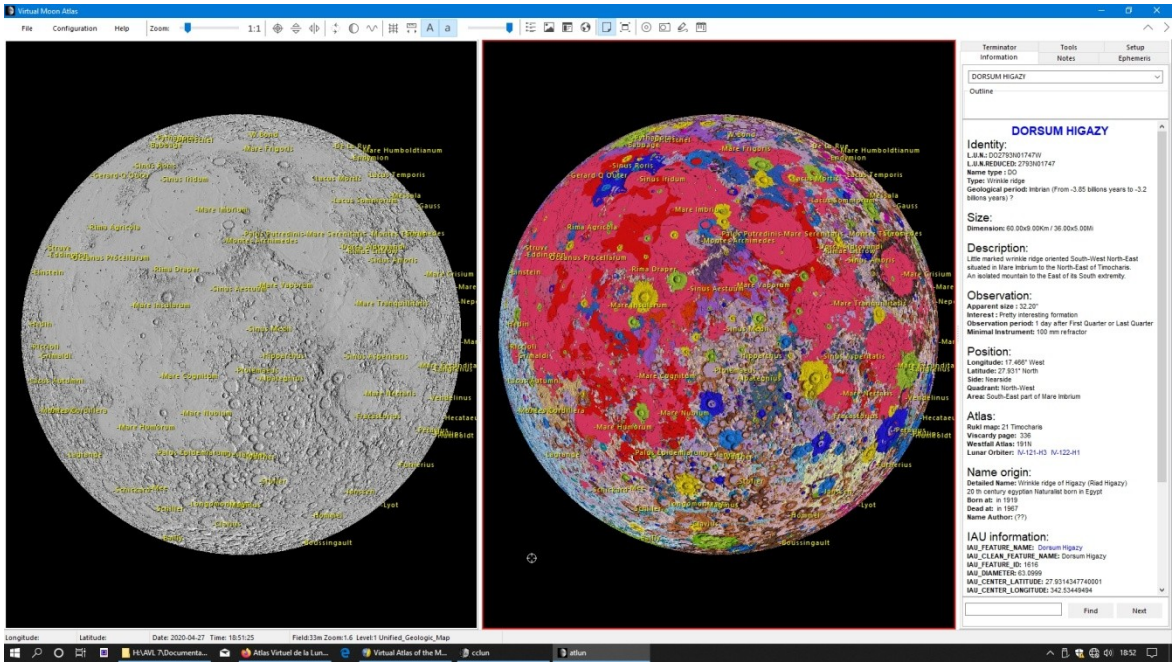
ATLUN

Mapping module of the Virtual Moon Atlas

Documentation for the VMA version 8

The AtLun module is the main module of the Virtual Moon Atlas (VMA) since it allows to generate lunar maps on the screen in the "Map" window. Its power is due to its link with the other components of the AVL: modules, databases, textures, historical textures, scientific layers, image libraries and now all documents outside the atlas linked through the new module NoteLun.

THE "ATLUN MODULE" SCREEN



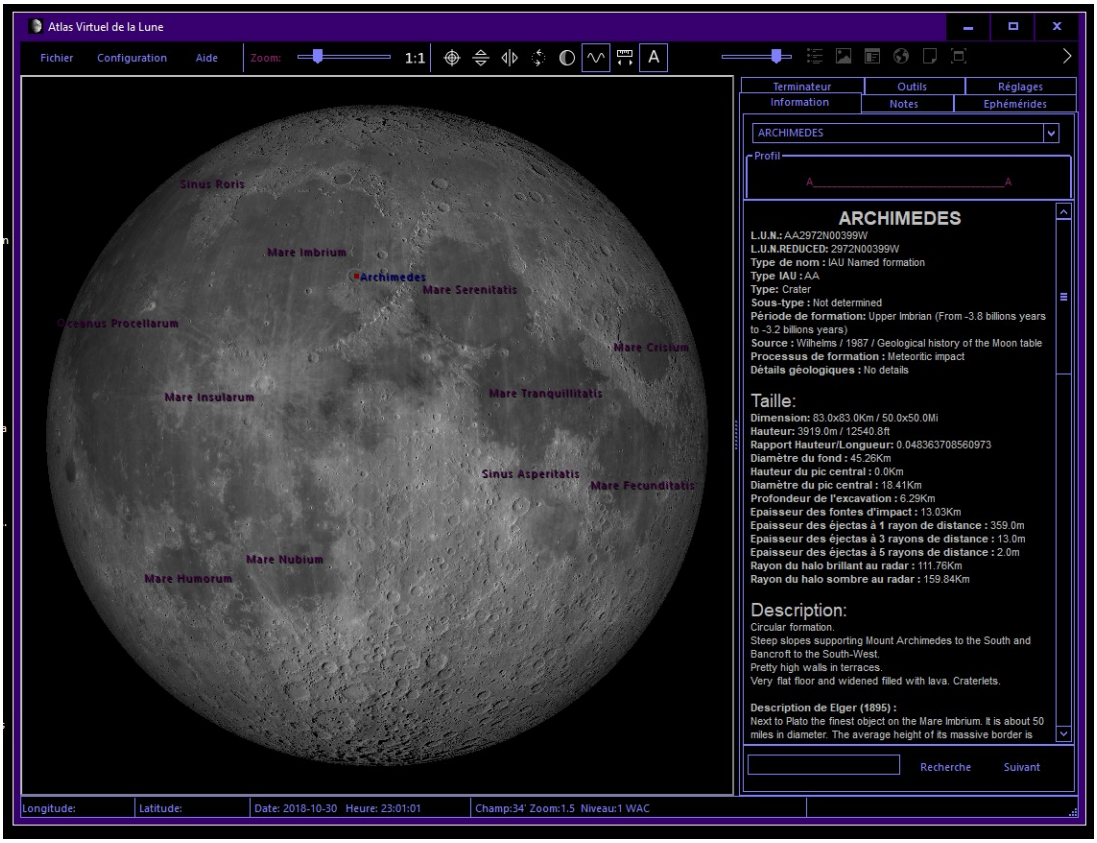
ATLUN screen on 16: 9/22 "monitor with:
Left : New texture "LOLA-Kaguya shaded"
Right : New texture "USGS Geological 2020"

"ATLUN" screen appears in a "Microsoft Windows style" window. As usual, you can minimize or maximize the window, or choose its size with the buttons in the title bar, on right.
You can open simultaneously two map windows, permitting maps comparisons as on the picture above. It's also possible to open the window of "DATLUN" (c), PHOTLUN (c), WEBLUN (c), NOTELUN (c), CALCLUN (c), and "PHOTLUN" (c).

This window includes:

- The menu bar and buttons
- The "Map" window can be split into two sub-windows as above
- The "Information", "Ephemeris", "Notes", "Tools", "Settings" and "Terminator" tabs with their associated windows that can be retracted or displayed on a second separate monitor if you have such a configuration.
- The status bar with a lot of information displayed in real time.

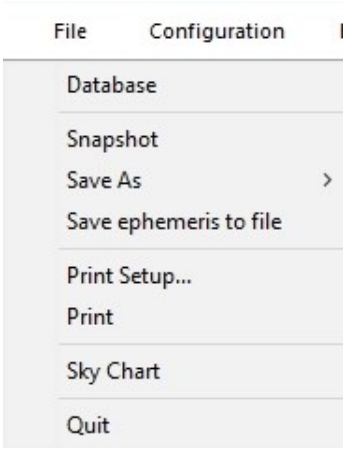
The VMA can use Windows dark themes to limit glare or for simple aesthetic reasons



THE MENUS AND BUTTONS BAR

This bar presents menus to access different functions and buttons to quick launch of some other useful functions.

THE "FILE" MENU



Traditional in all Windows softwares, this menu is used here to open DATLUN (c), save screen pictures, to setup printing, to launch Patrick Chevalley's freeware "**Sky Charts**" if it's installed on your computer, and to quit the atlas.

"Databases" FUNCTION

This function opens a new window containing VMA database manager **DATLUN**

"Snapshot" FUNCTION

This function can open a new small window containing a map window capture. You can compare this capture with a new configuration applied to the map window.

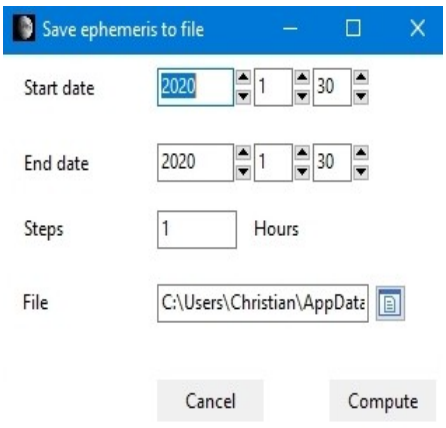
"Save as" FUNCTION

This function permits you to save the "**Map**" window as a .jpg or a .bmp file

"Printer setup" FUNCTION

This function permits you, with the use of the regular window selection, to choose your printer and to setup it.

"Save ephemeris to file" FUNCTION



This function allows you to save in a file "ephem.csv". It opens a window for choosing the deadlines, the recording step and the file saving directory. The "Compute" button creates the file from the specified dates and times. The button to the right of the "File" field allows you to choose the recording directory.

"Print" FUNCTION

This function allows you to print the documents you chose in the printed documents (Map, ephemeris and / or information page).

"Sky chart" FUNCTION

This option is used to launch Patrick Chevalley's freeware "Sky Charts" to determine Moon position according to stars and horizon. It can help you for star occultations for example.

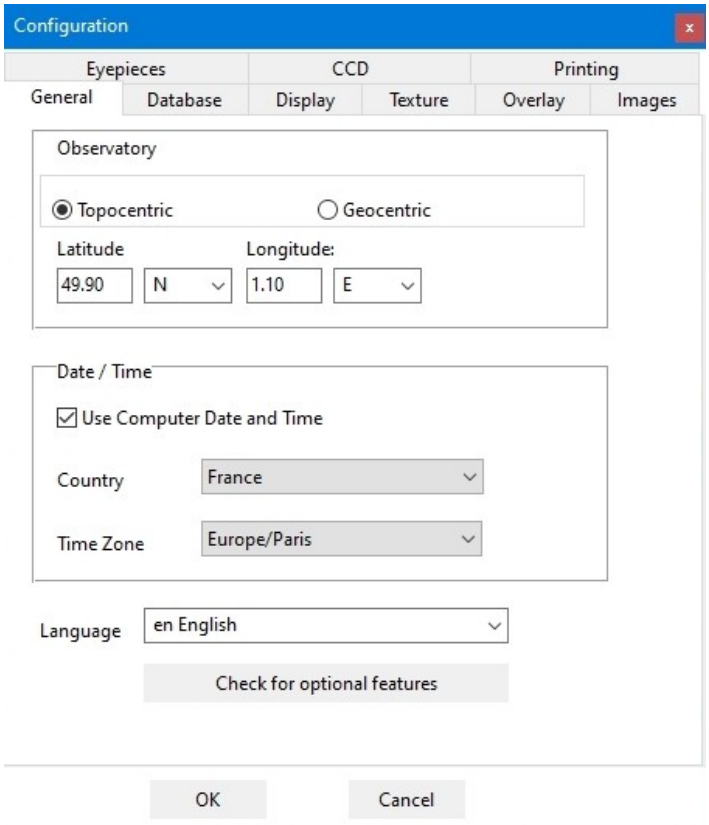
"Quit FUNCTION

You can leave the software using this option, closing all the open windows together.

THE "CONFIGURATION" MENU

This menu is used to adjust different parameters in **VMA**. It presents eight tabs

"General" tab



Observatory coordinates

Selecting "**Geocentric coordinates**", you will see the lunar globe as if you were positioned on the line joining the center of the Earth to the center of the Moon.

The software can instead use coordinates of your observing site to display a real time lunar disk with computations including diurnal libration.

To do this, you have to de-activate "**Geocentric coordinates**" (uncheck it) and input the latitude and longitude of your observing site.

Input also the time shift from GMT including eventual "summer time" in the "**Time zone**" field.

"Date / Hour" frame

The "**Date / Hour**" frame is used to precise the hour and the time zone to use.

Filling the box "**Use computer hour and time zone**" so that VMA use the computer internal clock as a reference.

If you don't fill the box, you can specify your own time zone with the case displayed.

"Language" scrolling list

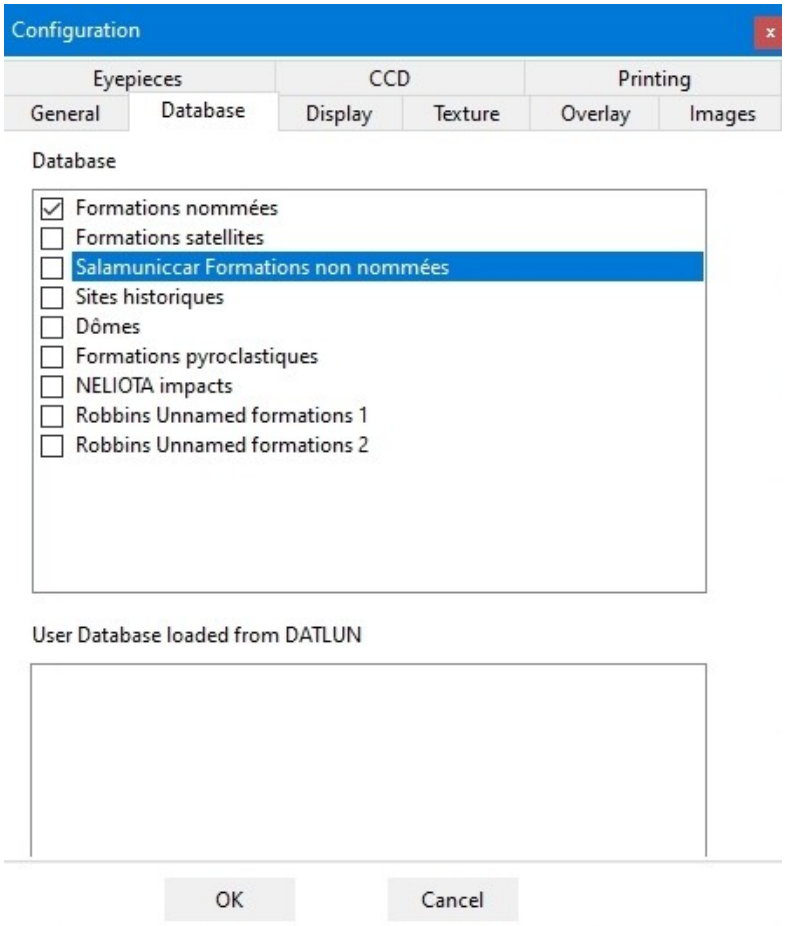
"**Languages"** scrolling list allows you to choose language used by the program and database. In this version, beyond French and English are now available in alphabetical order :

- Catalan
- Czech
- Dutch
- German
- Greek
- Hungarian
- Italian
- Lituanian
- Slovenian
- Spanish

You can also download from VMA Internet site, translations of words used in the menus in some other languages. Translation pages indicate if database translations are also available. You can also propose yoyrself to Patrick Chevalley if you are interested to translate VMA in your language if it's not yet done.

We would like th thank here the authors of the existing translations for their support to our action.

"Databases" tab



"Databases" boxes

The displayed databases are those automatically recognized by ATLUN.

"**Databases"** boxes allow you to choose the databases used together by the software.

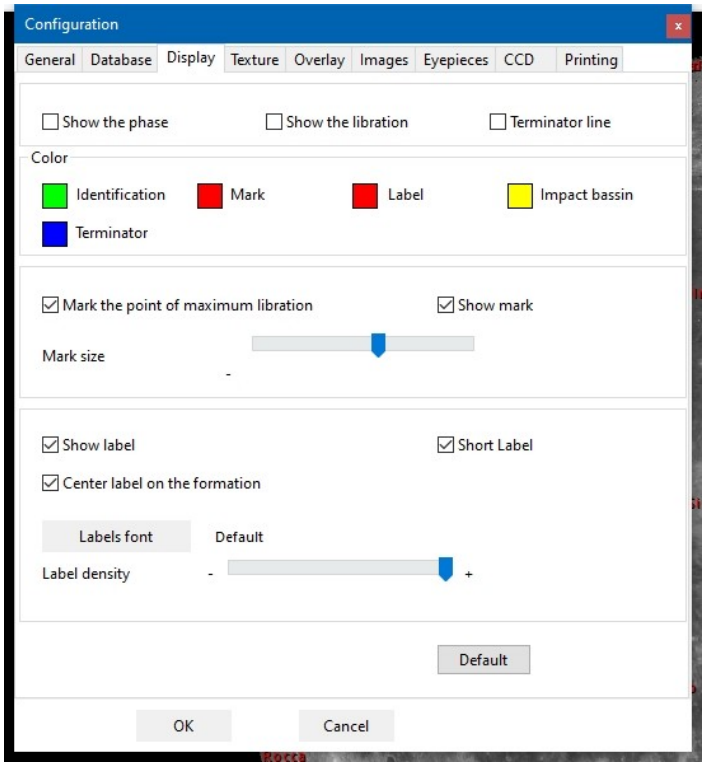
Check only the one useful if your computer is not too powerful.
When all databases are selected, VMA has more than 1 300 000 entries to manage.

The "**DATLUN Personal Databases**" frame allows you to enter the access paths of the personal databases that you wish to link to ATLUN and DATLUN.

Please note, these databases must be in "**csv**" format and have the same fields as the databases developed for VMA by Christian Legrand. The import procedure is described in the DATLUN manual and in the DATLUN program itself.

New databases are constantly on work and are released with new VMA versions.

"Display" tab



Display boxes

When clicking the "**Show the phase**" box, a penumbra zone is painted on the lunar globe. Its limit follows the terminator for the date and hour set by the user (See "Ephemerisis tab"). You can set the penumbra properties representation (See "Setup tab").

When clicking the "**Show the libration**" box, the lunar globe turns slightly so that it shows the effects of the global libration for the date and hour set by the user (See "Ephemerisis tab"). You can set the penumbra properties representation (See "Setup tab").

The libration display takes account of the latitude libration due to the Moon orbit inclination and of the longitude libration due to the Moon variable speed on its elliptical orbit. More, if you choose to input your observing site coordinates (See "Observatory coordinates"), the Moon globe will takes account also of the diurnal libration.

Colors

Clicking on the small colored squares allows you to choose colors indicating point and formation name label displayed on map.

You can also choose the color of the circles of the impact basins when this database is activated in the "Databases" tab.

You can also choose the color of the line materializing the lunar terminator in the "Map" window.

Labels and marks

Activating the corresponding boxes will make you display a point showing the chosen formation and / or its official name

When clicking on the "**Mark the point of maximum libration**" box, an arrow is displayed on the lunar limb where libration effects are maximum.

Activating the corresponding boxes, you display the point (mark) showing the chosen formation, its official name, and the names of the other principal formations visible on the map.

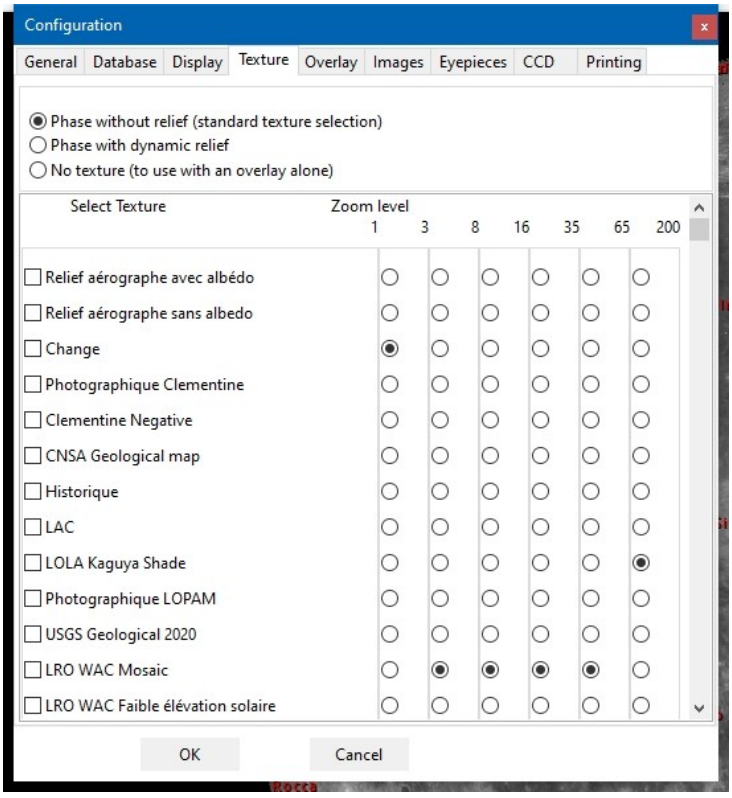
You can choose to center or to place on the right of the formation when using or not the "**Center label on formation**" box.

The button "**Labels font**" can be used to setup font type, size and style. The active font name is displayed right to the button.

The slider "**Label density"** can be used to setup the number of names displayed. You will certainly have several tests to determine the best compromise. These button and slider are also used to setup map printing because the printed map is exact clone of the map displayed in the screen window.

These two setups are also used to set the maps impression since the printed map is the exact copy of that displayed in the window.

"Textures" tab

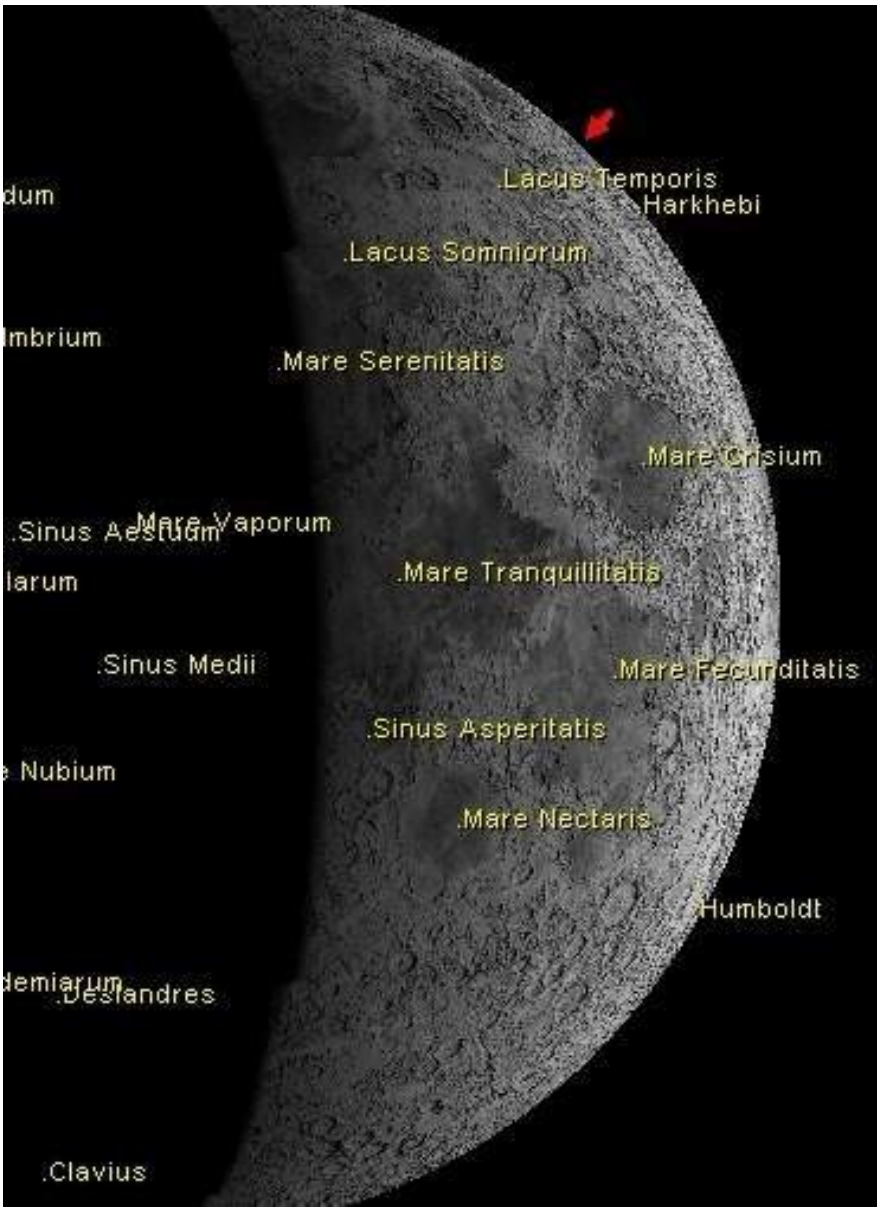


This tab allows you to choose the textures to apply depending on the zoom level reached.

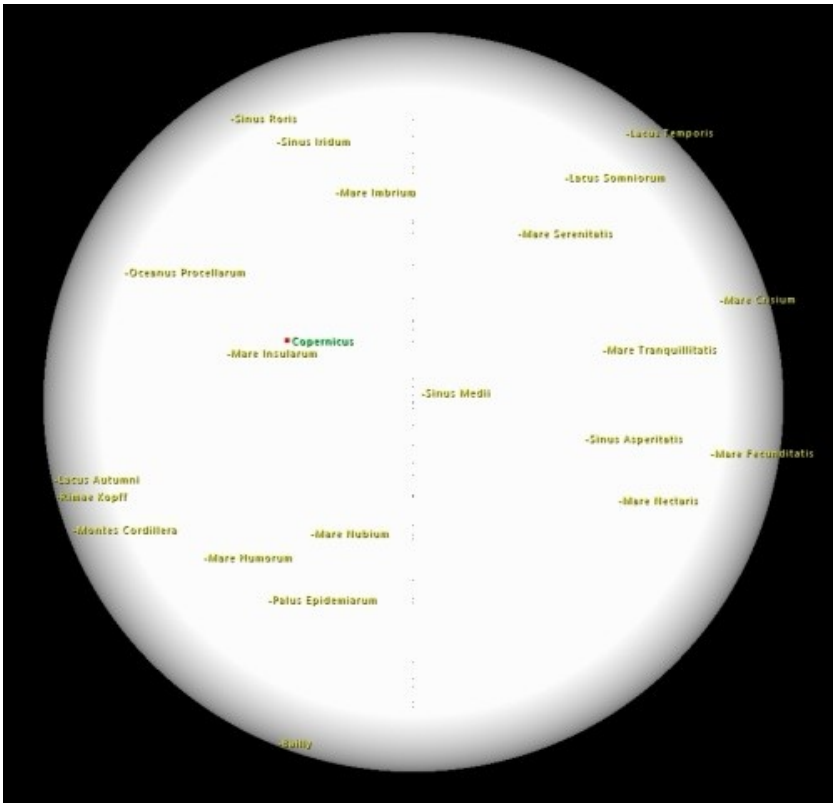
- Phase without relief (at the terminator)
- Phase with dynamic relief depending of the lighting on the terminator
- No texture (To use scientific overlays without relief underneath

« Phases » frame

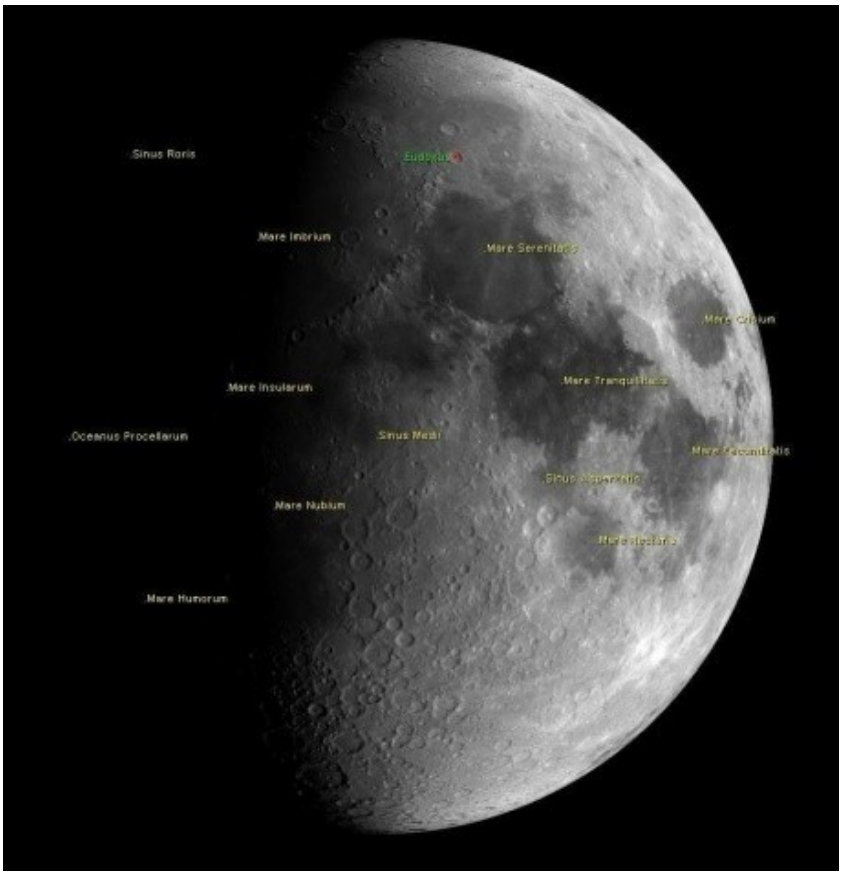
The three alternative boxes to check "**Phase with relief"**, "**Phase without relief**" and "**No texture**" are used to choose whether or not to activate the dynamic display of shadows at the terminator:



Phase without dynamic shadows on terminator

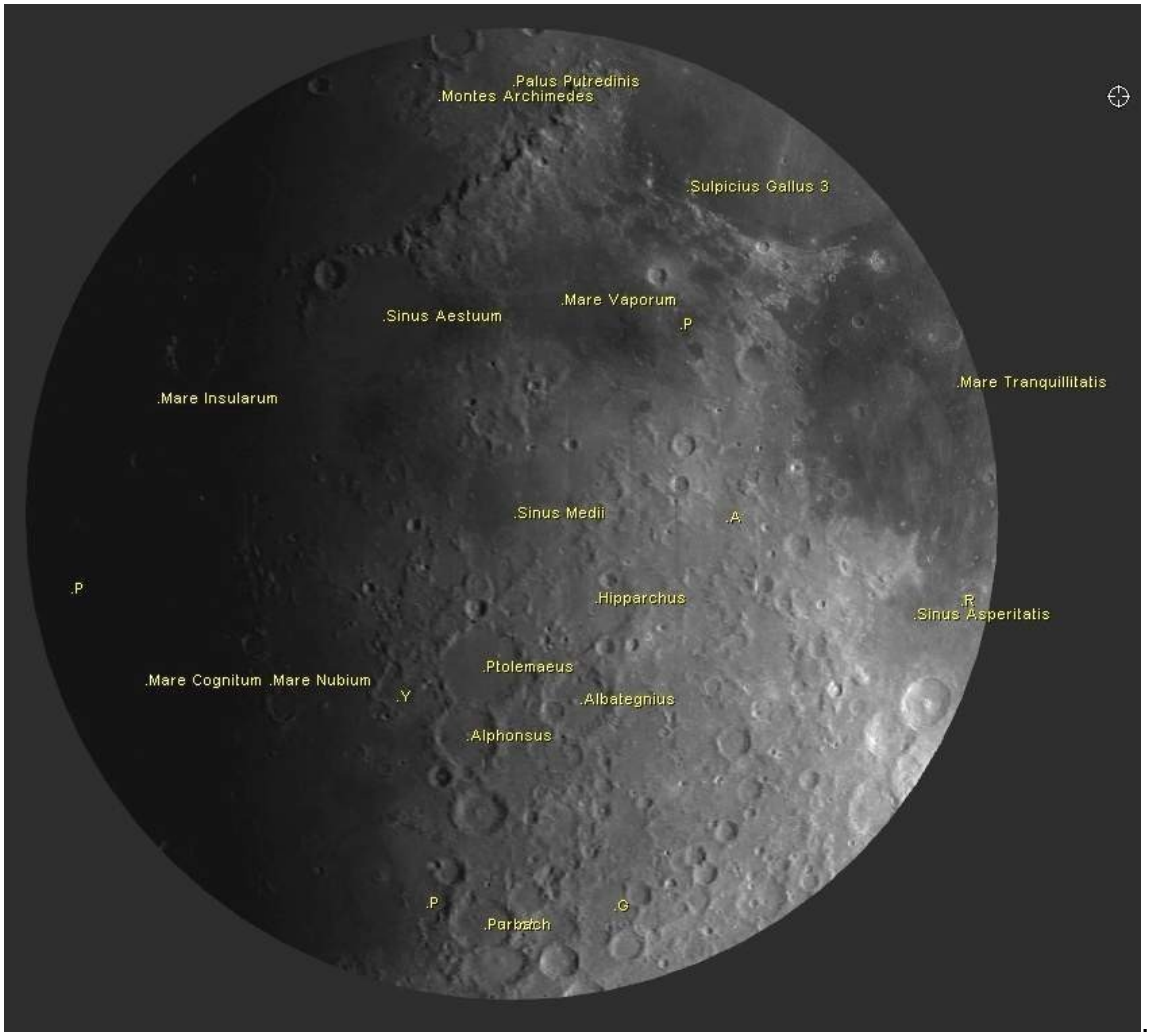


With display "Not texture", blank globe that can receive a single scientific layer



Phase with regular "Dynamic shadows" display on the terminator

This option gives a more realistic view, but doesn't permit a high power zoom. The use of the new « Digital Elevation Model » coming fron LRO probe datas has improved the shadows on terminator compared to our previous DEL and which can be really compared to the eyepiece view.



Eyepiece field with special "LRO dynamic shadows" display on the terminator.

You don't dream. This is a computer generated view, not a digital picture taken at the eyepiece of an instrument !

Beware : remind that it's not possible to use scientific overlays when using dynamic shadows.

Textures selection

This tab presents a matrix for selecting textures according to the applied zoom level. This function is a very useful way for choosing the textures display.

The program will detect automatically which textures are present (High Resolution or Very High Resolution) and will permet access to the maximum zoom level available with them.

You can choose to keep the same texture for all zoom range or select as above a progressive change parallel to the zoom change.

You have just to select the wished radio button. There can only have one texture choosen for a given zoom level

If you don't want to see any texture, fill the "No texture / To use with an overlay alone"

We think that it's better to use textures with increasing resolutions according to increasing zoom level. This is the choosen solution in the above exemple.

There are 6 resolution levels for the texture. The software loads automatically the levels indicated according to the zoom applied to the map.

The "Airbrush Relief" textures with or without albedo and the "Negative Clementine" texture have only 2 levels
The texture "USGS Geological 2020" and "China geological 2022" go to level 3
The “Positive Clementine” texture has 4 levels.
The “LAC” texture has 5 levels
The “LRO WAC”, “LRO WAC Big shadows”, “Photographic LOPAM”, “LRO-Kaguya shaded” and “Chang’é 2” textures have 6 levels.

The textures "Airbrush with albedo", "Airbrush without albedo" show the details visible in amateur telescopes up to 200 mm in diameter.

The textures "Clementine photographic" and "Chang’é 2 photographique" are used to show the aspect of the formations under the highest possible solar lighting.

The "LRO-Kaguya" texture is particularly suitable for displaying scientific layers.

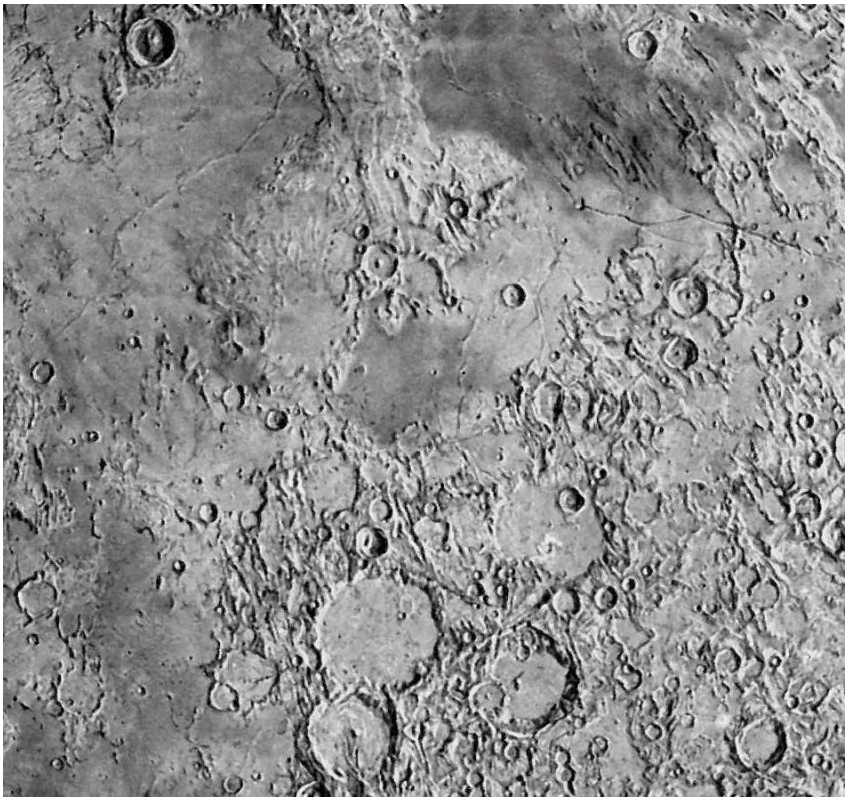
« Topographic textures » choice

The "matrix" checkboxes allow you to choose the high definition textures. The screenshots below show you the Alphonsus crater at maximum zoom for comparison. Twelve textures are available:

The following screen captures show you the Alphonsus crater area with maximum possible zooming with each texture as in the above exemple. Six textures are available :

- **"Aerographe with albedo"**

(USGS aerograph drawing realized from Clementine probe pictures with a uniform shadow, by David Seal from JPL and his team). In this "Expert" version, maximal resolution "**Full**" is 1 km / Pixel.

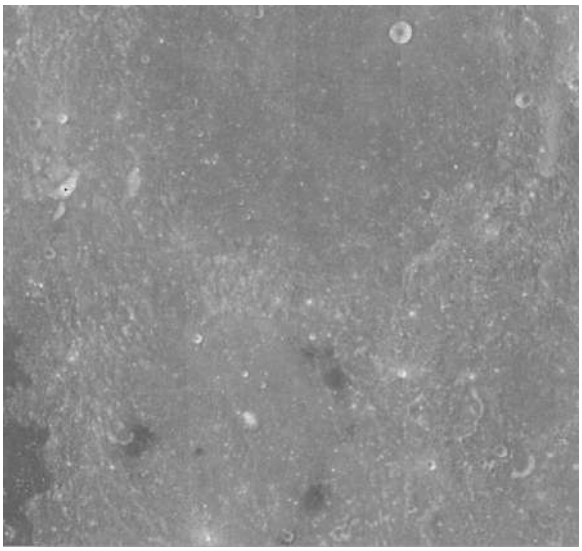


- "**Airbrush relief map**"

(Aerograph drawing without albedo hues realized from Clementine probe pictures realized by US geological Survey / USGS team, copyright USGS / Astrogeology). Improved by ChristianLegrand. This texture reaches a definition of 500 m / pixel. It is now of less interest given the addition of the LOLA-Kaguya-Shaded texture (See below).

- "**Clementine Photographic**"

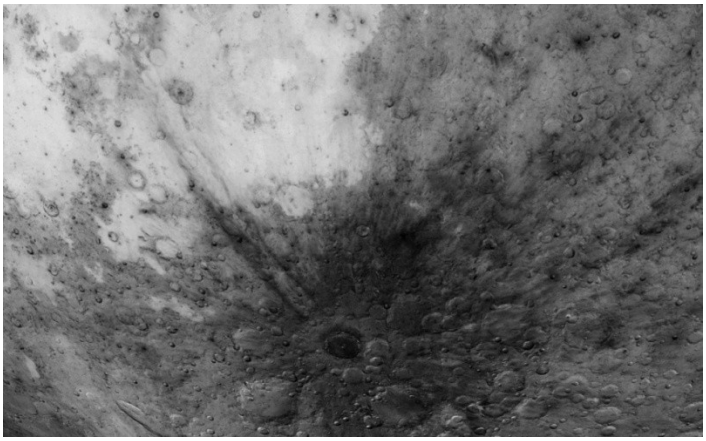
(Mosaïc of Clementine probe pictures realized by professor Mark S. Robinson, and his team of "Northwestern University", copyright USGS / Astrogeology).
This texture has a 200 m resolution. It's the most precise "**albedo texture**" presently available in computer lunar atlases. It’s one of the textures showing lunar formations without any shadow.



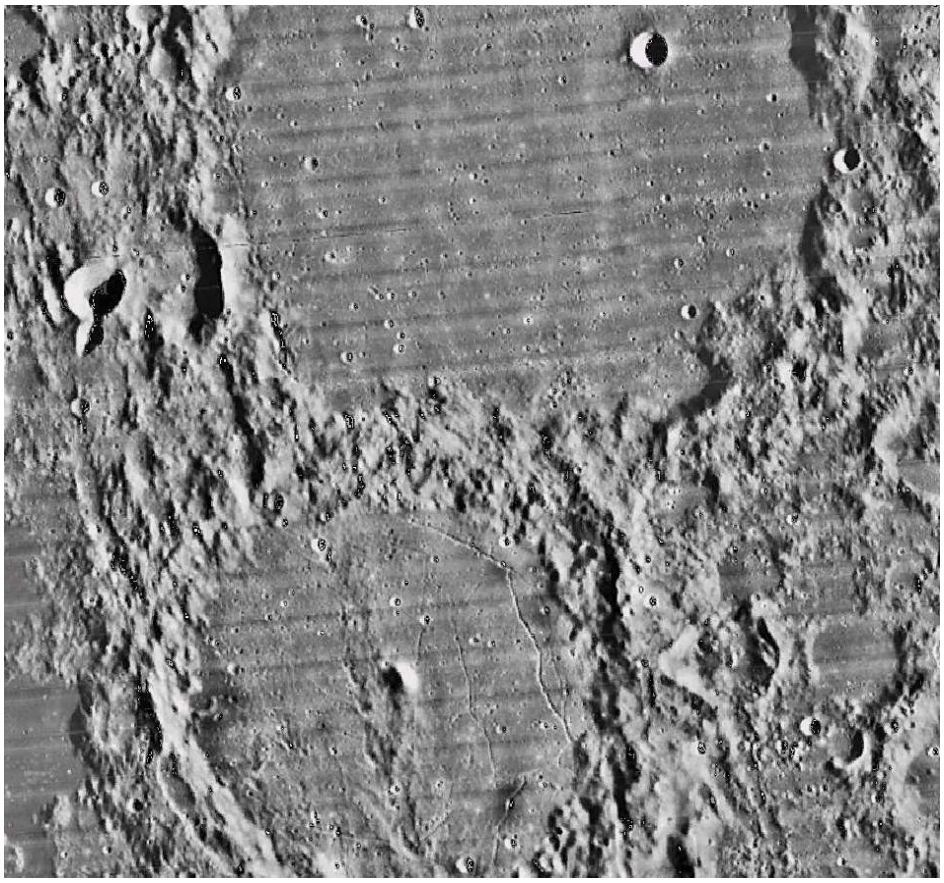
Important note : This texture has been built from Clementine original pictures treated by USGS. This is a remarkable work according to the amount of difficulties that have been encountered. This treatment can induce some formations distorsion at the borders of the plates. Also the position of some formations can be shifted slightly from its real place. We suggest you to confirm the exact aspect of a formation with the aerograph texture if you want to realize a precise survey..

- **"Clementine Negative"**

Mosaic of original photographs of the Clementine probe produced by Professor Mark S. Robinson, with his team from "Northwestern University", copyright USGS / Astrogeology. The texture obtained was then "inverted". This texture reaches a definition of 200 m / pixel. It is the only texture showing the "negative" formations, making it easier to visualize certain formations, in particular the ejecta of craters or recent craters.



- "**Lunar Orbiter Photographic VHR** / **LOPAM**" (Mosaïc of Lunar Orbiters 1, 2, 3 and 4 probes pictures based on new USGS realease, (copyright USGS). In this "**Pro**" version, this texture has a variable resolution that goes to 60 m/pixel resolution on the best places . It is a "texture with "shaded relief" benefiting from solar lighting at about 45 °.



