Glacial Geology - Lecture 9

Ice-Contact Landforms - a.k.a. Moraine Formation

WHAT IS ICE-CONTACT?

Deposits - landforms formed along the ice margin. Complex of deposits and processes.

In many areas these include stratified deposits such as kames, eskers, etc., but in southwest Ohio the primary landforms are moraines. These papers focus on the processes of moraine formation.

The key question to ask is "how to moraines form?"

Three possibilities: Thrust of large blocks (>100 m), thrust of small blocks (~10 m; Kruger's model), or simple resedimention at the ice margin (Lawson's model).

KRUGER'S MODEL

Processes - Winter freezing and thrust up.

Landforms - small (<5 m) ridges with lodgement tills on the proximal side and some debris flows on the distal side. With this processes it is possible to thrust up any sediment type.

LAWSON'S MODEL

Processes - resediment - flow, flow and more flow.

Landforms - Lawson does not describe these in detail. However examination of the margin of the Matanuska Glacier shows they exist, so something must build them.

The question I posed to you - under what conditions can flow of sediments down build up a ridge? Is this likely and under what conditions?

RELATIONSHIP TO PROJECT

Since one of the more common landforms in southwest Ohio are moraines we must consider them carefully.

Think about a walk along the length of either of the moraine types. What sediments would you encounter?

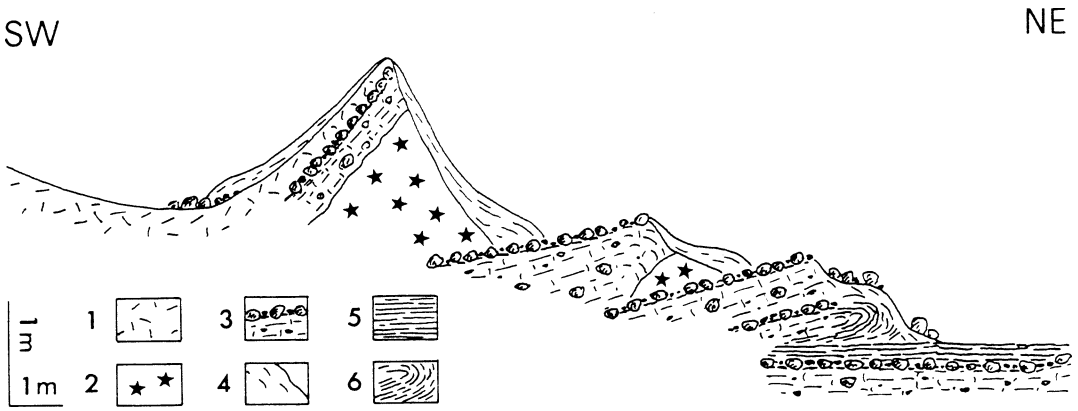

Fig. 5. Section in moraine ridge being formed along the margin of Myrdalsjökull in 1986. (1) Glacier ice. (2) Snow and firn. (3) Clast-paved lodgement till. (4) Sediment-flow deposits. (5) Downwash deposits of silt, sand or fine gravel. (6) Deformed downwash deposits.

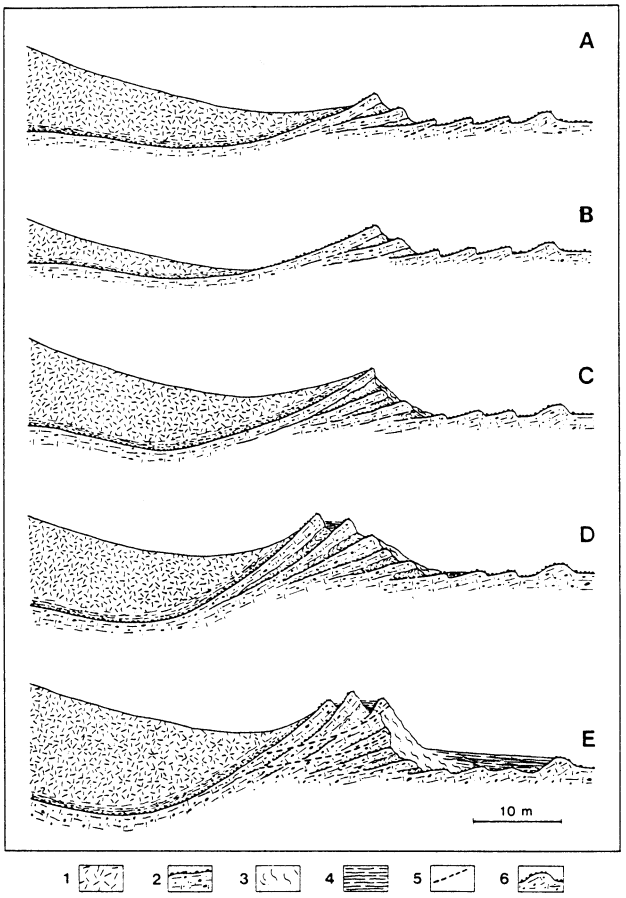

Fig. 9. Model for moraine ridge formation at Myrdalsjökull. (1) Glacier. (2) Clast-paved lodgement till. (3) Mass-movement deposits. (4) Down- and outwash deposits. (5) Thrust-plane. (6) Annual moraine.

