Laboratory studies of the behavior of water under martian atmospheric conditions

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Abstract

The major focus of recent and planned missions to Mars is the role that water has played both on the evolution of the surface morphology of Mars at all scales and as a necessary agent for the persistence of life on the planet. Various morphological features seem to require the melting of near-surface ice deposits close to the triple point but under conditions far removed from true phase equilibrium and where tuition based on everyday experience is unhelpful.
In an effort to reduce much of the speculation necessarily accompanying postulated mechanisms by which the survival of surface or near surface ice as it approaches melting may be prolonged, we are investigating the behavior of water under dynamically controlled conditions of CO2 and water vapor partial pressures and solar irradiance in the Andromeda planetary environmental chamber. The chamber is sufficiently large that perturbations in pressure and composition of the atmosphere by the vapors being released by the water or ice sample are not significant. We are investigating both the static case, where water vapor is allowed to accumulate above the source and diffusion limits its removal, and the dynamic case where buoyancy and other forces remove the water vapor as it is formed. In this way we are obtaining maximum and minimum evaporation rates for water under a variety of conditions thought to prevail on Mars. We will discuss these results and implications for some of the observed features on the surface of the planet.