

Geological Processes, Moon, and Mercury

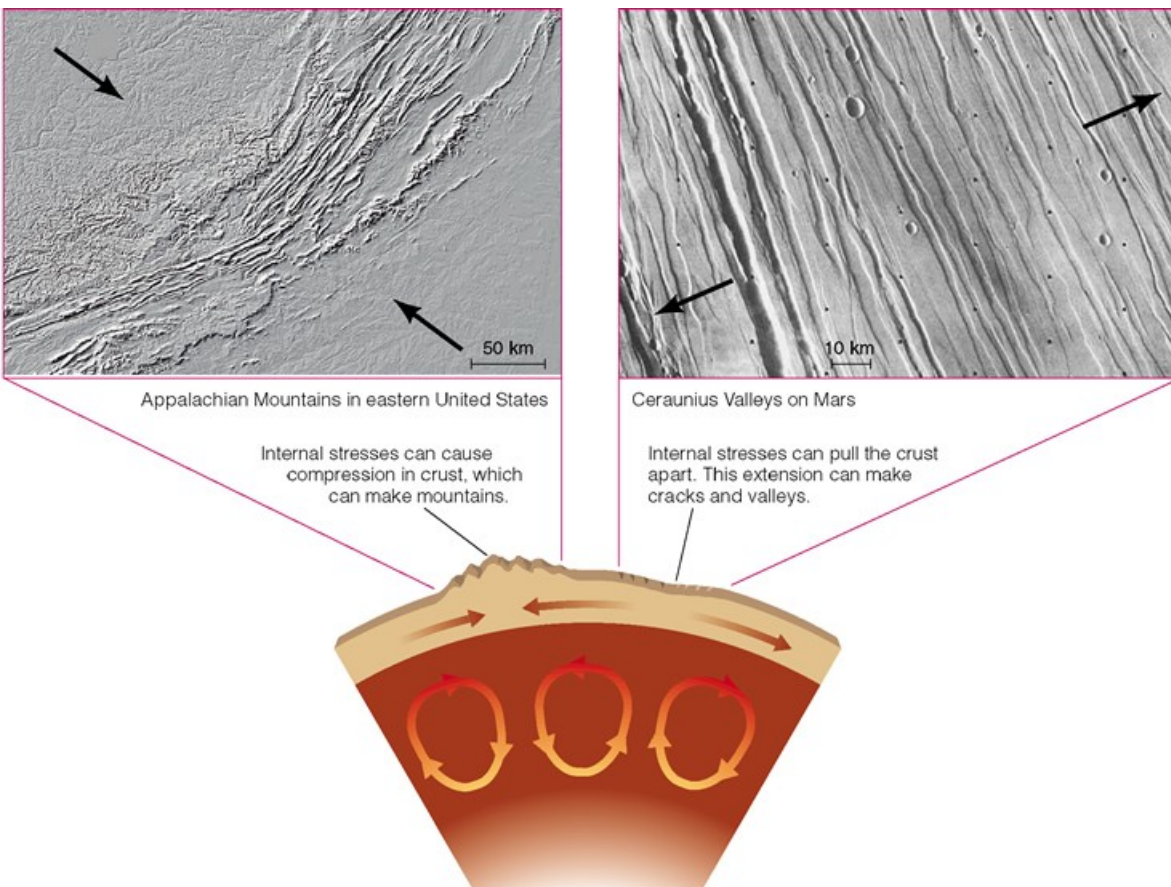
10-26-2005

Opening Discussion

- Have you seen anything interesting in the news?
- http://news.yahoo.com/s/space/20051025/sc_space/newmarsmapsimila
- http://news.yahoo.com/s/space/20051025/sc_space/ridingabeamoflight
- What did we learn from SL-9? Pics?
- Did the KT impact wipe itself out?
- Moon impact vs. extinction event impacts.
- Crater lake is not from an impactor, but impact craters could fill up with water and still be noticed for a while.
- Red dwarf stars are bigger than brown dwarf stars but smaller than our Sun.

Tectonics

- Mantle convection drives tectonic activity by pushing the lithosphere around.



Erosion

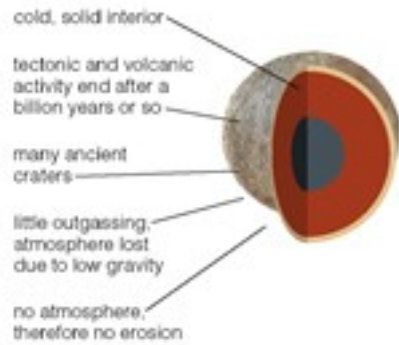
- The fourth motivator of geological change of surface features is erosion.
- Erosion comes from several sources. The ones you are familiar with are wind and water erosion. Technically, anything that flows across the surface of a planet can erode it. Glaciers have left significant features on the surface of the Earth as well.
- These types of erosion break down material at high altitude and deposit it at lower altitudes. That is how sedimentary rocks form.
- These types of erosion require that the planet have a reasonable atmosphere and weather of some type.

