

**July 19, 2021**

## **Notes and News**

A few items in the news that I thought were interesting:

- Researchers [David Peterman and Kathleen Ritterbus at the University of Utah](#) have been experimenting with full scale models ancient cephalopods, such as [Baculites compressus](#), to test their theories on how these creatures moved in the [epicontinental sea](#).
- Mexican geologists from the National Autonomous University (UNAM) have [discovered a new species of fossil fish](#). The fossil fish, now named *Choichix alvaradoi*, lived during the Cretaceous and is related to modern fishes such as bream, bass and snapper. The discovery was made in a quarry near [Ocozocoautla de Espinosa](#), located about 30 kilometres from Tuxtla Gutiérrez, the capital of [Chiapas](#).
- Geohazards: many deaths due to serious flooding this summer in [Belgium, Germany, Luxembourg and the Netherlands](#); see also this [report](#) and [this report](#).
- [Depletion of conventional oil resources](#) continues as [demand for petroleum product increases](#) with the return to near normal activity after the COVID-19 lockdowns. Be prepared for an increase in fuel prices.
- Congratulations to [Kevin Ansdell, PhD](#), on his election to be the president of [Geoscientists Canada](#) for 2021-22.

On another note, if you plan to be in Saskatoon, take some time to visit the [Geology Building](#) on the campus of the University of Saskatchewan. Here are some pictures I took recently during a trip to Saskatoon.



Fossils of Triceratops, T. Rex and a mosasaur

Fossil of a Stegosaurus



A model of pterodactyl

This monument to the 46th Battalion, CEF, AKA "[The Suicide Battalion](#)", is just down the path from the Geology Building.

The armoury of the [North Saskatchewan Regiment](#) (N Sask R) in Saskatoon is named after a heroic member of the 46th Battalion, CEF, [Sgt. Hugh Cairns, V.C.](#) As a former member of the N Sask R, I can attest that the ethos of the Suicide Battalion lives on in the mission oriented tradition of the N Sask R. A friend and co-worker, who served in another militia unit, remarked to me when I told him of my previous service in the N Sask R, stated bluntly: "those @\$%&\*! people are crazy, they'll do anything to get the job done". I took it as a profound compliment.



July 19, 2021

## Depositional Environments for Sedimentary Rocks - Part 2, Glacial Deposits



**Figure 1 - Nathorst glacier, Svalbard**

**Credit: AWeith, [Creative Commons Attribution-Share Alike 4.0 International license](#)**

Let's look again at the table of terrestrial depositional environments from last week and then discuss the first one on the list: glacial deposits. We'll look at glaciations and ice ages as a whole in another blog posting; here we'll just look at the sedimentary deposits left by glaciers.

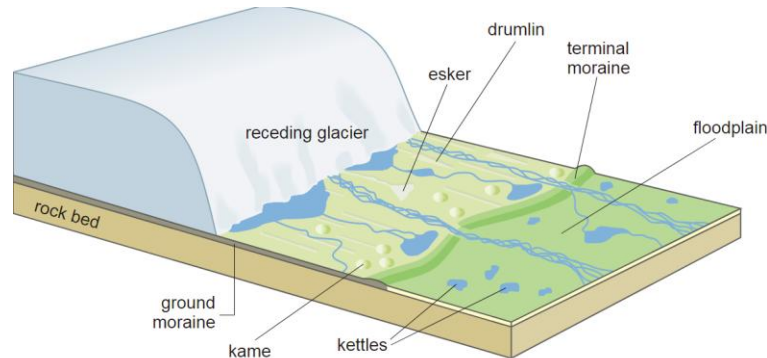
<b>Table 1 - Terrestrial Depositional Environments</b>			
<b>Environment</b>	<b>Key Transport Processes</b>	<b>Depositional Settings</b>	<b>Typical Sediments</b>
<b>Glacial</b>	Gravity, moving ice, moving water	Valleys, plains, streams, lakes	Glacial till, gravel, sand, silt, clay
<b>Alluvial</b>	Gravity, moving water	Where steep-sided valleys meet plains	Coarse angular fragments
<b>Fluvial</b>	Moving water	Streams	Gravel, sand, silt, organic matter
<b>Aeolian</b>	Wind	Deserts and coastal regions	Sand, silt
<b>Lacustrine</b>	Moving Water	Lakes	Sand, silt, clay, organic matter
<b>Evaporite</b>	Still water	Lakes in arid regions	Salts, clay

**Credit: [Steven Earle, Creative Commons Attribution-Noncommercial-Share Alike 4.0 International License](#)**

## Types of Glacial Deposits

The weight of glaciers grinds up the land beneath them. The ground up material becomes [moraine deposits](#) when the glaciers retreat. Meltwater from glacier can form glaciofluvial deposits such as eskers, drumlins and outwash deposits. The meltwater can also form glaciolacustrine lakes.

Figure 2 shows some of the general types of glacial deposits:



**Figure 2 - Glacial Landforms**

**Credit:** [Hans Hillewaert](#), [Creative Commons](#), [Attribution-Share Alike 3.0 Unported](#) license.

## Moraine - Glacial Till

When glaciers move across the landscape, they erode the underlying bedrock into a moraine deposit containing glacial till or [diamicton](#). The nature of the glacial till depends on the character of the underlying bedrock out of which it was made. For example, the [Surficial Geology of Southern Manitoba](#) shows three kinds of till in Manitoba: a calcareous clay diamicton, largely derived from Mesozoic; a calcareous silt diamicton, largely derived from Paleozoic dolomite and limestone; and a non-calcareous sand diamicton, largely derived from Precambrian crystalline rock. In general, glacial till is [poorly sorted](#), i.e. it is a mixture of grains of all grain sizes from clay sized to boulders.