Important note : This texture has been built from Lunar Orbiter original pictures that have been partially "destripped", redimensioned and rotated by USGS. This is a remarkable work according to the amount of difficulties that have been encountered.

This heavy treatment can induce some formations distorsion at the borders of the plates. Also the position of some formations can be shifted slightly from their real place. We suggest you to confirm the exact aspect of a formation with the aerograph texture if you want to realize a precise survey.

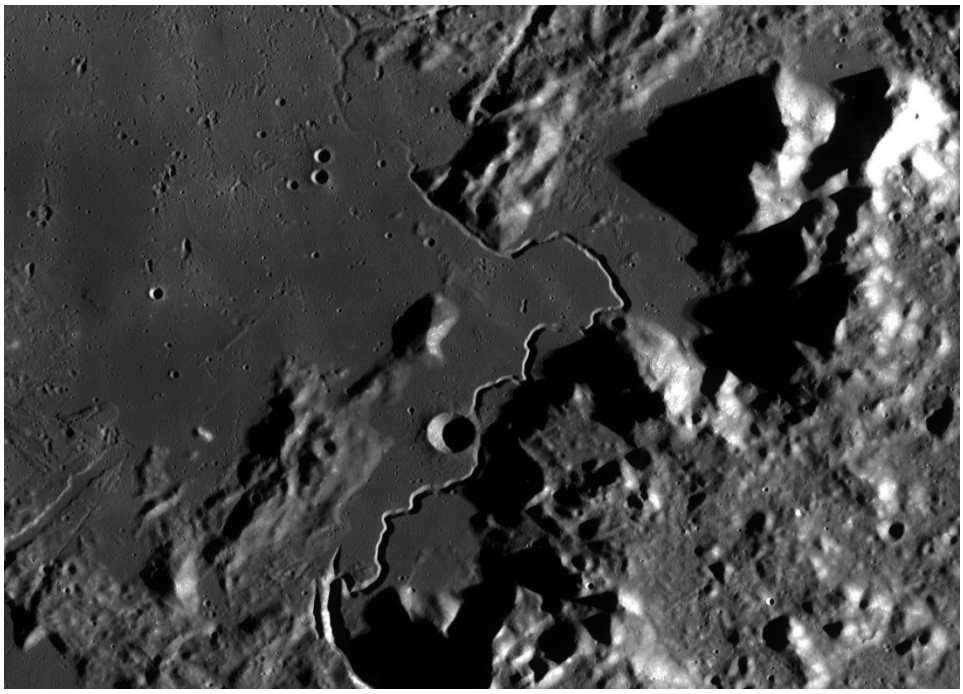
- "**Lunar Reconnaissance Orbiter Photographic VHR** / **LRO**" :

Mosaïc of original Lunar reconnaissance Orbiter pictures based on new USGS realease, (copyright USGS). In this "**Pro**" version, this texture has a variable resolution that goes to 60 m/pixel resolution on the best places . It's a "**shaded relief texture**" realized with a more vertical lighting than the previous LOPAM.

Important note : This texture has been built from Lunar Reconnaissance Orbiter original pictures. It has the very big advantage to be calibrated with the most precise lunar coordinates system available (Better than ULCN 2005) and this coordinates are also used in the new IAU lunar formations nomenclature now included in the VMA Pro 6 databases. So lunar formations are well centered with their labels on this texture.

- "Lunar Reconnaisance Orbiter Photographique VHR / LRO "Big shadows" "

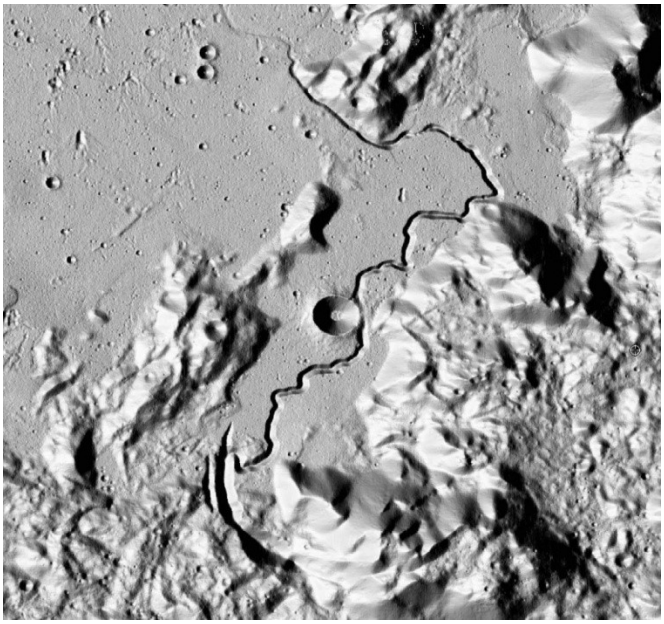
Mosaic of original Lunar Reconnaissance Orbiter images from USGS data, copyright USGS. In the present version 8, this texture has a variable resolution reaching 60 m / pixel in the best places. This is an "emphasized shadow relief texture" established with more horizontal sunlight than the previous VHR/LRO texture.



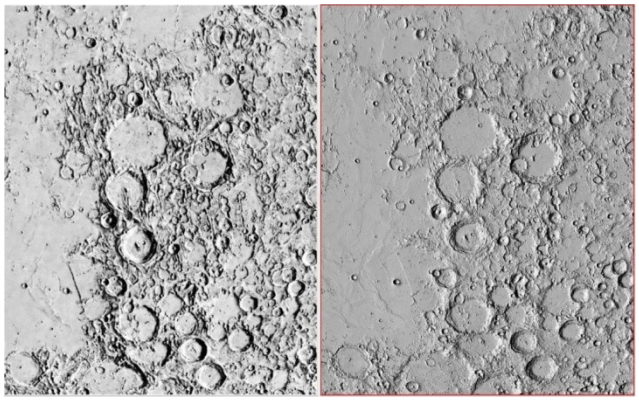
Important Note: This texture was built from the original LRO images. It has the enormous advantage of having been calibrated with the most precise possible coordinates of the lunar coordinate system (better than ULCN 2005) and these coordinates have been used in the new nomenclature of lunar formations of the International Astronomical Union included in the VMA 8 databases. Therefore, in the VMA, the IAU lunar formations are well centered with their labels on this texture.

- **"Lunar Reconnaisance Orbiter - Kaguya Shaded"**

Mosaic of the original images of the Lunar Reconnaissance Orbiter (USA) and Kaguya (Japan) probes from USGS data, copyright USGS. In this version 7, this texture has a variable resolution reaching 60 m / pixel in the best places. It is a "texture with shaded relief". It is not a photograph, it was established by computer from the altimetric data collected by the two probes to create a DEM (Digital Elevation Model). The initial texture only includes areas between -60 ° and + 60 ° latitude. Patrick Chevalley has reconstructed the polar zones from other LRO data.



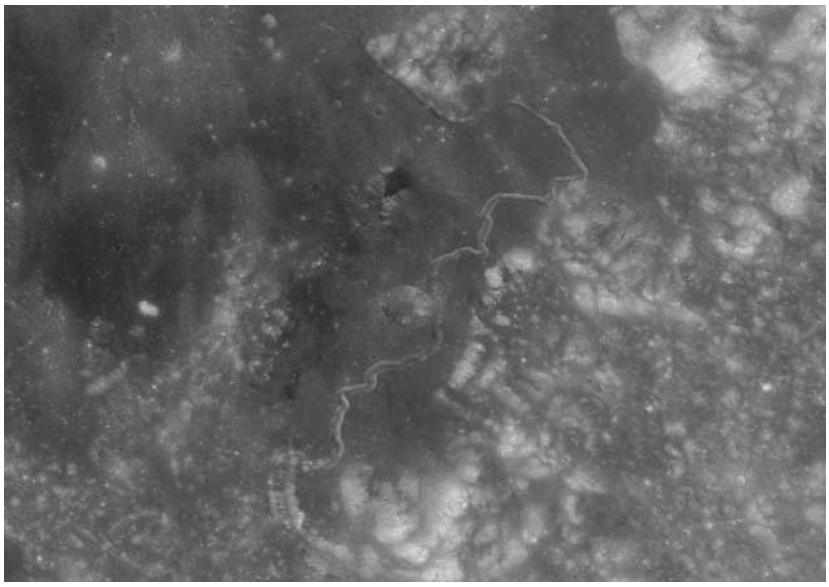
This texture now advantageously replaces the "Aerograph ss albedo" texture.



"Aerograph ss albedo" "LOLA-Kaguya-Shaded"

- **"Chang'é 2 photographic VHR"**

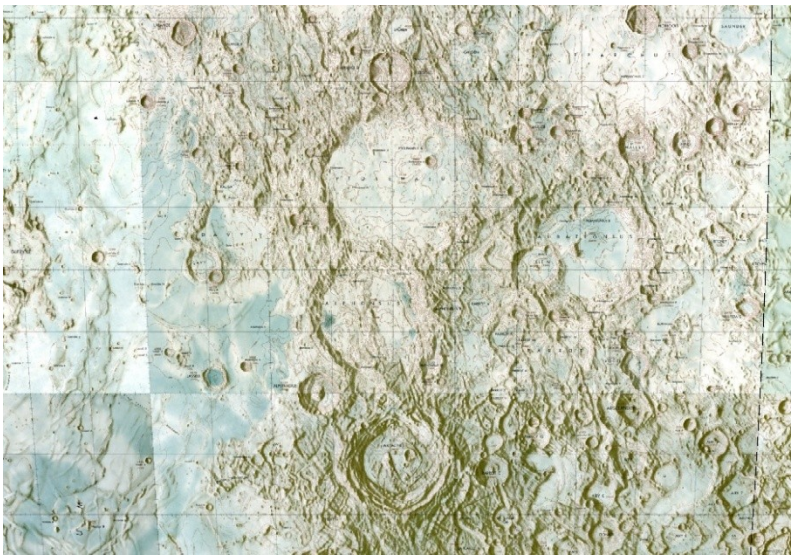
Mosaïc of original Chang'é 2 probe published by chinese authorities in february 2012 pictures based on new USGS realease, (Copyright China National Space Agency / CNSA). In this version 8, this texture has a variable resolution that goes to 60 m resolution on the best places . It's a "**not shaded relief texture**" as that of Clementine. It's the most resoluted texture available without stripes (Not as LOPAM).



Important note : This texture has been built from Chang'é 2 original pictures. This texture is not associated to the new lunar coordinates system of IAU. CNSA has brought very attention so that this mosaic will be the most precise possible with their own datas. Nevertheless, some formations labels can be slightly shifted from their image.

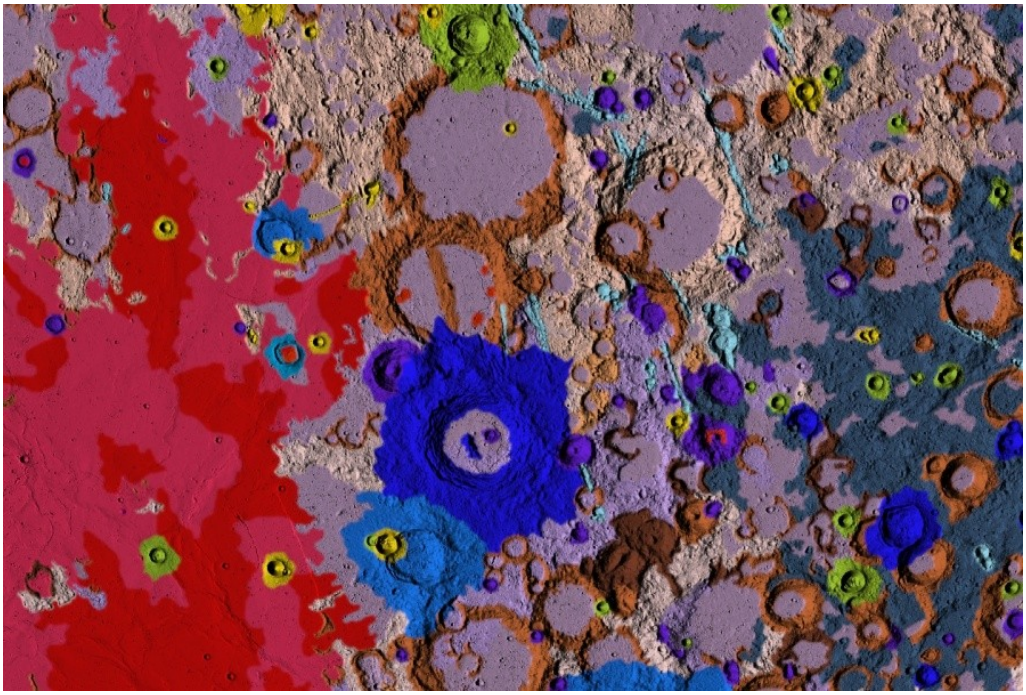
- **"LAC"**

Assembled scans of the Lunar Aeronautical Charts made by David O'brien of the Lunar and Planetary Institute with permission from the Lunar & Planetary Institute (LPI) and kindly made available for use in the AVL/VMA. A big thank you to all for this active participation.



- "**USGS Unified geological Map of the Moon**"

Compilation of datas collected by various probes on the age and composition of lunar terrans realized on 2019. This map drawn by Corey M. Fortezzo (USGS), Paul D. Spudis (LPI), and Shannon L. Harrel (SD Mines) for the U.S. Geologic Survey / Astrogeology Science Center in Flagstaff makes différence of the terrans types by colors. It's the most precise geological of the Moon today. We have applied it on the "LOLA / Kaguya Shaded" texture to associate it to the relief.



The caption is the following :

This legend is accessible in the "Right click" menu of the mouse.

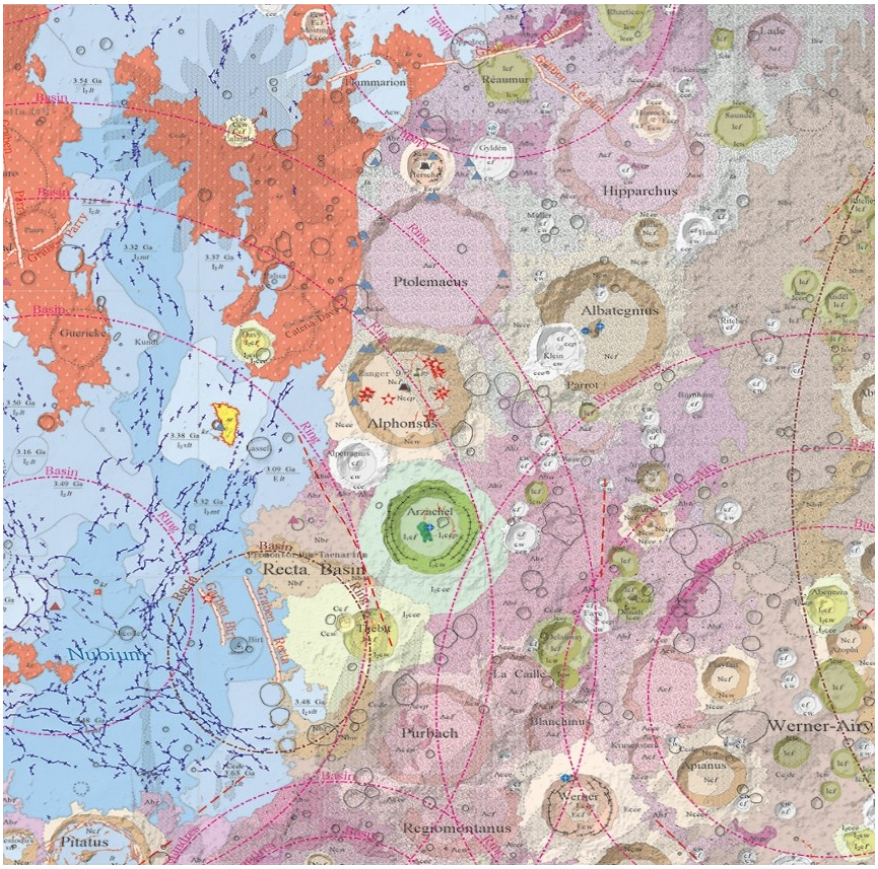
Important note: This texture was built by the USGS and LPI teams and is linked to the new IAU lunar coordinate system.

- "**CNSA Geological Map**"

Compilation of data provided by various Chinese probes of the Chang'é class on the age and composition of the lunar terrains produced in 2021. This map drawn up by J. Ji, D. Guo, J. Liu et al. differentiates the types of terrain by a color code. It is the most accurate lunar geological map to date. The original map can be downloaded at the following address:

The 1:2,500,000-scale geologic map of the global Moon, Science Bulletin,

https://doi.org/10.1016/j.scib.2022.05.021



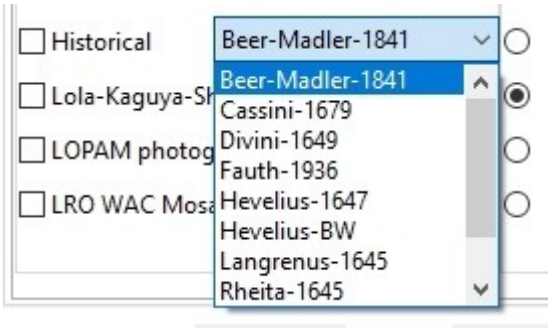
The associated legend in English describes in detail the different types of terrain associated with the colors. There is a version with legend in Chinese.

This legend is accessible in the "Right click" menu of the mouse.

Important note: This texture was built by the teams of the Center for Lunar and Planetary Science, Institute of Geochemistry, Chinese Academy of Sciences, Guiyang 550081, China

Available historical textures list

The box "Historical" gives access to a scrolling list of the historical textures used by VMA 8.



The following screen captures show you old maps extracts adapted to VMA. Four textures are available today and several others will be processed soon.

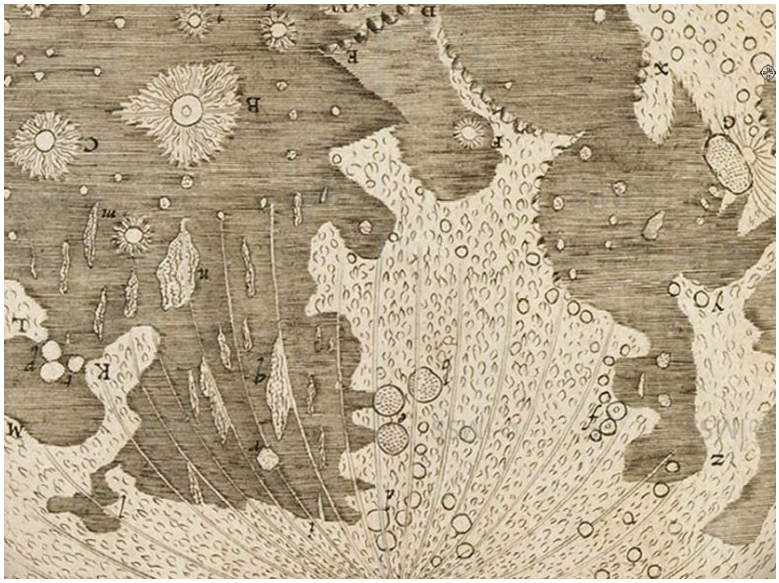
Important note: These textures realized from old maps without any coordinates system induce sometimes large shift between some formations and their labels. More, as they are Nearside maps, when apllied on the whole Moon globe, the Farside is not drawn.

"Langrenus 1645"

Texture from a map established by Michael Florentius Langrenus on 1645 and called : "Plenilunii - Lumina Austriaca Philippica". Note the completely different names compared to the present IAU nomeclature but some of them.

"Rheita 1645"

Texture realized from the map established by Anton Schylde de Rheita in 1645 and included in his "Oculus Enoch and Eliae sive Radius Sidereo Mysticus".

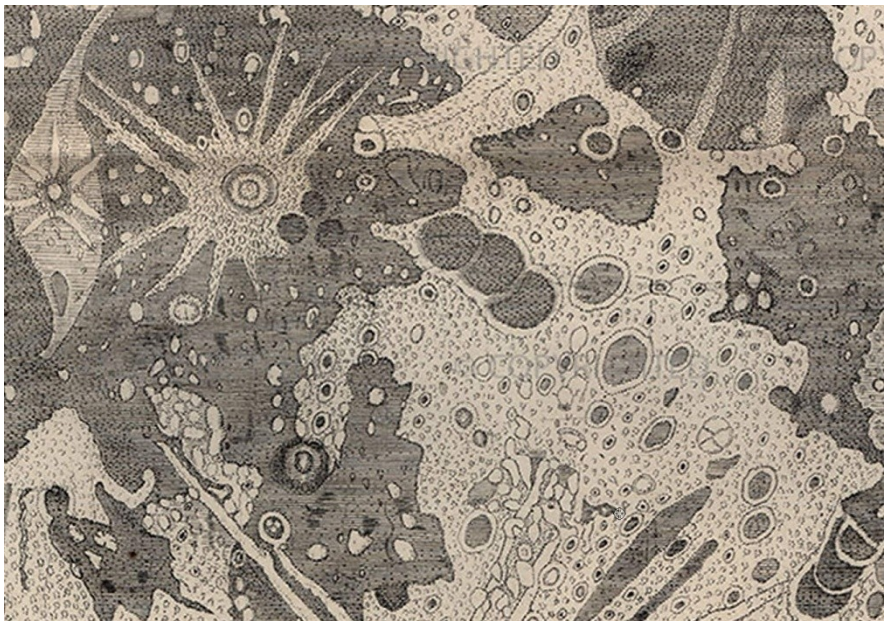


"Hevelius 1647" Color and black and white

Texture drawn on the basis of the map of Johannis Hevelii (or Ioanne Hevelio) and published on 1647 in his book "Lunae Descriptio". The orifinal map owns two extensions for the NE and SW librations not available in the texture. There is also a B&W version and some versions withouit any names. B&W versions can be engraved or gray scaled printed

"Divini 1649"

Texture realized from the map established by Eustachio Divini in 1649. It is an extrapolation of the map of Hévélius and not an own creation.



"Riccioli 1651"

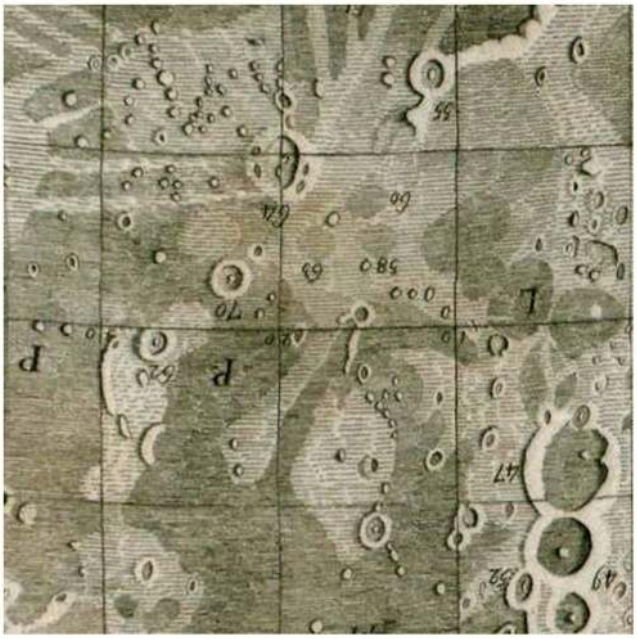
Texture realized from the map established by Francesco Grimaldi in 1651 which incorporated the nomenclature of Giovanni Riccioli, nomenclature which is still widely used today.

"Cassini 1679"

Texture drawn on the basis of the map of Giovanni Domenico Cassini (Jean-baptiste Cassini I) on the basis of observations with measures to the eyepiec and presented to the French Academy of Sciences on 1679. It was the most precise lunar map in its era. It was 52 cm in diameter and have been engraved on the basis of drawings by Sébastien Leclerc and Jean Patigny.

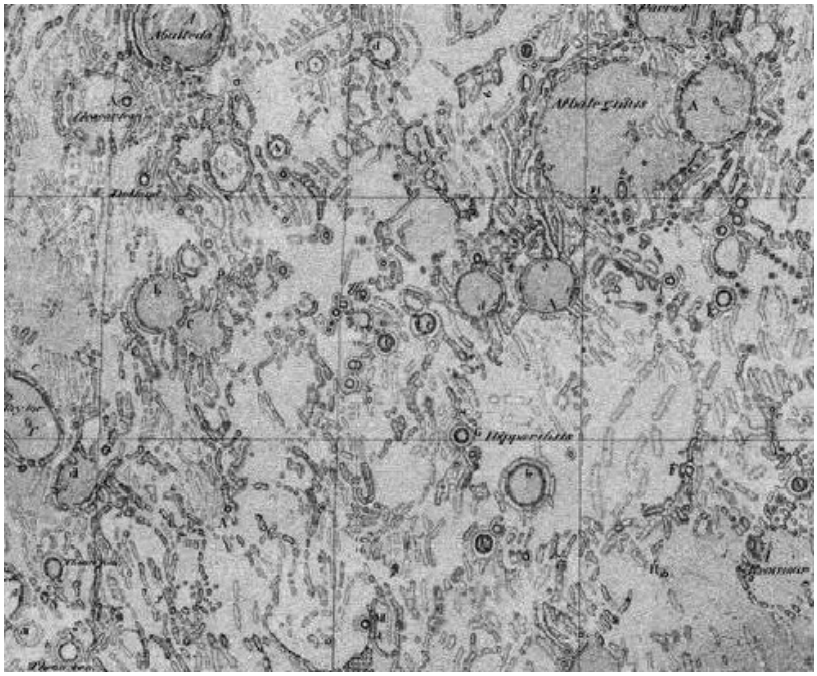
"Tobias Mayer 1791"

Texture built from the map of Tobias Mayeri on 1791 and published under the name of "Tob. Mayeri Tabula Selenographica".



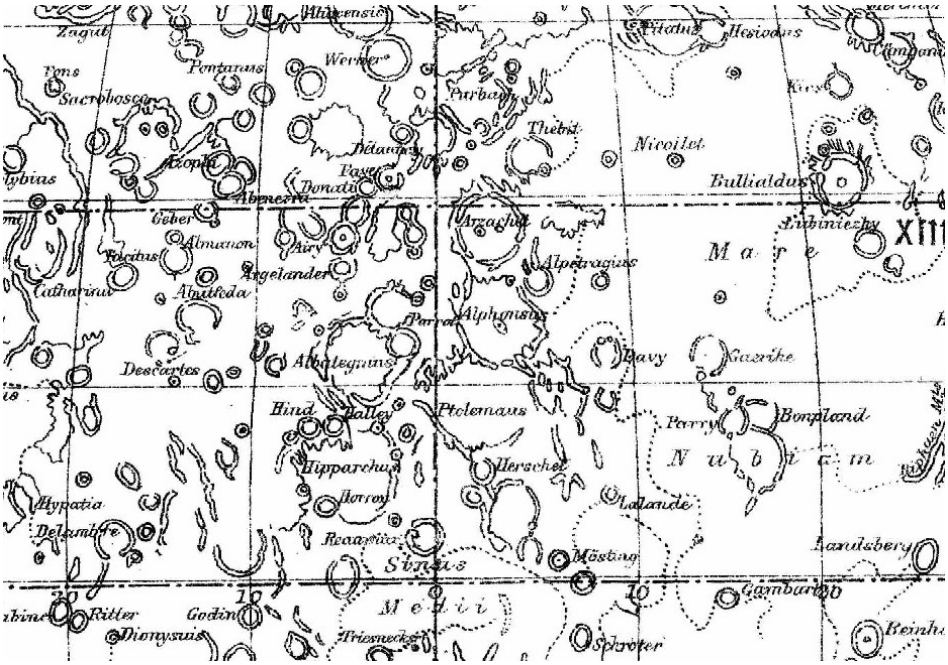
"Beer & Madler 1845"

Texture established from the map drawn up by Wilhelm Beer & Johann Heinrich Mädler in 1841 and published under the name of "Mappa Selenographica".



"Neison 1881"

Texture established from the map established by Edmund Neison in 1881 and published under the name of "Unser Mond".

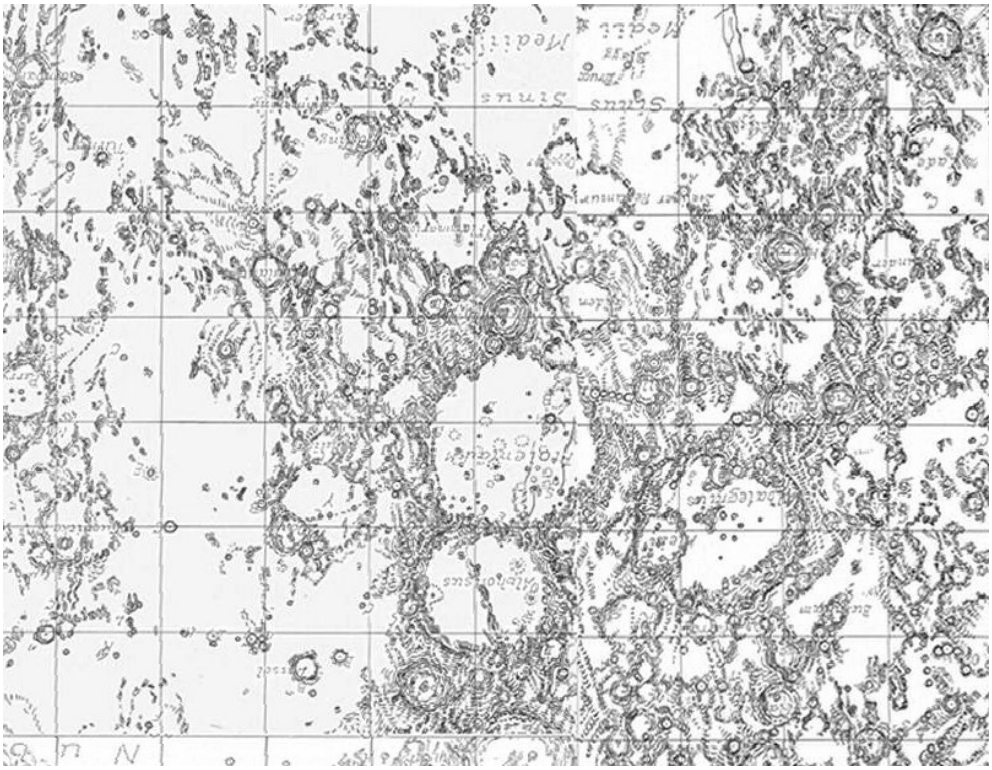


"Elger 1895"

Texture established from the map established by E. G. Elger in 1895.

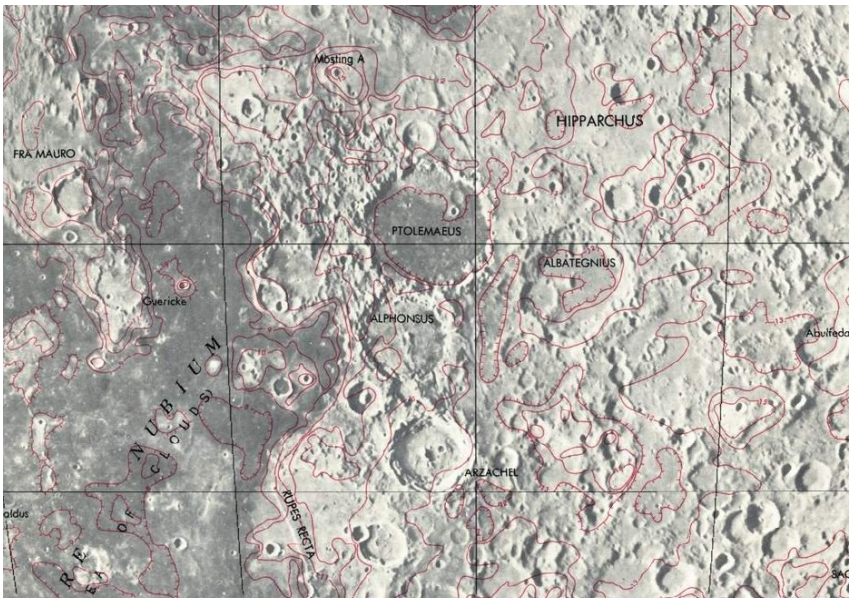
"Fauth 1936"

Texture established from the map established by Fauth in 1936 and published under the name of "Unser Mond".

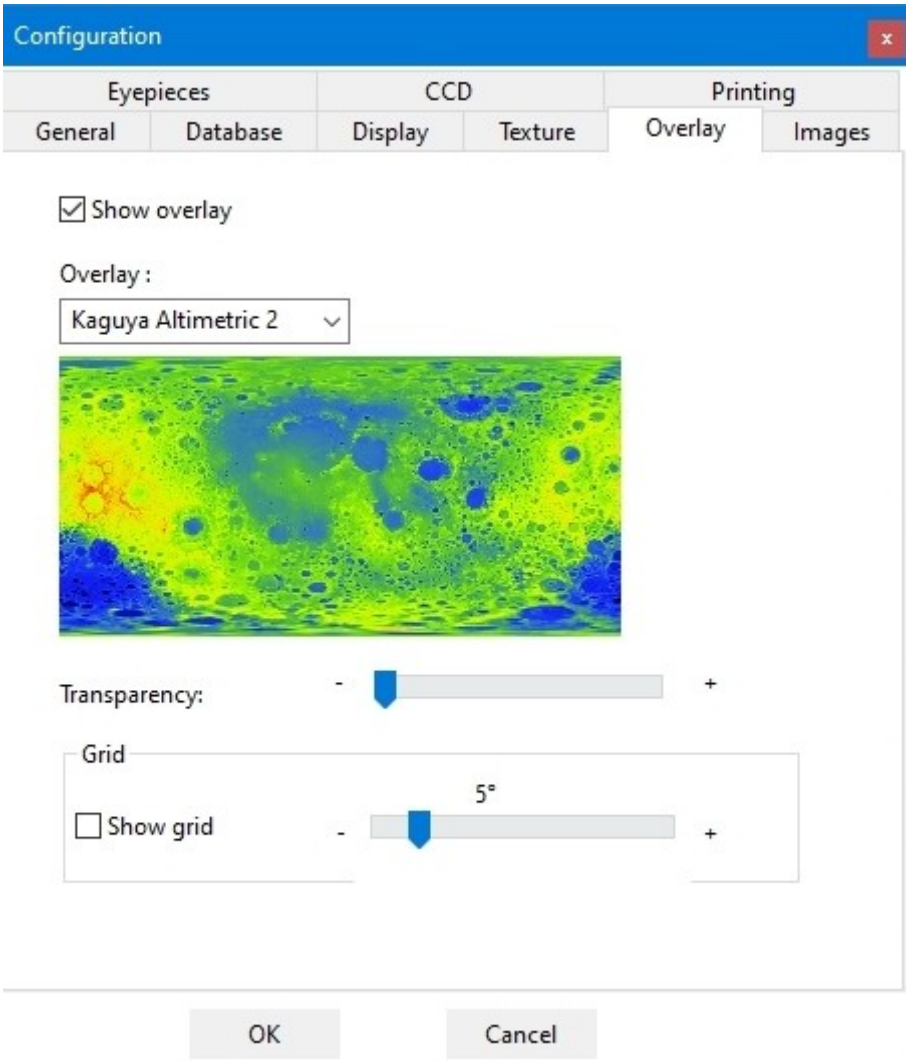


"Lunar Albedo Reference 1967"

Texture established from the "Lunar Albedo Reference" map established in 1967. This map was drawn by the Aeronautical Charts and Information Center of the US Air Force on behalf of NASA in 1967 under the supervision of Gerald Kuiper.



"Overlays" tab



The VMA includes the possibility of applying an overlay over the texture chosen in the "**Textures**" tab, the transparency of which can be adjusted to continue to see the texture used below. These overlays are maps for transposing scientific data from space missions (Clementine, Lunar Prospector, Kaguya, Lunar Reconnaissance Orbiter (LRO), Gravity Recovery and Interior Laboratory (GRAIL), Chandrayann 1, Chang'é), but also layers of colors and finally, the geological map of the entire lunar globe. This technique makes it possible to show for each lunar formation, its relationship with the available scientific data.

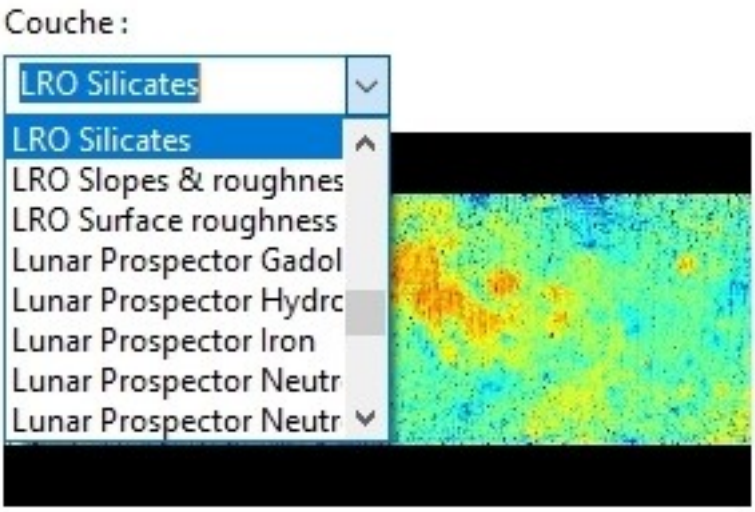
The texture "LRO - Kaguya - Shaded is recommended for the application of scientific layers. You can also choose not to display a texture in the" Textures "tab of the" Configuration "menu.

We are continually looking for new data posted online that can be incorporated into the AVL.

"Show overlay" Box

If you fill the "**Show overlay**" box, you display the overlay choosen with the scrolling list below over the choosen texture.

"Overlays" Scrolling list

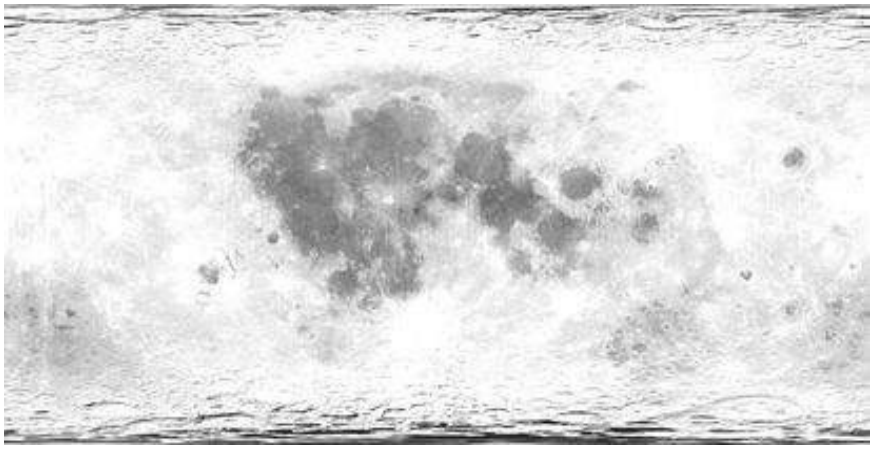


If you activate the scrolling list, you can choose in the list the overlay that you need. Here are the list of the overlays presently involved in VMA. We will add on our site new overlays to download as soon as they will be available. You'll find :

- Geological periods overlays
- Colors and albedo overlays
- Geological overlay
- Topographical overlays
- Elements concentration overlays
- Neutrons emissions overlays
- Gravity measurement overlays
- Temperature overlays

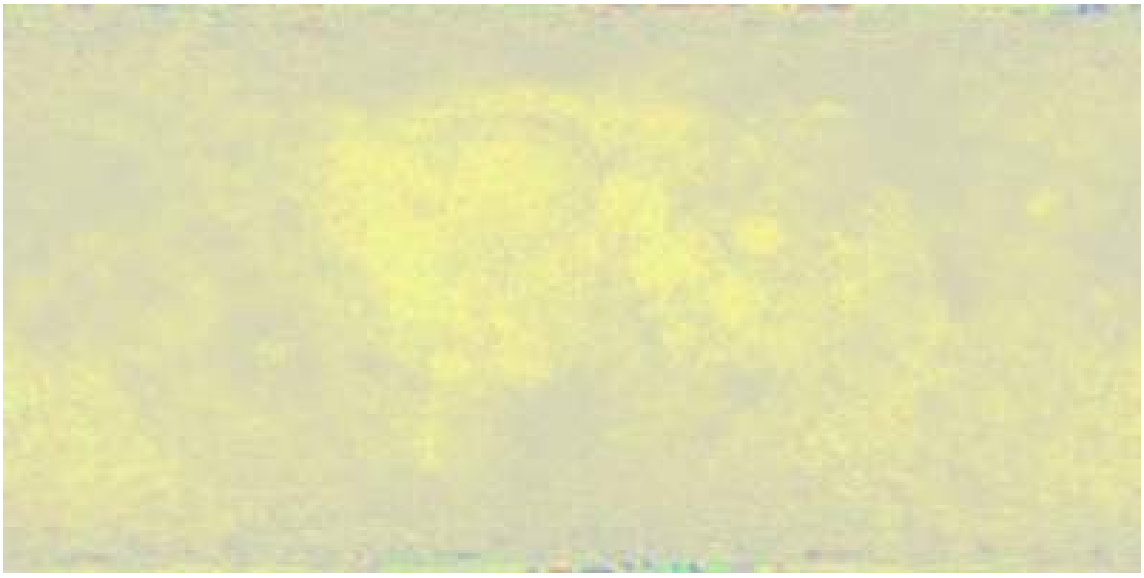
Colors and albedos overlays presentation

"Albedo" overlay



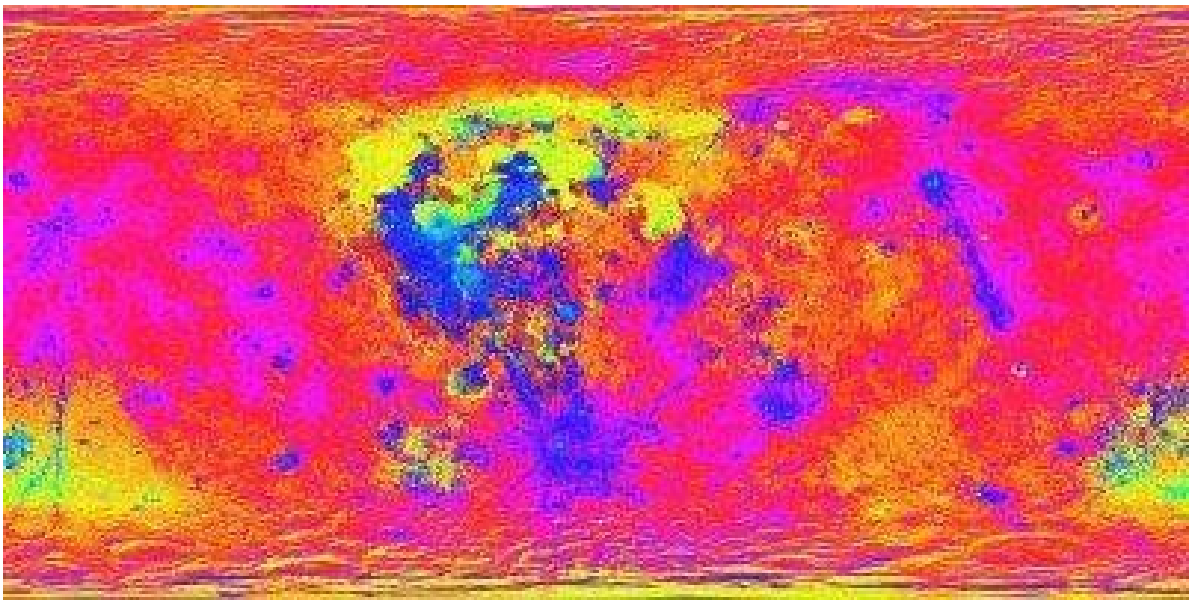
This overlay shows the Moon surface albedo. It's extracted from Clementine datas. This overlay id very useful with the "Aerograph without albedo" texture because this one doesn't present the albedo display. There is no caption since it's only an overlay.

