THE EARLY MARTIAN CLIMATE WAS EPISODICALLY WARM AND WET. Vic Baker, Dept. of Hydrology and Water Resources (and Lunar and Planetary Laboratory), The University of Arizona, Tucson, AZ 85721-0011. (e-mail baker@pirl.lpl.arizona.edu)

In 1991 an "outrageous hypothesis" [1] was proposed that throughout its long-term geological history the climate of Mars alternated between two states, as follows: 1. A long-term, stable state of general stability and cold, dry conditions, similar to those prevailing today at the planet's surface. 2. A short-term, quasi-stable state considerably warmer and wetter than those prevailing today. The necessity for postulating the past existence for state 2 derives from a great variety of geological evidence that otherwise seems inexplicable [2]. Among the geological phenomena explained by transitions between the two states are the following: extensive lacustrine and "marine" conditions (of relatively short duration) in the northern plains [3], extensive thermokarstic disruption of sedimentary deposits on the northern plains and in the outflow channels that fed water to them, extensive periglacial landform development (including especially near-surface ice flowage requiring much warmer temperatures than those prevailing today), valley networks developed on relatively young Martian volcanoes, extensive evidence for glaciation [4] (notably in the southern hemisphere of Mars, but also on high volcanoes, and perhaps in some of the outflow channels that had earlier debouched flood water to the northern plains). Although these and many other landforms developed during state 2, the very short duration of that state and the small number of its repetitions are indicated by extensive evidence for very slow denudation in the Martian cratered uplands. Crater morphologies are preserved such that prolonged precipitation, as occurring on Earth, could not have been possible. Clearly state 2 was a climate that on Earth would be classed as cold, dry and glacial. However, on Mars this contrasts with state 1 that was supercold and superdry, thereby precluding glacial conditions. The dry valleys of Antarctica are more similar to the ancient state 2 of Mars than they are to state 1.

The transition from the long-persistent state 1 conditions to the short-term glacial conditions (state 2) was induced cataclysmically. The outflow channels debouched absolutely phenomenal discharges of water [5], exceeding by an order of magnitude or more the largest known cataclysmic flood flows of Earth [6,7]. The energy for these immense floods could only have been supplied thermally, and a great phase of mantle plume activity was proposed, disrupting the permafrost and releasing both floods of water and immense bursts of radiatively active gases. The latter generated a transient greenhouse that facilitated the quasi-stable state 2 climate. A consequence of the above model/hypothesis is that extensive zones of the relatively warm, subsurface hydrosphere was delivered cataclysmically to the surface of the planet. If these zones, particularly those long-persistent beneath the permafrost, contained living organisms of the type tentatively identified in meteorite ALH84001, then these organisms must have been extensively dispersed to the planet's surface. Although phase 2 conditions may have been too transient for their survival on the surface, they may have flourished long enough to leave extensive fossil evidence. The latter would be accessible to future lander missions to Mars.

References: [1] Kerr, R.A., *Science*, 259, 910-911, 1993. [2] Baker, V.R., *et al.*, *Nature*, 352, 589-594, 1991. [3] Parker, T.J., *et al.*, *J. Geophys. Res.*, 98, 11061-11078, 1993. [4] Kargel, J.S., and Strom, R.G., *Geology*, 20, 3-7, 1992. [5] Komatsu, G., and Baker, V.R., *J. Geophys. Res.*, in press. [6] Baker *et al.*, *Science*, 259, 348-350, 1993. [7] O'Connor, J.E., and Baker, V.R., *Geol. Soc. America Bulletin*, 104, 267-279, 1992.