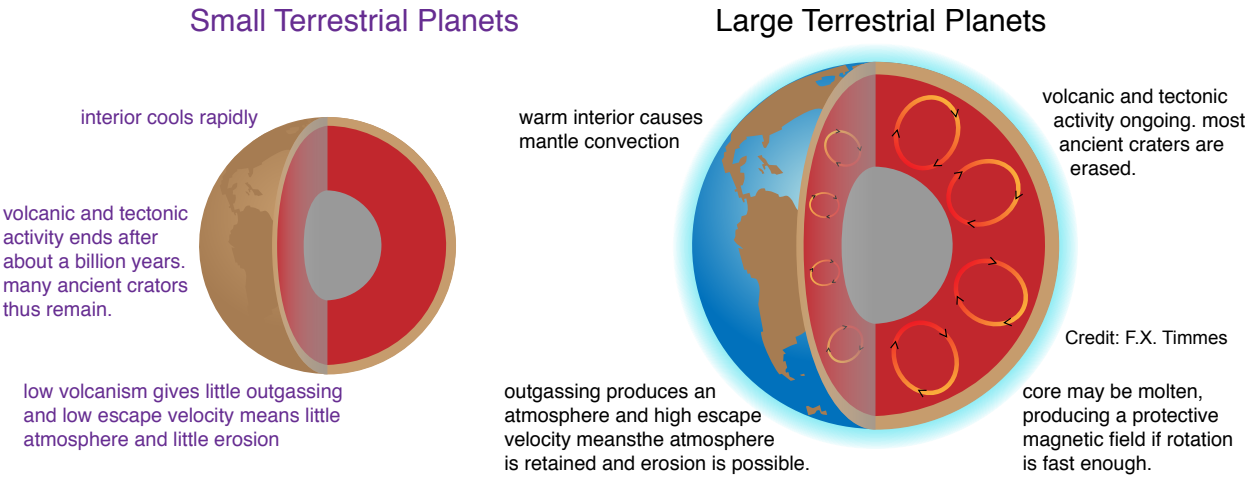
A hypothesis or theory is clear, decisive, and positive, but it is believed by no one but the person who created it. Experimental findings, on the other hand, are messy, inexact things, which are believed by everyone except the person who did that work.

Harlow Shapley

Not To Hot, Not Too Cold

Hi everyone. This module will be short as we polish off shaping planetary surfaces.



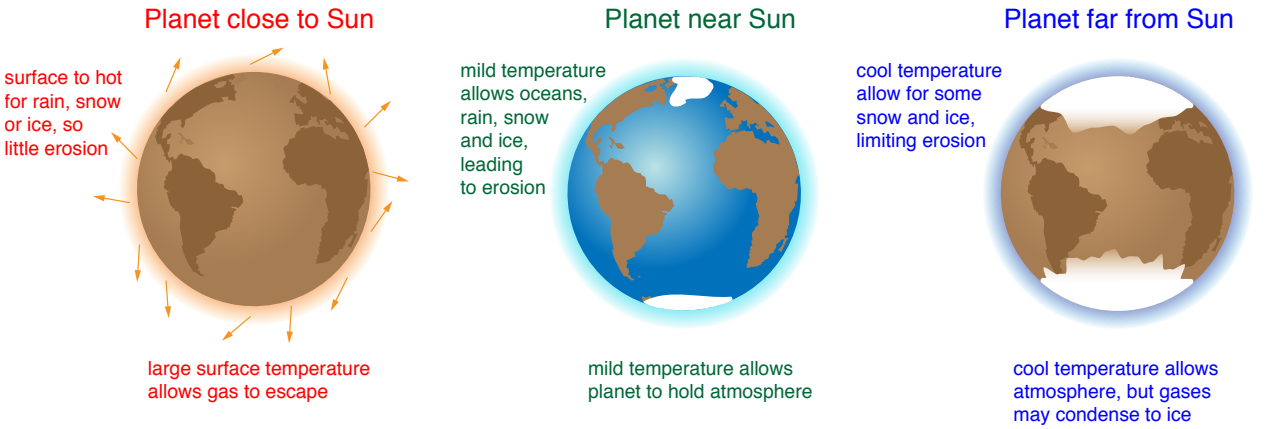
Why do the planets, the terrestrial planets, have different geological histories? Well, the most fundamental property that drives surface carpentry is the size of the planet. Mars is small, dying. Earth is alive, we've got very active geology. Larger planets hold onto their available thermal energy longer heat more. Its like a big potato versus a small potato - which stays hotter longer?

Larger planets have more volcanism. More tectonics. More atmosphere. Potentially larger magnetic fields.

