White Mars: The Story of the Red Planet without Water.

Present-day Mars receives 43% of the insolation of Earth and is in a state of global deep-freeze. Dry ice precipitates out directly from the atmosphere each hemispheric winter, consuming over 25% of the atmosphere and building extensive season polar snow or ice fields. The mean atmospheric pressure is less than 1% of Earth's and consists mostly of CO_2.

Early Mars experienced even less insolation due to the faint young Sun, yet there is evidence that some 3 billion years ago in the late Hesperian epoch, giant floods burst out from underground and rampaged across the surface. Some authors speculate that a northern Ocean may have existed at this time, and models of a warm wet Mars abound in the literature. Other authors develop atmospheric models that would have allowed warm and wet climates to persist on Mars for considerable durations.

A number of paradoxes exist in this view of Mars as an Earth-like world. Why is it no longer so pleasant? Where did the water come from and go to? Why is there no carbonate on Mars? Why do the flood channels look almost but not quite like water flood channels on Earth?

In a new view of the planet, instead of changing its surface conditions to explain how water could have flowed in the past, we examine the nature of the flows themselves and seek explanations that fit with the rest of the data for Mars. The new model – White Mars – is uniformitarian and parsimonious. All the paradoxes are instantly resolved, except for one human one – why do we keep wanting to make Mars an Earth-like planet?

Mars has always been cold and dry. Indeed in the past it was colder and dryer than it is today. (Modern Mars IS the warm and wet episode!). Instead of water, escape of pressurised liquid CO_2 from deep in the regolith could have produced the giant 'flood" channels from fluidised gas-supported density flows akin to volcanic pyroclastic flows, but operating at cryogenic temperatures (-50 to -20 degrees C). Mars probably never had rivers, lakes, or oceans, and surface life is contraindicated.

Mars is a CO_2-dominated planet on which water plays a minor role. Mars has limited heat flow, so liquid water is restricted to considerable depth in the regolith. Mars has no active volcanoes today, so hot springs are unlikely. The search for life on Mars will need to be a deep and careful one, looking for preserved biota from the deep dark biosphere, perhaps in igneous rocks such as the (in)famous ALH84001 meteorite.