

# SECRETS OF THE LOST QUARRY

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## PROGRAM OVERVIEW

TOPIC: Discovering the wonders of lost and mystery quarries

THEME: Through gathering clues to locate a mystery quarry, the participants will understand the geology and palaeontology of the badlands.

PROGRAM DESCRIPTION: During a virtual trip along a route to reach a potential mystery quarry, students are introduced to the palaeoenvironment, glacial history, and rock types of the valley. At the site, students sort through fossil and rock matrix, searching for quarry trash, and fossil evidence to solve the mystery of this quarry.

AUDIENCE: Grades 2–6

## CURRICULUM CONNECTIONS

- Grade 2     **Science:** Exploring Liquids; Small Crawling and Flying Animals
- Grade 3     **Science:** Rocks and Minerals
- Grade 4     **Social Studies:** Alberta; The Land, Histories and Stories
- Grade 5     **Social Studies:** Canada; The Land, Histories and Stories
- Grade 6     **Science:** Evidence and Investigation

## PROGRAM OBJECTIVES

Students will be able to:

1. Identify at least three different rocks in the badlands (sandstone, mudstone, ironstone, coal, glacial erratic).
2. Identify the main features of the badlands (cactus, hoodoos, sinkholes).
3. Describe how fossils are found and how to tell fossil bone from stone.
4. Describe how the badlands were formed.

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## SUGGESTED PRE-VISIT ACTIVITY

### 1. PROGRAM TERMINOLOGY

Introduce these terms to your class prior to your program at the Royal Tyrrell Museum to ensure your students are comfortable with the information presented.

**Badlands:** an arid terrain where sedimentary rocks have been extensively eroded by water and wind. Canyons, ravines, gullies, hoodoos, and other such geological formations are common in the badlands.

**Bentonite clay:** clay generated by the alteration of volcanic ash. Its main constituent is montmorillonite.

**Coal:** results from the compression of accumulated peat in ancient swamps. The Drumheller area contains mostly bituminous coal.

**Coulee:** comes from the French word *couler* meaning “to flow.” Coulees are commonly canyons or valleys characterized by steep walls that have been shaped by erosion.

**Cretaceous Period:** the third and last period of the Mesozoic Era, from 145 – 66 million years ago.

**Deposition:** the accumulation of sediments.

**Erosion:** the group of processes that loosen or dissolve rock material and transport it, mainly by water, ice, wind, and gravity.

**Erratics:** rocks that are mostly igneous or metamorphic that have been transported through glacial action and deposited after meltwaters have receded.

**Field jacket:** a covering of burlap and plaster that protects a fossil during transport.

**Fossil matrix:** concentrated fossil and rock material that has been processed by screen washing.

**Fossilization:** the process that preserves the remnants, impressions or traces of an organism in rock, over time.

**Geology:** the scientific study of the origin, history and structure of the Earth.

**Glaciation:** the scouring and wearing down of the earth through erosion and deposition by glaciers.

**Hoodoo:** a mushroom-shaped rock formation which is caused by differential resistance to erosion.

**Igneous rock:** rock formed from the solidification of cooled magma (molten rock).

**Ironstone:** iron-rich sedimentary rock formed when minerals in groundwater seep through layers of rock, converting it into consolidated rock.

**Joseph Burr Tyrrell:** (pronounced TEER-uhl). He was a Canadian geologist, cartographer, and mining consultant who accidentally discovered dinosaur (*Albertosaurus*) bones in Alberta’s badlands near Drumheller in 1884. He had been sent to the area by the Geological Survey of Canada to look for coal.

**Metamorphic rock:** sedimentary or igneous rocks that have been altered by heat and/or pressure.

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**Mudstone:** sedimentary rock formed from the deposition of fine particles of mud in low-energy environments (slow-moving water).

**Palaeoenvironment:** the environment of the ancient past.

**Palaeontology:** the study of ancient plant and animal life through the fossil record.

**Quarry:** a place of excavation/digging where, in this case, fossils are recovered.

**Sandstone:** sedimentary rock formed from the deposition of sand in high energy environments (fast-moving water). Drumheller sandstone is white.

**Sedimentary rock:** rocks formed by the accumulation and consolidation of mineral and organic fragments that have been deposited by water, ice or wind.

**Sedimentation:** the deposition of the material from which sedimentary rocks are formed.

**Sediments:** the solid materials that are the result of weathering and erosion.

**Stratigraphy:** the study of rock layers, their formation, composition, and sequence.

**Weathering:** the group of processes, both chemical (air, rainwater, plants, bacteria) and mechanical (changes of temperature), that change the character of a rock, but does not move it.

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## POST-PROGRAM ACTIVITIES

### 1. ROCK SORTING

Have a selection of different rock types (sedimentary – sandstone, mudstone, ironstone, coal; glacial – igneous and metamorphic). Identify and match to an environment.

### 2. RESEARCH THE “GREAT CANADIAN DINOSAUR RUSH”

**Older grades:** Identify one or two of the famous fossil hunters and what they discovered.

**Younger grades:** Imagine being one of these fossil hunters and finding a special fossil. What story can you tell? How did you find it? What did you do with it? What was the fossil?

<http://www.ucmp.berkeley.edu/diapsids/dinodiscoveriesna.html>

**Keywords:** Joseph Burr Tyrrell, Great Canadian Dinosaur Rush, Charles Hazelius Sternberg, Barnum Brown, William Cutler, early dinosaur discoveries

### 3. NEWSPAPER CLIPPING MYSTERY GAME

Select two (or more) newspapers (different dates) and find certain ads or classified announcements that are unique to a certain date or paper. Rip these pieces out and get the students to search for them in undamaged papers.

Make up a few questions on stories which can be verified by the matching of the piece(s) to a certain paper. Questions should not relate to the matched piece but should relate to the original paper.

Ask: (make up own examples) What is the name of the 2013 Nobel Peace Prize winner? Matched piece should show the student(s) the date and name of paper, which then contains this story. (This can be done as a scavenger hunt.

### 4. BONEBED TO ENVIRONMENT

Match fossil parts to body parts. Using pictures (preferably), tear fossil images into bits and have students reassemble using a fleshed out picture (do not necessarily need complete skeletons or fossils). Use different types of organisms to represent different habitats. Once images are constructed, have students reconstruct the environments represented by these fleshed-out images.

**Example:** make a “bonebed” of torn paper bits of a dinosaur, shells, plants, reptiles, or fishes. Have students try to identify the bits, reconstruct using full fleshed-out images to work with. A reconstruction of the environment would include: freshwater, marine, terrestrial, aerial.

**For accuracy:** try to select fossils from the same time period (Cretaceous, Devonian, or Carboniferous). Reconstructions will be a bit different.

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Examples of fossil images:

<http://www.bing.com/images/search?q=images+of+fossils&qpv=images+of+fossils&FORM=IGRE>

<http://www.fossilmuseum.net/Paleobiology/Cretaceous-Fossils.htm>

Examples for fleshed out:

<https://www.bing.com/images/search?q=images+of+cretaceous+life&qpv=images+of+cretaceous+life&FORM=IGRE>

**Keywords:** fossil images, Cretaceous fossils, fleshed-out dinosaurs

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