Retreating glaciers can leave hills of moraine and small pothole lakes. This is called [kame and kettle topography](#).

Glacial till from glaciations prior to the current Quaternary Ice Age formed deposits that [lithified](#) into rocks called [tillite](#). (We are still in an Ice Age, we're just in an interglacial between glaciations.) These prior glaciations include the [Karoo Glaciation](#) during the Carboniferous and Permian, the [Andean-Saharan Glaciation](#) during the Ordovician and Silurian, the [Cryogenian Glaciation](#) during the Neoproterozoic, and the [Huronian Glaciation](#) during the Paleoproterozoic.

## Glaciofluvial Deposits



**Figure 3 - Esker Ridge in Bow Valley Provincial Park, Alberta**

**Credit:** [Georgialh, Creative Commons Attribution-Share Alike 4.0 International](#) license

Glaciolacustrine deposits are formed by water flowing under glaciers. [Eskers](#) are long sinuous ridges deposited by meltwater streams that flowed under glaciers. They are made up of graded sand and gravel. Often eskers are important sources of aggregate for road construction.



**Figure 4 - Drumlins Near Friedrichshafen, Germany**

**Credit:** [Martin Groll, Creative Commons, Attribution 3.0 Germany](#) license.

[Drumlins](#) are tear drop shaped hills with the tail pointing in the direction of glacial flow. They are made up of graded layers of clay, silt, sand, gravel and boulders.

The exact mechanism of drumlin formation is not well understood. [Recent observations](#) of glacial retreat in Iceland suggest that drumlins grow during quiet intervals of normal glacial flow in between periods of rapid glacial movement or surges. Jerome Lesemann, a geologist from Vancouver Island University, has a good video on the creation of drumlins [here](#). One of the suggestions is that the large drumlin fields in North America were formed by the catastrophic release of water.

Another kind of glaciofluvial deposit is the [outwash plain](#) or sandur. As the name suggests, outwash plains are deposited by meltwater flowing off a melting glacier. Outwash deposits are mostly sand and gravel.

### **Glaciolacustrine Deposits**

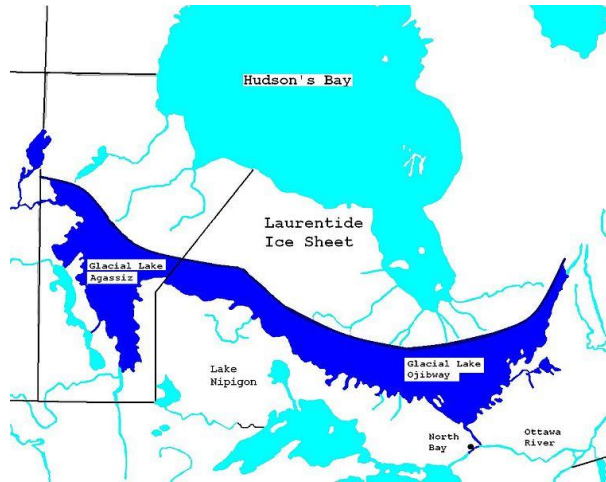


**Figure 5 - Moraine Lake, Banff National Park, Alberta**

**[Credit: Tobias Alt, Tobi 87, Creative Commons, Attribution-Share Alike 4.0 International, 3.0 Unported, 2.5 Generic, 2.0 Generic and 1.0 Generic license.](#)**

Glacial meltwater can accumulate in lakes, some of them strikingly beautiful such as Moraine Lake in Banff National Park, Alberta. Glaciolacustrine deposits are generally stratified sand, silt and clay. They can also contain [ice rafted boulders](#), that is, large rocks carried by icebergs that melted in the lake.

During the melting of the continental glaciers at the end of the Pleistocene and beginning of the Holocene, huge glacial meltwater lakes formed on the edge of glacier, as in Figure 6.



**Figure 6 - Glacial Lakes Agassiz and Ojibway, 7900 YBP**

**Credit: [Chris Light](#), [Creative Commons](#), [Attribution-Share Alike 3.0 Unported](#) license from [Teller and Leverington, 2004](#)**

## Loess Deposits



**Figure 7 - Loess Hills, Iowa**

**Credit: [U.S. National Archives and Records Administration](#), [public domain](#)**

[Loess](#) forms when wind blows dust off the outwash plains in front of continental glaciers. It is primarily very fine grained sand and silt. It forms fertile land that is easily eroded. One example in the United States are the [Loess Hills of Iowa](#). Another important loess deposit is the [Loess Plateau of China](#).

## Standard Caveat

The purpose of my weblog postings is to spark people's curiosity in geology. Don't entirely believe me until you've done your own research and checked the evidence. If I have sparked

your curiosity in the subject of this posting, follow up with some of the links provided here. If you want to, go out into the field and examine some rocks on your own with the help of a good field guide. Follow the evidence and make up your own mind.

**In science, the only authority is the evidence.**