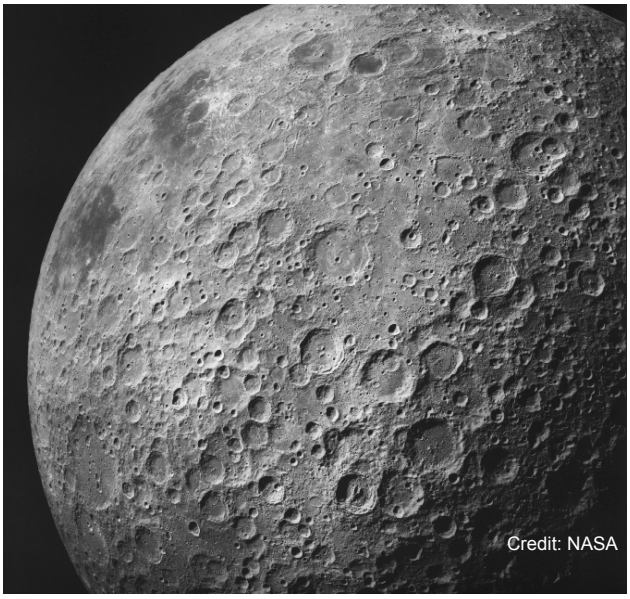
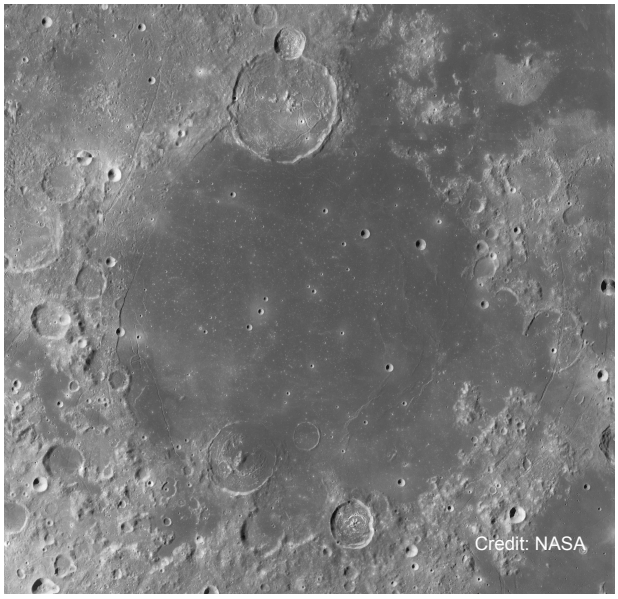
If aliens did visit us, I'd be embarrassed to tell them we still dig up fossil fuels from the ground as a source of energy.

Neil deGrasse Tyson

M & M's

Hi AST 111! In this module we'll delve a into the geological processes that shaped the Moon and Mercury - M & M.