"Natural colors" overlay



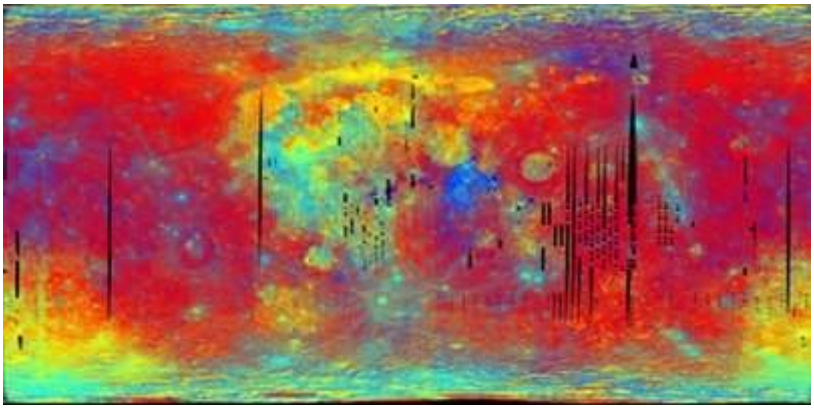
This overlay tries to show the Moon globe natural color. It's extracted from a color mosaic realized with Clementine filtered pictures with an equilibrium between the 3 RGB channels.. There is no caption since it's only a color.

"Enhanced colors" overlay



This overlay has been obtained while pushing to maximum color contrast enhancement in the three primal spectral colors. There is no caption since it's only a color. It shows subtile colors variations between highlands and mare surface and also shows different lavas flows in these marias.

"Clementine color ratio" overlay

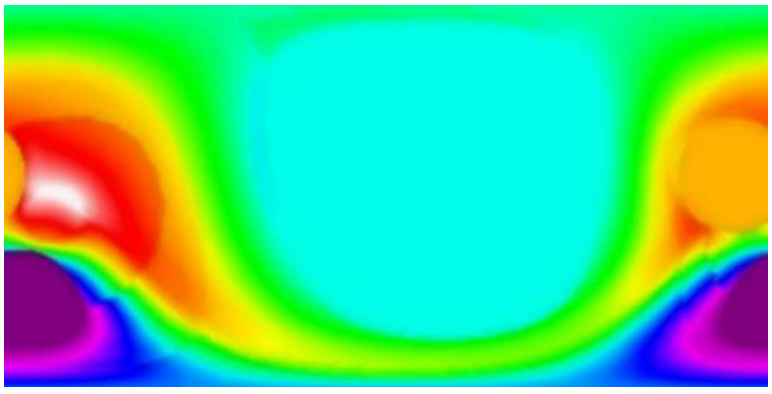


This overlay has been obtained from the Clementine maps of the "PDS Map A Planet" site. Colors variations indicate lunar surface composition variations.
The Clementine Ratio ("false color") views of the Moon are created by generating ratio images using 3 of the 5 Clementine UV/Vis camera bands and combining these into the red, green, and blue channels of a color image:
Channel Ratio (band/band)
Red 750 nm/415 nm
Green 750 nm/950 nm
Blue 414 nm/750 nm

The color ratio image product serves to cancel out the dominant brightness variations of the scene (controlled by albedo variations and topographic shading) and enhances color differences related to soil mineralogy and maturity. The lunar highlands, mostly old (~4.5 billion years) gabbroic anorthosite rocks, are depicted in shades of red (old) and blue (younger). The lunar maria (~3.9 to ~1 billion years), mostly iron-rich basaltic materials of variable titanium contents, are portrayed in shades of yellow/orange (iron-rich, low titanium) and blue (iron-rich, higher titanium). Superimposed on and intermingled with these basic units are materials from basins and craters of various ages, ranging from the dark reds and blues of ancient basins to the bright blue crater rays of younger craters. (Reference: Pieters, C.M., M.I. Staid, E.M. Fischer, S. Tompkins, and G. He, 1994, A sharper view of impact craters from Clementine data, Science, 266, 1844-1848)

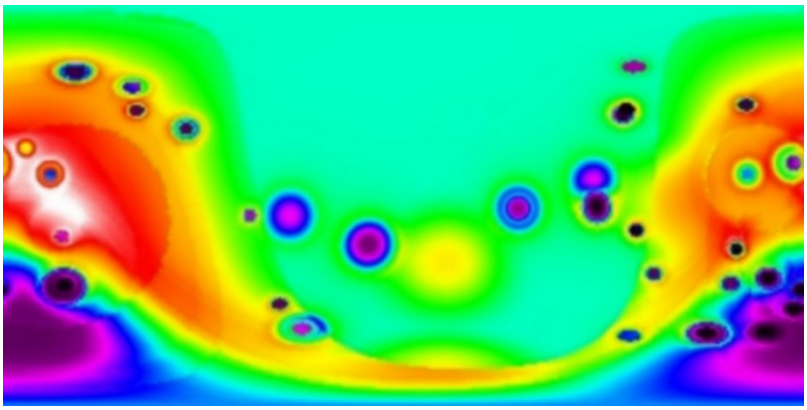
Présentation des couches « Périodes géologiques »

Couche "Byrne 1 Megabasins 4340 MY »



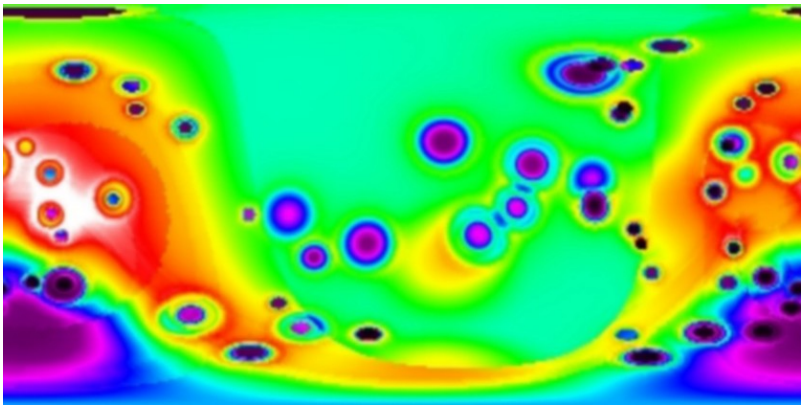
This layer was produced by Charles Byrne and his team and shows the formations generated at the time of the creation of the great primordial basins shortly after the formation of the Moon and before the "Pre-Nectarian" period. It allows to visualize the topography and the lunar surface altitudes during this period. 4340 MY means "4340 millions years ago". There is no legend for this layer.

Couche "Byrne 2 Prénectarian 4000 MY »



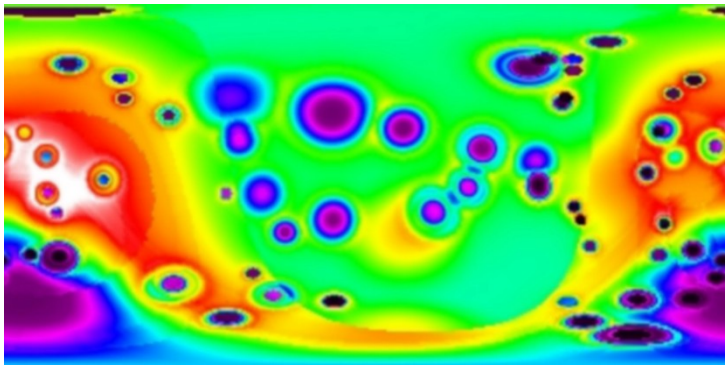
This layer was produced by Charles Byrne and his team and shows the formations generated at the time of the creation of the great primordial basins shortly after the formation of the Moon and before the "Pre-Nectarian" period. It allows to visualize the topography and the lunar surface altitudes during this period. 4000 MY means "4000 millions years ago". There is no legend for this layer.

Couche "Byrne 3 Nectarian 3900 MY »



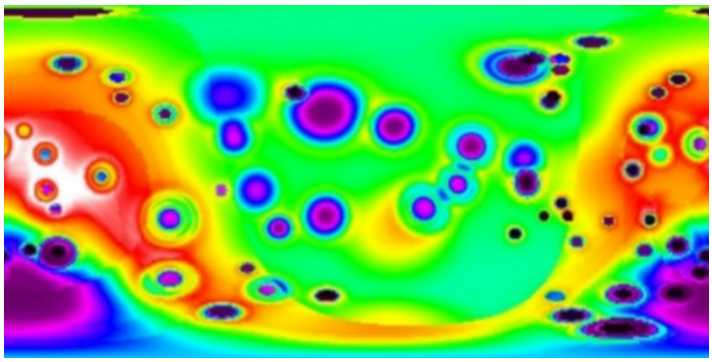
This layer was produced by Charles Byrne and his team and shows the formations generated at the time of the creation of the great primordial basins shortly after the formation of the Moon and before the "Nectarian" period. It allows to visualize the topography and the lunar surface altitudes during this period. 3900 MY means "3900 millions years ago". There is no legend for this layer.

Couche "Byrne 4 Lower Imbrian 3800 MY »



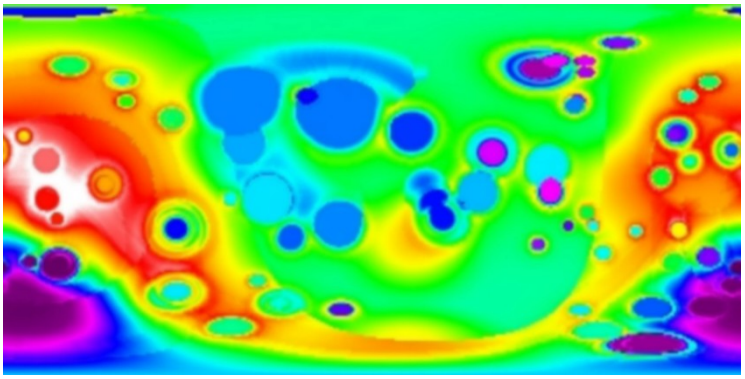
This layer was produced by Charles Byrne and his team and shows the formations generated at the time of the creation of the great primordial basins shortly after the formation of the Moon and before the "Lower Imbrian" period. It allows to visualize the topography and the lunar surface altitudes during this period. 3800 MY means "3800 millions years ago". There is no legend for this layer.

Couche "Byrne 5 Upper Imbrian 3100 MY »



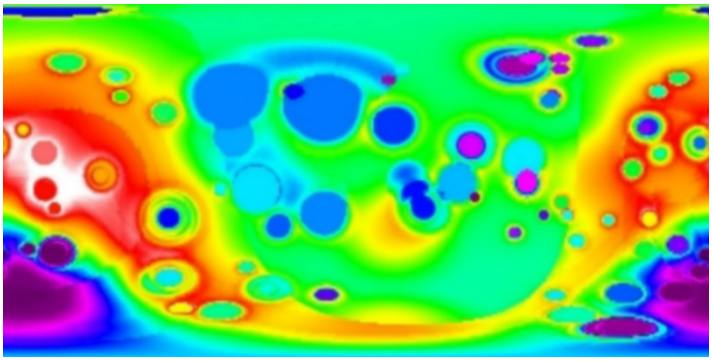
This layer was produced by Charles Byrne and his team and shows the formations generated at the time of the creation of the great primordial basins shortly after the formation of the Moon and before the "Upper Imbrian" period. It allows to visualize the topography and the lunar surface altitudes during this period. 3100 MY means "3100 millions years ago". There is no legend for this layer.

Couche "Byrne 6 Upper Imbrian + Marias 3000 MY»



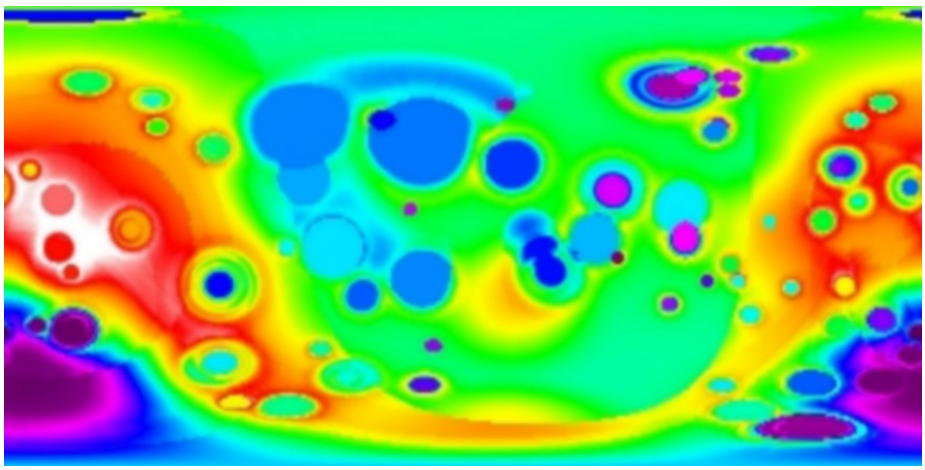
This layer was produced by Charles Byrne and his team and shows the formations generated at the time of the creation of the great primordial basins shortly after the formation of the Moon and before the "Upper Imbrian" period. It allows to visualize the topography and the lunar surface altitudes during this period. 3000 MY means "3000 millions years ago". There is no legend for this layer.

Couche "Byrne 7 Eratosthenian 800 MY»



This layer was produced by Charles Byrne and his team and shows the formations generated at the time of the creation of the great primordial basins shortly after the formation of the Moon and before the "Eratosthenian" period. It allows to visualize the topography and the lunar surface altitudes during this period. 800 MY means "800 millions years ago". There is no legend for this layer.

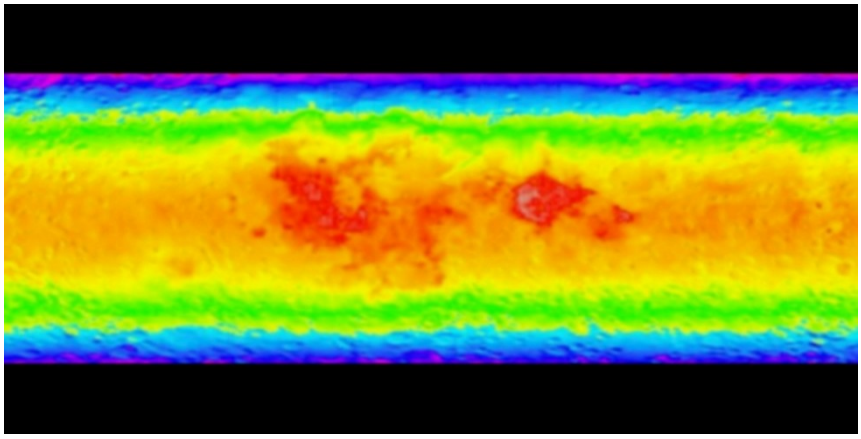
Couche "Byrne 8 Copernician 0 MY»

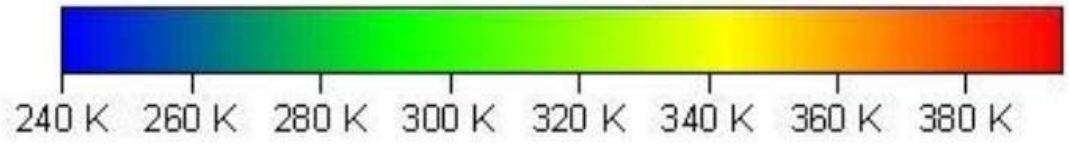


This layer was produced by Charles Byrne and his team and shows the formations generated at the time of the creation of the great primordial basins shortly after the formation of the Moon and before the "Eratosthenian" period. It allows to visualize the topography and the lunar surface altitudes during this period. 0 MY means "today". There is no legend for this layer.

"Temperatures" overlays presentation

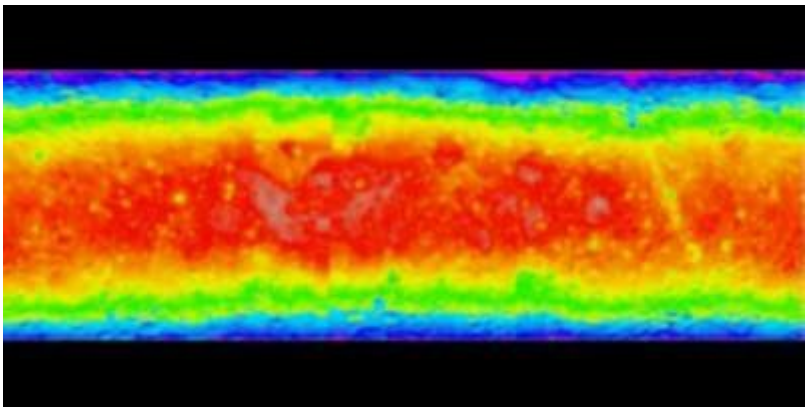
"Daytime surface temperature Chang'é 2 " overlay

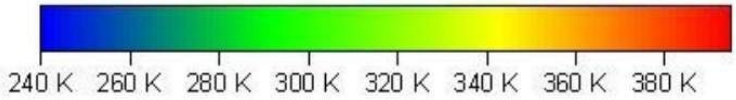




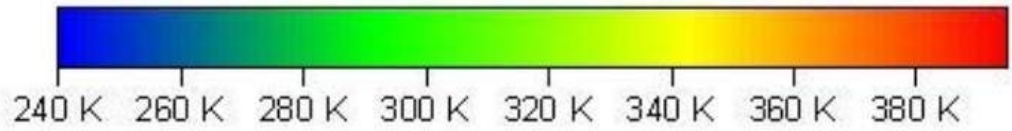
Thi s overlay has been realized with Chang'é 2 datas. It shows lunar surface temperature with the sun at the higher point in the sky. It doesn't shows real time surface temperature. The caption shows that temperatures range is between 240 °K (-33 °C) at poles to 400 °K (127 °C) at the equator.

"Night time surface temperature Chang'é 2 " overlay





This overlay has been realized with Chang'é 2 datas. It shows lunar surface temperature on the obscure part of lunar globe. It doesn't shows real time surface temperature. The caption shows that temperatures range is between 240 °K (-33 °C) at poles to 400 °K (127 °C) at the equator.

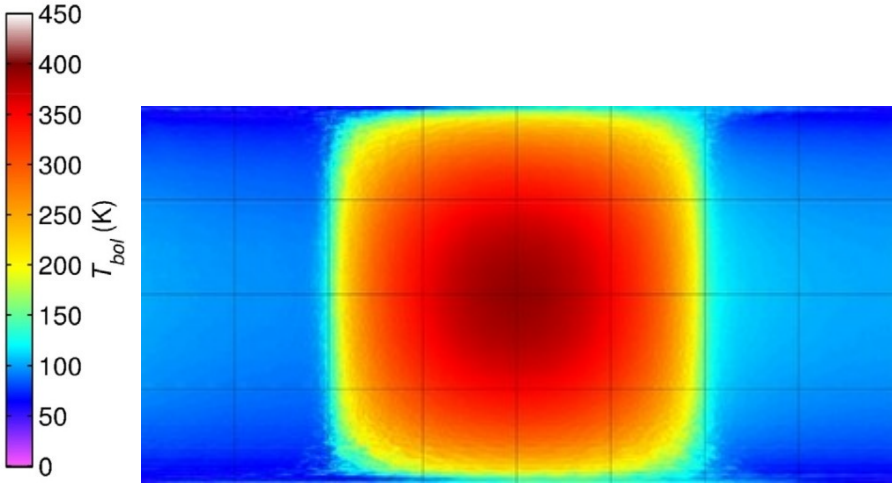


Couche "LRO Diviner temperature" / Chang'é 2 »

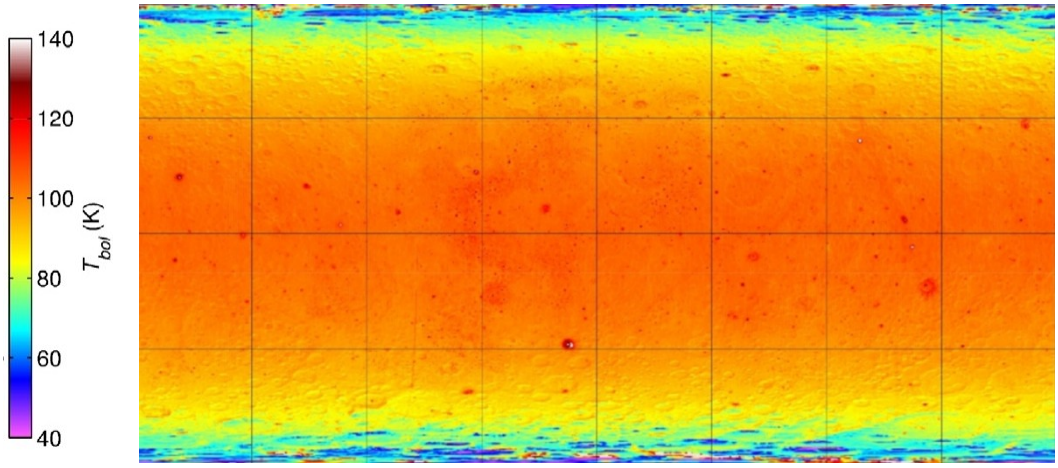
The Diviner instrument on board the LRO probe made it possible to measure the temperature of the lunar surface under different solar illumination conditions. It is therefore a whole set of temperature layers that are presented. Thanks to the team of Dr. Mark Robinson for this very exhaustive work.

Legends are in degrees Kelvin.

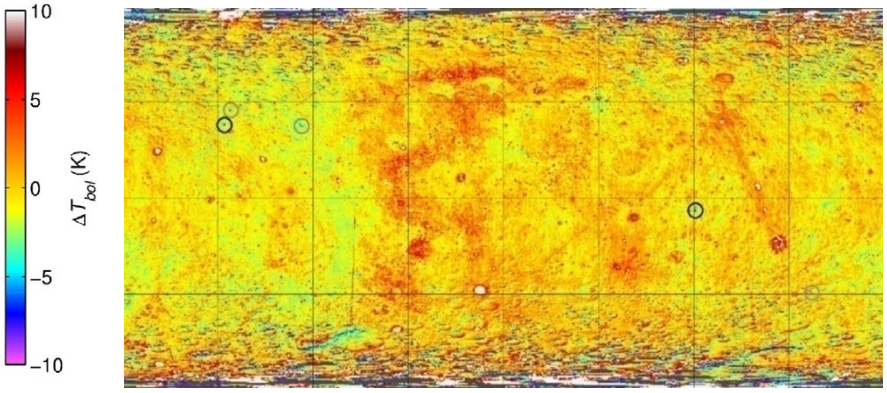
- LRO Diviner Average Full Moon temperature



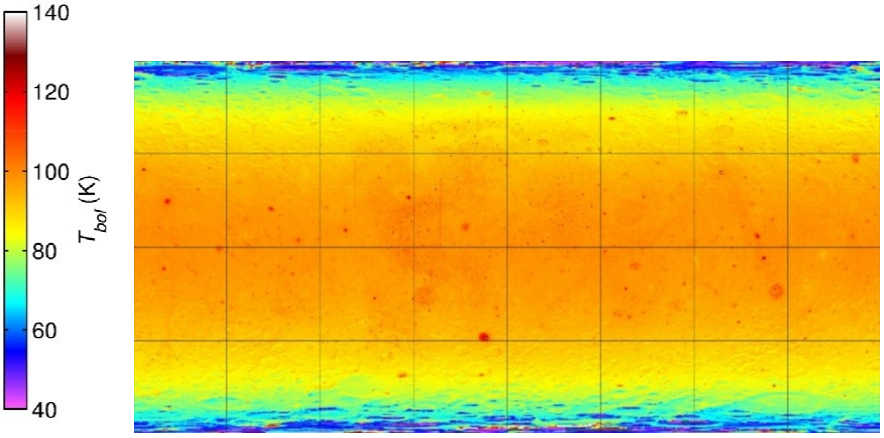
- LRO Diviner Early night temperature 20h to 0h



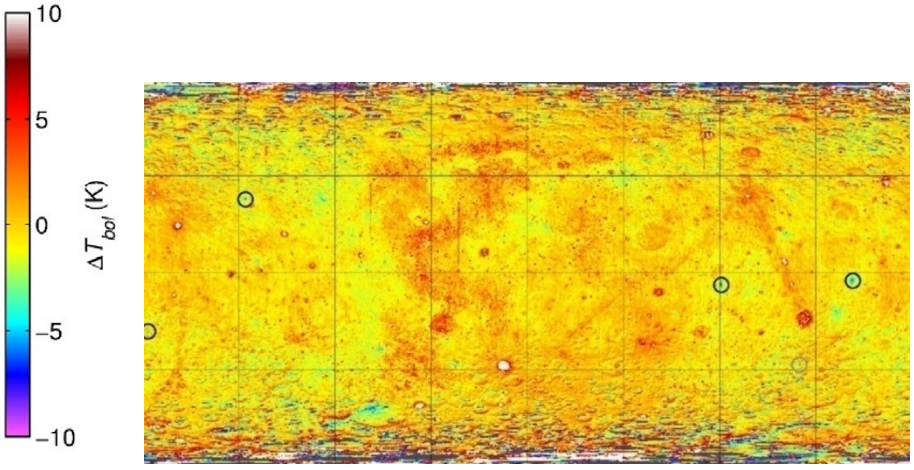
- LRO Diviner Early night temperature anomalies



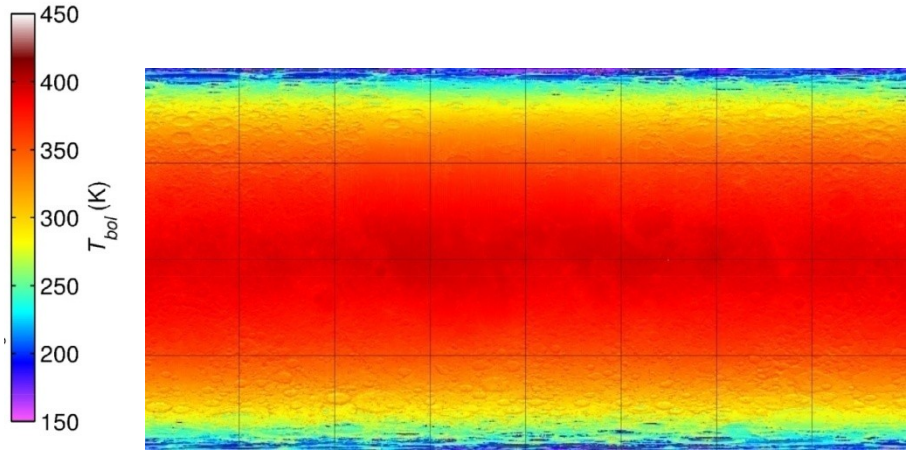
- LRO Diviner Late night temperature 0h to 4h



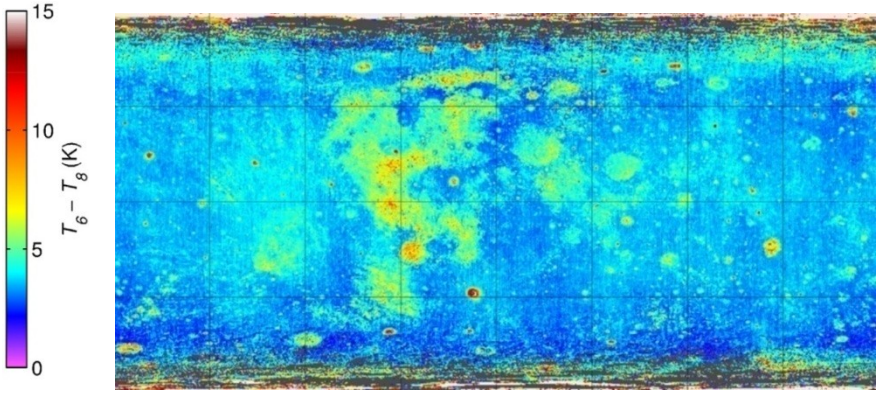
- LRO Diviner Late night temperature anomalies



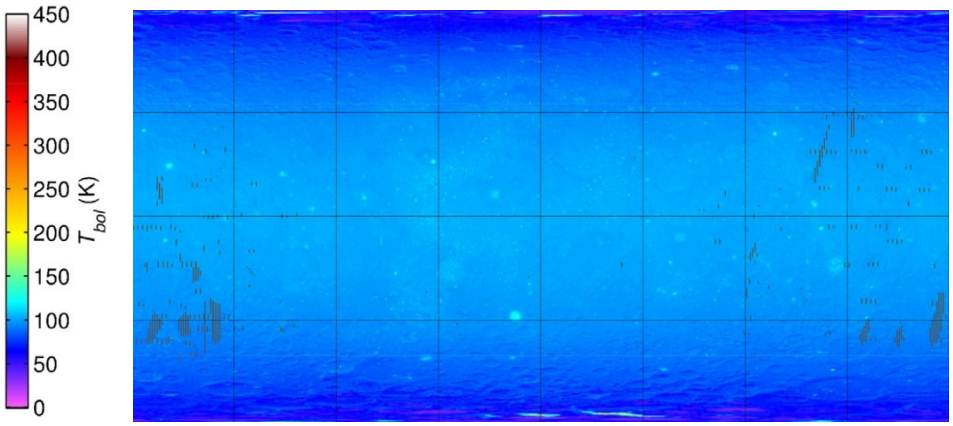
-LRO Diviner Maximum global temperature



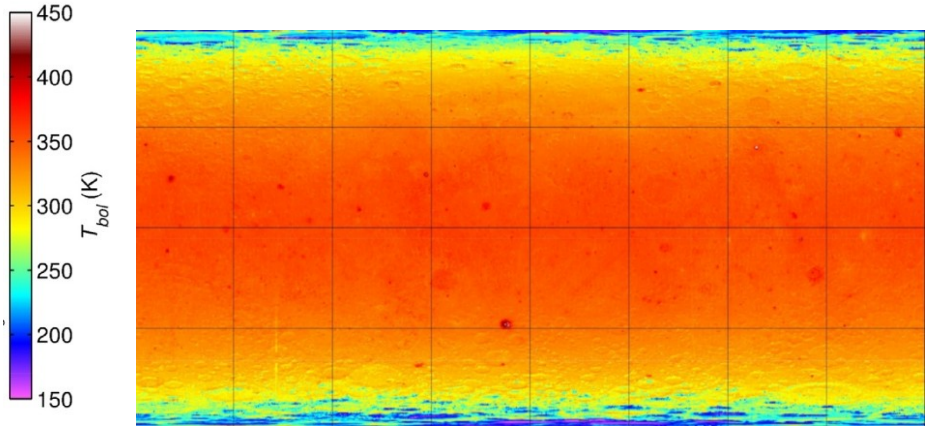
- LRO Diviner Mean nighttime brightness temperature difference



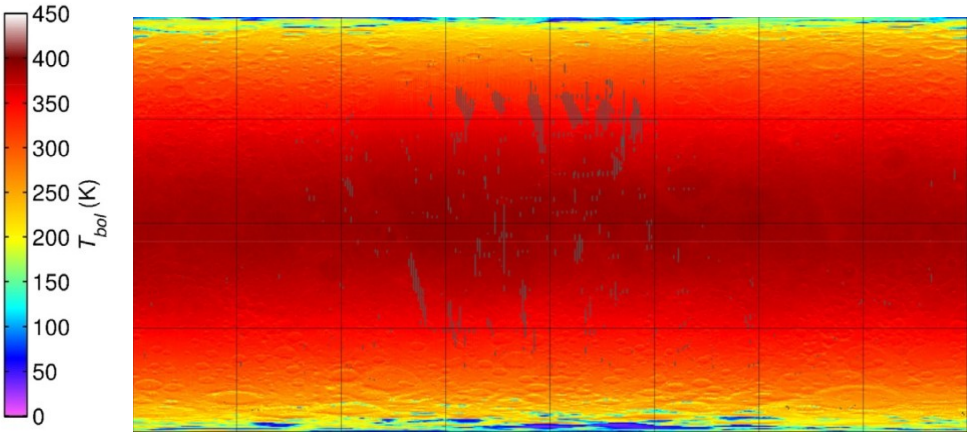
- LRO Diviner Midnight temperature



- LRO Diviner Minimum global temperature

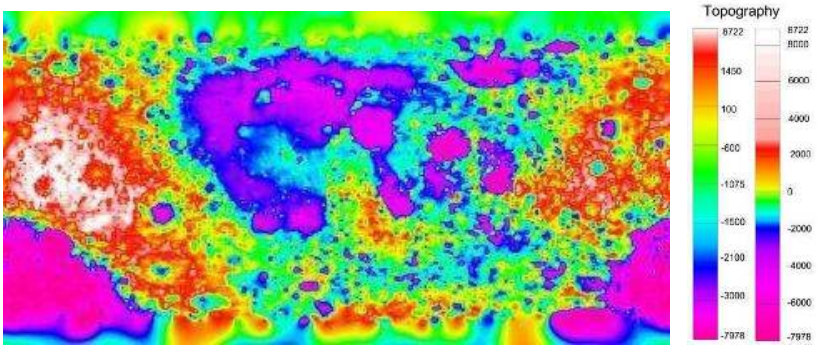


-LRO Diviner Noon temperature



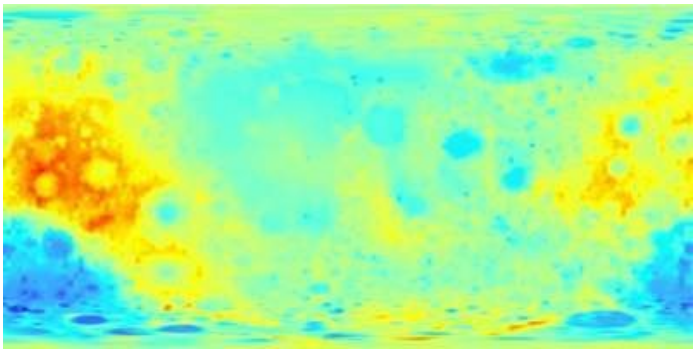
"Topographic" overlays presentation

"Clementine Altitude" overlay



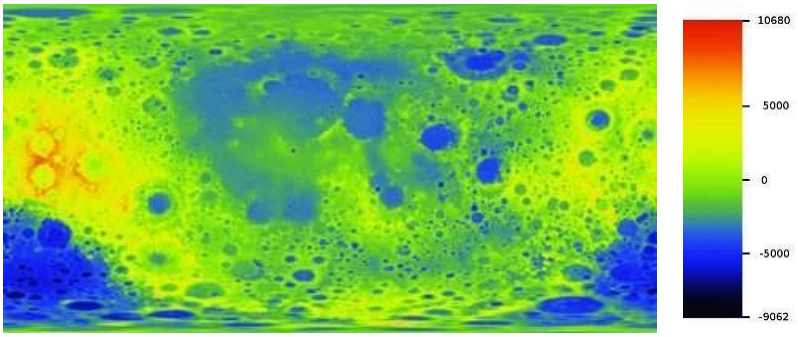
The captions are in feet. The left column is based on a linear scale for color spectra, while the right one is based on a linear scale for altitudes.
This overlay is conceived with altimetric datas recorded by Clementine probe and compiled by Maria T. Zuber and her LPI team. The overlay allows you to locate relative altitudes. It has been used to confirm the existence of the "South Pole / Atkein" impact basin in the Southern part of the Farside.

Altitude "ULCN 2005" overlay



This overlay is realized with a combination of altimetric datas recorded by Apollo missions, Clementine and Lunar Prospector probes and Earth based datas, specially with radiotelescopes in radar mode. They are online at the USGS site maintained by Brent Archinal and his team . It gives relatives altitudes of formations.
It's recommanded to use this overlay with the texture « Aerograph without albedo ».
There is no caption found for this overlay. So it's only indicative informations.

"Kaguya Altitude 2" overlay



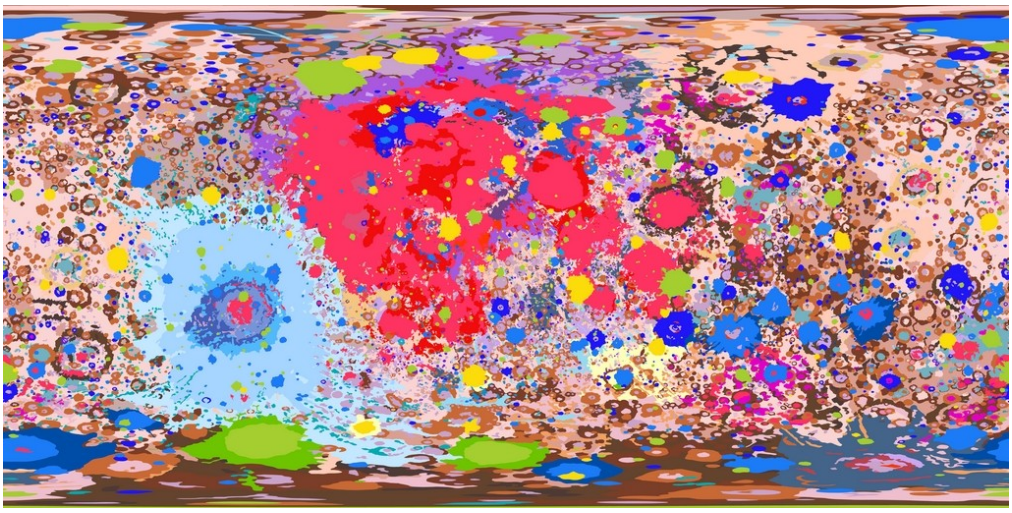
This overlay is a second one realized with altimetric datas recorded by the japanese probe Kaguya and put online by JAXA team. It gives relatives altitudes of formations.
It's presently the most precise altimetric lunar planisphere.

« Geological and gravimetric » overlays presentations

"Geological" overlay

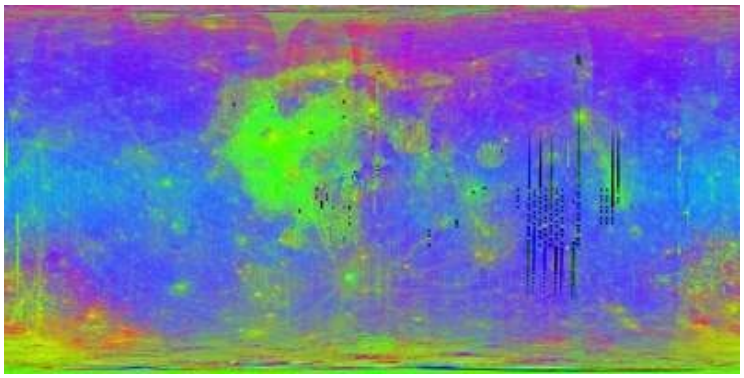
This overlay has been realized with datas available on the USGS "Astrogeology / Webgis" and gathers several different Moon geological maps. Because each of the composing map has its own caption, the global caption, difficult to conceive, is not available presently.

"USGS Geological 2020" layer



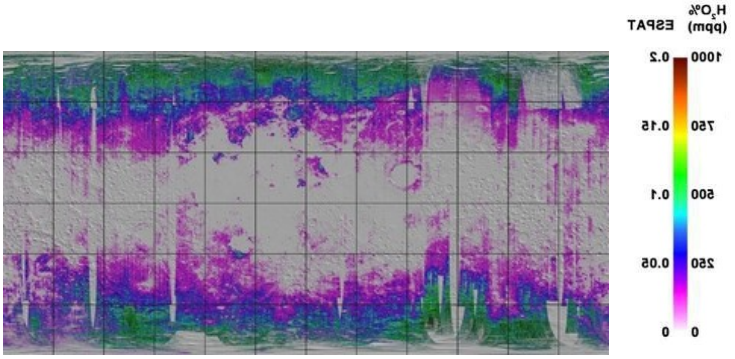
This overlay has been realized with datas available on the USGS "Astrogeology / Webgis" and gathers several different Moon geological maps in 2020. It's like the equivalent texture and have the same caption. We recommand to use it with **no texture**

"Rocks types" overlay



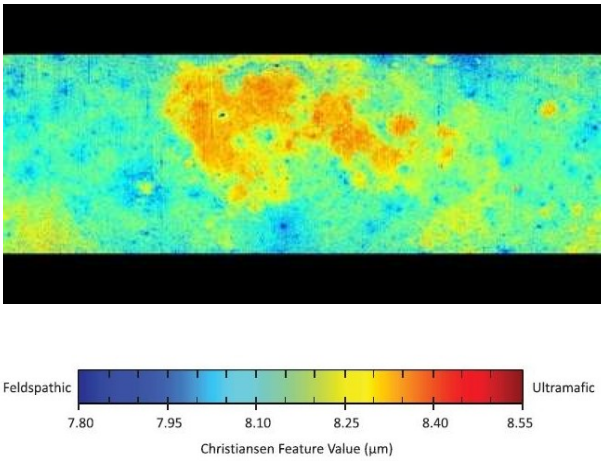
This overlay is realized with Clementine probe orbital datas compiled by Dr Maria T. Zuber and her USGS team. It shows differences between surface rocks compositions. There is no caption found for this overlay

"Water / Chandrayann" overlay



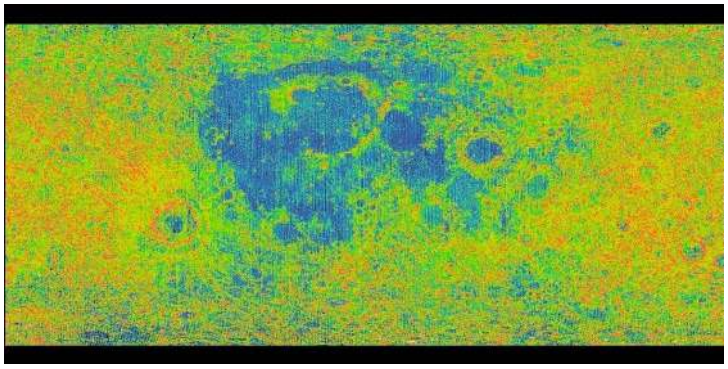
This layer is made from orbital data recorded by the Indian Chandrayann 1 probe and compiled by ISRO and Shuai Li and Ralph E. Milliken in 2017. It allows to visualize the presence of water in the surface rocks.

"Silicates LRO" overlay



This overlay has been realized with datas from LRO probe compiled by Dr Mark Robinson and its team. It shows the silicates percentage in the surface lunar rocs.

"Surface roughness LRO" overlay

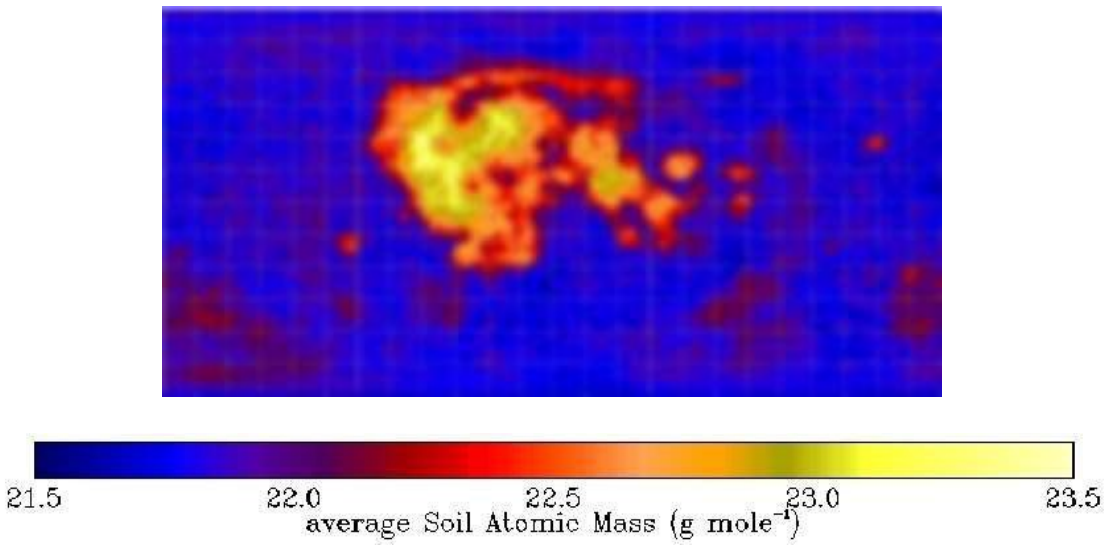


This overlay has been realized with datas from LRO probe compiled by Dr Mark Robinson and its team. It shows the lunar surface roughness. It is recommended to use it with the “Globe without texture” option.

"Slope & surface roughness LRO" overlay

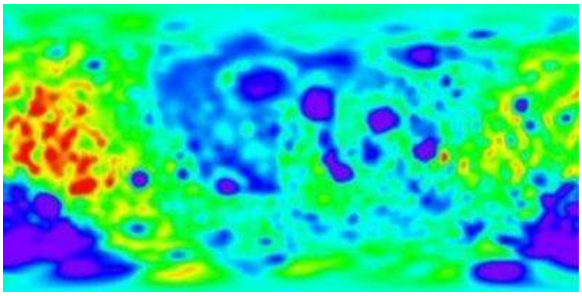
This overlay has been realized with datas from LRO probe compiled by Dr Mark Robinson and its team. It shows the lunar surface roughness associated to the terrans slopes. It's useful to determine probes landing surfaces. It is recommended to use it with the “Globe without texture” option.

