21-Day
MOON

Zeiss 100/640mm APQ refractor
ZWO ADI 183mm, 30sec AVI @ 30 FPS,
ROI 5496x3672 Px
AS!3 20% stack & sharpen
PSP tone & contrast adjust

MOON
2021-03-05, 05:30 AM
Lunation 21 days, Illum. 60%,
Altitude 13° due S in Scorpius
Temp. -3°C, Hum. 99%, clear
Transp. 4/7, Seeing 4-5/10 High Alt. winds

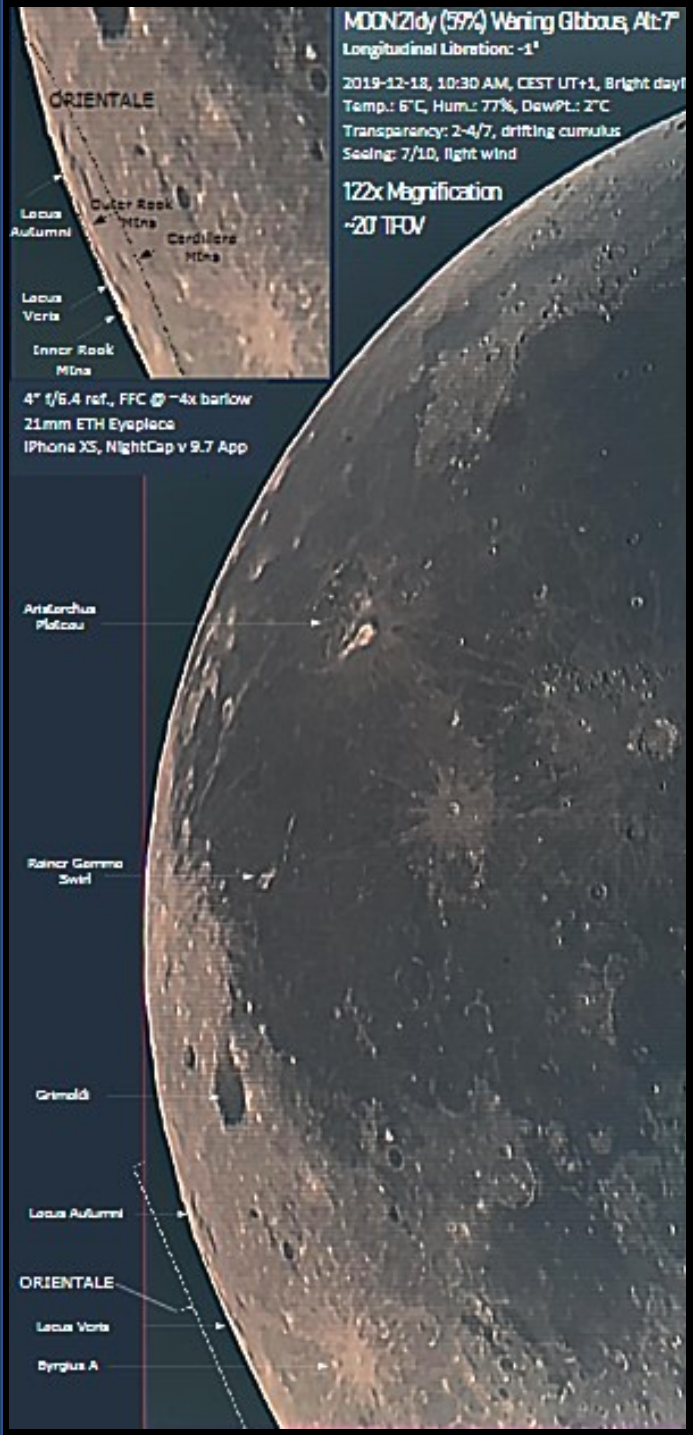
The *Last Quarter Moon*

It's an early morning (05:30 AM Local CEST, UT+1) in the start of March 2021. The Moon is low at 13° altitude and close to the meridian due S, dangling right below the upper claw of the Scorpion (the star *Beta Sco* aka "*Acrab*", -- an interesting quadruple system of hot massive main-sequence type B1-B2 stars).

It's cold and humid here close to dawn after a clear frosty night, and ice flowers are already starting to bloom on the dew shield of my 100mm f/6.4 refractor. The transparency is medium with a few patches of drifting high icy fog, and the seeing is undulating quite a bit due to atmospheric turbulence. I start my observation at 41x using an 41mm PAN with a 2x barlow. The view of the Moon is quite soft, mostly due to the seeing, as can clearly be seen in this short video I took this morning: https://youtu.be/LoAZBgmOHRo

There are however moments during the observation when the seeing calms down and I can get sharper views of some details on the lunar surface, such as the ***Aridaeus, Hyginus* and *Triesnecker* rilles** in the S Vaporum region, plus a glimpse of the Birt rille W of the Straight Wall. I did look for the Hadley rille E of Palus Putredinis, but I could not see it with certainty. The dark volcanic patches in ***Alphonsus*** were easily seen, but the fractures in the crater floor was washed out in the view. The rounded peak in ***Alpetragius*** was well exposed ("the egg in the bird's nest"), but the inner donut in the concentric crater *Hesiodus A* could just be glimpsed. Here's a "lucky image" (30 sec stack) from this morning's observation:

Daytime MOON
2016-08-17
iPhone 4



The Orientale Basin

The weather cleared up partially this AM (10:30 local), offering a view of the **21-day waning gibbous moon,** setting at 7° altitude towards the west. Not optimal conditions for moon observation, but I rushed out my 4" refractor and had a quick study of the W half of our satellite, with a focus on the **upper Imbrian *Orientale* basin**, which -- with a longitudinal libration of -1° -- was slightly tilted towards our line of sight.

The basin itself was beyond the W rim, but I did see:

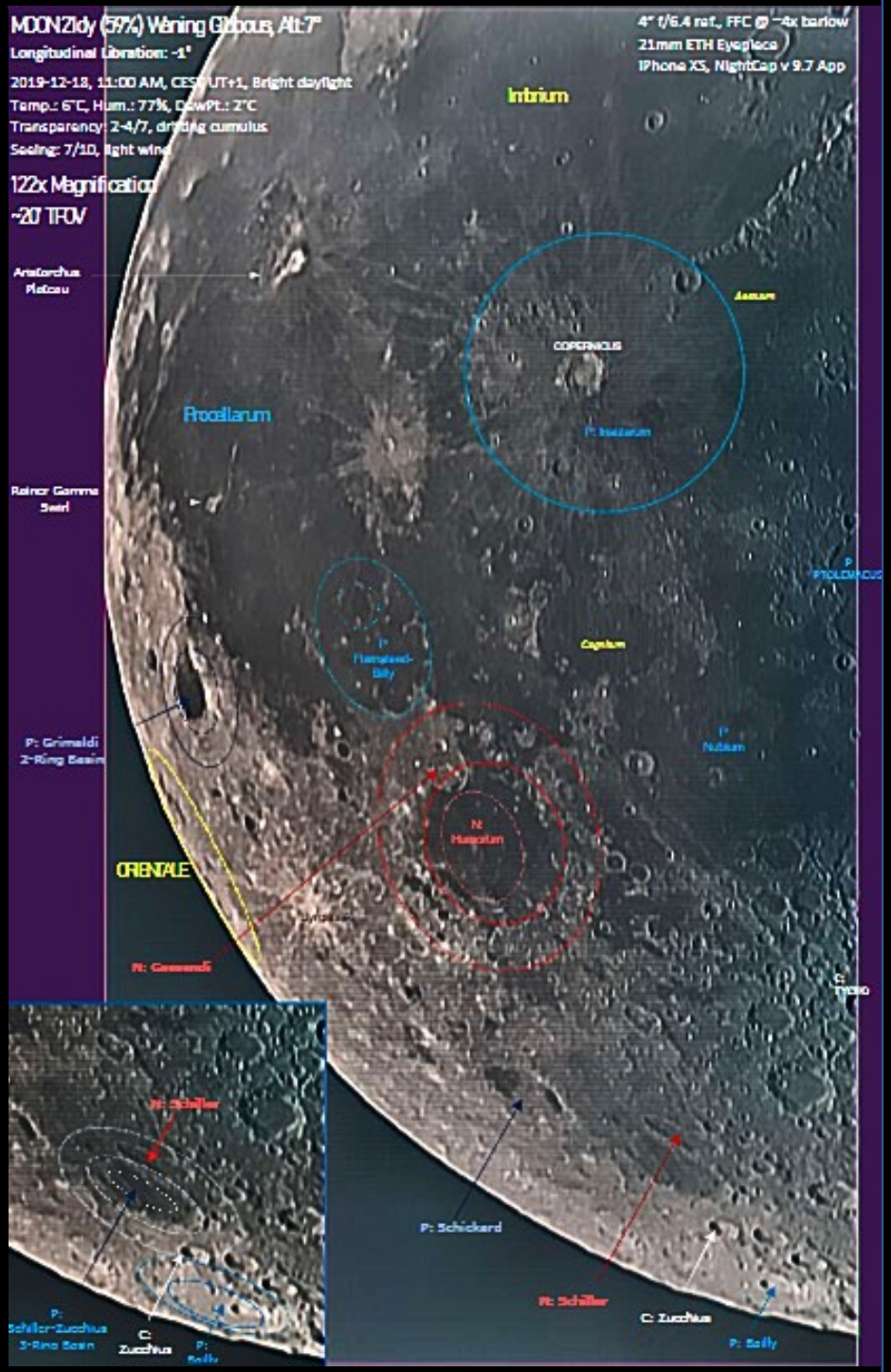
- the **Inner Rook Mountain chain (Ring #1)** as a bright line along the horizon
- the **Lacus Veris mare strip** stretched out between the Inner and Outer Rook Mtns
- the **Outer Rook Mtns (Ring #2),** -- a line of massifs in front of the lake
- the S-shape of the **Lacus Autumni** mare strip just inside the Cordillera ring
- the **Cordillera Mts (ring #3),** most visible east of *Byrgius A*

