

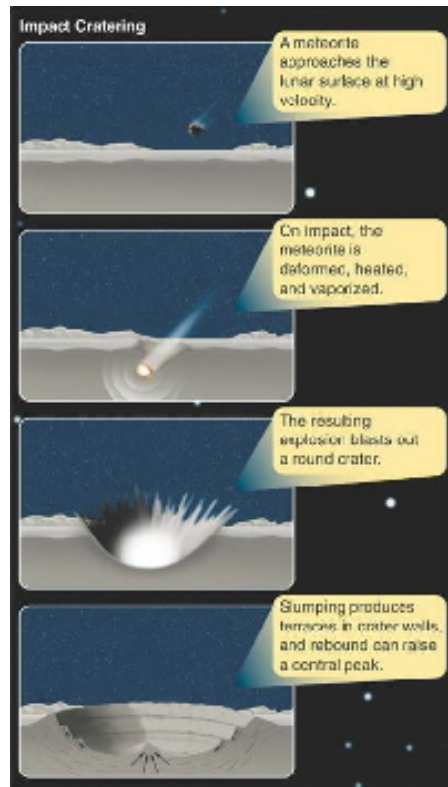
1 Moon



Always faces the same side toward Earth
Tidal coupling
Rotation rate = Orbital period

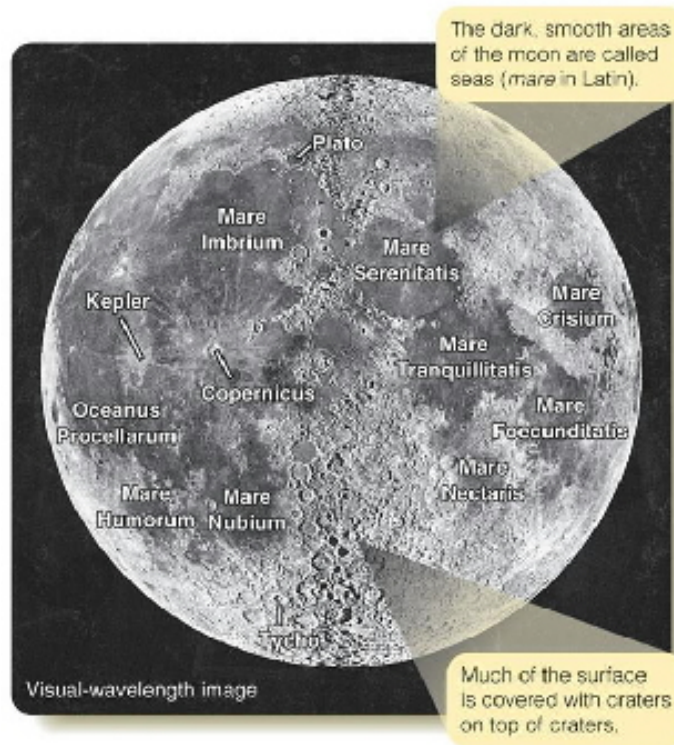
1.1 Features

Craters- impact; note the crater density increases in the light colored highlands



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Mountains - peaks and ranges due to impacts only
Mare - sea



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- Rays - bright ejecta
- Terminator - boundary of Sun's illumination
- Limb - the edge of its disk
- Rilles - long deep valleys

