Glacier Flow Mechanisms

Regelation and Ice Deformation

Regelation

ICE FLOW

water

High pressure
Low melting point

heat

Low pressure
High melting point

If we assume that L' /L=constant,

L

L'

Ice Deformation
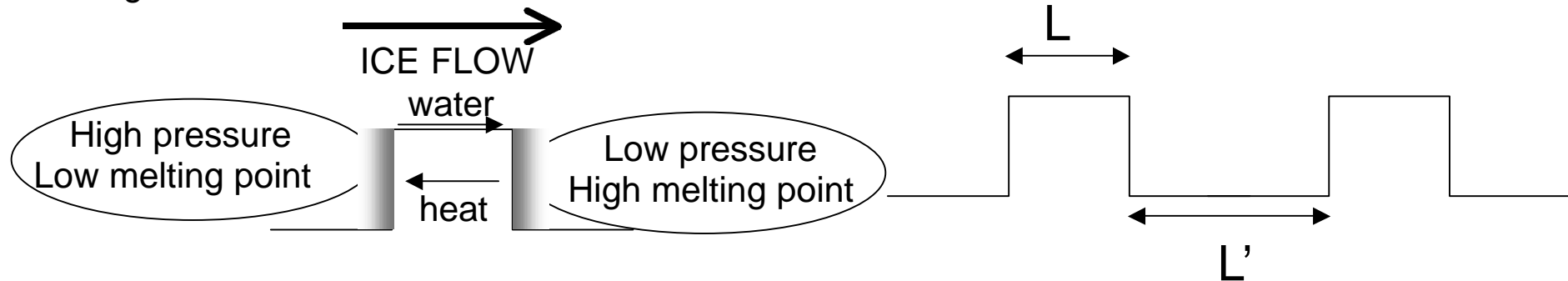
Stress
concentration
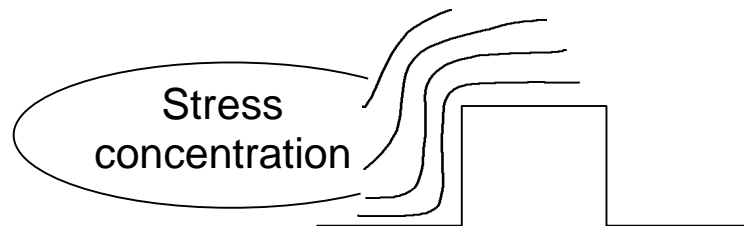
$U_{(regelation)} = A\{ \ (L'/L)^2 \}/L$

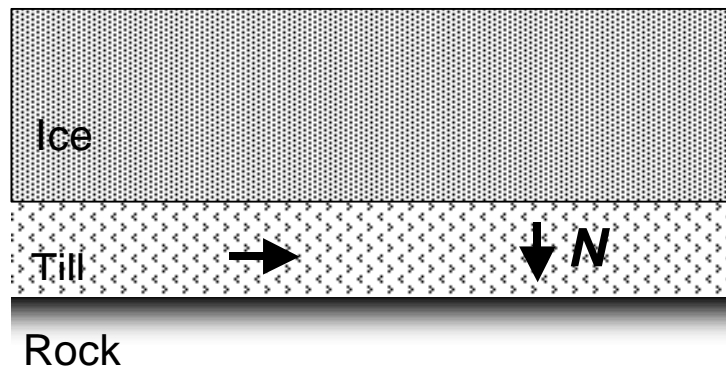$U_{(deformation)} = B \{ \ (L'/L)^2 \}^n \ L$