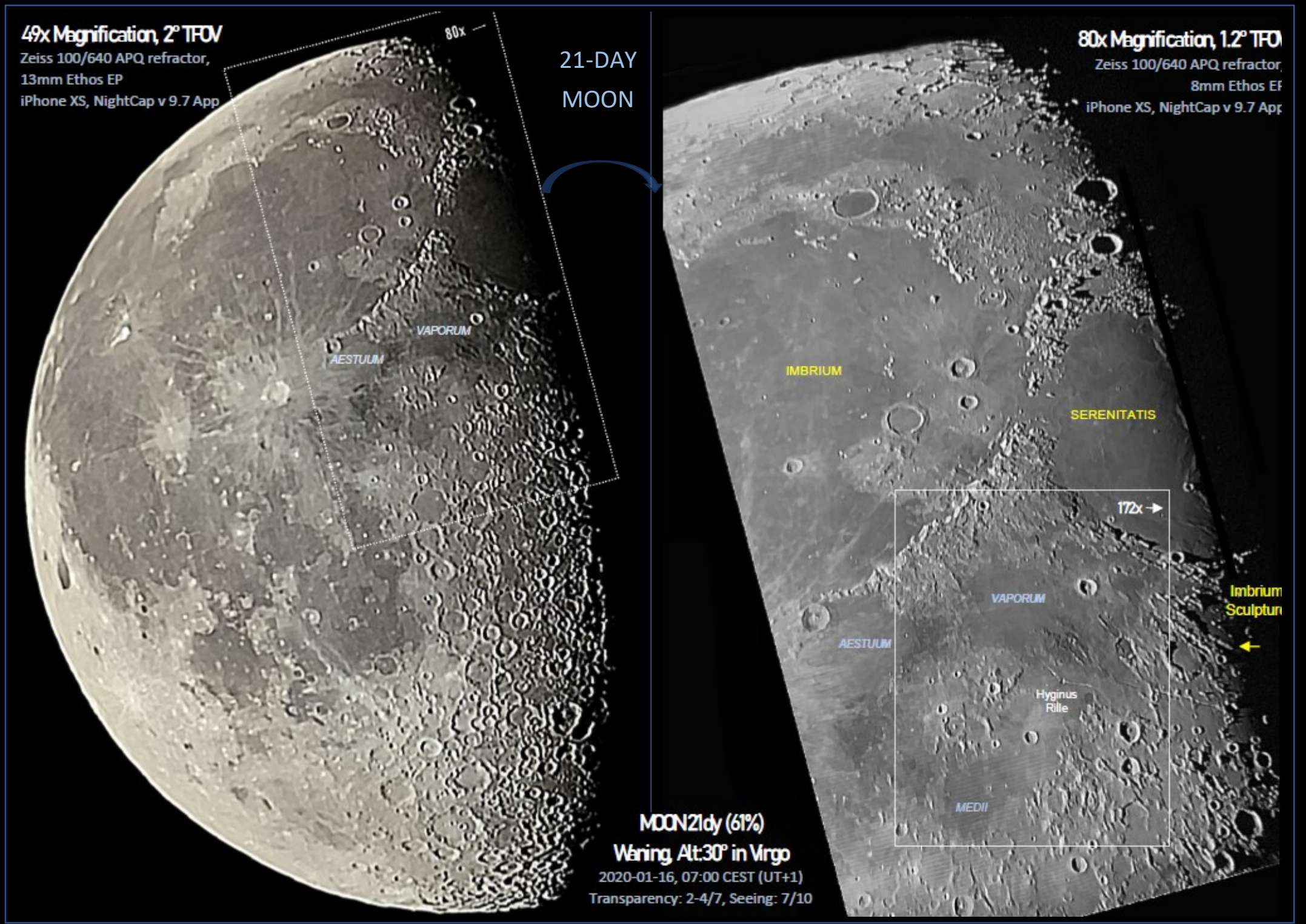
I'm looking forward to study this the latest large lunar basin impact at a more favorable libration, illumination and magnification, -- but good to at least catch a view of our Moon again. Here's a quick recording from my observation, -- pale because of the daylight and somewhat striated because of the phone camera, but never the less...

Moving further south along the W limb of the Moon, I can identify several interesting **older formations** below the otherwise primarily **upper Imbrian Orientale ejecta carpet.**

First, there are a couple of **old pre-Nectarian basins**, most obvious of course the large basin that holds *Mare Nubium*, but also -- much more subtle -- the ancient *Flamsteed-Billy* and *Insularum Basins*, now mostly buried below Mare Procellarum. Furthermore, I can see the two-ringed *Grimaldi basin* towards the west and the *3-ringed Schiller-Zucchius basin* plus the 2-ringed *Bailly* basin in the far south-west area. The Grimaldi rings are best seen at a lower solar angle, but the S-Z and Bailly basins are fairly easily recognized, even here in broad daylight at a 59% waning Moon. The large (227km Ø) pre-Nectarian crater *Schickard* shows an interesting big bright wedge of Orientale basin ejecta, covering the central part of the otherwise dark lava filled floor.

From the later **Nectarian epoch**, the *Humorum basin* is most prominent, with traces of a 3-ringed structure, and several large Nectarian craters can also be seen, like *Gassendi* at the N rim of Humorum and *Schiller* towards the SW edge.




49x Magnification, 2° TFOV
Zeiss 100/640 APQ refractor,
13mm Ethos EP
iPhone XS, NightCap v 9.7 App
80x
VAPORUM
AESTUUM
21-DAY
MOON
80x Magnification, 1.2° TFO
Zeiss 100/640 APQ refractor
8mm Ethos EF
iPhone XS, NightCap v 9.7 App
IMBRIUM
SERENITATIS
172x
VAPORUM
AESTUUM
Hyginus
Rille
MEDII
Imbrium
Sculptur
MOON 21dy (61%)
Waning, Alt:30° in Virgo
2020-01-16, 07:00 CEST (UT+1)
Transparency: 2-4/7, Seeing: 7/10

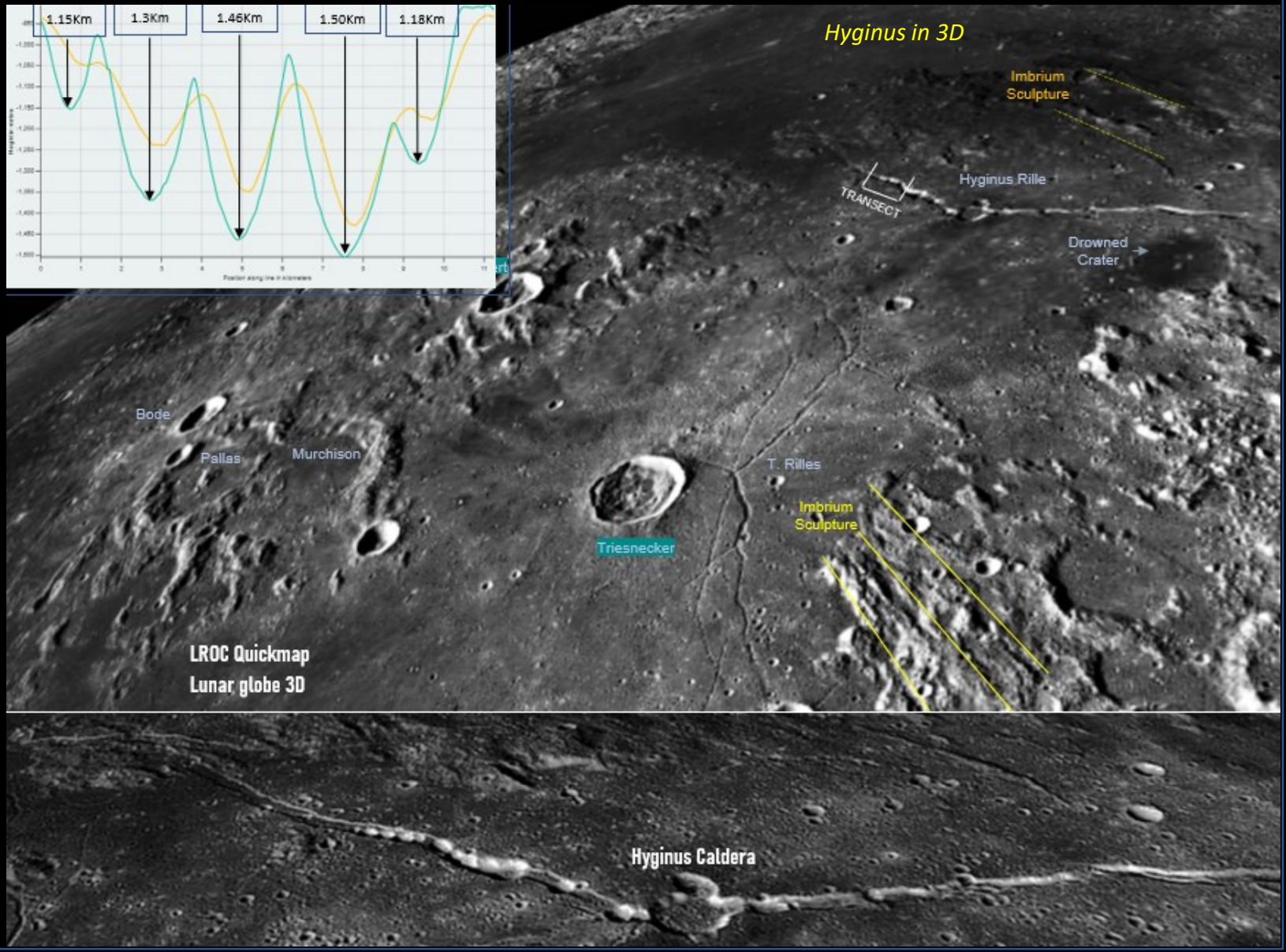
It's another early morning in **mid-January** (2020-01-16, 07:00 CEST, UT+1), -- and another civil dawn with thin high cirrus and drifting *Stratus fractus* clouds below, interspersed by a few long holes with clear(ish) sky, where I can catch the **21-day (61%) waning Moon**. My target this morning is reasonably high up at 30° altitude in *Virgo* towards the SW, so I can get some ½-1-minute-long views of our satellite between the clouds; I can work with that.

