Simulation Studies of Evaporation of Water on Mars

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Abstract

In order to better understand the stability of water on Mars and demonstrate the effectiveness of our laboratory simulation techniques in reproducing conditions approximate to Mars, we have determined the evaporation rate of brine at temperatures from 0oC to -25oC. Measurements were made in a CO2 atmosphere at 5.25 Torr with eutectic solutions of NaCl and CaCl2 and maintaining the atmospheric and chamber wall temperatures close (+/-loC) to the water temperature to avoid condensation effects. An extrapolation technique was used to remove the effect of water build-up in the atmosphere, but this was unimportant at temperatures below -10oC. We corrected the data for the lower gravity on Mars relative to Earth, by multiplying the data by 0.726, the ratio of buoyancy on Mars relative to that on Earth. We observed a very strong decrease in evaporation rate with temperature from 1.13 mm/h at 0oC to 0.04 mm/h at -25.0oC. The results are in excellent agreement with the theoretical predictions of Ingersoll's (1971) treatment, lending support to the theory and our procedures. Thus, brine formation could considerably increase the stability of water on Mars by both extending the temperature range over which water is stable to -40oC and by decreasing the evaporation rates by two orders of magnitude.