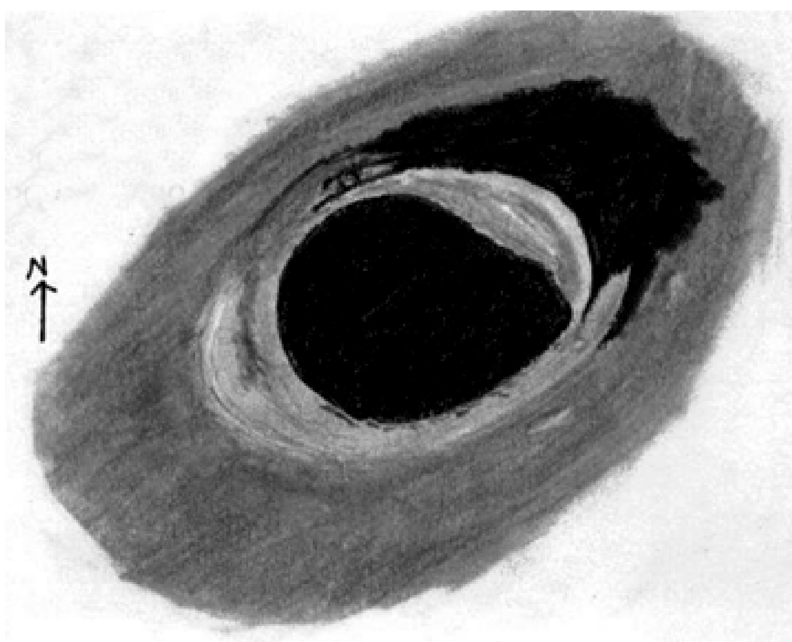


HERACLITUS
Sketch by Colin Ebdon - Colchester, Essex, England
June 25, 2004 - 21:45 to 22:45 UT
7 inch Maksutov-Cassegrain - 225x - Seeing AIII (variable)

RECENT TOPOGRAPHICAL OBSERVATIONS



CLAVIUS, TYCHO, AND ENVIRONS
Digial image by Raffaello Lena - Rome, Italy
June 27, 2004 - 19:43 UT
10cm f/15 Refractor - 12.5mm EP - Olympus Camedia C310



HARPALUS
Sketch by Daniel del Valle - Aguadilla, Puerto Rico
June 24, 2004 - 00:01 to 00:25 UT
120mm Refractor - 333x - Orion V-Block Filter

<u>LIGHT CUP POURED TEA DOWN LUNAR TROUGH</u>

Ron B[ee] – June 22, 2004

My 4-inch TV-102 Light Cup set out to find Apollo 17 tonight on a 4-day old Moon. The seeing was poor and couldn't support more than 110x (8mm TV Radian) and at times 146x (6mm Radian) could just barely make it.

Using my Modern Moon book as a guide, the Light Cup has no trouble showing me the nearby Vitruvius and Littrow craters as well as the South and North Massif. I had planned to look for Crater Camelot but it was hopeless judging how small the Massif looks. We'll have to retry at a higher sun angle.

While scouting around the weird looking Crater Torricelli area, I came across what looked like a semi-circular trough around a nameless mountain range between Crater Hypatia and Rimae Hypatia (see red curves in the image from the Consolidated Lunar Atlas E5).

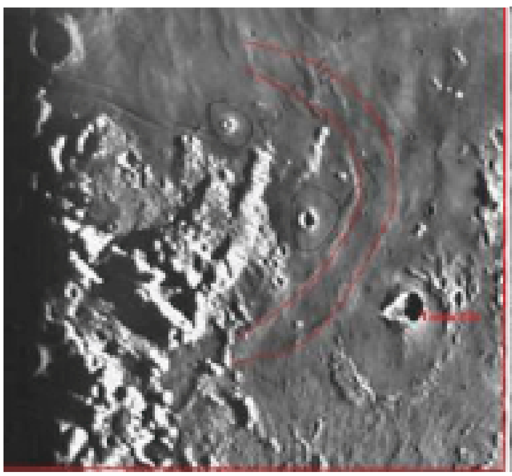


Plate E5

Plate E6

The depth of the trough was very evident due to the *very low sun angle* as part of the mountain range was still hidden beyond the terminator. The wrinkle ridges (left curve) and the plain where Crater Hypatia C (somebody had made a circle around it in the center of the image) resides, is noticeably higher than the trough, especially near the lower part of the image. If you look carefully, you might be able to see the trough in the photo as well! Why, the Light Cup thinks the whole mountain range and semi-circular plateau looks like a semi-circular Lunarian's fortress !

