

GLACIAL GEOLOGY - LECTURE 6 SUBGLACIAL DEFORMATION

WHAT IS THE PROCESSES ARE WE TALKING ABOUT?

Place in the till depositional processes

Scale of occurrence

localized beds

major thrust slices

stress system allows subsequent fracturing

WHAT IS THE SIGNIFICANCE

Source of heterogeneities

stress to make fractures (various scales)

CASE STUDIES

Hart and Boulton

study objective processes at sediment-ice interface

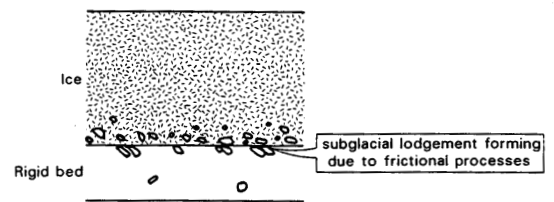
proglacial/margin - thrusts, open folds

subglacial simple shear

how much undeformed till?

Provide a simple model of systems

a) Rigid bed



b) Soft bed

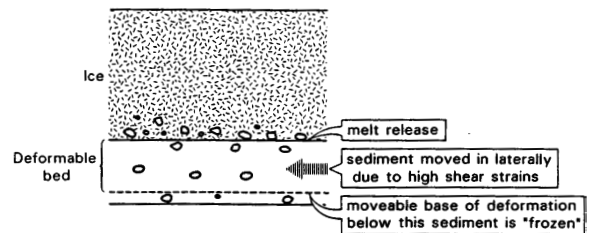


Fig. 1. Contrast between a) rigid and b) soft bed. After Hart and Boulton (1991)

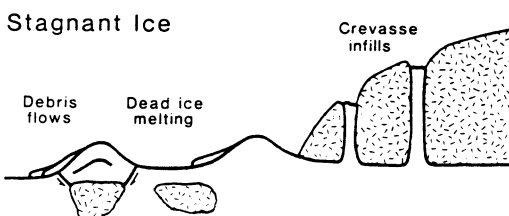
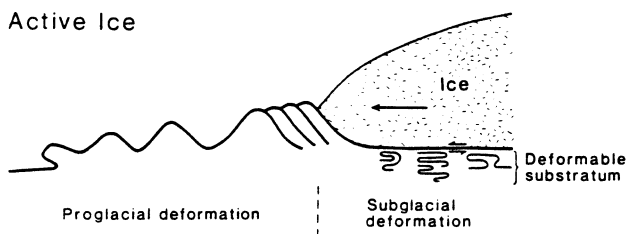


Fig. 2. Glaciotectonic deformation in active vs. stagnant glacier (After Hart and Boulton, 1991).

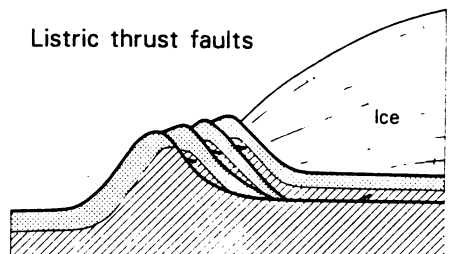
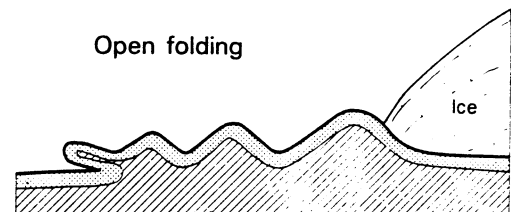


Fig. 3) Small moraines from open folds (top) and listric slices making large moraines (bottom) (After Hart and Boulton, 1991)

Menzies

intact sand interclasts incorporated into diamictons

possible melt-out origin

looked at details around clasts

clasts may contain undisturbed bedding or fractures

scale: cm-m, irregular shapes

associated with moraine

fabrics used to demonstrate the origin

Aber and others

composite ridges, mostly outwash sand and gravels, repeated sequences

push moraines vs. deposition moraines

Brandon Hills

inclined stratified beds, till cap

inclined beds

scale: km's long, 15 m high

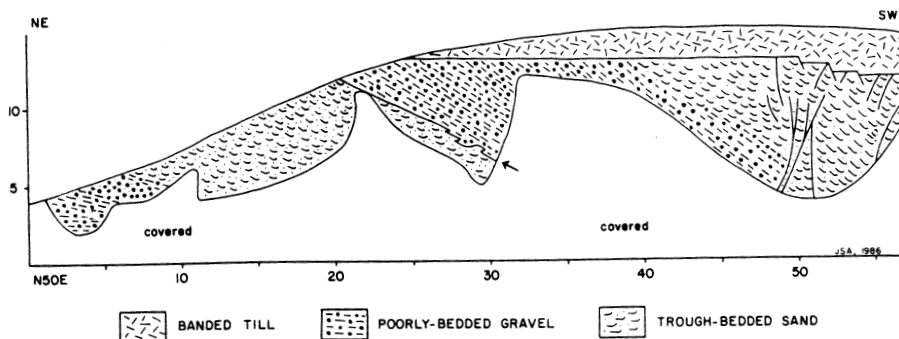


Fig.4. Brandon Hills stratigraphy. (After, Aber and others, 1989)

