AN HISTOICAL SEARCH FOR THE OCCURRENCE OF HABITABLE GROUND ICE AT THE PHOENIX LANDING SITE..

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A numerical model of the thermal history of Martian ground ice at the approximate location of the planned Phoenix landing site has been developed and used to identify instances of relatively warm ground ice over the last 10 Ma.

Many terrestrial organisms are adapted to life at or below the freezing temperature of water, and we will use the approximate doubling time of terrestrial microbial populations as a function of temperature, (Rivkina et al, 2000) is used as a metric against which to assess the "habitability" of Martian ground ice.

The boundary conditions that control the depth of the ground ice table are the surface energy balance, and the annual average H_2O vapor density at the surface. While it is possible to construct reasonably well-constrained thermal models of the regolith and ground ice, atmospheric H_2O, particularly at other orbital configurations cannot presently be predicted with confidence. Here, the annual average number density of H_2O at the Phoenix latitude is determined by ratioing the annual average H_2O pressure over a fixed latitude on the adjacent northern polar cap to the current annual average pressure, and using that ratio to scale the annual average number density from the current value, assumed here to be $1x10^{20}$ m^{-3}. The properties of CO_2 and

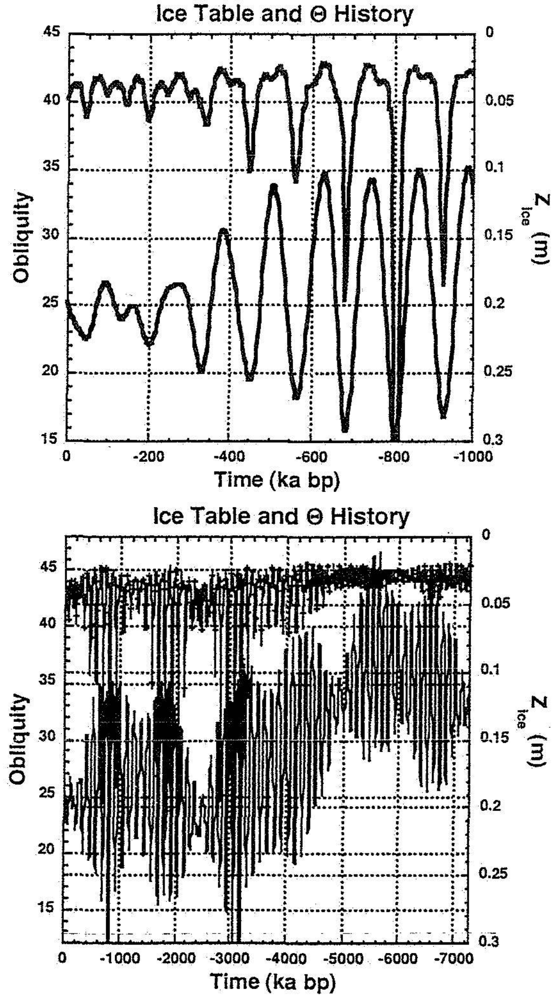

Fig. 1. The obliquity and depth to the ice table for the last 1 Ma (top) and 7 Ma (bottom). The $[H_2O]$ boundary condition is scaled from its present annual average value $[1x10^{20}$ $m^{-3}]$, via the pressure vapor at the cap.

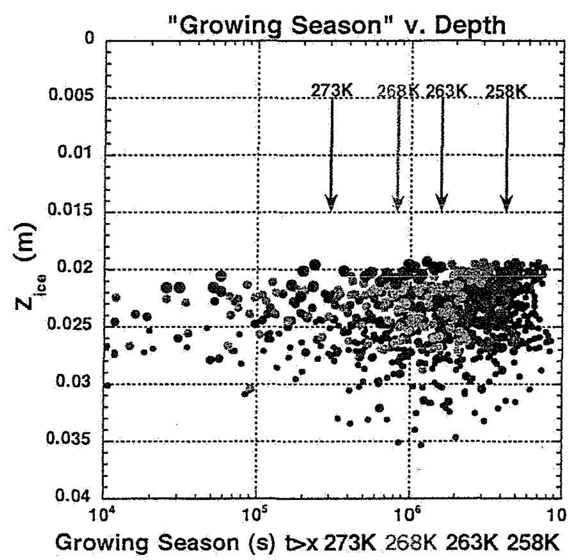

Fig. 2. The doubling time for terrestrial permafrost microbes is indicated by the arrows for each temperature. Through 7Ma, ground ice between 2 and 3.5 cm has sustained temperatures in excess of doubling times frequently.