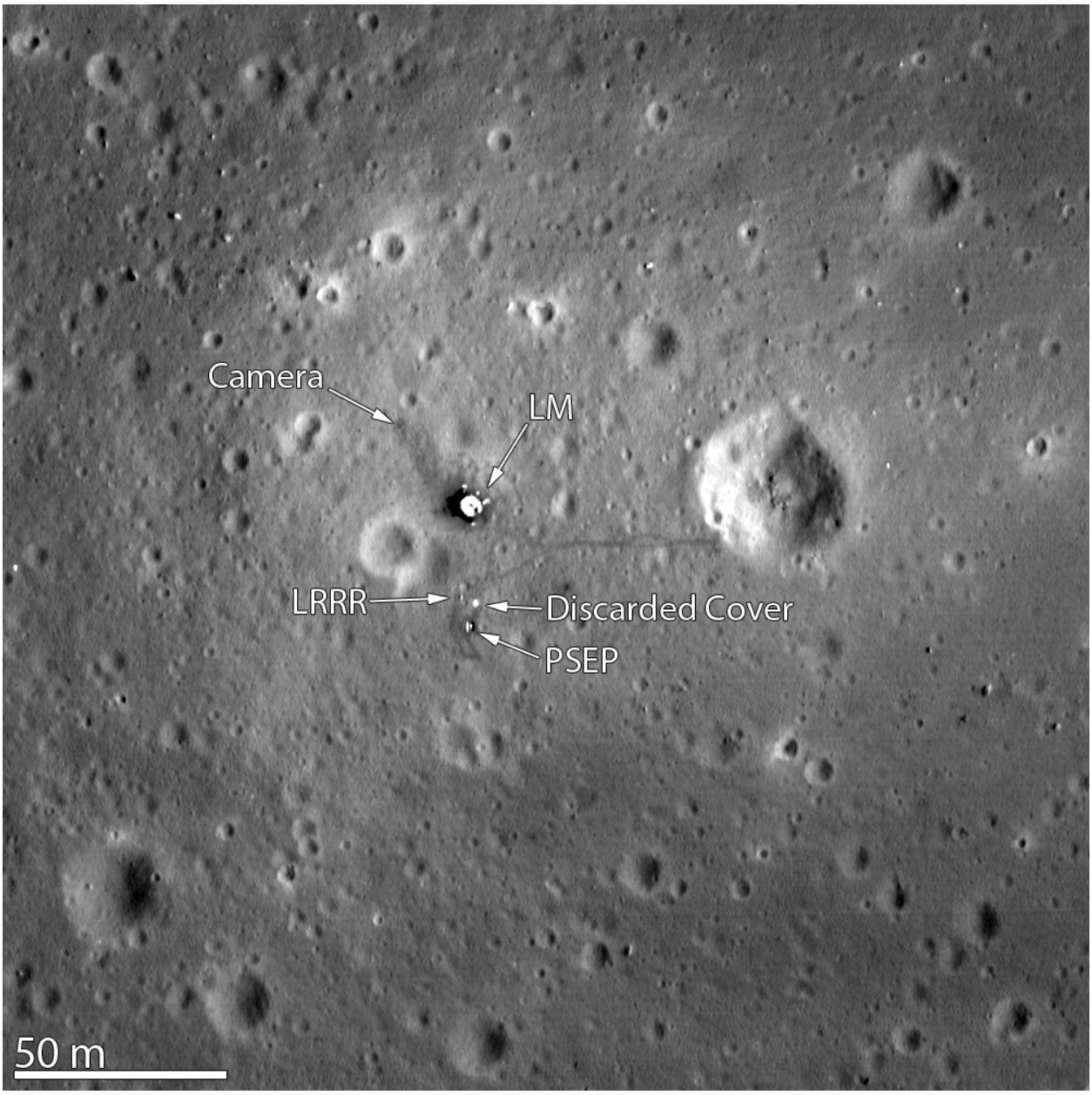




So the lunar surface is a combination of old, heavily cratered terrain and younger lava plains, the lunar maria. The image on the left above is the far side of the moon. Lots of craters and not much maria here. This means an old surface. The image on the right is a maria on the near side of the moon. Not many craters, so a younger surface.And if you ask yourself why there are only maria on the near side of the Moon … Stay Tuned!

