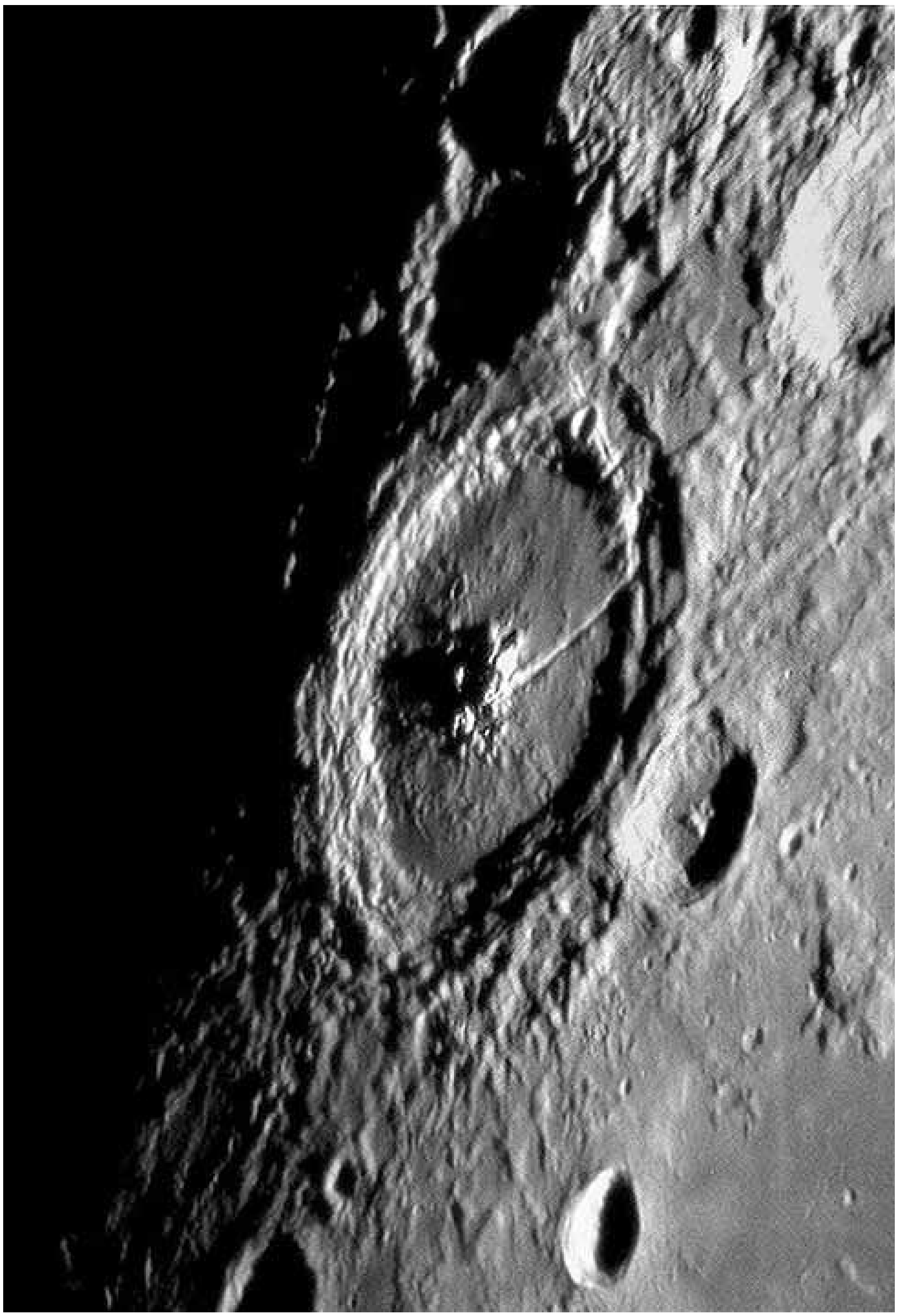
Devoted to the Study of Earth's Moon
Vol. 25 No. 2 Summer 2006

SELENOLOGY

The Journal of The American Lunar Society



Selenology

Vol. 25 No. 2 - Summer 2006

The official journal of the American Lunar Society, an organization devoted to the observation and discovery of the earth's moon

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COVER:

Petavius Crater. 2006 October 09 08:11:14 U.T. California. AstroPhysics 20.6cm f/7.7 EDF refractor. 12.5mm Orthoscopic eyepiece for afocal projection. Nikon Coolpix 995 digital camera. Non-filtered. Exposure : 1/15 seconds @ ISO 200. Image enhancement with Photoshop from a single frame image.

Photograph by Joseph H.C. Liu.
See page 17

Selenology, Vol. 25 No. 2, Summer 2006. A publication of the American Lunar Society.
President: Eric Douglass; Vice President: Steve Boint; Editor: Francis G. Graham.
This issue edited by Steve Boint

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If you don't have email, send them to Steve Boint

GEOLOGIC PROCESSES ON THE MOON

By Eric Douglass

I INTRODUCTION

Three major processes formed the features we see on the moon. These geologic processes are: the formation of craters, volcanic activity, and tectonic activity.

II CRATERING ON THE MOON

Introduction

The surface of the moon is generally divided into two types of terrain: highland ‘heavily cratered’ terrain, and volcanic maria (Fig 1). Although the maria appear to have relatively few craters from earth-based telescopic observation, this is not the case with higher-resolution spacecraft imagery. Indeed, when the Ranger series spacecraft imaged the moon, it was seen to have craters throughout (Fig 2). Yet, while the maria are covered with small craters, they are relatively lacking in craters large enough to be seen through earth-based telescopes. This is because larger impacts occurred relatively early in the moon’s history (over the first billion years of its existence—the highland regions because they are older record these early impacts) and the maria have been resurfaced by lava, covering over these larger craters. Since the end of maria formation, the majority of impacts have been smaller, resulting in the smooth appearance of the maria from earth-based telescopes.

Craters cover the surface of the moon. They are the result of hyper-velocity impacts by meteorites. The velocity of meteorites upon impact varies, but is generally between 10 and 40 km/sec. This number is a combination of the ‘approach velocity’ and the ‘escape velocity.’ The approach velocity of objects refers to the velocity of the object with respect to the moon. This varies with the type of object (for example, long period comets generally have a higher approach velocity than short period comets) and the direction from which it approaches the moon (for example, if approaching the moon ‘head on,’ it will have a higher approach velocity than if it is ‘catching up’ with the moon). The escape velocity is a measure of the extra velocity an object gains as it accelerates in the gravitational field of an airless moon/planet. For the moon, this number is 2.4 km/sec.

The velocity of a bolide (the technical name for a body that strikes any planetary surface) is impor-

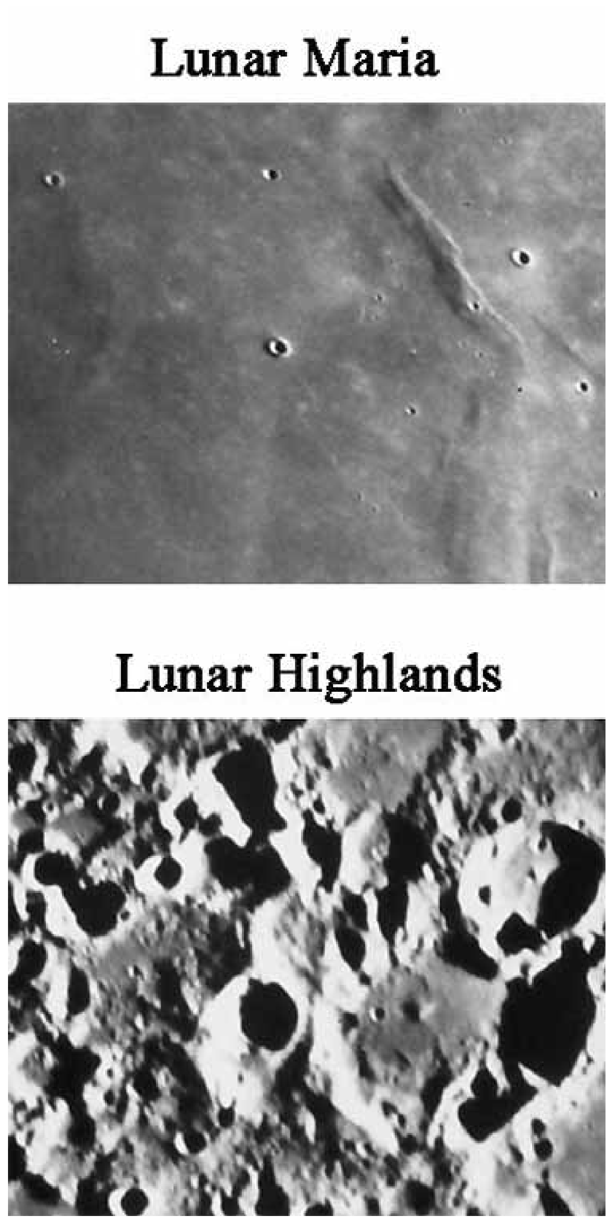


Fig 1

Fig 2: Top image shows general area; white line shows the same crater for all images; bottom images are of increasing resolution as Ranger 9 descended to the lunar surface.

tant because it is the major determinant of the amount of energy released upon impact. Bolides possess 'kinetic energy', and the value of this is proportional to the mass of the bolide multiplied by the square of its velocity. Thus, if two meteorites of the same mass strike the lunar surface but one has twice the velocity of the other, the faster one possesses four times (not two times) the kinetic energy of the slower one.

Upon striking the moon, the kinetic energy is transferred to a massive shock wave which goes down into the moon's surface and also rearward into the bolide itself. The shock wave that goes rearward is so powerful that it exceeds the strength of the rock—indeed, most of the bolide vaporizes. The shock wave that goes forward into the moon vaporizes part of the surface of the moon (several times the mass of the bolide), melts layers of rock below this (up to 100 times the mass of the bolide), and shocks (fractures) the surface layers to great depth. This brief interval in the cratering process is called the 'contact and compression' phase.

