**CO2 GAS FLUIDIZATION: A POSSIBLE MECHANISM FOR THE FORMATION OF MARTIAN POLAR GULLIES.**

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**Introduction:** Martian gullies landforms have been interpreted as evidence for the action of liquid H2O as groundwater or snowmelt [1], [2]. However, gullies are also present in polar regions [3], [4] where surface and subsurface temperatures are too low for the stable presence of pure liquid water.

Here, we investigate whether CO2 gas fluidization is a viable mechanism for the initiation of Martian polar gullies [5]. To test this hypothesis, we apply criteria for the fluidization of granular materials with a thermal model of the Martian surface and sub-surface. We test whether enough heat can reach a buried CO2 frost layer to induce sublimation rates sufficient to fluidize an overlying layer of sediment.

**Thermal Model:** To compute diurnal and seasonal surface (and subsurface) temperature variations (including the condensation and sublimation of CO2) throughout the Martian year we used the one-dimensional finite difference thermal model MARSTHERM [6]. MARSTHERM considers heat transfer only by conduction, assumes that the CO2 frost and sediment layers are homogeneous, and that the latter are optically opaque to visible and thermal radiation. For these reasons, and those of computation time, our MARSTHERM models are restricted to layers of 300 mm and thicker. Using MARSTHERM, we modeled the geological circumstances for climate conditions representative of the current epoch.

The tested models, Figure 1, are for pole-facing slopes of 25° at latitudes of 75°N and S, with no sediment mantle and with mantles of 300 mm to 10 cm thicknesses of sand or dust (results for 300mm, not shown, are nearly identical to those for 1 mm).

Figures 1a and 1b show maximum daily sublimation rates as functions of season; Figures 1b and 1c show hourly rates during the day of maximum sublimation.

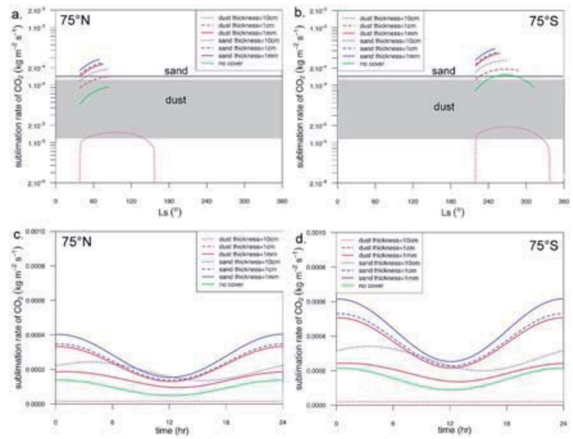


Fig. 1

**Conclusion:** These results (Figure 1) show that thin layers of eolian sediment deposited over a seasonal accumulation of CO2 frost could be fluidized by sublimation of that frost.

**References:** [1] Malin, M.C. and Edgett, K.S. (2000). *Science, 288*, 2330-2335, [2] Costard F. et al., (2002) *Science, 295*, 110-113, [3] Balme M. et al., (2006), *J.Geophys. Res., 111*, E0500. Doi:10.1029/2005JE002607, [4] Hansen, C.J. et al., (2011) *Science, 331*.575-578, doi10.1126/science.1197636. [5] Cedillo-Flores Y. et al., (2008) *Lunar Planet. Sci*., *XXXIX*, Abstract #8019, [6] Clifford S.M. and Bartels, (1986) *Lunar Planet. Sci., XVII*,142-143.