So are there depths around this region perhaps where lava used to be carried into Mare Tranquilitatis or was it simply a sun angle illusion? As you can see in the E6 plate of the Consolidated Lunar Atlas (taken when the Moon was much older in its cycle), the depth perception has all disappeared.

So what you think? Has anyone noticed this phenomenon?

Ron B[ee]

PS - Ok, my Light Cup knew it's impossible to see Apollo Lunar Lander, but it sure does hurt nothing none to try.

INTERNATIONAL BRIGHT LUNAR RAYS PROJECT

EXCERPT OF THE MONTH

LUNAR CRATER RAYS: COMPOSITIONS AND MODES OF ORIGIN (Part 2):

B.R. Hawke 1, D.T. Blewett 1, P.G.Lucey 1, C.A. Peterson 1, J.F. Bell III 2, B.A. Campbell 3
, and M.S. Robinson 4,
1 Planetary Geosciences/HIGP, Univ.of Hawaii, Honolulu, HI 96822,
2 CRSR, Cornell Univ., Ithaca, NY 14853,
3 CEPS, National Air & Space Museum, Washington, DC 20560,
4 Dept. of Geological Sciences, Northwestern Univ., Evanston, IL 60208.

Lichtenberg Crater Rays:

Lichtenberg crater (diameter = 20 km) is located in Oceanus Procellarum on the western portion of the lunar nearside (31.8° N, 67.7° W). This Copernican-aged impact structure displays a relatively high-albedo ejecta blanket and ray system to the north and northwest. However, Lichtenberg ejecta is embayed by mare basalt south and southeast of the crater. The FeO map produced for the Lichtenberg region indicates that the ejecta and rays north and northwest of the crater exhibit relatively low FeO abundances. These deposits appear to be dominated by low-FeO highlands debris. The maturity image demonstrates that these highlands-rich ejecta deposits and rays are fully mature. Hence, the Lichtenberg rays exhibit a relatively high albedo because of their composition. These mature highlands-rich rays appear bright in comparison to the adjacent mature mare surfaces. These "compositional" rays stand in stark contrast to the immaturity rays associated with the Messier crater complex.

Tycho Ray in Mare Nectaris:

A major ray from Tycho crater crosses much of Mare Nectaris. The 80-km long ray segment northeast of Rosse crater (17.9° N, 35° E) has a somewhat conical shape, ranging in width from 8 km near Rosse to 16 km northwest of Bohnenberger crater. Spectra were obtained for Rosse crater (diameter = 12 km), mature mare units, and two small areas on the Tycho ray northeast of Rosse. Both of the spots on the ray are located near a Tycho secondary crater cluster which is ~1400 km from the center of the parent crater. The spectrum collected for a mature mare area east of Rosse exhibits an 8.5% absorption feature centered at 0.98 µm. Both ray spectra have 11.6% bands centered at ~0.99 µm. It appears that the ray in the areas for which spectra were collected are dominated by fresh mare debris. These results are in agreement with those presented by Campbell et al. [6]. These workers noted that the Tycho secondary craters in the cluster are easily seen in high-resolution 3.0-cm radar images, and a radar-bright area extends 10-15 km downrange of Tycho from the approximate center of the cluster. In addition, they noted that the radar-bright region exhibited a deeper "1-µm" feature in multispectral ratio images and suggested that fragmental material was emplaced well downrange of the visible secondaries, perhaps by a secondary debris surge. The FeO and maturity images support this interpretation. In summary, analyses of near-IR reflectance spectra, multispectral imagery, and a variety of radar data suggest that Tycho ray in Mare Nectaris is dominated by fresh local material excavated and emplaced by secon-dary craters. While some highlands material from Tycho is undoubtedly present in the ray, the major factor that produces the brightness of the ray is the immature mare basalt.

Tycho Ray Southwest of Nectaris:
We also investigated a continuation of the Tycho ray discussed above in the highlands southwest of Mare Nectaris. The ray segment studied extends from Wilkins crater (30°S, 19°E) to the northwest rim of Fracastorius (20°S, 31°E). The FeO and TiO2 values associated with this ray segment are very similar to those exhibited by the adjacent highlands terrain. The maturity map shows that the brighter portions of this ray segment are composed of immature material. In summary, this ray is composed of relatively fresh highlands debris.

References:

[1] Shoemaker E. (1962) in Physics and Astronomy of the Moon, 283.

[2] Pieters C. et al. (1985) J. Geophys. Res., 90, 12393.

[3] Oberbeck V.(1971) Moon, 2, 263.