The next period in the cratering process is called the 'excavation' phase which begins with the formation of a release (rarefaction) wave that develops at the edges of the impact, and forms a

Fig 3

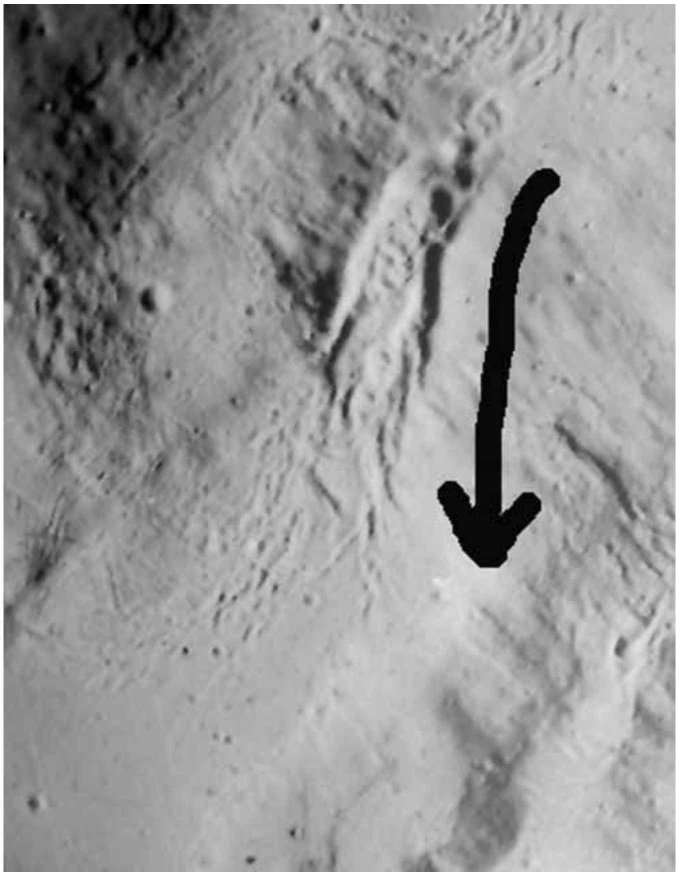


Fig. 4: *Impact melt flowing in the direction of the arrow.*

route of escape for some of the vaporized/melted/ shocked rock. This escape of material produces the crater itself and the material that escapes forms the ejecta that goes outward onto the moon's surface (Fig 3). After the removal of ejecta, the crater is bowl shaped and called the 'transient crater' form. It is called 'transient' because the crater will undergo a number of later changes before assuming its final form. Lastly, the decaying shock wave continues to travel through the bedrock of the moon, creating effects further away (such as activating older faults, creating landslides, etc.).

The third period in the cratering process is called the 'modification' phase. Here the liquid materials (impact melt) on the crater's sidewall and semi-stable materials on the rim slip down to the crater's floor (Fig 4;). Additionally, in larger craters, this is the time that the central peaks and sidewall terracing occur (Fig 5). The peaks form from rebound of compressed floor materials. The

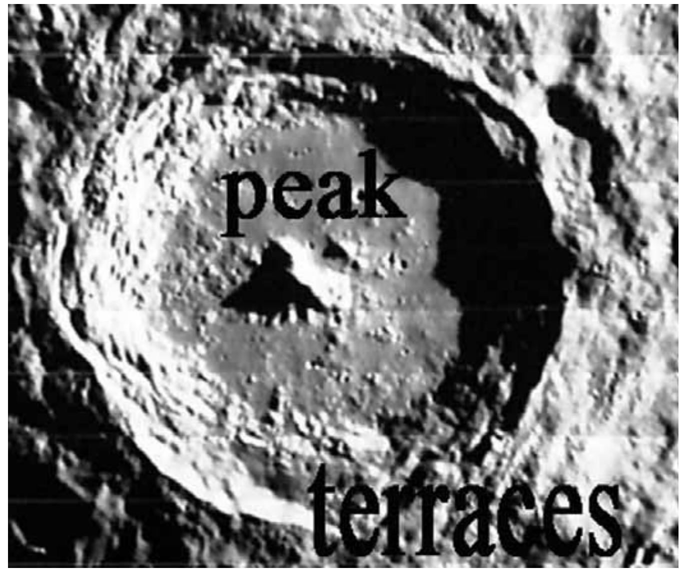


Fig. 5

terraces form due to heavy loads (the rim materials) sitting on deeply fractured ground (the fractures are from the shock wave of the impact). The rim material activates the fractures, causing them to slide in a stepwise fashion. This leaves us with the final crater form.

One final modification needs to be addressed. At the end of the modification phase, much solid debris sits on the rim of the craters. When shock waves from other impacts cross the rim, some of

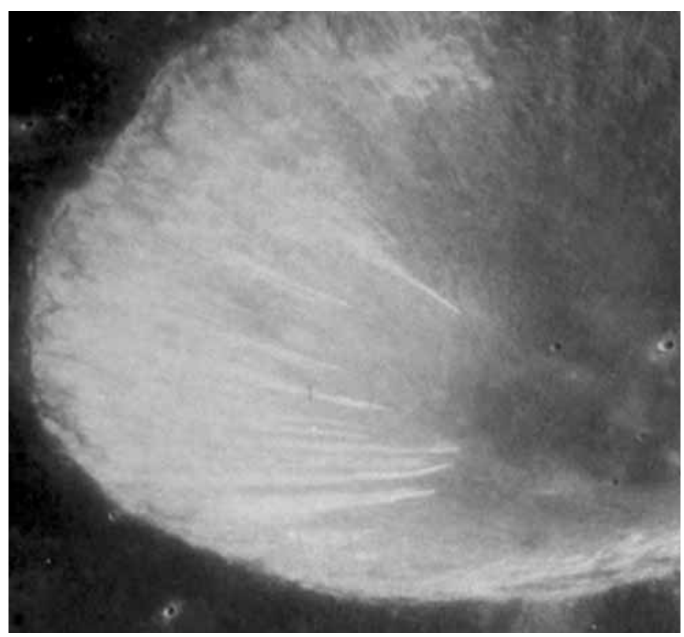


Fig. 6: Landslides

this material will fall into the crater as small landslides (Fig 6). While these slides are not visible from earth-based telescopes, they are interesting to see in spacecraft imagery.

From this brief description of the mechanics of crater formation, we will turn to the types of craters and the unique morphology of each. While craters are variously classified based on their size and morphology, I am going to use the most common classification: simple craters, complex craters, and basins.

Simple Craters

Simple craters are bowl-like depressions in the lunar surface (Fig 7). They range from sub-millimeter size to approximately 15 km in diameter (15-20 km is the transition zone between simple and complex craters).

A simple crater forms when a small meteorite strikes the moon at high velocity. The bolide is vaporized along with the surface area struck (the target). This vaporized rock is injected into the floor of the crater, and follows the release wave to escape outside where it will be emplaced as ejecta. As the shock wave begins to dissipate, the next layer of target materials will not be vaporized but only melted (called ‘impact melt’). This material is also injected into the crater’s floor and escapes to the outside as ejecta. As the shock wave further dissipates, it is no longer able to melt the target materials, but instead only fractures the rock. This fractured rock is again pushed in both directions.

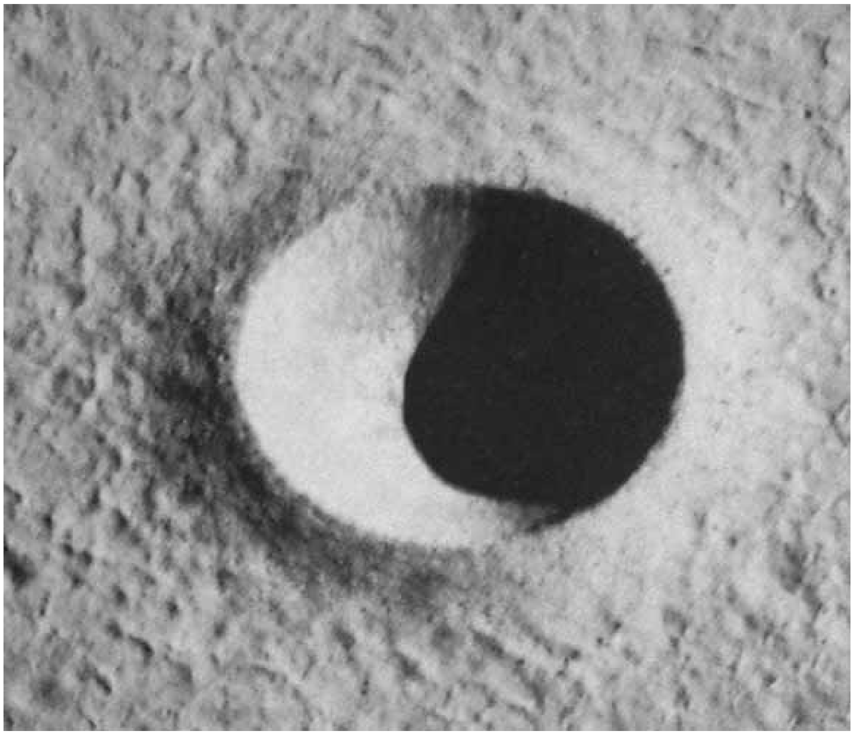


Fig. 7: Simple crater.

The crater itself is formed by decompression along its sides, allowing vaporized, melted, and shocked fragments to escape. This material will lay itself down as the ejecta blanket, which has four distinct parts. Just outside of the crater rim is the zone of continuous ejecta which is formed from the last material ejected from the impact (Fig 8: section labeled “C”). The next layer out is the discontinuous ejecta which inter-fingers with the surrounding lunar surface (Fig 8: section labeled “D”). Further out yet is the bright ray system which is formed from the first material ejected (Fig 9). The fourth part of the ejecta is found in the area of the discontinuous ejecta and just beyond it—this is the area of ‘secondary cratering’ which

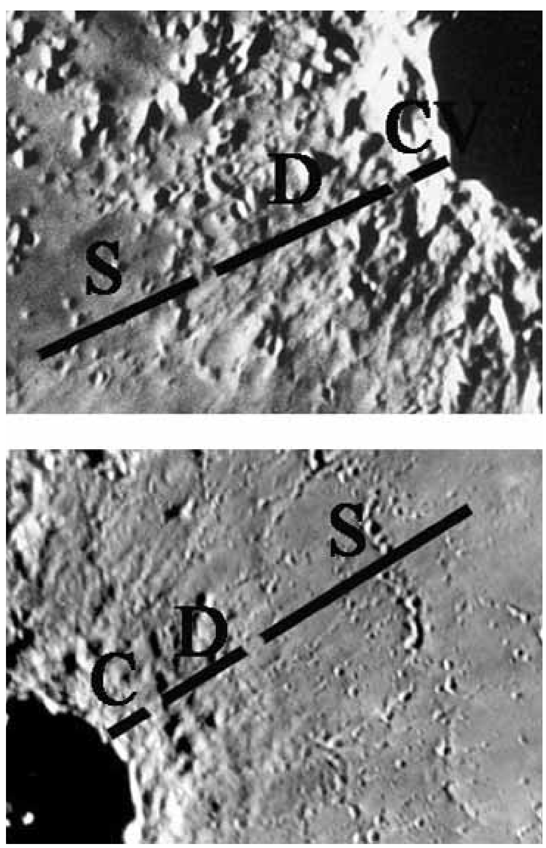


Fig. 8: Ejecta blankets.

