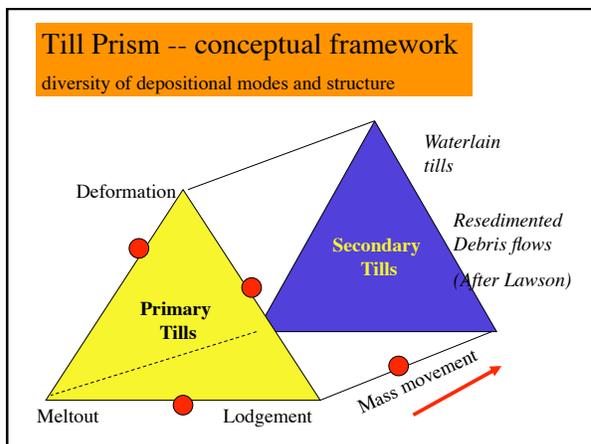


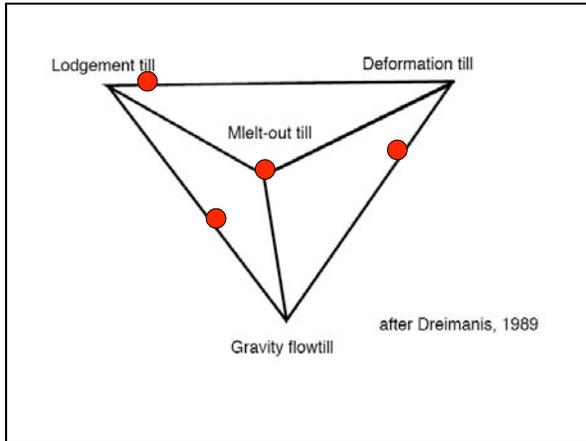
We now know....

- Why a glacier exists (mass balance)
- How it flows
- How it abrades and erodes
- How it entrains debris
- So, now how is basal debris deposited
  - How is it classified, how is it related to types of landforms, spatial extent.

**Sedimentary vs. genetic terms**

- Diamict (diamicton)= a sediment composed of a wide range of clast sizes; includes varying proportions of boulders-cobbles-sand-silt-clay; with no genetic connotation
- Till = a sediment that has been transported and deposited by or from glacier ice with little or no sorting by water; usually poorly sorted, commonly massive, may contain striated clasts; till is a glacial diamict.





Processes of deposition	Types of till
<ul style="list-style-type: none"> <li>• <b>Lodgement</b>- frictional resistance between a clast in transport at the base exceeds the drag imposed by the ice; grain by grain plastering</li> <li>• <b>Meltout</b>- direct release by melting</li> <li>• <b>Sublimation</b> -- vaporization of ice causing direct release of debris</li> <li>• <b>Subglacial deformation</b>- assimilation of sediment into a deforming layer beneath a glacier</li> </ul>	<ol style="list-style-type: none"> <li>1. Lodgement till</li> <li>2. Subglacial meltout till</li> <li>3. Deformation till</li> <li>4. Supraglacial meltout till</li> <li>5. Flow till</li> <li>6. Sublimation till</li> </ol>

