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Impact-Induced Melting by Giant Impact Events

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During the late accretion phase (~4.4 Ga – 3.8 Ga), the thermochemical evolution of the Earth-Moon System was heavily influenced by the Moon-forming event and subsequent large scale collisions with other cosmic bodies. As a result of the heat generation during such impacts, the formation of local magma ponds or even global magma oceans is likely. By conducting a series of numerical models we determine and locate the amount of impact-induced melt during large-scale impact events (1-1000 km impactor diameter). In this study, we focus on different body's (Mars, Earth, Moon) and vary their thermal profile. We find that melt production can be significantly enhanced compared to scaling-law assumptions especially for young and hot planets and for impactors larger than 10 km in diameter. By combining the modeled melt volumes with impactor flux models, the total melt production for certain time intervals during the late accretion phase can be estimated. For the Earth-Moon system we find, that a global magma ocean results from the Moon-forming event. The subsequent impactor flux may extent the crystallization time of the magma ocean, but does not generate new episodes of a global magma oceans.

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