Geophysical Research Abstracts
Vol. 18, EGU2016-10450, 2016
EGU General Assembly 2016

A field study of the geomorphic effects of sublimating CO_2 blocks on dune slopes at Coral Pink Dunes, Utah.

Mary Bourke (1), Jo Nield (2), Serina Diniega (3), Candy Hansen (1), and Jim McElwaine (1)

(1) Planetary Science Institute, Tucson, Arizona, USA (mbourke@psi.edu), (2) Department of Geography and Environment, University of Southampton, UK, , (3) Jet Propulsion Laboratory, California Institute of Technology, Pasadena, CA,

The seasonal sublimation of CO_2 ice is an active driver of present-day surface change on Mars. Diniega et al (2013) proposed that a discrete type of Martian gully, found on southern hemisphere dunes, were formed by the movement of CO_2 seasonal ice blocks. These 'Linear Gullies' consist primarily of long (100 m - 2.5 km) grooves with near-uniform width (few-10 m wide), and typical depth of <2 m. They are near-linear throughout most of their length but sometimes contains zones of low-to-high sinuosity. They are commonly bounded by levées. The groove is generally prefaced by a small alcove that originates at the dune brink.

We present the results of a set of field experiments that were undertaken at the Coral Pink sand dunes, Utah. These are sister experiments to those undertaken in Arizona (Bourke et al, 2016). The experiments were undertaken on an active barchan dune with a 16 m long lee slope (30.3°). Ambient air temperature was 30°C and relative humidity was 25%; sand surface temperatures were 26.5°C.

A CO_2 ice block (60x205x210 mm) was placed at the dune brink and with a gentle nudge it moved downslope. The dynamics of the block movement were recorded using a pair of high resolution video cameras. Geomorphological observations were noted and topographic change was quantified using a Leica P20 terrestrial laser scanner with a resolution of 0.8 mm at 10 m, and change detection limits less than 3 mm. The block run was repeated a total of 10 times and launched from the same location at the dune brink. The experiment ran for 45 minutes. The block size was reduced to (45 x 190 x 195 mm) by the end of the run series.

The resultant geomorphology shows that the separate block runs occupied different tracks leading to a triangular plan form shape with a maximum width of 3.5 m. This is different from the findings in Arizona where a narrower track span was recorded (1.7m) (Bourke et al, 2016). Similar block dynamics were observed at both sites (as blocks moved straight, swiveled and bounced downslope). Distinctive pits with arcuate rims on their downslope edge were formed where blocks bounced on the surface. These pits are at an almost equidistant spacing. Despite a longer slope (16 m as opposed to 8m at Grand Falls), no depositional apron was formed. Levee development was less consistent compared to the Arizona site, but a pronounced unpaired-levee formed towards the base of the lee slope.

These data show that sublimating blocks of CO_2 ice leave signatures of transport paths and are capable of eroding and transporting sediment.

Diniega,S. et al (2013) A new dry hypothesis for the formation of Martian linear gullies. Icarus. Vol. 225, 1, p. 526-537.
Bourke, M.C. et al (2016) The geomorphic effect of sublimating CO_2 blocks on dune lee slopes at Grand Falls, Arizona. LPSC