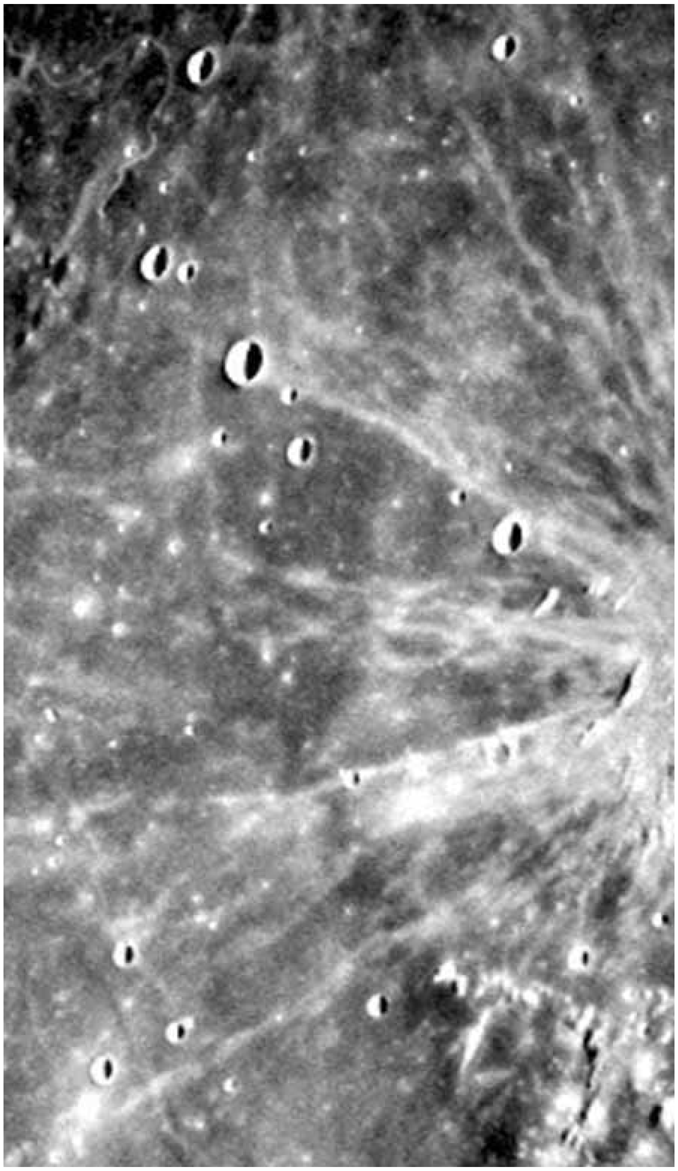


Fig. 9: Bright ray system.

results from 'chunks' of rock being thrown from the crater (Fig 8: section labeled "S"). Secondary cratering typically forms a 'herringbone' pattern on the lunar surface with multiple craters in a formation having small 'v' shaped lines emanating from them (Fig 10: this can't been seen in earth-based telescopes).

Once the ejecta has exited, the remaining crater is called the transient crater since other processes will modify its final form. For simple craters, this final 'modification' involves the sliding down of impact materials (impact melt and unstable rim/wall materials) onto the floor of the crater. For

Fig. 10: Secondary cratering.

craters in this size range, these materials generally fill the lower third to half of the transient crater's depth. This will result in the crater's final form.

Observation of such a crater will reveal a bowl shaped depression with a sharp rim, some rim deposits (blocks of material thrown out at the end of excavation), a discrete ejecta blanket grading from continuous to discontinuous, and a bright ray system. Across time, parts of this crater will degrade due to the erosive rain of micrometeorite impacts. The first structural element to disappear will be the ray system, followed by the discontinuous ejecta and, finally, the sharp rim. This process will continue until only a bowl-shaped depression with a gentle slope remains.

Complex Craters

Complex craters begin at 20 km in diameter. They are characterized by the morphology of a bowl-like depression with a central uplift of one or more massifs (small, mountain-like structures) and terracing on the sidewalls (Fig 5).

Complex craters form when medium-sized meteorites impact the lunar surface. This occurs as discussed in the simple crater above, though the energies involved are much greater. The real differences begin after the formation of the transient crater, during the stage of "modification." At this

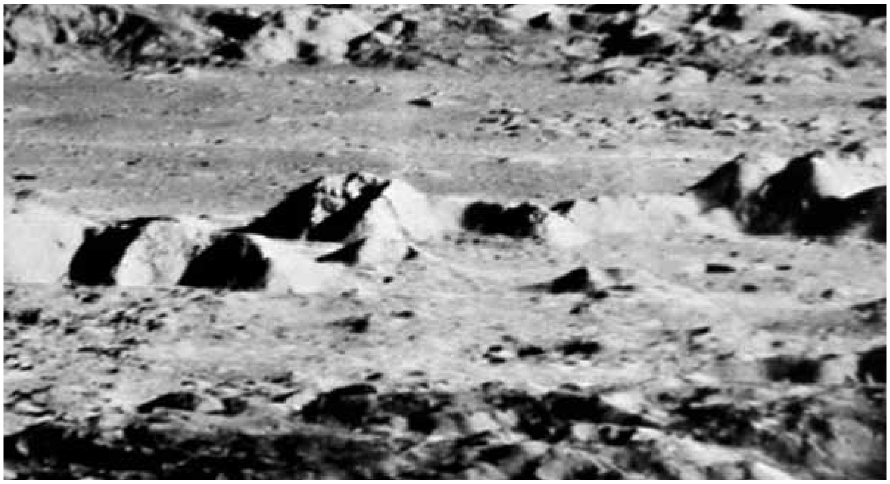


Fig. 11: Side view of the central peaks in Crater Copernicus.

point the rim is more massive than in a simple crater, being piled high with ejected crater materials. Because the subsurface rock is extensively fractured, this rim material cannot be supported. It slides down the fractures (called 'slumping') creating a series of 'terraces' on the crater's inner walls. Central peak or peaks also form at this time (Fig 11). Peaks form because the impact compresses the underlying rock, and this rock rebounds after the shock energy is dissipated—much like a bedspring that is compressed and then released (the size of the central peaks is also modified by slumping of the rim material, which pushes rock towards the central uplift). At the same time that the processes of slumping and peak formation are occurring, the impact melt on the sides of the crater is sliding down to the crater's floor. This again covers the bottom of the temporary crater and ponds in some of the terraces (Fig 4). These processes result in the 'final' form of the crater

Fig. 12: Craters in various states of degradation.

The central uplift, which can be one or several peaks that may attain heights of over a 1000 meters, occupies the center of the crater. Moving from the central peak(s) outward, a flattened floor of impact melt which grades into the terraced sidewalls is encountered. The rim occurs at the top of the crater and grades out into the continuous ejecta, the discontinuous ejecta, the larger secondary craters (which can be seen by earth-based telescopes—easy examples for even small scopes are those around Copernicus), and the bright ray system.

Degradation occurs in complex craters as in simple craters. First the ray system goes, followed by discontinuous ejecta and then the sharp rim. The continuous ejecta erodes later along with the terracing and central peak. Across geologic time, the crater will become a simple bowl like depression (Fig 12).

[In the next installment of this paper, we will address the processes of basin formation, volcanic forms, and tectonic features.]

Figures:

Fig 1: Consolidated Lunar Atlas, Kuiper et. al., dig. ed. Douglass; C7, G9.

Fig 2: Ranger IX Photographs of the Moon, NASA SP-112, 1966.

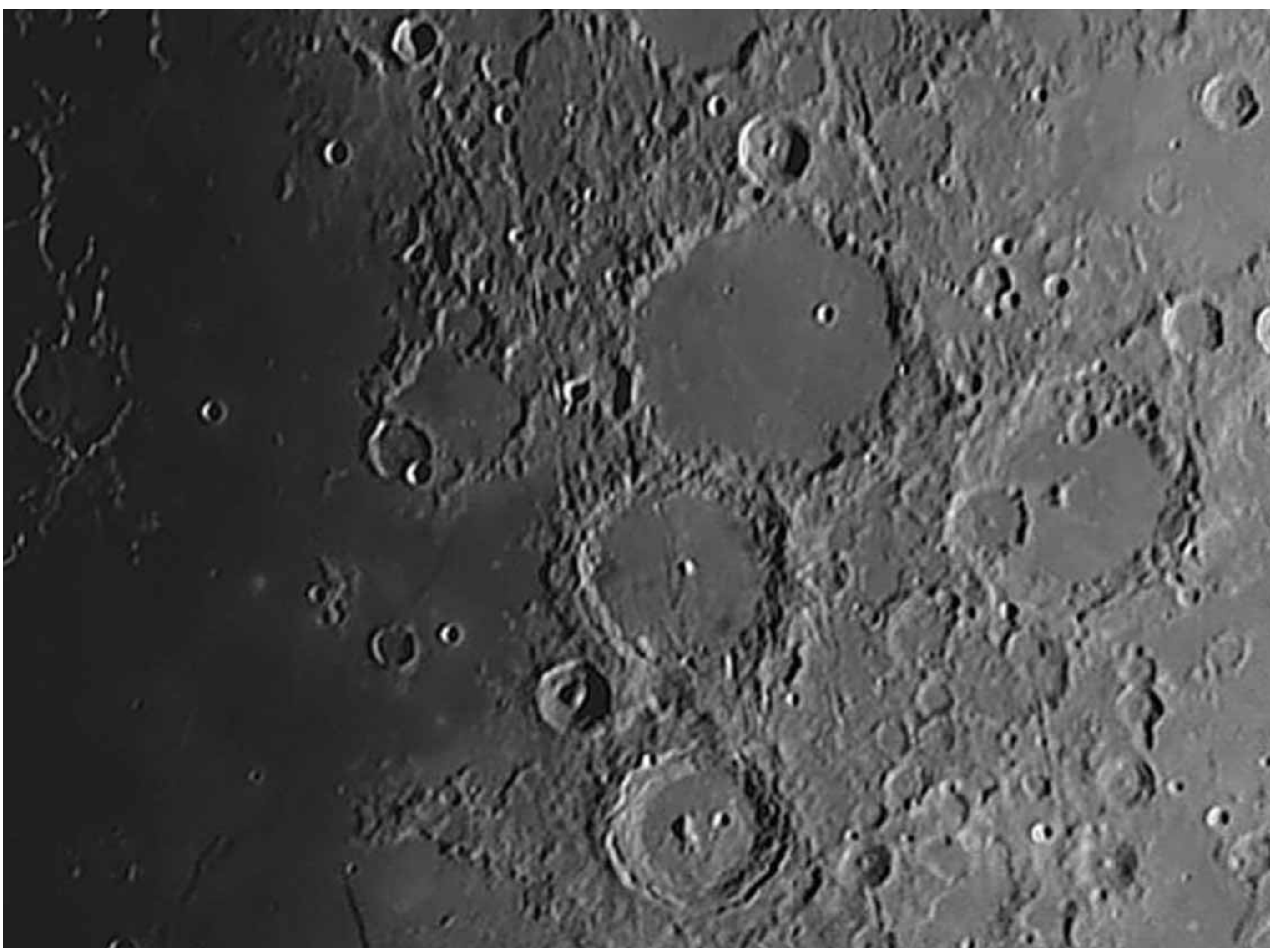
Fig 3: Consolidated Lunar Atlas, Kuiper et. al., dig. ed. Douglass; D23.

