

Subglacial Landforms I

GES- 441

Variety of streamlined features -**drumlins, flutes**
and transverse features - **Rogen moraine**

Very often occur in fields

Flutes

elongated, streamlined ridges parallel to flow, 10s cm to few meters high, may be grouped

commonly but not always found downstream of lodged boulder
commonly straight, but may swerve to avoid boulder
mainly of till, although may have deformed core of preexisting material
herringbone fabric

Some models of formation -

- 1) subglacial sediment deformation in lee side cavities
- 2) represent deformation of till due to fast flow - probably because some areas resist flow more than others



Flutes, photo from T. Lowell.

Drumlins

Almost as many theories as there are drumlins

Smooth, oval to elongated streamlined hills, resembling inverted spoon

Blunt upglacier, tail downglacier

Parallel to flow

In fields of thousands

Commonly associated with Rogen moraines

Most common although not exclusive to broad lowlands and big valleys

Composition - varied - some have rock cores with till carapace, most are entirely sedimentary, many have cores of what may be preexisting material, some sorted sediments

May be undeformed or highly deformed

Surface fabric commonly parallel to flow, with divergence around hill

Interior fabric may show no relationship to surface

Formation - We really don't know.

Boulton hypothesis - Less soupy and more well-drained areas (i.e., sandier) of deforming till don't deform very much, stay still. Results in inhomogeneous bed with till moving around static areas and streamlining them. Notes many are in sandy areas



Drumlin. Ice flow was right to left.

Rogen Moraines

30 m high, 100 m wide, coalescent, crescentic forms transverse to flow, horns bent downglacier

Commonly occur in depressions, generally steeper downglacier than upglacier

Are associated with drumlins and megaflutes

Composed of massive or laminated diamicton, gravel, sand, silt, may be highly deformed

Most theories implausible or can't explain all features

Boulton - 1987 - early stages of drumlins - differential rate of sediment transport in ridges due to sediment variations cause fragmentation of ridge and crescentic shape

Other ideas - lift-off moraine at crescentic margin

Megaflow hypothesis of Shaw to explain rogen moraines and drumlins

Two variations of his model – 1) meltwater erosion of underside of ice produces large ripple-like scours; these areas infill 2) modification suggests drumlins and Rogen moraines may be erosional remnants of preexisting material, perhaps with till dropped on them.



Rogen moraines, Canada.