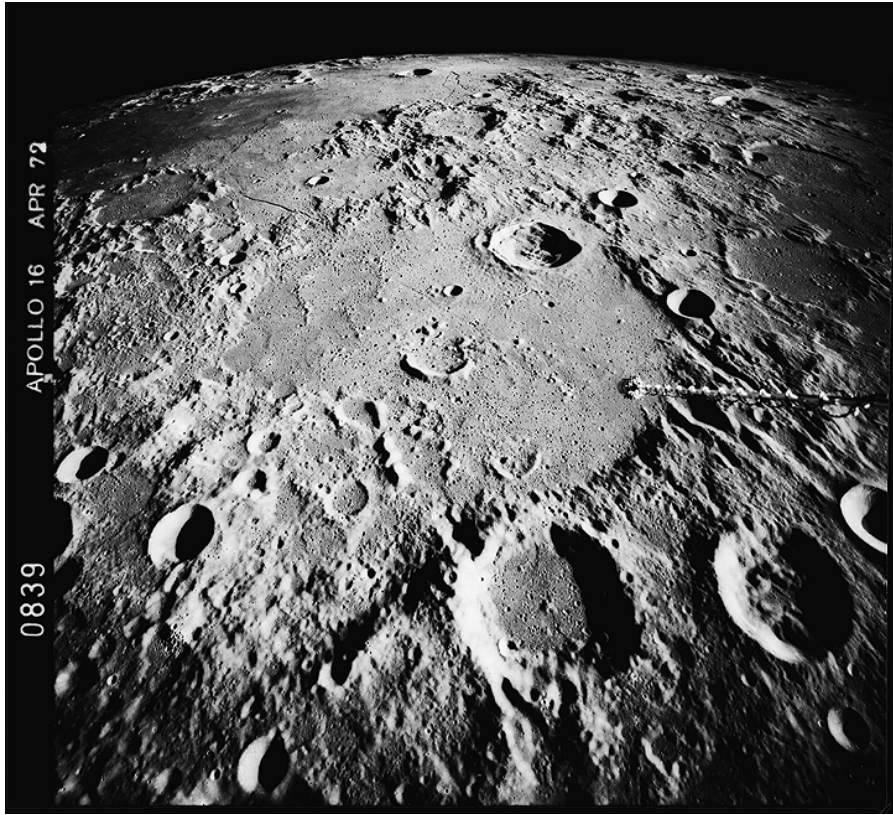


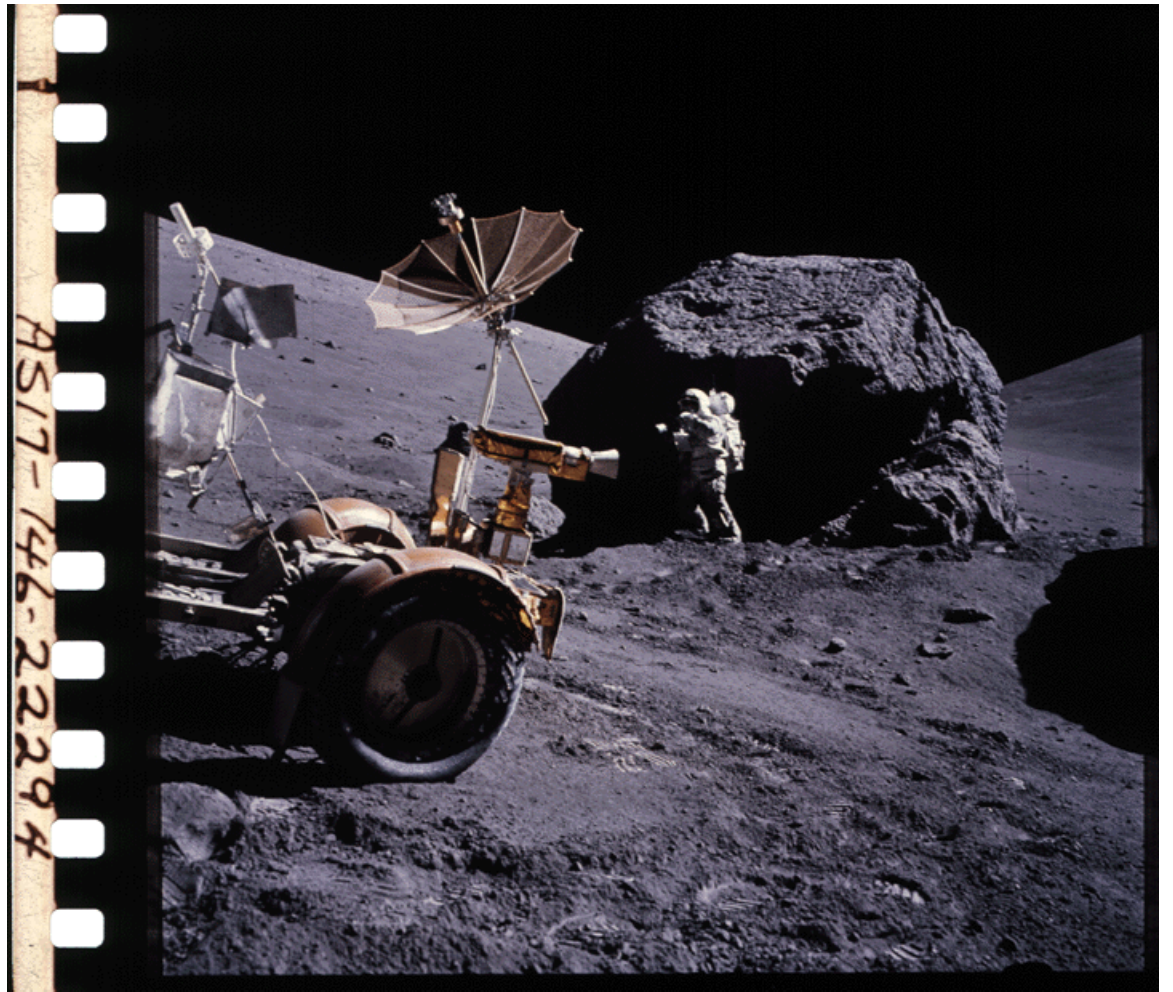
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1.1.1 Terrain Ages