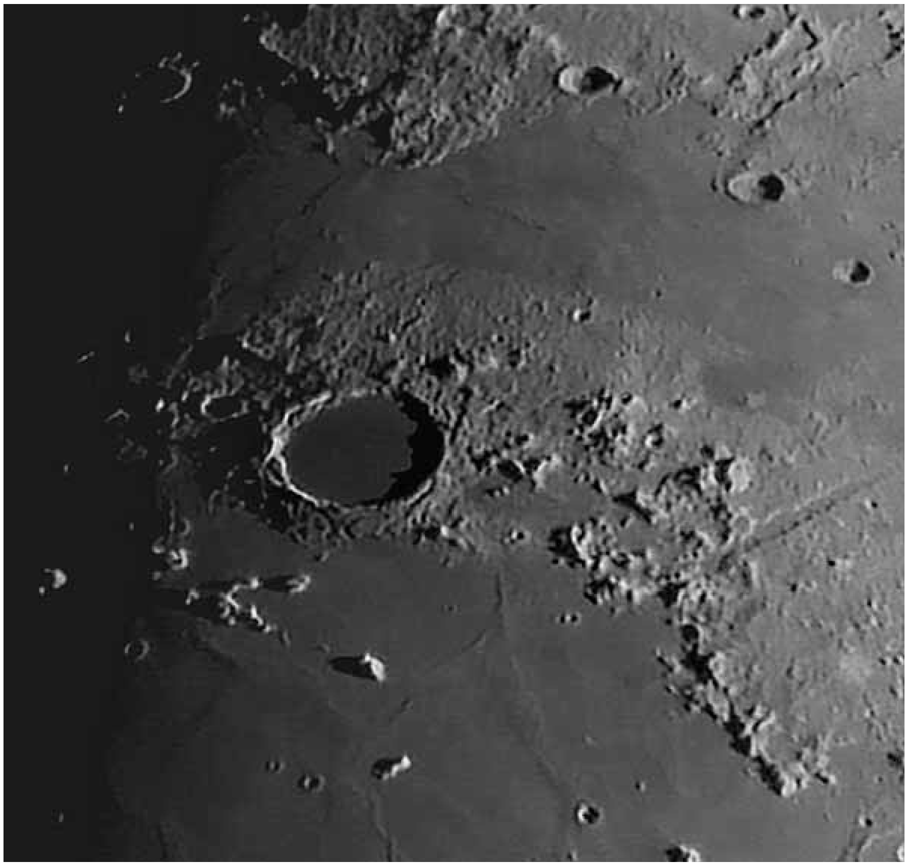
Fig 4: Wilhelms, D. Geologic History of the Moon. USGS Professional Paper 1348. (Washington: GPO, 1987), 53.

Fig 5: Lunar Orbiter Photographic Atlas of the Moon, NASA SP-205; Bowker and Hughes, dig. ed. Gillis; v 118, h2.

Fig 6: Apollo Over the Moon, NASA SP-362. Masursky, et. al. (Washington: GPO,1978), 126.
Fig 7: Wilhelms, D. “The Geologic History of the Moon.” USGS Prof. Paper 1348. (Washington: GPO, 1987), 28.
Fig 8: Consolidated Lunar Atlas, Kuiper et. al., dig. ed. Douglass; D17, D23.
Fig 9: Consolidated Lunar Atlas, Kuiper et. al., dig. ed. Douglass; D24.
Fig 10: Apollo Over the Moon, NASA SP-362. Masursky, et. al. (Washington: GPO,1978), 130.
Fig 11: Schultz, P.; Moon Morphology (Austin: Univ. of Texas Press, 1976), 511.
Fig 12: Consolidated Lunar Atlas, Kuiper et. al., dig. ed. Douglass; F12.

PHOTOGRAPHS BY ALS MEMBERS

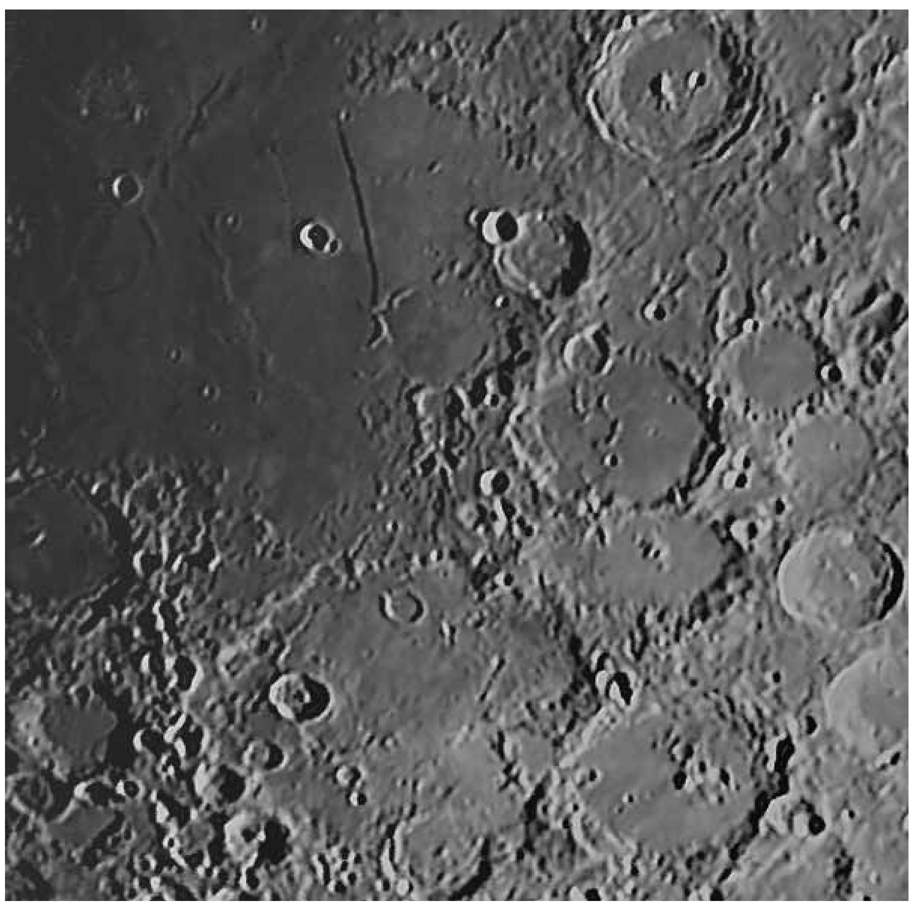




At left:

Plato and Montes Alpes
William M. Dembowski, FRAS -
Elton, Pennsylvania, USA
30 October 2006 - 23:11 UT -
Colong: 19.2 - Seeing AIII
8 inch f/10 SCT - Celestron
NexImage Camera

PHOTOGRAPHS
BY
WILLIAM M.
DEMBOWSKI



At right:

Rupes Recta & Rima Birt
William M. Dembowski, FRAS -
Elton, Pennsylvania, USA
30 October 2006 - 22:52 UT -
Colong: 19.0 - Seeing AIII
8 inch f/10 SCT - Celestron
NexImage Camera

Opposite page:

Ptolemaeus, Alphonsus,
and Arzachel
William M. Dembowski, FRAS -
Elton, Pennsylvania, USA
30 October 2006 - 22:41 UT -
Colong: 18.9 - Seeing AIII
8 inch f/10 SCT - Celestron
NexImage Camera

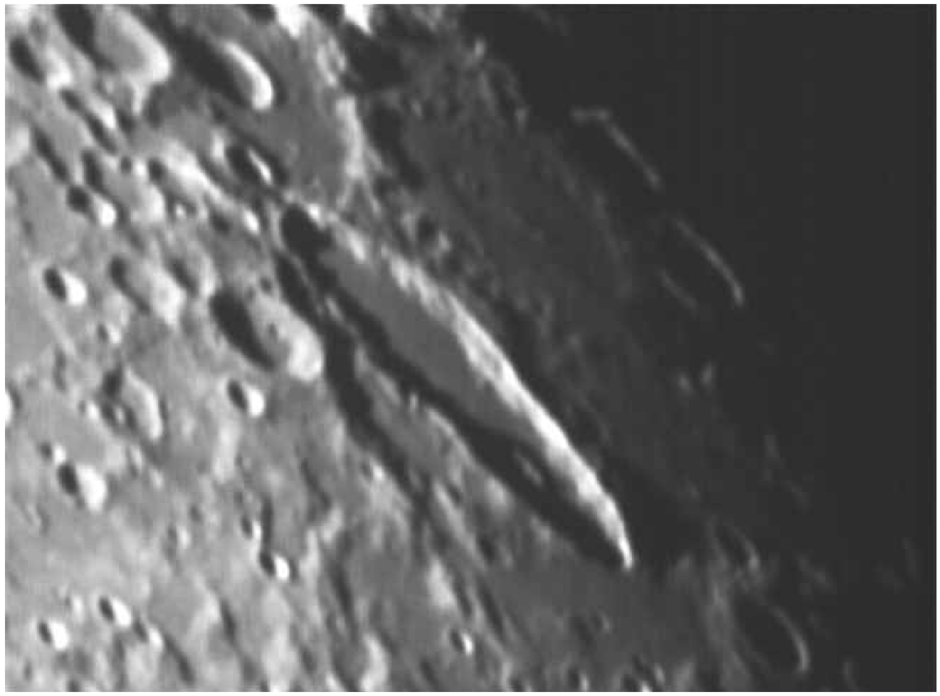
Above:

The Moon by Stephen Miller, Florida. 03/16/06. 6". 40mm Konig. 24mm lens. D70 afocal.

