



Production and preservation of the smallest drumlins

John K. Hillier (1), Ívar Benediktsson (2), Tom Dowling (3), and Anders Schomacker (4)

(1) Loughborough University, Department of Geography, Loughborough, Leicestershire, United Kingdom (j.hillier@lboro.ac.uk), (2) Institute of Earth Sciences, University of Iceland, Iceland, (3) Geospatial Insight Ltd., Coleshill, B46 3AD, UK, (4) Department of Geosciences, UiT The Arctic University of Norway, Norway.

Few very small drumlins (e.g. $H < 4$ m) are typically mapped in previously glaciated landscapes, which might be an important signature of sub-glacial processes or an observational artefact. 143 newly emergent drumlins, recently created by the Múlajökull glacier, have been mapped using high-resolution LiDAR and aerial photographs in addition to field surveying. In this note, these are used as evidence that few small drumlins are produced; at least, few survive to pass outside the ice margin in the only known drumlin field that has both an exposed zone and a zone that is probably geomorphically active. Specifically, the lack of a multitude of small features seen in other landforms (e.g. volcanoes) is argued not to be due to i) Digital Elevation Model (DEM) resolution or quality, ii) mapper ability in complex (i.e. anthropogenically cluttered or vegetated) landscapes, or iii) post-glacial degradation at this site. So, whilst detection ability must still be at least acknowledged in drumlin mapping, and ideally corrected for in quantitative analyses, this observation can now be firmly taken as a constraint upon drumlin formation models (i.e. statistical, conceptual, or numerical ice flow). Our preferred explanation for the scarcity of small drumlins in apparently immature zones (i.e. elongation ratio < 2.0), at least at sites similar to Múlajökull (i.e. ice lobes with near-margin drumlin genesis), is that drumlins form by streamlining pre-existing landforms (e.g. moraines, debris fans) rather than through progressive growth from small perturbations to full-size features.