Curricular Outcomes:

Big Idea: *Weathering and erosion processes continually reshape landscapes through the interaction of the geosphere with the hydrosphere and atmosphere.*

Content: *Weathering and erosion processes; periods of glaciation.*

Introduction:

While we have had at least four large-scale Ice Ages in Earth's past, the Quaternary glaciation (also known as the Pleistocene glaciation) has been a focal point for us at the Beringia Centre due to the abundance of quality mummies, fossils, and other artefacts that come out of the frozen grounds of unglaciated areas from this time. Above the frozen ground, to the east of the unglaciated areas of the territory, is a plethora of evidence of this glaciation, in the form of both erosional and depositional glacial features.

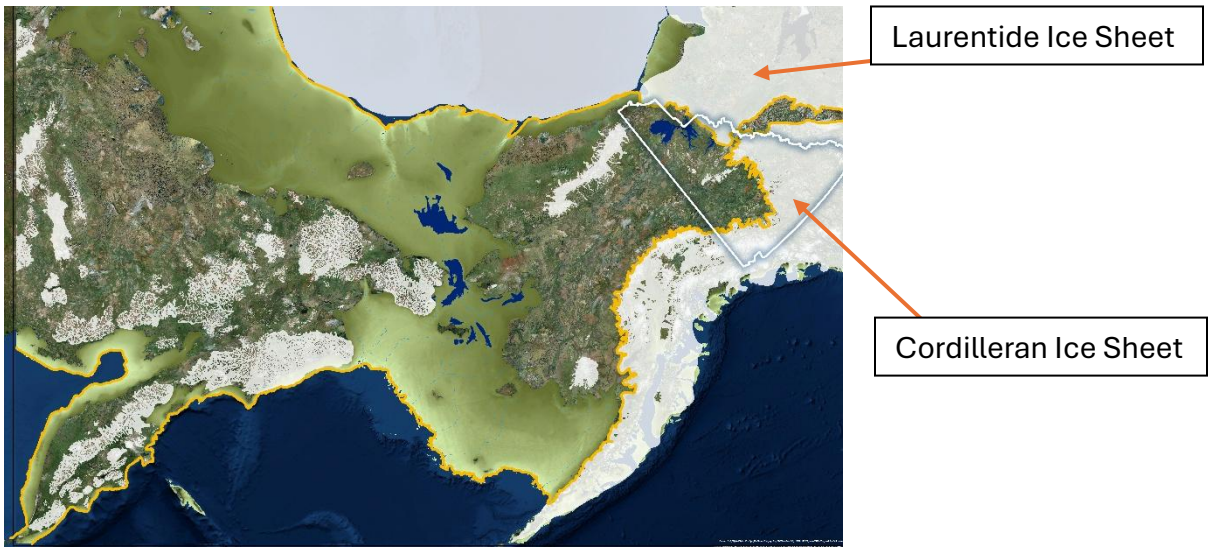
Ongoing Activity: Ice Cube Glaciers

This is an activity you can begin at the start of this lesson, as it will take some time (sometimes up to 10-15 minutes) for the ice to fully melt to the point of changing the landscape. I recommend discussing the content of this lesson while the ice melts.

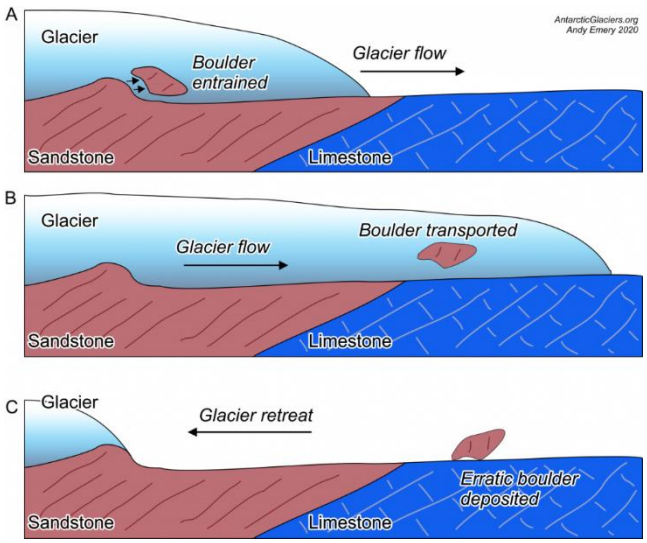
For this activity, you will need: **an ice cube tray (with ice cubes made ahead of time), a plastic container, rockets (candy), and sand.**