The American Lunar Society needs your help!

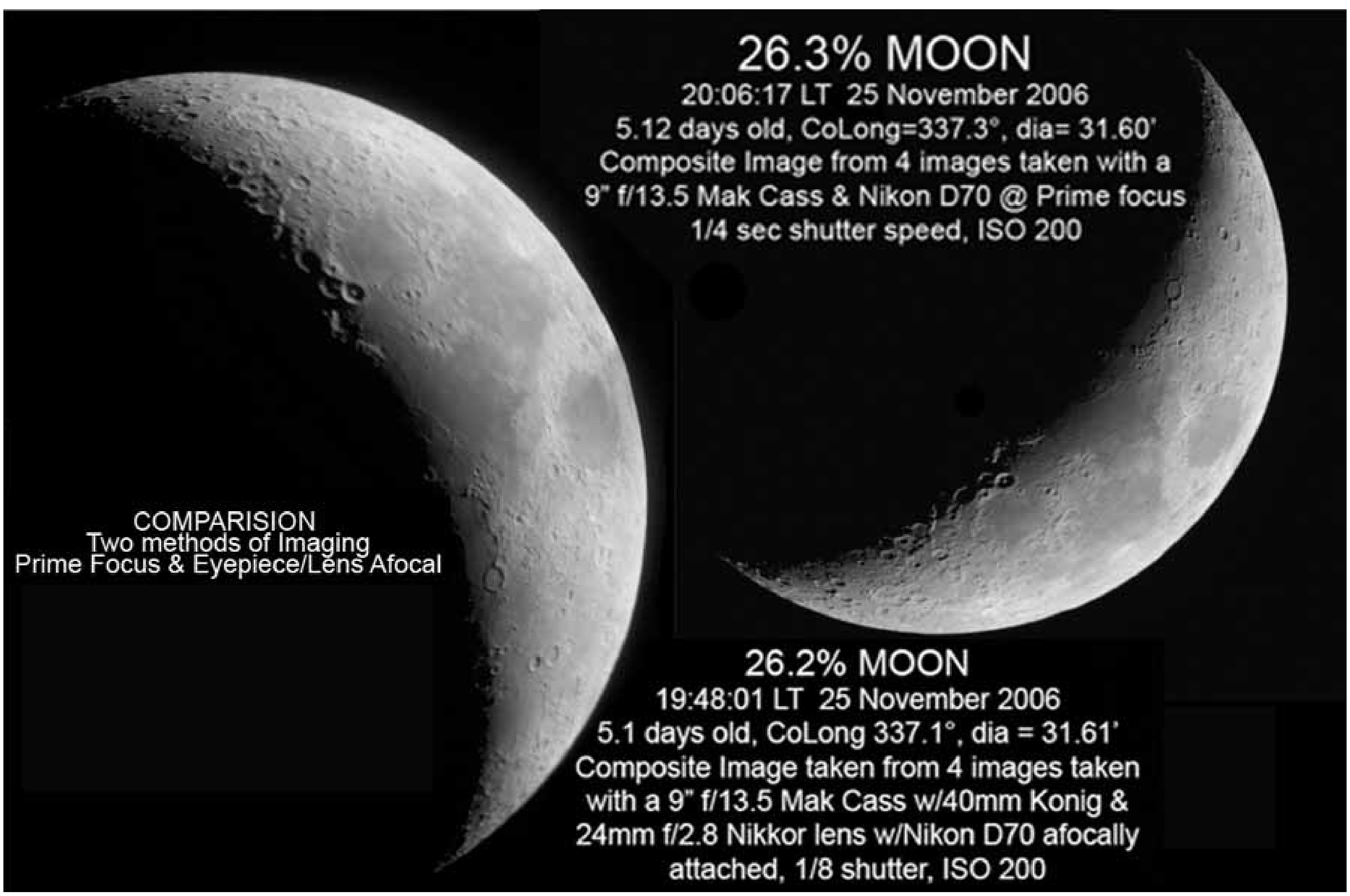
We need people willing to perform several different administrative tasks. If you can lend a hand, contact: Eric Douglass at ejdftd@mindspring.com

Earthshine by Stephen Miller, Florida. 10/26/06 23:24 UT.



Schiller by Rik Hill, Arizona. 11/02/06 5:29 UT. 10" f/4.5 C14. Seeing 6/10. Wratten 21, IR filter. Philips Toucam.

PHOTOGRAPHS BY STEPHEN MILLER



TWO DAYS ON THE MOON

By Craig D. Wandke

The beauty of the monuments and the wonder of all the usual visitor sites in Washington D.C. thrilled and inspired me, but could not compare to the two days in May 2000 I spent at the National Air and Space Museum, the Library of Congress, and the National Space and Science Data Center in Greenbelt, Maryland.

I spent a day at the Space Museum thrilling to all the principal machines of the early space age - the Apollo 11 command module, as well as its Friendship 7 and Gemini 4 cousins which stood silently on nearby pedestals. Particularly impressive was an actual Lunar Module, its gangly presence still as inspiring to me as it was on that day in 1969 when I looked at the moon, through a muggy Honduran sky as a Peace Corps volunteer, with Neil's familiar words crackling over my little short-wave radio. As I stood next to the Lunar Module, in the presence of a machine whose counterpart voyaged onto that new world so many years ago, my mind returned to those wonderful times of lunar exploration and the beginnings of my love affair with the moon.

He returned to his tiny office and suddenly I was all alone with tens of thousands of pristine moon images!

Looking towards the ceiling above the Lunar Module, I marveled at Lunar Orbiter, Surveyor, and Ranger, each a daring precursor to Neil's first step. I smiled to think that the following day I would be visiting the NSSDC, hopefully to study and touch lunar images taken with these instruments.

During my earlier visit to Arlington National Cemetery, I inquired about the location of Pete Conrad's grave and went out and paid my respects to the gap-toothed, laughing Apollo 12 astronaut who was kind enough to sign my moon globe and share a couple of minutes levity with me during his visit to a Monterey art gallery in 1993.

Prior to leaving Monterey, I had written to Dr. David Williams, Principal Scientist at the Solar System Science Group of NSSDC, who very graciously told me to call him at Goddard upon my arrival. When I told David that I specifically wanted to see Lunar Orbiter photographs as well as Apollo images of the moon taken from the Service Module while in orbit, he took me over to another building to meet with Robert Tice, Manager of Goddard's Photo Archive. Bob led me into an adjacent and rather cluttered room with equipment, mailing tubes, canisters, and files from floor to ceiling.

One enormous filing cabinet was labeled for Lunar Orbiter images. I could feel my heart pounding in my chest as I took out my laptop, into which I had scanned over a thousand key images of the moon from my personal collection and books at UCSC. Thanks to the miracle of the modern laptop, I was able to have these with me for reference as I examined Goddard's collection! Bob gave me a brief orientation to the contents of the room: "...Orbiter stuff is over here in these drawers... Apollo stuff over there in those round canisters.... Let me know if you need anything!" He returned to his tiny office and suddenly I was all alone with tens of thousands of pristine moon images!!! Since I had a fairly clear idea of what I wanted, it was not difficult to go to the specific drawers and retrieve the images. I stuck my trusty Hallwag moon map on the wall with some tape to consult as a reference in case, in my excitement, I forgot the location of Mare Crisium or Sinus Iridum!!! For the next several hours, I looked at images and consulted my laptop, noting image numbers and details

At left:

Craig Wandke experiences the sublime as he reviews Lunar Orbiter images at the Goddard Visitor Center in Greenbelt, Maryland

for possible subsequent ordering.

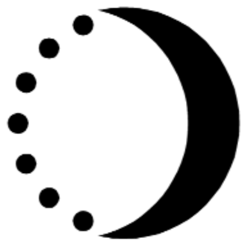
At one point I leaned back on one of the file cabinets and just smiled all to myself.....hey!...here I was in a room surrounded by, to borrow a phrase from Egyptologist Howard Carter, "...wonderful things, wonderful things!" The Orbiter images were huge transparencies (two feet by two feet) that I lovingly took out of big envelopes and examined in detail, cross-referencing pertinent images to my own collection. I was originally a bit disappointed that I would not be able to see actual paper positives for purchase right there, but the NSSDC's collection is available on a made-to-order basis. In the end, it was probably better for me as I might have later regretted the expense incurred had I been able to write a check or surrender my credit card number!

After three hours of poring over Lunar Orbiter images, I became aware of my growling stomach. So I rushed down the hall, bolted down a sandwich and drink from a machine, and quickly returned to my duties.

I asked Bob to let me see the Apollo film canisters, and he took out a huge roll of 5" x 5" film that was labeled boldly, "Apollo 15, NASA-MSC, Frames 001-679, Part 1 of 5, August 1971: HEAD" As he hefted the roll onto a viewing table with two rollers on either end, I could hardly contain my excitement. Memories of meeting Apollo 15's Jim Irwin in San Diego in 1972 and Al Worden at Moffet Field in 1994 rushed through my mind as Bob made final adjustments on the viewing table and I leaned over excitedly, turning the right handle as the images traveled over the fluorescent lights in front of me.

Huge and crystal-clear, they took my breath away with the purity of their presence and, in my excitement, I had to be careful to accurately note the full number of each image I would consider ordering, since a mistake in one digit would mean the wrong image.

Most impressive were the sequential shots, covering hundreds of images, made during trans-lunar injection and lunar approach, each image taken from outside the service module, showing a moon that grew progressively larger in each subsequent frame. (How could anybody doubt we ever went to the moon!!) The images of the Hadley region



The Artist's Moon

a Petrarchan sonnet for Alan Bean

by Marianne Dyson

The moon is gray, but not for those still free –
to dare the red of love, to stroke the sky
with flaming orange and silver ships that fly
beyond the pallid dawn of history.
The dreamers' moon is cast in rosy light,
a canvas bright with crystal beads and hopes
that lure the spirit high upon its ancient slopes
and paint its hills with hues of future sight.

The hero's brush disturbs the settled lust
of youthful goals, long patient human souls
who yearn with passion's palette for the day
they thrust aside the current veil of dust
and see creation's art, a mural whole
with fingerprints of God in lunar gray.

where Apollo 15 eventually landed were spectacular and breath-taking in their clarity, tone, depth, and detail. Mesmerized by seeing so many photographs of my favorite and most mystical area of the moon, I painfully realized I had a limited time with each roll and I still had two more full missions, of perhaps five rolls each, to examine.