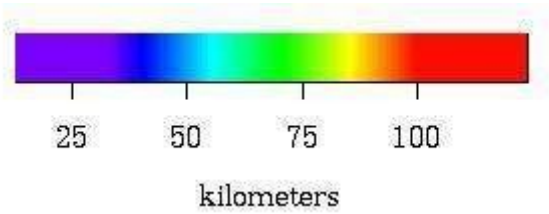
"Soil atomic mass" overlay



This overlay is realized with Lunar Prospector probe datas compiled by Dr Alan Binder and his team. It shows soil atomic mass. It's visible that Nearside seas have higher atomic mass showing heavy elements presence. The caption is in grams / mole.

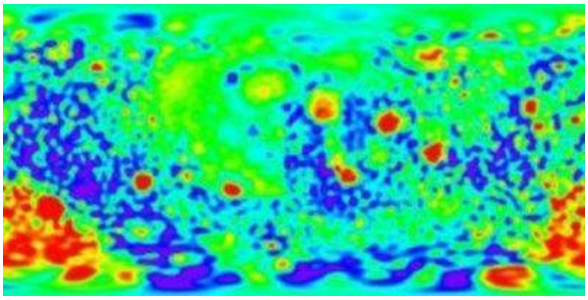
"Crust thickness" overlay

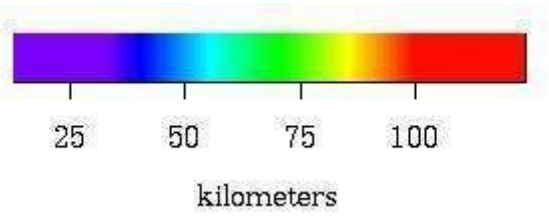




This overlay is conceived with orbital variations datas recorded by Clementine probe and compiled by Maria T. Zuber and her LPI team. The overlay allows you to visualize the lunar crust thickness under the formations. It will confirm you that this one is the lowest under the marias and the thickest on the Moon Farside.

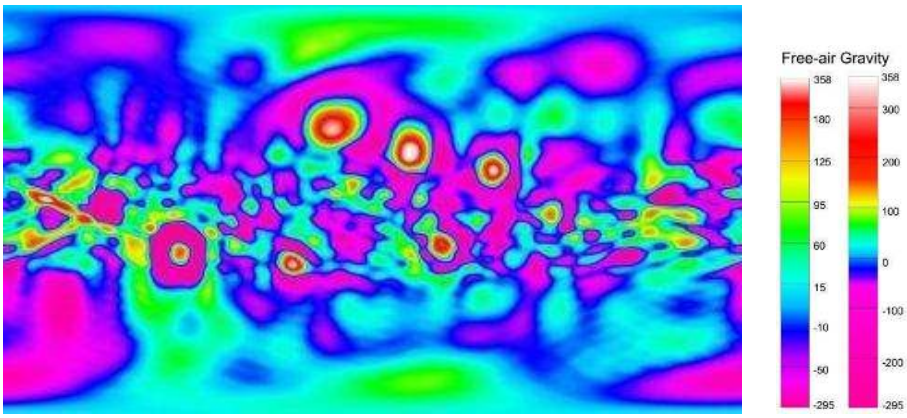
"Bouger Gravity" overlay





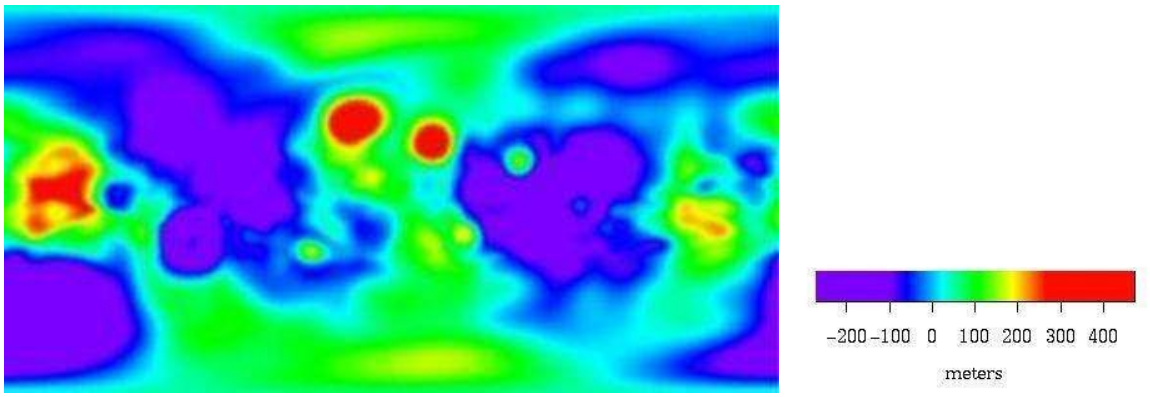
This overlay is conceived with gravimetric datas recorded by Clementine probe and compiled by Maria T. Zuber and her LPI team. They have been completed with Dr Alan Binder and his team results from Lunar Prospector probe.overlay allows you to visualize gravitic anomalies under the formations. The unit is milligals. The biggest anomalies are under the marias showing the famous "mascons" presence. These datas are corrected with the Bouger method taking account of the soil density in the measurement site.

"Free Air Gravity" overlay



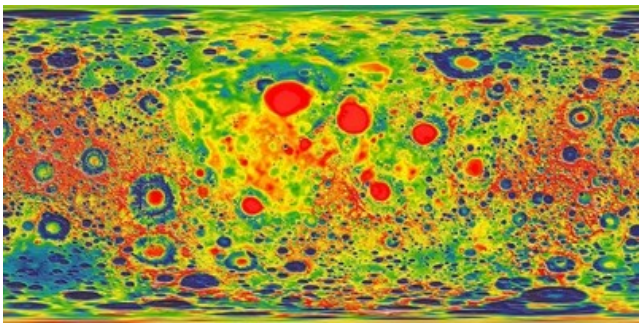
This overlay is conceived with gravimetric datas recorded by Clementine probe and compiled by Maria T. Zuber and her LPI team. They have been completed with Dr Alan Binder and his team results from Lunar Prospector probe.overlay allows you to visualize gravitic anomalies under the formations. The unit is milligals. The biggest anomalies are under the marias showing the famous "mascons" presence. These datas are corrected with the "Free air" method taking account of the altitude above the measurement site.

"Geoid anomalies" overlay



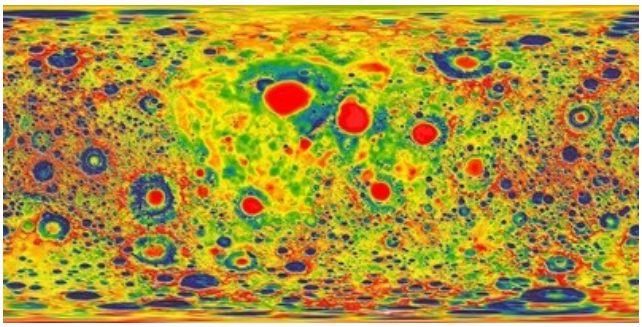
This overlay is conceived with graviimetric datas recorded by Clementine probe and compiled by Maria T. Zuber and her LPI team. They have been completed with Dr Alan Binder and his team results from Lunar Prospector probe.overlay allows you to visualize Moon globe shape anomalies which is not perfectly spherical. It whows that the Farside is less round than the Nearside.

"Free Air Gravity / GRAIL degree 2 to 700" overlay ("Free Air gravimetry with harmonic degrees less than 700")



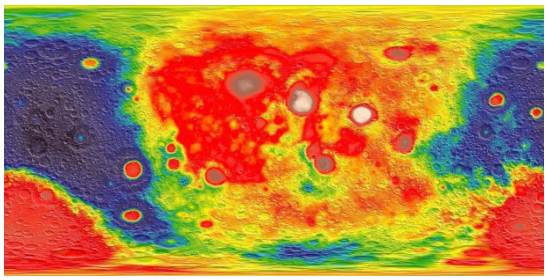
This overlay is produced from gravimetric data recorded by the two GRAIL Ebb & Flow probes and compiled by Dr Maria T. Zuber and his team from the USGS. It is expressed in milligals. It allows you to view gravity anomalies in the area of formations. We thus realize that strong anomalies correspond to the seas and betray the presence of the famous "mascons". These data are corrected according to the "Free air" method which takes into account the altitude of the formations at the measurement right. We have not found a legend for this overlay.

"Free Air Gravity / GRAIL degree 7 to 700" overlay ("Free Air gravimetry with harmonic degrees between 7 & 700")



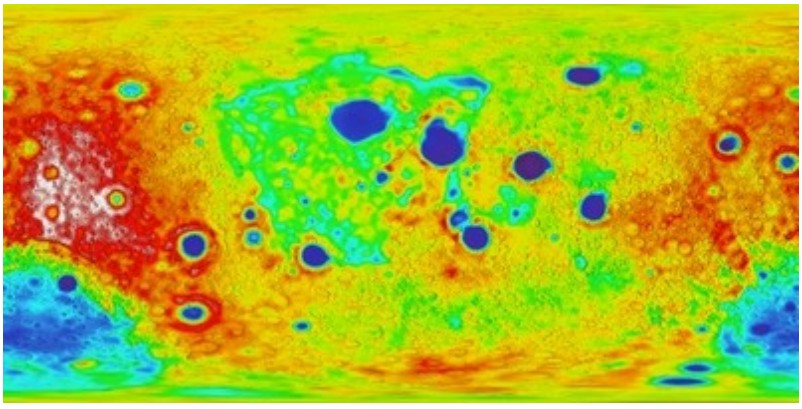
This overlay is produced from gravimetric data recorded by the two GRAIL Ebb & Flow probes and compiled by Dr Maria T. Zuber and his team from the USGS. It is expressed in milligals. It allows you to view gravity anomalies in the area of formations. We thus realize that strong anomalies correspond to the seas and betray the presence of the famous "mascons". These data are corrected according to the "Free air" method which takes into account the altitude of the formations at the measurement right. We have not found a legend for this layer.

"Bouguer Gravity / GRAIL" overlay ("Bouguer" Gravimetry)



This overlay is produced from gravimetric data recorded by the two GRAIL Ebb & Flow probes and compiled by Dr Maria T. Zuber and his team from the USGS. It allows you to view gravity anomalies in the area of formations. It is expressed in milligals. We thus realize that the strong anomalies correspond to the seas and betray the presence of the famous "mascons". These data are corrected according to the Bouguer method which takes into account the density of the soil at the right of the measurement. We have not found a legend for this overlay.

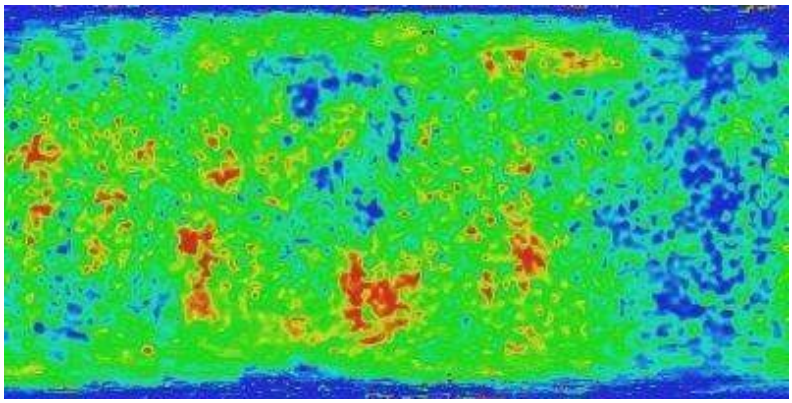
"Crustal thickness / GRAIL degree 1 to 700" overlay



This overlay is produced from gravimetric data recorded by the two GRAIL Ebb & Flow probes and compiled by Dr Maria T. Zuber and his team from the USGS. It is expressed in km. It makes it possible to visualize the variations in the thickness of the crust at the level of the formations. We thus realize the strong under-thicknesses corresponding to the seas which betray the presence of the famous "mascons".

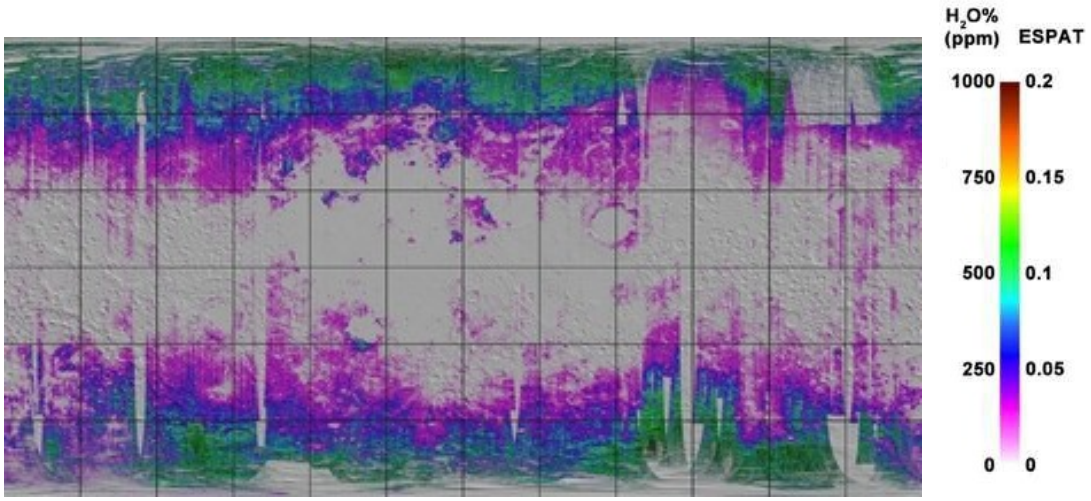
« Elements presence » overlays presentation

"Hydrogen" overlay



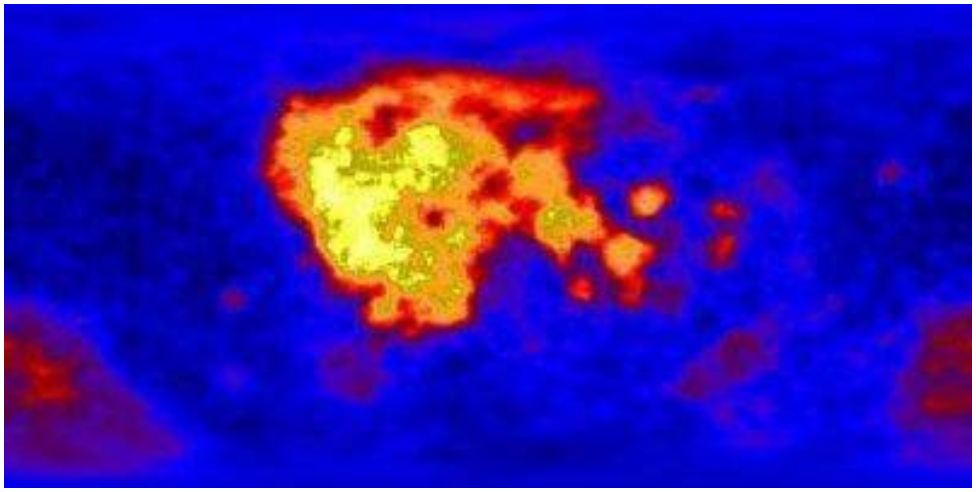
This overlay is conceived with Dr Alan Binder and his team results from Lunar Prospector probe. This overlay allows you to visualize hydrogen repartition on the surface. There is no caption available presently, but red is for high hydrogen concentrations and blue for the lowest.

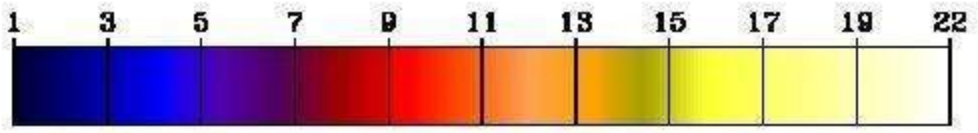
"Chandrayann 1 / Water" overlay



This overlay is conceived with ISRO results from Chandrayann 1 probe. This overlay allows you to visualize waterrepartition on the surface.

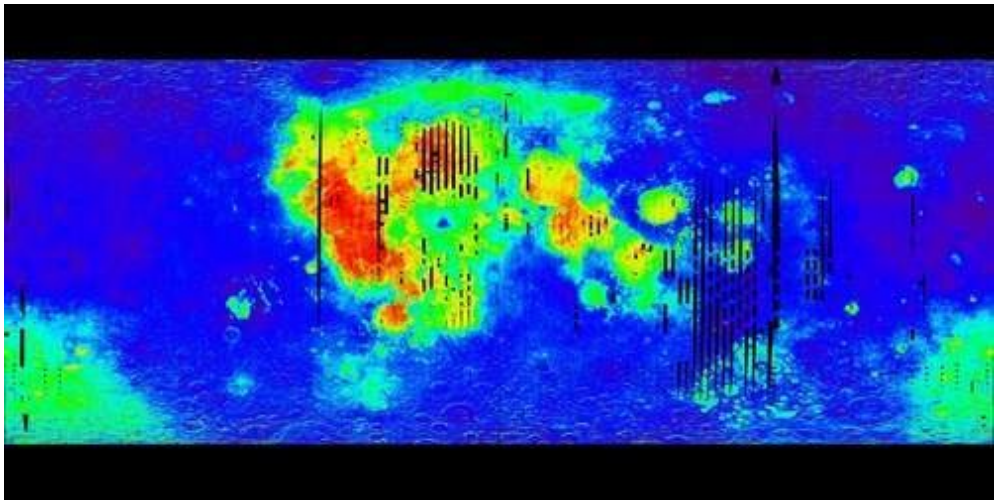
"Iron" overlay





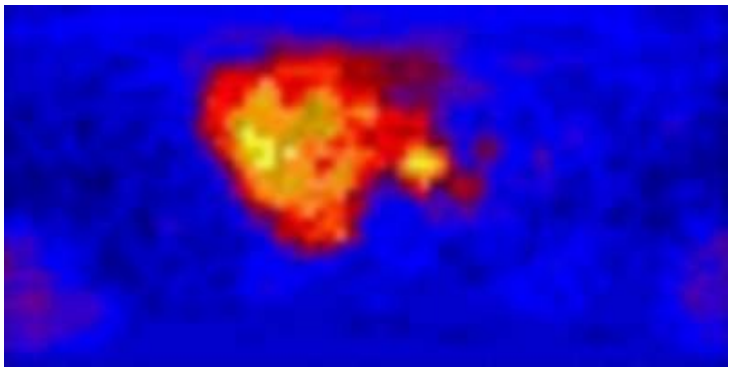
This overlay is conceived with Dr Alan Binder and his team results from Lunar Prospector probe. This overlay allows you to visualize iron repartition on the surface. Immediatly, you can see that Nearside marias are rich with iron.

"Iron oxyde / FeO" overlay



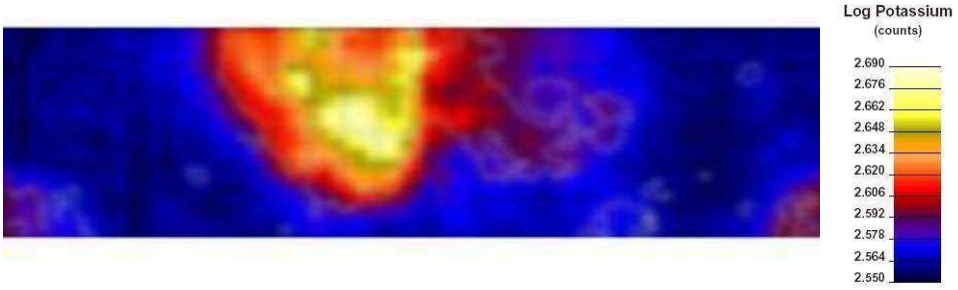
This overlay is conceived from Clementine probe datas. FeO (Iron oxydes) values can be useful in identifying basalt-excavating craters, and so possible cryptomares (Basalt seas covered by more recent materials).

"Titane" overlay



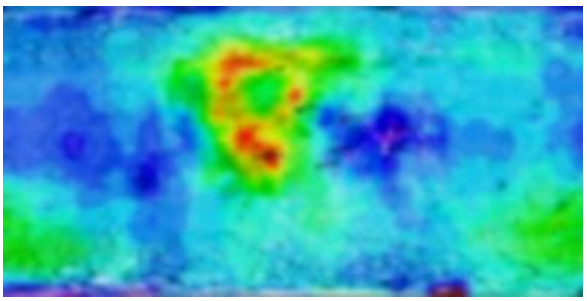
This overlay is conceived with Dr Alan Binder and his team results from Lunar Prospector probe. This overlay allows you to visualize titane repartition on the surface. Immediatly, you can see that Nearside marias are rich with this metal.

"Potassium" overlay



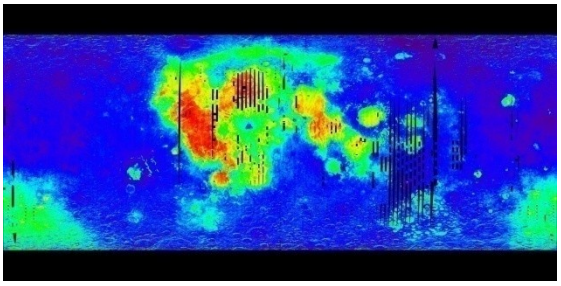
This overlay is conceived with Dr Alan Binder and his team results from Lunar Prospector probe. This overlay allows you to visualize potassium repartition on the surface. The measurement unit is based on detection counts. Immediatly, you can see that Nearside marias are rich with this element.

"Gadolinium" overlay



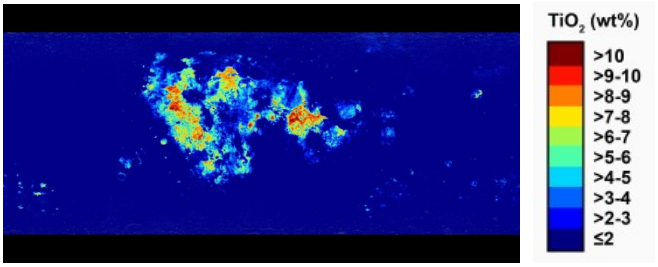
This overlay is conceived with Dr Alan Binder and his team results from Lunar Prospector probe. This overlay allows you to visualize gadolinium repartition on the surface. Immediatly, you can see that Nearside marias are rich with this element.

"Clementine FeO" (Iron oxydes)



This layer is established from data from the Clémentine probe. FeO (iron oxide) values can be useful to identify craters with basalt excavation and "cryptomares" (basalt seas covered by more recent materials).

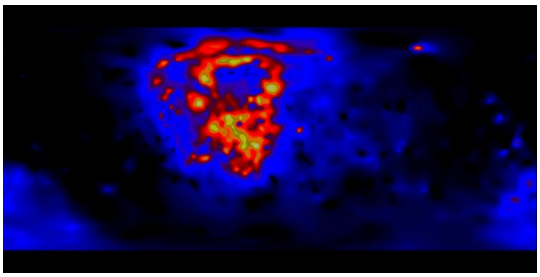
Couche "LRO TiO2" (Oxyde de titane)



This layer is based on data from the Lunar Reconnaissance Orbiter probe. One realizes immediately that the seas of the Visible Side are rich in this metal. Note that the readings do not cover latitudes over 60°. The abundance ranges from less than 2% by weight for blue to more than 10% for red.

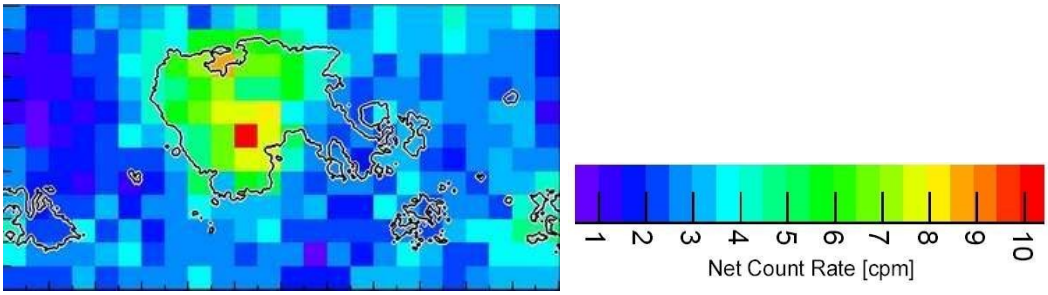
« Radioactive elements repartition" overlays

"Thorium" overlay



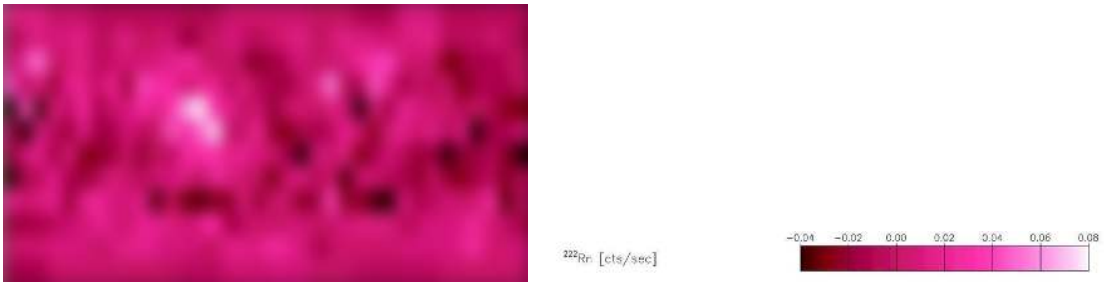
This overlay is conceived with Dr Alan Binder and his team results from Lunar Prospector probe. This overlay allows you to visualize potassium repartition on the surface. No caption is available presently, but red is for high hydrogen concentrations and blue for the lowest.Immediatly, you can see that Nearside marias are also rich with this element.

"Uranium" overlay



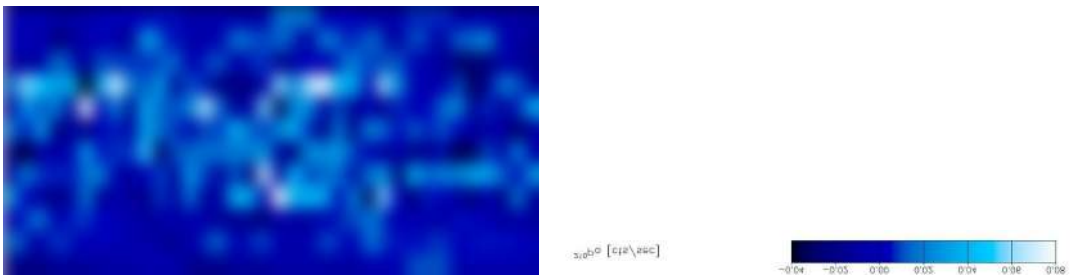
This overlay is realized with japanese probe datas compiled by JAXA team. The caption is based on uramium emitted particles count. It can vizualize roughly uranium in formations. It's easily seen that Nearside seas are rich with this element.

"Radon" overlay



This overlay is conceived with Dr Alan Binder and his team results from Lunar Prospector probe. This overlay allows you to visualize radon repartition on the surface. The caption is based on radon emitted particles count. It can vizualize roughly radon in formations.

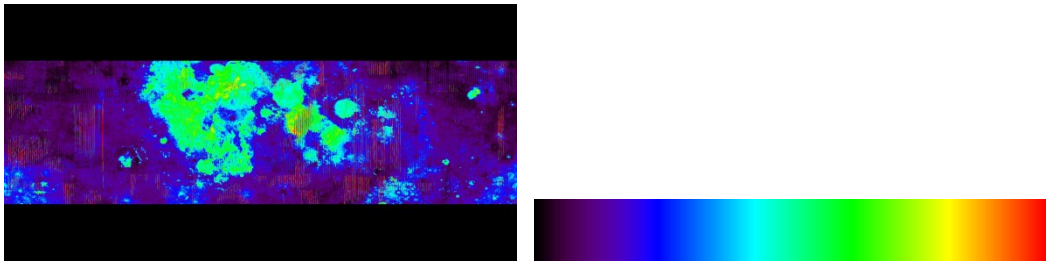
"Polonium" overlay



This overlay is conceived with Dr Alan Binder and his team results from Lunar Prospector probe. This overlay allows you to visualize polonium repartition on the surface. The caption is based on polonium emitted particles count. It can vizualize roughly radon in formations.

« Rocks types » layers presentation

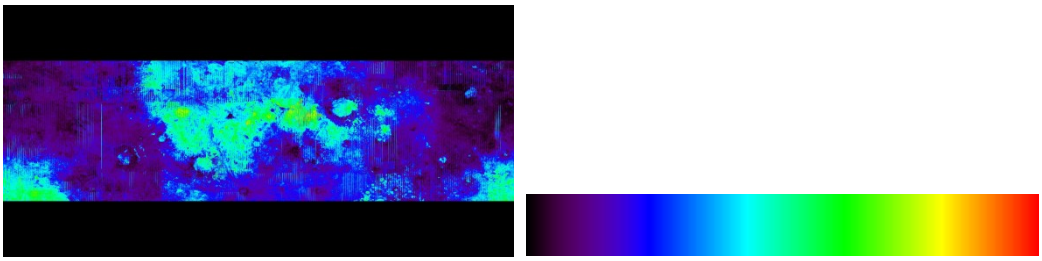
"Kaguya clinopyroxene" overlay



This layer is made from data from the Kaguya probe compiled by the JAXA team. It makes it possible to visualize the distribution of clinopyroxene to the right of the formations. We immediately realize that the seas and the large impact craters are rich in this rock. Note that the readings do not cover latitudes over 60°. Abundance ranges from 0% for black to 50% for red.

Pyroxenes are a family of minerals from the inosilicate group. They are common components of igneous and metamorphic rocks. They are related to amphiboles. Pyroxenes generally belong to the monoclinic (clinopyroxene), sometimes orthorhombic (orthopyroxene) system.

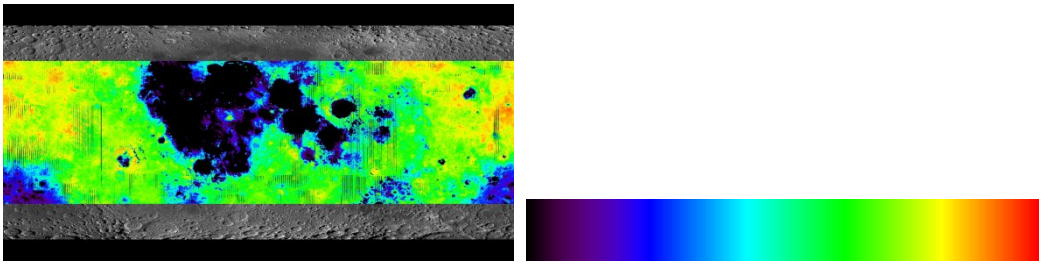
"Kaguya orthopyroxene" overlay



This layer is made from data from the Kaguya probe compiled by the JAXA team. It makes it possible to visualize the distribution of orthopyroxene to the right of the formations. We immediately realize that the seas and the large impact craters are rich in this rock. Note that the readings do not cover latitudes over 60°. Abundance ranges from 0% for black to 50% for red.

Pyroxenes are a family of minerals from the inosilicate group. They are common components of igneous and metamorphic rocks. They are related to amphiboles. Pyroxenes generally belong to the monoclinic (clinopyroxene), sometimes orthorhombic (orthopyroxene) system.

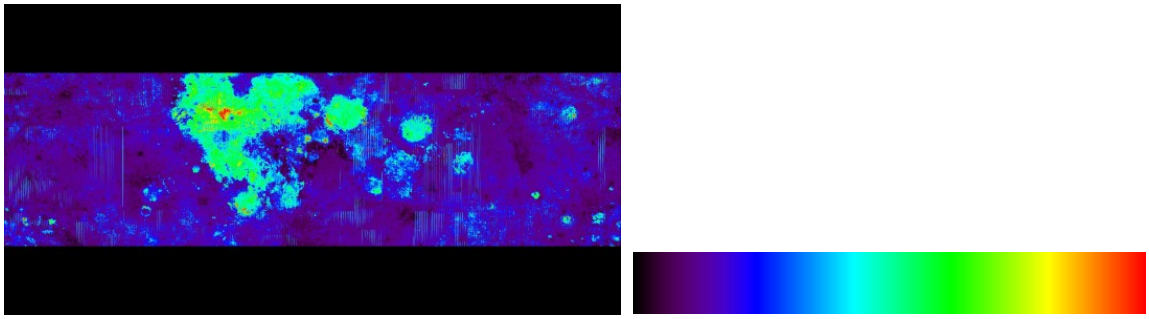
"Kaguya plagioclase" overlay



This layer is made from data from the Kaguya probe compiled by the JAXA team. It makes it possible to visualize the distribution of plagioclase at the level of the formations. We immediately realize that the seas and the large impact craters are poor in this rock. Note that the readings do not cover latitudes over 60°. Abundance ranges from 50% for black to 100% for red.

Plagioclases are silicate minerals, tectosilicates of the feldspar family.

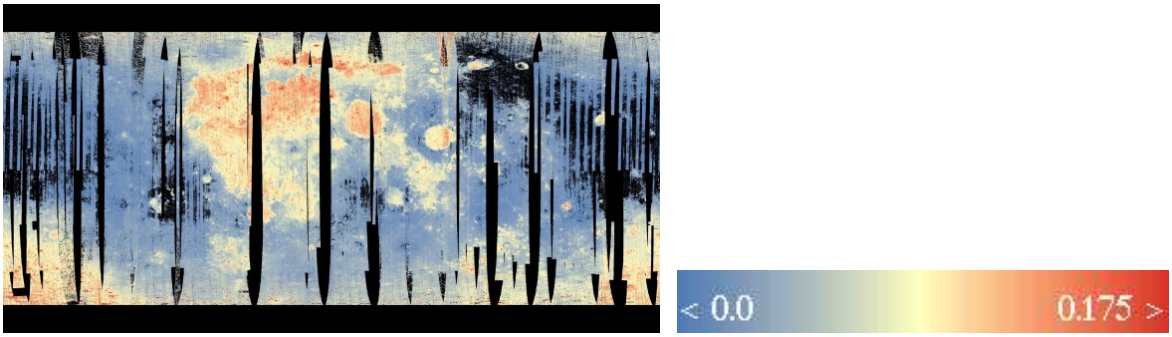
"Kaguya Olivine" overlay



This layer is made from data from the Kaguya probe compiled by the JAXA team. It makes it possible to visualize the distribution of the olivine to the right of the formations. We immediately realize that the seas and the large impact craters are rich in this rock. Note that the readings do not cover latitudes over 60°. Abundance ranges from 0% for black to 25% for red.

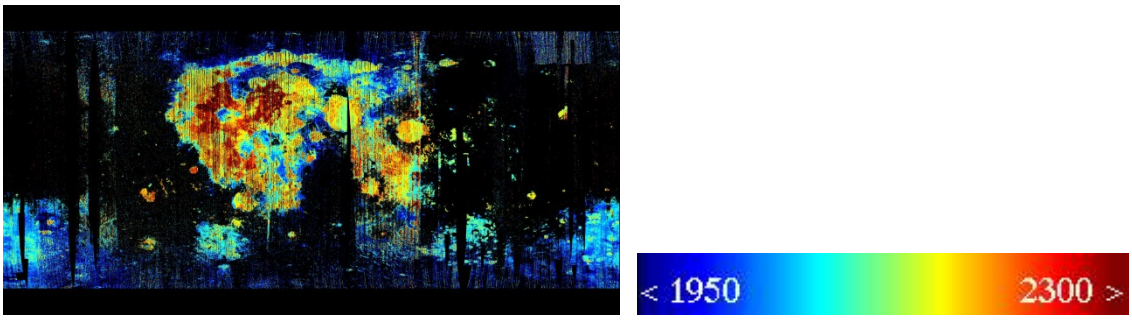
Olivine is a mineral of the group of silicates, subgroup of neosilicates. It crystallizes in the orthorombic system.

"Chandrayann MAFIC" overlay



This layer is produced from orbital data recorded by the Indian probe Chandrayann 1 and compiled by ISRO. It makes it possible to visualize the distribution of mafic rocks to the right of the formations. We immediately realize that the seas and large impact craters are rich in this type of rock. The legend gives a scale from 0 to 17.5%. A silicate or a silicate rock is called "mafic" when it is rich in magnesium and iron (Contaction of magnesium and ferric). Also called "ferromagnesian". this family includes olivine, pyroxenes, amphibole and biotite. This layer therefore does not make it possible to differentiate the components, unlike those of the Kaguya probe.

"Chandrayann Pyroxene" overlay

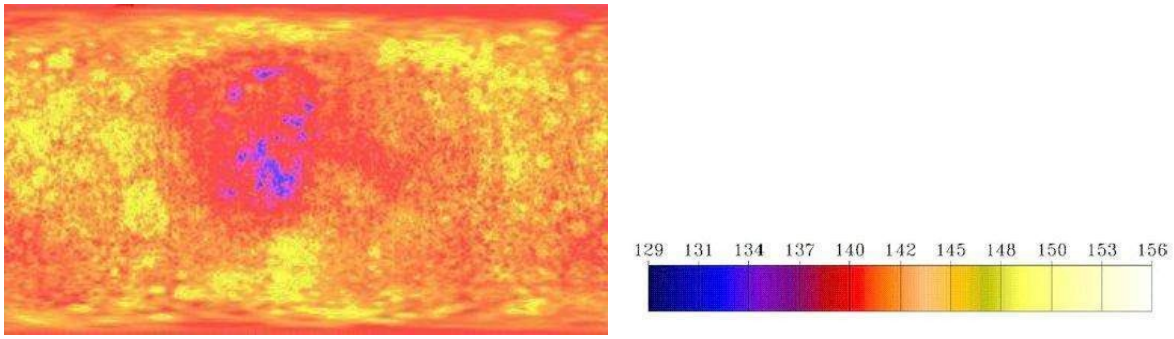


This layer is produced from orbital data recorded by the Indian probe Chandrayann 1 and compiled by ISRO. It makes it possible to visualize the distribution of pyroxenes at the level of the formations. One realizes immediately that the seas and the large impact craters are rich in rocks. The legend gives a scale ranging from 1950 to 2300 without further precision.

Pyroxenes are a family of minerals from the inosilicate group. They are common components of igneous and metamorphic rocks. They are related to amphiboles. Pyroxenes generally belong to the monoclinic (clinopyroxene), sometimes orthorhombic (orthopyroxene) system.

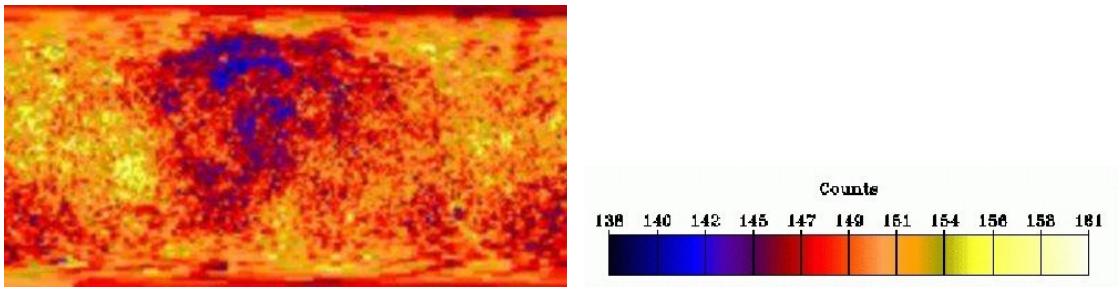
« Neutrons emissions» overlay presentation

"Neutrons epithermal" overlay



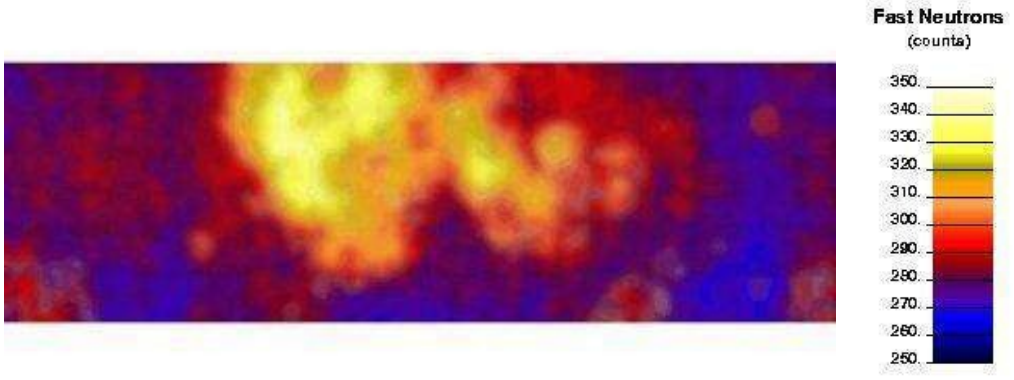
This overlay is conceived with Dr Alan Binder and his team results from Lunar Prospector probe. This overlay allows you to visualize number of detected "epithermal" neutrons on the surface. The measurement unit is based on detection counts. Immediatly, you can see that Nearside marias are powerful emiters.

"Neutrons broadband" overlay



This overlay is conceived with Dr Alan Binder and his team results from Lunar Prospector probe. This overlay allows you to visualize number of detected "broadband" neutrons on the surface. The measurement unit is based on detection counts. Immediatly, you can see that Nearside marias are powerful emiters.

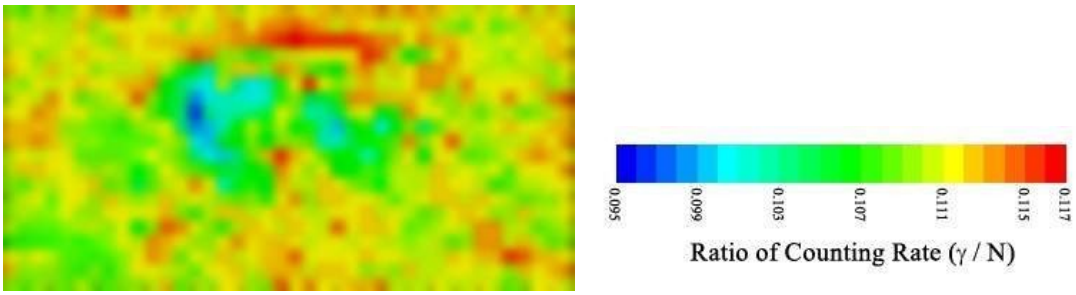
"Neutrons fast" overlay



This overlay is conceived with Dr Alan Binder and his team results from Lunar Prospector probe. This overlay allows you to visualize number of detected "fast" neutrons on the surface. The measurement unit is based on detection counts. Immediatly, you can see that Nearside marias are also powerful neutrons emiters.

« Radiations emissions" overlays presentation

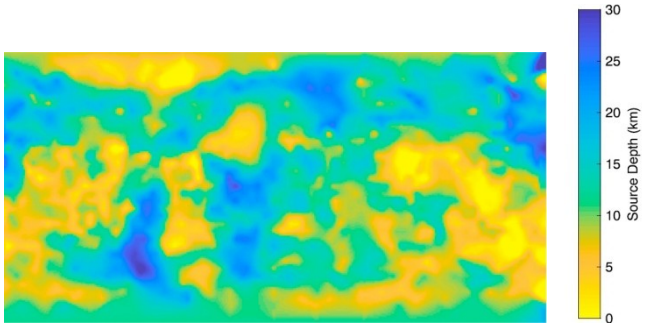
"Gamma rays" overlay



This overlay is realized with japanese probe Kaguya datas compiled by JAXA team. The caption is based on gamma rays level detected by the probe. It can vizualize roughly gamma rays levels in formations. It's easily seen that this repartition is rather uniform.

