

PRIMORDIAL ICE RESERVOIRS OF THE SOLAR SYSTEM

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We now know that primordial ice exists in at least three distinct Solar system reservoirs; the Oort cloud, the Kuiper belt and the asteroid main-belt. Continuing efforts to determine the nature of the ice and its distribution are important for several scientific reasons. First, the mere existence of the ice sets a limit to the degree of thermal processing of the objects in which it is found, and therefore constrains geophysical models of thermal evolution of ice rich bodies. Second, water ice, if in the amorphous form, can trap other volatiles from the protoplanetary disk of the Sun at high abundance. Their subsequent release upon crystallization can perhaps explain the anomalous activity observed in many comets and is a source of energy, since crystallization is exothermic. Third, water and other volatiles on the terrestrial planets seem likely to have been delivered, in part, from the ice reservoirs. The comets and ice-rich asteroids therefore may hold the key to understanding the origin of the oceans and atmosphere.

In this talk, I will aim to provide a broad overview of our current knowledge (and lack of knowledge) of the primordial ice reservoirs. I will emphasize links to the formation epoch and draw connections for those interested in the origin of the oceans and the atmosphere and in the thermal evolution of asteroids and comets. I will try to do this in a way interesting to astronomers, Earth scientists and atmospheric scientists alike.