Lessons in Ice Sheet Appreciation: Glacial Geology & Geomorphology in Wisconsin

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University of Wisconsin PARKSIDE
Southeastern Wisconsin's University of Opportunity

Motivation

Many of the distinctive features in southeastern Wisconsin owe their existence to the Laurentide Ice Sheet, particularly the Lake Michigan and Green Bay Lobes. This landscape provides a particularly accessible natural laboratory for students in a variety of classes, including sedimentology, geomorphology, and glacial geology. For students interested in gaining first-hand research experience, there are a wide variety of projects that can stem from their immediate surroundings.

The Last Glacial Cycle in Wisconsin

Years Before Present	Events
100,000-32,000	Laurentide Ice Sheet expands and contracts over NA but is not recorded in Wisconsin
31,000	Advance of Laurentide Ice Sheet
29,000	Stable glacial maximum reached (LGM)
21,000	Retreat of Laurentide Ice Sheet
18,000-13000	Short-term advance and retreats
11,000	Laurentide Ice Sheet disappears from Wisconsin

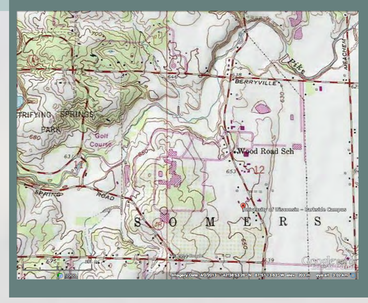
Geomorphology & Glacial Geology

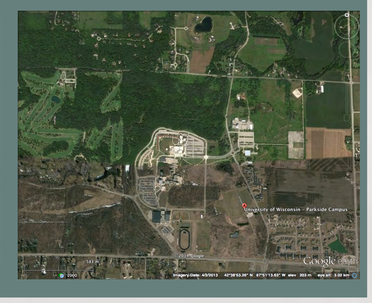
Link glacial landforms to processes, from ice ice motion to water flow
Tie landforms to paleoenvironments & modern use
Distinguish between human and natural influence

Learning Goals & Tasks

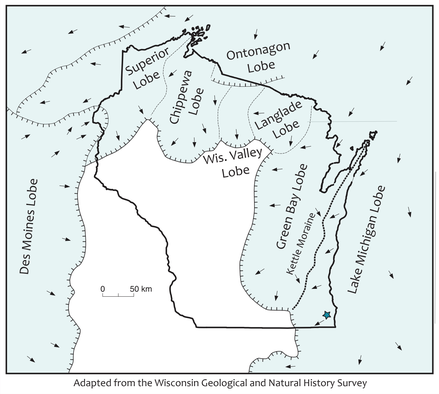
- Use Google Earth and/or ArcGIS
- Identify different landforms
  - Maps/Aerial Photographs
  - In Situ
- Model glacial and water flow

Example: Students use Google Earth to find local (and global) glacial landmarks. They can take elevation profiles of many features to see distinctive properties, like the shape of an esker. Students can find locations of visible surface features that we later visit in field trips. Tying in humans and vegetation, they can then look at how the natural features can be influenced by man-made ones over time.

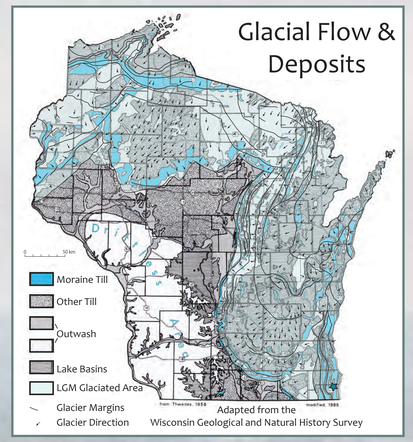




LGM Ice Lobes in Wisconsin



Adapted from the Wisconsin Geological and Natural History Survey



Sedimentology & Stratigraphy

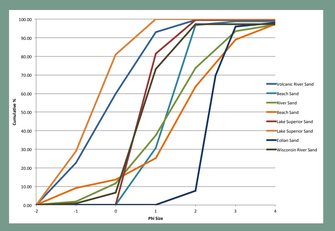
Distinguish sediments formed through different processes and influences
- Fluvial
- Lacustrine
- Ice-carried

Link sediment deposits to their provenance

Learning Goals & Tasks

- Sieve sediment
- Identify granular properties
  - Shape
  - Size Distributions
  - Basic mineraology
- Present granular data

Example: Students each had one of 8 sediment samples from a variety of locations. They were asked to find the grain size distribution of the samples. Using various resources, such as their textbook (Boggs, 2012), they were to identify and justify a depositional environment for the sediment. They also compared their samples to other samples that were similar and vastly different.



Sample #	2				
Phi Units	Mesh Size (mm)	Sieve No.	sample weight (g)	weight (%)	cumulative %
Total Sample Before Sieving			246.01		
Total Sample After Sieving			243.35		
-2	4		0.00	0.00	0.00
-1	2	10	0.06	0.02	0.02
0	1	18	0.16	0.06	0.08
1	0.5	35	75.18	30.56	30.64
2	0.25	60	162.87	66.20	96.84
3	0.125	120	5.03	2.04	98.88
4	0.0625	230	0.00	0.00	98.88
		Sum	243.30		
Sample Loss/Gain			2.66		

In the future, this will involve using samples collected by students in this course or independent study students, with specific moraine and till plain samples.

Independent Studies & Research Projects

Investigate short-length scale variations in till properties
Tie these variations to processes and/or provenance

Learning Goals & Tasks

- Plan and implement a local field study
- Process sedimentary samples
- Analyze statistics of samples
- Interpret results
  - Provenance/Locality
  - Glacial & glaciofluvial processes

Example: One student's family owns property "Up Nort" with an esker running through it. This student will make a plan to sample till at a variety of depths along the esker. They will then use various properties of the sediments to relate (hopefully) to depositional environments, distance from source, depositional energy, etc.

References

- Attig, J., et al., Glaciation of Wisconsin, Educational Series 36, Wisconsin Geological and Natural History Survey, 2011.
- Hubbard, B. and Glasser, N., Field Techniques in Glaciology and Glacial Geomorphology, Wiley, 2005.
- Lueck, L. and Johnson, B., Lithologic and particle-size change of outwash sands and gravels along flowpaths of the Green Bay Lobe during the Wisconsin episode deglaciation, Eastern Wisconsin, GSA North-Central Section - 48th Annual Meeting, 2014.