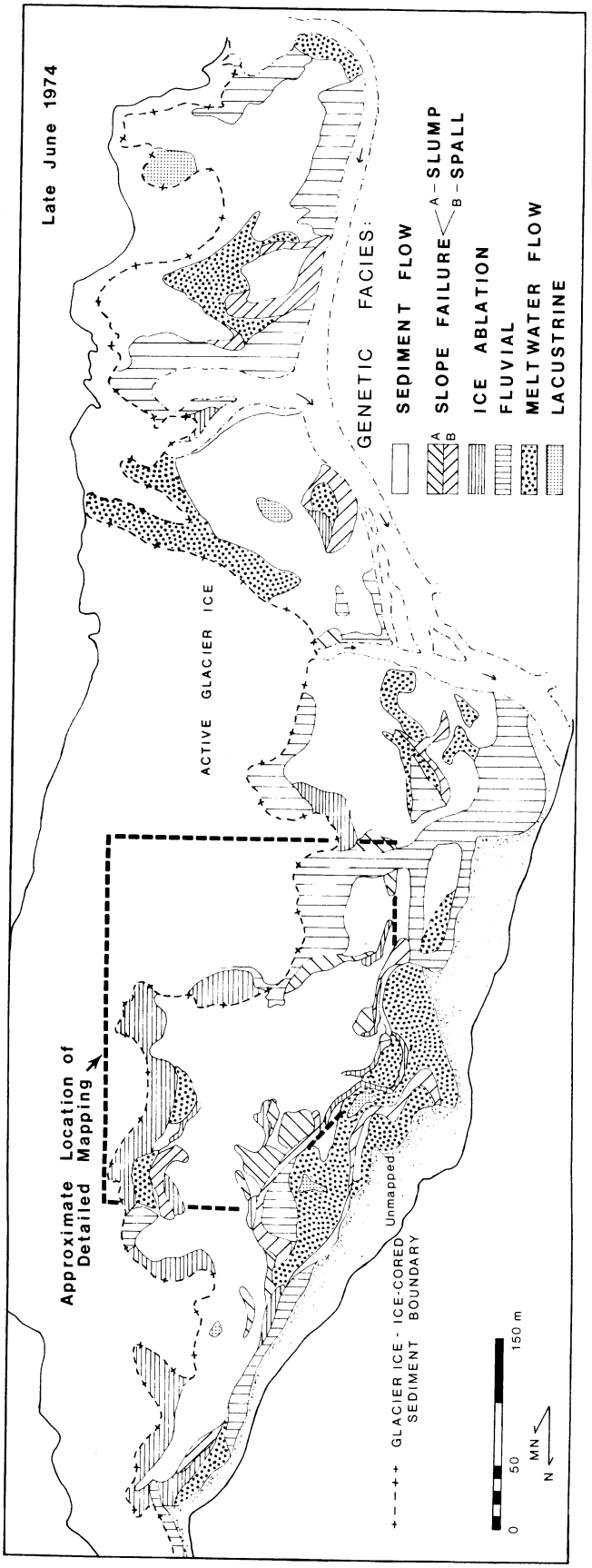

Figure 67. Map of surface distribution of genetic facies in late June 1974. A lack of pattern and dominance of the sediment flow facies are shown. Dashed line encloses approximate location of Figures 68 and 69.