At the end of the day, Bob began to get ready to go home and I was careful not to impose on his time any longer. My head swimming with the wonder of the day, I headed out of the building and back onto the Metro for my return trip to the city.

I stopped by the Library of Congress and procured a Photo-ID Reading Card (anyone can get one with proper ID!), which allowed me into the Main Reading Room and Science Building. I was literally speechless at the grandeur and the glory of the atmosphere of learning and academia that surrounded me, from the leather, brass, marble, and mahogany everywhere, to the hushed staff who moved about with a palpable sense of restraint and dignity under the huge, gilded cupola that towered over us.

I sat down at one of the computer terminals and entered “SEARCH FOR: Moon” and was greeted with “Display first 10,000 items? Y/N” YES!! YES!!!! YES!!!!!!! And the second 10,000, too!!! I found two intriguing books on Lunar Orbiters I and II which appeared to be internal McDonnel-Douglas reports, so I asked the librarian to bring those to me...just to say I had researched the moon in the Library of Congress! The books turned out to contain a lot of technical specifications on Lunar Orbiter with few images, but it was fun going through the process of retrieving them.

As the 9:30pm closing time approached, I went out the side door of the library and into the balmy night air; the white dome of the Capitol gleamed, surreal in the distance, but I was present neither in time nor space for my mind was still in that cramped room back at Goddard or floating outside of the service module over the lunar Apennines so long ago, retrieving those precious canisters.

Craig invites interested fellow lunatics to email him at craterman@earthlink.net

– 8.20

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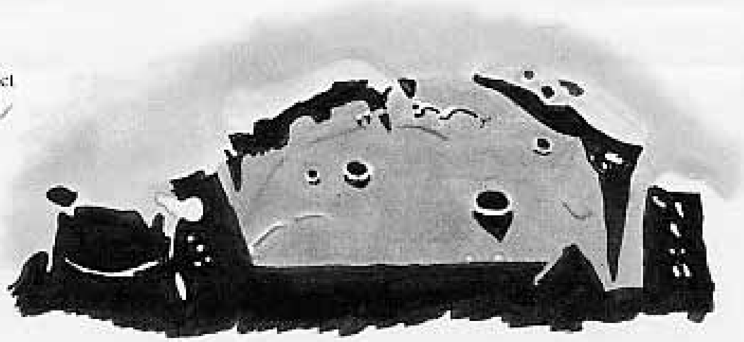

Object: Crisium - West Shore

Long: ________ **Seeing:** 1 -- ② -- 3 -- 4 -- 5

Observations Wonderful, wonderful new view with the Nagler. Once again, a somber, grand, silent scene of eternal majesty, as evening settles on the great west shore.

✓ Mirror ___Erect

✓125 Nagler

95x___

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Ref: __________

Rating: 1

7, 15, 95

GMT 1130

Age: 17.0

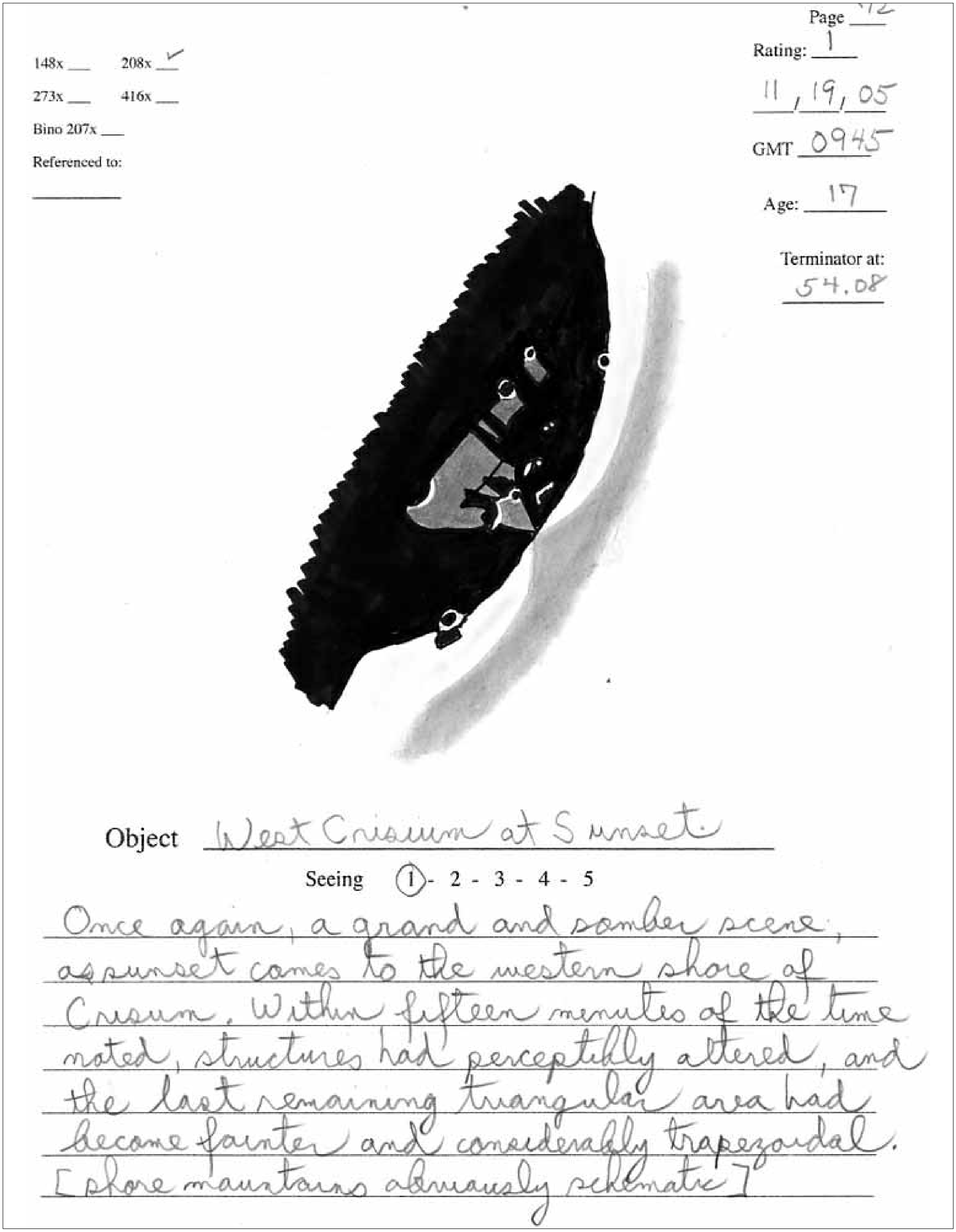
Terminator at: 55.28

Object: Crisium - West Shore

Long: ________ **Seeing:** ① -- 2 -- 3 -- 4 -- 5

Observations With the moon in transit moments ago and near-perfect seeing, this area is even more magical. I shall miss being here until I return next month.

