

Study of moon rocks shows barrage 4 billion years ago was mainly asteroids

May 18 2012, by Bob Yirka



(Phys.org) -- Researchers have known for some years that the Earth and moon were subjected to a veritable barrage of objects striking their surfaces nearly four billion years ago, but less certain was whether those objects were asteroids, comets or even pieces of other protoplanets after they broke apart. Now however, new research by a group of lunar scientists has found, after studying moon rocks brought back by astronauts during the Apollo 16 mission, that it appears they were mostly asteroids. But not, they write in their paper published in the journal *Science*, the same kind as we see falling on our planet today.

The researchers, led by Katherine Joy, looked at specific types of [moon](#)

[rocks](#) known as regolith breccias, which are in essence dirt balls with embedded fragments of rocks and other debris from impacts. They are believed to have formed somewhere around three and a half billion years ago, which was close to the time of the great barrage. To find out more about the fragments, they put samples in an [electron microscope](#) and also used other micro-probing techniques to get a closer look. In so doing they found that many of the fragments were of nearly the same type as carbonaceous chondrite meteorites, which come from certain types of asteroids.

They also found a certain uniformity in the samples that is not present in samples from meteorites that have impacted the moon in more recent times, which the researchers write, suggests that such rocks striking the moon during the barrage were somewhat different from those that strike today which are quite diverse. They also found that the fragments found in different regolith breccias were sufficiently different from each other to rule out the possibility of them coming from a [protoplanet](#) that broke apart.

That leaves asteroids as the most likely kind of object striking both the Earth and the moon during the barrage which other scientists have suggested occurred due to a relatively sudden change in the distance between the planets in the early solar system. The suspicion is that all or most of the planets formed in rather close proximity to the sun, then slowly moved farther away. If that was the case, then changes in gravitational effects caused by the planets would likely have had a profound impact on other bodies moving around, causing many of them perhaps, to run into one another and the planets. Some even suggest the bombardment that resulted could have been a major contributing factor to the development of life here on Earth, which many believe occurred right around the same time.

More information: Direct Detection of Projectile Relics from the End

of the Lunar Basin–Forming Epoch, *Science* DOI:
[10.1126/science.1219633](https://doi.org/10.1126/science.1219633)

ABSTRACT

The lunar surface, a key proxy for the early Earth, contains relics of the asteroids and comets that have pummeled terrestrial planetary surfaces. Surviving fragments of projectiles in the lunar regolith provide a direct measure of the types and, thus, sources of exogenous material delivered to the Earth-Moon system. In ancient [>3.4 billion years ago (Ga)] regolith breccias from the Apollo 16 landing site we located mineral and lithologic relics of magnesian chondrules from chondritic impactors. These ancient impactor fragments are not nearly as diverse as those found in younger (3.4 Ga to today) regolith breccias and soils from the Moon, or that presently fall as meteorites to Earth. This suggests that primitive chondritic asteroids, originating from a similar source region, were common Earth-Moon-crossing impactors during the latter stages of the basin forming epoch.

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