« Magnetism" overlays presentation

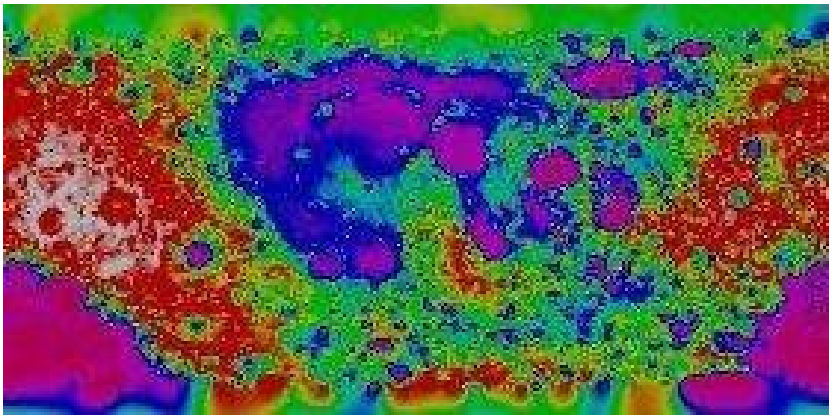
"Moon magnetic sources depth"

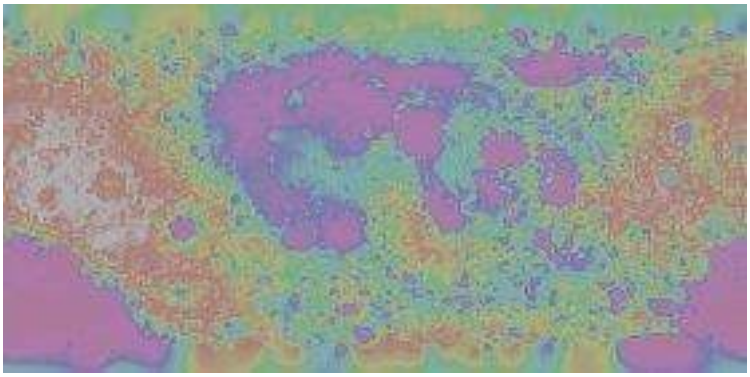


This layer is made from data from Mark Wieczorek's article on the hypothesis of the origin of "swirls". The legend indicates the depth of the magnetic source at the level of the formations

"Transparency" cursor

This cursor allows you to choose the transparency degree of the overlay applied above the texture. It doesn't operate on the texture. When the cursor is on the right, the overlay very visible. On left, the underlaying texture is almost invisible. Choose what degree you would apply to be able to see all the details together. (Example shown without underlaying texture).

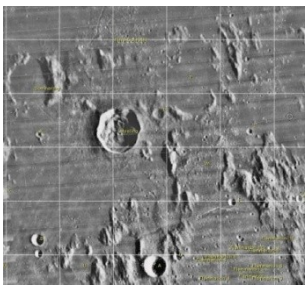

< Non transparent overlay

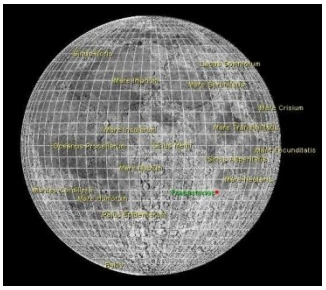

< Transparent overlay

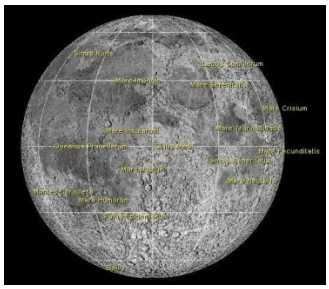
"Grid " frame

The radio button « Show grid » displays or not a white grid with meridians and parallels on the lunar globe surface.

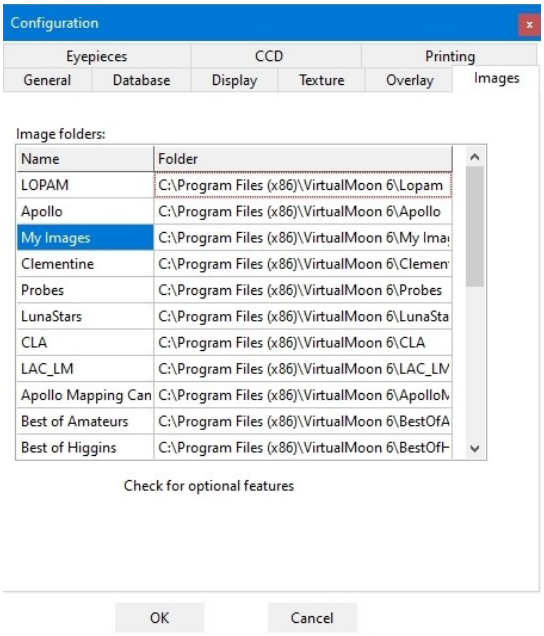
The cursor changes grid density. This one varies from 1° until 30 °.


1° Grid


5° Grid


30° Grid

"Pictures" tab

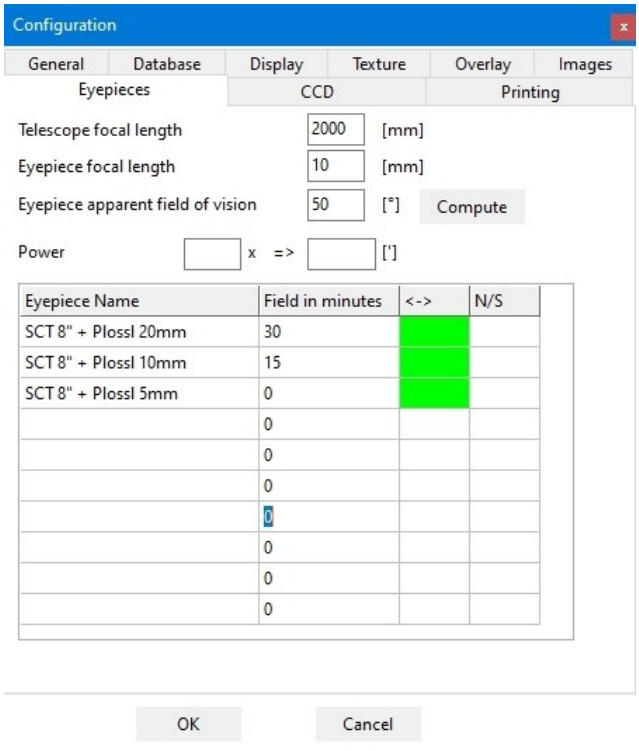


This tab is used to sort the available pictures in the library because their number will increase constantly, and the pictures display setup.

Pictures directories list

You can edit the list of the "**picture directories**". In addition to the "**LOPAM**", "**Clementine**", "**Probes**", "**Apollo**", "**Apollomapping**", "**CLA**" and "**My images**"downloadable pictures, you can create one or more new directories to put in your own webcam or CCD pictures, or pictures coming from other sources and legally acquired, such as the "**Best of amateurs series"** present on VMA Web site..

"Eyepieces" tab



This tab is used to setup parameters of your own eyepieces so thet, you could display the real Moon aspect when observed in your instrument with "**Eyepiece**" context menu function ("LUN" is for "LUNETTE" = "REFRACTOR" in french).

Eyepieces list

You can enter directly your eyepieces parameters in list fields if you know them, as shown by the exemple which can be erased. "**Name of the eyepiece**" is in the left column and the "**apparent field**" in arc minutes in the right column. You can enter up to 10 eyepieces. It's better to enter them in the increasing magnification way.

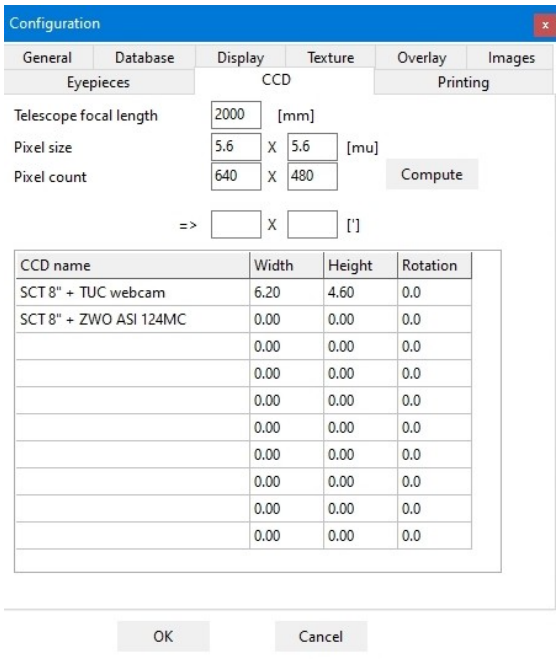
Eyepieces parameters computation

Eyepieces parameters can be computed with the help of our calculator. First enter the "**Instrument focal length**". Then enter the "**Eyepiece focal length**". Then enter the "**Apparent eyepiece field of view**" in the third field. This field is that indicated in eyepieces advertisements. For example, Plossl eyepieces apparent field is about 50° and Ultra Wide Angle eyepiece is 82°.

Push the "**Compute**" button. In the "**Real eyepiece field** " frame, the area diameter is displayed in arc minutes. In the "**Eyepiece magnification**" frame, the magnification of the choosen eyepiece is indicated. After that, you have just to copy these two values in the two colums of the lower table.

You can also input directly the orientation view effects according to your instrument type by clicking in the boxes of the "<->" (Right - left inversion) and "**N/S**" (North / South inversion). If the rectangle is green, so the effect is activated. If it's red, so the effect is not activated. For example : if you use a Schmidt-Cassegrain or a refractor, the "<->" rectangle of the eyepiece must be green, but the "N/S" must be red. For a Newtonian telescope, the "<->" rectangle must be green and the "N/S" must be green too.

"CCD" tab



This tab allows you to enter parameters of your CCDs cameras or others pictures makers to view their real field on the lunar map according to your instrument specifications.

Cameras list

You can enter directly your cameras specifications in the list fields if you know them :

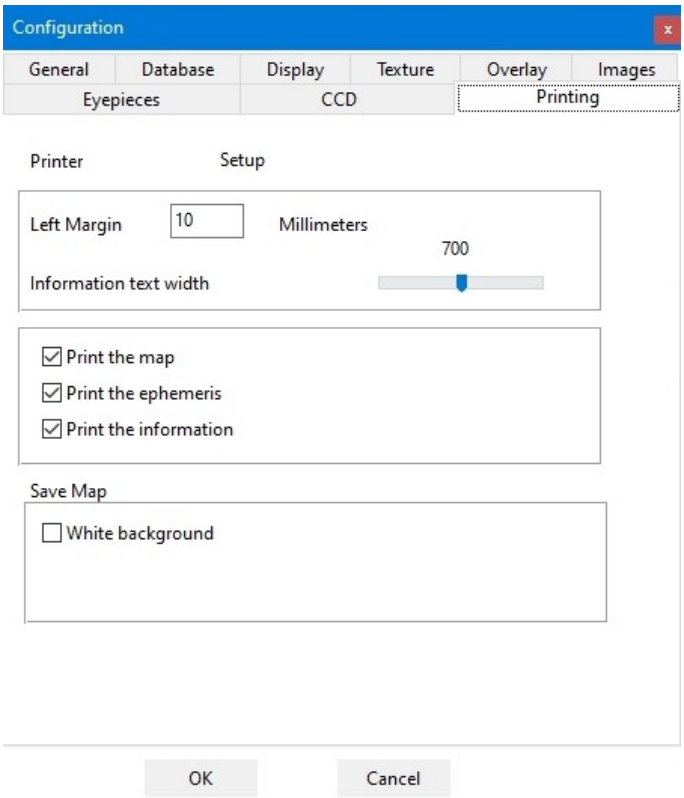
Description in the left column "CCD Name" and field dimensions in pixels. An exemple is shown by default. You can enter 10 products at maximum. It's better to enter them with their increasing magnification.

Computing cameras parameters

If you don't know your cameras parameters, a small calculator can help you. Just enter the instrument focal length and capteur dimensions in pixels.

push the "compute" button. In the real field cases you will see the dimensions of the lunar area that will be imaged.

"Printing" tab



This tab is used to setup map printing parameters.

"Setup" button

This button shows the standard Windows printing setup window.

Printing format

This area is used to choose printing margins width and change the Description text width.

Printed documents

These boxes are used to select the documents that will be printed. The printed map is that of the last window map. Topographic maps are black and white and geologic map are colored with color names in both types. Maybe you will have to change the Description text width to better see printed names.

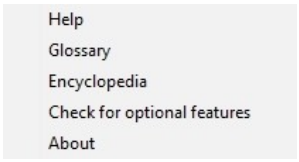
"**Ephemeris**" text contains orbital, phase and libration information according to the last date and hour selected in the "Ephemeris" window.

"**Description**" text contains the information page of the last chosen formation on the map.

"Save map" frame

Displayed map can be printed on paper with white background around the lunar disk to speed up printing and save ink!

"Help" MENU

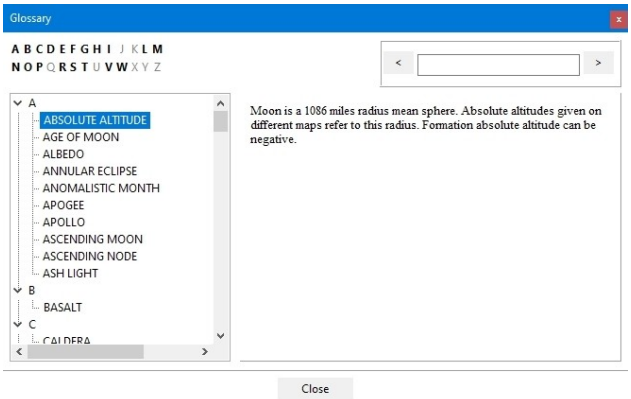


This menu brings up help tools to aid using the atlas.

"Help" choice

This choice displays the present manual in an independent window.

"Glossary" choice



This choice gives access to a glossary containing more than 100 words and expressions linked to the Moon and its observation.

The glossary is also in an independent window which is divided in three distinct parts

Upper part contains alphabet letters. Clicking on one of them gives access to the words beginning with this selected letter.

Left lower part is a tree of letters and associated words.

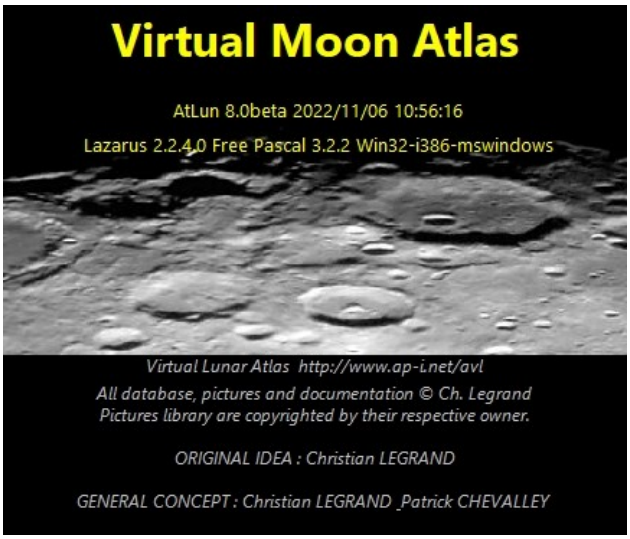
Right lower part contains an explanation of the selected word or expression.

"Encyclopedia" choice

This choice shows you a page with main dimensions of Moon globe and orbit.

"About" choice

This choice shows the version of the program, and indicates how Christian Legrand and Patrick Chevalley divide their work in the creation and development of this atlas.



ZOOM CURSOR

Sliding this cursor from left to right increase zoom magnifying power of the map (See "Map window").

If cursor is on left, lunar globe is entirely visible. Moving it to the right increases zoom power (zooms in).

Depending on the resolution textures chosen in the settings (See "Settings tab"), zoom will not show new details and map display can become fuzzy.

Display of labels and marks is a function of zoom factor and of labels density (See "labels and marks").

It can be increased or decreased with the label cursor further to the right on the button bar.

"1:1" BUTTON

Clicking on this button returns the map to the whole lunar globe display in the "**Map window**".

"Center" BUTTON

Clicking on this button will make the lunar globe center displayed on the center of your screen when zoom is 1/1. It also centers the formation you have selected.

"North / South " BUTTON

If you click on this button, you immediatly invert the North - South in the "Map" window. It must be used with the "East - West" button below to change from naked eye view to Newtonian view.

"East / West " BUTTON

If you click on this button, you immediatly invert the East - West in the "Map" window. It must be used to change from naked eye view to refractor or catadioptric telescope view.

"Full globe / Rotation" button

When clicking on this button, you access to the most powerful function of **ATLUN** (c). If the button is Up, the map window shows you the Near Side visible from the Earth with phase and libration applied if you checked the boxes in the "**Display**" tab of the "**Configuration**" menu.

But if you click down on this button, you go to "**Full globe**" mode and the map window displays a complete globe in three dimensions that you will be able to observe on all its faces.

"Libration" BUTTON

If you click on this button, you display or remove the libration effect on the Moon globe of the "Map" window.

"Grid" BUTTON

When clicking on this button, the grid choosen in the "Overlays" tab of the "Configuration" menu is displayed on the luner globe. The space between parallels and meridians is that has been choosen in the tab, from 1 to 30 °.

"Phase" BUTTON

If you click on this button, you display or remove the phase display on the Moon globe of the "Map" window.

If the "Dynamic shadows" option has been selected in the "Textures" tab of the "Configuration" menu, it's displayed.

"Terminator" BUTTON

The "Terminator" button allows displaying or removing a line materializing exactly the colongitude of the lunar terminator. The color of this line can be chosen in the "Display" tab of the "Configuration" menu.

"Scale" BUTTON

When clicking on this button, a scale in angular dimension is displayed at the left botton of the map window.

Beware ! This scale indicates the "visual" angular size. It doesn't indicate the dimensions on the lunar globe. For measuring distances on the globe, you must use the "distance measure" tool comprised in the "Tools" tab.

"Labels" BUTTON

This button allows you to access the color choice window for map labels. Its use helps a lot to adapt quickly the labels colours to the map hues context, specially with scientific overlays use.

"Short labels" BUTTON

The "Short label" button is used to reduce the clutter of the display that may occur if you use the databases of indexed craters and/or anonymous craters. If you check this box, the names of the "indexed" craters will be reduced to their index. Example: "ERATOSTHENES A" will be displayed as "A". But by clicking on it, it will again be identified as "ERATOSTHENES A". In addition, the names of "anonymous" craters (Bases Unnamed 1 & 2) will not be displayed and they will be indicated by a single star. If you click on a star, the data concerning said crater will be displayed in the "Information" tab

THE LABEL CURSOR

By adjusting this slider, you can adjust the number of labels displayed at the same time on the selected "Map" window.

Completely to the left, the lunar globe is entirely devoid of labels. By moving the cursor to the right, we increase the number of visible labels. This number also varies depending on the zoom level.

Depending on the number of databases used, the display can be very crowded, even at maximum zoom.

"Neighbor" BUTTON

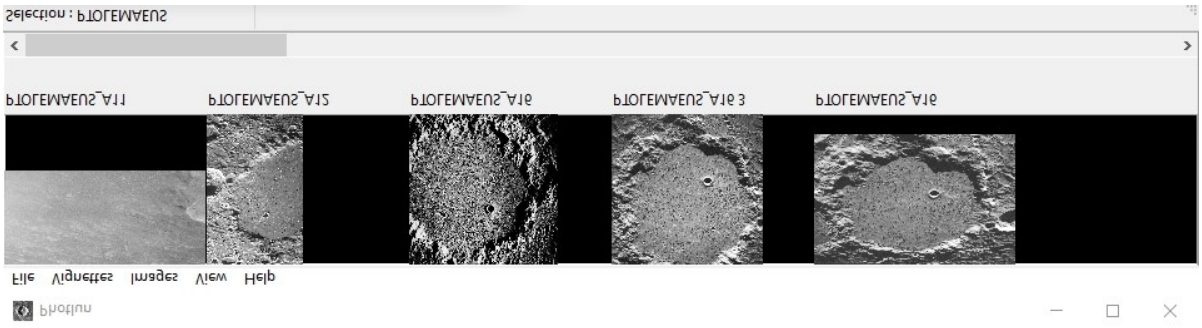
When clicking on this button, a new picture that contains the names of the formations in the neighborhood of the selected formation. You can click on one of them to go directly there.

"PhotLun" BUTTON

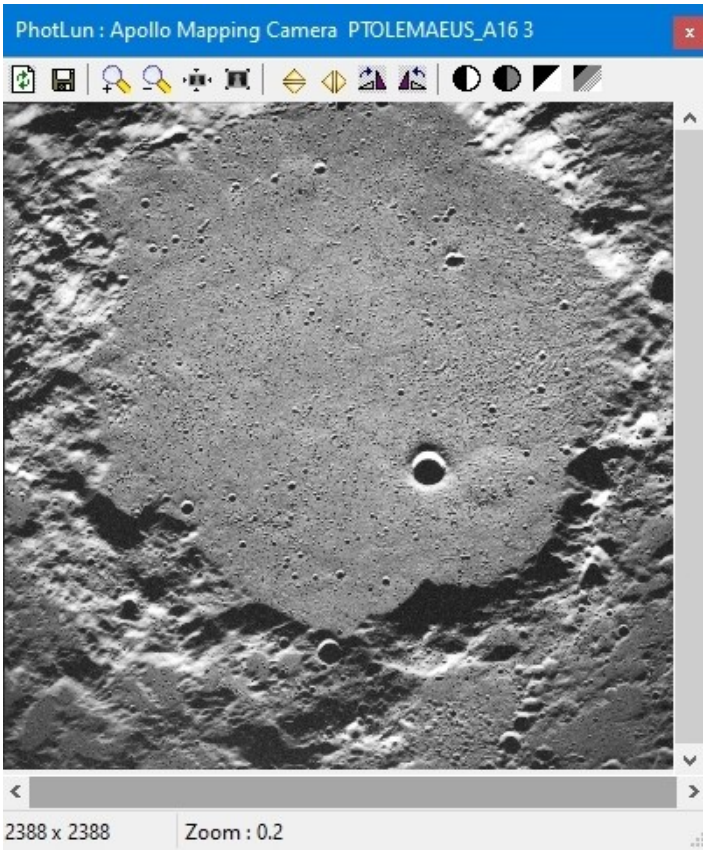
The "Picture" button gives now access to **PHOTLUN (c)**, the VMA Pro pictures manager.

The "PhotLun" (c) window

The miniatures band appears with the menu bar.



This module allows a more easier choice for displaying pictures because of the pre-visualization miniatures pictures.You get the original image of the tab you clicked on in a separate window.

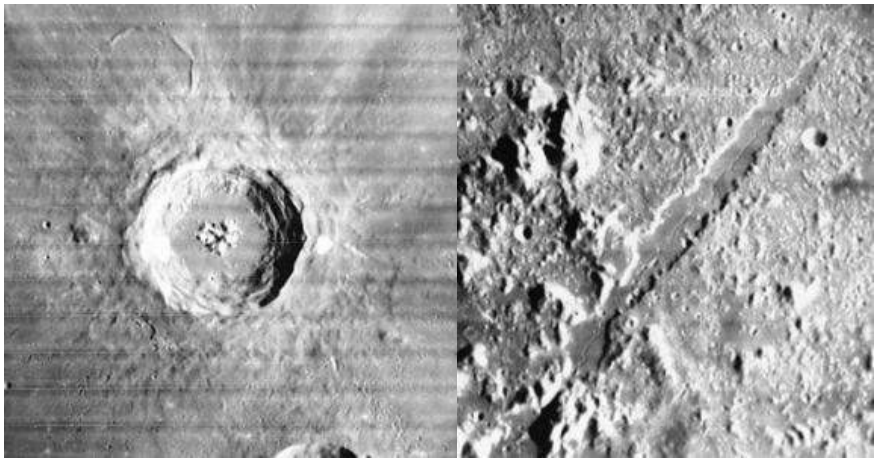


We send you back to the specific **PHOTLUN** (c) documentation to discover all its possibilities and specially the pictures treatment functions (Rotation, zoom, contrast and luminosity).

The pictures library

The pictures library is modular, so you can add a number of sources. You can download for this version picture files coming from various sources. These files have obtained the necessary authorizations to be used ***only*** in VMA.

"LUNAR ORBITER PHOTOGRAPHIC ATLAS OF THE MOON" PICTURES



"Aristillus" and "Vallis Alpes"

These pictures have been extracted from the electronic version of the "**Lunar Orbiter Photographic Atlas of the Moon**" (LOPAM) realized by **Jeff Gillis** and his team at the **Lunar and Planetary Institute**. This remarkable atlas can be consulted on the site http://www.lpi.usra.edu/resources/lunar_orbiter/

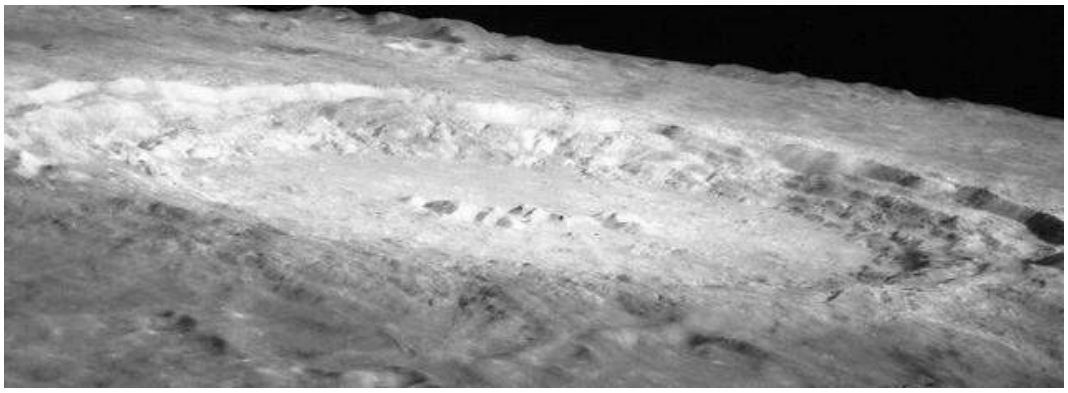
Christian Legrand has extracted from each of the more than 200 LOPAM photos, pictures of each named formation. He compiled about 3000 pictures. Then, he chose the best one for each formation. For some formations, which were spread on several photos, it was necessary to cut and join several peaces. Some others need a new orientation. All these pictures were then compressed so that small size for downloading that doesn't alter quality. Please note that these pictures have been **"lines removed"** using the powerful software provided by **Niels Noordhoek**

Despite of this important work, about 150 formations haven't been recovered in the LOPAM photos because Lunar Orbiter 4 didn't photography the entire visible face with sufficient resolution. For those who don't wish to download all the pictures, Christian Legrand has selected the more famous lunar formations (130) and has gathered them in the "**Lunar stars**" library.

These pictures are under "Lunar and Planetary Institute" copyright and cannot be used outside VMA.

LOPAM pictures are in the "LOPAM" sub-directory.

APOLLO MISSIONS PICTURES



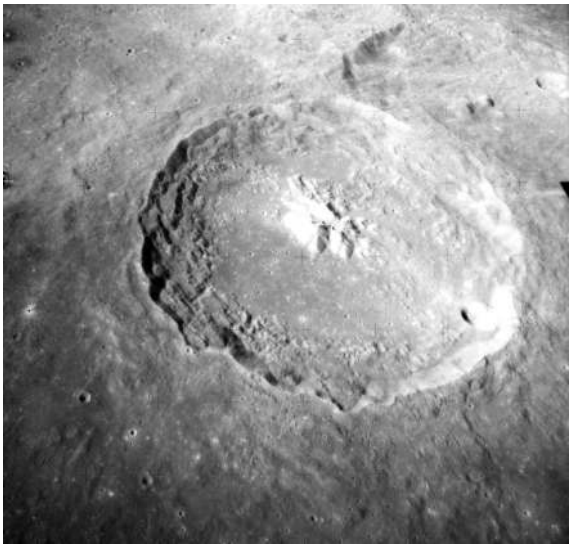
With the goal to provide the most complete image of each lunar formation, Christian Legrand has also selected in the Apollo missions pictures more than 400 pictures related to more than 300 different formations. These pictures are very often from the hand-held Hasselblad pictures.

These pictures are provided under the general copyright of the "National Air and Space Administration" (NASA) which own reproduction rights (http://www.nasa.gov) and they can't be used outside of the atlas.

Picture name indicates the formation name and the Apollo mission that took the picture when it's known : so COPERNICUS_A12.JPG is the name of a picture of Copernicus taken during Apollo 12 mission.

APOLLO pictures are in the "**Apollo**" sub-directory.

APOLLO MAPPING CAMERAS MISSIONS



Theophilus seen by Apollo 16 Mapping Camera.

Put online by the "**Lunar and Planetary Institute**", "**Apollo Mapping Cameras**" pictures, who were on board "Apollo Service Modules", are among the most detailed ever realized. Christian Legrand has selected among hundreds of published frames, those which give the most interesting views of Nearside formations as those above.

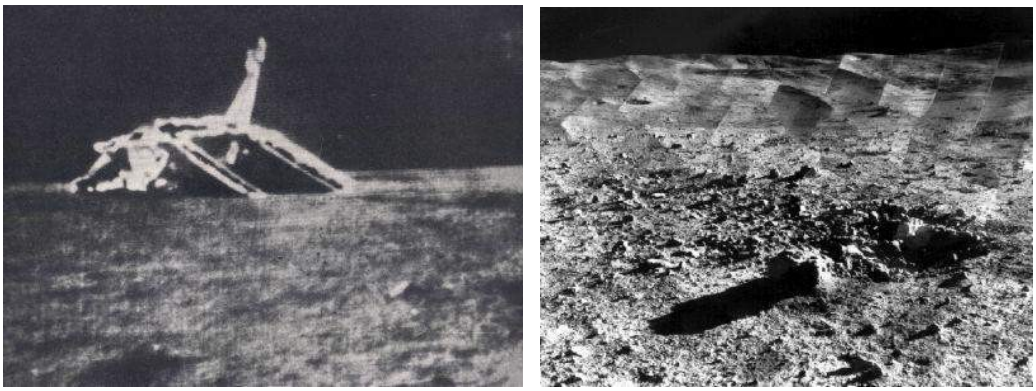
Christian Legrand has extracted about 1000 pictures and has choosen about 700 ones.

These pictures are provided under the general copyright of the "Lunar and Planetary Institute" and they can't be used outside of the atlas.

Picture name indicates the formation name and the Apollo mission that took the picture when it's known : so COPERNICUS_A12.JPG is the name of a picture of Copernicus taken during Apollo 12 mission.

APOLLO MAPPING pictures are in the "**Apollomapping**" sub-directory.

LUNAR PROBES PICTURES



Soviet **Luna 17** pictured by mobile robot Lunakhod 1 (Left) and Tycho crater walls panorama taken by american probe **Surveyor 7** (Right).

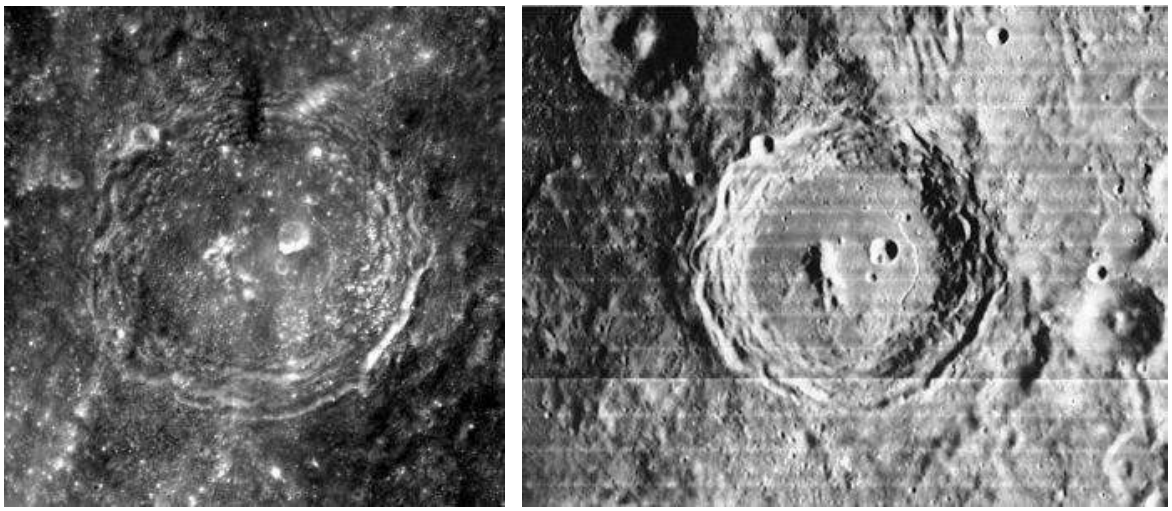
Many other automatic probes than Lunar Orbiter 4 have measured and photographed the Moon. These are american Ranger, Lunar Orbiter 1,2,3,5 and Surveyor. In the historical "Moon race" context, ex USSR has also launched a great number of Luna probes.

This picture library realized by Christian Legrand contains about 120 pictures taken by these probes. Found on the Web, these pictures are provided under the general copyright of the "National Air and Space Administration" (NASA) which own reproduction rights (http://www.nasa.gov) and they can't be used outside of the atlas. Soviet probes pictures have no identified copyright owners.

Picture name indicates the formation name and the probe or Apollo mission that took the picture when it's known : The following code is used associated with XX as the mission number :
- AXX : Apollo
- LOXX : Lunar Orbiter
- LUXX : Luna
- RAXX : Ranger
- SUXX : Surveyor

For example, LUNA 9_LU9.jpg is a picture of Luna 9 site taken by Luna 9 probe itself. Probes pictures are in the "**Probes**" sub-directory.

CLEMENTINE PROBE PICTURES



Arzachel crater picture taken by Clementine (Left) compared to that of LOPAM (Right).

The other great source of lunar formations pictures is the american Clementine mission. This small probe has mapped the lunar surface with à 100 to 200 m per pixel. Christian Legrand works on the general files and extracts pictures of each formation.

Clementine pictures are complementary to those of LOPAM. If their resolution and general quality are better, they have a big defect for terrestriel observers. They were taken with Meridian passing Sun, with the most vertical possible lighting that erases shadows and gives the formation albedo.

For formations situated in a + 45 ° North and - 45 ° South, Pictures show first the albedo. Compare for example with Bessarion LOPAM and Clementine pictures to see the difference. For formations above these latitudes, shadows reappeared and many pictures are better than LOPAM. Compare with Anaxagoras for example.

Clementine pictures are in the "**Clementine**" sub-directory.

JAPANESE PROBE KAGUYA PICTURE

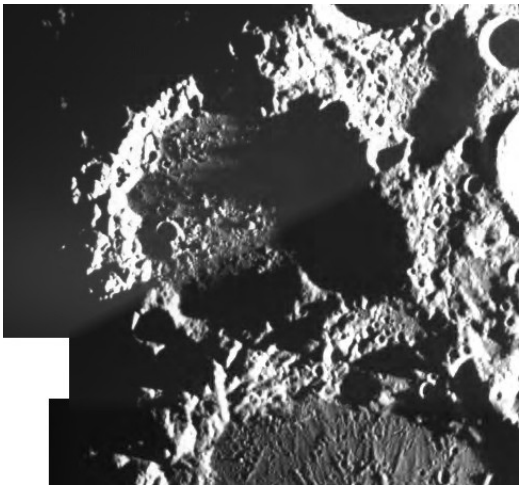
Rupes Recta photographied by Kaguya (c) JAXA

These pictures have been obtained from datas returned by the japanese probe KAGYA et put online on the **Japan_Aerospace_eXploration_Agency (JAXA) Web site.** You can see the original pictures here :

http://wms.selene.jaxa.jp/index_e.html

Christian Legrand has extracted from each original picture, a picture of each present formation. 160 useful pictures have been collected today. The pictures are taken with an angle from the surface. This feature brings new informations about the real shape of the formations. (see Rupes Recta above)

SMART-1EUROPEAN PROBE PICTURES

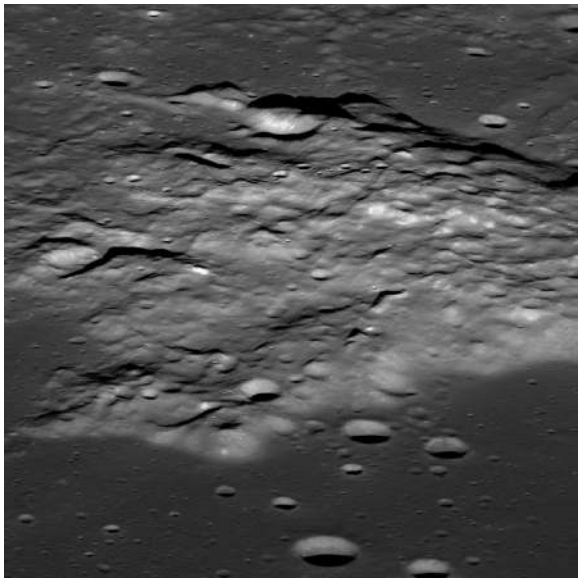


These images were obtained from images taken by the European SMART-1 probe and posted on the Japan_Aerospace_eXploration_Agency (JAXA) website. This remarkable work can be consulted on the website:

https://www.esa.int/ESA_Multimedia/Missions/SMART-1/(result_type)/images

With the authorization of Professor Bernard Foing (Thanks to him!), Christian Legrand was able to extract from each of the photos images of each formation that was there. He thus "harvested" 102 usable images. Smart-1 notably took images of interesting polar formations, which brings new data on the real shape of the formations (see Hermite above)

LUNAR RECONNAISSANCE ORBITER US PROBE OBLIQUE PICTURES

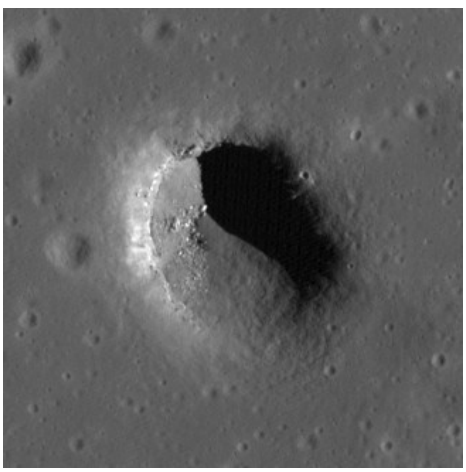


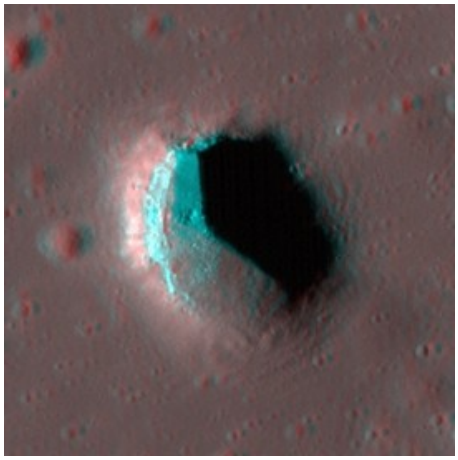
These images were obtained from images taken by the American LUNAR RECONNAISSANCE ORBITER probe and posted on the Lunar Reconnaissance Orbiter Camera website. This remarkable work can be consulted on the website:

https://www.lroc.asu.edu/posts

If the LRO probe maps the surface of the Moon, it also takes particularly impressive images in oblique view. Thanks to the work of Mark Robinson's team (Thanks to them!), Christian Legrand extracted from each of the photos images of each formation that was there. He has thus "harvested" about thirty usable images so far. These are images of formations taken obliquely, which provide new data on the real shape of the formations (see Mons Rümker above)

LUNAR RECONNAISSANCE ORBITER US PROBE PITS PICTURES





These images were obtained from images taken by the American LUNAR RECONNAISSANCE ORBITER probe and posted on the Lunar Reconnaissance Orbiter Camera website. This remarkable work can be consulted on the website:

https://www.lroc.asu.edu/posts

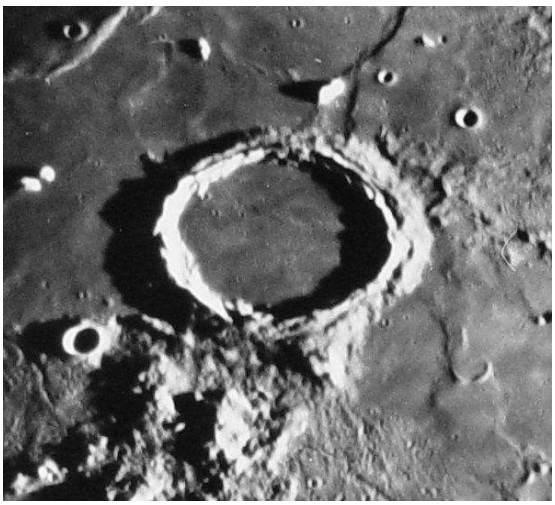
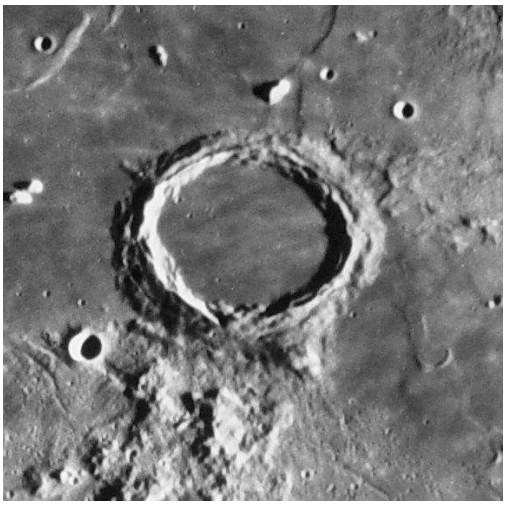
If the LRO probe maps the surface of the Moon, it also takes particularly impressive very high resolution images (50 cm/pixel!). It thus allowed the discovery of the “Lunar pits” which are cavities opening on old lava tubes. Thanks to the catalog put online by Mark Robinson's team (Thanks to them!), Christian Legrand took the images of the pits and associated them with a "Lunar pits" database. The catalog, the database and the present library contain 250 entries. Almost all of them are lined with 3D "Anaglyph" images allowing you to see the wells in relief with red & blue glasses. These are images of formations taken obliquely, which provide new data on the real shape of the formations (see LUNAR PIT CENTRAL MARE FECUNDITATIS above)

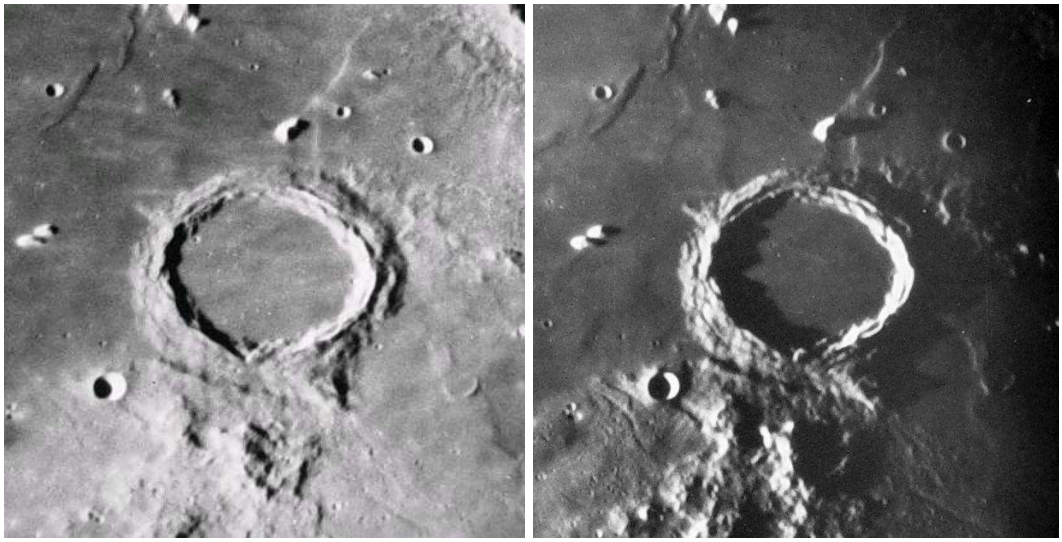
CONSOLIDATED LUNAR ATLAS PICTURES

The best ever published lunar atlas for the lunar observer is the "Consolidated Lunar Atlas " by Gerard Kuiper and al. It compiles best Moon pictures taken from Earth by some great observatories as Catalina and Pic du Midi. Resolution of some pictures are about 1 km. Only since little time, amateurs equiped with webcams and large telescope begin to have better results than those ones.