Drawings of Crisium's West Shore by Craig Wandke



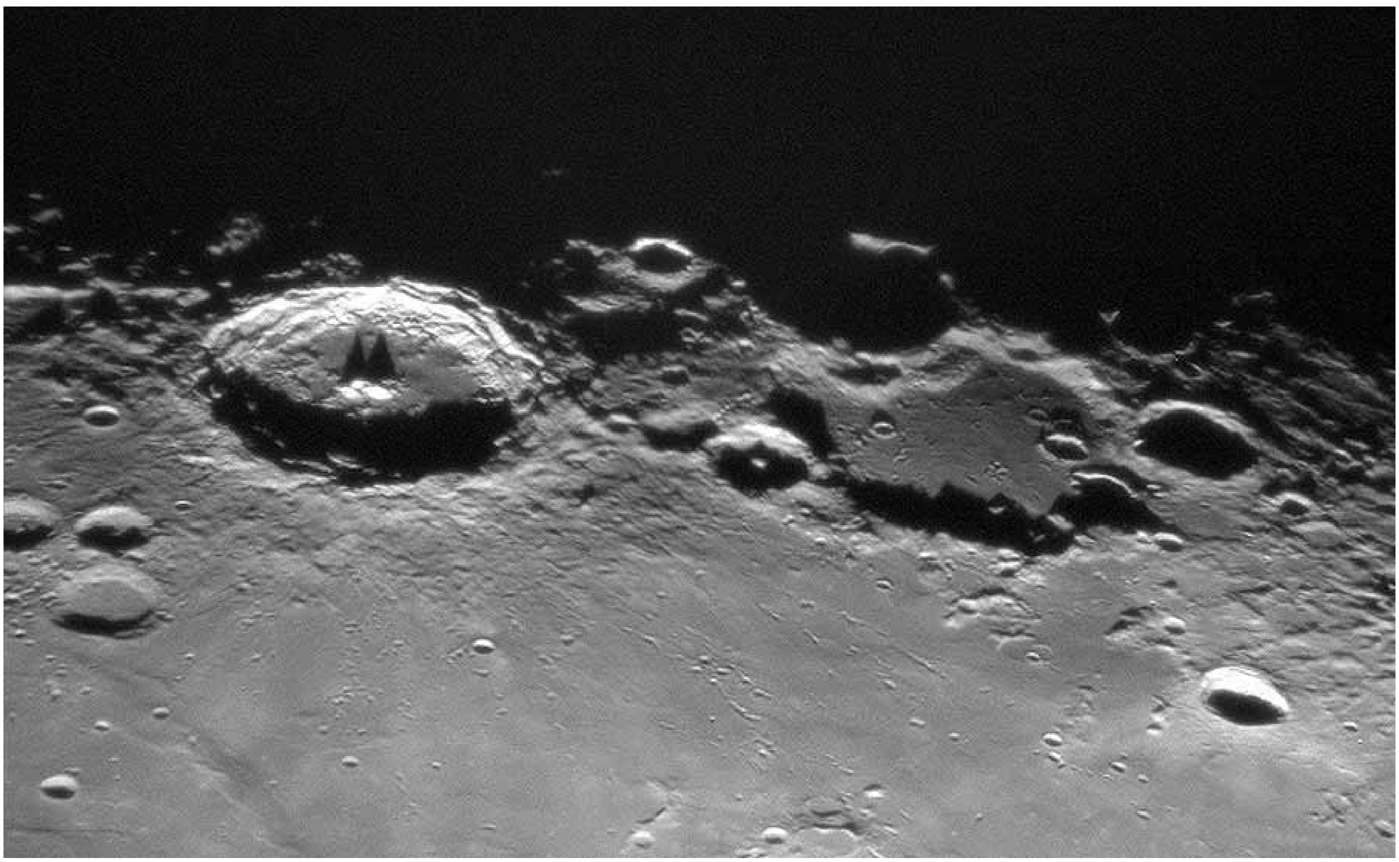
Drawing of West Crisium by Craig Wandke

A LITTLE-KNOWN SECONDARY CRATER CHAIN

By Joseph H.C. Liu

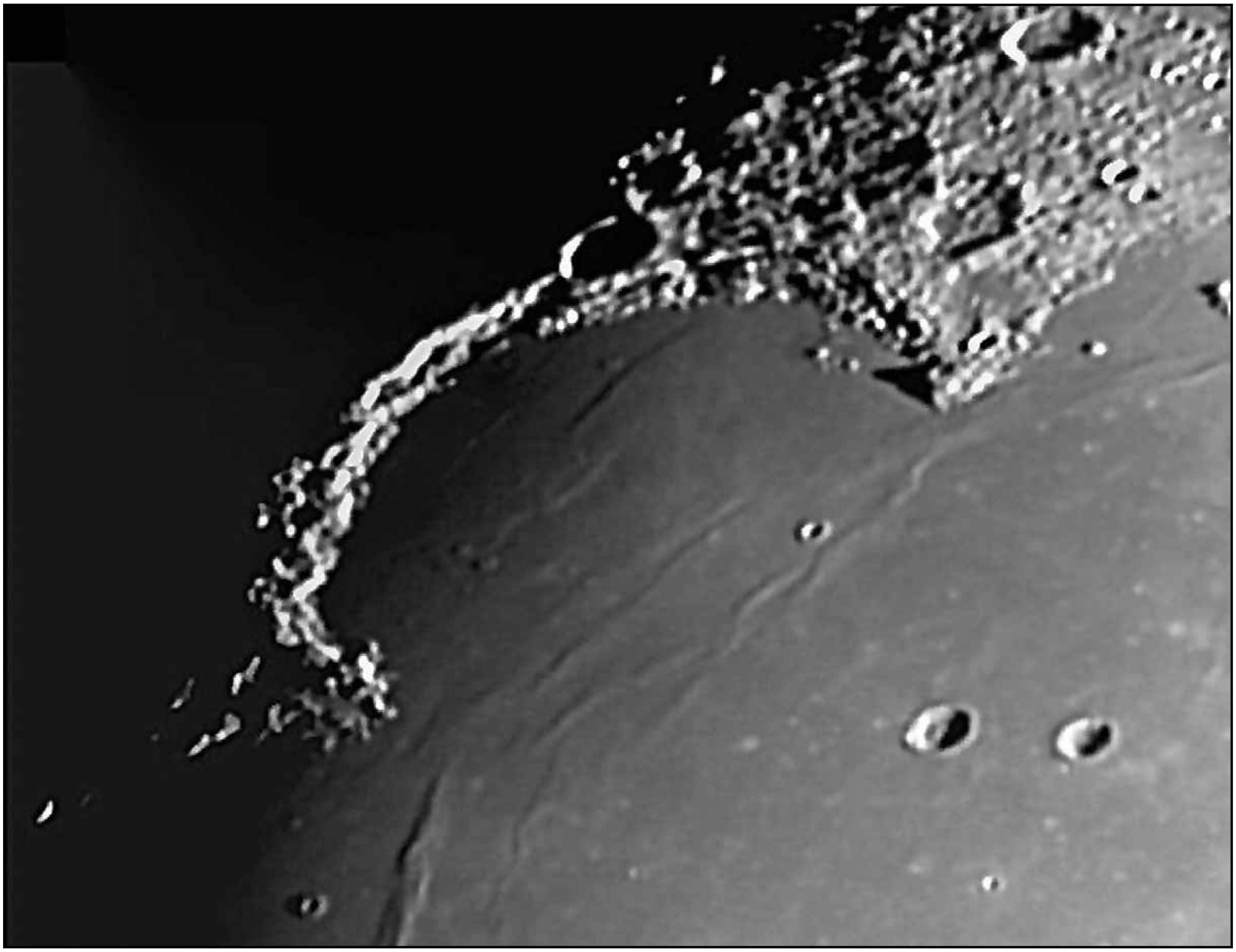
On October 09 UT, I had the chance of recording lunar surface features in the region of craters Vendelinus and Langrenus. Upon processing the recorded images, a tiny, yet quite interesting surface detail caught my attention. I noticed a chain of craterlets situated between the mentioned large craters, just east of the crater Lohse (this chain of seven or eight craterlets is near the center of the photograph). The feature is not shown in the *Atlas Of The Moon* by Antonin Rukl (see Chart 49 on page 125) or maps drawn by Walter Goodacre in his book *The Moon— Its Surface and Formation*.

However, upon checking the exact position for this tiny chain on the actual photographs # 1 & 2 in Section E of the Consolidated Lunar Atlas (personal collection), the chain appeared (barely discernable—probably due to lighting or libration differences—but it appears to me that it is there).



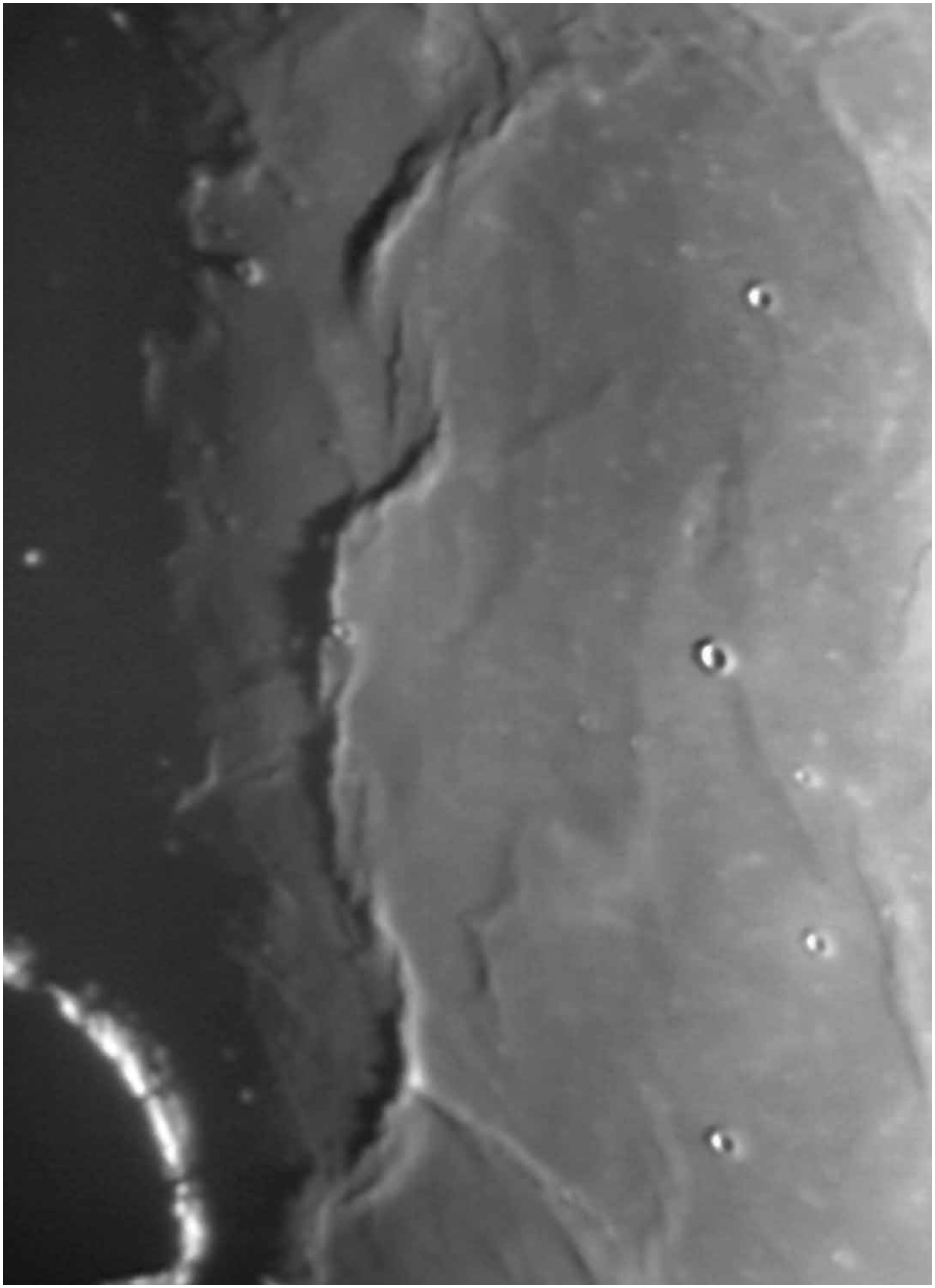
Above: Secondary craters between Vendelinus and Langrenus craters. Joseph H.C. Liu - 2006 October 09 08:19:32 U.T. California.AstroPhysics 20.6cm f/7.7 EDF refractor. 12.5mm Orthoscopic eyepiece for afocal projection. Nikon Coolpix 995 digital camera Non-filtered. Exposure:1/15 seconds @ ISO 200. Image enhancement with Photoshop from a single frame image.Likely a secondary chain of impact craters, this is a difficult call since no spacecraft images are available to detail the actual shapes, impingement of chain elements on each other, herringbone patterns, etc. A lot of secondaries are in the region from Petavius, though this chain is a bit more tangential than usual...but still not out of the running. It is visible on E2 of the CLA; it is also visible in the Times Atlas (a reproduction of the LAC maps: page 76--which shows the chain nicely); the New Photographic Atlas of the Moon by Kopal (just barely visible here--plate 62); and the USAF Lunar Atlas (just barely visible--A5b, A5d); it is not visible on LOPAM (due to the appropriate images being washed out).