Utrecht Ridge

fine sands, etc., from alluvium, coarser material from prior glaciation

thrust slices, basins upflow from ridges

scale: 10's km long, 50 m high

Vatnajokull, Iceland

sands, tephras, not much diamicton

longitudinal differences in compression

scale: km's long, 5-10 m high

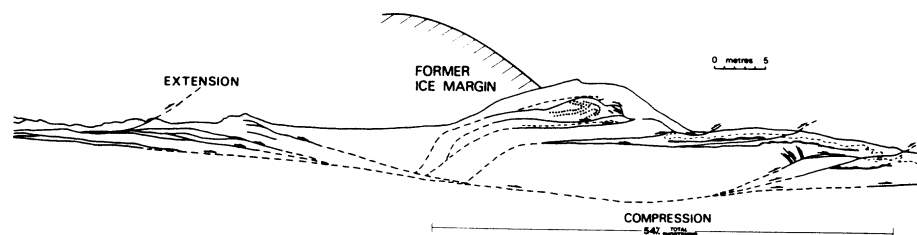


Fig. 5. Eyjabakkajokull model stratigraphy. (After, Aber and others, 1989)

McKay and others

primary pathway for flow

3 orders of magnitude higher than unfractured in lab

porosity drops with depth, but the high values near the surface allow infiltration

high lateral migration (24 m/d)

APPLICATIONS TO OHIO

extensive moraine belts - what is their origin

“tills” locally have deformed sediments

Advance and Retreat patterns

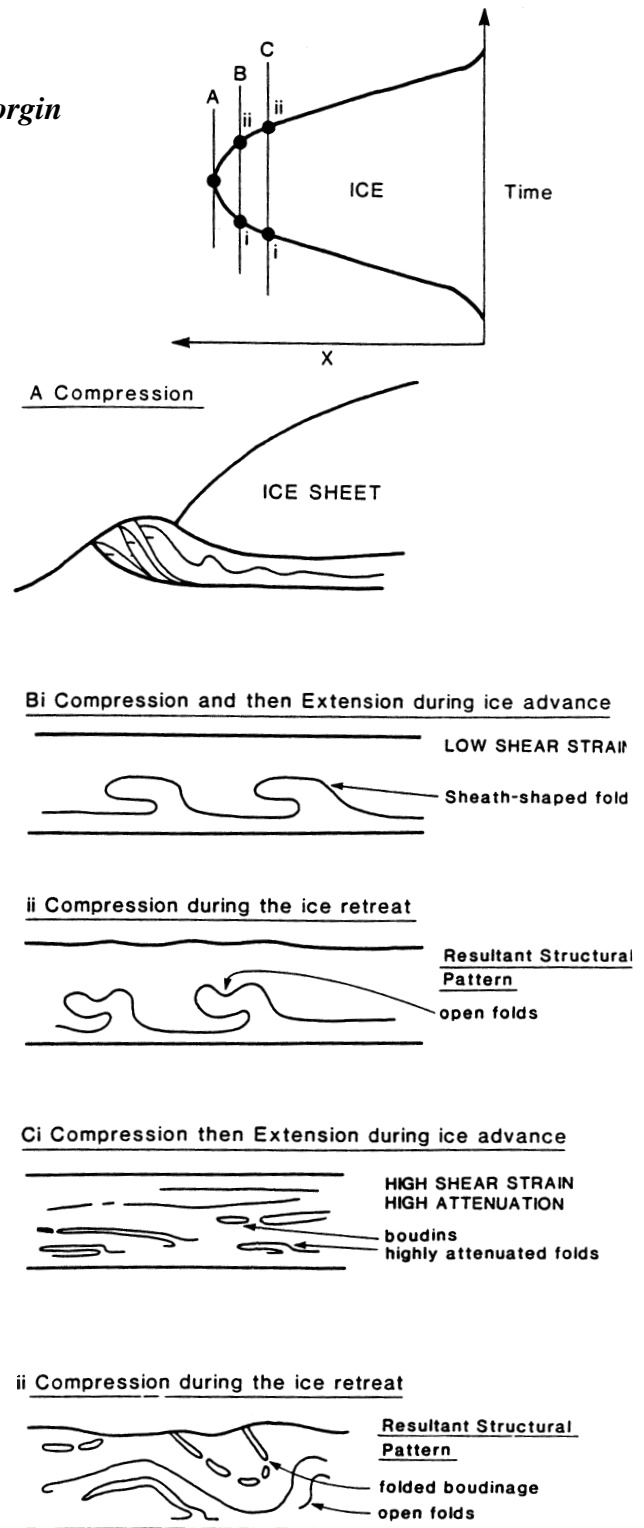


Fig. 6. Schematic diagram of change in type of glaciotectonic deformation during an advance and retreat phase. Various positions labeled with letters in the time-distance at the top. Time intervals lables with small case Roman numerals. Various deformation in the diagrams below the time-distance diagram. (After Hart and Boulton, 1991).