

Moon 101

By Rachel Heath and Cheshta Singh
Essex High School
Vermont

Giant Impact Hypothesis

The Giant impact Hypothesis is a hypothesis widely agreed upon by many scientist. In short the Moon formed as a result of a colossal impact into the accumulating Earth, heating it & flinging the raw ingredients for the moon into orbit around the Earth. This is consistent with ideas of how planets were assembled, and this explains some important features of its construction. This theory also fits into the picture of planet formation being painted by physicists studying how planets could have accumulated.

If there were large crater impacts on the Earth, then there would be large amounts of material lofting around that could have collected to form the Moon. The Moon could have formed within ten years or less if it was very hot. This is consistent with the idea that the Moon was surrounded by an ocean of magma when it formed.

According to some scientists the moon probably continued to be hit by craters up to half its size. These impacts would have contributed to it's size and to the maintaining of a magma ocean. Also, it would have contributed to its unique rock composition. And the hypothesis also explains its unique and otherwise unexplained features.

The Origin of the Moon

The primary lunar crust formed 100 million years after the oldest datable materials found in meteorites precipitated from the solar nebula. The assembly of the Moon was a relatively late event during the formation of the Solar system. This is consistent with the planetesimals accretion hypothesis. The planetesimals accretion hypothesis states that the origin of the Moon was innately linked to the evolution of the Earth through gigantic collisions between proto-planets.

The Evolution of the Moon

The Moon formed about 4.517 billion years ago. 61 million years later the molten sphere had partially cooled forming the anorthosite crust. Then, the final crystallization completed over the next 39 million years. Lunar Cataclysm occurred about 3.9 billion years ago, and may have lasted less than 100 million years. Lunar cataclysm is responsible for the formation of most of the lunar craters. Volcanic activity on the Moon ended about 1 billion years ago. A global ocean of magma surrounded the Moon when the moon was first formed. This ocean formed the primary feldspar-rich crust of the lunar highlands.

All about the Global Moon Image

In this image it is apparent that there are slightly more highlands than maria. The dark areas show the presence of maria. In this picture is also apparent that craters are numerous over the whole surface.

ep
ating



Volcanoes on the Earth

On Earth volcanic material is composed mostly of silica in varying compositions (>63% silica = felsic), (52%-63% silica = andenstic), (45%-52% silica = Basaltic), (<42% silica is extremely rare).

On Earth there are 9 types of volcanic features:

1. Shield Volcanoes
2. Lava Domes
3. Cryptodomes
4. Cinder Cones
5. Stratovolcanes
6. Supervolcanoes
7. Submarine Volcanoes
8. Subglacial Volcanoes
9. Mud Volcanoes

The Moon's Volcanic Features

The moon's volcanic rocks are basalts. There is also evidence of pyroclastic deposits (glass beads).

There are 5 types of volcanic formations on the Moon:

1. Sinuous Riles: similar to lava channels and collapsed lava tubes found on Earth. Lunar Riles are typically much larger than those found on Earth.
2. Domes of Shield Volcanoes: broad, shallow land formations.
3. Lava Terraces
4. Cinder Cones
5. Dark-halloed Crater & Pyroclastic Deposits

Some Differences between the Earth's and Moon's Volcanic Rock

Three of the volcanic features seen on Earth that are not on the Moon have water. Additionally, combinations of common volcanic features have been given a single name. Some volcanoes on Earth are still active, forming new volcanic rock constantly. This tells us that the interior of the Moon is very stable.

Some more Information

There are three types of lunar Rilles:

1. Sinuous
2. Arcuate
3. Linear

These formed by sub surface volcanic flows that collapsed.

Why the idea of Lunar Cataclysm is a Hypothesis

The idea of Lunar Cataclysm is a hypothesis and not a theory because of the relatively small amount of sampling and the unknown origin of many of the lunar samples. The lunar cataclysm hypothesis is actually relatively untested.

Comparison of Impact Craters

There are so many impact craters on the moon compared to the Earth because the Moon has no atmosphere.

Lunar Exploration

Lunar orbiter missions (1966-1967)- launched to study the moon. The first three missions were devoted to mapping potential lunar landing sites. The fourth and fifth missions were intended for more broad scientific goals.

Ranger missions- took different pictures of the moon ranging from a scale of 0.6 km to 216.9 km

Apollo- took pictures of the moon both from the orbit and the moon's surface

Lunar Exploration Cont.

Clementine spacecraft- It mapped the moon with 4 cameras. With this new data, it will be possible to map the rock types of the entire Moon.

Lunar Prospector- mapped the surface composition of the moon

Google map- helped people see the moon in 3D

Lunar reconnaissance orbiter- showed us the geology of the moon

Apollo 11 Regional Image

There are some impact craters that have formed. These craters formed during impacts from meteorites. The craters probably formed after the maria did. There are also some secondary craters that were produced from large primary impact craters. The secondary craters often form chains or clusters. Cracks and fissures have resulted because of uplift of the floor of craters.

There are some maria that have formed. The maria formed because of massive impacts. These impacts left basins which filled with lava and then cooled.

There are also some visible mountains that formed.