Winning rhythm
Djokovic starts Paris Masters with victory over his Argentine rival SPORTS, PAGE 20

New rules to bolster banks, real economy
BUSINESS, PAGE 13

Fresh chapter
Bookstore back in business after two-year refurbishment
LIFE SHANGHAI, PAGE 17

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Deep-Earth blobs hint at collision that formed the moon

An international team of scientists from China and the United States has made a remarkable discovery, suggesting that two massive objects buried in the Earth's deep mantle could be relics from the moon's formation about 4.5 billion years ago.

Scientists have long suspected the origin of the moon may be different from other moons in the solar system, as the size of the moon compared to the Earth is significantly larger than most other planets' moons compared with the planets they revolve around.

A leading theory holds that the moon formed when a Mars-sized planet dubbed Theia struck Gaia, or the early Earth, and the collision flung the top layer of the Earth into space, where the debris recombined to form the moon.

The researchers from California Institute of Technology, Arizona State University and Shanghai Astronomical Observatory of the Chinese Academy of Sciences have provided new evidence for this hypothesis in a study published on Thursday in the journal Nature.

They proposed that two continent-sized anomalies with low seismic velocities in the lowermost mantle, one beneath the African continent and the other beneath the Pacific Ocean, might stem from Theia mantle materials, which are 2 to 3.5 percent denser than proto-Earth's mantle.

Using giant-impact simulations, the team revealed that a fraction of Theia's mantle could have been delivered to and preserved in the proto-Earth's solid lower mantle after the moon-forming impact.

They have found that Theia's relics, like moon rocks, are rich in iron, making them denser than their surrounding substance.

The dense blobs measuring tens of kilometers in the aftermath of the impact might later sink and accumulate into thermochemical piles atop the Earth's core and survive to the present day to become a natural consequence of the moon-forming giant impact, according to the study.

The results also provide a new perspective for understanding the internal structure of the Earth, the long-term evolution of the Earth, and even the formation process of the inner solar system.

"The moon-forming giant impact appears to be the origin of the early mantle's heterogeneity and marks the starting point for the Earth's geological evolution over the course of 4.5 billion years," said Deng Hongping from the Shanghai Astronomical Observatory, a co-author of the study.

"Our study may lend clues to the habitability of exoplanets beyond our solar system," Deng added.

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