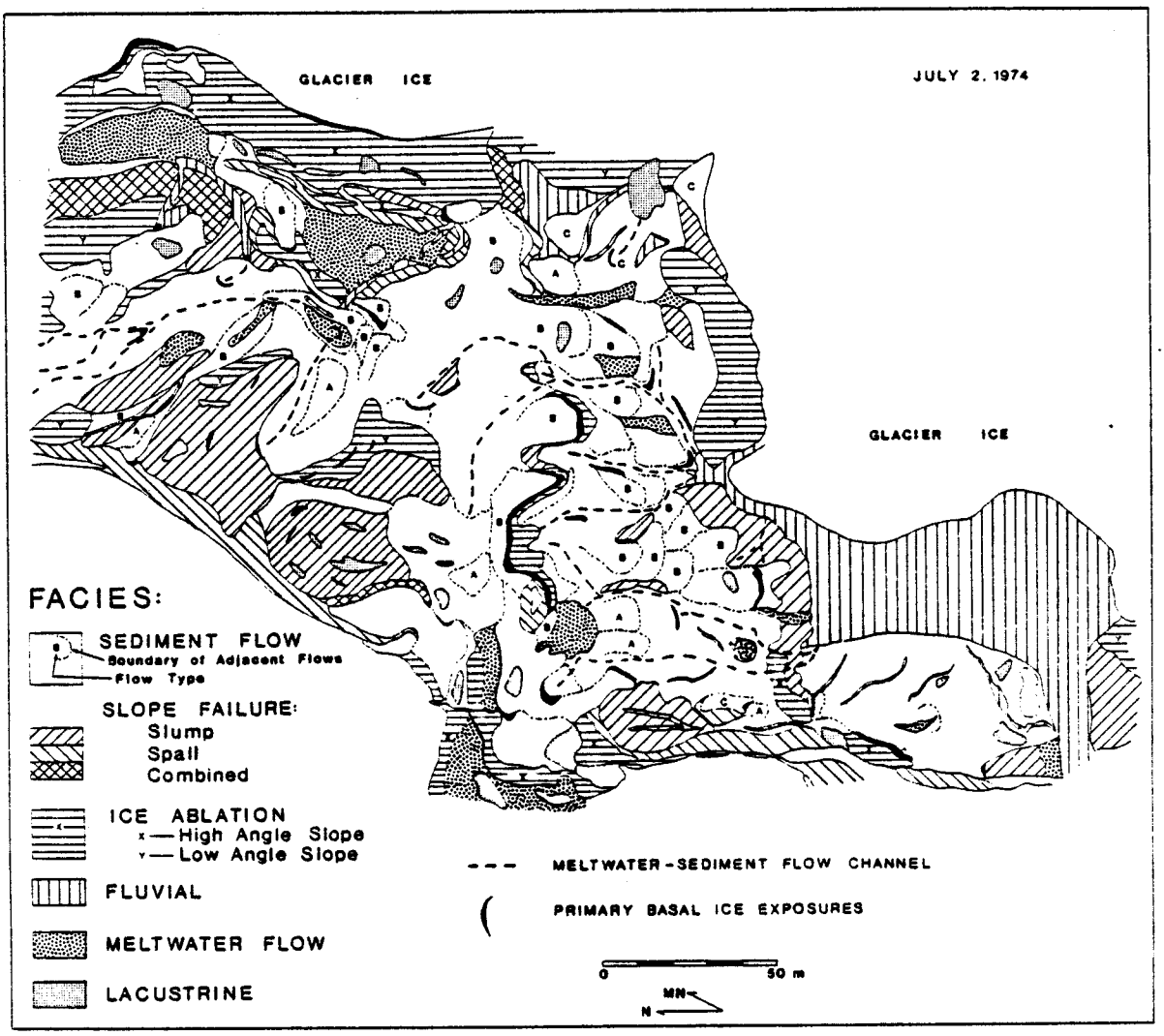

Figure 68. Surface distribution of genetic facies over a part of north area of study region on 2 July 1974. Location shown on Figure 67. Symbols A through D indicate flow types I through IV which were identified where possible. A complex distribution without definitive relationships between facies is shown. Sediment flow facies, mainly type II, dominate the surface materials.