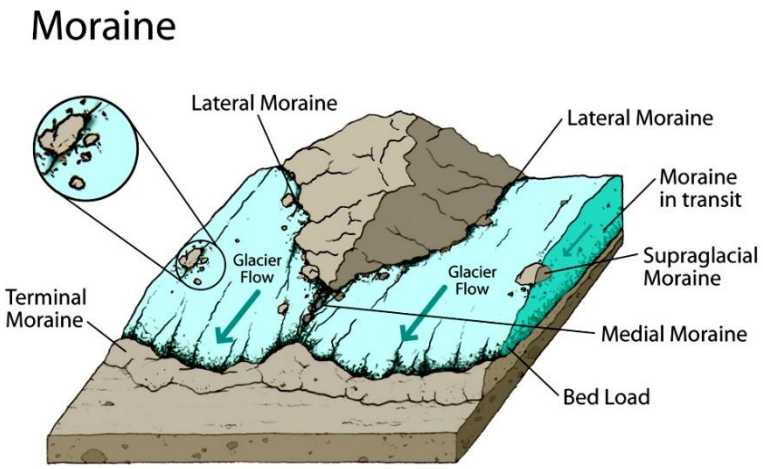
Prepare your "mountain range" by filling a lunch-sized container halfway with sand. You will then arrange this sand into 2-3 mountains by piling it up in mounds (it can also help to pick up some sand and pour it out of your hands in a pile). It's helpful for the demo to arrange two mountains side-by-side on one end of the container, and then one large mound on the other side. Crush up a few rockets and place them where you plan on placing your ice cubes. Place one ice cube in between the two smaller mountains, and an ice cube on top of the larger mound. When the ice melts, it will impact a) the space in between the two smaller mountains, and b) the shape of the top of the larger mountain. Revisit the container periodically, and once the ice is almost or fully melted, get students to give you some observations regarding changes to the "landscape".

Across the Yukon, there is evidence of both **continental** and **valley glaciers**. Continental glaciers, as the name suggests, is the larger of the two, and can cover a massive amount of land. These glaciers are also called **ice sheets**. The cordilleran ice sheet expanded into the Yukon from the south at the height of the last glacial maximum, and the mighty Laurentide ice sheet, which covered most of Canada, covered small parts of central-eastern Yukon. The presence of glaciers in an area *usually* correlates with a lack of fossils and ice age faunal remains, as the glaciers move and "bulldoze" the ground beneath - which can churn up artefacts if not destroy them. Despite this lack of faunal remains, the clues these glaciers have left behind on the land have helped inform scientists of not only the extent to which these ice sheets grew, but also how this could have impacted the surrounding area(s).



Erosional glacial features are those primarily created by the *scraping* of glaciers across the land. When glaciers exist on the land, there may be opportunities for water at the bottom to seep into the rocks underneath. When this water freezes within the rock, it expands and causes the rock to break apart and be carried away with the glacier as it moves. It is this loose rock, at the bottom of a glacier, that causes much of the physical abrasion we can see today. Large pieces of rock that are transported by a glacier are called *erratic boulders*. We can see these scratches as *glacial striations*, and they are a product of both continental and alpine glaciers moving along the land. When an alpine glacier is moving, it may go beyond simple striations – glaciers can carve valleys. When a glacier is moving in between two peaks, it can transform a V-shaped valley into a U-shaped one.





Above are two images: on the left, a diagram showing the progression of an erratic boulder; on the right is an image portraying some examples of moraines. While both erratic boulders and moraine material is similar in the sense that they both contain rocks and debris transported by glaciers, moraines are a *collection* of various-sized rocks, which usually appear today as a major landscape feature (along hills or mountains), while an erratic is just one big boulder, such as the *Okotoks Erratic*. Sometimes, these varied glacial deposits are reworked by the subsequent meltwater. This results in materials that *could* have originally been defined as moraine but are usually organized by size as rivers carry them downstream. This results in outwash plains, eskers, and kames, to name a few.

All of this activity would be taking place *each time* the ice sheets expanded over the Yukon. This happened at least seven times in Whitehorse when glacial periods were at their peak. Lasting anywhere from 60,000 to 100,000 years, these glacial periods dominated much of the recent past. Warmer, shorter interglacials came in between glacial times, as the name suggests, and were only about 10,000 to 15,000 years long. It is believed that we are currently within an interglacial period, the *Holocene*, and this began roughly 11,000 years ago.

Discussion Questions:

1. What happened to the mountains and terrain in the plastic bin as the ice melted? How about when the ice was fully melted? Explain how the looks of the terrain changed.

2. Can you define some glacial deposits left in the wake of the melting mini glaciers? If not a specific type of deposit, what kind of general glacial deposits can you see?

3. How would you explain glacial deposition to someone who has never heard of this process before?

4. Along the **side** of a hypothetical mountain, there is an accumulation of rock material that runs from top to bottom, with clear remnants of a glacier around the base of the mountain. How would you define this accumulation based on images above?

5. Explain how the albedo effect caused glaciers in the Yukon to melt faster and faster as the glacial period came to an end.

6. If the current interglacial period began around 11,000 years ago, should we expect another glacial period anytime soon? Why or why not?