Applications of Surficial Geology data

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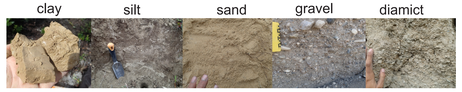
Surficial geology maps provide information on:

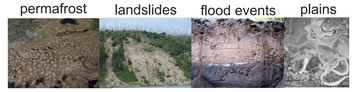
Areal distribution of different sediment types

clay | silt | sand | gravel | diamict



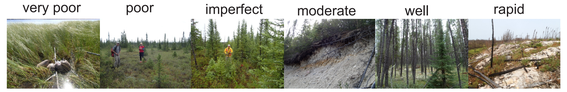
Hazards

permafrost | landslides | flood events | flood plains



Drainage

very poor | poor | imperfect | moderate | well | rapid



Till composition

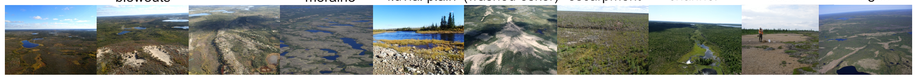
shield | mixed | carbonate

Geologic origin (genesis)

bedrock | glaciolacustrine over till | glaciofluvial | till: basal | till: ablation/melt-out | marine | organic

Geomorphology (landform)

organic plain | active eolian blowouts | eolian dunes | Rogen moraine | active fluvial plain | marine beaches (washed esker) | wave-cut escarpment | meltwater channel | raised beach | crevasse ridges



Questions surficial geology can help to answer

Where to find the correct sampling material for drift exploration

Right of way routing (pipeline, powerline, road)

Hazard mitigation and/or avoidance during planning and construction
- -susceptibility to flooding, erosion (slope or surface), gullying, landslides, slumps, debris flows

Aggregate resource management
- -sand and gravel locations, size of potential deposits
- -field site data can provide detailed grainsize information

Construction-material sourcing (clay caps, carbonate-rich sediment, etc)

Initial outline of engineering characteristics (layering, plasticity, ground ice presence, depth to bedrock, boulder content....)

Land capability for agriculture (stonieness, clay content, relief, drainage)

Ecology and wildlife inventories (physical basis for soil and biophysical studies)

Derivative maps

Aggregate

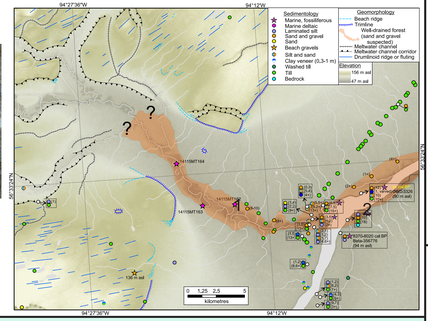
Aggregate potential maps can be generated from surficial geology maps, by highlighting polygons classified as:
- -esker, kame, terrace (glaciofluvial)
- -delta, fan-delta, fan (glaciolacustrine, glaciomarine, glaciofluvial)
- -beach ridge (glaciolacustrine, glaciomarine)

Post-glacial (fluvial, alluvial, lacustrine, marine) deposits may also provide aggregate.

*Variations such as clast abundance, clast quality (granitoid vs carbonate) and degree of sorting, mean that any 'potential aggregate' polygons must be field-verified to confirm quality.

Exposure of glaciofluvial outwash gravels in the Fox Lake area. The deposit infills a large meltwater channel system extending along the Limestone river.

Exposure of glaciofluvial terrace gravels in the Fox Lake area. The deposit infills a large meltwater channel system which continues along the Nelson River. The deposit is poorly-sorted at this site.

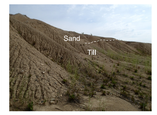


Hazard: Surficial geology maps can be used as a 'first pass' method of assessing:

a) Erosion potential, based on soil texture and slope.