[4] Schultz P. and Gault D. (1985) J. Geophys. Res., 90, 3701.

[5] Blewett D. et al. (1995) J. Geophys. Res., 100, 16959.

[6] Camp-bell B. et al. (1992) Proc. Lunar Planet. Sci., 22, 259.

[7] Zisk S. et al. (1974) Moon, 10, 17.

[8] Thompson T. (1987) Earth, Moon, Planets, 37, 59.

[9] Hawke B. et al. (1996) Lunar Planet Sci. XXVII, 507.

[10] Lucey P. et al. (1995) Science, 268, 1150.

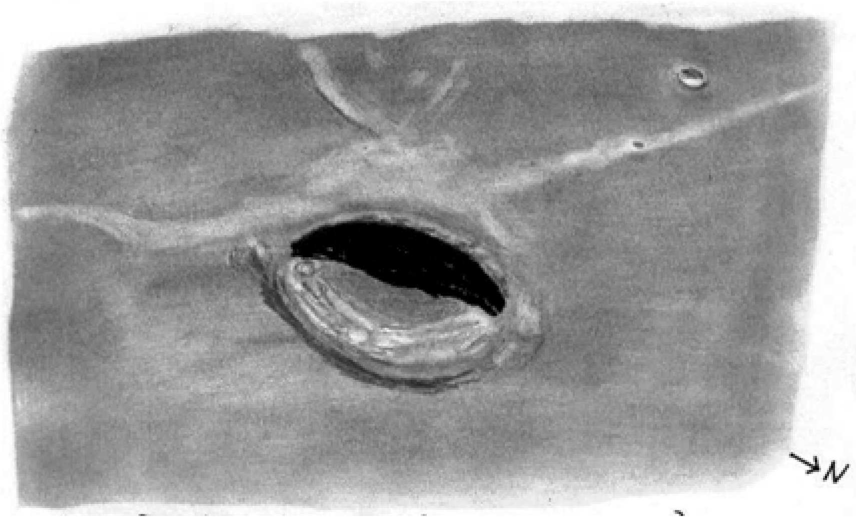
[11] Lucey P. et al. (2000) J. Geophys. Res., submit-ted.

[12] Hawke B. et al. (1999) Workshop on New Views of the Moon II, 22.

RECENT RAY OBSERVATIONS

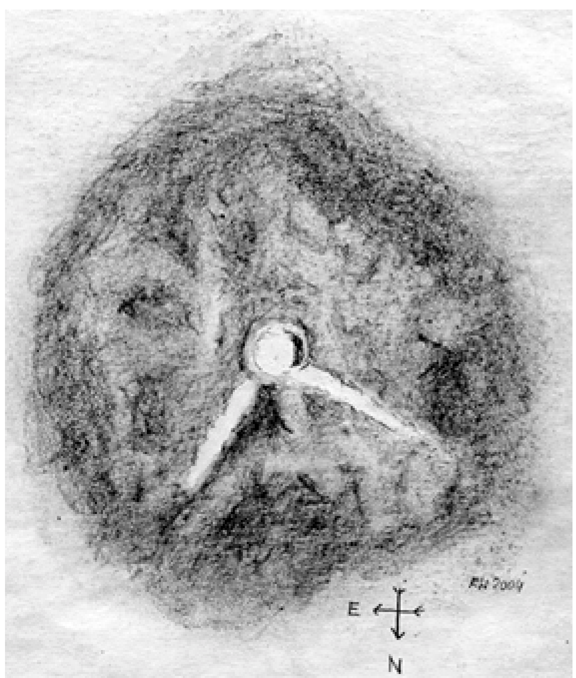
KEPLER RAYS & REINER GAMMA
Digital image by Howard Eskildsen - Ocala, Florida, USA
10 inch Refractor - 2x Barlow - Nikon Coolpix 4300

RECENT RAY OBSERVATIONS



SELEUCUS
Sketch by Daniel del Valle - Aguadilla, Puerto Rico
July 1, 2004 - 02:12 to 02:43 UT
120mm Refractor - 222x - 333x - Orion V-Block Filter

OBSERVING NOTE: Interesting ray system passes near east rim. Possible origin: Olber's crater.