Deformation of Subglacial Till

Yied stress of till

$$s = c + N \tan\phi$$

c: cohesion, ϕ: angle of friction

N: Normal Stress

Stress

Yield Stress

Strain

Ice

Till → ↓ N

Rock

Strain rate of till at $\tau > s$

$$\dot{\varepsilon} = A(\tau - s)^a / N^b$$

A: constant, τ: shear stress

Yield Stress s

Cohesion

NormalStress N
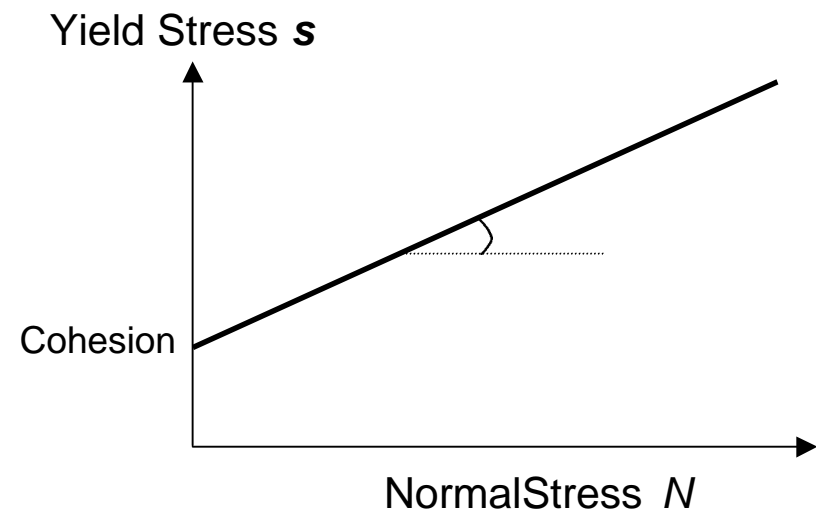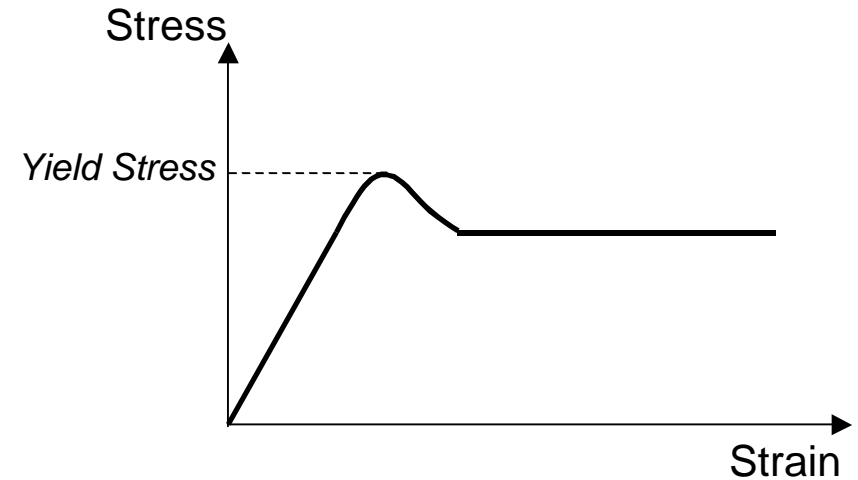
Deformation of Subglacial Till with Water

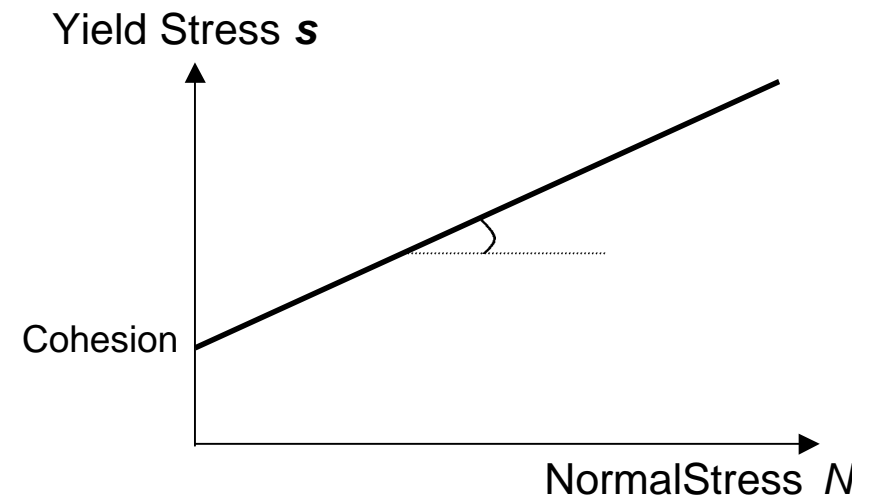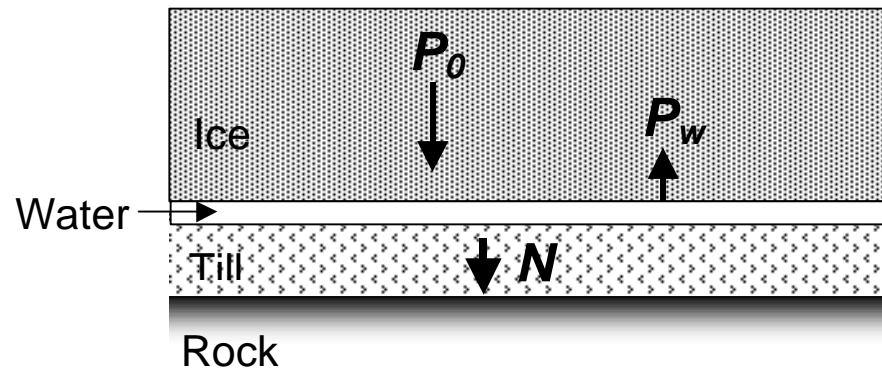**Yied stress of till**

$S = c + N \tan$

$= c + (P_0 - P_W) \tan$

P_o: Overburden Pressure

P_w: Water Pressure

Strain rate of till at $> s$

$$= A(\ -s)^a / (\ P_0 - P_W)^b$$

Glacier Flow Mechanisms and Controlling Factors

Mechanism			Controlling factor
Internal Ice Deformation			Bed Condition
Subglacial Flow	Basal Sliding	Ice Deformation	Bed Morphology
			Ice Mechanics
			Water Pressure
			Cavitation
		Regelation	Bed Morphology
			Impurity
	Till Deformation		Till Mechanics
			Water Pressure
			Ice-Till Decoupling