Evolution of the reservoir of volatiles in the proto-solar nebula

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Understanding radial distribution of volatiles in the proto-solar nebula is key to understand the solar system history. To model the distribution of volatiles, models have considered condensation lines and the presence of amorphous ice. However, the impact of formation of clathrate hydrates on volatiles radial distribution has not been investigated yet.
We have modeled the transport of 11 volatiles species in the PSN (CO, CO2, CH4, H2S, N2, NH3, PH3, Ar, Kr and Xe) in two scenarios. Scenarios I, where the PSN is fed with pure condensates only. Scenario II, where the PSN is fed with all volatiles trapped in amorphous ice. All volatiles evolve in a PSN model described in Aguichine et al 2020, with an α-turbulent parameter of 10^{-3} and a PSN mass of 0.1 M_{sun}.
In scenario I the model is able produce enrichment peaks at the clathration and ice lines of species. Producing enrichment 2 to 4 times the proto-solar abundances (lodders et al 2009).
In scenario II only one enrichment peak is present at the amorphous to crystalline transition zone of water ice, where all volatiles are released from amorphous ice. The peak is broad and located at 5 au for all species, producing an enrichment peak up to 10 times the proto-solar abundances.
We conclude that clathrate hydrates have an impact on the volatiles' radial distribution only if the PSN was not fed with amorphous ice.

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Lodders, K., Palme, H., & Gail, H.-P. 2009, Landolt Boumlrnstein, 4B, 712. doi:10.1007/978-3-540-88055-4_34