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On the Chemical Evolution of the Impact-Generated Protolunar Disk

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Abstract

The giant impact theory suggests that the Moon was formed from a silicate disk resulting from the collision between the young Earth and a Mars-sized body. Here, we investigated the chemical composition of the two-phase silicate disk consisting of a melt layer surrounded by a vapor atmosphere. To do so, we used the disk's thermodynamic properties and the same number of elements (O, Na, Mg, Al, Si, K, Ca, Ti, Fe, and Zn) as those proposed by [1]. In order to compute the disk's equilibrium composition, we utilized the commercial software *HSC Chemistry*, which is widely used in the fields of geophysics and planetary science. When comparing our equilibrium calculations against those made by [1] with their own house code, we found that both sets of results are very close in the temperature range explored by these authors (1800–4200 K). Because recent models suggest that the silicate disk's temperature range could be more extended, we also investigated the disk's chemical composition in the 1000–4500 K range. We finally determined the partition of the elements found both in vapor and melt phases in this temperature range in order to trace back the evolution of volatiles and refractories throughout the disk.

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References

[1] Visscher, C., Fegley, B., Jr. 2013. Chemistry of Impact-generated Silicate Melt-vapor Debris Disks. The Astrophysical Journal 767, L12.