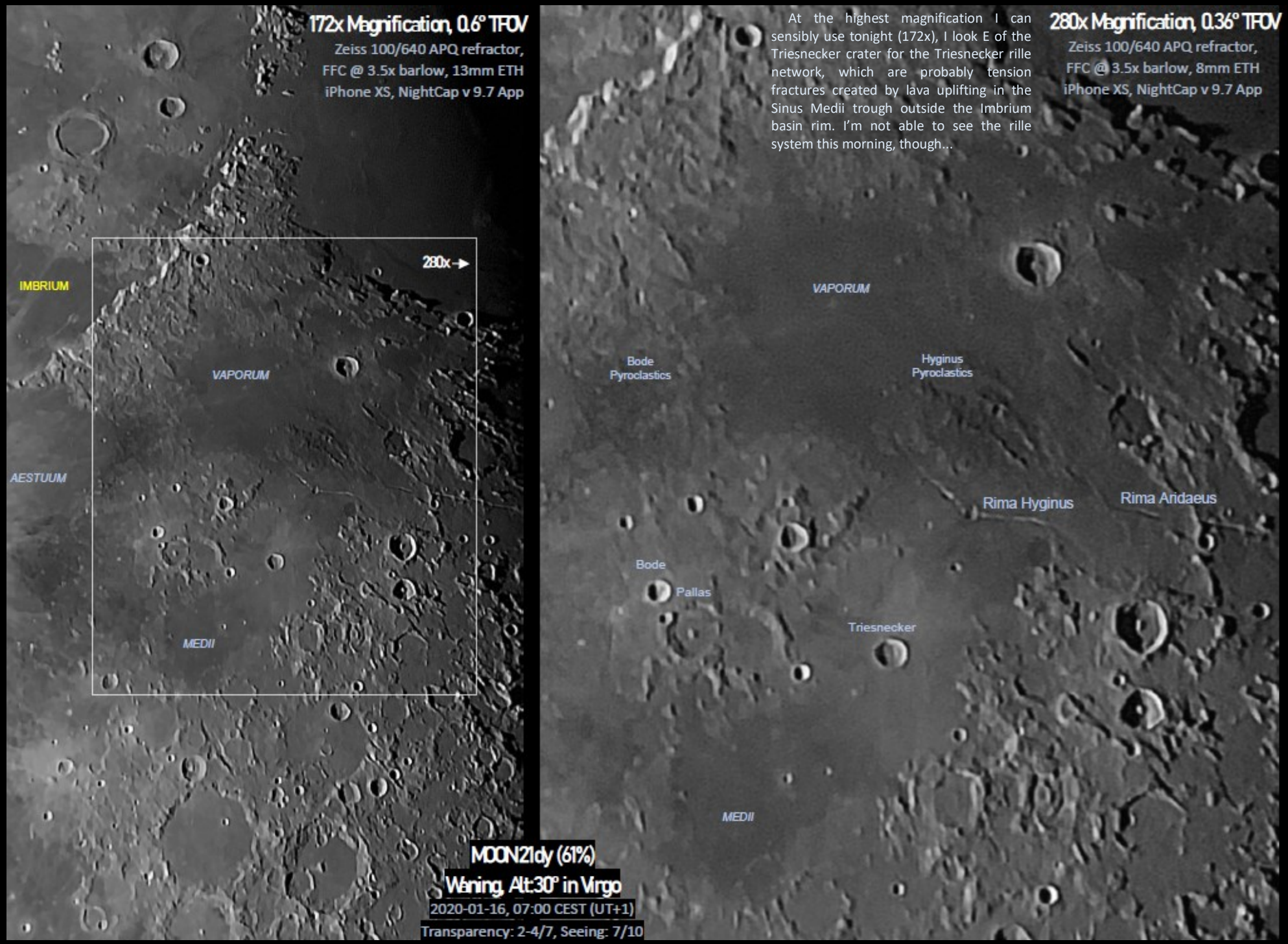
The terminator this morning passes through *Serenitatis*, along the W shoreline of *Tranquilitatis* and then through the E part of "*the Great Peninsula",* close to *Macrolytus*. Some of the most interesting sites on the Moon are those shaped by endogenic forces of volcanism such as lava shields and ash domes, uplifted fractured crater floors (FFC), fire fountain dark ash deposits (DMD), volcanic vents, calderas and sinuous rilles created by collapse of emptied lava channels. These are found concentrated in several locations on the moon including the NW sector of Procellarum (the *Aristarchus* plateau) plus the area around *Pallas-Murchison* SE of the Apennine Mountains. In this short observation I'll try to focus in on the DMDs and sinuous rilles in the trough just SE of the Apennines (the basin rim of Imbrium)

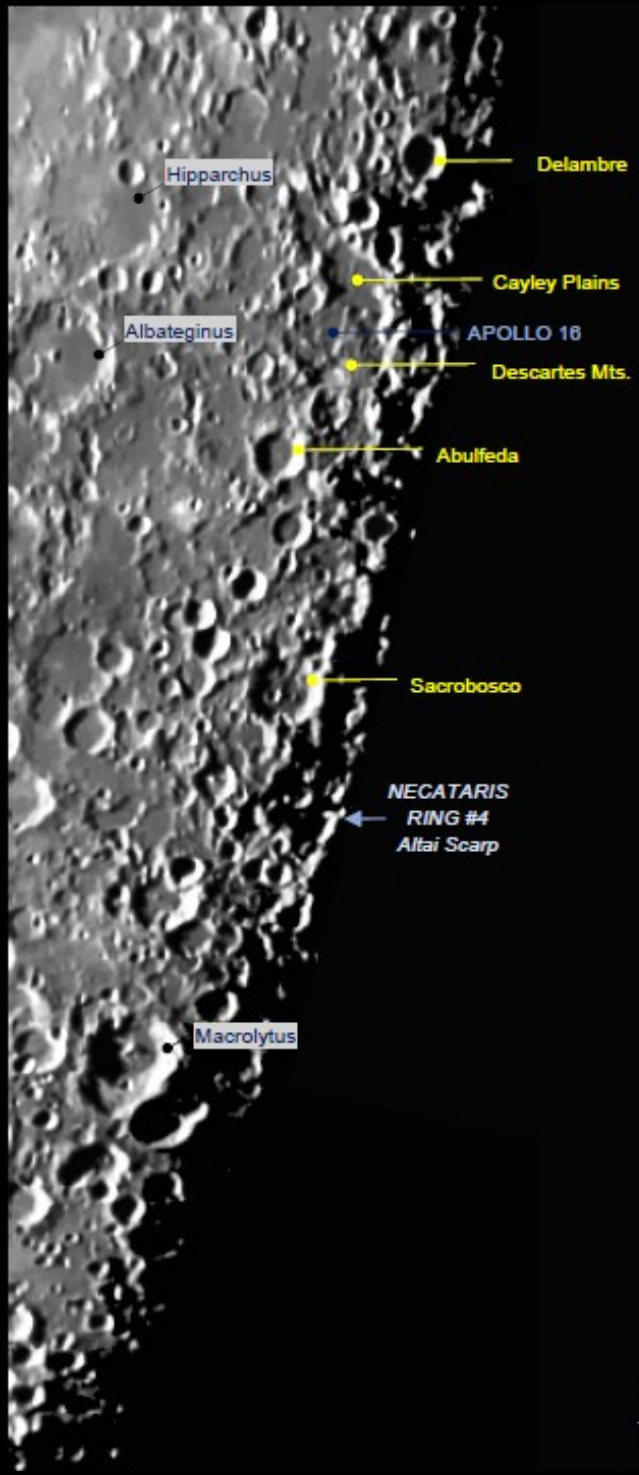
Already at low magnifications (49x) the dark ash deposits (the **Aestuum and Bode pyroclastics**) at the E shores of Sinus Aestuum are quite conspicuous, as are also the **Hyginus pyroclastics** N of the Hyginus; At a higher magnification (80x), I can see the volcanic sinuous *Hyginus rille* itself (and also the *Aridaeus rille* to the E, which is a straight flat-floored graben between two parallel fault lines and not of volcanic origin). At the highest magnification I can sensibly use tonight (172x), I look E of the Triesnecker crater for the **Triesnecker rille** network, which are probably tension fractures created by lava uplifting in the *Sinus Medii* trough outside the Imbrium basin rim. I'm not able though to see this rille system this morning though.

Inspired by some excellent 3D fly-by videos created by John Moore, I did this simple **3D view of the Hyginus area** using LROC images in Quickmap. It shows the Triesnecker rilles quite well, and also the Imbrium sculpture, both in the area E of Triesnecker and in the long DMD covered hills N of Hyginus.

I also did a short transect along the bottom of the W "arm" of the Hyginus rille close to the large caldera; The surrounding lava plain is at roughly -780m elevation and the flat bottom of the lava channel is at -900m elevation (i.e. ~ 120m depth). Along the short (ca. 10Km length) transect in the bottom of the rille there are five fire-fountain vents of diameters 1-2 Km and depths 1.1-1.5 Km, as indicated in the figure.




172x Magnification, 0.6° TFOV
Zeiss 100/640 APQ refractor,
FFC @ 3.5x barlow, 13mm ETH
iPhone XS, NightCap v 9.7 App
280x
IMBRIUM
VAPORUM
AESTUUM
MEDII
At the highest magnification I can sensibly use tonight (172x), I look E of the Triesnecker crater for the Triesnecker rille network, which are probably tension fractures created by lava uplifting in the Sinus Medii trough outside the Imbrium basin rim. I'm not able to see the rille system this morning, though...
280x Magnification, 0.36° TFOV
Zeiss 100/640 APQ refractor,
FFC @ 3.5x barlow, 8mm ETH
iPhone XS, NightCap v 9.7 App
VAPORUM
Bode
Pyroclastics
Hyginus
Pyroclastics
Rima Hyginus
Rima Aridaeus
Bode
Pallas
Triesnecker
MEDII
MOON 21dy (61%)
Waning, Alt:30° in Virgo
2020-01-16, 07:00 CEST (UT+1)
Transparency: 2-4/7, Seeing: 7/10



172x Magnification, 0.6° TFOV

Zeiss 100/640 APQ refractor,
FFC @ 3.5x barlow, 13mm ETH
iPhone XS, NightCap v 9.7 App

MOON 21dy (61%)
Waning, Alt:30° in Virgo
2020-01-16, 07:00 CEST (UT+1)
Transparency: 2-4/7, Seeing: 7/10


22-Day
MOON

The Last Quarter Moon

It's an early morning here in the start of November (2020-11-08, 03:30), and I'm out in my sub/urban transition backyard (SQM 19.3, NELM 5.7) with my small 4" F/6.4 refractor to observe the last quarter, Moon. **The 22-day moon** is 55% illuminated, hanging up at 51° altitude in Cancer, the temperature is a cool 5°C with 93% humidity and the dew point is close at my heels at 4°C. The transparency is negatively affected by the high humidity resulting in a faint high-altitude haze with intermittent drifting alto-cumulus clouds. The seeing is OK tonight, calm and just above medium.

This early morning will be "second light" for my new IMX183 2.4µm pix 20MP camera, an upgrade from my ICX445 3.752.4µm pix 1.3MP. “First light” was 5 days ago in worse conditions (more haze and wind), but I had a good observation never the less, and the new camera tested out well on my small refractor. I really like the option of using it with good resolution both natively at prime focus as well as at 2x Barlow, and I love the flexibility of easily scaling the field of view by adjusting the region of interest from a whopping 5496x3672 down to 800x600!

