Morphology, Petrology and Structure of Basaltic Volcanic-Clastic Sand Dunes at Kvensödull in Iceland

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Introduction: Sand dunes with a variety of morphologies have been imaged on the surface of Mars [1, 2, 3]. Dunes on Mars are generally dark hued and their sand is believed to be derived from the erosion of volcanic rocks which due to the geology of Mars is most likely to be composed of basalt [4]. Further studies of Martian meteorites, plus recent data from landers, rovers and remote sensing data confirm that the Martian crust is predominantly composed of basalt with some areas interpreted as andesite or weathered basalt [e.g. 5]. Although Iceland has been identified as a suitable analogue for Mars, and Iceland is reputed to have the world's largest volcaniclastic sand fields [6], there is very little published information on the sand dunes of Iceland. The review by Edgett and Lancaster [4] contains little information on the dune morphology in Iceland and no information on the dune composition.

In this paper we describe the results of a geophysical and petrological investigation of a basaltic volcanic-clastic sand dune in Iceland. The sands are fine to medium grained and poorly sorted. They are composed largely of volcanic glass, average 60%, with around 35% lithic clasts. The percentage of volcanic glass is greater than previously described from other volcanic-clastic dune sands. Despite this difference in composition, the bulk density of the sands is similar to that of desert sands from the Sahara. The dune morphology is influenced by local wind regime as well as the local topography. The dune appears to be barchanoid in planform but lacks a slipface. The lack of a slipface is attributed to the variable wind regime. GPR profiles reveal that the internal structure is dominated by low-angle strata which dip towards the north, confirming that the dune has not had a slipface in the past, and that it has accreted in a northward direction. The east-west alignment of the dune crest and the northward dipping strata indicate that this is a transverse dune. The barchanoid morphology is due to valleys and ridges in the underlying topography that influence the width and thickness of the dune which is wider and thicker within the valleys and narrower and thinner across the ridges.

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