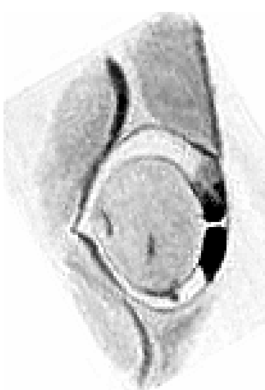
BRIGHT PLATEAU & RAYS OF GAMBART A
Sketch by Robert Wlodarczyk - Czestochowa, Poland
July 7, 2004 - 00:15 to 00:30 UT
18cm Newtonian - 36x - Seeing AII-III

TRANSIENT LUNAR PHENOMENA

Coordinator – Dr. Anthony Cook – acc@cs.nott.ac.uk
Assistant Coordinator – David O. Darling – DOD121252@AOL.COM

June has been a poor month for observing, presumably due to the Moon's low altitude in the evening sky for many northern hemisphere observers. Despite this, routine observations have been received from: Jay Albert (Florida, USA), Clive Brook (Plymouth, UK), and Marie Cook (Mundesley, UK). There were also attempts to look for meteor impact flashes in the Earthlit part of the Moon for the June Bootid meteor shower by Colin Ebdon and Brendan Shaw in the UK and by Raffello Lena of GLR in Italy. However attempts at observing impact flashes between June 21-24 were largely clouded out although Colin Ebdon did manage one hour of observing on June 21st and some observing on June 22nd until cloud rolled in - but saw no impact flashes.

Now one of the great things about participating in the TLP program, whatever you think about many of the past TLP reports, the programme is an excellent way to learn your way around the Moon and to see many craters under spectacular appearances. Also the observations you provide are of great use to other researchers in the BAA and ALPO. For example the following Proclus observation (top left) was received from Jay Albert *"The only thing I noticed that looked unusual was the shadow on the east wall of Proclus. The east wall was divided by a bright vertical feature. To the south of this feature, the shadow on the crater wall was black (as would be expected). To the north of the bright vertical feature, however, the shadow started black, but gradually lightened until it ended where the crater wall was brightly sunlit. I'm used to seeing lunar shadows as black with sharp boundaries, so this struck me as odd. Since I've never looked closely at Proclus before, it's possible that what I saw was normal for this solar angle and the intensity difference is due to the color of the feature"*. Note all the sketches below are with north at the top.



2004 Jun 24 UT 01:15-03:15– Jay Albert

Sub-solar point 103.2E, 1.2N

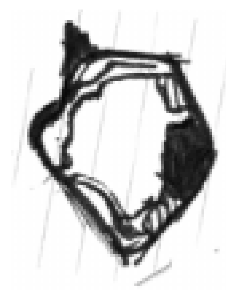
Sub-observer point 7.5W, 5.0S

Solar Altitude +32.5deg

279mm Celestron x311

Seeing 8-10 (excellent)

Transparency magnitude 3



1978 Feb 13 UT 18:58-19:08- Tony Cook

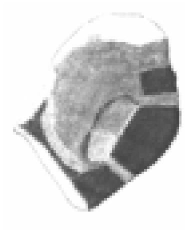
Sub-solar point 108.1E, 1.1N

Sub-observer point 5.1E, 4.4N

Solar Altitude +27.8 deg

300mm reflector x240

Seeing Antoniadi III (moderate)

2003 Feb 08 UT 02:09-03:07– Robin Gray
Sub-solar point 103.5E, 1.5S
Sub-observer point 1.3W, 3.8N
Solar Altitude +31.3 deg
152mm refractor x305
Seeing 6-7 (good)
Transparency 6

2003 Apr 08 UT 03:49-04:50- Robin Gray
Sub-solar point 104.1E, 1.1S
Sub-observer point 6.9W, 2.7S
Solar Altitude +30.8 deg
152mm refractor x305
Seeing 5-6 (poor-good)
Transparency 5-6

Upon receiving this sketch I checked up a few past observations (not many of these are in my database yet, so apologize to observers whom I have missed out) and found the following additional three sketches. My own crude sketch (top right) from 1978 confirms a less dark area to the north of the bisecting line. Robin Gray (Winnemucca, USA) also has a couple of sketches from 2003, his Feb 8th observation (bottom left) description is as follows: *"The black shadow covering the east 40% of Proclus last night (Feb 7th) had broken up into three patches separated from each other by lighter bands. These were confined to the east crater wall. Only the central patch was black, the other two were considerably lighter. Running along the southwest edge of the crater floor was what appeared to be a ridge and on the east side of the crater floor appeared to be a hill to the north of which was a less elevated plateau. As the observing period progressed part of the brilliantly illuminated north crater wall developed a darker area which gradually became more prominent. As the sun is getting higher I would expect shadows and dark areas to diminish-what was happening here is unknown. However, this is not an unusual event for this part of Proclus."* In his Apr 8th observation (bottom right) Robin makes no mention about the shadow densities.

