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Theia (/ ' th i: ? /) is a hypothesized ancient planet in the early Solar System which, according to the giant-impact hypothesis, collided with the early Earth around 4.5 billion years ago, with some of the resulting ejected debris coalescing to form the Moon.

Theia is thought to have struck Earth at an oblique angle when Earth was nearly fully formed. Computer simulations of this "late-impact" scenario suggest an initial impactor velocity below 4 kilometres per second (2.5 mi/s) at "infinity" (far enough that gravitational attraction is not a factor), increasing as it approached to over 9.3 km/s (5. ...

Analysis of lunar rocks published in a 2016 report suggests that the impact might have been a direct hit, causing a fragmentation and thorough mixing of both parent bodies.[3]

The giant-impact hypothesis is currently the favored hypothesis for lunar formation among astronomers.[4] Evidence that supports this hypothesis includes:

In 1898, George Darwin made the suggestion that Earth and the Moon were once a single body. Darwin"s hypothesis was that a molten Moon had been spun from Earth because of centrifugal forces, and this became the dominant academic explanation.[9] Using Newtonian mechanics, he calculated that the Moon had orbited much more closely in the past and was drifting away from Earth. This drifting was later confirmed by American and Soviet experiments, using laser ranging targets placed on the Moon.

Eighteen months prior to an October 1984 conference on lunar origins, Bill Hartmann, Roger Phillips, and Jeff Taylor challenged fellow lunar scientists: "You have eighteen months. Go back to your Apollo data, go back to your computer, and do whatever you have to, but make up your mind. Don"t come to our conference unless you have something to say about the Moon"s birth." At the 1984 conference at Kona, Hawaii, the giant-impact hypothesis emerged as the most favored hypothesis.

Before the conference, there were partisans of the three "traditional" theories, plus a few people who were starting to take the giant impact seriously, and there was a huge apathetic middle who didn"t think the debate would ever be resolved. Afterward, there were essentially only two groups: the giant impact camp and the agnostics.[13]

In 2001, a team at the Carnegie Institution of Washington reported that the rocks from the Apollo program carried an isotopic signature that was identical with rocks from Earth, and were different from almost all other bodies in the Solar System.[6]

In 2014, a team in Germany reported that the Apollo samples had a slightly different isotopic signature from

Earth rocks.[25] The difference was slight, but statistically significant. One possible explanation is that Theia formed near Earth.[26]

This empirical data showing close similarity of composition can be explained only by the standard giant-impact hypothesis, as it is extremely unlikely that two bodies prior to collision had such similar composition.

According to research (2012) to explain similar compositions of the Earth and the Moon based on simulations at the University of Bern by physicist Andreas Reufer and his colleagues, Theia collided directly with Earth instead of barely swiping it. The collision speed may have been higher than originally assumed, and this higher velocity may have totally destroyed Theia. According to this modification, the composition of Theia is not so restricted, making a composition of up to 50% water ice possible.[28]