LEARNING PORTAL

ROYAL BC MUSEUM

Mountain Dinosaur Bone Search

Lesson Plan

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Rationale

This lesson can be used as an introduction to the Grade 7 geology unit. It could be used as a stand-alone activity, or done before or after visiting the *Dinosaurs of BC* exhibit at the Royal BC Museum or alongside the dinosaur Digital Field Trip. Students will be looking at 3D bone images of the mountain dinosaur (*Ferrisaurus sustutensis*) on the Learning Portal and piecing together fossil evidence like a palaeontologist. Students will also use an online simulation to understand how the Earth and climate changed over geological time.

First Peoples Principles of Learning

- Learning is holistic, reflexive, reflective, experiential and relational.
- Learning is embedded in memory, history and story.
- Learning involves patience and time.

Curriculum Connections

Grade 7 Science

Big idea: Earth and its climate have changed over geological time.

Curricular competencies:

- Identify a question to answer or a problem to solve through scientific inquiry
- Observe, measure and record data (qualitative and quantitative), using equipment, including digital technologies, with accuracy and precision
- Seek patterns and connections in data from their own investigations and secondary sources
- Use scientific understandings to identify relationships and draw conclusions
- Demonstrate an understanding and appreciation of evidence (qualitative and quantitative)
- Communicate ideas, findings and solutions to problems, using scientific language, representations and digital technologies as appropriate

Content: The fossil record provides evidence for changes in biodiversity over geological time.

Estimated time required: 120 minutes

Lesson Activities

Materials

- Computer and internet access
- Buster Bone Search Worksheet
- Scissors
- Glue

Part 1: Meet Buster—class discussion (30 min.)

1. Start a KWL list in the class: ask students what they *know* about dinosaurs and what they *want to know*. (We will return to what they *learned* at the end of the lesson.) Explain that palaeontology is the study of ancient life including dinosaurs. Palaeontologists study fossils, which are traces of animals and plants from the past like bones, footprints, leaves or shells.
2. Did students know that dinosaurs could be found in BC? Explain that many dinosaur fossils have been found in northeastern BC near places like Tumbler Ridge. In fact, British Columbia is home to one of the best dinosaur footprints and trackways in the world. The province's mountainous topography makes it challenging to access fossils compared with Alberta's badlands, but it doesn't mean that we can't find them!
3. Introduce students to Buster, the mountain dinosaur of BC. Show the introductory video, "This Week in History: A New Dinosaur for BC." After the video, review the key pieces of information below.

Buster's scientific name	Buster's scientific name is *Ferrisaurus sustutensis*, meaning "the iron lizard from the Sustut River." Explain that scientific names are made up of two parts, the genus and the species. Students may be familiar with the Latin name for humans, *Homo sapiens*.
Buster's family	Buster belongs to a family of dinosaurs called Leptoceratopsidae. The well-known triceratops are also a part of this group, but they had horns on their head, whereas Buster did not.
Where Buster was found	Buster was found on a railway line near Smithers. This is the traditional territories of the Nedut'en/Witsuwit'en-, Tse'khene- and Gitsenimx-speaking peoples. Learn how to pronounce these territories correctly: watch this video, or click on the areas in this First Peoples' map of BC.
Who discovered Buster	Kenny F. Larsen, a geologist, discovered Buster's bones by accident in 1971.
Who identified Buster	Dr. Victoria Arbour, curator of palaeontology at the Royal BC Museum, identified *Ferrisaurus sustutensis* as a new species.

Part 2: Fossil puzzle—small group activity (45 min.)