A GALLERY OF LUNAR MARIA

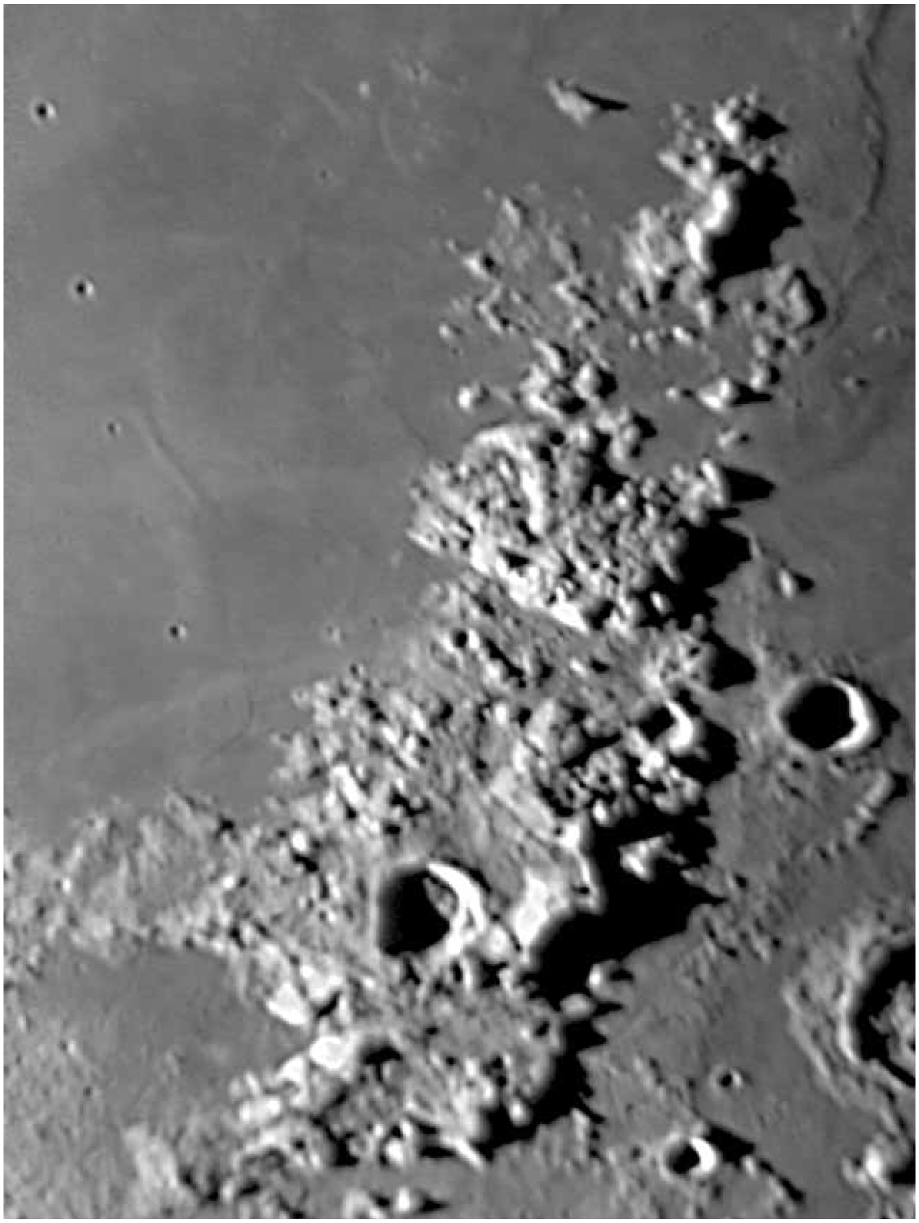


Above:

Sinus Iridum
by Howard Eskildsen,
Florida. 12/01/06 1:28 UDT.
Seeing 6/10. Clarity 4/6.
6" f/8 refractor.
2x Barlow.
Neximage. IR filter.



Above: Dorsa Smirnov by KC Pau, Hong Kong. 12/13/03 21:22 UT. Colong. 152. Seeing 3/10. Transparency 5/10. 250 mm f/6 Newtonian. 2.5x Barlow. Philips Toucam Pro. 194 frames stacked.



Opposite page:

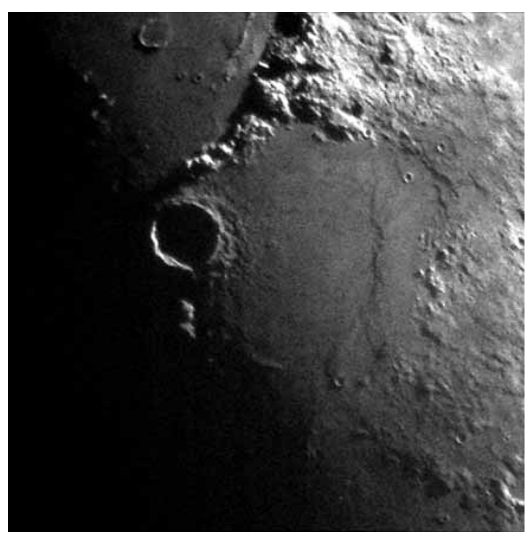
Southern Orientale by Howard Eskildsen, Florida. 01/02/05 11:42 UT. 6" f/8 refractor. 40 mm MaxView. 2x Barlow. Nikon Coolpix 4300. "I became interested in this area after reading and pondering the October 18 LPOD (Chuck Wood describe this feature as a volcanic ash ring that was ejected from an elongated crater pit at the center). It dawned on me that some indication of the dark-albedo material might at times be visible from earth during favorable librations. I looked at some of my best Orientale photos and believe that part of the dark-ring material is visible in this photo. Arrows mark what I believe to be corresponding areas on my photo and the Clementine image. I wonder if more of the material, possibly even hinting at a ring shape, might be visible from Earth during the most favorable librations."

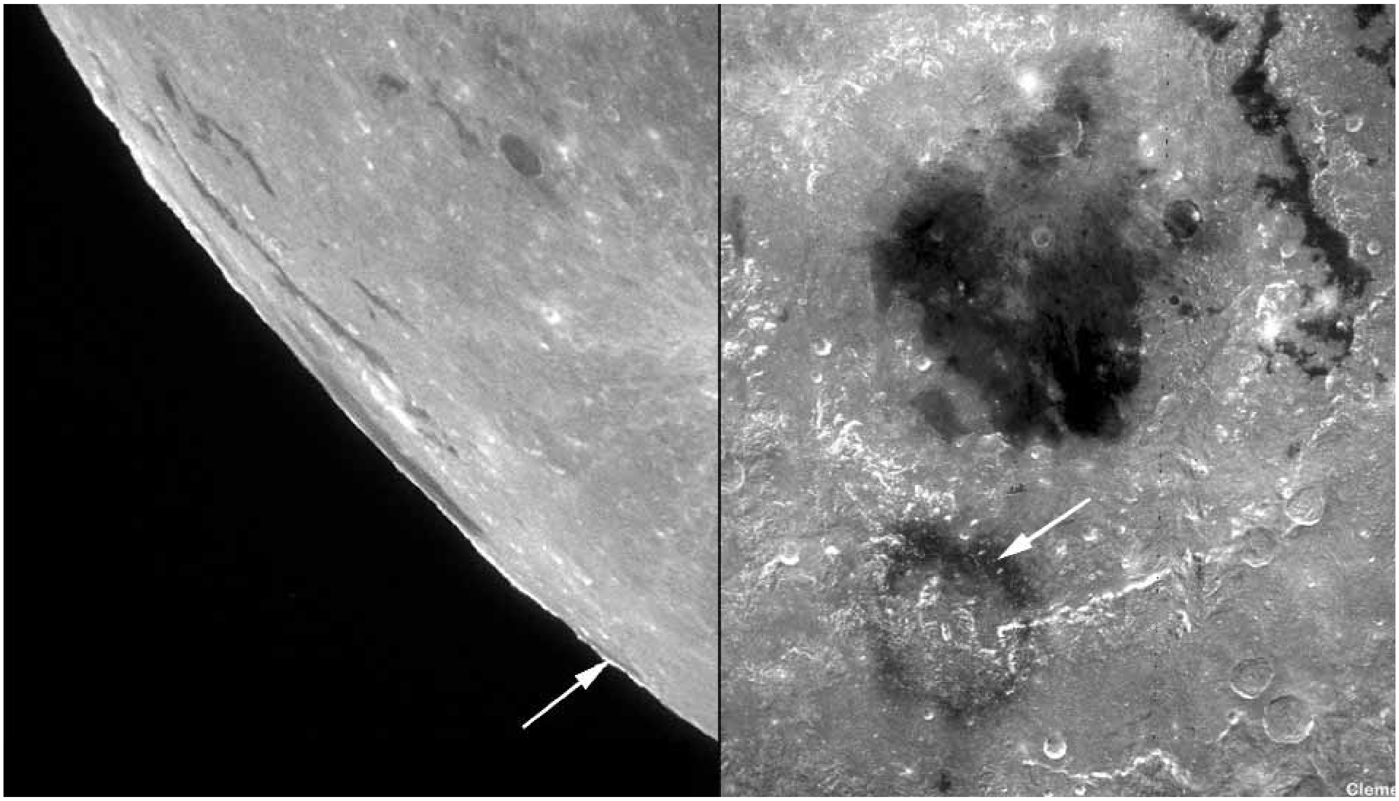
Above:

Montes Caucasus by KC Pau, Hong Kong. 12/01/03 12:09 UT. Colong. 2. Seeing 3-4/10. Transparency 4/10. 250 mm f/6 Newtonian. 2x Barlow. Philips Toucam Pro. 115 frames stacked.

At right:

Sinus Aestuum by Steve Boint, South Dakota. 10/15/02 2:34 UT. 10" f/4.5 Newtonian. 2x Barlow. SBIG 237a.





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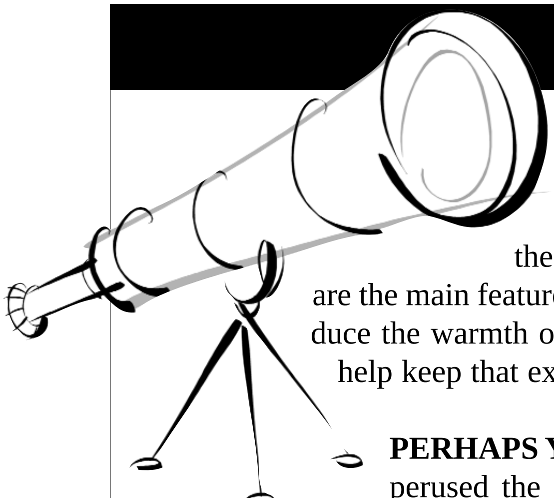

DO YOU DRAW images of lunar features you observe? Is your new digital camera providing amazing images of craters, mountains or maria? Have you mastered the difficulties of coupling your 35mm to the telescope? Submit your images to *Selenology*. While interesting articles are the main feature of the journal, it's the pictures provided by your participation that produce the warmth of each issue. You know the excitement of viewing the work of others, help keep that excitement going by sharing your images with all of us**!**

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