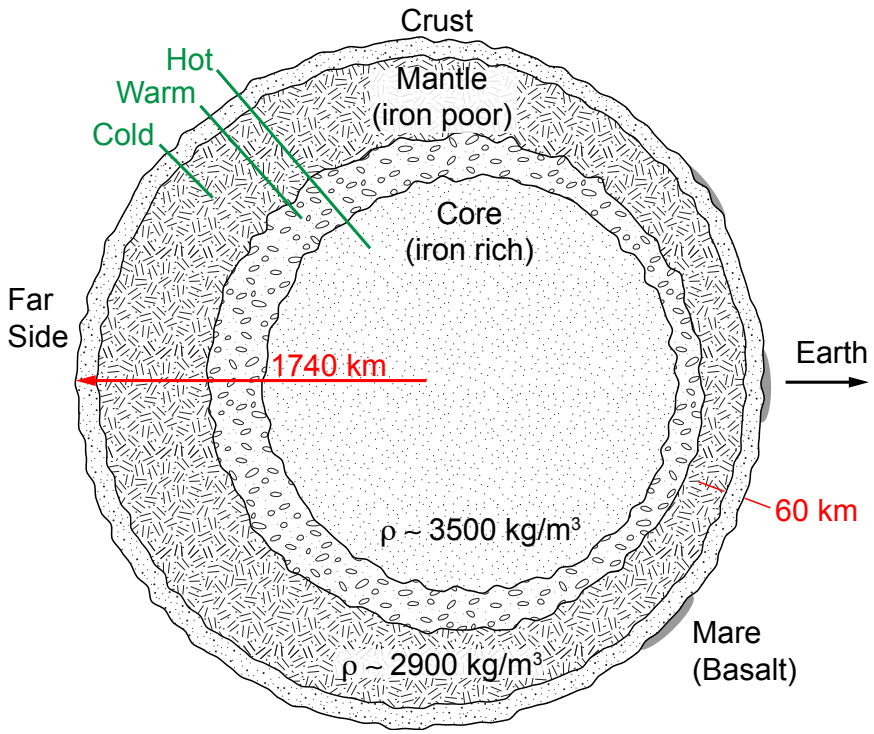
During the Apollo missions we put seismometers (with 1960's technology!) on the Moon. So we know there are small moonquakes and signs of small tectonic features.

The stunning image below, taken by the Lunar Reconnaissance Orbiter Camera headquartered at ASU, shows the lunar module and other belongings of the Apollo 11 mission.


Camera
LM
LRRR
Discarded Cover
PSEP
50 m

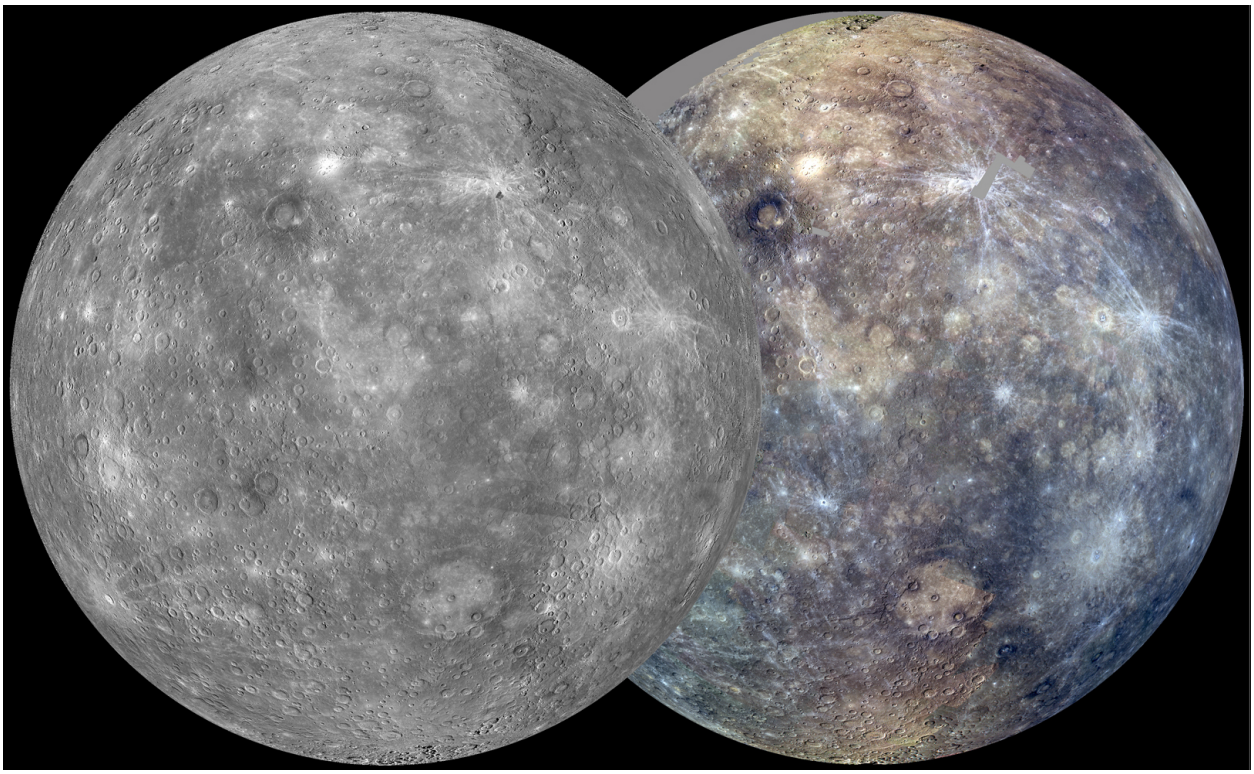
The Moon lacks erosion in part because it has so little atmosphere. This Apollo 11boot print on the surface of the Moon will be there for about 200 million years in near pristine condition.