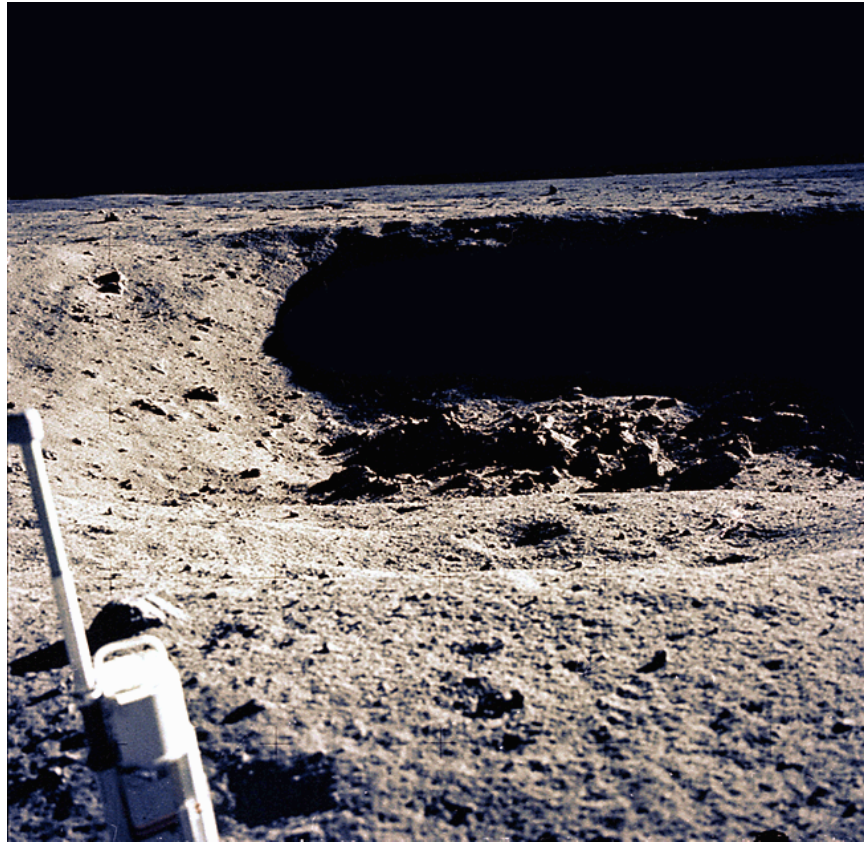
Relative Ages - more cratering in older areas of terrain