**Describing Diamicts - nothing diagnostic**

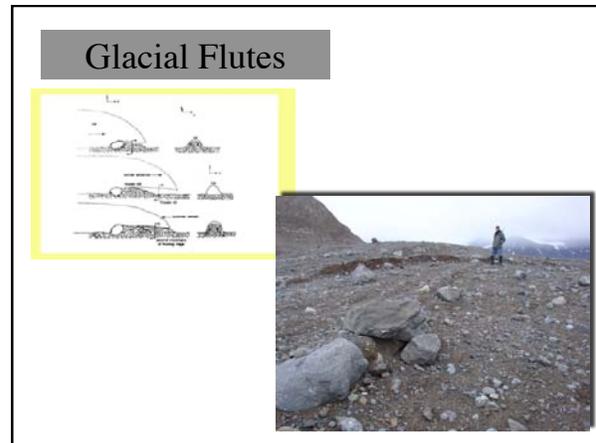
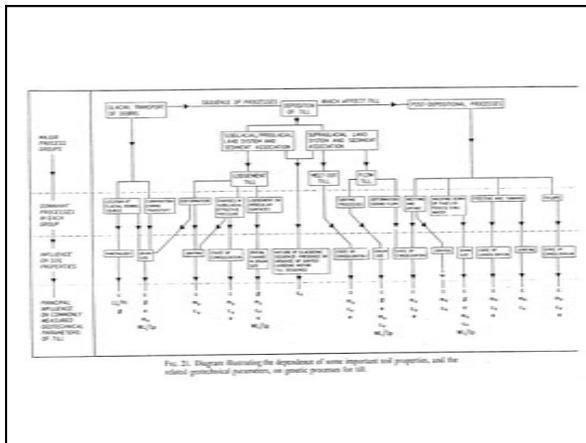
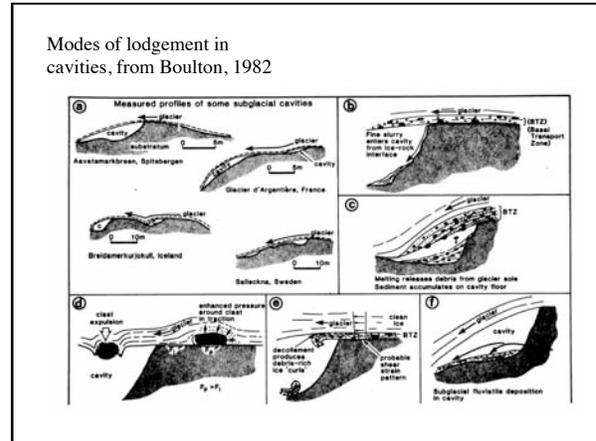
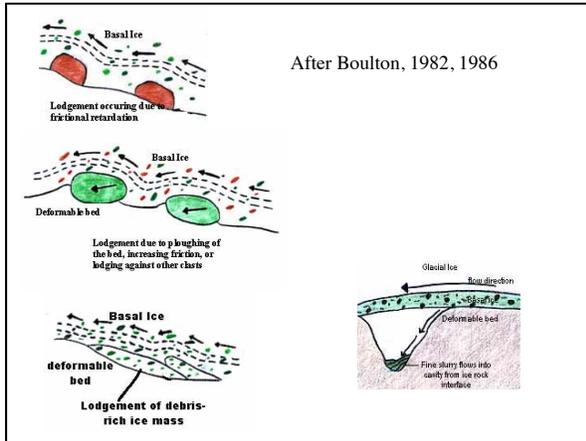
1. Texture
2. Clast shape
3. Clast mineralogy and lithology
4. Sedimentary structures, grading, lenses
5. Clast fabric
6. Spatial relationships with other units
7. Geotechnical properties, porosity, permeability, consolidation history

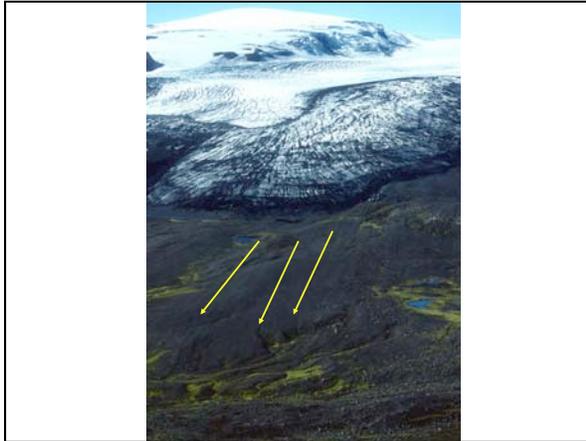
**Lodgement Till**

subglacial lodgement in three ways by actively moving ice; rates ~ 3cm/yr

- **Direct lodgement** - grain by grain plastering
- **Basal melting (pmp) and debris release**
- **Deposition in cavities**-roof melting, clast expulsion etc.

Lodgement till...well..... about to become something else





### Deformation Till

pre-existing subglacial materials folded, sheared, partially homogenized by movement above of debris rich ice; commonly confused with subglacial melt out.