Tonight, I’ll use my 4" at f/12.8 for catching the **full last-quarter moon** at ROI 4120x3672, **with zoom-in**, first at 1920x1200 (S. Pole region) and then **close-ups** at 800x600 (Tycho-Clavius, E. Nubium, Copernicus areas). Here are a couple of my observations, starting with the full view of the last quarter moon. This photo was created from a 15s capture using 2.3ms exposure with 190 gain for histogram ~75%. 25% of the recorded frames were then stacked and the resulting image was adjusted in tone and sharpness.

To maintain resolution across the entire dynamic range of the full lunar surface I ended up with a rather dark version of the Moon, but with lots of details as can be studied in the zoomed-in version: from the sun-facing Orientale, Gamma Reiner and Aristarchus past Copernicus with the Hortensius domes, and down to the Straight Wall with the nearby Birt Rille (including the volcanic vent with DMD) close to the terminator. Not bad I’d say, on an only so-so day (night).Quarter Moon

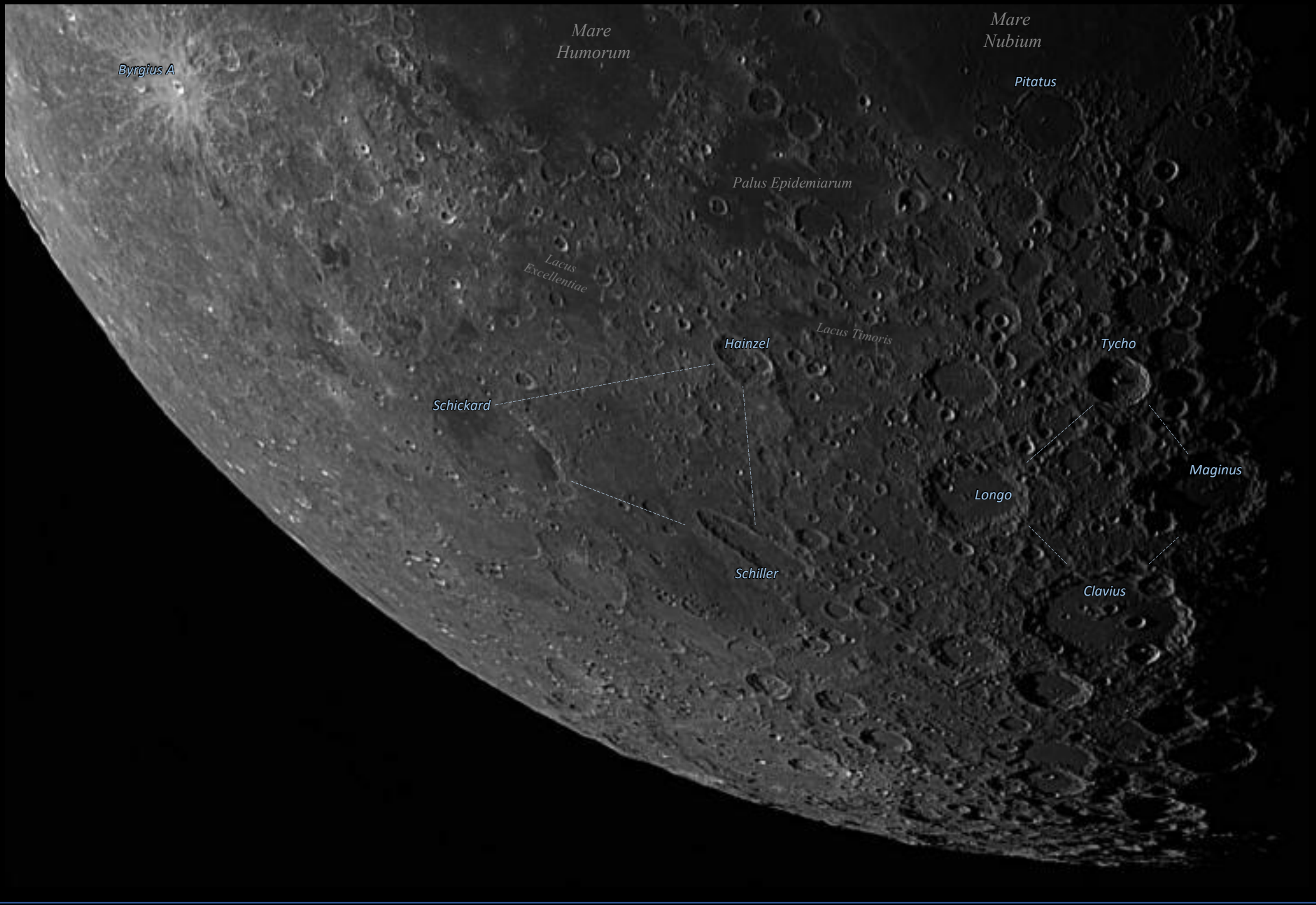
---

The Last Quarter Moon -- SW region

Below is seen the **SW region of the southern cratered highlands**, caught at last quarter Moon during the same observation as described in my previous post. I’ve reduced the ROI to a medium of 1920x1200, taking a 30sec recording at 4ms exposure, using gain 165 for 75% histogram. The image is the result of 30% AS!3 stacking with subsequent adjustment of tone and sharpness for max detail.

The 19km Ø young Copernican crater *‘Byrgius A’* is prominent at the NW corner of the photo, as are the triangle of large craters at the center: *Schickard-Schiller-Hainzel*, and indeed the “Ace of Diamonds” towards the SE formed by *Tycho-Longomontanus-Maginus-Clavius*.

Some long rilles can be seen, including the 3 Hippalus Rilles at the SE end of Humorum and the long Hesiodus Rille from Capuanus up to Pitatus. Many interesting details can be studied in **the crater walls and floors**, where craterlets down to 2-3km Ø can be glimpsed:


Mare
Humorum
Mare
Nubium
Byrgius A
Pitatus
Palus Epidemiarum
Lacus
Excellentiae
Lacus Timoris
Hainzel
Tycho
Schickard
Maginus
Longo
Schiller
Clavius

The Last Quarter Moon
Ancient Thebit

Closing this observation, here's a couple of close-up images captured with a smaller region of interest (800 x 600px).

The first image shows the **E Nubium area**, with -- among other features -- the Birt Rille (volcanic pit with lava channel) and the Straight Wall (linear fault) in the large 200Km Ø lava-drowned "Ancient Thebit" crater.

Also prominent in this area is the even larger 235km Ø **Deslandres walled plain**, with a roughly textured crater floor, filled by impact ejecta and pitted by the large Hell crater plus several clusters and chains of small secondary craters.

The Last Quarter Moon
Copernicus

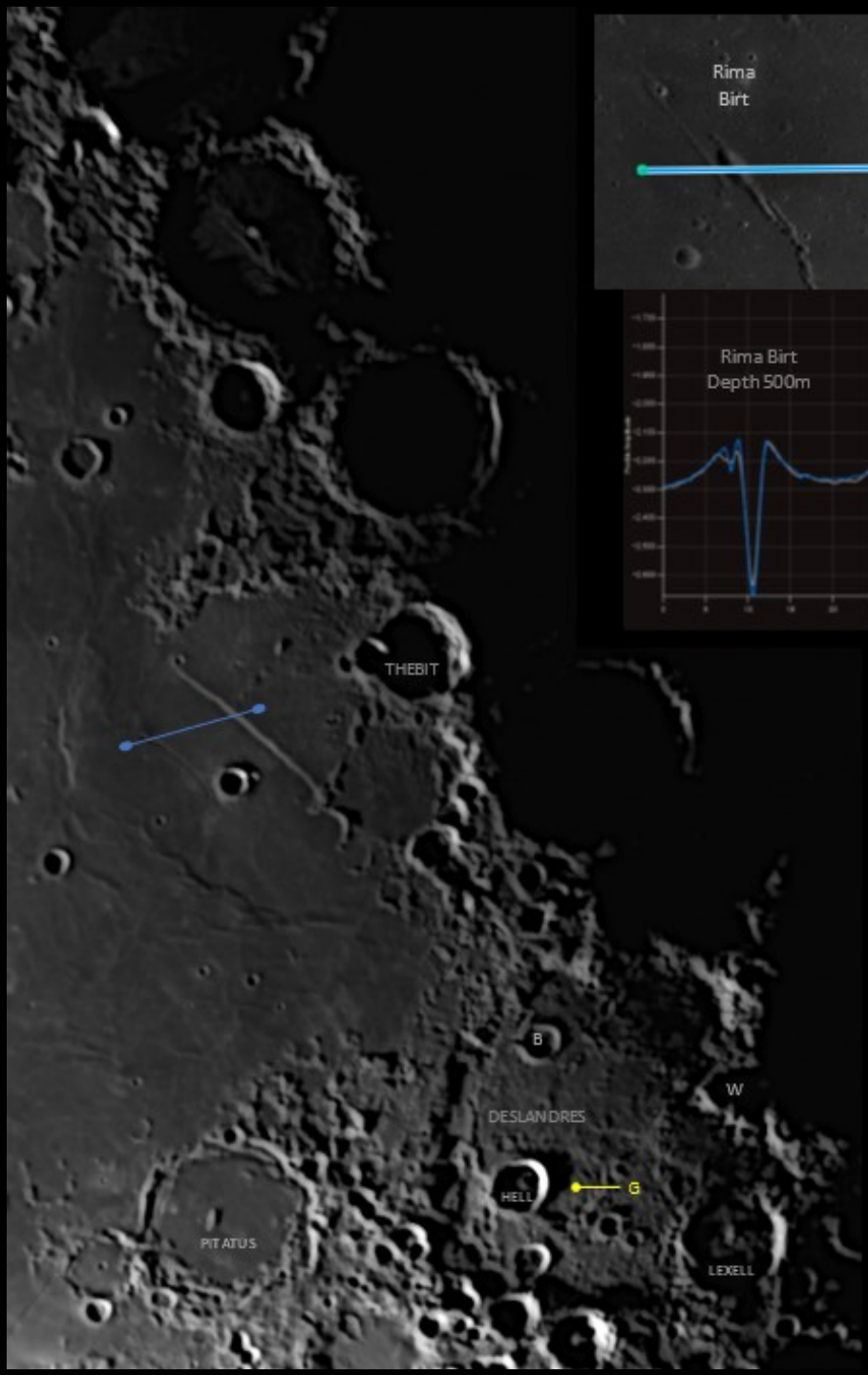
The autumn weather here in Denmark the past couple of weeks has been abysmally abominable with windy, overcast and rainy days and nights. Not a chance for even a quick grab-&-go view of the universe... So, here's instead a final observation from the latest night, when I was able to go out and study the moon, -- specifically the area around the magnificent *Copernicus* crater.