Absolute Ages - radioactive decay of returned samples, Apollo missions

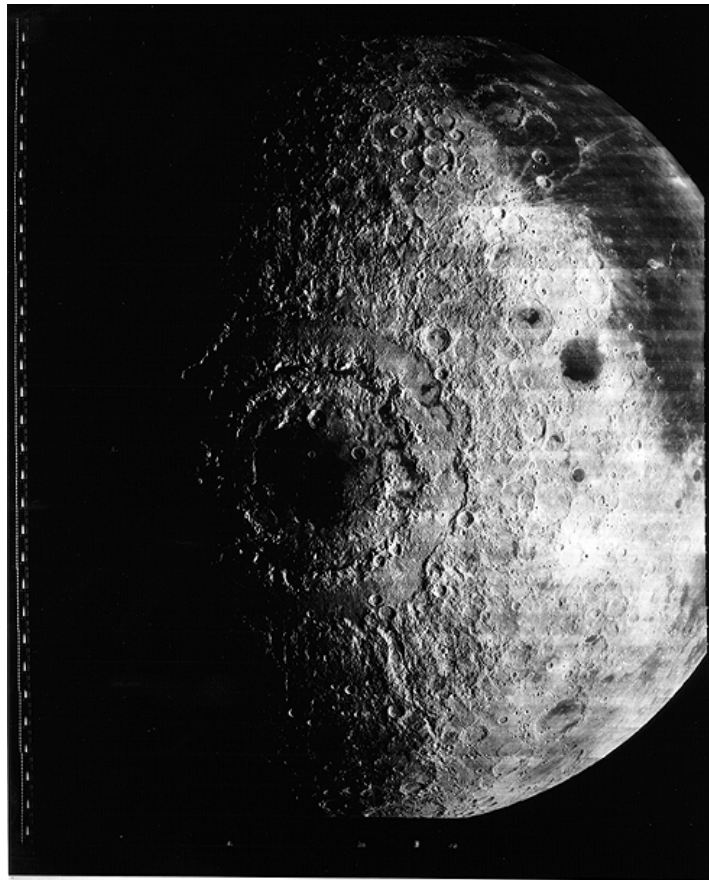




Impact Craters



Energy of motion is mainly converted into heat energy
Size of the crater is over 10 times the size of the meteorite
The heat is enough to vaporize itself and nearby rock
Rebounding shock wave moves upward and outward
This blasts away the surface producing a crater
Rocks blasted from the crater falls nearby to form the rim
Central peak - rebounding of the surface
Multi-ringed basins - Mare Orientale (Lunar Orbiter 4)

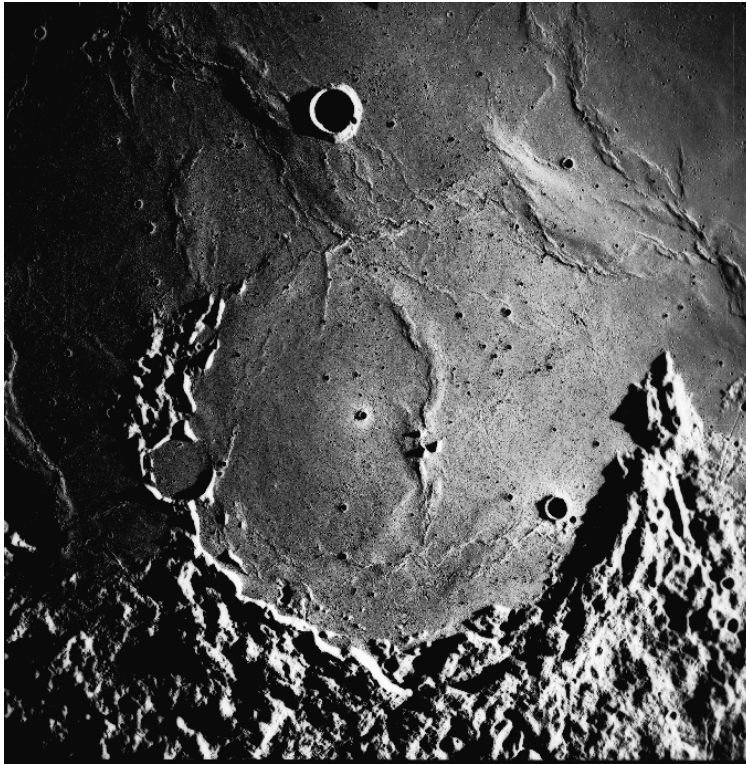


IV-187M

NASA-LRC-A



Letronne Crater has its northern wall eroded by lava flows from Ocean Procellarum