So what does this tell us? Well Jay's original suspicion of the bright bisecting line turns out to be a normal appearance, possibly caused by a notch in the rim, or some other topographic effect. What is interesting is that he has not drawn in the 2nd bisecting line or a 3rd shadow. I doubt if this is a TLP, but perhaps more due to the Sun being at a sufficiently high altitude that any remaining shadow vanishes. Why are some shadows black and others grey in Proclus? This could be due to whether shadow is contiguous and un-interrupted, or whether there are lots of unresolved topography and surface roughness protruding out of the shadow. Also all four sketches are at different libration angles (sub-observer lon/lats), so undoubtedly this may have an effect on appearance. Another point to note about Proclus is that it is only 30km in diameter and subtends a relatively small diameter of less than 15 sec of arc (or smaller than the disk of Saturn), so it is not surprising that the sketches differ slightly in what can be resolved and their internal geometric accuracy as seeing conditions will have a drastic effect on what you can and cannot see.

So what are the guidelines if you see something strange? Firstly make a brief sketch, notes and if you can please take some CCD images. Next, does the feature change over time? If it is a simple illumination related effect then it will change gradually. Please also check out the appearance of other similar sized nearby craters in order to judge whether the effect is seeing related - if so it will affect others. You should also be looking for colour and brightness variations. I cannot give advice on when it is appropriate to telephone/email myself or David Darling to initiate a TLP alert - this depends upon individual cases, but we will definitely ask you if nearby features are exhibiting similar effects, so please be prepared to answer any questions about these.

Further predictions, including the more numerous illumination only events can be found on the following web site: http://www.lpl.arizona.edu/~rhill/alpo/lunarstuff/ltp.html. For members who do not have access to the internet, please drop me a line and I will post predictions to you. If you would like to join the TLP telephone alert team, please let me know your phone No. and how late you wish to be contacted. If in the unlikely event you see a TLP, 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!

Dr Anthony Cook, School of Computer Science & IT, Nottingham University, Jubilee Campus, Wollaton Road, Nottingham, NG6 1BB, UNITED KINGDOM. Email: acc@cs.nott.ac.uk

SELECTED AREAS PROGRAM
Observations Needed

Coordinator - Julius L. Benton, Jr., Ph.D. - jlbaina@msn.com

The missions of *Apollo* transformed our nearest celestial neighbor from a virtually unknown and inaccessible object into a relatively familiar world. Including the unprecedented historical events of July 20, 1969, twelve astronauts from Earth have set foot upon the Moon's surface, collecting and returning to Earth some 380 kg. of rocks and debris from six *Apollo* ventures. Of course, in mentioning any lunar explorations from Earth, we cannot omit the small but no less important 130 gm. of rocks gathered during the unmanned Russian *Luna-16* and *Luna-20* missions.

Apart from the vast collection of photographs, supplementing previous data from missions such as *Surveyor* and *Orbiter*, the *Apollo* program enabled equipment to be set up on the lunar surface to monitor moonquakes, meteoric impacts, thermal characteristics of the lunar surface material, and alleged magnetic phenomena. Adding to the wealth of accumulated data that now exists has been the massive collection of photographs of the entire lunar surface made in unprecedented detail in 1994 by the orbiting *Clementine* spacecraft. It will be many years, no doubt, before all of this information will be thoroughly assimilated and developed into a realistic account of the Moon and its cosmic history.

For the amateur astronomer, the Moon has always been a favorite subject for his telescopes, and until the first really energetic space efforts, he in large part dominated the field of selenography. Now, with the impact of a great multitude of photographs taken at close-hand, with precise measurements of the Moon's complex chemical composition, radioactivity, and seismic profile, and following sophisticated petrographic investigations of lunar materials, one might quickly assume that the work of the amateur astronomer has been relegated to redundancy or insignificance from our fixed vantage point in space. Too many people have gotten the idea that no awe and mystery remains about our "Queen of the Night."

The activities by *Apollo* astronauts on the Moon and close-range photographic surveys by lunar orbiting spacecraft are obviously out of the domain of the amateur astronomer. Yet, it must be emphasized that there are areas of lunar observation that still remain the forte of the amateur astronomer, fields that may be pursued without an imminent threat of obsolescence by the onslaught of imposing professional equipment. Unlike the professional specialist, the amateur is often blessed with the freedom to scan a lunar feature of his choice for extended periods of time in hopes of drawing or capturing photographic or CCD images of low-sun shadows of minor relief features, varying tonal patterns exhibited in lunar environments exposed to a high sun, and other possible long-term or transient events.

