

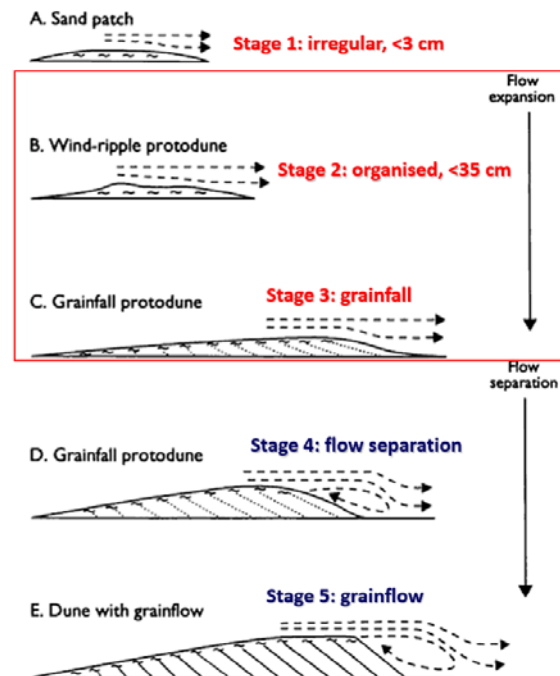
**PROTODUNES ON MARS.** Serina Diniega<sup>1,\*</sup>, Jo Nield<sup>2</sup>, Giles Wiggs<sup>3</sup>, Matt Baddock<sup>4</sup>. <sup>1</sup>Jet Propulsion Laboratory, California Institute of Technology (\*[serina.diniega@jpl.nasa.gov](mailto:serina.diniega@jpl.nasa.gov)), <sup>2</sup>University of Southampton, Southampton, UK, <sup>3</sup>University of Oxford, Oxford, UK, <sup>4</sup>Loughborough University, Loughborough, UK.

While studies of aeolian sand dunes on different planetary bodies have yielded much information on the evolution of these features [1], little is known about the way in which dunes are first initiated. “Protodunes” are the small sand patches that eventually become large organized sand piles [2] (Figure 1), and it is not known which environmental factors control the genesis and evolution of these early stage aeolian bedforms. A UK NERC-US NSF supported project to study The Origin of Aeolian Dunes (TOAD) seeks to address this question via detailed field measurements on the Earth [3]; an additional focus of this work is to identify potential protodunes on Mars and to compare their morphometrics and spacing to their terrestrial analogs, as well as to characterize their local environment for a comparison with environmental controls identified via the terrestrial field studies.

This presentation will focus on the martian investigation, describing our methodology for identifying protodunes and trends seen in the morphometrics, spacing, and environments of such features. Potential protodunes have been identified within HiRISE images [4] (e.g., Figure 2). Comparison between observations of protodunes on Mars and the Earth will also be shared (e.g., Figures 2, 3).

**References:** [1] Diniega et al., 2017. *Aeolian Res.* 26, 5-27. [2] Nield, J.M., Wiggs, G.F., & Squirrell, R.S. 2011. *Earth Surf. Proc. & Landforms*, 36(4), 513-522. [3] TOAD website, 2020. <https://cmg.soton.ac.uk/research/projects/the-origin-of-aeolian-dunes-toad/>. [4] McEwen, A.S., et al., 2007. *J.*

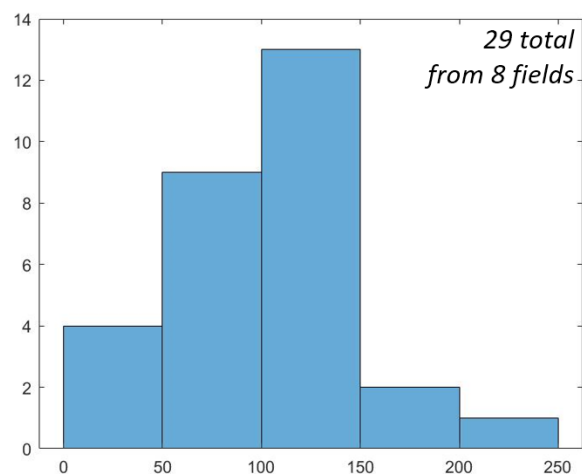
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**Figure 1.** The stages of terrestrial dune development, from [5].



**Figure 2.** Example of a protodune on Earth (left) and a potential protodune on Mars (right). Both have a steep and narrow ridge of sand on the stoss side of the feature and a longer, ~flat, rippled patch on the lee side. This stage of protodune is the transition from a symmetric sand patch (Stage 1) and a protodune where grainfall begins to generate a steeper lee slope (Stage 3) [5].



**Figure 3.** The length (in wind direction) of 29 martian protodunes, from 8 fields. These are ~10x bigger than Earth protodunes, which matches with the size difference seen between terrestrial and martian mature dunes [6].