1.1.2 Types of rocks

All rocks on Moon are igneous - solidification of molten rock

No sedimentary rocks ever found on Moon

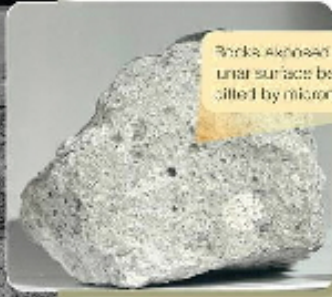
Moon rocks contain no water, extremely dry

Basalts - lava, dark colored, rich in heavy elements such as iron, manganese and titanium, dated to be 3.1 to 3.8 billion years old

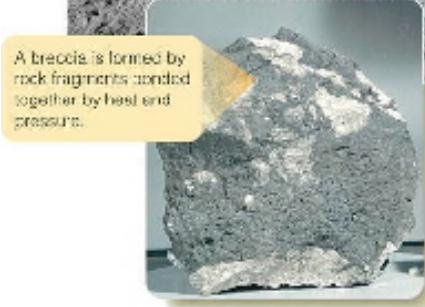
Vesicular basalts - contain holes caused by bubbles of trapped gas

Anorthosite - found in the highlands, are light in color and lower density, rich in calcium, aluminum and oxygen, true crustal rock, dated to be 4.0 to 4.5 billion years old

The Apollo astronauts found that all moon rocks are gneiss, meaning they solidified from molten rock.



Rocks exposed on the lunar surface become pitted by micrometeorites.



A breccia is formed by rock fragments conded together by heat and pressure.



Vesicular basalt contains bubbles frozen into the rock when it was molten.

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Breccias - rocks fused together during meteorite impacts, multi-colored



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1.2 Apollo Missions

11, 12, 14, 15, 16, 17

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1.3 Origin of Moon

Many hypotheses

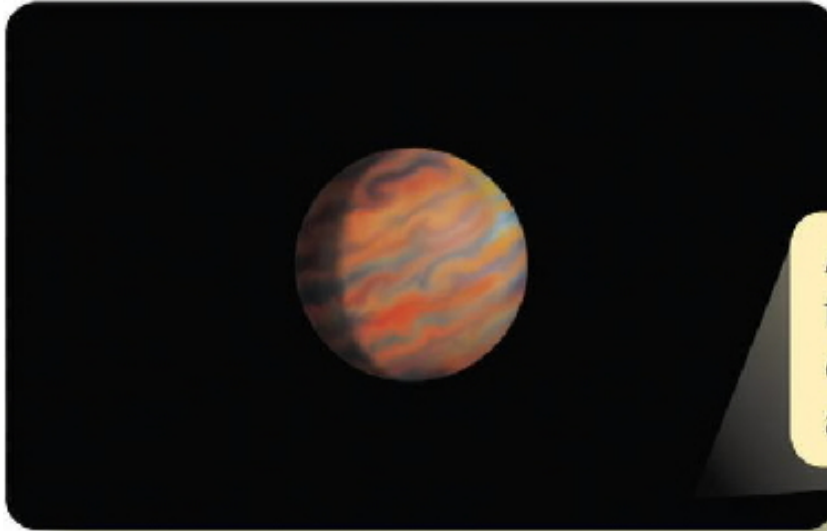
Fission hypothesis - Earth spun too fast and a blob flung off

Co-accretion hypothesis - Moon formed right alongside Earth from the solar nebula, Moon should have the same chemical composition as Earth, it doesn't

Capture hypothesis - Moon formed somewhere else in the solar system, highly unlikely events must occur

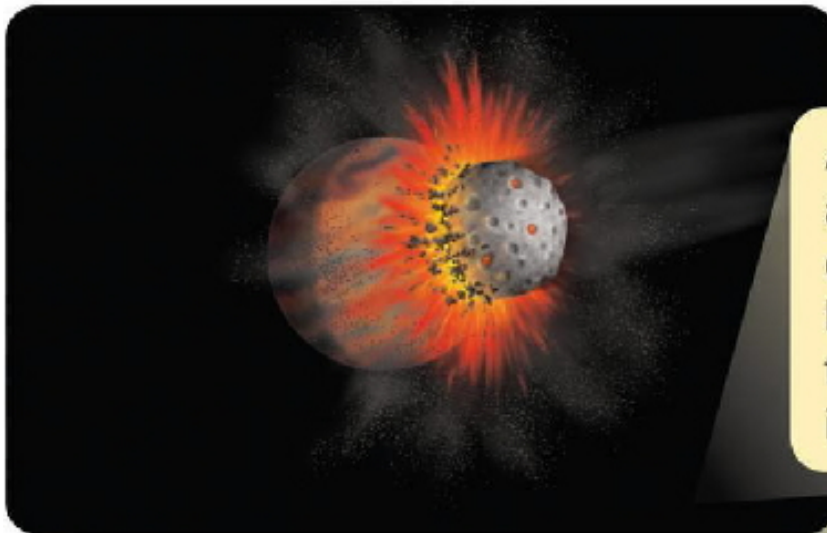
Large-impact hypothesis - debris from Earth impact, collision and merger of two large planetesimals

