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Sand Furrows: A new surface feature on martian dunes

Mary Bourke (1)
(1) Trinity College, Geography, Dublin, Ireland (bourkem4@tcd.ie), (2) Planetary Science Institute, Tucson, Arizona, USA

Planetary geomorphology is at the forefront of today's Geoscience endeavours. A characteristic of frontier science is the discovery of new landforms and processes. Sand furrows are a new geomorphic feature that has not been previously described. They are ubiquitous and occur on 95% of polar dune images. Furrows are shallow and narrow erosion forms which can extend up to 300 m along a dune surface. Patterns are reminiscent of fluid flow, perhaps even fluvial flow (e.g., sinuosity, braiding and anastomosing) and are often slope-normal. However, furrows also display attributes that defy gravity (e.g., upslope trending flow paths) and they are not associated with terminal deposits. This suggests that the formative fluid is likely to be a pressurised gas.
Cryo-venting has been proposed to explain the formation of dark spots and fans in the seasonal ice cap. It has also been linked to the formation of araniform. Here it is proposed to be the process by which aeolian sediment is eroded to form sand furrows.
During the Martian spring, basal sublimation of the seasonal CO_2 ice cap occurs on dune surfaces. Weaknesses in the ice allow pressurised gas and some dune sediment to be transported through vents to the surface. Furrows are eroded along the gas flow paths as it moves towards the vent. Cryo-venting is therefore identified as a new style of sediment transport on aeolian dunes in our solar system, and one that is, so far, unique to Mars.
An estimate of the sand volume eroded from a sample dune during one Mars' spring is geomorphologically significant and is equivalent to that of a small dome dune on Mars (500m3). The deposits are diffuse and extend into the interdune as well as back onto the source dune. The geomorphic efficacy of cryo-venting as a mechanism of aeolian dune erosion is dependent on the magnitude and frequency of venting, the location of vents and the scale of the source dune. Small dunes may undergo accelerated erosion rates as the ability to intersect vented sediment is reduced by a small surface area.