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Magma ocean in planetesimals – the case of Vesta.

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The asteroid 4 Vesta is widely held as the parent body of the HED meteorites. However, the origin of the HEDs is still under debate. Their formation can be linked to the early partial melting of the silicates, or to the late residual melts from a crystallising whole-mantle magma ocean. Here we present numerical calculations of Vesta´s early evolution, taking into account the insights provided by the Dawn mission. We compare evolution scenarios for different formation times and consider convection and effective cooling in a magma ocean and in a core. During differentiation, an important process for the formation and evolution of a magma ocean is the partitioning of ^{26}Al and its relocation with the silicate melt. We show that in contrast to previous findings a global magma ocean does not form if partitioning of ^{26}Al is considered. Instead, a shallow sub-surface magma ocean forms with a life-time of < 1 Ma for a magma viscosity of 1 Pa s. Our results support the formation of eucrites by percolation of early partial melt. Magma ocean formation in smaller bodies (R=10-250 km) is also considered. Here, loss of ^{26}Al is less efficient and a thicker magma ocean with a variable life-time is probable.

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