This atlas has an unvaluable value because, as "Georges Viscardy's Photographic Atlas", it shows the formations under sevearl sun lightings and at the Full Moon.

For example, here are the pictures extracted for Archimedes :



These pictures allows you to see the aspects of a given formation related to the observing day. This library is presently not complete. It contains more than 2000 pictures and will be updated regularly. Priority is given to CLA pictures above Clementine pictures because they are more useful for terestrial observers. And our "Clementine 500 m resolution" texture replaces them momentarily. Check regularly our Web site to see if CLA library updates are available.

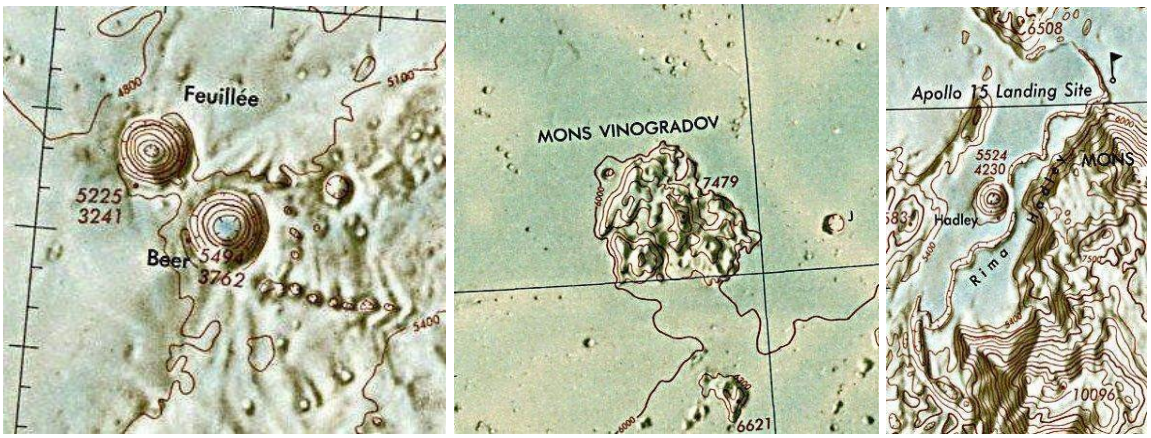
This fabulous work is visible on the site :

http://www.lpi.usra.edu

The CLA pictures are in the "**CLA**" sub-file.

LUNAR ASTRONAUTICAL CHARTS AND LUNAR MAPS PICTURES

The best drawn Moon maps ever published are the "Lunar Astronautical Charts" and the "Lunar Maps". Their scale is 1 / 1 000 000. Most of them include altimetric levels curves allowing to determine heights or depths of formations.



Christian Legrand has extracted from LAC / LM more than 800 formations pictures of the Nearside. Because of their precision and their colors, these pictures have not been compresses. This library is then heavy to download.

These pictures are under "Lunar and Planetary Institute" copyright and cannot be used outside VMA.

This fabulous work is visible on the site :

http://www.lpi.usra.edu

The Lunar Astronautical Charts and the Lunar Maps pictures are in the "**LAC / LM**" sub-file.

All this unique set of pictures librairies provides you numerous views of formations for comparing or studying them.

"BEST OF AMATEURS" LIBRARIES

Some of the world best lunar imagers have accepted to show their pictures in a special VMA pictures library only usable with VMA.. Compiled by Christian Legrand, this new library contains presently more than 350 images from **Craig Zerbe, Mike Wirths, Wes Higgins, Zac Pujic and Paolo Lazzarotti**. Others amateurs have been contacted and their pictures will be added in this library whose pictures are very often better than those of Consolidated Lunar Atlas, and which rival sometimes with lunar automatic probes.

Because of the great numbers of pictures they provided, pictures by Paolo Lazzarotti and Wes Higgins ar in separate libraries.

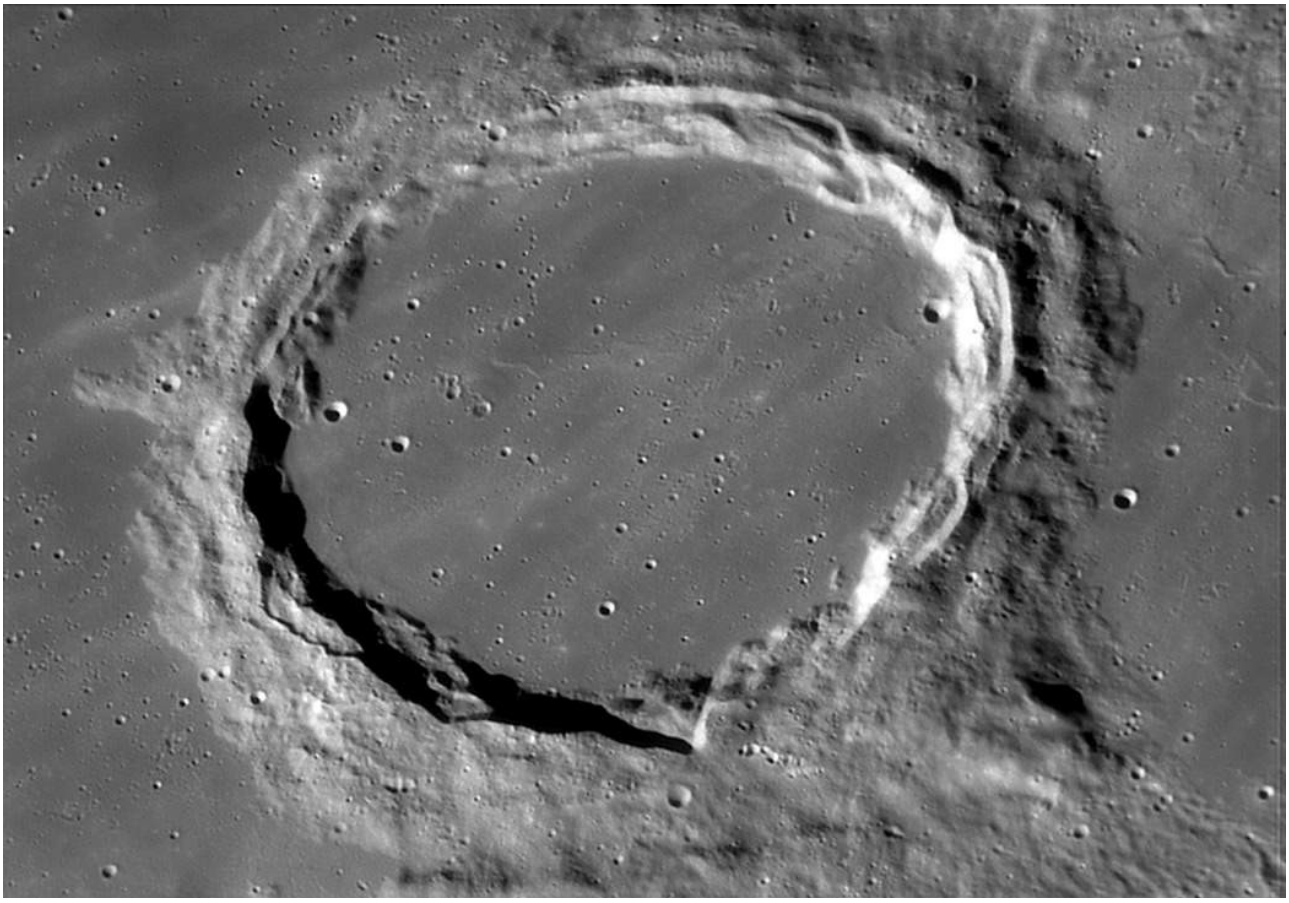
Christian Legrand has treated, with the authorization of the authors some of the pictures for harmonicizing contraste and luminosity to boost the resolution.

Pictures name indicate the formation name and that of the author. For example, Plato_Lazzarotti.jpg is a picture of Plato crater taken by Paolo Lazzarotti.

ATTENTION: These images are provided under the copyright of each of the original authors holding the reproduction rights and cannot be used outside the VMA. Any other use must be explicitly requested from the original author. We thank them for agreeing to include them in the VMA.

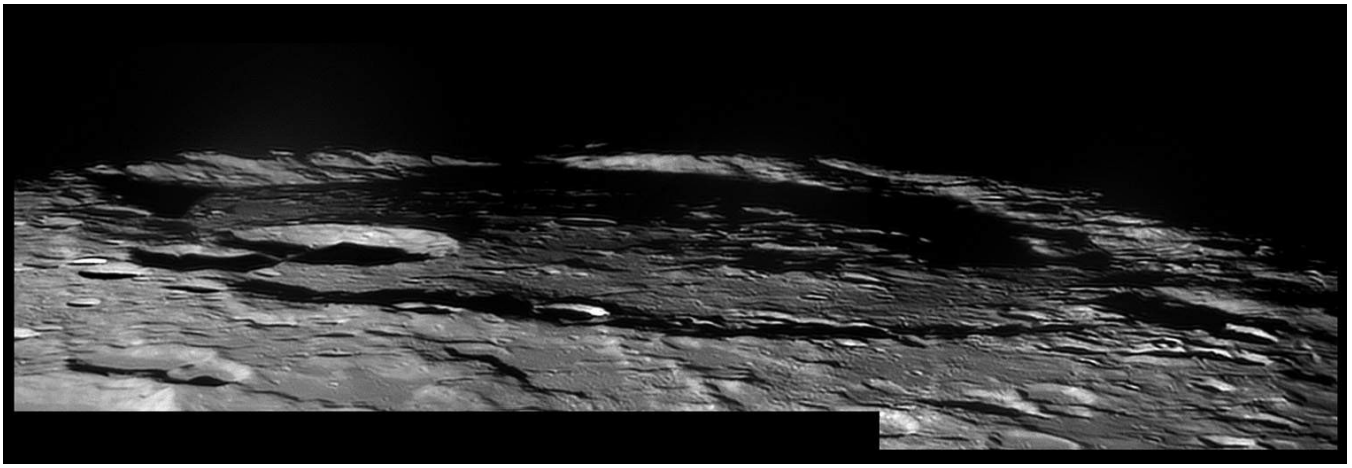
- T1MPDM / 1 meter Pic du Midi telescope

It contains pictures realized by JL Dauvergne , F. Colas, C. Mansion, T. Legault and C. Villadrich with the 1 m Pic du Midi telescope which are the lunar pictures taken from the surface of Earth (Archimedes below).



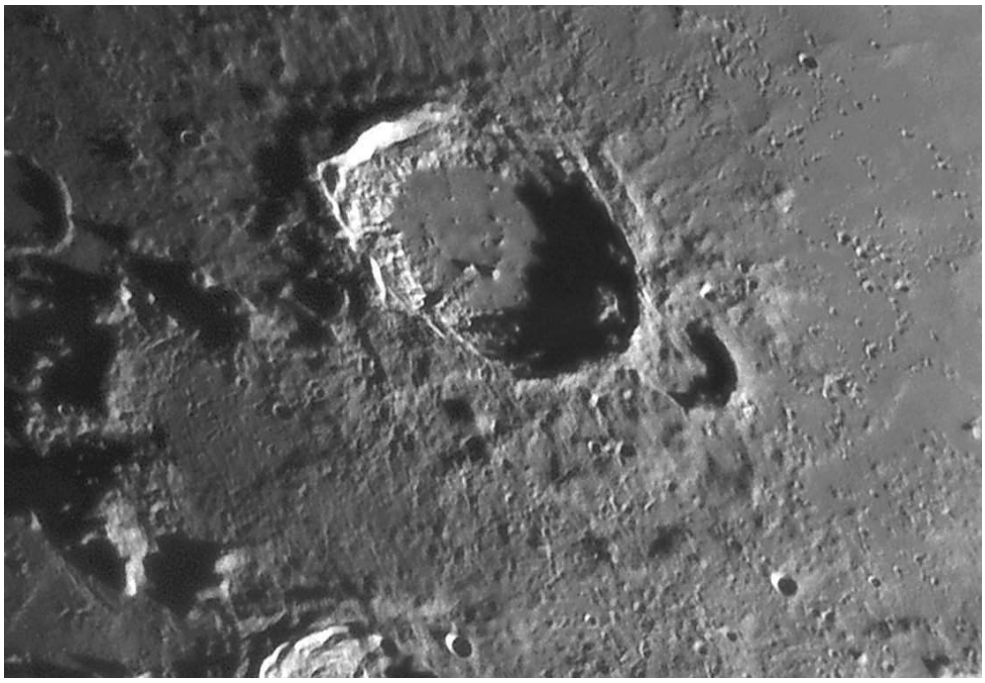
- **Best of Peach**

It contains pictures taken by Damian Peach with his Celestron 14 et un Celestron 9,25 (Bailly below). It's one of the most important amateur pictures library.

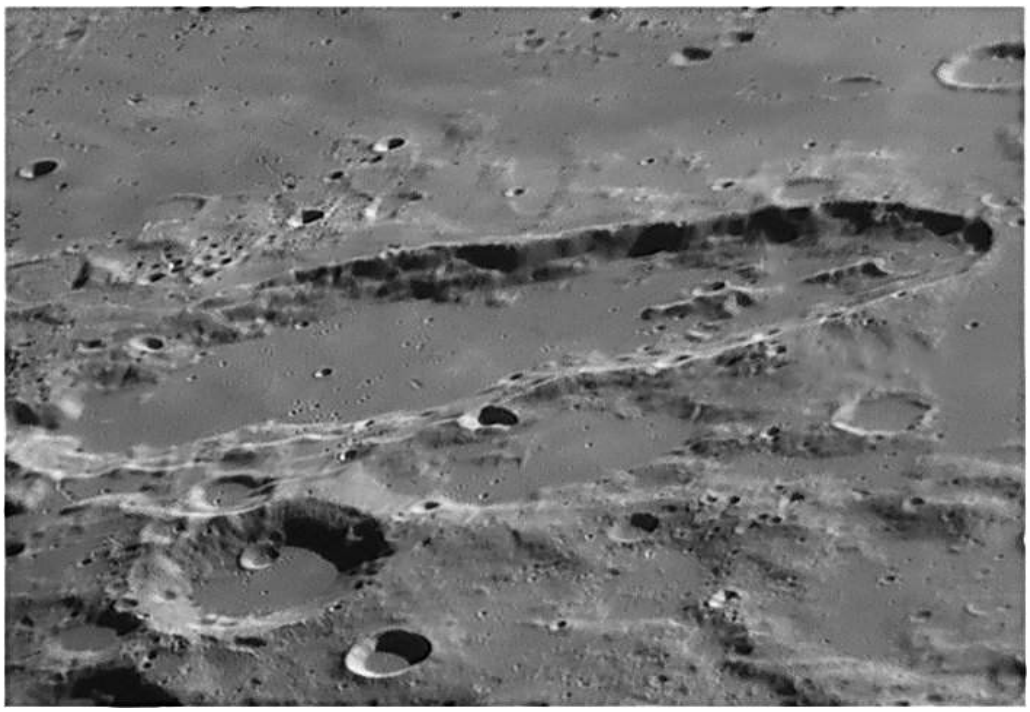


Best of Lazzarotti

Contains pictures realized by Paolo Lazzarotti with his 12" Gladius (Aristoteles here)

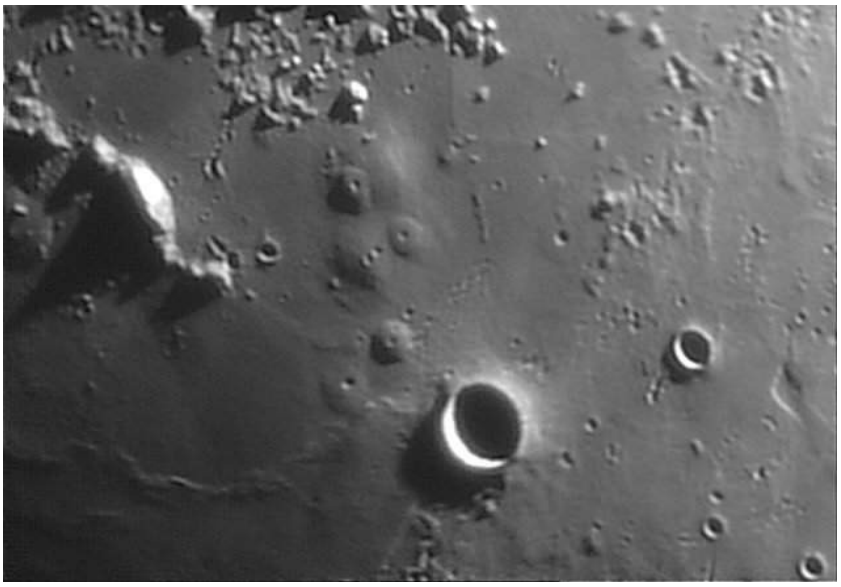


- **Best of Higgins** : Contains pictures realized by Wes Higgins with his 18" Dobson (Schiller here)



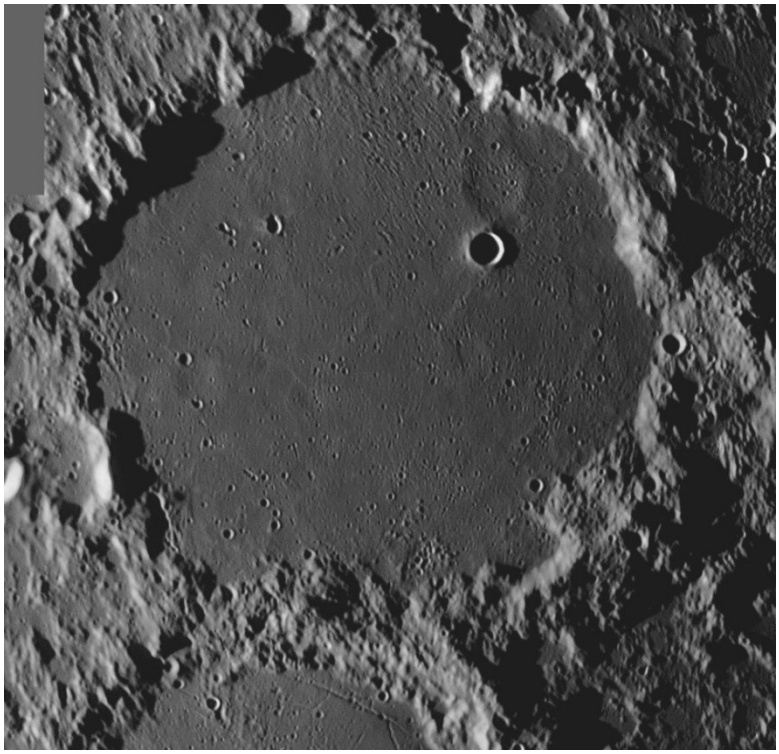
- **Best of Amateurs**

Contains picture relized by Mike Wirths (Hortensius domes here) and Craig Zerbe

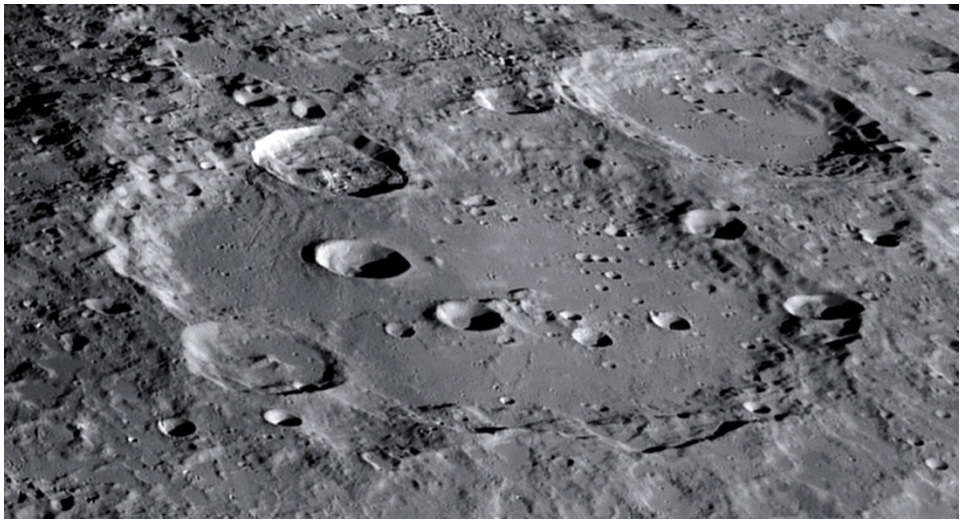


Best of Cathala

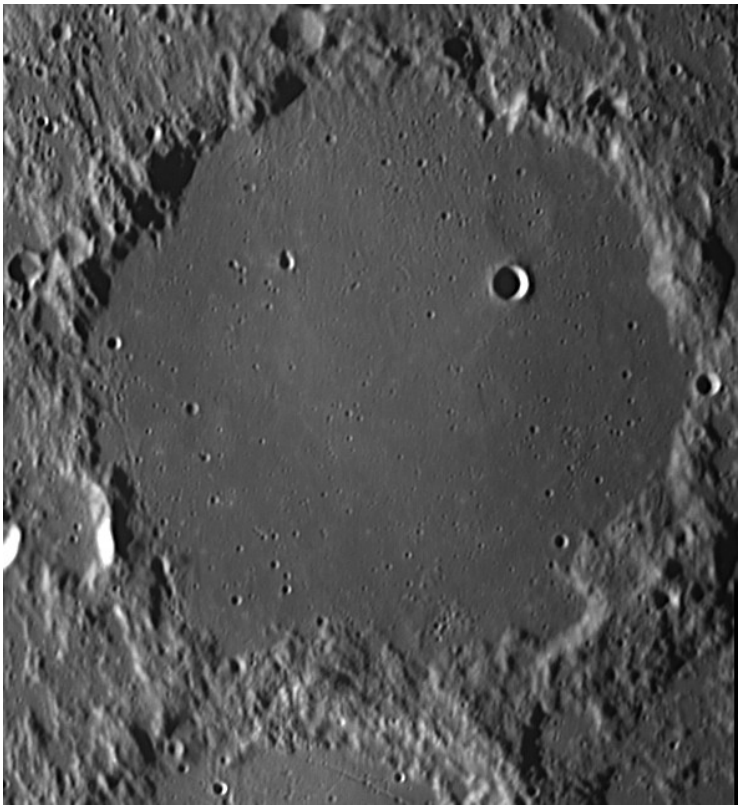
It contains the images taken by Luc Cathala with a motorized Dobson telescope of personal manufacture of 625 mm in diameter with a QHYSIII178M camera. It is the most supplied "amateur astronomer" library with nearly 700 very high resolution images.



Best of Brahic: It contains images taken by Jean-Pierre Brahic with a Celestron 14 and a 350 mm Ritchey-Chrétien (Bailly below). It is one of the largest amateur libraries associated with the AVL with nearly 1000 images.



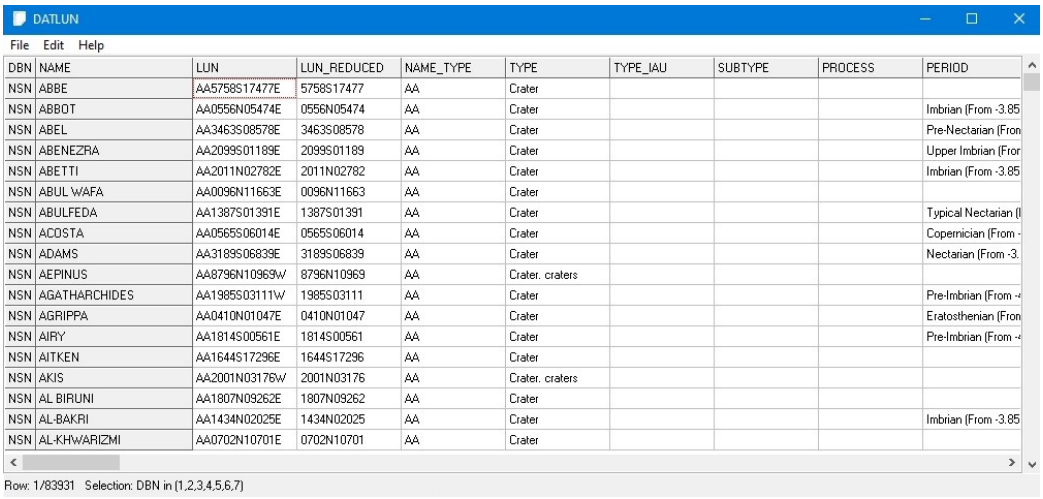
Best of Viladrich: It contains the images made by Christian Viladrich with a Celestron 14 and a Ritchey-Chrétien 500 mm (Ptolemaeus below). It is the biggest amateur library associated with the AVL with nearly 1100 images.



All these libraries give now more than 8 000 formations pictures available to VMA users.

"DATLUN " Button

If you click on this button, you can open the "**DATLUN**" (c) window, which is the VMA database manager :

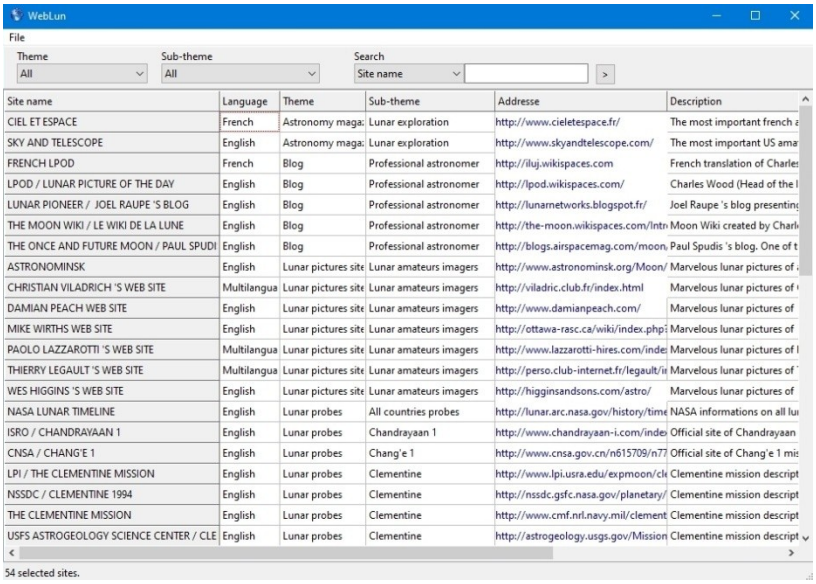


DBN	NAME	LUN	LUN_REDUCED	NAME_TYPE	TYPE	TYPE_IAU	SUBTYPE	PROCESS	PERIOD
NSN	ABBE	AA5758S17477E	5758S17477	AA	Crater				
NSN	ABBOT	AA0556N05474E	0556N05474	AA	Crater				Imbrian (From -3.85
NSN	ABEL	AA3463S08578E	3463S08578	AA	Crater				Pre-Nectarian (Fron
NSN	ABENEZRA	AA2099S01189E	2099S01189	AA	Crater				Upper Imbrian (Fror
NSN	ABETTI	AA2011N02782E	2011N02782	AA	Crater				Imbrian (From -3.85
NSN	ABUL WAFA	AA0096N11663E	0096N11663	AA	Crater				
NSN	ABULFEDA	AA1387S01391E	1387S01391	AA	Crater				Typical Nectarian (I
NSN	ACOSTA	AA0565S06014E	0565S06014	AA	Crater				Copernician (From -
NSN	ADAMS	AA3189S06839E	3189S06839	AA	Crater				Nectarian (From -3.
NSN	AEPINUS	AA8796N10969W	8796N10969	AA	Crater. craters				
NSN	AGATHARCHIDES	AA1985S03111W	1985S03111	AA	Crater				Pre-Imbrian (From -4
NSN	AGRIPPA	AA0410N01047E	0410N01047	AA	Crater				Eratosthenian (Fron
NSN	AIRY	AA1814S00561E	1814S00561	AA	Crater				Pre-Imbrian (From -4
NSN	AITKEN	AA1644S17296E	1644S17296	AA	Crater				
NSN	AKIS	AA2001N03176W	2001N03176	AA	Crater. craters				
NSN	AL BIRUNI	AA1807N09262E	1807N09262	AA	Crater				
NSN	AL-BAKRI	AA1434N02025E	1434N02025	AA	Crater				Imbrian (From -3.85
NSN	AL-KHWARIZMI	AA0702N10701E	0702N10701	AA	Crater				

You can discover all the potential of this new software conceived by Christian Legrand and written by Patrick Chevalley if you consult its user's manual.

"WEBLUN " Button

If you click on this button, you open the "WEBLUN" (c) window containing the lunar Web sites database manager.

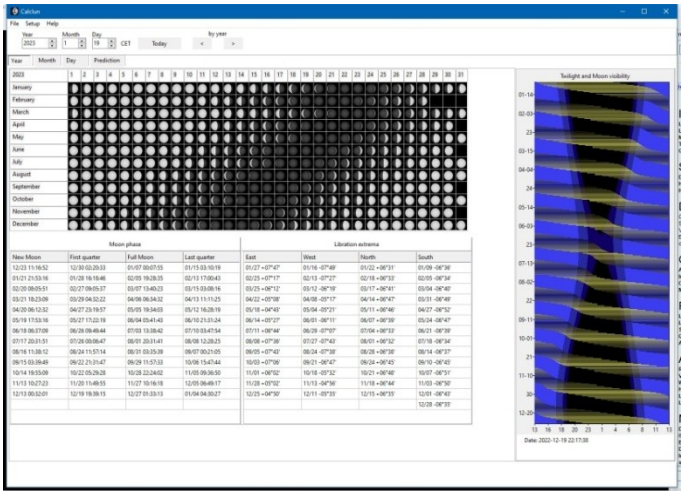


Site name	Language	Theme	Sub-theme	Addresse	Description
CIEL ET ESPACE	French	Astronomy maga:	Lunar exploration	http://www.cieletespace.fr/	The most important french a
SKY AND TELESCOPE	English	Astronomy maga:	Lunar exploration	http://www.skyandtelescope.com/	The most important US ama
FRENCH LPOD	French	Blog	Professional astronomer	http://iluj.wikispaces.com	French translation of Charles
LPOD / LUNAR PICTURE OF THE DAY	English	Blog	Professional astronomer	http://lpod.wikispaces.com/	Charles Wood (Head of the I
LUNAR PIONEER / JOEL RAUPE 'S BLOG	English	Blog	Professional astronomer	http://lunarnetworks.blogspot.fr/	Joel Raupe 's blog presentin
THE MOON WIKI / LE WIKI DE LA LUNE	English	Blog	Professional astronomer	http://the-moon.wikispaces.com/Intr	Moon Wiki created by Charl
THE ONCE AND FUTURE MOON / PAUL SPUDI	English	Blog	Professional astronomer	http://blogs.airspacemag.com/moon	Paul Spudis 's blog. One of t
ASTRONOMINSK	English	Lunar pictures site	Lunar amateurs imagers	http://www.astronominsk.org/Moon/	Marvelous lunar pictures of
CHRISTIAN VILADRICH 'S WEB SITE	Multilangua	Lunar pictures site	Lunar amateurs imagers	http://viladric.club.fr/index.html	Marvelous lunar pictures of
DAMIAN PEACH WEB SITE	English	Lunar pictures site	Lunar amateurs imagers	http://www.damianpeach.com/	Marvelous lunar pictures of
MIKE WIRTHS WEB SITE	English	Lunar pictures site	Lunar amateurs imagers	http://ottawa-rasc.ca/wiki/index.php	Marvelous lunar pictures of
PAOLO LAZZAROTTI 'S WEB SITE	Multilangua	Lunar pictures site	Lunar amateurs imagers	http://www.lazzarotti-hires.com/inde	Marvelous lunar pictures of
THIERRY LEGAULT 'S WEB SITE	Multilangua	Lunar pictures site	Lunar amateurs imagers	http://perso.club-internet.fr/legault/i	Marvelous lunar pictures of
WES HIGGINS 'S WEB SITE	English	Lunar pictures site	Lunar amateurs imagers	http://higginsandsons.com/astro/	Marvelous lunar pictures of
NASA LUNAR TIMELINE	English	Lunar probes	All countries probes	http://lunar.arc.nasa.gov/history/time	NASA informations on all lu
ISRO / CHANDRAYAAN 1	English	Lunar probes	Chandrayaan 1	http://www.chandrayaan-i.com/inde	Official site of Chandrayaan
CNSA / CHANG'E 1	English	Lunar probes	Chang'e 1	http://www.cnsa.gov.cn/n615709/n77	Official site of Chang'e 1 mis
LPI / THE CLEMENTINE MISSION	English	Lunar probes	Clementine	http://www.lpi.usra.edu/expmoon/cl	Clementine mission descript
NSSDC / CLEMENTINE 1994	English	Lunar probes	Clementine	http://nssdc.gsfc.nasa.gov/planetary/	Clementine mission descript
THE CLEMENTINE MISSION	English	Lunar probes	Clementine	http://www.cmf.nrl.navy.mil/clement	Clementine mission descript
USFS ASTROGEOLOGY SCIENCE CENTER / CLE	English	Lunar probes	Clementine	http://astrogeology.usgs.gov/Mission	Clementine mission descript

You can discover all the potential of this software conceived and written by Patrick Chevalley if you consult its user's manual.

"CALCLUN " Button

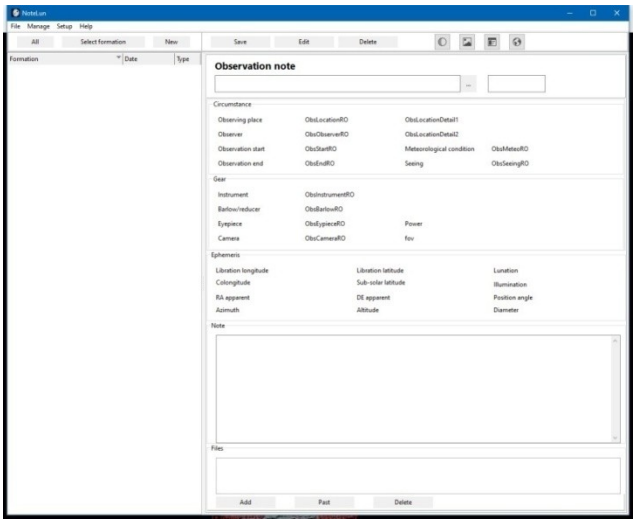
If you click on this button, you open the "CALCLUN" (c) window containing the lunar ephemerisis manager.



You can discover all the potential of this new software conceived and written by Patrick Chevalley if you consult its user's manual.

"NOTELUN " Button

If you click on this button, you open the "NOTEUN" (c) window containing the lunar external documents manager.

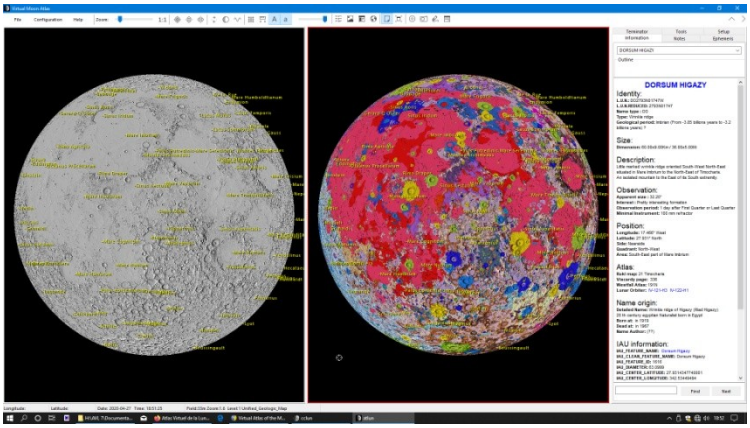


You can discover all the potential of this new software conceived by Christian Legrand and written by Patrick Chevalley if you consult its user's manual.

"2nd Window" BUTTON

If you click on this button, the "Map" window separates in two windows with equal width. This new window has the same properties as the main window. You obtain the "map" window, the "configuration" menu, the tabs and the buttons bar. Tomake active one of the 2 windows and access to its setup, click in it. The active window is then surrounded by a red border

This new window opens with the same lunar area as the first. So, you can easily compare the two windows and you can apply in this second window textures and overlays different from those of the first window.



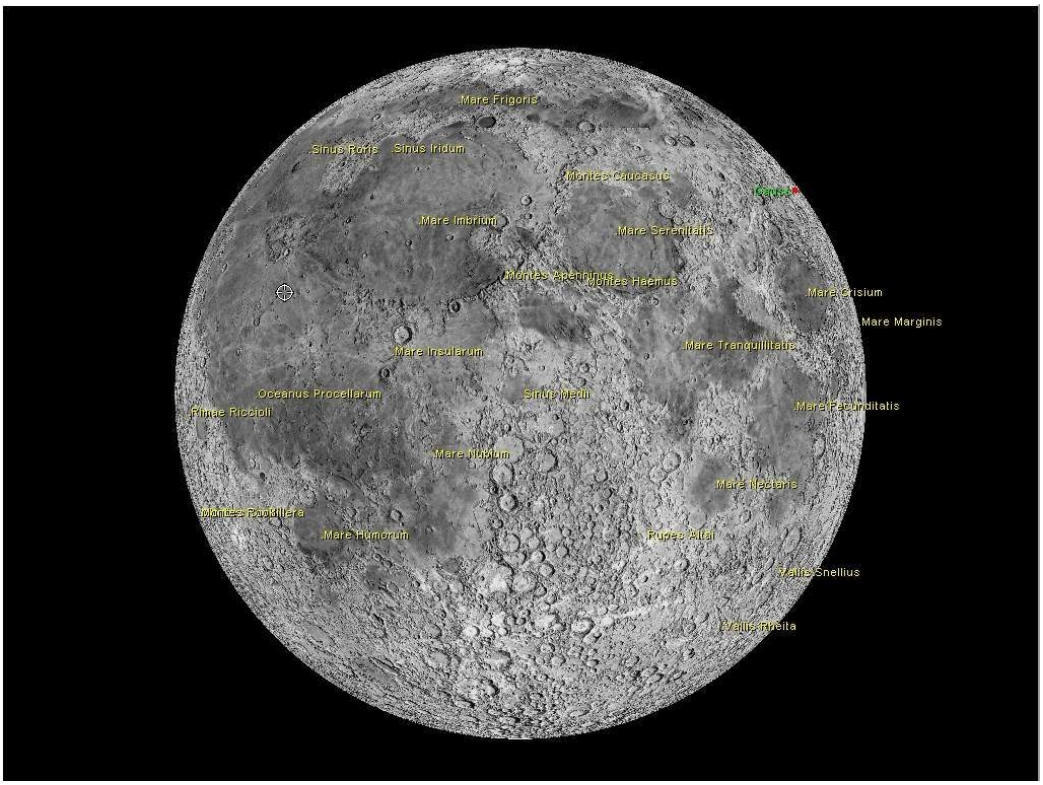
Screen capture showing VMA one window with "altitude" overlay and second window with "iron" overlay.

The "Mother" window which is affected by the cursor is surrounded by a red border. Just click on the other window so that it becomes active in turn and surrounded by red.

Beware ! This new function needs a powerful computer to be exploited with all its possibilities (If possible, processor frequency above 2 GHz, 512 Mb RAM and a graphic card supporting OpenGL with 64 Mb video RAM)

"Full Screen" BUTTON

If you click on this button, the tabs on the right, the title bar and the status bar all disappear, leaving only the map window or the double map window only on the screen.



Fabulous for large monitors, LCD and plasma TV, and videoprojector !!!
It's also a very useful tool for lectures and planetariums about the Moon !

A click on the left button selects a formation.

Pressing the left button and moving the mouse moves the map. The mouse wheel drives the zoom.

You have still access to the right click menu for managing the views.

To find menus & tabs, simply press the "Esc" key or go to the context menu of the "Right click" and click on "Back window".

"EYEPIECE" BUTTON

By clicking on this button, you can directly open the "Eyepieces" tab of the "Configuration" menu with direct access to the list of eyepieces that you have entered.

"CCD" BUTTON

By clicking on this button, you can directly open the "CCD" tab of the "Configuration" menu with direct access to the list of cameras that you have entered.

"NOTES" BUTTON

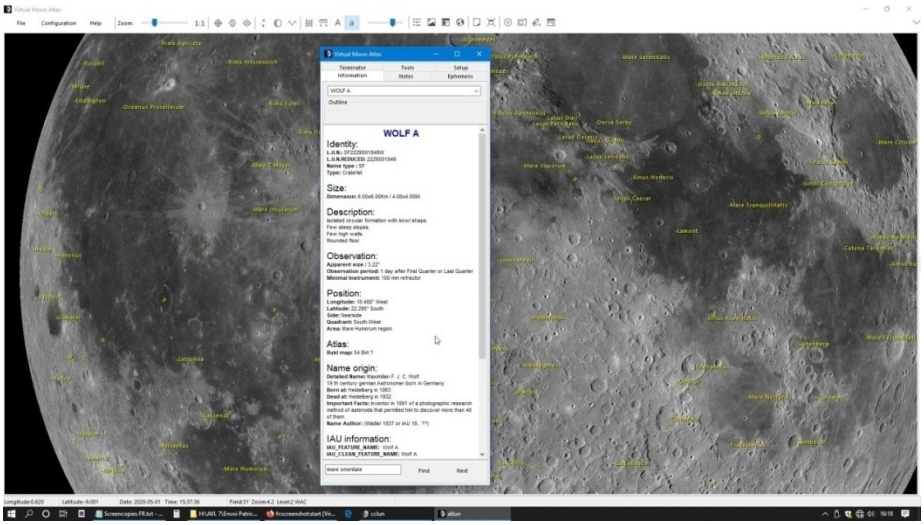
By clicking on this button, you can directly open the "Notes" tab) on the right with direct access to the note taking tool.

"EPHEMERISIS" BUTTON

By clicking on this button, you can directly open the "Ephemeris" tab with direct access to the date & time scanning tool.

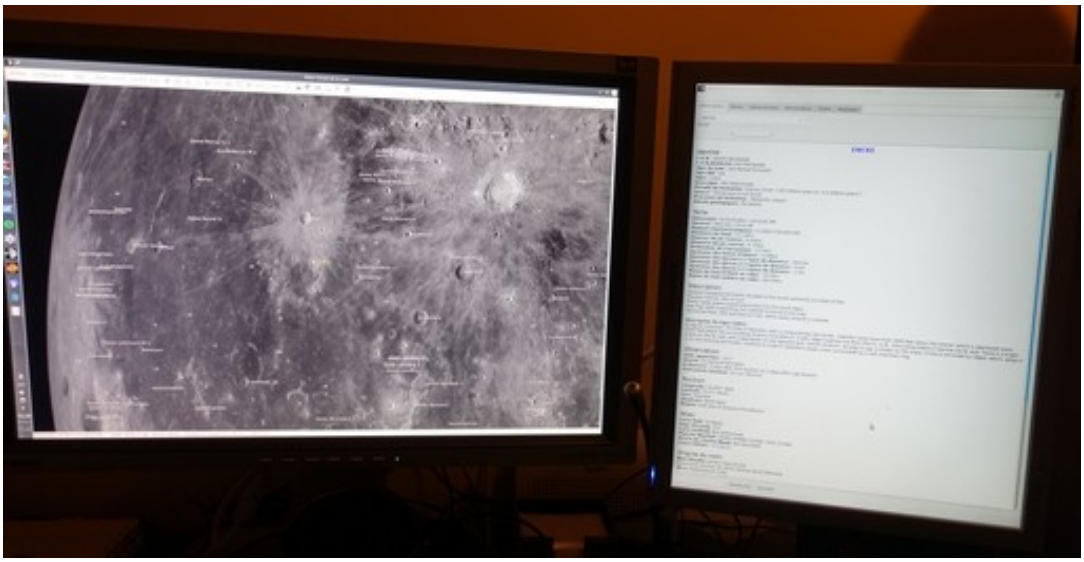
"TABS" BUTTON

By clicking on this button, you can temporarily "detach" the tabs on the right to enlarge the "Map" window (s) (in two-window mode). You can then position them where you want as in the screenshot below. The "Tabs" window has the "Windows" buttons to put it in full screen (Global view of the "Information" data, for example "or delete it. The arrow of the" Tabs "button will change direction and by clicking a second time on it , you can redisplay the tabs.