The Large-Impact Hypothesis



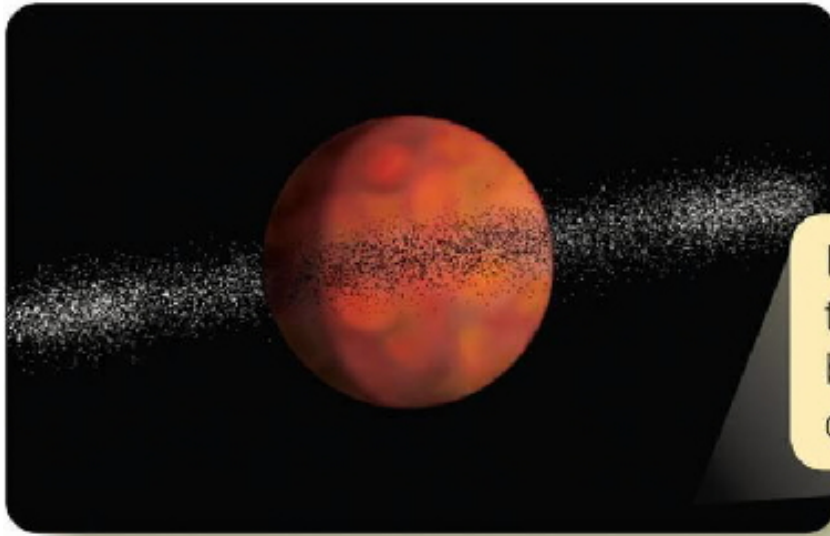
A protoplanet nearly the size of Earth differentiates to form an iron core.

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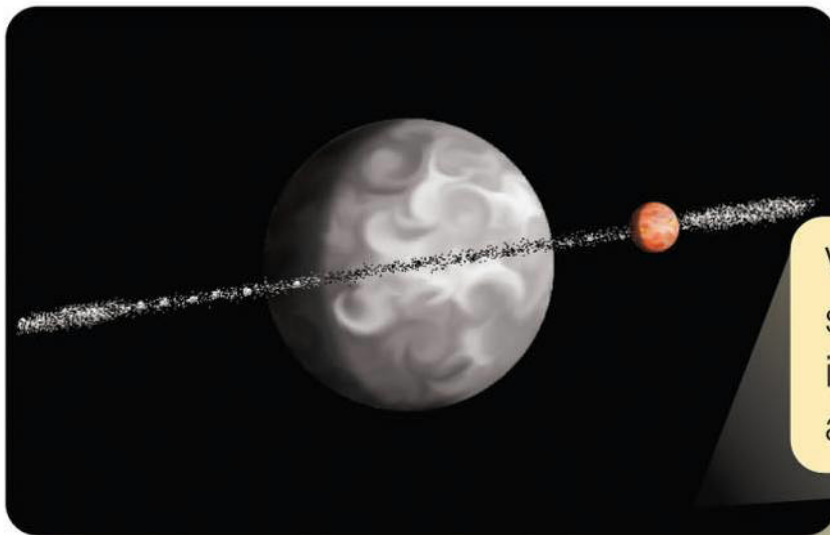
Another body that has also formed an iron core strikes the larger body and merges, trapping most of the iron inside.

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Iron-poor rock from the mantles of the two bodies forms a ring of debris.

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Volatiles are lost to space as the particles in the ring begin to accrete larger bodies.

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Eventually the moon forms from the iron-poor and volatile-poor matter in the disk.

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