Glacial Sediments and Landforms Deposited in Lakes

Proglacial or ice-dammed lakes- depression may be created by moraines, in rock basin, or caused by isostatic depression

Glacier ends in near vertical cliffs at grounding line
Pattern of sedimentation controlled by lake stratification
Stratification caused by temperature, salinity, sediment content

Sedimentation Processes

1) meltwater flows - manner of deposition depends on relative densities of lake and incoming water - if big difference, get coherent plume

   a) underflows - meltwater denser than lake water - forms turbidity current
   b) interflow - meltwater same as lake, enters at depth
   c) overflow - meltwater less dense, rises to surface

b and c tend to produce **deltas**
a tends to produce **subaqueous fans** with channels and levees

2) Direct sedimentation from glacier front

   material is dumped into water or melts out, results in diamicton that may or may not have weak stratification

3) Rain-out from icebergs - ice-rafted detritus (IRD)

4) Deposition from suspension - clay, silt

5) Gravity flows - slumping from sides, results in diamicton with flow fabrics

6) shoreline sediments - reworking by waves, ice, hillside debris

7) biological sedimentation - may not be important in some lakes because of high sediment load and ice cover, but is important in some cases

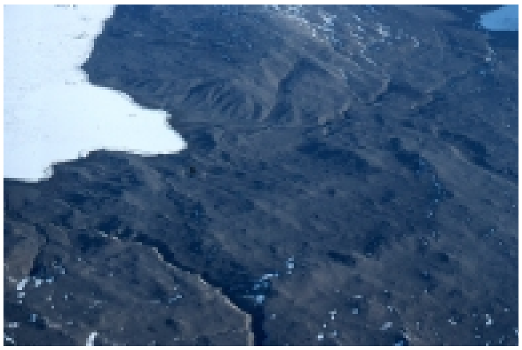
Biologically precipitated carbonate plates with iceberg dropstones.

Nature of sediments depends on lake size and size of calving margin
Generally coarser sediment near glacier

If low IRD, get **rhythmites** interrupted by turbidity flows -fewer turbidity flows with distance from calving front, turbidites don't only come from underflow - can result from slope instability; **varves** - annual, grade up from sand to clay with, each couplet separated by sharp contact

Landforms

Grounding-line moraines (moraine banks) composed of till and stratified sediments, commonly disturbed; **Subaqueous fans**; **Deltas**; **Ice-push ridges**, formed when lake ice is blown against shore by wind.

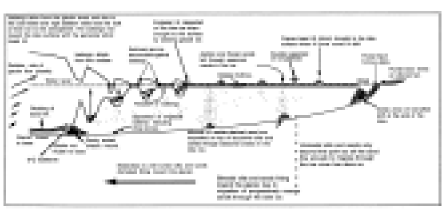


Moraine bank, eastern Taylor Valley.

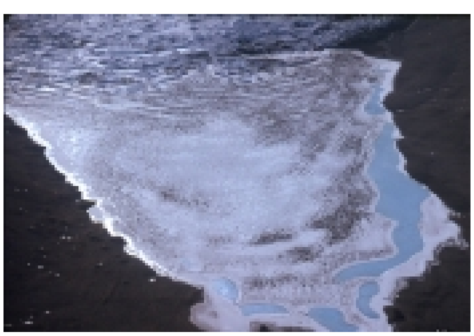
Lake-Ice Conveyor

Unusual, polar case; perennial ice cover required.

Sediment is transferred to permanent ice cover through calving of icebergs. Debris that melts out from icebergs below water level forms grounding line moraines. That which melts out above water level ends up on the lake ice surface. The ice is moving towards the distal end of the lake because of pressure exerted by the glacier through calving. This rafts the lake-ice sediment towards the distal moat, where it is deposited. Fine-grained sediment melts its way through the lake ice at a rate inversely proportional to its size. Coarse sediments cannot melt through the ice and end up in the moat - or on the lake floor if lake-level drops. Sediment sequence consists of fine-grained sediments overlain by coarse debris dropped from the lake ice. The landform sequence consists of a moraine bank, followed distally by grounding-line mounds composed of silt and iceberg dropstones, sheets of lacustrine sediments that may be capped by coarse debris, and moat ridges and mounds. Deposition is patchy and sediments of many ages can be adjacent to each other.

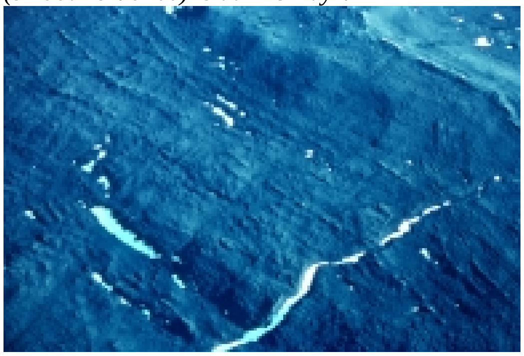


Conveyor model of Hendy et al. 2000.



Trough Lake, Antarctica, a conveyor in action.

Koettlitz Glacier is calving into the lake at the top of the photo. Rafting of sediment to the moat (smooth blue ice) is at ~18 m/yr.



Moatlines, eastern Taylor Valley.