

Remelting of the Moon ~4.36 billion years ago resolves chronological paradoxes

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The last giant impact on Earth is thought to have formed the Moon, marking the end of terrestrial planet formation in the solar system. However, despite its importance, the age of the Moon is uncertain, with estimates ranging from 4.51 to 4.36 Gyr. The youngest age of 4.36 Gyr (1) is conventionally associated with the final crystallization of the lunar magma ocean (LMO), but is hard to reconcile with the presence of much older zircons (2), unless the crystallization of the LMO was very prolonged (3). Here we suggest that the 4.36 Gyr age is instead recording an episode of crustal remelting driven by intense tidal heating during the Moon's orbital evolution (4). This new paradigm reconciles existing discrepancies in current estimates for the Moon's formation age, permits an early, but still poorly-defined, formation time for the Moon, and implies that the early Earth dissipated relatively little tidal energy.

(1) Borg et al. *Nature* 477, 70-72, 2011 (2) Barboni et al. *Sci. Adv.* 3, 2017 (3) Maurice et al. *Sci. Adv.* 6, 2020 (4) Desch & Jackson, *LPSC*, 1536, 2024.