Erodibility Classification	Soil Type	Soil Erodibility Rating
Most	Silt	High
	Silty Loam	High
	Silt Loam	High
	Silty Sand	High
	Sandy Loam	Medium
	Loamy Sand	Medium
	Sandy Clay Loam	Medium
	Sandy Loam	Medium
	Sandy Clay	Low
	Clay	Low
	Silty Clay	Low
	Loamy Sand	Low
	Sand	Low
	Poorly Graded Gravel	Low
Least	Well Graded Gravel	Low

Source: Adapted from Alberta Transportation (2007)



Once the vegetation cover is removed, the sediment is exposed to water erosion through overland/groundwater flow.

Each sediment type responds differently to erosion.

b) Terrain stability, based on identification of existing colluvial deposits, and/or landslides.

Slump within marine clays, and resulting earthflow over stronger till; Churchill River (summer 2014)

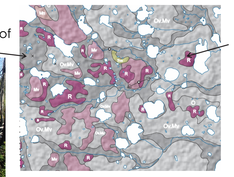
Runout zone within Quaternary sediments, near South Knife Lake (summer 2013).

Slump and earthflow within Quaternary sediments, above Paleozoic bedrock; Churchill River (summer 2014).

Bedrock outcrop location

The majority of Manitoba is covered by Quaternary sediments. Surficial geology maps capture the location of bedrock outcrops, and can be a good source to use when planning a bedrock field project. Keep in mind that older pre-GPS maps may have "suggested" rather than actual locations.

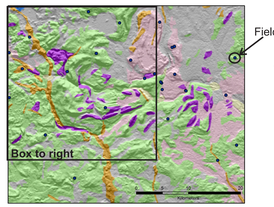
Point
Small outcrop within a polygon of different material



Polygon
Bedrock outcrop large enough to appear at the map scale

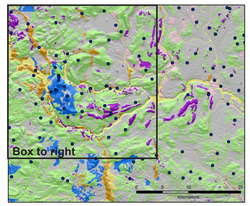
*Remember that maps are a mixture of air-photo interpretation and ground-truthing. Data is 99% trustworthy only if there is a field-site symbol. If not....user beware.

Caution about scale: Derivative products and infrastructure decisions MUST be made using the appropriate scale map.



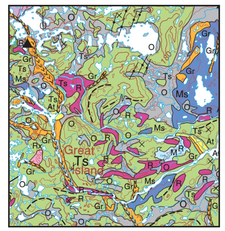
1:500 000 scale map
-fewer field sites
-regional map data
-simplified labels

Simplified digital maps

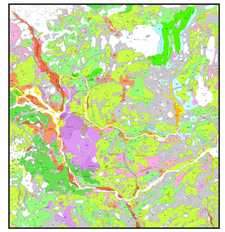


1:50 000 scale map
-more field sites
-more map detail
-more complex labels

*Looking at the number of field sites, this map would provide a guideline of what to expect in this area - BUT property-scale maps should still be produced for Local Study Areas; especially where polygons were not field-verified.



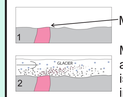
Excerpts from published PDF maps



1:50 000 scale maps may be useful for regional projects, while 1:20 000 to 1: 5 000 scale maps will provide more accurate data for property-scale projects

Drift prospecting (*Modified from GSC Open file 7261)*

The mineral and chemical composition of till samples can be assessed for anomalous element enrichments, which can then be traced back to the bedrock source.



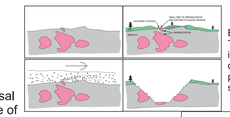
Mineralized zone at surface

Mineralized zone eroded by a glacier; mineralized debris is transported 'down-ice' in the direction of glacier flow.

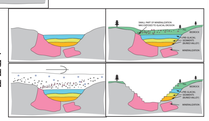
After glaciation, glacial dispersal train (pink) in till (green); scale of dispersal depends on numerous factors.

But remember that the lack of exposure of mineralization to glacial erosion might have limited glacial dispersal.

Stratigraphy is important!



Based on Gibraltar Mine in BC. The small dispersal train was NOT indicative of the entire extent of the deposit, because only a small portion of the deposit outcrops at surface.



Based on Highland Valley Mine in BC. The presence of thick pre-exising sediment limits the amount of mineralized detritus that can be eroded and transported by the glacier.

Manitoba