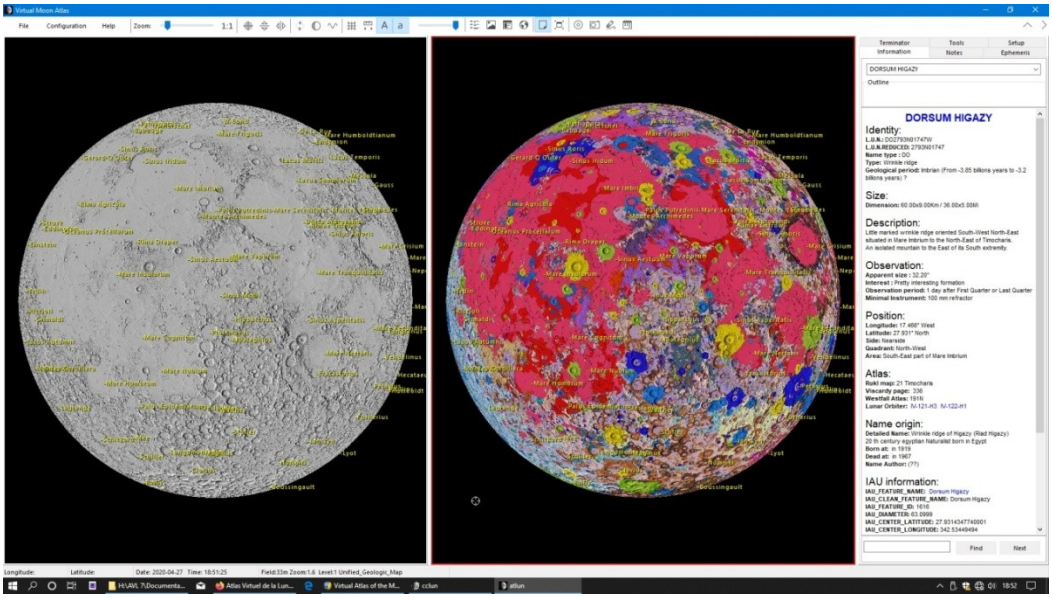


"2ND MONITOR" BUTTON

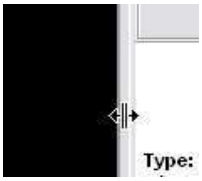
If you have two monitors connected to your computer as in the photo below, by clicking on this button >, you can temporarily display the tabs on the right on this second monitor to maximize the window or windows on your main screen " Map "(In two-window mode) without losing the tab information. Your mouse should be able to move around on both monitors.
The arrow of the button will change direction and by clicking a second time on it, you will be able to redisplay the tabs on the first monitor.



THE MAP WINDOW



"**Map**" window is on the left of general window. At opening, it shows It shows Nearside according to the options selected (See "Map display "). This window can't be removed and is now independently sizable. Go with the pointer one the separation line with the right tabs. A new pointer appears. Stay with the mouse left button pushed and move it. The "Map" window width will be set.

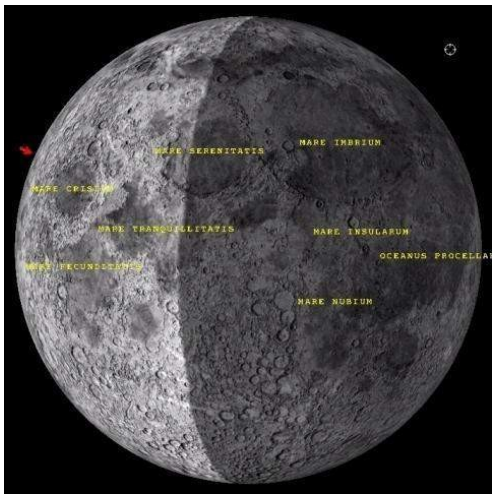


Slide bars appear according to the applied zoom factor (See "Zoom cursor").

THE GLOBE MAP

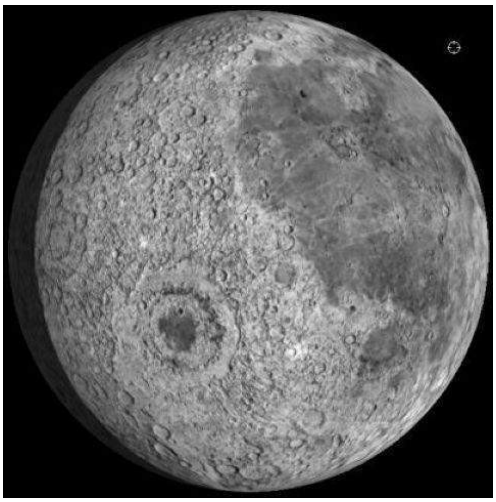
It's oriented in the same direction as Moon seen with naked eye or binoculars.
You can turn the map around its center to copy the eyepiece vision in a Newtonian.
You can display the map as in a mirror to see it as in a refractor or a Schmidt-Cassegrain instrument (See "Tools" tab).

"Near Side" map with inversion "<->"



If the "**Libration**" option (See "Configuration menu") is choosen, center of the map is not absolutely the center of the presented drawing because of libration. "Expert" version texture has been configured by Patrick Chevalley for an optimal display, specially for libration zones.

"Full globe" map



It permits to view a complete lunar globe and to study the Far Side invisible from the Earth (On the above screen capture, you can remark Mare Orientale). It's always the same "David Seals" texture presenting details visible in a 120 mm (5") instrument applied on a 3D sphere, but in that case with no limited move.

If the options "**Display libration**" and " **Display phase** " (See "Configuration menu ") are checked, the lighting of the lunar globe is as the real one, for the date and hour choosen in the " **Ephemerisis**" tab.

Map move

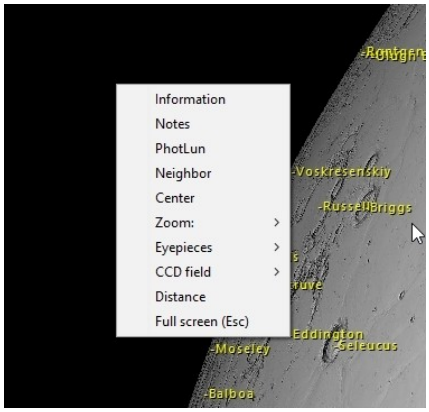
As a zoom factor is applied to map, you will be able to move into it.

In the "**Near Side**" mode, you can also "grab" the map in left clicking on it and keeping left button clicked while moving the mouse.

In the "**Full Moon**" mode, you can also "grab" the globe with a mouse left click and while keeping left button click, you can *turn* the globe in the East or West direction when moving the mouse.

Mouse right click

A right click on the mouse and a context menu appear with several choices.



Information : Sends you to the information database window.

Notes : Send you to the "Notes" tab

Picture : Displays the pictures list or the LOPAM picture of the selected formation.

Neighbour : Displays in a new window the formations list in the neighbourhood of the selected formation.

Center : Centers the map on the selected formation.

Zoom : Can setup directly the zoom factor to 1/1, 1/2 or 1/4.

Eyepieces : Allows you to choose the used eyepiece and have the exact view in the associated instrument. A black mask with a round centered hole appears on the "**Map**" window. To cancel, just click the "**None**" option.

CCD : Allows you to choose your electronic camera and to vizualize its field on the Moon. A colored frame appear. If you want to remove it, just click on the "none" option.

Distance : Activate the mode "**Distance measurement**" (Voir "Distance measurement")

Full screen : Allows you to remove the menus and tabs to assign the one or two "Map" windows (In two-window mode) to the entire screen area.

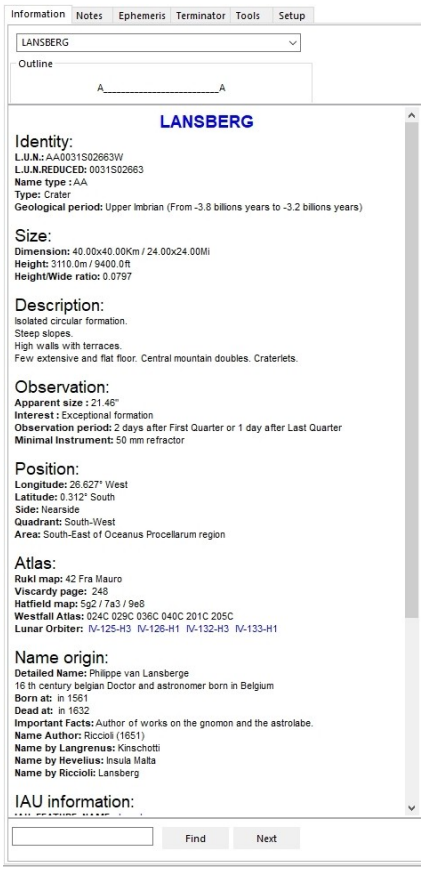
Orbit the Moon : Activated only in the "**Full globe**" mode. Activate an automatic rotation to "scroll" the globe as in the case of a simulated "satellisation". Indicated speeds are in "degree of longitude per second", or the manual rotation with "**Direction**".

Overlay caption : Activated only when one overlay is displayed above the texture. Note that some overlays don't have a caption as indicated above.

THE TABS

To the right of the "Map" window, the tabs allow you to provide as much information as possible for the training selected at a specific time, without cluttering the screen.

THE "INFORMATION" TAB



SEARCH SCROLLING LIST

You can enter in this scrolling list some letters of the name of the formation you want to find. It will accept "wildcards", so "*tri" will include in the scrolling list "Triesnecker" and "Rimae Triesnecker", for example.
.

"Outline" FRAME

In this frame, outline of the formation selected within your search and whose description is in the "Database window" is displayed (See "Outline" for more information on the display). Here is a semi-graphic field presenting the formation profile. This information is only provided when height is known.

Profile has not be constructed for some formations types :
- Sea
- Lake
- Gulf
- Marsh
- Ocean
- Probe
- Human mission

The profile is generated according to the following description :

Crater outline :

Crater is presented so :

A_____A

< n characters>

"A" characters show the slope height. The number of "_" characters shows the crater width with the same scale as height.

Because the "A" character is twice high than wide on an html screen, in the above example, the width / height crater ratio is 1/8.

The central mountain of crater has not been represented because their height has often not been found.

Don't forget that each formation has its own profile. You can't compare two craters dimensions using their profile representation.

A_____A Profile of (Length =20 km & height = 4000 m)

A_____A Profile of (Length = 5 km & height = 1000 m)

On screen, these two profiles are identical, but as you can see, dimensions are different.

Relief outline :

For mountains, mountains ranges, wrinkle ridges or domes, an other viewing mode is selected :

___A___

"A" character shows the formation maximum height. The number of "_" characters shows the formation width with the same scale as height.

Rille outline :

For rilles, rilles system and valleys, profile is shown like this :

___ ___
V

"V" character shows the formation maximum depth. The number of "_" characters shows the formation width with the same scale as depth.

THE UPPER BAND

Given the increase in the volume of data presented for the selected formation, the links presented in this banner allow you to go directly to the desired information section by simply clicking on it.

THE DATABASE WINDOW

The Database window is organized to display formation information extracted from the database. It has a slide bar on the right if not all the data can be displayed in the window.

The version 8 database is the largest existing lunar database to date. The files represent nearly 400 MB of text in French and as much in English ! It contains the descriptive files of more than 1 million lunar formations with varying amounts of data depending on the official bases from which they originate.

It is separated into twelve distinct bases:

- NAMED FORMATIONS : The formations of the visible & hidden faces which have a specific name validated by the UAI (ex: Clavius, Rima Hyginus, Montes Alpes ...): (1,800 entries approximately)

- SATELLITE FORMATIONS: The formations of the visible & hidden faces which do not have a specific name, but a lettered index backed by an official name and which are validated by the UAI (ex: Clavius D, Hyginus A .. .): (Around 7000 entries)

- SALAMUNICCAR UNNAMED FORMATIONS: The formations of the visible & hidden faces which do not have a specific name or an index and which are not validated by the UAI. These are from the work carried out by Goran Salamuniccar of the Faculty of Electrical Engineering and Computing, University of Zagreb and his team (Base LU 78 287) who gave us permission to include them in the VMA (Thanks to him!) . The name of these courses is represented by the LUN (Lunar Universal Number) developed by Christian Legrand specially for the VMA: (approximately 69,600 entries)
WARNING ! Given the extremely large number of formations listed in this database that the software must display, it is advisable to use it only with zoom levels corresponding to levels L4 to L6. The display of all formations may take some time. We also recommend checking the "Short label" box in the "Configuration / Display" menu so as not to clutter the map too much with labels.

- ROBBINS UNNAMED FORMATIONS: The formations of the visible & hidden faces which do not have a specific name or an index and which are not validated by the UAI. These are from the work of Stuart J. Robbins of the Southwest Research Institute (Robbins Lunar Crater Database 2018-08-15) who gave us permission to include them in the AVL (Thanks to him!). The name of these courses is represented by the LUN (Lunar Universal Number) developed by Christian Legrand specially for the AVL: (approximately 1,300,000 entries). This base contains only 4 fields taken from the base of S. J. Robbins so as not to weigh down the display performance of the VMA.
WARNING ! Given the extremely large number of formations listed in this database that the software must display, it is advisable to use it only with zoom levels corresponding to levels L4 to L6. The display of all the formations may take some time depending on the configuration of your computer. We also recommend checking the "Short label" box in the "Configuration / Display" menu so as not to clutter the map too much with labels.

- **HISTORICAL SITES :** Historical sites on both sides: The sites of all voluntary or accidental impacts of human origin compiled specially for VMA by Christian Legrand (ex: Apollo 15 Base, Ranger 7, Luna 9, Apollo 17 S-IVB, Chang'é, Chandrayann 2 ...) (59 entries)

- PYROCLASTICS FORMATIONS : The list of pyroclastic deposits compiled by Lisa Gaddis and her team (80 entries)

- DOMES: A list of lunar volcanic domes compiled by the members of the ALPO association (700 entries)

- NELIOTA: The list of contemporary meteoritic impacts on the lunar surface listed by the Athens National Observatory as part of the NELIOTA (Near Earth objects Lunar Impacts and Optical TrAnsients) program piloted by the European Space Agency (ESA). Periodically updated.

- SINUOUS RILLES : A list of lunar winding volcanic rilles compiled by Debra Hurwitz Needham who gave us permission to incorporate it into the AVL. Thank her! Specific information from this original database has been introduced in the description paragraphs.

- IMP: A list of "Irregular Mare Patches" listed by Le Qiao in 2019 which gave us permission to incorporate it into the AVL. Thank him! IMPs are formations probably of recent volcanic origin (10 million years) with a very special geological facies and of small size. Only the largest of them (Ina, Sosignenes, Hyginus...) are perceptible in amateur instruments. Specific information from this original database has been introduced in the description paragraphs.

- LUNAR PITS : A list of "Lunar Pits" put online by Mark robinson and the LROC team listing the lunar cavities giving access to lava tubes. Thanks to them! These cavities are sought because they could house hypothetical exploration bases This database is associated with the library of “Lunar Pits” images which show what these wells, inaccessible to observation, look like given their small size (a few tens of meters).

- IMPACT BASINS: A first list of the great impact basins which later gave rise to the lunar seas. A first list was compiled by Charles Wood in 2004. Since then, other lists have been produced, including those of the GRAIL probe team (Maria Zuber et al.) and especially that of Charles Byrne in 2016. In order to agglomerate the maximum of information concerning these essential formations, we gathered these two bases in the AVL base. Given that a number of impact basins remain putative, this arrangement maximizes research possibilities. It is recommended to use this database with the functionality of tracing the contours of formations or with the scientific layer "Impact basins" in order to clearly visualize their respective extents.

Specific information from the original bases has been introduced in the description paragraphs.

For each formation, available information is :

- the formation name origin.
- the main lunar atlases for amateur astronomers page where to find the formation.
- the formation location on the lunar disc.
- the formation description.
- various useful information for serious observing.
- official 2020 IAU datas about this formation
- datas from the Lunar Impact Craters Database

Given the mixed sources of the various databases, certain information may not be available in a given database.

Warning : In such detailed work, the data will certainly contain some mistakes - mainly input mistakes. You can also report them to Christian Legrand so that he can correct the database.
The authors thank you in advance for your cooperation. They will be corrected as soon as possible.

DATABASE DETAILED INFORMATION PRESENTATION

You can find more detailed informations about the databases in the **DATLUN** (c) user's manual, the database manager of VMA.

OFFICIAL NAME :

This field presents the formation main name in Latin used officially by the International Astronomical Union in capital letters.

In the "**Historical sites**" database, it's the name of the mission (eg : Apollo 15 Base, Ranger 7, Luna 9, Apollo 17 S IV B...)

For anonymous craters, the "name" begins with the 3 letters AVL and uses after the reduced LUN (c) defined below. For domes and pyroclastics deposits, it's the name in the original database.

LOCAL NAME :

The main name of the formation translated into the language of the program when it exists (Example: Platon / French name for Plato / Official UAI name)

LUNAR UNIVERSAL NUMBER / L.U.N. © :

In order to be able to recognize formations that do not yet have an official name and to standardize the names used in the new databases, Christian Legrand has developed the "Lunar Universal number" (LUN) allowing to know the nature and the position training just by reading it.

Here are the LUN description :

The LUN is composed by the assembling of the following characters chain :

XX : 2 letters corresponding tothe “Descriptor term” of IAU. These 2 letters are officially used by IAU. Attention, they are less numerous than the original VMA formations types, so several VMA types can have the same “descriptor term”.

Here is the official list of IAU Descriptor Terms (Some of them are not used on the Moon presently) :

Albedo Feature (AL)	Geographic area distinguished by amount of reflected light
Arcus, arcūs (AR)	Arc-shaped feature
Astrum, astra (AS)	Radial-patterned features on Venus
Catena, catenae (CA)	Chain of craters
Cavus, cavi (CB)	Hollows, irregular steep-sided depressions usually in arrays or clusters
Chaos, chaoses (CH)	Distinctive area of broken terrain
Chasma, chasmata (CM)	A deep, elongated, steep-sided depression
Collis, colles (CO)	Small hills or knobs
Corona, coronae (CR)	Ovoid-shaped feature
Crater, craters (AA)	A circular depression
Dorsum, dorsa (DO)	Ridge
Eruptive center (ER)	Active volcanic centers on Io
Facula, faculae (FA)	Bright spot
Farrum, farra (FR)	Pancake-like structure, or a row of such structures
Flexus, flexūs (FE)	A very low curvilinear ridge with a scalloped pattern
Fluctus, fluctūs (FL)	Flow terrain
Flumen, flumina (FM)	Channel on Titan that might carry liquid
Fossa, fossae (FO)	Long, narrow depression
Insula, insulae (IN)	Island (islands), an isolated land area (or group of such areas) surrounded by, or nearly surrounded by, a liquid area (sea or lake).

Labes, labēs (LA)	Landslide
Labyrinthus, labyrinthi (LB)	Complex of intersecting valleys or ridges.
Lacuna, lacunae (LU)	Irregularly shaped depression on Titan having the appearance of a dry lake bed
Lacus, lacūs (LC)	"Lake" or small plain; on Titan, a "lake" or small, dark plain with discrete, sharp boundaries
Landing site name (LF)	Lunar features at or near Apollo landing sites
Large ringed feature (LG)	Cryptic ringed features
Lenticula, lenticulae (LE)	Small dark spots on Europa
Linea, lineae (LI)	A dark or bright elongate marking, may be curved or straight
Lingula, lingulae (LN)	Extension of plateau having rounded lobate or tongue-like boundaries
Macula, maculae (MA)	Dark spot, may be irregular
Mare, maria (ME)	"Sea"; large circular plain; on Titan, large expanses of dark materials thought to be liquid hydrocarbons
Mensa, mensae (MN)	A flat-topped prominence with cliff-like edges
Mons, montes (MO)	Mountain
Oceanus, oceani (OC)	A very large dark area on the moon
Palus, paludes (PA)	"Swamp"; small plain
Patera, paterae (PE)	An irregular crater, or a complex one with scalloped edges
Planitia, planitiae (PL)	Low plain
Planum, plana (PM)	Plateau or high plain
Plume, plumes (PU)	Cryo-volcanic features on Triton
Promontorium, promontoria (PR)	"Cape"; headland promontoria
Regio, regiones (RE)	A large area marked by reflectivity or color distinctions from adjacent areas, or a broad geographic region
Reticulum, reticula (RT)	reticular (netlike) pattern on Venus
Rima, rimae (RI)	Fissure
Rupes, rupēs (RU)	Scarp
Satellite Feature (SF)	A feature that shares the name of an associated feature. For example, on the Moon the craters referred to as "Lettered Craters" are classified in the gazetteer as "Satellite Features."
Scopulus, scopuli (SC)	Lobate or irregular scarp
Serpens, serpentes (SE)	Sinuous feature with segments of positive and negative relief along its length
Sinus, sinūs (SI)	"Bay"; small plain
Sulcus, sulci (SU)	Subparallel furrows and ridges
Terra, terrae (TA)	Extensive land mass
Tessera, tesserae (TE)	Tile-like, polygonal terrain
Tholus, tholi (TH)	Small domical mountain or hill
Unda, undae (UN)	Dunes
Vallis, valles (VA)	Valley
Vastitas, vastitates (VS)	Extensive plain
Virga, virgae (VI)	A streak or stripe of color

YYYYYN or YYYYYS for the digital value of latitude in 1/1000 ° deg. N and S indicate North or South and are used to deparate latitude and longitude to clarify the characters chain. The last 3 digits on the right are those of the 1/1000 ° deg and are always present, even if they are zeros. The first 2 left digits are absent if the latitude is 00 °.

ZZZZZZ for the digital value of longitude in 1/1000 ° deg. The last 3 digits on the right are those of the 1/1000 ° deg and are always present, even if they are zeros. The first 3 left digits are absent if the longitude is 000 °.

Here are two examples of LUN (AAYYYYYNZZZZZZ) :

- AA2741S114220 : Crater located at 02,741° South and 114,220° East

- RI85000N000 : Rill which middle is situated about at 85,00° North et 0,00° East.

With all thes features, the LUN is always the shorter possible and it's always easily "readable". and this structure garantees always a lone LUN for each formation.

>>>> With the L.U.N. , you can find each lunar formation and this allows you to share observations of this formation with others colleages without any error

LUNAR UNIVERSAL NUMBER / L.U.N. REDUCED © :

It exists a "Reduced LUN" which is the LUN with the « descriptor term »

NAME TYPE :

This field contains the category of the type of formation among:
- Named formation
- Satellite training
- Registered formation
- Anonymous formation (not named)

FORMATION TYPE :

This field contains formation type according with tradition or International Astronomical Union, **plus some specific additions** :

- Cape
- Cliff
- Crater
- Craterlet
- Crater chain
- Dome
- Gulf
- Lake
- Marsh

- Mountain
- Mountains range
- Plain
- Probe
- Rille
- Rilles system
- Sea
- Tray
- Valley
- Walled plain
- Wrinkle ridge
- Wrinkle ridges system

The "**Historical site**" database contains specific types given that these sites are not officially listed by the International Astronomical Union :
- Human mission / soft landing
- Inert equipment / voluntary impact
- Inert equipment / unvoluntary impact
- Probe / voluntary impact
- Probe / unvoluntary impact
- Probe / soft landing

TYPE OF UAI:

This field contains the abstract of the type of formation in accordance with the definitions of the International Astronomical Union (Cf "Descriptor term" of the LUN) or traditional plus some specific adaptations:
- TH (Tholus) was chosen to characterize the volcanic domes.
- Pyroclastic deposits have no type of UAI formations that can be applied directly. They have been assigned the added type PD (Pyroclastic deposit).
- "Historical" sites have no type of UAI formation that can be applied directly. They have been assigned the added type HS (Historical Site).

SUB-TYPE:

This field contains categories of types specific to each type of formation (Example: Craterlet / Crater / Plain walled for craters). This field has not yet been fully documented in version 7.

FORMATION PROCESS:

This field contains information on the geological process at the origin of the formation (Example: Meteoritic impact / Extrusive volcanism / Tectonic extension ...)

FORMATION PERIOD :

This field contains information on the lunar geological period which saw the appearance of the formation concerned. This information is for the most part from the "Improved lunar craters database" produced by Charles Byrne, Don E. Wilhelms (USGS) and their team which allow the re-use of this data (Thanks to them).

The 6 periods generally accepted in current literature are:

The Pre-Nectarian: (-4550 MA to -3920 MA)
The Nectarian: (-3920 MA to -3850 MA)
Lower Imbrian: (-3850 MA to -3800 MA)
Upper Imbrian: (-3800 MA to-3200 MA)
The Eratosthenian: (-3200 MA to-1100 MA)
The Copernician: (-1100 MA to the present day)
MA = Millions of years

For some formations, it was not possible to find information concerning the implementation period.
"Formation period not found" is then indicated.
For the "Historical sites" database, the mission launch date is indicated in this field.

SOURCE OF THE FORMATION PERIOD :

This field contains information on the source which cites the probable lunar geological period which saw the appearance of the formation considered. This information is for the most part from the "Improved lunar craters database" produced by Charles Byrne, Don E. Wilhelms (USGS) and their team which allow the reuse of this data.

GEOLOGY :

This field contains interesting geological information on the formation concerned found in various sources.

SIZE :

The following four fields contain data relating to the dimensions of the formations. These vary from source to source. We can therefore find values different from those of other works. Priority was given to data from the International Astronomical Union, then to data from other sources when they seemed plausible. Finally, certain dimensions were directly measured on maps or atlases when they could not be found in the literature. In the "Historic sites" database, these fields are empty.

Dimensions:

This field gives the length in kilometers of the formation and the width. In the case of crater-like formations, the length is in most cases equal to the width since it is in fact the average diameter of the formation.
This field has been revised with the values from the "Improved lunar craters database" produced by Charles Byrne, Don E. Wilhelms (USGS) and their team which allow the reuse of this data. Many thanks to them!

Height :

You find here relative altitudes, not absolute ones referring to the mean lunar sphere. It gives the formation height when it's known.
For craters, it's the difference between the upper part of the internal slopes and the floor.
For other formations, it's the difference between the formation summit and surrounding land.

For mountains and mountain ranges, it's a mean height and higher summits height is generally detailed in description fields.
For rilles and scarps, it's the difference between surrounding lands and the formation lower floor.

The field has been revised with the values from the "Improved lunar craters database" produced by Charles Byrne, Don E. Wilhelms (USGS) and their team.

Ratio :

This data is only indicated for formations whose height is known. It's very often given for craters where it means the diameter / height ratio.

DESCRIPTION :

This field is divided in four sections for the formation detailed description. But this division is not really visible when consulting the
formation form on screen or printing it.

Cardinal points are reference to indicate where the different details are situated according to formation center. For a crater, reference point is the area center.

If observed with naked eye, on the Moon, North is up, South is down, West is left and East is right.

North

North-West_____North-East

Formation
center

South-West_____South-East

South

For example, a craterlet located on a crater wall down left will be described as "Walls ridden by a craterlet at South-West".

Craters are the most numerous formations. Their description is well divided in four parts.

General description

First, information about shape, location and preservation of the formation.

External slopes description

Then, the external "slopes" are described. Generally, the comments are about their inclination. If radial valleys are present, slopes are described as "tormented". This part also indicates craters and craterlets situated on external slopes.

Internal walls description

The "walls" which are described are the internal ones. They link the upper rim of the slopes to the crater floor. The walls are described as "little high when the altitude difference is less than 2,000 m, "pretty high" between 2,000 and 3,000 m, "high" between 3,000 and 4,000 m and "very high" if more than 4,000 m. The indicated information is that which seem the most believable according to important variations in different bibliographical sources. This part also indicates craters and craterlets situated on internal slopes.

Crater floor

The crater "floor" is described as "flat" if no hills can be found to "tormented" if it's very irregular. The non circular shape is mentioned. If lava seems to have flooded the crater floor, it has been indicated. This part also indicates craters and craterlets situated on the floor.

Historical sites

In the "**Historical sites**" database, specific descriptions includes :

- Launch date and hour
- Astronauts names for a human mission
- Probe or spaceship description
- Mission main phases dates and hours
- Scientific results

ELGER DESCRIPTION

This field contains the description of the formation as it has been published by Thomas Gwynn Elger in his book "THE MOON, A FULL DESCRIPTION AND MAP OF ITS PRINCIPAL PHYSICAL FEATURES" released in 1895. All formations aren't described in this book. This description contains often interesting observational details.

OBSERVATION

Interest :

This field will help you to determine which formations to observe. It gives you information on the formation interest. It has been defined by the authors according to their own experience. Sure, you can disagree with them.

Formations are indicated as :

- Low interest formation
- Pretty interesting formation
- Very interesting formation
- Exceptionally interesting formation

Lunar month day for evening observation :

This expression means "Day of lunar month permitting an evening observation of the formation". It has been observed that Eastern limb formations can only be well observed 2 days after New Moon.

The indicated day is the one for a null libration. It has been computed from formation longitude. According of the real libration value, it can be shifted by one day more or less.

Lunar month day for morning observation :

This expression means "Day of lunar month permitting an morning observation of the formation". It has been observed that Western limb formations can only be well observed 2 days before New Moon.

The indicated day is the one for a null libration. It has been computed from formation longitude. According of the real libration value, it can be shifted by one day more or less.

Useful instrument :

This field presents the smallest instrument needed to comfortably observe the formation. It has been computed from the formation width and from practical resolution power (PRP) of the instruments defined as the double of TRP. It is supposed to be obtained when using a magnification equal to instrument diameter in centimeters.

This data is provided for a Moon mean distance of 202,000 miles. An arc second is then about 1 mile on the Moon.

This data depends on other external criteria such as instrument quality, observer's eye health, seeing...).
- Naked eye (PRP = 10O miles)
- x10 binoculars (PRP = 20 miles)
- 2" refractor (PRP = 5 miles)
- 4" reflector (PRP = 2.5 miles)
- 6" reflector (PRP = 1.6 miles)
- 8" reflector (PRP = 1.2 miles)
- 10" reflector (PRP = 1 mile)
- 12" reflector (PRP = 0.8 mile)

POSITION :

Longitude :

You can find here the selenographic longitude of the formation with a tenth of degree precision or more. This data is provided by International Astronomical Union. Longitude is negative to the West of central meridian. About craters, it's the center longitude. For lengthened or irregular formations, it's an internal point the closest to central.

Latitude :

You can find here the selenographic latitude of the formation with a tenth of degree precision or more. This data is provided by International Astronomical Union. Latitude is negative to the South of lunar Equator. About craters, it's the center longitude. For lengthened or irregular formations, it's an internal point the closest to central.

Quadrant :

Information has been included to make easier the location of the formation on the lunar disk. The location system is that of the International Astronomical Union since 1988. When you look at the lunar disk with the naked eye, the North is up and the East is right.

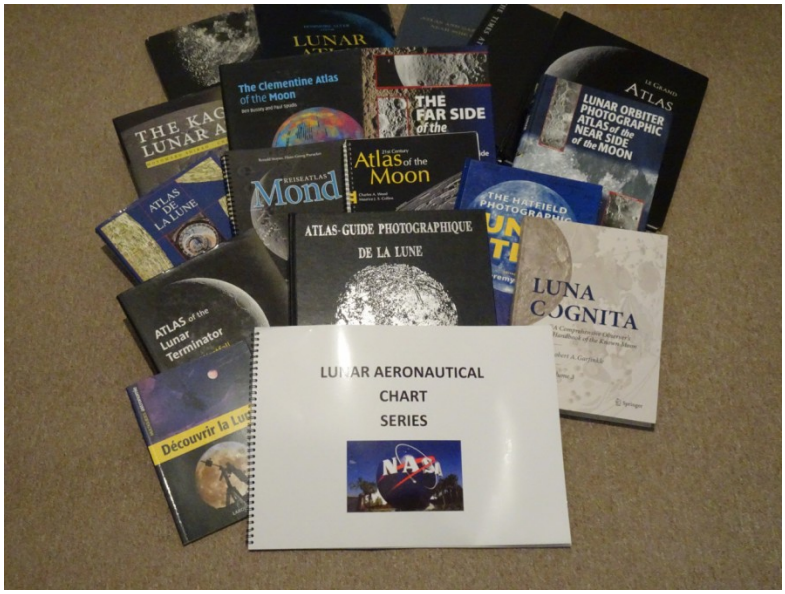
This first field indicates the lunar quadrant where is situated the formation according to the "Lunar Quadrant Charts" by Arthur and Agnieray published by the University of Arizona :
- North-East
- South-East
- North-West
- South-East

Area :

This field indicates clearly the lunar region where can be found the formation according to a more known one (sea, mountain or large crater) or according to the position on the edge of the lunar disk (limb) or according to the center of the lunar disk.

ATLAS :

This field contains pages, maps or picture of the main paper atlases presently available on which the selected formation is indicated.



Rükl :

In honor to its author for his contribution to Astronomy popularization, we have mentioned the map number of the "**Atlas of the Moon**" by **Antonin Rükl** on which is found the formation.

Viscardy :

Also in honor to its author for his contribution to Astronomy popularization, we have also mentioned the page number of the "**Photographic Atlas of the Moon**" by **Georges Viscardy** on which the formation is found with a text on it, or on which a photograph shows the place where is situated the formation.

For this last work, when the formation does not figure on at least one photograph, there is no page indicated. Similarly, if the formation appears on, at least, a photograph, but is not described in the text, it is the page of the best photograph where it is normally visible that is indicated.

Westfall :

In honor to its author for his unique work, we have mentioned the maps numbers of the "**Atlas of the Lunar Terminator**" from **Professor John E. Westfall** on which the formation is found, because it's the only one that shows all librations variations.

Wood :

We mentioned **Charles Wood's articles on numerous** formations edited in **Sky and Telescope** and the number of his "**Lunar 100 list**", with his courtesy.

LOPAM :

Adding to downloadable picture of the LOPAM, we have indicated numbers of "**Lunar Orbiter Photographic Atlas of the Moon**" pages on which you can find the selected formation. Just click on this link and go to the Internet site of **Jeff Gillis** of **Lunar and Planetary Institute** and you will admire the entire picture from which was extracted the picture.

Nevertheless, if you are not permanently connected to the Internet, another possibility is offered.

CLEMENTINE :

We have mentioned the pages of the atlas established from the images of the American probe CLEMENTINE and written by the late Paul Spudis & Ben Bussey and published in 2004 by Cambridge University Press, pages on which the selected formation appears

CENTURY 21ST :

We have mentioned the pages of the atlas "21ST CENTURY ATLAS OF THE MOON" established by Charles Wood & Maurice Collins from images of the LRO probe and published by the two authors in 2005, pages on which the selected formation appears.

HATFIELD :

In honor to its author for his contribution to Astronomy popularization, we have mentioned the map number of the "**Hatfield Atlas of the Moon"** republished by **Jeremy Cook** on which the formation is found.

REISE :

We have mentioned the pages of the "REISE ATLAS MOND" atlas written by Ronald Stoyan & Hans-Georg Purucker and published in 2012 by Oculum, pages on which the selected formation appears.

CHANGE1 :

We have mentioned the pages of the atlas established from the images of the Chinese probe CHANG'E 1 and written by Chunlai Li & al. and published in 2016 by Springer Verlag, pages on which the selected formation appears

DISCOVER_MOON :

We have mentioned the pages of the observation guide "DISCOVER THE MOON" written by Christian Legrand and Jean Lacroux, and published in 1995 by Bordas then Larousse, pages on which the selected formation appears.

TIMES_ATLAS :

We mentioned the pages of the atlas "THE TIMES ATLAS OF THE MOON" published in by Times Life in 1969, pages on which appears the selected formation.

KAGUYA :

We have mentioned the pages of the atlas "THE KAGUYA LUNAR ATLAS" established from the pictures of the Japanese probe SELENE / KAGUYA and written by Charles Wood & Motomaro Shirao., and published in 2011 by Springer Verlag, pages on which appears the selected formation.

BYRNE_NEAR :

We have mentioned the pages of the atlas "LUNAR ORBITER PHOTOGRAPHIC ATLAS OF THE NEAR SIDE OF THE MOON" established from the images of the American LUNAR ORBITER probes written by Charles Byrne, and published in 2005 by Springer Verlag, pages on which appears the selected training

BYRNE_FAR :

We have mentioned the pages of the atlas "LUNAR ORBITER PHOTOGRAPHIC ATLAS OF THE FAR SIDE OF THE MOON" established from the images of the American LUNAR ORBITER probes written by Charles Byrne, and published in 2008 by Springer Verlag, pages on which appears the selected formation.

SIX_INCH :

We have mentioned the pages of the "SIX INCHES LUNAR ATLAS" written by Don Spain in 2009 and published by Springer on which the selected formation appears.

DASE :

We have mentioned the pages of the "FREE LUNAR FIELD ATLAS" written and published by Fred Dase on which the selected formation appears.

PAU :

We have mentioned the pages of the Atlas "PHOTOGRAPHIC LUNAR ATLAS FOR MOON OBSERVERS" written by K. C. Pau and published in 2016 on which the selected formation appears.

LUNA COGNITA :

We have mentioned the pages of the three volumes of the remarkable work "LUNA COGNITA" by Robert Garfinkle and published in 2020 by Springer on which the selected formation appears.

LAC :

We have mentioned the numbers of the "Lunar Astronautical Charts" published in 1967 by NASA's "Aeronautical Chart and Information Center" on which the selected formation appears.

NAME ORIGIN :

Real name :

This field presents the real name of the person whose name has been given to the formation. When it also exists, a nickname is indicated between parentheses.

For other formations than craters, the official name is first translated in English, and then you can find the real name of the person whose name has been given to the formation.

Works :

This field indicates, for craters, the activities of the person whose name has been given to the formation.

Here is the list of the"works" you can find in the database:- Agronomist
- Alchemist
- Admiral
- Anthropologist
- Archaeologist
- Archbishop
- Architect
- Artist
- Astronaut
- Astronomer
- Astrophysicist
- Aviator
- Banker
- Biologist
- Botanist
- Calif
- Cartographer
- Chemist
- Clockwork
- Consul
- Cosmographer
- Egyptologist
- Engineer
- Engraver
- Explorer
- Geodesist
- Geographer
- Geologist
- Geometer
- Geophysicist
- God
- Hero
- Historian

- Humanistic
- Hydrographer
- Inventor
- Jurist
- King
- Manufacturer
- Mathematician
- Meteorologist
- Mineralogist
- Missionary
- Mythological fame
- Naturalist
- Navigator
- Oceanographer
- Optician
- Paleontologist
- Pharmacist
- Philologist
- Philosopher
- Physicist
- Physiologist
- Poet
- Political man
- Priest
- Printer
- Professor
- Scientist
- Sailor
- Saint
- Sismologist
- Sponsor
- Stateman
- Technician
- Theologian
- Writer
- Zoologist

Please note that some people have been credited with 2 or 3 works.

Nation :

This field indicates the nationality generally attributed to the person whose name has been given to the formation. It can be the birth nationality. You can also find nationalities no longer in existence.

Here is the list of nationalities present in the database:

- American
- Arabian
- Australian
- Austrian
- Babylonian

- Belgian
- British
- Byzantine
- Brazilian
- Canadian
- Carthaginian
- Castillan
- Chinese
- Cretian
- Dalmatian
- Danish
- Dutch
- Egyptian
- English
- Finnish
- French
- Greek
- German
- Hungarian
- Indian
- Irish
- Italian
- Japanese
- Jewish
- Macedonian
- Mexican
- Norwegian
- Persian
- Polish
- Portuguese
- Roman
- Russian
- Scottish
- Soviet
- South African
- Spanish
- Swedish
- Swiss
- Czech
- Venetian

Birth place :

This field indicates the birth place of the person whose name has been given to the formation when it has been possible to find it. If not found, it is indicated " ? ". Please note that for imaginary persons, there is no birth place.

Birth year :

This field indicates the birth year of the person whose name has been given to the formation if it has been possible to find it. If not found, it is indicated " ? ". Please note that for imaginary persons, there is no birth year.

Death place :

This field indicates the place of death for the person whose name has been given to the formation when it has been possible to find it. If not found, it is indicated " ? ". Please note that for imaginary persons, there is no place of death

.

Death year :

This field indicates the year of death for the person whose name has been given to the formation if it has been possible to find it. If not found, it is indicated " ? ". Please note that for imaginary persons, there is no year of death.

Prominent facts :

This field describes prominent facts during the life of the person whose name has been given to the formation if it has been possible to find it. If not found, it has been indicated " ?? " .

This information is adapted from information given by the International Astronomical Union, and additional data coming from various bibliographical sources.

Generally, you can find the discoveries, inventions and important works attributed to the person, as well as distinctions obtained during life (nominations, price. ..) with associated dates when they have been found.

Name author :

This field indicates, when it's known or supposed, the organization or person name that has given the name to the formation. Also included in this chapter is the year of nomination when it has been found. In this paragraph, IAU means" International Astronomical Union ". You can find mainly 3 origins:
- Hevelius
- Riccioli
- IAU

When the origin has not been found, the field contains (??). Additionally, some uncertain origins end with "?".

These name origins are purely indicative and are not to be held as rigorously exact because of numerous additions made during all periods to the lunar nomenclature.

In the "**Historical sites**" base, it's the country and the agency which conceived the mission that are indicated.

Name given by Langrenus:

This field indicates the name given by Michel Florent Van Langren on his Moon map in 1644. When the formation has not received a name, "Not named" is indicated.

Name given by Hevelius :

This field indicates the name given by Johannes Hevelius on his Moon map in 1647. When the formation has not received a name, "Not named" is indicated.

Name given by Riccioli :

This field indicates the name given by Riccioli on the Moon map drawn in 1651 by Francesco Grimaldi. When the formation has not received a name, "Not named" is indicated.

INTERNATIONAL ASTRONOMICAL UNION DATAS

These fields mention the official data of the lunar nomenclature of the International Astronomical Union published in 2012. They are the only ones to refer to.

IAU Feature Name :

Official name given by IAU to the formation with all the additives on letters (Accents, tilde, etc...) as they have been given to the honored character.

IAU Clean Feature Name

It's official IAU name above without all the additives on letters (Accents, tilde, etc...) so that they can be managed internationally by computers.

IAU Diameter

Approximate diameter or biggest dimension in kilometers.

IAU Center Latitude

Latitude of the center of the formation. Positive numbers indicates that the formation is localized in northern hemisphere and negative numbers indicate that the formation is localized in the southern hemisphere.

IAU Center Longitude

Longitude of the center of the formation. On the Moon, positive numbers indicates longitudes towards East and negative numbers indicate longitudes towards West.

IAU Northern Latitude

Latitude the most on North of the formation. Positive numbers indicates that the formation is localized in northern hemisphere and negative numbers indicate that the formation is localized in the southern hemisphere.

IAU Southern Latitude

Latitude the most on South of the formation. Positive numbers indicates that the formation is localized in northern hemisphere and negative numbers indicate that the formation is localized in the southern hemisphere.

IAU Eastern Longitude

Longitude the most on the East of the formation. On the Moon, positive numbers indicates longitudes towards East and negative numbers indicate longitudes towards West.

IAU Western Longitude

IAU Western Longitude

Longitude the most on the West of the formation. On the Moon, positive numbers indicates longitudes towards East and negative numbers indicate longitudes towards West.

IAU Coordinates System

Coordinates system used for latitudes and longitudes. For the Moon, it's planetographic with east longitudes as positive and counted from 0 to -180° and from 0 to 180° from the meridian 0. It's ULCN 2005(Unified lunar coordinates network de 2005). Mean lunar sphere is considered withe a radius of 1737,4 km

IAU Continent

Continent or great geographic divisin associated to the name.

Africa (AF)
Antarctica (AN)
Asia (AS)
Europe (EU)
North America (NA)
Oceania (OC)
South and Central America (SA)

IAU Ethnicity

Ethnic or cultural or nationalty associated to the name.