Any observing program, for its results to be scientifically useful, requires of its participants a suitable blend of preparation, skill, patience, and tenacity. Because of the large image size and brightness of the Moon, lunar studies are especially suited for amateur astronomers using small to moderate apertures. More importantly, there have been numerous instances when professional astronomers, in trying to resolve some observational query by relying solely on existing spacecraft photographs, have enlisted the services of amateur astronomers. For example, by a fortuitous improper positioning of the spacecraft camera or as a result of unfavorable solar illumination, an optimum view was not afforded of the morphology of a particular lunar crater or other feature. Fortunately, amateur observers were able to come to the rescue by monitoring the specific region of the Moon under the conditions sought by professional astronomers. In a few cases, needed data already existed in amateur observational archives. Such cooperative efforts clearly demonstrate how meaningful amateur observations of the Moon can be.

Lunar Transient Phenomena (LTP)

There are many areas of lunar research in which the skillful and imaginative amateur astronomer can find worthwhile observational opportunities. One example of a very interesting research program is the monitoring of *Lunar Transient Phenomena (LTP)*. The LTP represent alleged variations at the lunar surface that are typically of ephemeral or instantaneous nature and usually are quite unpredictable. Systematic, simultaneous studies by a team of regular observers using top-quality instrumentation is especially worthwhile, since under optimum conditions LTP events might be glimpsed for only a few seconds to some twenty minutes or so. What is of greatest importance within the scope of such a program is to try to observationally differentiate between LTP "reports" and bona fide LTP events.

No more than a cursory perusal of the available literature will turn up historical accounts of LTP, and while reports of most activity turn out to be dubious, there are growing numbers of undisputedly authentic LTP phenomena from analytical evaluations of available data. Some events have been observed simultaneously by distant and independent observers. As investigative procedures have been refined and improved over the years, it has been possible to confirm some LTP events photographically or with CCD techniques.

Of the more than 1,500 LTP reports and events catalogued since A.D. 557, perhaps the widely publicized Alphonsus spectrograms of Kozyrev in 1958, the observations of Greenacre and Barr of Aristarchus in 1962, and the *Moon-Blink* reports of the mid-1960's and early 1970's, are the most familiar. Observers are generally more prone to study areas on the lunar surface which are known to have generated LTP reports and events, giving the data sample to date a somewhat lopsided appearance, but it has become evident that LTP events may take place elsewhere on the Moon and not just in the aforementioned "preferential" areas. There are many regions on the lunar surface, indeed, which have been suspected of LTP events, although most of the lesser-known features have never been adequately followed observationally.

Rare and elusive as they may seem, LTP events do appear to fall within roughly defined categories. *Small, temporary reddish or pinkish patches,* presumably due to fluorescence or incandescent gaseous substances, have been noted shortly after lunar sunrise, while *glows* lacking any distinct hue have been noticed, sometimes seen on the night hemisphere of the Moon. Emerging quite instantaneously or lasting for several minutes have been *bright points of light* near the lunar terminator or on the darkened hemisphere of the Moon, while *rapid fluctuations in the brilliance of a specific area* have been occasionally recorded, again most often in the early lunar morning. *Obscurations*, visible directly as "fog" or "mist," or indirectly by concealing or obliterating known surface features, are also curiously associated with times of lunar sunrise, but not always so. Any number of variations may sometimes be reported in Earthshine conditions or in conjunction with partial or total lunar eclipses.

From the analytical information to date, it might be concluded that LTP events are probably of random internal origin and are only weakly attributable to external influences. As noted here, the phenomena seem to be of several kinds and involve possible gas or gas/dust mixtures, luminescence of these gaseous substances, and possible luminescence of surface materials. Perhaps many causative factors operate together to give strong sunrise correlations found in many of the LTP events. Supporting this tentative conclusion of an internal origin of the LTP is the distribution and association of many LTP sites with volcanic maria, dark-haloed craters, sinuous rills, and lunar domes.

The Lunar Selected Areas Program (SAP)

Well over a decade ago, the *Lunar Transient Phenomena (LTP) Patrol* was introduced as a new program for the A.L.P.O. Lunar Section, and the major thrust of the endeavor was to visually monitor the supposed transient variations at the lunar surface just discussed. In addition to looking for short-lived events, individuals were asked to supplement their observations with a monitoring of certain selected lunar features suspected or historically known to exhibit "seasonal" or long-term phenomena. For example, a variation in the tone or hue of a given area, which *cannot* be attributed to varying solar illumination and which *does not repeat* systematically from lunation to lunation, has been seen in certain areas. Principally, these tonal changes occur where dark radial bands or dark haloes are seen within or around some craters, or where darker regions or patches exist on the lunar surface in limited environments. Unusual changes in the apparent morphology, pertaining to overall size and shape, have been detected in conjunction with tonal or color fluctuations in many, but not all, cases. Thus, the intensive studies of specific features such as Alphonsus, Aristarchus, Eratosthenes, Herodotus, Kepler, Messier-Pickering, and Plato, have occurred, and as data were accumulated and reports on specific regions published, new areas were then added to the list (e.g., Atlas, Ross D, Hell, Pico, Piton, Colombo, etc.).