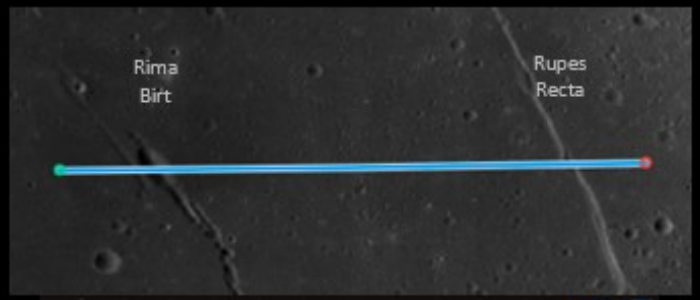
The image below shows the arc of Nectarian Epoch lunar crust, uplifted by the Imbrium Basin impact, and settled as the rugged massifs of the **Carpathian and Apennine Mountain ranges.** From the same event, Imbrium impact melt and crushed crust were ejected and deposited radially in large swaths of hilly, hummocky terrain, intermixed with regions of underlying faulted Nectarian bedrock; Examples of such *Lower Imbrian ejecta deposits* are seen W of Copernicus and to the S and E of Reinhold.

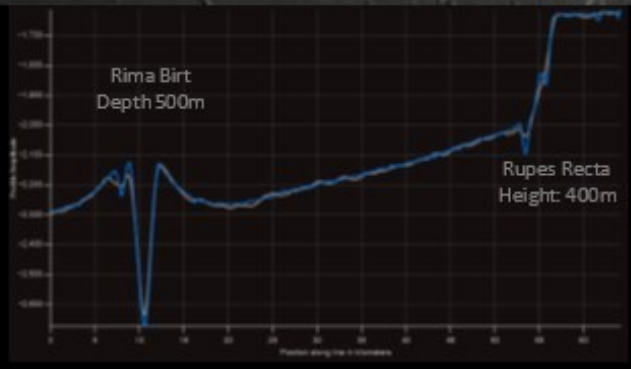
Later, the impact basin and its surroundings with Lower Imbrian craters like Stadius, were partly covered by **lava flows** in Upper Imbrium, and some regions (as can be seen SE of Copernicus) were further coated by fire-fountain pyroclastic dark mantle material (**DMD**: ash with small glass beads) or adorned with **domes** from slowly erupting lava vents over small near-surface magma chambers (examples N of Hortensius crater).

Recently, in the Eratosthenian and following Copernican Epochs, large impacts formed terraced craters like Eratosthenes and Copernicus, the youngest with rays of bright pulverized ejecta and chains of secondary craters.

So all-in-all, this is a geologically quite interesting area of the lunar surface. The weather conditions were not the best though, with a transparency varying from 2-4/7 and getting worse as the observation progressed. The image below was taken through a thickening layer of high clouds, so the result is somewhat softer than it otherwise could have been...







LROC: :QuickMap Transect 70Km length

Last Quarter Moon, 2020-11-08 03:30

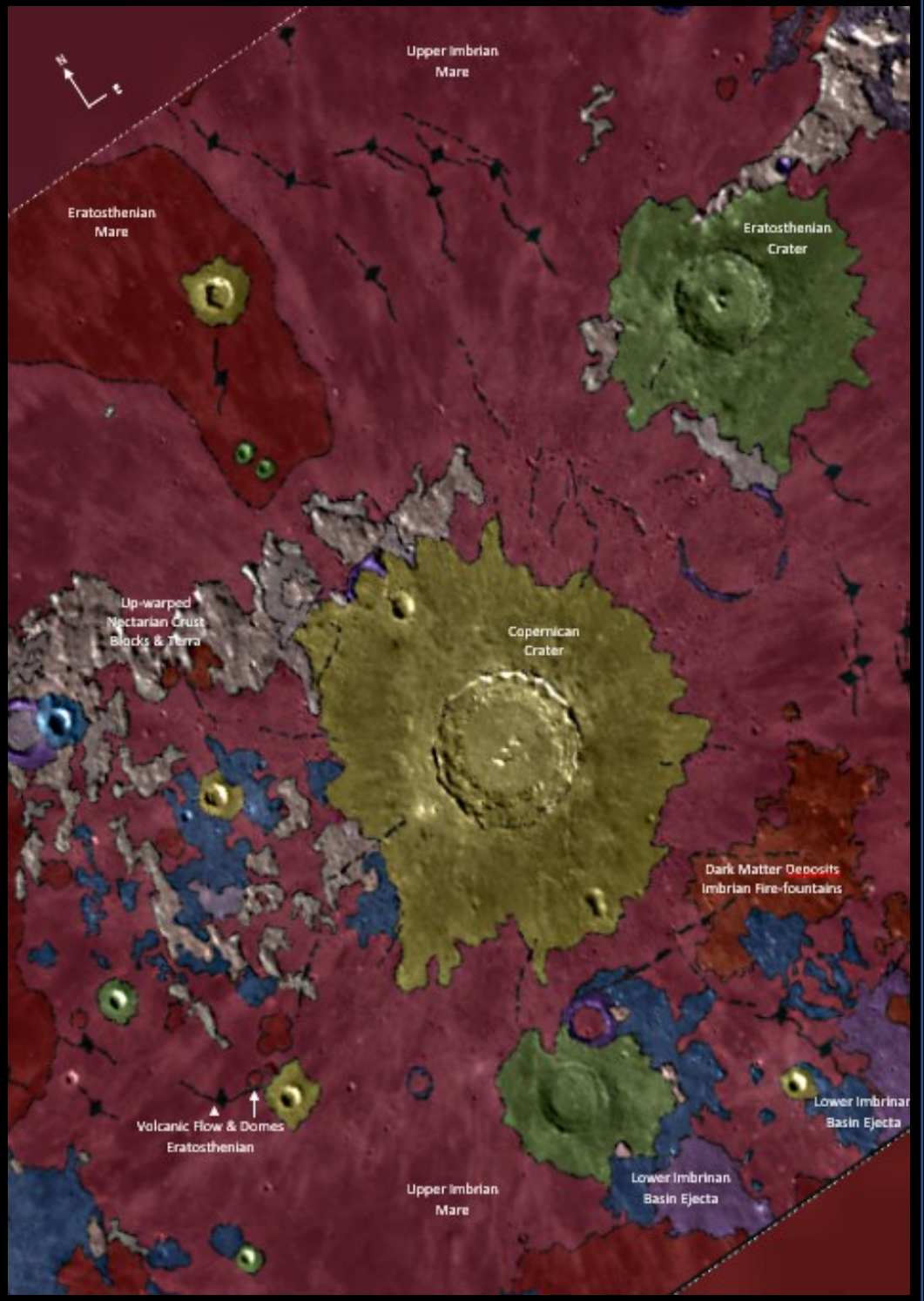
55% illuminated, 22 Days, 51° Alt in *Cancer*
5°C, 93% humidity, 4° dewpoint
SQM 19.3 (NELM 5.7) Sub/Urban transition
Transparency: 2-4/7, Seeing: 6-7/10

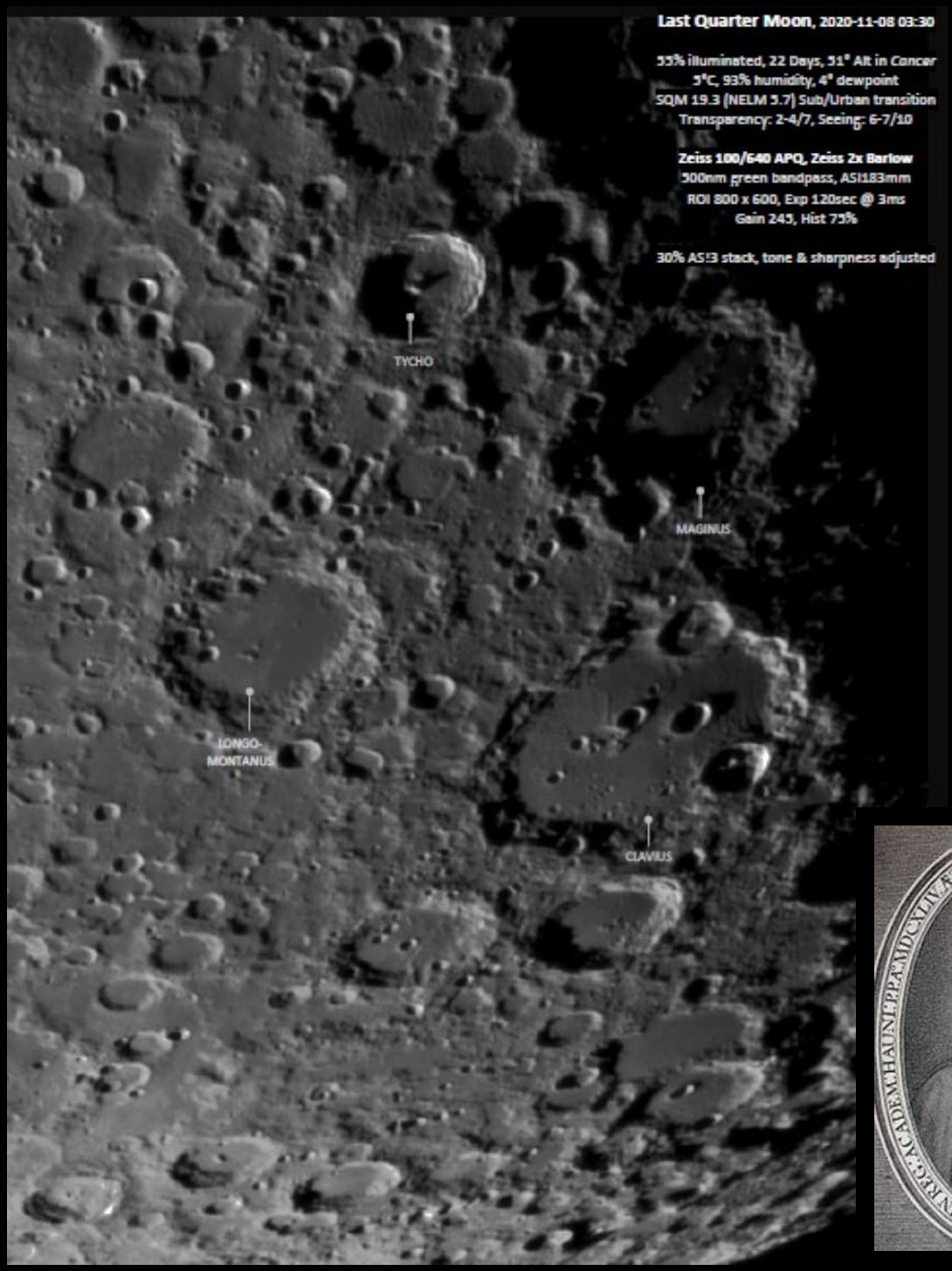
Zeiss 100/640 APQ, Zeiss 2x Barlow
500nm green bandpass, ASI183mm
ROI 800 x 600, Exp 120sec @ 4ms
Gain 340, Hist 65%

