THE WHITE ROCK ON MARS COMPARED TO TERRESTRIAL SALT DIAPIRS AND GLACIERS.
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Introduction: The White rock on Mars is an enigmatic geological formation within a large Southern Hemisphere crater. Despite its high reflectivity it is not presently believed to represent surface ice, due to the prevailing equatorial temperature. Instead, evaporites or other unusual minerals are invoked. Here I demonstrate that uplift rates of an ice diapir are sufficient to balance sublimation into the atmosphere of a few metres/yr at most. The White Rock is reinterpreted as an icy diapir and glacier complex, akin to salt glaciers in arid zones on Earth such as the Great Kavir desert of Iran [1], or to submarine salt tongues in the Gulf of Mexico [2].

It is widely known that ice in the equatorial regions of Mars is thermally unstable, therefore it is assumed unlikely that any significant deposits of ice exist to be found there. However, on Earth we can document a number of present and geologically recent examples where soluble rock salt has emerged at the surface in a large diapir and flowed downslope in glaciers or salt tongues. The trick is to balance solubility at the surface with upward flow rate, with the additional detail that a thin crust of less-soluble residue or a skin of sediment may protect the underlying salt from dissolution. Obviously, an arid climate assists this process so salt glaciers and piercement diapirs are associated with desert areas .

Oil exploration in the Gulf of Mexico has documented a number of salt tongues that can be shown to have flowed out at the seabed and travelled downdip for several km without being dissolved in the overlying seawater, being protected by a thin film of mud and sands.

In a similar manner, it is proposed that the White Rock on Mars may be the surface expression of an ice diapir that has emerged at the surface and is flowing downhill in a series of ice glaciers. Surface dust will help protect the ice from sublimation and the surface texture of the deposit shows signs of wind-sculpting just as do the polar caps and salt outcrops on Earth.

Figure 1: A Salt Diapir emergent in the Great Kavir desert of Iran with complex surface textures akin to the White Rock on Mars

Figure 2: Surface sculpting of a larger salt outcrop in Iran showing rectilinear weathering due to preferential solution by a combination of channelled winds and jointing. Compare with surface details of the White Rock on Mars.

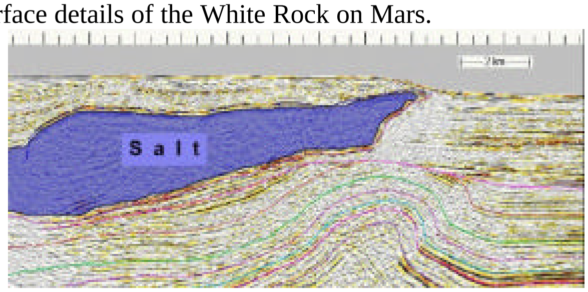

Figure 3: Seismic Section through a salt tongue in the Gulf of Mexico

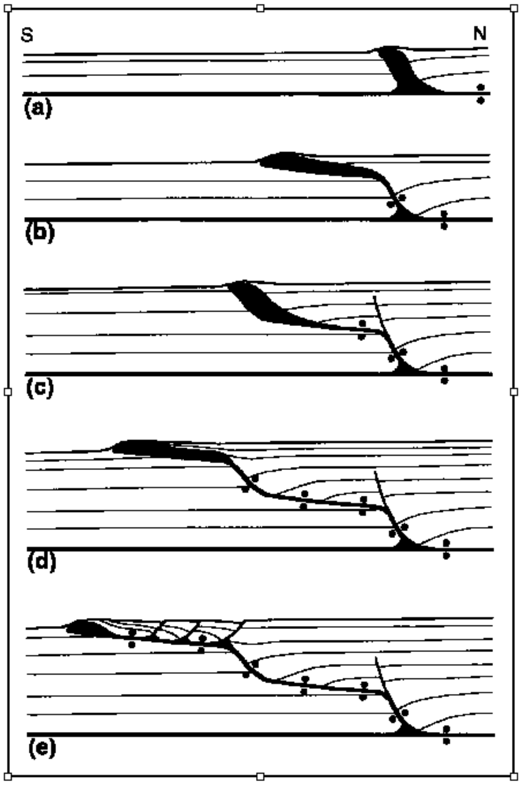

Figure 4: Reconstruction of the process as the salt was squeezed out and flowed downslope underwater with very little sediment cover to protect it from dissolution.

The critical requirements for diapirism on Mars are the creep behaviour and volatility of the various ices believed to be present in the subsurface. Water ice is less volatile, but stronger. Clathrate is weaker and would feed the diapir stock well, but would transform at the surface to water ice plus CO_2 gas, or would directly sublime. CO_2 ice is a less known quantity but is also weak [3] and is certainly the most volatile of the three. A cap rock of less volatile ices or other material concentrated from the body of the rising diapir is to be expected.

References: [1] Jackson M. P. A. et al. (1990) *GSA memoir 177*. [2] Jackson M. P. A. et al. (1995) *AAPG Memoir 65*. [3] Durham W. B., Kirby S. H., and Stern L. A. (1999) Abstract - 30th *Lunar and Planet. Sci. Conf.*