By 1971, the A.L.P.O. Lunar Recorders decided to segregate the study of LTP from the study of long-term or "seasonal" events, forming the *LTP Survey* for strictly transient lunar events and the *Selected Areas Program (SAP)* to deal with long-term variations, each area of concentration headed by a dedicated Recorder. In the years that followed this change, observational data were collected by each program, catalogued, reduced, and published in the *Journal of the A.L.P.O.*, and the results of both programs showed real promise. There were quite a few instances of LTP events and recognized "seasonal" variations apparent in the accumulated data sample.

Indeed, the Selected Areas Program (SAP) and LTP Survey represents meaningful enterprises at the fundamental level of amateur observational astronomy. A major goal of organizations like the A.L.P.O., these are pursuits that are largely concerned with *long-term visual monitoring of variable phenomena at the surface of the Moon*. The scope of such work has definitely not been rendered obsolete by spacecraft gathering such a great wealth of information about our satellite. Persistent, patient observers, participating in the A.L.P.O. LTP Survey and Selected Areas Program (SAP) can successfully and vitally supplement the findings of space missions and other ongoing professional research, increasing our overall knowledge about the Moon.

Today, the A.L.P.O. Selected Areas Program (SAP) and LTP Survey exist as somewhat separate endeavors, although both programs have achieved greater significance through emerging cooperative ventures of data exchange and comparison. This trend will continue to insure a steady flow of meaningful, scientific data for the future.

The success of the A.L.P.O. Lunar Selected Areas Program (SAP) is dependent upon long-term systematic observations of specific lunar features not only throughout a given lunation, but also from lunation to lunation for many years. Such regular and careful monitoring will familiarize one with the normal, yet often complex, changes in appearance that many features undergo from lunar sunrise to sunset, and it will be possible for the individual to recognize anomalous phenomena more readily from one lunation to the next, should they occur. Special inherent talents for drawing lunar features, although definitely helpful, are not necessary, nor is exceptional visual acuity. The most fundamental and essential prerequisite for participation in the Selected Areas Program is the willingness to follow the Moon and the chosen feature(s) for many consecutive lunations, year after year. Scientific objectivity is mandatory, whereby the observer must develop a constant practice of recording precisely what is seen at the eyepiece, not what one might expect to see (as may be derived from one's previous observations or from studies of published reports from other individuals). Should there be any doubt whatsoever about what is perceived, the observer must routinely note such uncertainties. The resulting data will be far more reliable and of lasting value. While initial efforts to detect rather delicate details on the lunar surface may result in some disappointment, persistent observations will bring about the reward of eventual successful perception (i.e., through training of the eye) of subtle features at the threshold of vision. The joy of recording phenomena or details hitherto unrecognized is reserved largely for the person who has maintained the perseverance to observe the Moon regularly.

Although no inflexible minimum size telescope need be specified for active participation in the A.L.P.O. Selected Areas Program (SAP), most experienced observers are in agreement that the largest aperture available, which can be employed with the existing seeing and transparency conditions, should be used. Even so, a good 10.2cm. (4.0in.) refractor or 20.0cm. (8.0in.) reflector will deliver sufficient resolution of lunar detail for full participation in nearly all aspects of the observing program. No attempt here is made to address the various pros and cons of instrument type or design, and the driving factors in choosing a telescope should be the reliability of the manufacturer, optical and mechanical excellence (giving high-contrast, relatively bright, and crisp images), and reasonable portability.

The percentage of sunlight reflected by the surface of the Moon, as we have seen, varies as the *phase angle, g*, changes throughout the lunar month. Taken a step further, observers are well aware that one area of the Moon reflects more light (e.g., a crater rim or central peak) than another region (e.g., the maria), regardless of the phase angle, and these areas in turn vary in appearance as the illumination changes. These differences in *tone* are generally more conspicuous at Full Moon ($g = 0^{o}$), and the investigation of light and dark areas of the Moon is an interesting observational endeavor.