30% AS!3 stack, tone & sharpness adjusted

- G: Ghost of Hell (older crater)


Last Quarter Moon, 2020-11-08 03:30
55% illuminated, 22 Days, 51° Alt in Cancer
5°C, 93% humidity, 4° dewpoint
SQM 19.3 (NELM 5.7) Sub/Urban transition
Transparency: 2-4/7, Seeing: 6-7/10
N
E
MTS. APENNINUS
Eratosthenes
Stadius
MTS. CARPATUS
Copernicus
DMD
Domes
Hortensius
Reinhold
Domes
Zeiss 100/640 APO, Zeiss 2x Barlow
500nm green bandpass, ASI183mm
ROI 800 x 600, Exp 120sec @ 30FPS
Gain 245, Hist 75%
30% ASI3 stack, tone & sharpness adjusted


N
E
Upper Imbrian
Mare
Eratosthenian
Mare
Eratosthenian
Crater
Up-warped
Nectarian Crust
Blocks & Terra
Copernican
Crater
Dark Matter Deposits
Imbrian Fire-fountains
Volcanic Flow & Domes
Eratosthenian
Lower Imbrinar
Basin Ejecta
Upper Imbrian
Mare
Lower Imbrinan
Basin Ejecta



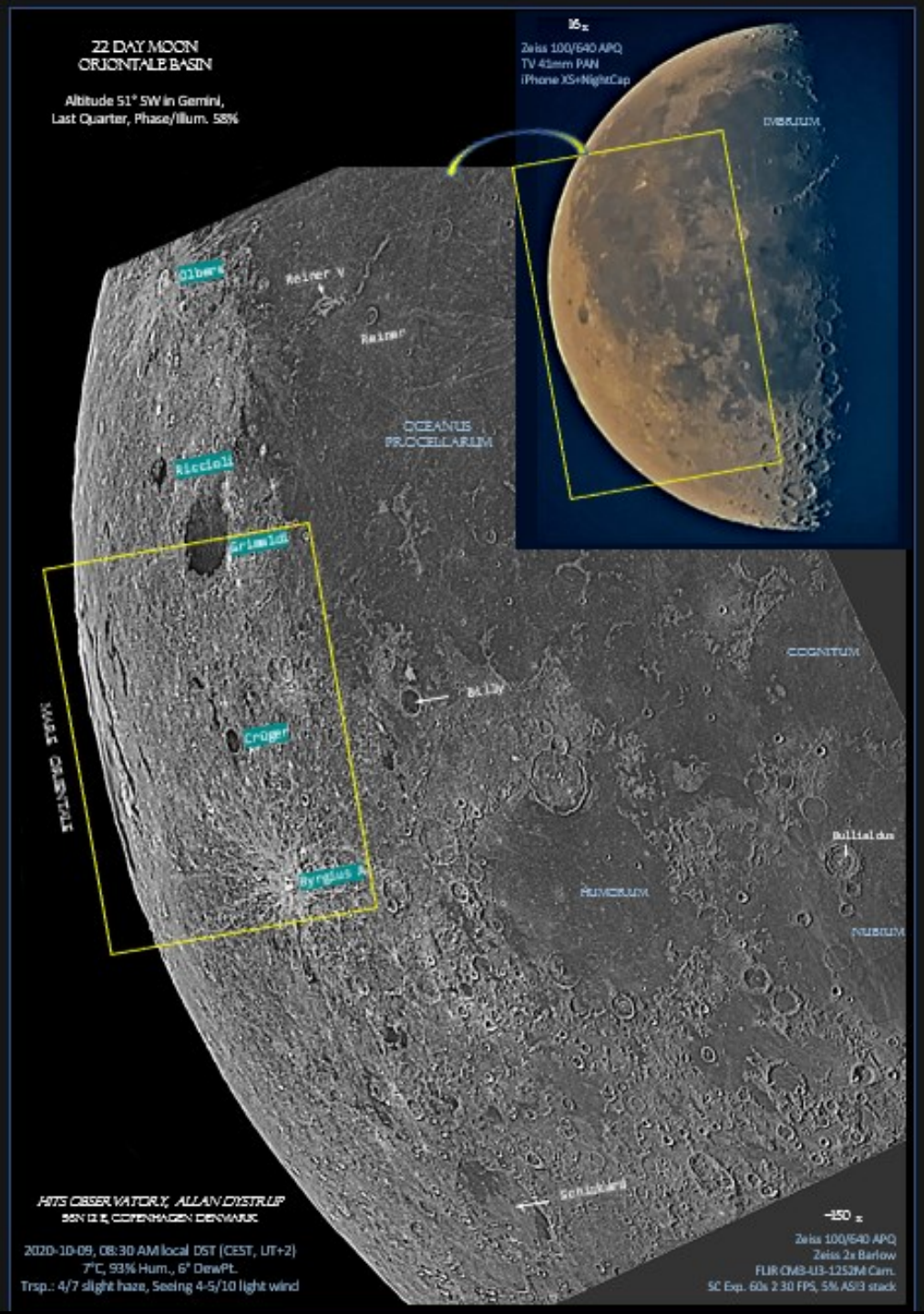
The Last Quarter Moon: ***Tycho* and *Longomontanus***

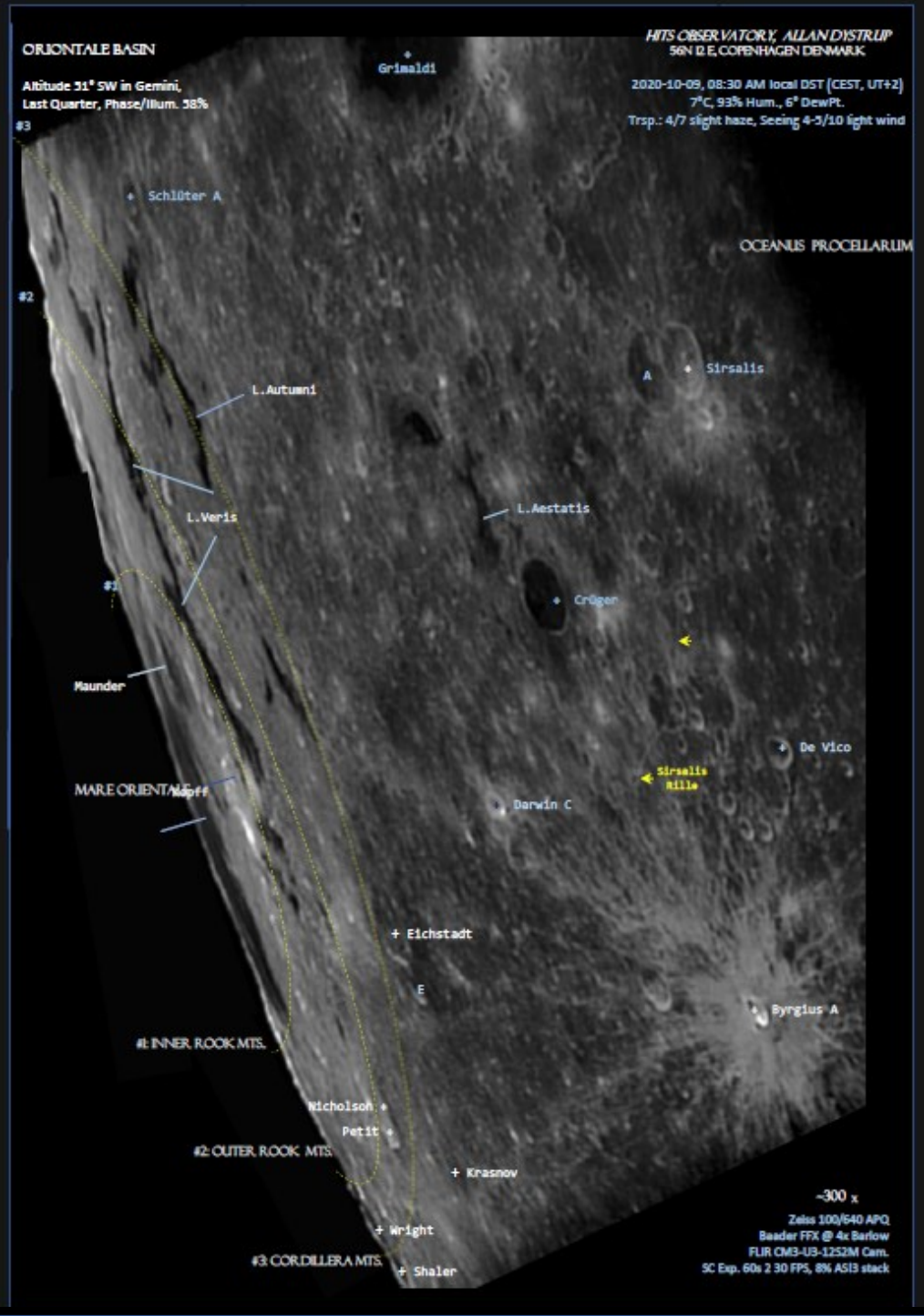
In **medieval times, astronomy** was primarily what we would today refer to as solar system positional astrometry, -- it was taught as a branch of mathematics in monasteries, and used as a tool for calendar planning and astrology.

