Evidence supporting aeolian depositional origin of landforms of Sputnik Planum, Pluto, from New Horizons imagery.

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Prior to, and immediately after, New Horizons flyby of Pluto on July 14th 2015, there had been speculation that aeolian bedforms might be conceivable on the surface, despite the insubstantial nature of the atmosphere. Other planetary bodies (such as comet 67P Churyamov-Gerasimenko) with very thin atmospheres have indeed been shown capable of forming, and sustaining, aeolian bedforms [1].

Whilst the morphological and geological diversity evident on the surface was striking, and has now been widely reported upon [e.g. 2,3,4], initial candidates for depositional aeolian features (i.e. dunes) reported in the wider media proved to be unconvincing in appearance, or have more credible explanations for their morphology [e.g. 5].

Here we report spatial analysis and numerical modelling which suggest that landforms of the western Sputnik Planum icefield are most credibly explained as depositional aeolian features; dunes. We base this interpretation on analysis of imagery from the LOng Range Reconnaissance Imager (LORRI), and by combining numerical models based on likely surface and atmospheric conditions for Pluto, and the morphology of the bedforms.

An aeolian origin for the features is supported on the grounds of a) their morphology, bearing a close resemblance to transverse dunes elsewhere in the solar system, b) the presence of pronounced windstreaks precisely orthogonal to the dunes, c) their location, d) their orientation, and regional changes in this orientation, e) their inter-relationship with other landforms and f) distinctions in morphology from landforms clearly associated with sublimation. We discuss the distinction between sublimation-derived and aeolian-derived features, and find the latter more credible in explaining the observed features.

Supporting this, we present numerical modelling which suggests that the wavelength of the dunes – via the inferred saturation length – is most credibly explained under Pluto surface conditions by the hysteretic mobilization of fine sand-sized (~130-220 μm) grains, presumably of nitrogen and methane snows. The necessary conditions for mobilization and continuation of aeolian transport on Pluto are considered

The presence of dunes on Pluto provides further evidence of the remarkably diverse planetary conditions under which these landforms can emerge, and has implications for both surface and atmospheric conditions on Pluto.

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