- Pervasive : sediment deforms en masse so all structures etc are erased
  - Non-pervasive: discrete shear planes develop that carry most stress, original structure is partially preserved.
- See JBG slides

### Interesting articles

- Quat. Science Reviews v. 16, 1997, pg 93  
-- Jane Hart  
surveys drumlin structure as principle indicators of deforming till
- J. Of Glaciology, v. 45, 1999, pg. 101  
-- R. Hock  
examines important implications of the presence of deforming till layer at the ice bed

### Go to overheads on deformation tills

### Meltout Till

released either supraglacially or subglacially from stagnant ice beneath a confining overburden in which some of the original englacial features are preserved. (Boulton, 1972)

- Stagnant ice
- original englacial structure is partially preserved.
- Fabrics are strong

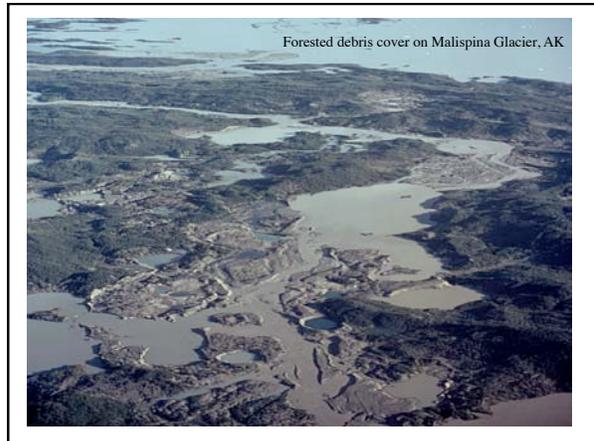
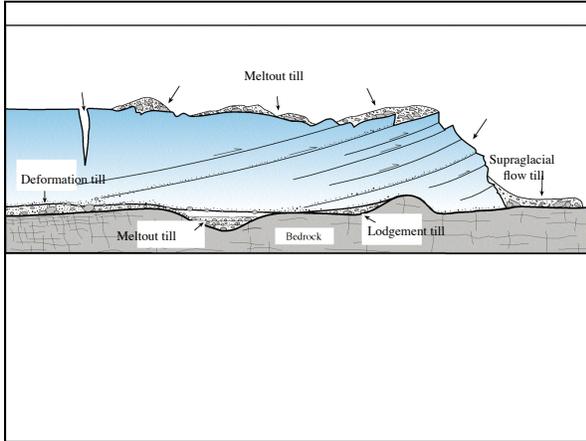


Debris on stagnating margin of the Kaskawalsh glacier, AK. (K. Hamblin)

### Features..

- Involves release of meltwater and takes place simultaneously within large volumes of ice
- Cavities of flowing water being evacuated may sort enough to create sorted sediment lenses.
- Lack of sliding or creep, so it's a passive process
- Preserves the englacial structures





*Paul and Eyles, QSR 1990, v. 9, n1, p. 51+*

On preservation of meltout tills

- Meltout uncommon in modern glacier environs, thin, laterally discontinuous, low preservation potential
- Glacier margin is only place where have enough englacial debris to for signif. Diamict thickness
- High porewater pressures and sediment deformation can be induced during meltout
- Classic meltout only found in restricted conditions. Handouts!

Halverson and Shaw, 1982,  
Boreas v.11, 261-277

- 1. Presence of unlithified sorted and stratified sediments within or interstratified with tills
- 2. Presence of statistically preferred orientation of stone axes closely related to ice float directions
- Configuration of till with recognizable textural and lithological properties closely related to the configuration of the englacial debris with the same properties.

Parting quote: "The interpretation of till genesis must be based on the balance of probability, as absolute proof is unrealistic in most cases"



Go to Svalbard pics

**Sublimation Till**

-- results from slow removal of ice by its direct transformation To the vapor state; important in extremely frigid, arid areas

- Freeze drying process preserves englacial structures well
- Very slow depositional process handouts
- Occurs on top of ablating ice -- so supraglacial process only

**Secondary tills**—glacial diamict that has been displaced by mass movement or resedimented through water column subsequent to release

- Flow tills or
- Resedimented debris flows
- Waterlain tills