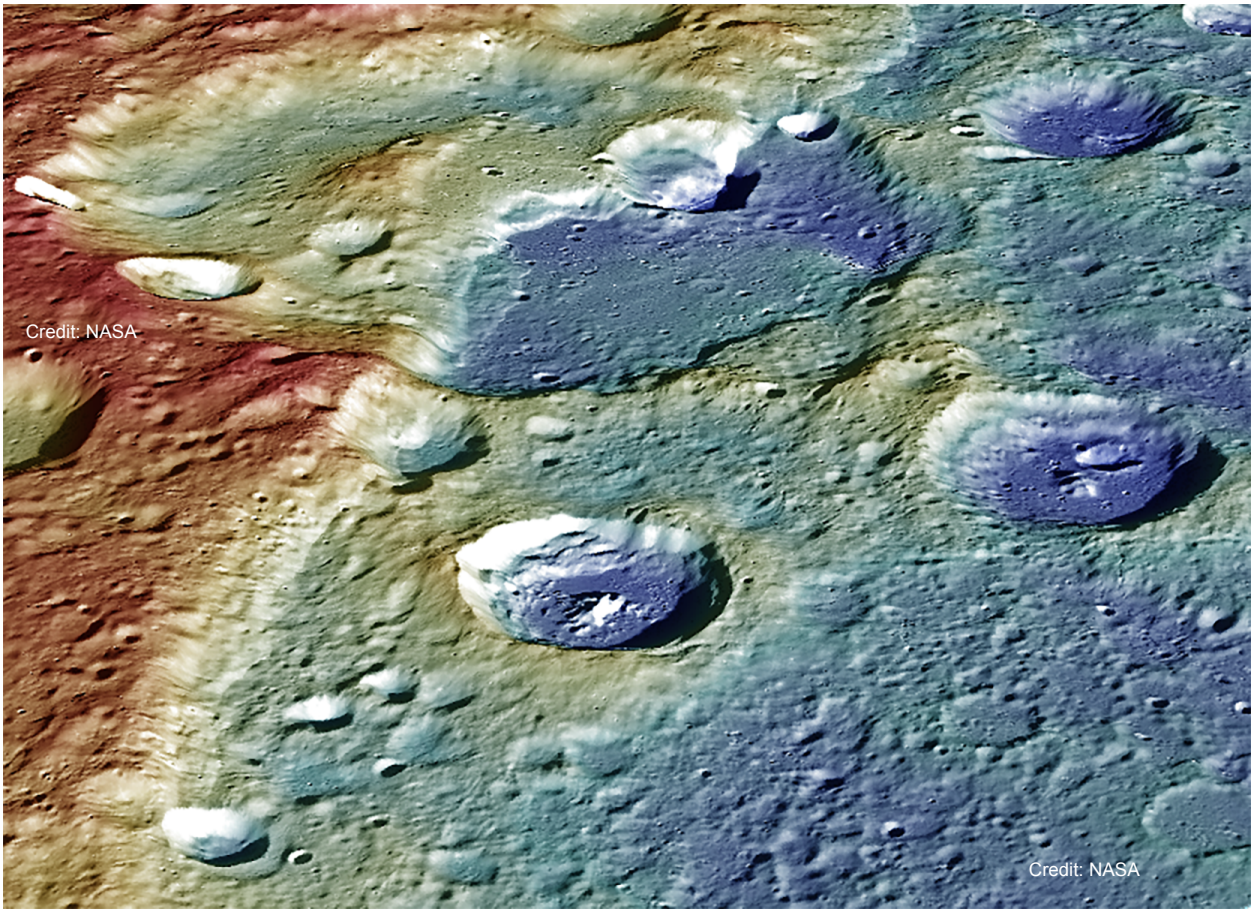
Now, there are erosion processes on the Moon. But it's not like erosion processes on Earth, where we have abundant liquid water and wind and all the stuff you're familiar with. The Moon lacks any of that. But it does have erosion processes, which are caused by micrometeorites and even the solar wind itself. This erosion process is slow. This is where the 200 million year estimate comes from.

