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# Impact-induced convection as the main mechanism for formation of mare basalt

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Using a suite of numerical models, we show that impact-induced convection in the Moon could explain the formation of lunar mare basalts for the observed delay between impact basin formation and starting time of the mare flows, and the long duration of the basaltic flow. The effects of an impact on the thermal evolution of the Moon and its melt production in mantle are investigated using convection calculations in an axi-symmetric cylindrical coordinate system. The mantle is allowed to melt as it crosses the solidus temperature. We consider two different models, permeable and impermeable. In the permeable models the melt is allowed to migrate inside the partially molten zone and is extracted from an extraction zone of 90 km depth. The models have temperature-dependent viscosity, and time dependent radioactive heat sources. A thin KREEP layer with higher concentration of radioactive materials is also incorporated immediately beneath the crust. Five different viscosity models are examined, where the ratio between the viscosity at the surface and at the bottom of the computation domain is 100, 500, 1000, 1500 and 2000, respectively. Also different impact sizes capable of producing Imbrium-size basins, the SPA-size basin, small Orientale-size basins, and large Copernicus-type craters are considered. The total amount of melt produced by the permeable model with 1000 times viscosity contrast is comparable with the observed mare flow in the Imbrium-size basins. Moreover, the starting time of the major melting in the mantle and its duration are also comparable with the observation and also allow a rigid lithosphere to develop beneath the basins that is capable of supporting the mascons largely created during the peak flow period. The model for SPA basin results in substantial amount of melting in the mantle that does not seem to be compatible with the observation. However, the lack of mascon associated with the basin can be explained by themodel. The KREEP layer in all of our models has minor effects on the melt production in the mantle.