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Large impact cratering during lunar magma ocean solidification

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The lunar cratering record is used to constrain the bombardment history of both the Earth and the Moon. However, it is suggested from different perspectives, including impact crater dating, asteroid dynamics, lunar samples, impact basin-forming simulations, and lunar evolution modelling, that the Moon could be missing evidence of its earliest cratering record. Here we report that impact basins formed during the lunar magma ocean solidification should have produced different crater morphologies in comparison to later epochs. A low viscosity layer, mimicking a melt layer, between the crust and mantle could cause the entire impact basin size range to be susceptible to immediate and extreme crustal relaxation forming almost unidentifiable topographic and crustal thickness signatures. Lunar basins formed while the lunar magma ocean was still solidifying may escape detection, which is agreeing with studies that suggest a higher impact flux than previously thought in the earliest epoch of Earth-Moon evolution.