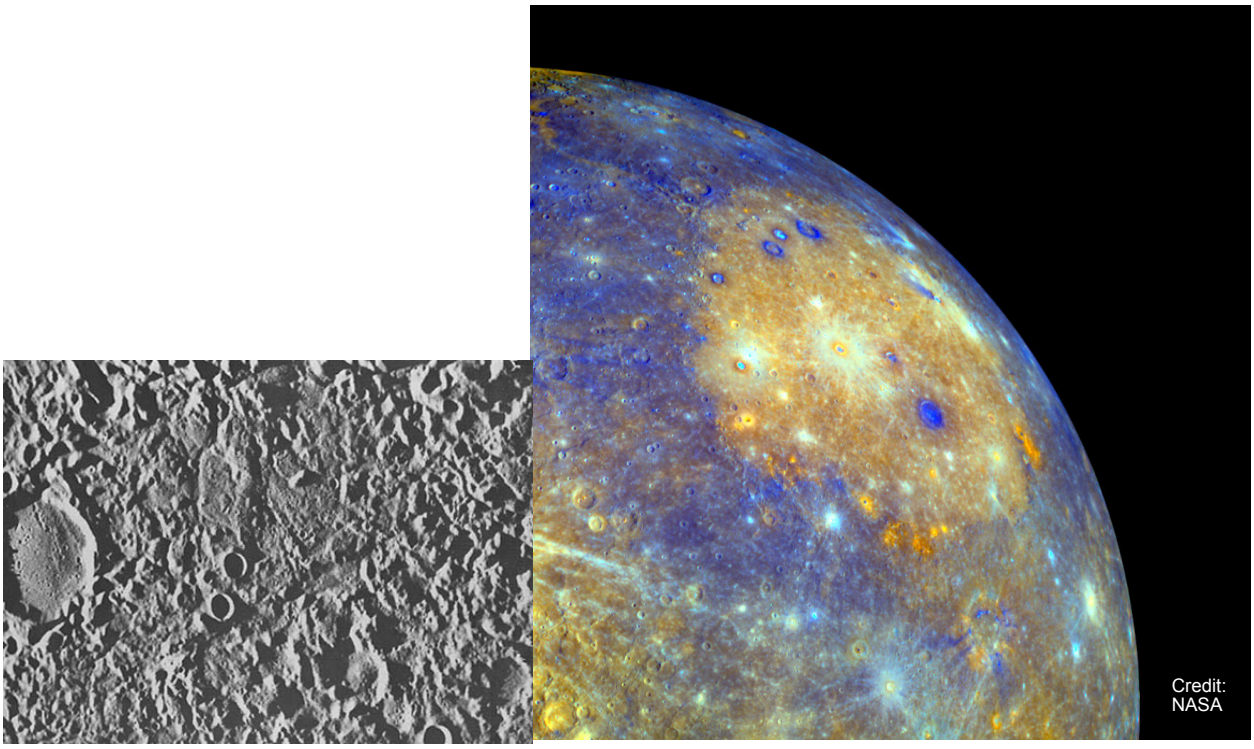


The Moon is lopsided. The illustration above shows the crust is thinner towards the Earth, the near side of the Moon, and much thicker on the far side of the Moon. It got this way because the near side of the Moon faced the hot young Earth shortly after the collision that gave birth to the Moon. This means the far side will cool to solid rock quicker than the near side since the near side is bathed in “Earthshine”.