Earth hardly has any large impact craters. Arizona's got one at Meteor Crater. If you ever a chance to go see Meteor Crater, you should, its a neat hole in the ground. But we don't have a lot of craters. Why? Because Earth's surface gets repaved about every 100 million years or so so by its volcanism, tectonics, and erosion. While certainly there have been large impact craters, i.e. the dinosaur killer, those have all been paved over as Earth remakes its face, remakes its surface, every 100 million years or so.

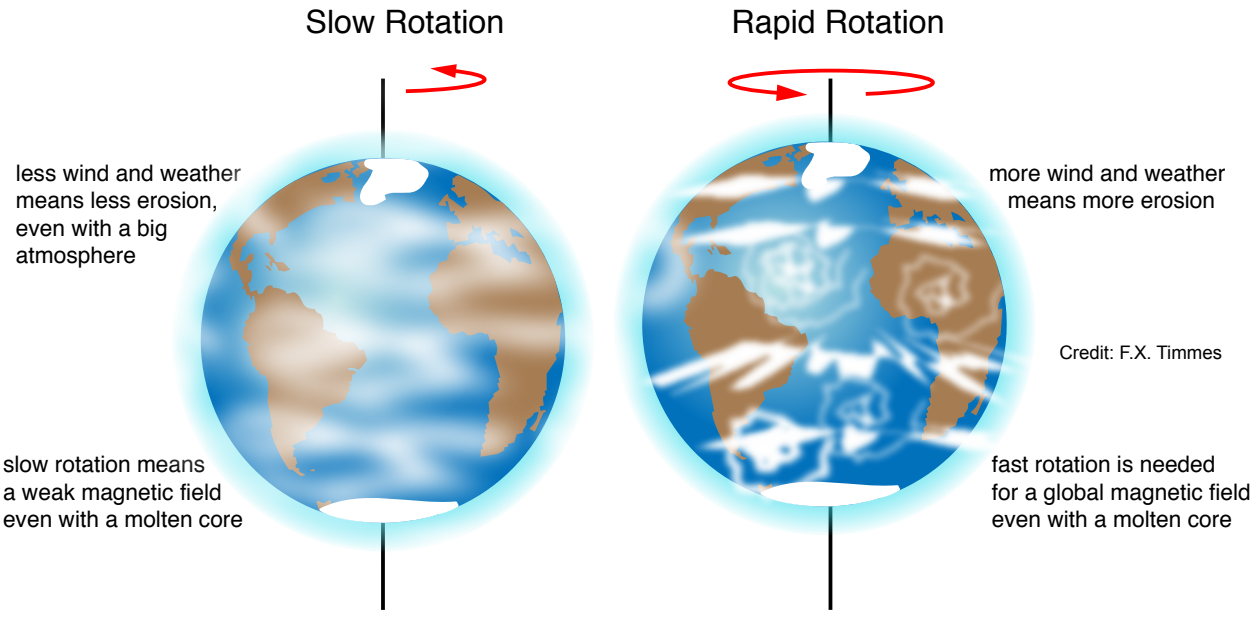
Let's digress for a moment. The number of craters on the surface can help determine how old a planet's surface is. It's like tree rings. You start counting the rings, because every year the tree puts on a new ring. And you can get an age of how old that tree is. Likewise craters. If you have a very old surface without significant erosion, like the far side of the Moon, you count the crater density, how many per square kilometer say. On the other hand, the maria on the Moon, which are low viscosity lava flows from an impact, erase craters. But you can count how many craters

there are. The relative number of impact craters gives you a handle on the relative ages of the surface — if its got a lot of craters the surface is old, if it has few craters the surface is young. If you want to get an absolute age, well, then you need to go get a sample of it, like we've done with the Moon, and do radioactive dating.



Why do the planets, the terrestrial planets, have different geological histories? Another factor is distance from the Sun. Terrestrial planets close to their parent stars have surfaces that are too hot for things like rain or snow. So less erosion. In addition being hot means the atmosphere is also hot, meaning the gas particles are moving fast, meaning they can escape the gravity of the planet. At the other end, as shown in the illustration above, planets that are far from their Sun are colder, limiting the availability of liquids like water and perhaps even causing their atmosphere to condense onto polar ice caps or the ground.

Its like the porridge in Goldilocks and the Three Bears - too hot, just right, and too cold. Only in the middle range is their mild temperatures that allow liquids on the surface and an atmosphere that stays gaseous with the planet.



Why do the planets, the terrestrial planets, have different geological histories?A third reason is simply rotation. As the illustration above shows, slow rotation means less magnetic field and less weather - so less erosion. Rapid rotation though gives a magnetic field and more weather thus more erosion.

Fundamentally, planets have geological histories because of size, distance from the Sun, and rotation.

Thanks! Bye bye.