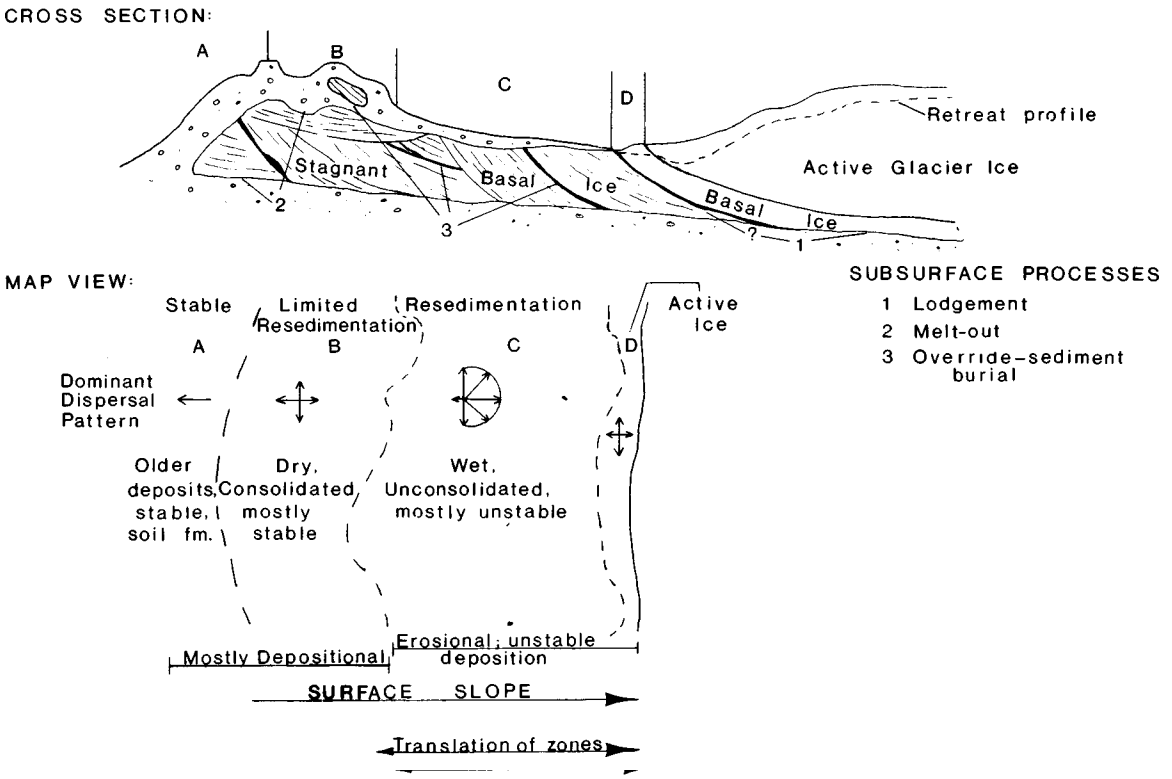

Figure 71. Idealized cross section and map view of process distribution at glacier margin with regional up-glacier slope. The processes occurring within each zone are: A) Stable older deposits may overlie ice, which melts out over a long period of time; surface materials may be reworked by eolian and fluvial processes. B) Limited resedimentation may include failure of slopes, but is dominated by internal melting; wind and slopewash locally rework surface materials. C) Resedimentation including active slope spall and slump, sediment flow, meltwater flow, ice ablation associated with backwasting ice-cored slopes and fluvial and lacustrine processes. (Buried ice melt may occur, but the products are rapidly reworked by surface processes.) D) Control of debris and meltwater release by ablation.

