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Bifurcation of planetary building blocks during Solar System formation

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Geochemical and astronomical evidence demonstrate that planet formation occurred in two spatially and temporally separated reservoirs. The origin of this dichotomy is unknown. We use numerical models to investigate how the evolution of the solar protoplanetary disk influenced the timing of protoplanet formation and their internal evolution. Migration of the water snow line can generate two distinct bursts of planetesimal formation that sample different source regions. These reservoirs evolve in divergent geophysical modes and develop distinct volatile contents, consistent with constraints from accretion chronology, thermo-chemistry, and the mass divergence of inner and outer Solar System. Our simulations [1] suggest that the compositional fractionation and isotopic dichotomy of the Solar System was initiated by the interplay between disk dynamics, heterogeneous accretion, and internal evolution of forming protoplanets.

[1] Lichtenberg T. et al. (2021), *Science* 371, 365–370.