

Modeling early meteorite impacts on the moon

July 10 2019



Credit: CC0 Public Domain

As our solar system was forming nearly four and a half billion years ago, a planet-sized object struck the early Earth, leading to the formation of the moon, possibly from a hot, spinning cloud of rock vapor called a

synestia. But after the Earth and moon had condensed from the vapor, there was another phase of growth as meteorites crashed into both bodies.

Despite their [common origin](#) there are curious differences between the Earth and moon. Elements such as gold, iridium, platinum and palladium (known as highly siderophile or 'iron-loving' elements) are relatively scarce on the moon compared to Earth. Because these elements were delivered by meteorites, explanations for the difference put limits on how growth by meteorite bombardment unfolded over hundreds of millions of years. Understanding this problem is crucial to figuring out exactly what happened as the Earth and moon grew into the bodies we know today.

"This has been a major problem in terms of how we understand the Moon's accretion history," said Qing-zhu Yin, professor of earth and planetary sciences at UC Davis.

Yin and an international group of collaborators have now carried out a detailed reconstruction that resolves the highly siderophile element problem and gives new insight into the late accretion history of the moon. Their results are published July 11 in the journal *Nature*.

Less retention of meteorite material

The researchers modeled the millions of [meteor impacts](#) that would have brought material to the Earth and moon. They validated their model by comparing the number of predicted impacts with the number of actual craters on the moon.

They found that because of the moon's smaller size, and because some impacts would be at a shallow angle to the surface, relatively less material was left behind by meteorites that hit the moon than by those

hitting the Earth.

Yin and colleagues calculated that the [siderophile elements](#) would have been retained in the lunar crust and mantle only from about 4.35 billion years ago, later than previously thought and about the time that the magma ocean covering the moon solidified. Siderophile elements arriving before that time would have been absorbed into the moon's iron core.

Taken together, these factors account for the discrepancy in highly siderophile [elements](#) between Earth and [moon](#).

"The beauty of this work is such that all of these things are now coming together nicely. We may have solved this problem, at least until someone find new discrepancies!" Yin said.

More information: Reconstructing the late-accretion history of the Moon, *Nature* (2019). [DOI: 10.1038/s41586-019-1359-0](https://doi.org/10.1038/s41586-019-1359-0) , [nature.com/articles/s41586-019-1359-0](https://www.nature.com/articles/s41586-019-1359-0)

Provided by UC Davis

Citation: Modeling early meteorite impacts on the moon (2019, July 10) retrieved 25 April 2024 from <https://phys.org/news/2019-07-early-meteorite-impacts-moon.html>

This document is subject to copyright. Apart from any fair dealing for the purpose of private study or research, no part may be reproduced without the written permission. The content is provided for information purposes only.