An impactor coming in will have a much easier time penetrating or cracking the thinner crust on the near side than the thicker curst on the far side. This is why you see maria, lava seas, on the near side of the moon and not the far side of the moon.




Credit: NASA
Credit: NASA

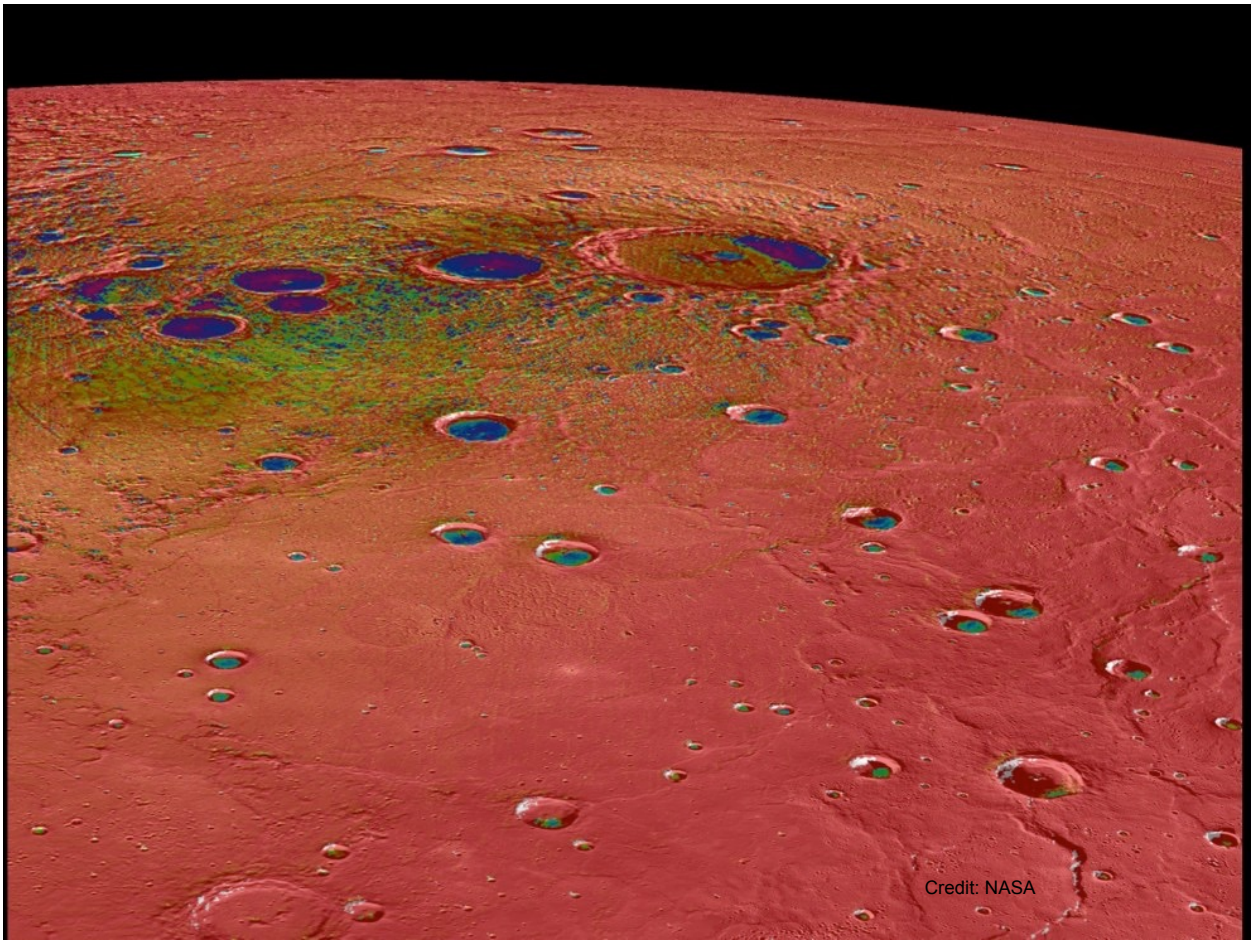


What about Mercury? Well, Mercury's surface resembles the Moon, in that it is being shaped by impact cratering and volcanism. The images above are from the Messenger mission, the first ever mission to orbit Mercury. The colors on the right image show variations in the surface composition, while the monochrome image on the left has a higher resolution. The coverage is good enough the properties of both broad terrains and small, distinct features such as volcanic vents and fresh craters can be studied.

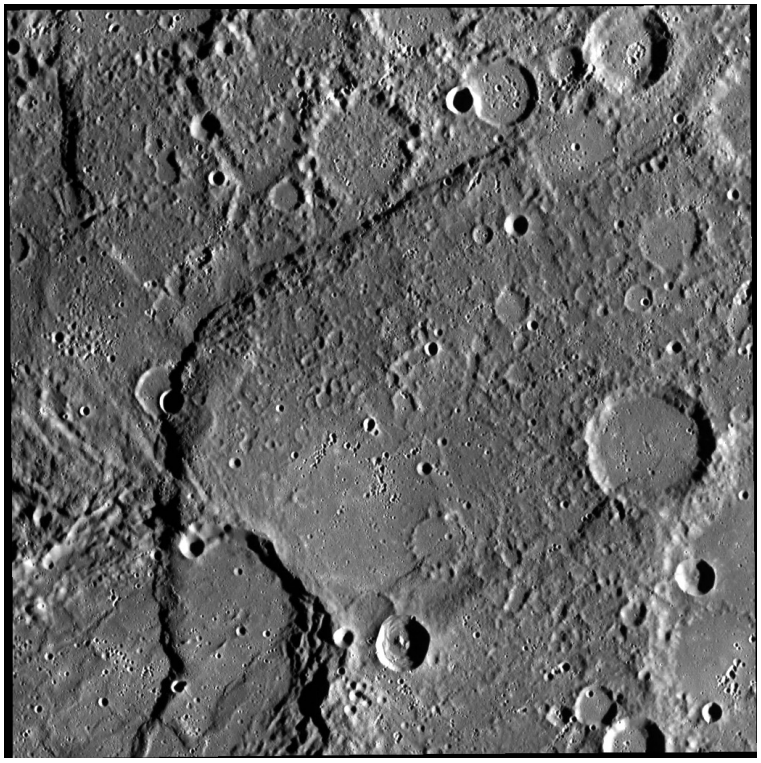
Credit: NASA

The Caloris Basin is the largest feature on the surface of Mercury, and is one of the largest impact basins in the Solar System. It is shown below on the right. Color represents composition variations. Caloris was likely formed by a large impactor during the era of heavy bombardment early in the solar system's history.

This was a really big impact. It likely had global implications for Mercury. For one, at the exact opposite side of the planet, there is a large area of hilly grooved region called "Weird Terrain". Its shown in the monochrome image above on the left. One hypothesis is that shock waves generated by the impact converged on the exact opposite side of Caloris and literally ruptured the surface. For two, the Caloris impactor likely cracked Mercury's crust to release lava that left large smooth plains, like the lunar maria.



Mercury has tremendous cliffs that are probably formed as the whole planet cools and contracts. In the Messenger mission images above and below you can see the surface is crumpling, the blue hued regions. As you take away that center support, because the core is shrinking, the surface crumples. The height of these cliffs range from hundred of meters to over 1.5 kilometers. By studying these cliffs we can estimate that Mercury has shrunk in size by about 11 kilometers in radius since it was formed in the early solar system. The incredible shrinking Mercury!



Finally, Mercury's surface is extremely hot (red in the image below) -- except where it's not, inside permanently shadowed craters at the planet's north pole (blue/purple) where there is ice water. Ice on Mercury. Wow!

So that is a bit about the geology of the M & M.

Thanks. Bye Bye!