

Origin of Water and Organic Molecules on the Earth and Mars

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Stable liquid water and organic molecules distinguish the Earth from other solid bodies with atmosphere in our solar system. Mars once had liquid water but organic molecules have yet to be found; Saturn's moon Titan has abundant organic molecules but only transient episodes of liquid water. New dynamical models and geochemical data present potentially conflicting but informative constraints on the origin of water on the Earth. Almost certainly not primarily from comets, water was derived either locally (supported by cosmochemical data) or from the asteroid belt (supported by disk models and dynamical models of accretion). Deciding between these may require a new look at both data and models, and a critical examination is provided here. Eventually Mars will provide better constraints as we obtain more precise isotopic data on Martian water and on the geochemical history of Mars. The origin of organic molecules on both bodies may be entirely distinct from the origin of water, perhaps involving primarily comets.