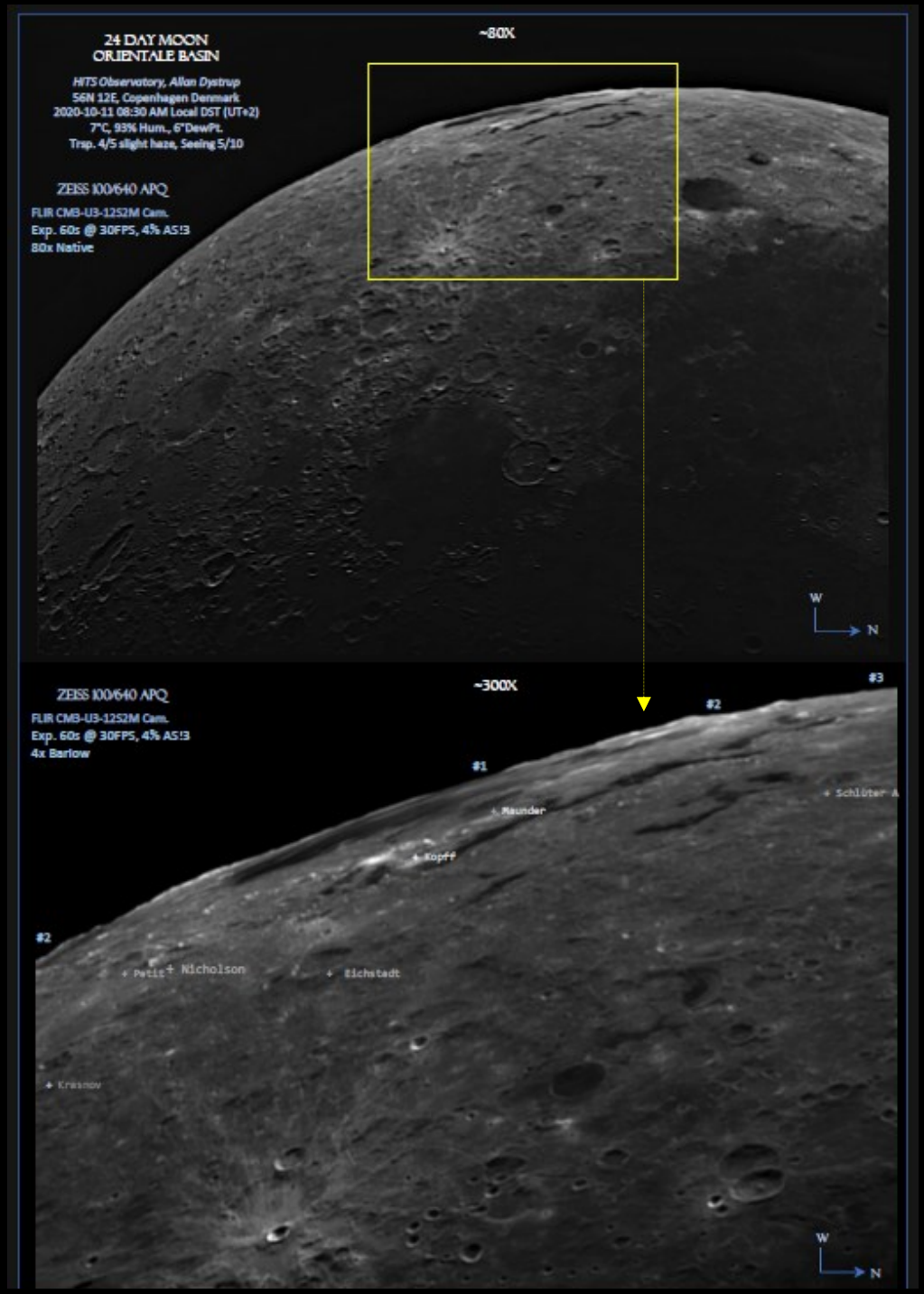
After **Tycho Brahe's** ground breaking observational work (described here: https://www.cloudynights.com/topic/585769-classic-astronomy-history/?p=9511525), a separate chair in Astronomy was set-up in Denmark at the University of Copenhagen (1605), and one of Tycho's pupils: **Christian Sørensen Lomborg**, was granted the first astronomy professorship in Denmark. (the surname 'Lomborg' indicates the place he was born, and was translated to Latin **as Long Mountain = *Longomontanus***). Longomontanus was the son of a low-rank farmer, but he had an outstanding talent for mathematics, especially calculation of and use of logarithmic tables (before the logarithmic formulae were properly formulated), so - typical for Tycho - he employed Longomontanus as a member of his observatory staff.

Longomontanus' greatest contributions to astronomy were writing the university textbook ***"Astronomia Danica"*** and establishing the new Danish Observatory at the *Round Tower* in central Copenhagen, after Tycho disbanded his own observatory at the island of *Hven* and finally left the country for *Pragh* in 1598, following disputes with the Danish king Christian IV.

The textbook Astronomia Danica contains chapters on spherical astronomy, astronomical instruments and observation methods, calculations and tables (all subjects he learned from Tycho). The textbook was widely used over most of Europe in the following half century, and *the Round Tower* is still in use today as the oldest functioning observatory in Europe, -- but now for public astronomical outreach events. The instruments of Longomontanus (sextant, azimuthal quadrant etc.) have of course been substituted by a modern telescope (a 150mm refractor from 1929). Apart from preserving the Tycho Brahe legacy, Longomontanus was a conservative mind who was not prepared to think out of the box with regards to new instruments (telescopes) or Keplerian cosmology, so maybe it's fitting that his name was attached to the large but in other ways rather anonymous crater just SW of Tycho (though the name 'Long Mountain' would have been a better fit to what is now known as Schiller...).


22 DAY MOON
ORIONTALE BASIN
Altitude 51° SW in Gemini,
Last Quarter, Phase/Illum. 58%
~35x
Zeiss 100/640 APO
TV 41mm PAN
iPhone XS+NightCap
Olbers
Reiner V
Reiner
OCEANUS PROCELLARUM
Riccioli
Grimaldi
MARE ORIENTALE
Cruger
Bailly
COGNITUM
Byrgius A
Bullialdus
HUMORUM
NUBIUM
Schickard
HITS OBSERVATORY, ALLAN DYSTRUP
56N 12 E, COPENHAGEN DENMARK
2020-10-09, 08:30 AM local DST (CEST, UT+2)
7°C, 93% Hum., 6° DewPt.
Trsp.: 4/7 slight haze, Seeing 4-5/10 light wind
~150 x
Zeiss 100/640 APO
Zeiss 2x Barlow
FLIR CM3-U3-1252M Cam.
SC Exp. 60s 2 30 FPS, 5% AS!3 stack


ORIONTALE BASIN
Altitude 51° SW in Gemini,
Last Quarter, Phase/Illum. 58%
HITS OBSERVATORY, ALLAN DYSTRUP
56N 12 E, COPENHAGEN DENMARK
2020-10-09, 08:30 AM local DST (CEST, UT+2)
7°C, 93% Hum., 6° DewPt.
Trsp.: 4/7 slight haze, Seeing 4-5/10 light wind
Grimaldi
#3
Schlüter A
OCEANUS PROCELLARUM
#2
A
Sirsalis
L.Autumni
L.Veris
L.Aestatis
#1
Crüger
Maunder
De Vico
Sirsalis Rille
MARE ORIENTALE
Darwin C
Eichstadt
E
Byrgius A
#1: INNER ROOK MTS.
Nicholson
Petit
#2: OUTER ROOK MTS.
Krasnov
Wright
#3: CORDILLERA MTS.
Shaler
~300 x
Zeiss 100/640 APO
Baader FFX @ 4x Barlow
FLIR CM3-U3-12S2M Cam.
SC Exp. 60s 2 30 FPS, 8% ASI3 stack



22-24 DAY MOON

Daytime view of Orientale Basin

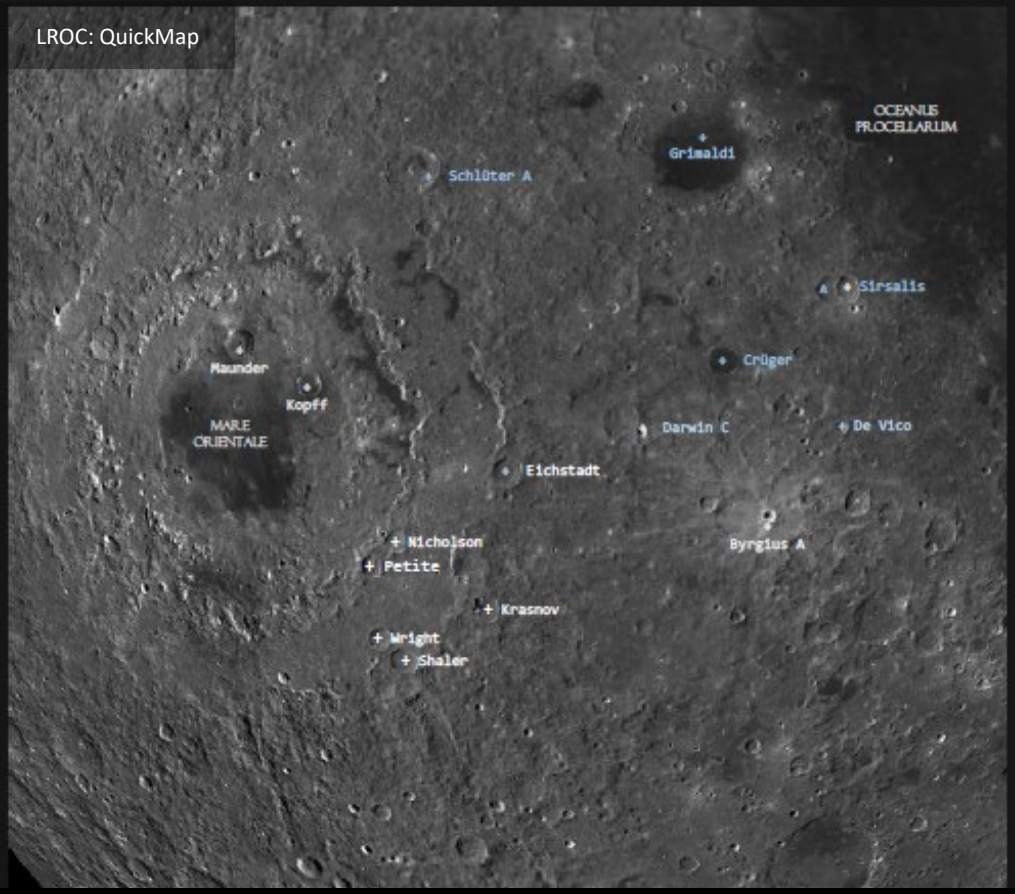
The large 3-ringed **Orientale Basin** is the result of a young Imbrian impact, featuring two large craters in the central lava-filled interior: Maunder and Kopff. The crater Kopff is right on 90° W longitude, so the Orientale Mare with Maunder and the far side of the basin rings are all "beyond the bend" so to speak, out in the western libration zone.

