

## **Spatial analysis of drumlins within the Arran, Guelph, and Galt drumlin fields of southern Ontario, Canada**

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Reconstruction of former ice conditions and glacier dynamics in previously glaciated terrains requires understanding of the processes and controls on the development of subglacial landforms such as drumlins. This paper presents a quantitative analysis of the spatial distribution of drumlins identified from digital elevation model (DEM) data within three drumlin fields in southern Ontario, Canada (the Arran, Galt and Guelph drumlin fields) formed in the Late Wisconsin by the Ontario and Georgian Bay ice lobes of the Laurentide Ice Sheet. Detailed field description of a partially excavated drumlin within the Guelph drumlin field provides further insight to compliment the geomorphometric analysis.

Drumlins are identified and their morphological parameters documented using a computer-based process that allows direct comparison of forms within and between individual fields. Statistical analysis of the morphological characteristics and spatial distribution of drumlins within each of the three drumlin fields, using kernel density and nearest neighbour analysis, indicates that drumlins of particular types show distinct patterns of clustering that appear to be related to several different factors including length of time under ice, bedrock topography, and ice velocity. Sediments exposed in an excavated drumlin within the Guelph drumlin field show a relatively undisturbed older fluvial or glaciofluvial crudely stratified sands draped by a thin veneer of coarse grained deformation till. This stratigraphy is similar to that described from modern drumlins in Iceland and is consistent with models of drumlin formation by subglacial deformation processes. The methodology of drumlin analysis can be applied to the study of any drumlin field with an adequate coverage of digital spatial data. The ability to consistently identify and characterize drumlin morphology and distribution will allow more objective and systematic comparison of these landforms both within and between drumlin fields and will enhance understanding of the spatial controls on the development of these enigmatic landforms