

There remain many unresolved issues in our understanding of the formation of the Moon. There is a large difference between theory and observation in the timescale for the formation of its crust, with existing models suggesting a period of order 10 Ma, and rock sample dating suggesting approximately 200 Ma. There is also a dichotomy of crustal thickness between its near side and far side that is not fully explained - the far side has a mean crustal thickness around twice that of the near side.

We consider a fluid-dynamical model in which a significant solid fraction remains entrained in the Lunar magma ocean. This gives rise to a situation with a thick surface boundary layer known as a stagnant lid. In our calculations, a persistent difference between nearside and farside stagnant lid thicknesses develops, which can help explain the crustal dichotomy if the crust forms from the stagnant lid. Furthermore there are periods of oscillation in the thickness of the stagnant lid, which bring large amounts of heat towards the surface and may provide a mechanism for delaying crustal formation.

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