1. Explain that students will now look further at how Dr. Victoria Arbour pieced together Buster's skeleton. Distribute the Buster Bone Search Worksheet, scissors and glue. Ask them to go to the Royal BC Museum's Mountain Dinosaur of BC Learning Portal pathway. Depending on the number of computers available, students can work on their own or in small groups to complete the sheet. Some additional tips:
    - Emphasize the process of thinking, rather than getting the fossil pieces in the right place. It is normal for groups to have slightly different responses, such as the orientation of the bone.
    - Borrow human anatomy books from the school library if available. It might help students to visualize the human skeleton further.
    - If students finish the activity early, encourage them to visit other parts of the pathway on the Learning Portal. See extension activities on the worksheet.
2. When all groups have completed the worksheet, show students the complete image of Buster's skeleton. What was correct, and what was tricky? Invite students to explain how they put the fossil bones together. Encourage them to explain their thinking by asking, "What makes you say that?" This is also a great opportunity to address the common misconception that students have about science: that scientific facts are absolute and never change. Science is grounded in evidence-based reasoning. As more information becomes available over time, scientists need to adjust information that was previously considered to be "true."

Part 3: Changing Earth—teacher-led activity (45 min.)

1. In this lesson, students will learn about what BC looked like when Buster lived on Earth. As a class, listen to Dr. Victoria Arbour discuss "Climate Change and Plate Tectonics in BC." Students can take notes while they listen to the recording. Review the following key points with the class.

Time	Buster lived on Earth about 67 million years ago, near the end of the age of dinosaurs. An asteroid caused a mass extinction of dinosaurs at the end of the Cretaceous period (66 million years ago).
Environment	Buster lived in a dawn redwood forest in northern BC. There were flowering trees and ferns in the lush forest, making it an ideal environment for herbivores like Buster. In 1971, Buster's bones were found along a BC railway line in a grassy area. This suggests that the environment changed over time.
Climate	The climate in northern BC was subtropical and warmer 67 million years ago. This is because BC was located further south owing to the movement of plate tectonics.

2. For the rest of this activity, you will be showing how the Earth and its climate changed over time using the HHMI EarthViewer. (Click on Start Interactive, and make sure Paleo Earth is selected in the left column.) First, review how geological time is divided into eons, eras and periods. Explain that

dinosaurs lived in the Mesozoic era across three periods called the Triassic, Jurassic and Cretaceous periods. For more on geological time, you can show these videos:

- PBS's "A Brief History of Geologic Time"
- "Earth's Entire History (Visualized on a Football Field)"

3. Next, show how land masses moved throughout time. Use the slider on the left to move through the Phanerozoic eon. Ask students to focus on how Los Angeles and Calgary (closest city markers to BC) move over time. They should see that BC was once a part of an island chain, which eventually drifted upwards to connect with North America. The climate would have been warmer 67 million years ago, allowing many plants and animals to flourish during that time.
4. Lastly, explore how the biodiversity on Earth changed over time. Click on Charts and then Biodiversity at the bottom. This will produce a graph showing the number of marine animals over time. Explain how to read this graph (*mya* is million years ago), and ask what patterns they notice. Some tips for guiding the discussion:
    - The graph shows a general increase in biodiversity over time. These correlate to the increase in available oxygen and decrease in carbon dioxide on Earth. Move the slider to see how these change over the Phanerozoic eon. More oxygen allowed larger active animals to meet their metabolic demands.
    - Do students see any sudden changes in biodiversity? There are five points on the graph where the biodiversity drops suddenly, which correspond to mass extinctions. There were five mass extinctions on ancient Earth: at the end of the Ordovician period (444 mya), Devonian period (360 mya), Permian period (252 mya), Triassic period (201 mya) and Cretaceous period (66 mya). Click on View and then Mass extinctions at the bottom to see them on the timeline.
    - The famous extinction of dinosaurs at the end of the Cretaceous period is called the K–Pg (Cretaceous–Paleogene) extinction event. Watch this video to learn more about how an asteroid caused a mass extinction of dinosaurs. The impact of this asteroid can be seen today at the Chicxulub crater in the Yucatán peninsula in Mexico.
5. Wrap up the activity with a quiet reflection exercise. Ask students to reflect about what they learned over the lessons in their notebooks. They can use the prompt "I used to think . . . Now I think . . ." When they're ready, ask them to share their final thoughts with the class. Add this to the L section of the KWL list from part 1.