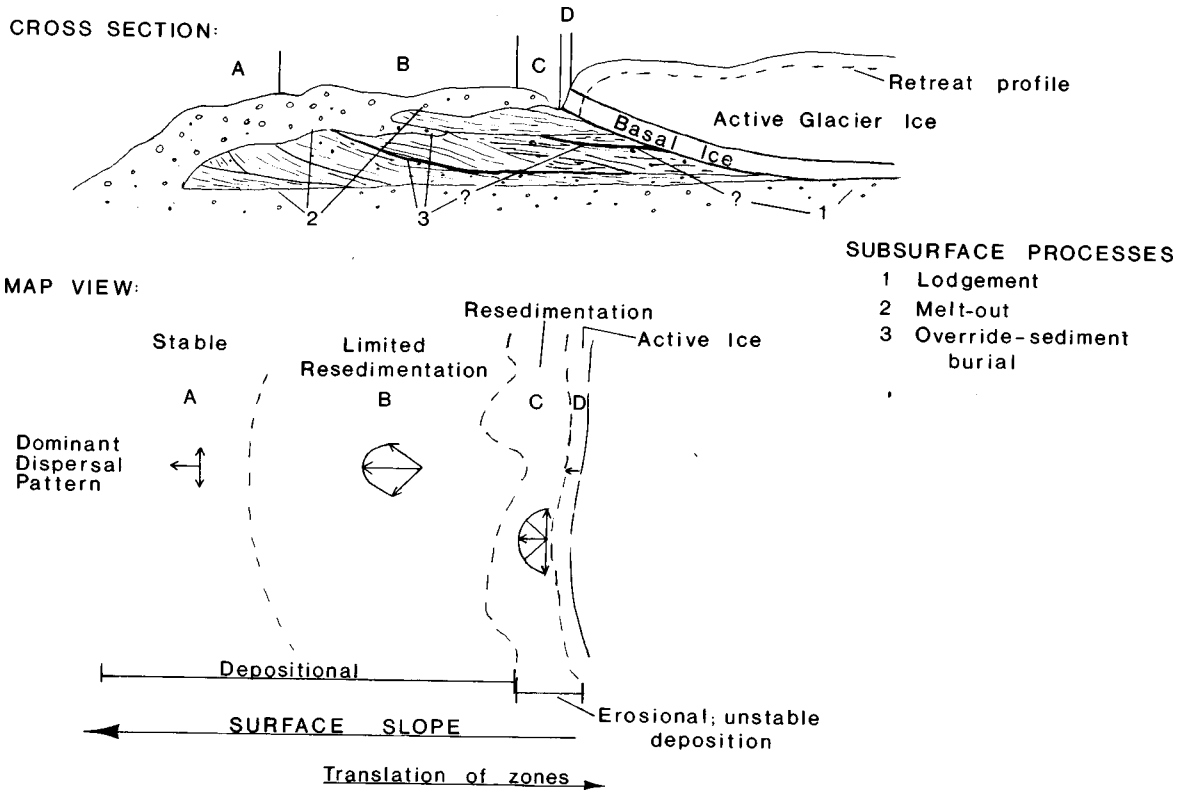

Figure 72. Idealized cross section and map view of process distribution at glacier margin with regional down-glacier slope. Process occurrences in zones given in Figure 71.

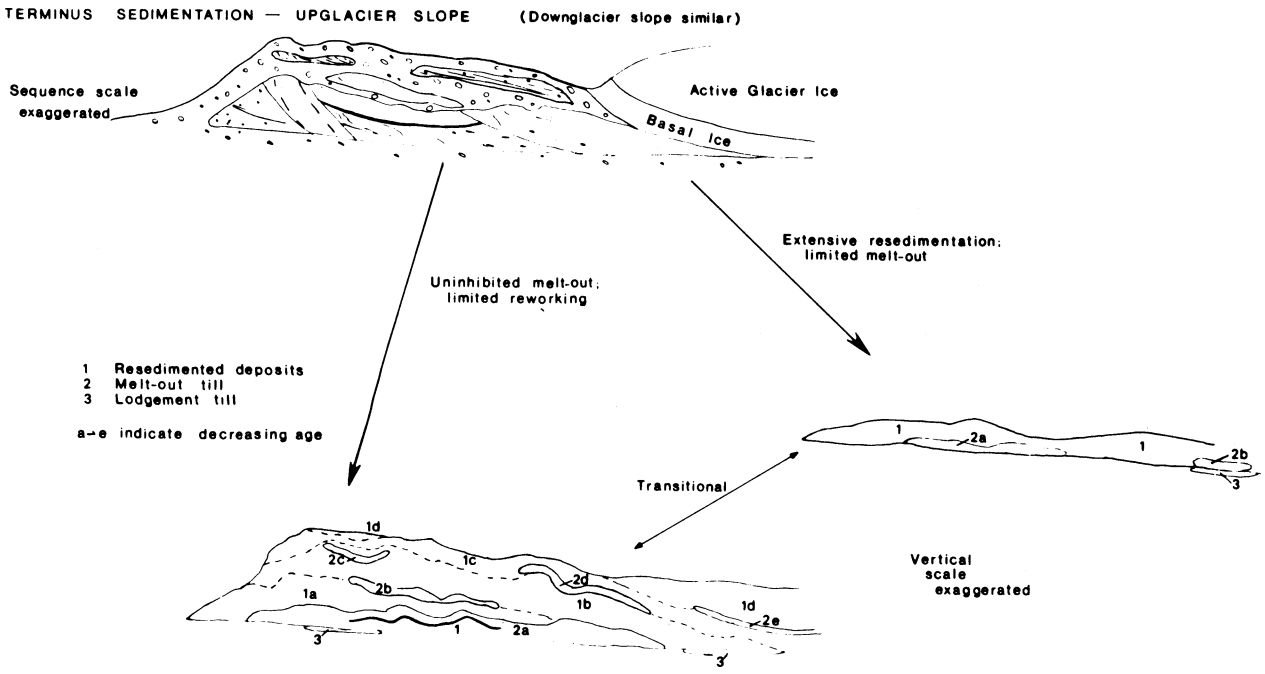

Figure 73. Idealized development of sedimentary sequence from Matanuska Glacier terminus sedimentation. Uninhibited melt-out results in a stacked sequence of resedimented and till facies units; more continuous deposits than shown may form. Extensive resedimentation may eliminate all deposits except those of the resedimented facies association. Facies associations which occur may be similar for regional upglacier or downglacier slopes; sediments derived from regional upglacier slope will probably show greatest diversity. Extent of reworking will determine this diversity. Conditions may exist which permit a vertical sequence to develop that contains multiple till or resedimented units, or lacks either of these, from a single period of glaciation.