More Erosion

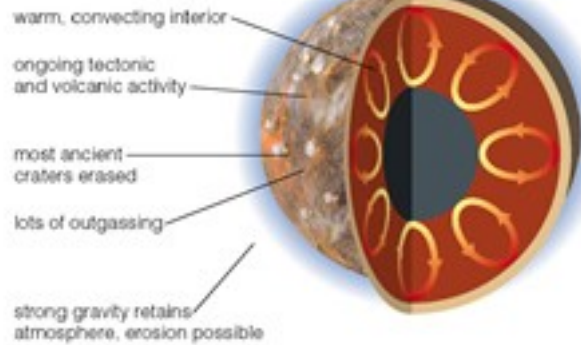
- Whether a planet has an atmosphere with weather depends on the size of the planet, its distance from the star, and its rotation rate. You don't expect much erosion on planets that are too small, too close to or too far from the star, or that don't spin enough to keep winds moving.
- A source of erosion you might not normally consider comes from micrometeorite impacts. This is a smaller effect and doesn't matter at all if there is an atmosphere.

The Role of Planetary Size

Small Terrestrial Planets



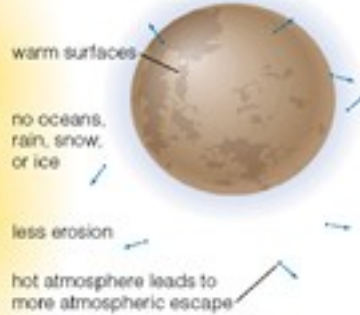
Large Terrestrial Planets



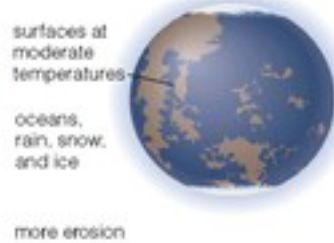
Pictorial Summary

The Role of Distance from the Sun

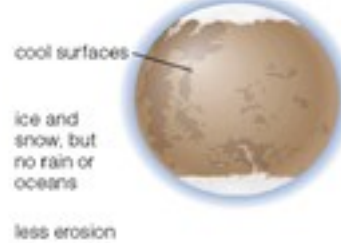
Planets Close to the Sun



Planets at Intermediate Distances from the Sun

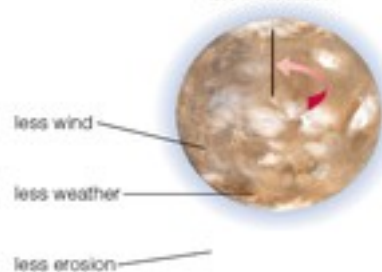


Planets Far from the Sun

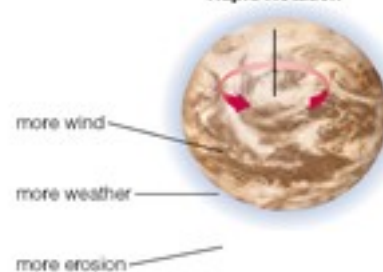


The Role of Planetary Rotation

Slow Rotation



Rapid Rotation



Moon and Mercury

- We start off by looking at the two smallest terrestrial planets since size is the most significant impactor of the geology of these bodies.
- Both bodies are very heavily cratered. Because they are small, neither has active volcanism, nor do they have atmospheres and erosion.
- Volcanism and tectonics were active in the early history of both of these worlds. Since they cooled off, both have little geological activity other than the occasional impactor.

Moon

- The surface of the moon has records of ancient volcanism and minor tectonics. After the Moon formed and solidified, the heavy bombardment blasted the surface with numerous craters. Later, radioactivity heated the inside up to the melting point and low viscosity lava flows filled in the large regions we called the maria. Since then less frequent impactors have dotted the maria with some craters.
- There are wrinkles on the surface of the Moon that are the evidence of tectonics. They likely formed when material cooled and shrunk so some regions bunched up a bit.

Mercury

- Mercury's craters are less dense than the lunar highlands, indicating they were resurfaced more recently.
- Mercury has one impact crater, the Caloris Basin, that spans more than half of the radius of the planet. The small number of craters in the basin tell us it happened late in the heavy bombardment.
- Mercury has many small lava plains.
- Mercury also has some remarkable cliffs (up to 3 km high, hundreds of km in length) that were formed by tectonics. These were likely formed by large scale shrinking as it cooled.

Minute Essay

- What is the most important factor in determining the geology of a terrestrial planet?
- It has been requested that people attend Trinity Idol tonight at 9pm in Laurie. Tyson is one of the finalists.