AFRICA

Algeria	AL
Angola	AN
Bantu	BA
Benin	BE
Botswana	BT

Burkina Faso (Upper Volta)	BF
Burundi	BR
Bushman	BU
Bushongo	BH
Cameroon	CR
Canary Is.	CI
Dahomean	DH
Egypt	EG
Ethiopia	ET
Gabon	GB
Gambia	GA
Ghana	GH
Gold Coast	GC
Guinea	GU
Hottentot	HO
Ivory Coast	IC
Kenya	KY
Lesotho	LE
Liberia	LI
Libya	LB
Madagascar	MD
Malawi	MW
Mali	ML
Mande	MN
Mauritania	MU
Mauritius	MA
Mbundu	MB
Mende	ME
Morocco	MR
Mozambique	MZ
Namibia	NM
Niger	NG
Nigeria	NI
Pygmy	PY
Republic of Chad	CH
Republic of Seychelles	SY
Rwanda	RW
Semitic	SE
Senegal	SN
Sierra Leone	SL
Somalia	SO
South Africa	SA
Sudan	SU
Swaziland	SW
Tanzania	TA
Togo	TO
Tunisia	TN

Uganda	UG
Unknown	--
Yao	YA
Zaire	ZA
Zambia	ZM
Zimbabwe	ZI
Zulu	ZU

ASIA

Afghanistan	AF
Akkadian (Accadian)	AK
Altai	AL
Arabian	AR
Armenian	AM
Assyrian	AY
Assyro-Babylonian	AB
Azerbaijan	AZ
Babylon	BY
Bangladesh	BA
Bhutan	BH
Buriat	BR
Burma	BU
Cambodia	CM
China	CH
Chukchi	CU
Elamite	EL
Evenki	EV
Georgia	GE
Hebrew	HE
Hindu	HI
India	IN
Indonesia	ID
Iran	IR
Iraq	IQ
Israel	IS
Itelmen	IT
Japan	JA
Jewish	JW
Jordan	JO
Kashmir	KA
Kazakhstan	KZ
Ket	KT
Korea	KR
Kuwait	KU
Kyrgyzstan	KY
Laos	LA
Lebanon	LE

Malaysia	MA
Mansi	MS
Mesopotamian	ME
Minyong	MY
Mongolia	MO
Monguor	MG
Nanai	NA
Neghidhian	NG
Nepal	NE
Nganasan	NS
Oman	OM
Ostyak	OS
Pakistan	PK
Persian	PE
Philippines	PH
Phoenician	PO
Sanskrit	SA
Saudi Arabia	SB
Scythian	SC
Semitic	SE
Siberia	SI
Sri Lanka	SR
Sumerian	SU
Syria	SY
Taiwan	TW
Tajik	TJ
Thailand	TH
Tibet	TB
Tungu	TN
Turkey	TU
Turkmenistan	TK
Tuva	TV
Ulci	UL
Unknown	--
Urartu	UR
Uzbekistan	UZ
Vietnam	VT
Yakutian	YK
Yemen	YE

EUROPA

Albania	AL
Andorra	AN
Austria	AS
Bashkir	BS
Belarus	BL
Belgium	BE

Bosnia-Herzegovina	BH
Bulgaria	BU
Byzantine	BZ
Caucasus	CC
Celtic	CE
Chuvash	CH
Croatia	CR
Cyprus	CY
Czechoslovakia	CZ
Denmark	DE
England	EN
Eskimo (Greenland)	EK
Estonia	ES
Finland	FI
Flemish	FL
France	FR
Germany	GE
Great Britain	GB
Greek	GR
Greenland	GL
Gypsy	GY
Hungary	HU
Iceland	IC
Ireland	IR
Italy	IT
Kalmyk	KL
Karelia	KA
Komi	KO
Lapp	LP
Latin	LA
Latvia	LV
Liechtenstein	LE
Lithuania	LI
Luxembourg	LU
Macedonian	MA
Malta	ML
Mari	MR
Moldova	MD
Mordvinian	MO
Netherlands (Dutch)	DU
Norse	NS
Norway	NO
Oscan	OS
Ostrogoth	OG
Poland	PO
Portugal	PG
Roman	RM

Romania (Rumania)	RO
Russia	RU
Scandinavian	SD
Scotland	SC
Scythia	SY
Slavic	SL
Slovakia	SV
Slovenia	SI
Soviet	SO
Spain	SP
Sweden	SW
Switzerland	SZ
Tartar	TT
Teutonic	TU
Udmurtian	UD
Ukraine	UK
Unknown	--
Wales	WA
Yugoslavia	YU

NORTH AMERICA

Aleutian	AU
Algonquin	AL
American	AM
Arikara	AR
Blackfoot	BL
Canada	CA
Cherokee	CE
Cheyenne	CY
Chickasaw	CH
Chinook	CI
Choktaw	CO
Chumash	CU
Creek	CR
Dakota	DA
Dominica	DO
Eskimo	ES
Hopi	HO
Iroquois	IR
Klamath	KL
Lakota	LA
Mandan	MA
Mexico	ME
Navajo	NV
Osage	OS
Pawnee	PW
Pequot	PE

Potawatomi	PO
Pueblo	PU
Salish	SA
Seneca	SE
Shoshoni	SH
Sioux	SX
Tlingit	TL
United States	US
Unknown	--
Zuni	ZU

OCEANIA

Australia	AU
Caroline Is.	CI
Cook Islands	CO
Fiji	FJ
Guam	GM
Hawaii	HA
Marquesas Islands	MA
Marshall Is.	MI
Melanesia	ME
Micronesia	MC
Nauru	NA
New Britain	NB
New Guinea	GU
New Zealand	NZ
Papua New Guinea	PN
Polynesia	PO
Republic of Palau	PA
Samoa	SA
Society Is.	SI
Toamotu	TU
Tonga	TO
Unknown	--
Vanuatu	VA

CENTRAL AND SOUTH AMERICA

Argentina	AR
Auracanian	AC
Aztec	AZ
Barbados	BB
Bolivia	BO
Bororo	RR
Brazil	BR
Chile	CH
Chimalateco	CI
Colombia	CO

Costa Rica	CR
Cuba	CU
Dominican Republic	DR
Ecuador	EC
El Salvador	ES
Falkland Islands	FI
French Guiana	FG
Grenada	GR
Guatemala	GU
Guyana	GY
Haiti	HA
Honduras	HO
Inca	IN
Jamaica	JM
Mayan	MY
Nahuatl	NA
Netherland (Dutch) Antilles	DA
Nicaragua	NI
Panama	PM
Paraguay	PA
Peru	PE
Puerto Rico	PR
Suriname	SU
Unknown	--
Uruguay	UR
Venezuela	VE
Virgin Islands	VI

IAU Feature Type

IAU descriptor term ein greek or latin (cf Lunar Universal Number above)

IAU Feature Type Code

Code in two letters of the IAU descriptor term (cf Lunar Universal Number above)

IAU Quad Name

Specific quadrant where is localized the formation center.

IAU Quad Code

Two letters code of the specific quadrant where the formation center is localized.

IAU Approval Status

Approval level of the formation in 2011.

1 Proposed (not currently used)
2 Task Group approval (not currently used)
3 WGPSN approval (not currently used)
4 Executive Committee approval (not currently used)
5 Adopted by IAU
6 Dropped, no longer in use
7 Never approved by the IAU

IAU Approval date

Date when the name has been approved by IAU. Complete dates begin at half september 2006 and are recorded as (YYYY-MM-DD).

IAU Reference

Reference book from where the origin and the orthograph of the name are given.

IAU Origin

Short explanation of the formation name.

IAU Link

Internet link towards the official IAU site formation page.

LUNAR IMPACT CRATERS DATABASE

The named craters (NAMED) and the lettered craters (SATELLITE) are linked to the fields of the "Lunar Impact Crater Database" of 2015 carried out by Charles Byrne, Don E. Wilhelms (USGS) and their team. They appear in the "Information" tab after the fields relating to data from the International Astronomical Union. When an LICD field does not contain a value, it is shown empty.

Some of these fields come from previous studies which are indicated in the title (Pike / Kring / Moore / Horz / Cintala...)

Other formations do not show these fields in the "Information" tab

List of LICD fields (Unit of measurement is in parentheses):

1. Name

2. Diameter (km)

3. Latitude (°)

4. Longitude (°)

5. East Longitude (°)

6. Radius (km)

7. Radius (m)

8. Apparent diameter (km)

9. Transient cavity diameter for single craters (km)

10. Transient cavity diameter for complex craters (km)

11. Bottom diameter (km)

12. Measured depth from ledge to bottom (km)

13. Depth from ledge to bottom (km)

14. Apparent depth (km)

15. Transient Cavity Depth (km)

16. Interior volume (km3)

17. Rim height (km)

18. Width of ledge flank (km)

19. Measured height of central peak (km)

20. Height of central peak (km)

21. Diameter of central peak (km)

22. Area of the base of the central peak (km2)

23. Maximum diameter of ejected blocks coef 2 (km)

24. Maximum diameter of ejected blocks coef 1 (km)

25. Thickness of ejecta at a distance equal to a radius (m)

26. Thickness of ejecta at a distance equal to two radii (m)

27. Thickness of ejecta at a distance equal to three radii (m)

28. Thickness of ejecta at a distance equal to four radii (m)

29. Thickness of ejecta at a distance equal to five radii (m)

30. Ejecta thickness at a distance of 10,000 m outside the rim according to Kring (m)

31. Ejecta thickness at a distance of 10,000 m outside the rim according to Pike 9 (m)

32. Ejecta thickness at a distance of 10,000 m outside the rim according to Pike 10 (m)

33. Ejecta thickness at a distance of 10,000 m outside the rim according to Pike 12 (m)

34. radial distance of continuous ejecta according to Moore (km)

35. Radial distance of continuous ejecta according to Horz (km)

36. Radius of ejecta cover greater than 10 m thick from Pike 9 (km)

37. Minimum radius of ejecta cover greater than 10 m thick according to Kring (km)

38. Radius of ejecta cover >10 m thick according to Kring - Best estimate (km)

39. Maximum radius of ejecta cover greater than 10 m thick according to Kring (km)

40. Radar Shining Halo Radius (km)
41. Measured radius of bright halo to radar (km)

42. Radar dark halo radius (km)

43. Measured radius from dark halo to radar (km)

44. Depth of excavation according to Cintala (km)

45. Depth of excavation according to Stoffler (km)

46. Melting depth according to Cintala 22 (km)

47. Melting depth according to Cintala 23 (km)

48. Melting volume (km3)

49. Melting volume with impact at 45° for basalt (km3)

50. Melting volume with 45° impact for anorthosite (km3)

51. Age

52. Age class

53. Remarks

54. Source of Age

55. Other sources of age

56. Pelvis age group

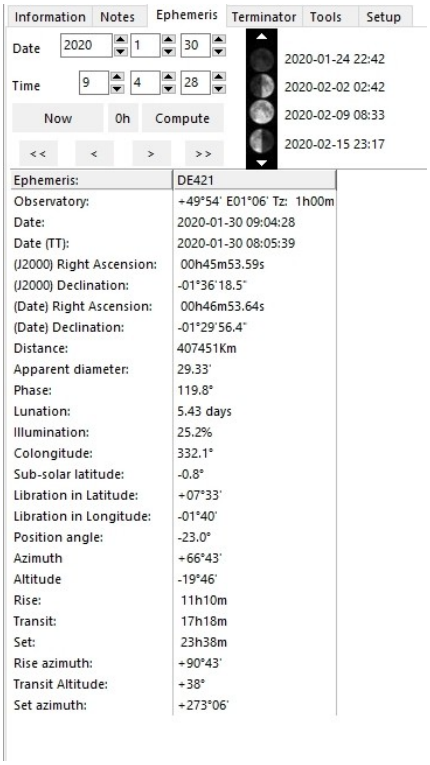
57. Citation for first mention or citation for nomenclature

58. Approval by the UAI

59. Central Peak Lithology
60. Central peak olivine content from Clementine data according to Cahill (% vol)
61. Central peak orthopyroxene content from Clementine data according to Cahill (% vol)
62. Central peak clinopyroxene content from Clementine data according to Cahill (% vol)
63. Plagioclase content of the central peak according to Clementine data according to Cahill (% vol) 64. Mafic compound content of the central peak according to Clementine data according to Cahill (% vol)
65. Modeled ratio orthopyroxene to central peak clinopyroxene from Clementine data according to Cahill
66. Mean abundance of plagioclase according to Kaguya according to Lemelin (% weight)
67. Average olivine abundance according to Kaguya according to Lemelin (% weight)
68. Average orthopyroxene abundance according to Kaguya according to Lemelin (% weight)
69. Mean abundance of clinopyroxene according to Kaguya according to Lemelin (% weight)
70. Average FeO abundance from Kaguya according to Lemelin (% wt)
71. Central peak lithology after Clementine according to Tompkins & Pieters
72. Status
73. Average location of the Christiansen element [µm] according to LRO according to Song
74. Average value of the optical maturity parameter according to Clementine according to Song
75. Average FeO content from Clementine according to Song (% wt)
6. Range of the optical maturity parameter according to Kaguya according to Othake
77. Class of the modal abundance estimate of plagioclase according to Kaguya according to Ohtake
78. Geological province
79. Degradation of the central peak
80. Location of the spectroscopic detection of the purest anorthosite after Chandrayann 1 according to Donaldson
81. Rays

THE "EPHEMERIS" tab

When you click on the "**Ephemeris**" tab, the right frame window fills with Moon sky and orbit position data: This position can be set entering some parameters. You can also continuously manage time with the "tape recorder" buttons.



DATE AND TIME INPUT

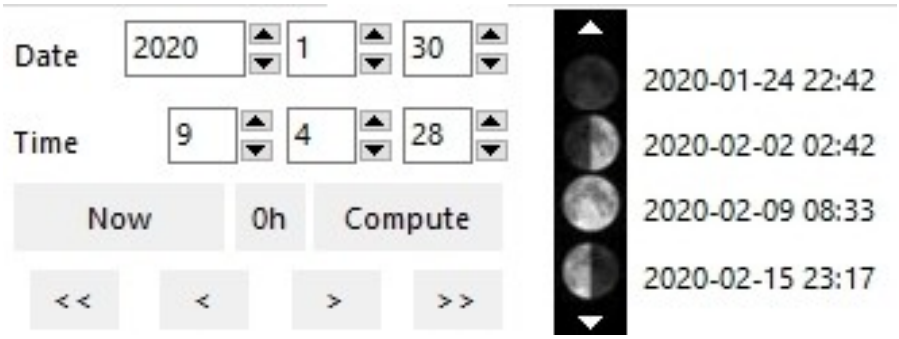
Observation **date** and **hour** can be set with upper case, either clicking and entering them directly or using the arrows. The "**Compute**" button displays the map with the choosen date and hour.

The "**Now**" button can show directly the Moon aspect at the current time. Date and hour used are those of your operating system. Verify if it's on time. This setting is very useful when using the software "in the field".

The "**Compute**" button display the Moon as it looks like to the date and hour selected with the previous paragraph.

The "**O h**" button shows you the Moon at 0 h on the date selected with the previous paragraph.

"VIDEO RECORDER" BUTTONS



"Video recorder" buttons are a powerful provision meant for real Moon aspect changes. They are very useful when using Open gL 3D display with the "Phase" and "Lib ration" options activated.

"**>>**" and "**<<**" buttons can increase or decrease date with a one day rate. ">" and "<" buttons increase or decrease hour with a one hour rate.

These buttons allow you to observe the phase and librations evolution during time. They can be used to detect best observing periods of formations which are near or inside the librations zones.

"PHASES CALENDAR"

This is a tool to help you for preparing next observing sessions. This part of the frame shows you a Moon phases calendar. It contains the next four phases. But, with the white arrows, you can navigate in the list and retrieve old or future phases dates.

THE "EPHEMERIS" WINDOW

Ephemeris:	DE421
Observatory:	+49°54' E01°06' Tz: 1h00m
Date:	2020-01-30 09:04:28
Date (TT):	2020-01-30 08:05:39
(J2000) Right Ascension:	00h45m53.59s
(J2000) Declination:	-01°36'18.5"
(Date) Right Ascension:	00h46m53.64s
(Date) Declination:	-01°29'56.4"
Distance:	407451Km
Apparent diameter:	29.33'
Phase:	119.8°
Lunation:	5.43 days
Illumination:	25.2%
Colongitude:	332.1°
Sub-solar latitude:	-0.8°
Libration in Latitude:	+07°33'
Libration in Longitude:	-01°40'
Position angle:	-23.0°
Azimuth	+66°43'
Altitude	-19°46'
Rise:	11h10m
Transit:	17h18m
Set:	23h38m
Rise azimuth:	+90°43'
Transit Altitude:	+38°
Set azimuth:	+273°06'

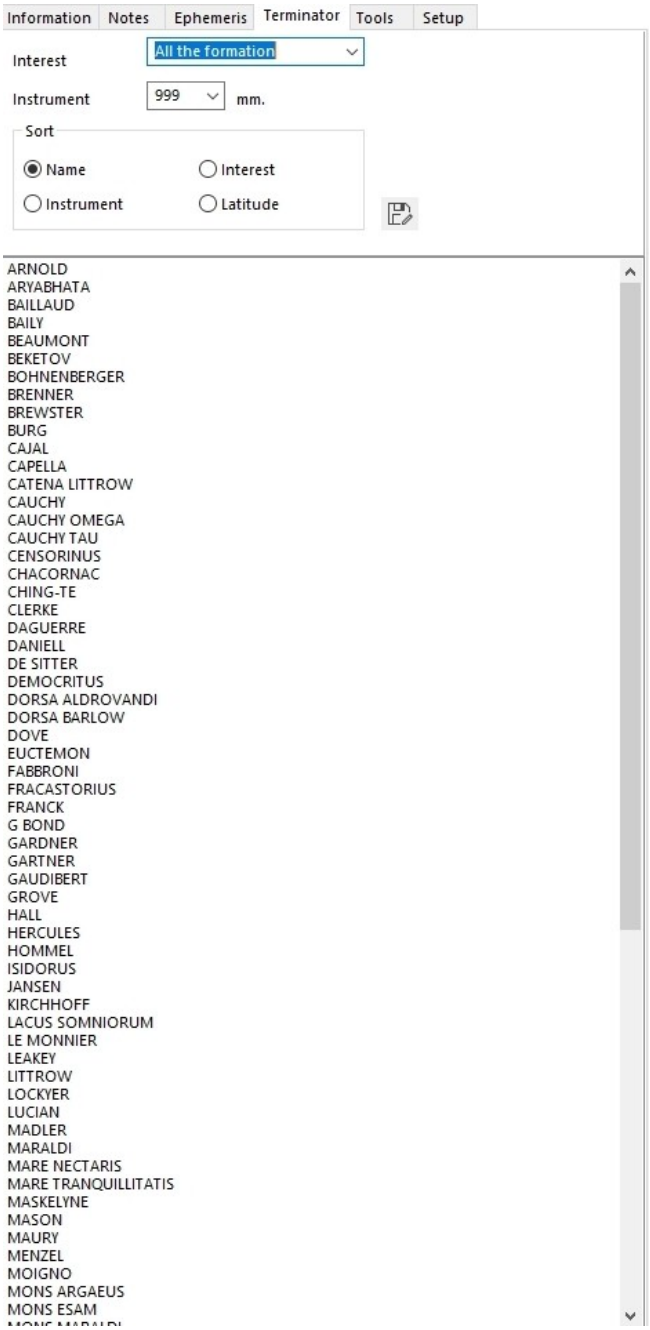
The right frame window contains the following information on Moon position :

Moon right ascension
Moon declination
Distance :
Apparent diameter:
Phase angle
Lunation day
Illumination percentage
Solar inclination
Latitude libration value
Longitude libration value
Maximum libration position on limb
Moon rise hour
Moon meridian transit hour
Moon set hour
Moon rise azimuth
Moon set azimuth

The following informations are not displayed if you check the box "**Geocentric coordinates**" in the "**General**" tab of the "**Configuration**" menu.

Moon rise hour
Moon meridian transit hour
Moon set hour
Moon rise azimuth
Moon set azimuth

THE "TERMINATOR" TAB



This option can list in the right frame window, a list of formations visible along the terminator according to date selected in the "Ephemeris tab". And more, you can extract and sort these formations using some choices.

"INTEREST" SCROLLING LIST

You can set with the scrolling list "Interest" a filter for limiting your choice. You can choose between :
- All the formations

- The pretty interesting formations
- The very interesting formations
- The exceptional formations (The best ones)

"INSTRUMENT" SCROLLING LIST

A second filter can be set to limit the listed formations to those which are visible in a given instrument (See "Useful instruments "). You can choose this one in the scrolling list. "999" doesn't limit the list (No applied filter).

You can see that most of the formations can yet be observable in a 100 mm (4 ") instrument.

"SORT" BUTTONS

These selections choose the presentation mode of the extracted formations list

- Name

Clicking this point sorts formations by alphabetical order

- Latitude

Clicking this point sorts formations by latitude from equator to North pole and then, from equator to South pole.

- Interest

Clicking this point sorts formations by interest.

- Instrument

Clicking this point sorts formations by instrument capability

THE "NOTES" TAB

It's in this tab that you can input all your notes written during an observation of the selected formation. Each formation has its "notes sheet" waiting your commentaries. These are stored in a personal special dtabase.

The "**Update**" button is used to input the notes you have just written in the database.

These personal notes will be integrated into the notes database, which also includes links to articles or websites related to the training in question.

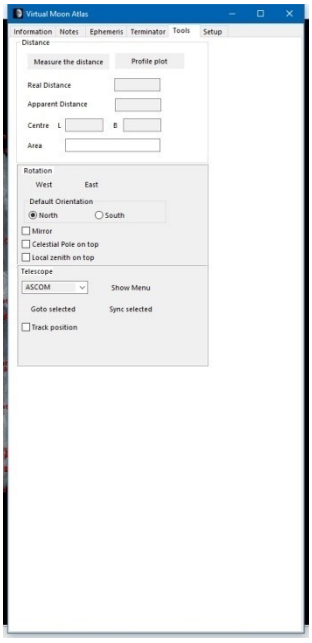
The list of notes specific to the selected formation appears in the frame.

For more information on this database, we refer you to the use of the NOTELUN (c) module and its specific manual.

Don't forget to click it or your notes will be lost, but ther is a security window before closing the "Notes" tab.

THE "TOOLS" TAB

"Tools" tab in "Telescope" mode



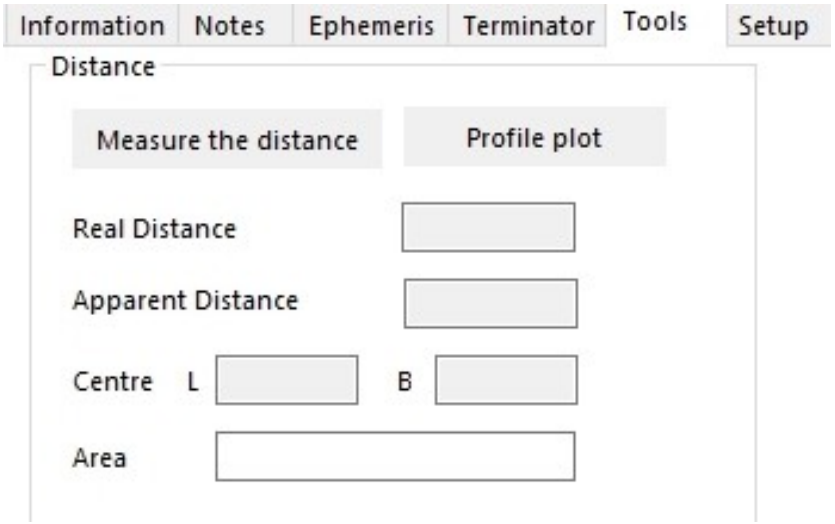
"Normal mode / Distance measure" BUTTON

This button changes cursor action mode on the map. It's a toggle button. Its caption changes to allow you to go back to the other mode.

"Normal mode"

When in normal mode, the cursor is like a round bull's eye and is used to select formations.

"Distance measure"



When in this second mode, the cursor changes its shape and is used for measuring distances between lunar formations or for measuring dimensions of a selected formation.

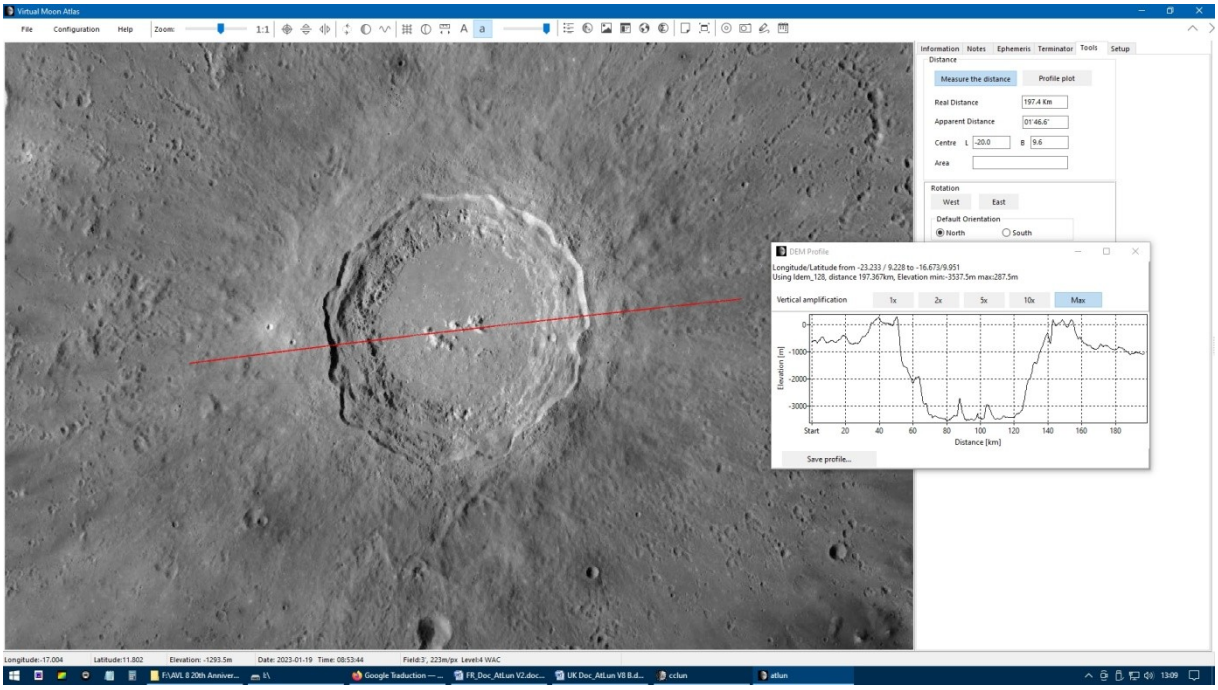
Put the cursor on the beginning of the distance to measure. Click with the left button and hold it down. Move the mouse. A color line originating at the first point appears. You just have to go to the end of the distance you want to measure by moving the mouse. Once there, release the mouse button. The line stays visible.

Up in the "Tools" panel, a box indicates the length of the drawn line in km and in arc minutes. Spherical shape of the Moon in included in the computing method. So, near the lunar limb, two perpendiculars lines with the same apparent length will indicate different dimensions.

"Profile plot"

In "Distance measurement" mode, the "Profile plot" button allows you to draw a section of the terrain along the line drawn, thus allowing you to view the variation in altitudes in relation to the mean radius of the Moon equal to 1734 km.

By clicking on it, a “DEM Profile” window appears displaying the graph obtained. This window can be made full screen by clicking on the square icon at the top left of the cross [X].



Profile plot of Copernicus

The text at the top left gives the following indications:

- Longitude & latitude of the starting and ending point of the line drawn

- The Digital Elevation Model used (Range 16 to 128)

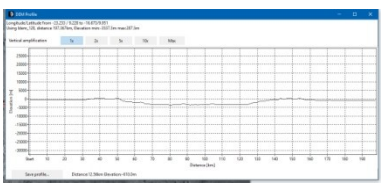
- The length of the drawn line

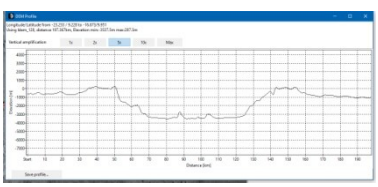
- The minimum and maximum altitudes encountered on the line drawn in meters relative to the mean radius of the Moon

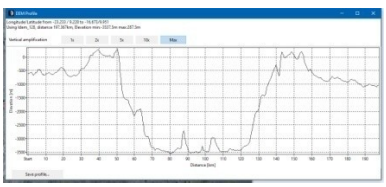
The horizontal abscissa of the graph shows the distance in km and the vertical ordinate the altitude in m with respect to the mean radius of the Moon indicated by 0.

The scale of the graph can be modified by clicking on the upper buttons (x1…Max)

The 1x button shows the reality. The 5x button shows the profile magnified 5 times. The Max button uses the window to the maximum by tangenting the top and bottom edges.





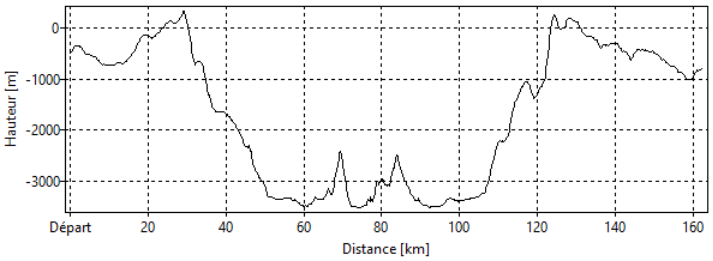


Copernicus profile at

1x **5x** **Max**

If you hover the mouse cursor, at the bottom of the graph are displayed the distance from the starting point of the line drawn and the altitude at the point of the graph flown over.

The "Save profile" button gives you the choice of saving an image of the graph in "png" format or the distance / altitude values associated with the graph in a file in "csv" format that can be used in a spreadsheet.



SauvegardeGrapheCopernicFR.csv - LibreOffice Calc

Fichier Édition Affichage Insertion Format St

Liberation Sans 10 pt G

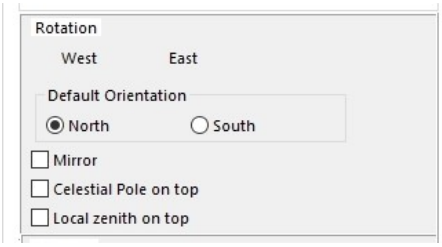
A1 Index

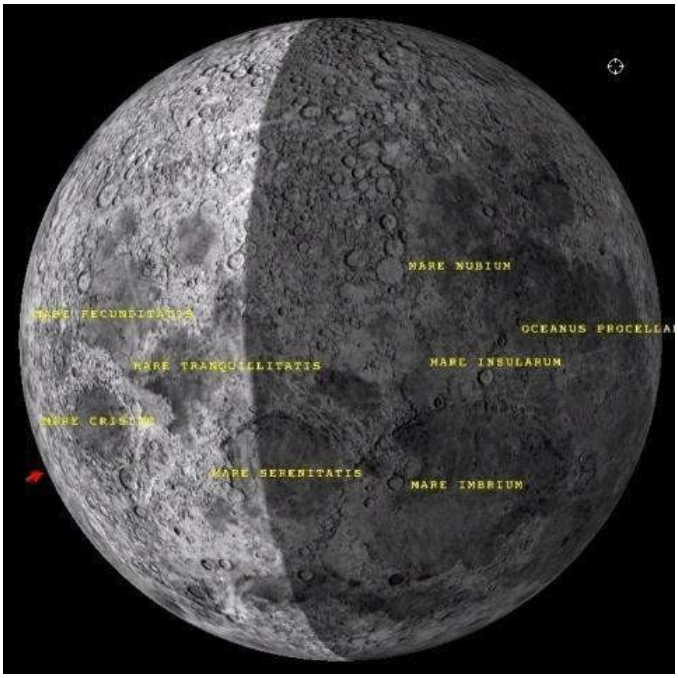
	A	B	C	D
1	Index	Distance	Height	
2	0	0.000	-490.5	
3	1	0.237	-471.5	
4	2	0.474	-446.0	
5	3	0.711	-427.0	
6	4	0.948	-404.0	
7	5	1.185	-358.5	
8	6	1.421	-350.0	
9	7	1.658	-347.5	
10	8	1.895	-352.5	
11	9	2.132	-354.5	
12	10	2.369	-357.0	
13	11	2.606	-376.0	
14	12	2.843	-384.0	
15	13	3.080	-400.5	
16	14	3.317	-442.0	
17	15	3.554	-460.5	
18	16	3.790	-474.5	
19	17	4.027	-504.0	
20	18	4.264	-504.0	

Image sauvegardée **Fichier CSV**

MAP ROTATION

You can turn the map so that it matches what you are observing through the eyepiece of a Newtonian telescope.

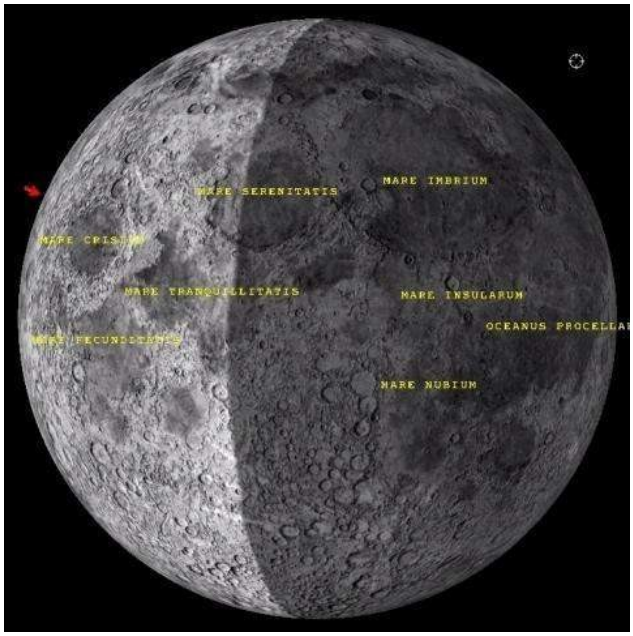




When clicking the "**East**" or "**West**" button, you rotate the map display with a slight angle in the choosen direction.

"Mirror" BOX

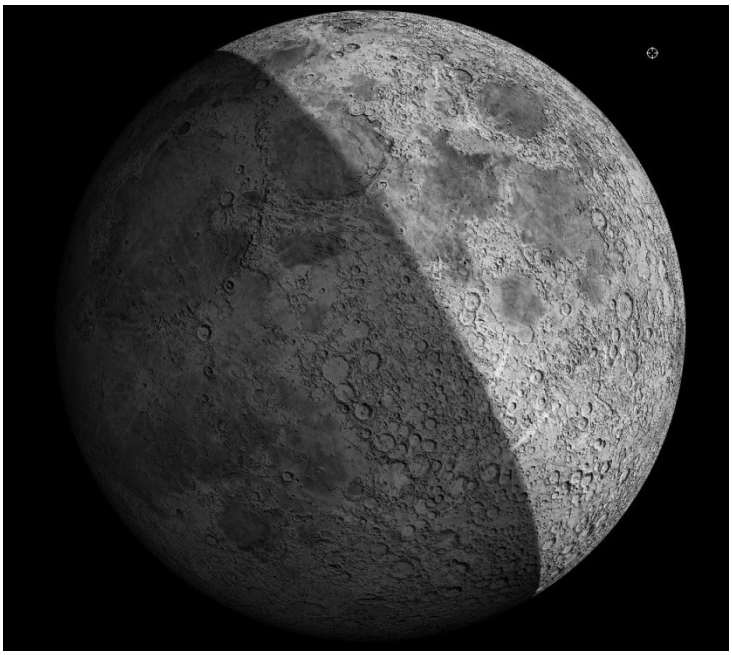
When you select this box and the "**North**" box together, the Moon map will show you what you will see in an instrument as a refractor or catadioptric reflector as Cassegrain, Schmidt-Cassegrain or Maksutov telescope.



"Local zenith up" BOX

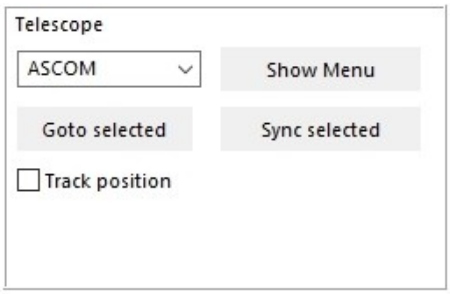
When you select the box "L**ocal Zénith up**", the Moon drawing will be that you can observe in an instrument on an altazimutal mount. You will have to check also the

"**Mirror**" box if your instrument is a refractor or a Schmidt-Cassegrain. If it's a Newtonian, you will have also to turn the map, but without checking the "**Mirror**" box.



"Telescope" Frame

This frame allows you to setup your "Goto" mount.



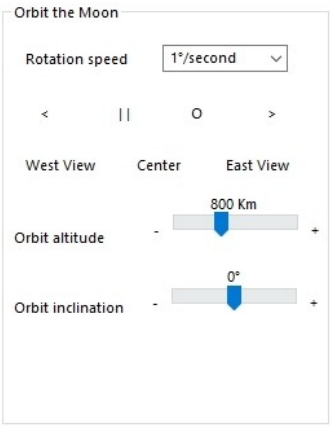
If you own a such computerized mount which accepts the ASCOM protocol, the Virtual Atlas of the Moon will track it directly on the Moon.
First of all be sure that you have installed the good ASCOM drivers on your computer. If not, go on the internet to the site to download them. Install them.

http://ascom-standards.org/

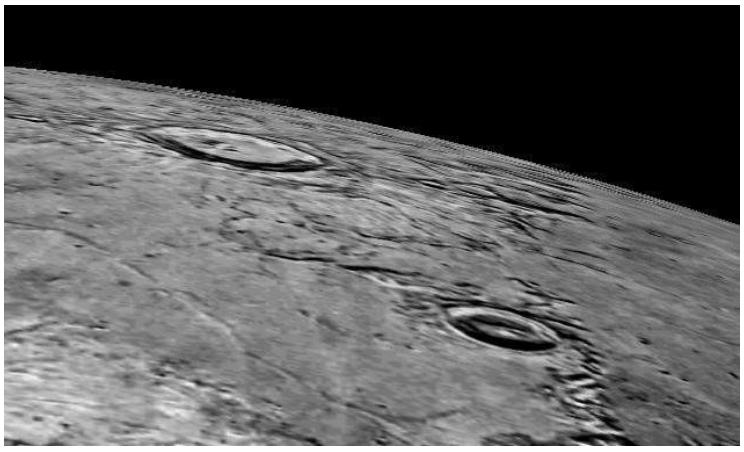
Connect your mount to your computer. Start your computer and the version of the software.
First initialize tour telscope as usually, then use the pad or a planetarium software to point the Moon.
Click on the "**Show menu**" button and launch the connection.
Begin centering a well known formation in the eyepiece fieeld and select it on the map. Push the "**Sync selection**" button for initializing telescope coordinates on this position.
It's also possible to make this operation on a star near the Moon with the planetarium program.
After, check the box "**Track position**" so that the map displays always the telescope

position.
If your telescope can do automatic pointing, you can now click on a formation on the map, or choose it with the "**Search**" function of the "**Information**" tab and then click on the "**Goto selected**" button
If you check the "**Correct the Moon motion"** box, you can choose the period correction with the choice box below.

"Orbit the Moon" Frame

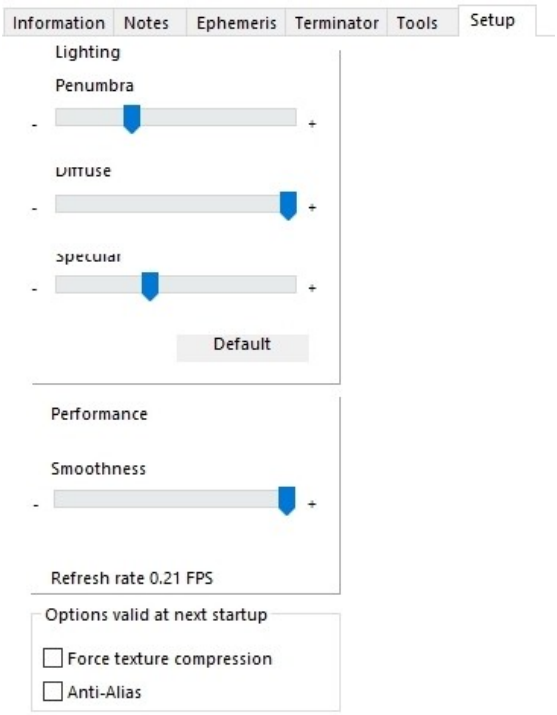


This frame can simulate the view you should have from a spaceship orbiting around the Moon.
Choose the automatic rotationspeed in the scrolling list.
"**<**" et "**>**" buttons allows you to choose the rotation direction.
" **II** " button stops the automatic rotation.
"**East view**", "**Center**" et "**West view**" buttons send you to the Moon Equator on the East or West limb or on the center of the Moon disk.
Names display is only effective when rotation is stopped.
"**Orbit altitude**" can be choosen from 100 to 2000 km by moving the cursor.
"**Orbit inclination**" compared to the lunar equator can be choosen from 0° (on the equator) to 90° (Passing on the two poles). The negative side of the cursor gives retrograde motion.



Above : Copernicus rise simulation

THE "SETTINGS" TAB



This tab will allow you to choose the special settings for the display.

"PENUMBRA" CURSOR

This cursor sets the transparence of the "night" part of the Moon globe when the box " when the "**Show the phase**" box in the "**Display**" tab of the "**Configuration**" menu is activated. We think it's better to choose an intermediate setting to give an "Ashen Light" appearance to the rest of the globe. Cursor at left gives a night part completely black. But if you want to use VMA as an atlas, put the the cursor to right or uncheck the "**Show the phase**" box in the "**Display**" tab of the "**Configuration**" menu

"DIFFUSE" CURSOR

This cursor sets the general quality of the map.

"DIRECT" CURSOR

This cursor manages the transition zone between light and shadow width. At left, it's maximal but not too realist. Ce curseur sert à gérer la largeur de la zone de transition entre la partie éclairé et la partie nocturne de la face visible. Complètement à gauche, cette largeur est minimale. A droite, la transition est maximale, mais peu réaliste. Il vous est conseiller d'adopter un réglage intermédiaire.

"RESOLUTION" CURSOR

This cursor manages the 3D sphere when textures is applied precision. At left, it's not a sphere but a rough polyedra with visible flat faces.
Moving the cursor at right increases the faces number, but this needs a more powerful computer.
An image number indicator (fps) shows you the performance of your configuration. Don't go under 4 fps to keep a sufficiently speedy display when handling the map.
But, going to a better spherical resolution also slightly increases the formations place precision on the map.

"OPEN GL INFO" BUTTON

This button displays a window giving informations on your graphic card. Use it to know what options are available on your compuuter and to check if it workw well.

"OPTIONS VALID AT NEXT STARTUP" FRAME

As indicated , changing one of the following options will be taken account only at next computer startup.

"**Force texture compression**" :
Normally, this option must be checked to avoid display flickering. Removing it can nevertheless improve performances with some graphic cards types.

"Anti Alias" :
Try this option to remove scale effects on map window. Beware, only some graphic cards can handle this option.

THE SEARCH ZONE

THE "TYPING SEARCH ZONE"

Elle vous permet de chercher de nouvelles formations en y entrant leur nom ou de resélectionner une formation recherchée récemment. Vous pouvez entrer dans cette liste des lettres figurant dans le nom d'une formation et employer des "jokers". Ainsi, "*tri*" inclura dans la liste déroulante "Triesnecker" et "Rimae Triesnecker"

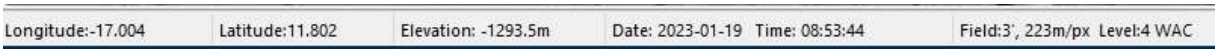
THE "FIND" BUTTON

When you click on this button, you display the first formation alphabetically corresponding to the search criteria choosen in the "Search" field".

THE "NEXT" BUTTON

When you click on this button, you display the next formation alphabetically corresponding to the search criteria choosen in the "Search" field".

THE STATUS BAR



"COORDINATES" DISPLAYS

Latitude and longitude of the pointer on the moon globe are displayed on the left side of the status bar. Don't mix them with your observing site coordinates

"ELEVATION" DISPLAY

The altitude on which the center of the cursor is displayed in the status bar at the bottom

"DATE AND HOUR" DISPLAY

The date and time in the status bar corresponds to the time selected in the "Ephemeris" tab. It should not be confused with the date and time of your system!!!

"FIELD" DISPLAY

The field value corresponds to the visual apparent field of the map window selected.

"TEXTURE AND OVERLAY" DISPLAY

The used texture and its definition level, and the overlay eventually used are clearly indicated in the status bar.

END OF ATLUN MODULE MANUAL OF THE VMA 8

(This english version has been partially corrected by **Jim Gartner.** Thanks to him !

The authors thank in adavance users to inform them about every mistake encountered in this manual in using the VMA Internet site forum.