While there is a definite requirement to know how various lunar features change their normal appearance throughout a lunation in response to variations in phase angle, even more intriguing are those lunar features that behave in an unusual, sometimes unpredictable, and non-repeating manner as solar illumination changes. The A.L.P.O. Lunar Selected Areas Program (SAP) is chiefly concerned with systematically monitoring regular and cyclical long-term variations during many lunations of specifically designated, or *"selected,"* areas on the Moon. The SAP is designed to intensively study and document for each of these features the *normal* albedo changes in response to conditions of varying solar illumination. The program is equally concerned with the following possible *anomalous* phenomena:

1. *Tonal and/or Color Variations*. These are variations in tone or color, or in the size and shape of a region of tone or color, that is not related to changing illumination (i.e., the phenomenon

does not exactly repeat from lunation to lunation). Areas in lunar features most subject to such anomalous behavior are *radial bands, dark patches, and nimbi or haloes*.

2. *Shape and Size Changes*. These are variations in the appearance and morphology of a feature that cannot be traced to changing solar illumination or libration.

3. *Shadow Anomalies*. These are deviations of lunar shadows away from the theoretical normal absolute black condition, or a shadow with an anomalous shape or hue, in most cases not attributable to changing phase angle.

4. *Appearance or Disappearance of Features*. Although exceedingly improbable and controversial, these are features that seem to be present now, but appear to be absent on earlier maps or photographs; or, features that are no longer visible today but which are clearly indicated on earlier maps or photographs.

5. *Features Exposed to Earthshine*. These are any anomalous tonal or albedo phenomena (any of the categories listed here) that occur under the conditions of Earthshine.

6. *Eclipse-Induced Phenomena*. These are features that exhibit anomalous characteristics (categories 1 through 4 above) during and after an eclipse, compared with previous eclipses when the same areas were monitored.

Most of the phenomena listed above are related to anomalous variations in morphology, tone (albedo), or color, which cannot be attributed to changing solar angle (phase angle) or libration, and which clearly *do not* repeat systematically from lunation to lunation. As stated earlier, however, it is essential in our program *to establish a record of both the normal and abnormal behavior of suspect lunar areas* under all conditions of illumination.

Generally, the SAP has retained some of the methods pioneered years ago by past Lunar Recorders, but a few significant changes have been necessary as the SAP evolved with time. Several areas had been selected in the past for inclusion in the SAP, and while massive files exist on many of these regions, there has been no reason to simply abandon study of these areas. A few published reports appeared in the *JOURNAL OF THE A.L.P.O.*, and some very interesting data resulted, but further investigations are needed to establish a long-term record of normal and any abnormal albedo variances. The lunar features that are currently designated as the *official* lunar formations that are being monitored as part of the SAP appear below.

SAP Feature	Selenographic Latitude	Selenographic Longitude
Alphonsus	4°W	13°S
Aristarchus	47 W	23 N
Atlas	43 E	46 N
Copernicus	20 W	9 N
Plato	9 W	51 N
Theophilus	26 E	11 S
Tycho	11 W	42 S

(the nearby *Herodotus* is also considered a part of the program with its environs)

All of the areas listed above were chosen because they are relatively easy to find, convenient to observe, and have historically shown numerous instances of suspected anomalies. Complete outline charts and observing forms are available from the A.L.P.O. Lunar Section for each of the features noted.

The standard SAP procedure is to visually monitor as many of the selected lunar features as possible throughout successive lunations, employing established systematic, objective methods of observation. It has already been stressed earlier in our discussions how important the quality of the instrument being used is, and individuals should be familiar with their telescopes and accessories, how to recognize scattered or reflected light, irradiation, as well as aberrations caused by the eye, the instrument, and the atmosphere.

Thus, observations of the Moon that are specific to the Lunar Selected Areas Program may be summarized as:

1. Visual photometry of specific lunar features, defining their normal albedo profiles throughout a lunation as a function of changing solar illumination.

2. Visual photometry of specific lunar features, monitoring variances from their normal albedo that are not simply a result of changing solar illumination.

3. Drawings of specific lunar features throughout a lunation and from lunation-to-lunation in conjunction with visual photometry.

4. Routine photography, CCD imaging, photoelectric photometry, and videography of specific lunar features to supplement visual photometry programs throughout a lunation and from lunation-to-lunation.

5. Comparative analysis of lunar features and albedo profiles.

<u>NOTE</u>: Now included as part of the Selected Areas Program is the Bright and Banded Craters Program and the Dark-Haloed Craters Program. Further information on these programs are available upon request.

Complete details on our observing programs can be found in the ***A.L.P.O. Lunar Selected Areas Handbook***. Individuals interested in participating in the A.L.P.O. Lunar Selected Areas Program should contact:

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