Conceptual model: Erosional origin of drumlins and mega-scale glacial lineations

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The erodent layer hypothesis (EHL) argues that drumlinization leaves no substantial stratigraphic record because it is primarily an erosional process that creates a low-friction surface at the base of accelerating ice. The wide variety of hard and stiff cores of drumlins and associated megaridges (flutings) within tracts of mega-scale glacially lineated (MSGL) terrain does not support models where bedforms grow upwards by vertical accretion ('emergence') from deforming subglacial till ('soft beds'). Drumlins and megaflute ridges predominantly have autochthonous cores of antecedent till(s), other stiff and coarse-grained sediment and rock or any combination thereof explaining the close juxtaposition (and common origin) of rock and sediment drumlins within the same flow sets ('mixed beds'). EHL argues that drumlins and megaflutings are remnant features that did not 'grow upwards' from soft till beds but 'grew down' by erosional carving of pre-existing stiff till, sediment and/or rock, by abrasive subglacial streams of deforming subglacial debris. This process is well known to the science of tribology (science of wear) where remnant 'microdrumlins', ridges and grooves (wear tracks') directly comparable to MSGL are cut by a thin abrasive 'erodent layer' on surfaces in relative motion. In the subglacial setting the erodent layer is thin (<1m) and comprises deforming diamict containing harder 'erodents' such as boulders, clast rich zones or frozen rafts.

Drumlins and megaflutings form a continuum in many flow sets recording 'bisection' (cloning) of parent ovoid drumlins as the bed is progressively lowered to create a low friction, low slip surface, which is reflected megaflutings. Limiting factors in this evolutionary continuum are the duration of fast ice flow and subglacial sediment thickness; the latter controls the extent of bed lowering; in areas of thin drift, megagrooves and ridges may become stencilled into rock as it becomes exposed by erosion. EHL predicts 'transient subglacial storage' of tills deposited as non-streamlined till plains during sluggish 'steady state' flow for long periods earlier in the glacial cycle and subsequently eroded into a low friction 'self-organized' streamlined surface during a late, short-lived episode of fast ice flow. This presentation recognizes that till is a *glacial cataclasite* and that there is a fundamental commonality of all forms of erosional wear on sliding interfaces from the microscopic scale to the geological. They are examples of textured 'self-organized' shear surfaces meaning that there is no unique glacial explanation for MSGL.