

## Water delivery to the Earth during the formation of the solar system

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It is an important issue to clarify when and to what extent the water was delivered to the Earth. Previous studies have mainly considered the late accretion scenario, in which water was delivered to the Earth through the collision of water-bearing planetesimals left after the dissipation of the protoplanetary disk near the asteroid belt. In other words, it is assumed that the formation of giant planets such as Jupiter is already completed and that planetesimals are delivered without being affected by the gas disk. However, recent simulations of solar system formation suggest that the growth and orbital migration of giant planets affect the distribution of planetesimals in the asteroid belt, and that this effect depends on the strength of the gas drag on planetesimals.

We investigate the water delivery by N-body simulation of planet formation that starts from the growth stage of terrestrial planets and giant planets in the gas disk. We also track the orbital migration stage of giant planets and the late accretion stage after the disk dissipation. By performing this simulation, we can clarify the efficiency of the water delivery to the Earth at each stage. As a result of simulations, we find that the delivery of water-bearing planetesimals can occur during the growth stage of Earth and Jupiter. We also find that the amount of water delivered to the Earth during the growth phase can be significantly larger than during the late accretion phase, although this depends on the setting of the simulation.

Keywords: N-body simulation, Water delivery, Earth