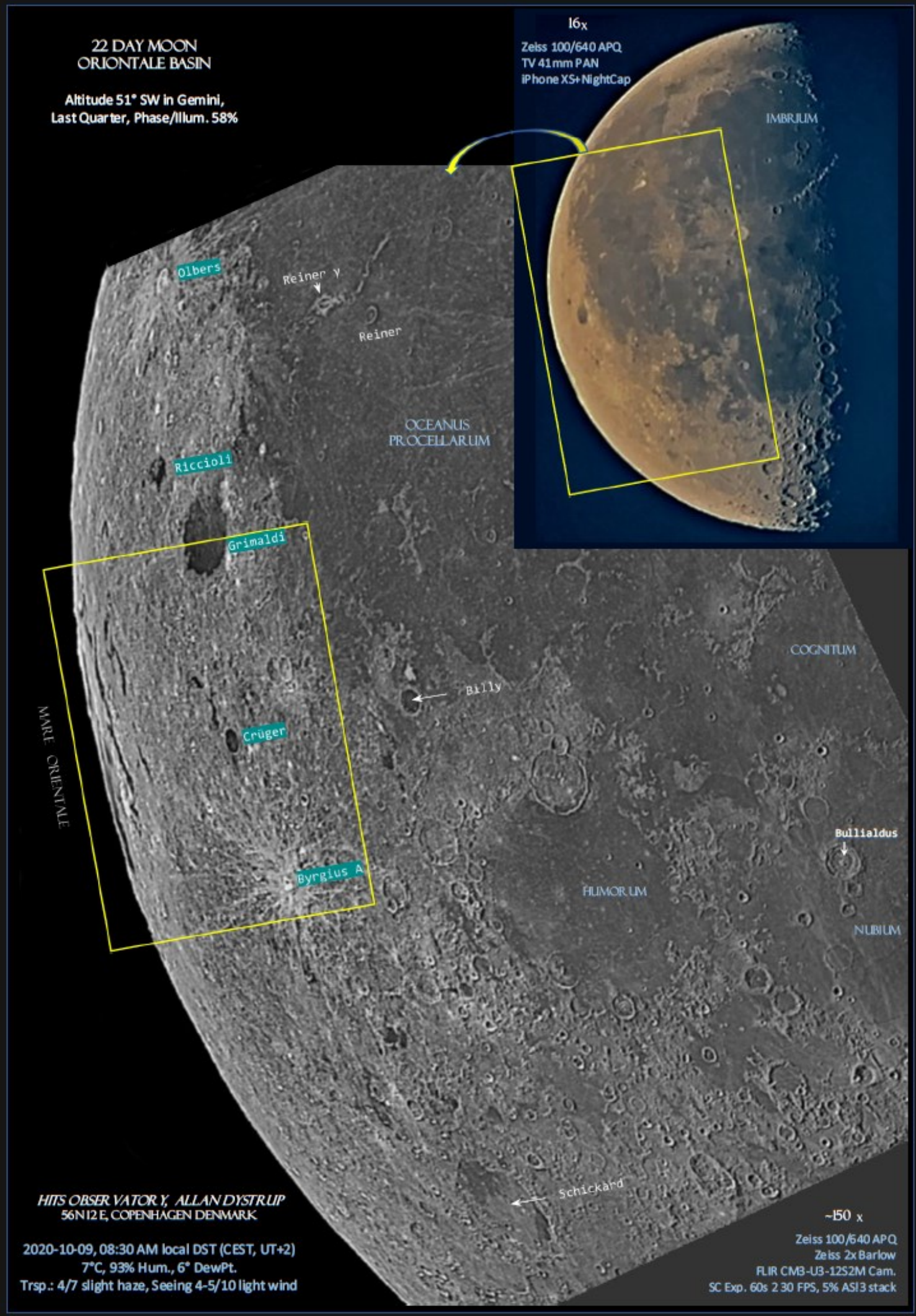
Here's first a view of the region from October 11. 2020 showing the main features in perspective as seen through my 4" refractor, and then a "rectified" view based on LROC:: Quickmap data:

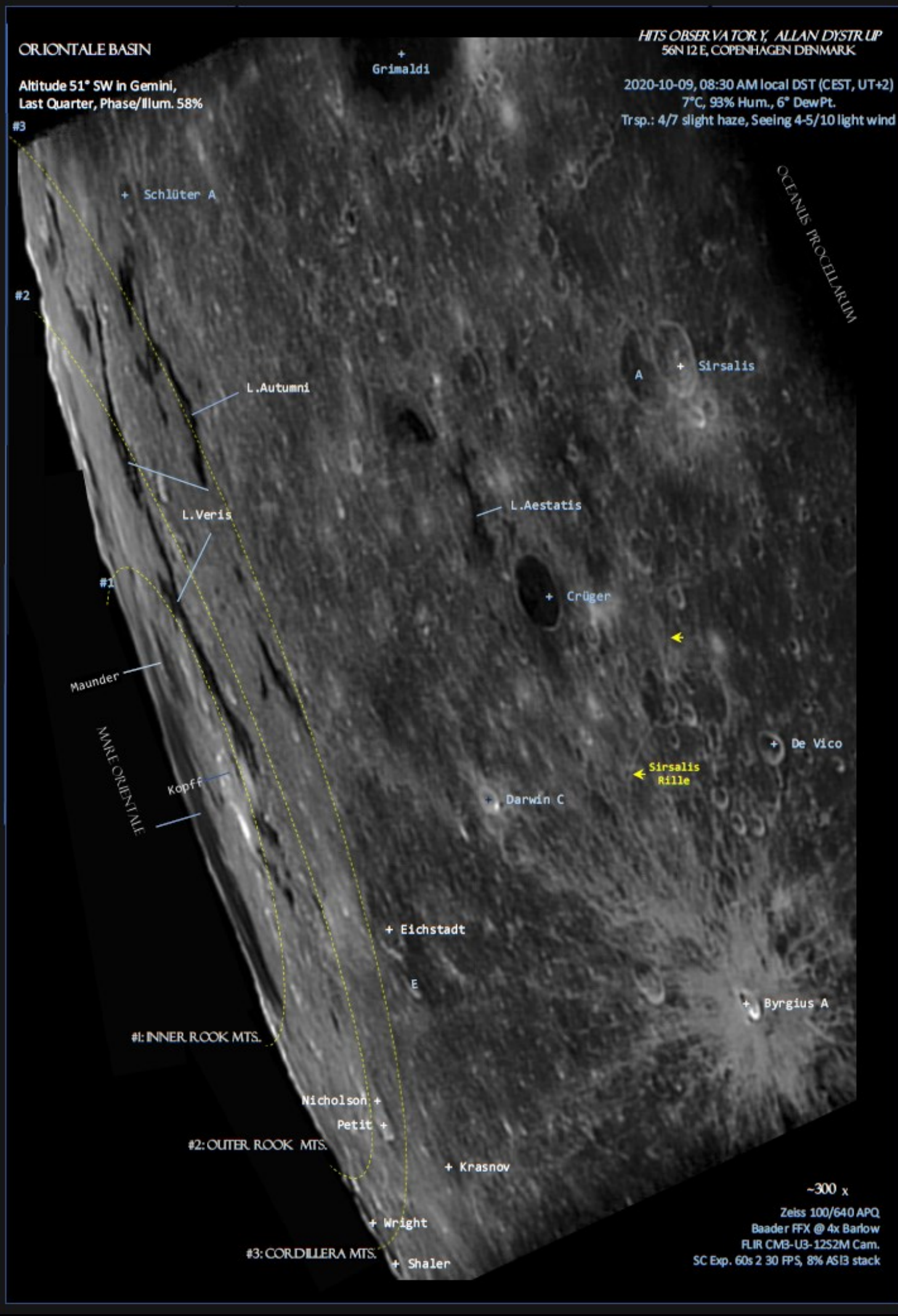
The first basin ring **#1: the Inner Rook Mts.** can be seen as a range of bright mountin peaks bordering Mare Orientale towards the E, and it can be faintly traced right at the limb in the far distance beyond the Mare.

Outside ring #1 is seen the long lava-filled trench *Locus Veris*, enclosed by basin ring **#2: the Outer Rook Mts.** This ring can be traced from the crater pair *Petit* and *Nicholson* at the S end, up along the E shore of *Lake Veris* and then seen clearly in ragged profile at the lunar limb NW of the Orientale basin.

The outer ring **#3: the Cordillera Mts.** can be followed from the crater pair *Wright* and *Shaler* at the S end, up N past *Krasnov* and *Eichstädt*, enclosing the trench with *Locus Autumnis* before bending W past the crater *Schlüter A*. The *Cordilleras* is an upwarped scarp facing away from us so there are no dramatic peaks or mountain ranges seen in profile here...




22 DAY MOON
ORIONTALE BASIN
Altitude 51° SW in Gemini,
Last Quarter, Phase/Illum. 58%
16x
Zeiss 100/640 APQ
TV 41mm PAN
iPhone XS+NightCap
IMBRIUM
Olbers
Reiner γ
Reiner
OCEANUS
PROCELLARUM
Riccioli
Grimaldi
Billy
Crüger
MARE ORIENTALE
COGNITUM
Bullialdus
FLAMMARION
NUBIUM
Byrgius A
Schickard
HITS OBSERVATORY, ALLAN DYSTRUP
56N12E, COPENHAGEN DENMARK
2020-10-09, 08:30 AM local DST (CEST, UT+2)
7°C, 93% Hum., 6° DewPt.
Trsp.: 4/7 slight haze, Seeing 4-5/10 light wind
~150 x
Zeiss 100/640 APQ
Zeiss 2x Barlow
FLIR CM3-U3-12S2M Cam.
SC Exp. 60s 2 30 FPS, 5% ASI3 stack


ORIONTALE BASIN
Altitude 51° SW in Gemini,
Last Quarter, Phase/Illum. 58%
HITS OBSERVATORY, ALLAN DYSTRUP
56N 12 E, COPENHAGEN DENMARK
2020-10-09, 08:30 AM local DST (CEST, UT+2)
7°C, 93% Hum., 6° DewPt.
Trsp.: 4/7 slight haze, Seeing 4-5/10 light wind
Grimaldi
#3
Schlüter A
OCEANUS PROCELLARUM
#2
A
Sirsalis
L.Autumni
L.Veris
L.Aestatis
#1
Crüger
Maunder
De Vico
MARE ORIENTALE
Sirsalis Rille
Kopff
Darwin C
Eichstadt
E
Byrgius A
#1: INNER ROOK MTS.
Nicholson
Petit
#2: OUTER ROOK MTS.
Krasnov
Wright
#3: CORDILLERA MTS.
Shaler
~300 x
Zeiss 100/640 APQ
Baader FFX @ 4x Barlow
FLIR CM3-U3-12S2M Cam.
SC Exp. 60s 2 30 FPS, 8% AS!3 stack