BADLANDS, GOODLANDS

PROGRAM OVERVIEW

TOPIC: Geology

THEME: Geology is an essential part of understanding our planet, both past and present.

PROGRAM DESCRIPTION: Bad or good! It depends on your perspective. To early explorers, the badlands posed many challenges, but to palaeontologists, they hold the mysteries of ancient life. Discover how the Alberta badlands came to be by learning the secrets of sedimentation, erosion, fossilization and glaciation through an interactive reader's theatre and a competitive game of "Geopardy."

AUDIENCE: Grades 7 – 12

CURRICULUM CONNECTIONS

Grade 3	Rocks and Minerals (Science)
Grade 7	Science: Planet Earth
	Social Studies: Canada: Origins, Histories and Movement of People
Grade 8	Science: Freshwater and Saltwater Systems
Grade 11	Science 20: The Changing Earth

PROGRAM OBJECTIVES

Students will be able to:

1. Explain how understanding geology is essential to interpreting fossils.
2. Describe and demonstrate one law or process of geology.
3. Describe how erosion is essential to the formation of the badlands and fossil discovery.
4. Identify the different steps in field palaeontology

The Badlands, Goodlands program is divided into two parts:

1. Story – Reader's Theatre Format: The story is a fictionalized narrative about Joseph Burr Tyrrell and his explorations of the Alberta badlands. Through the telling of this adventure story, the class will hear the key words used in context, either with an explained or inferred meaning. This will enable them to answer questions in the game.
2. Game: The game is a *Jeopardy*-style question and answer format where teams of students earn points for correct answers.

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SUGGESTED PRE-VISIT ACTIVITIES

1. PROGRAM TERMINOLOGY

Following are some terms you may want to go over with your class before you attend this program. These terms will help the students with the activities involved in the program.

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 badlands.

Palaeontology: the study of ancient life through the fossil record.

Geology: the study of the Earth, the rocks of which it is composed, and the changes which it has undergone or is undergoing.

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

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

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

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

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

Deposition: the accumulation of sediments.

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

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

Joseph Burr Tyrrell: pronounced teer-uhl. He was a Canadian geologist, cartographer and mining consultant who discovered dinosaur (*Albertosaurus*) bones in Alberta's badlands near where the Royal Tyrrell Museum now stands in 1884.

Sedimentary rock: rock that is made up of sediments that have been transported by water or precipitated out of solutions.

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

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

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

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

SUGGESTED PRE-VISIT ACTIVITIES

PROGRAM TERMINOLOGY (cont.)

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

Coal: results from the compression of accumulated plant material in ancient swamps. Drumheller has mostly bituminous coal.

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

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

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

Palaeoenvironment: the environment of the prehistoric past.

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POST-PROGRAM ACTIVITIES

1. WHAT DO YOU KNOW ABOUT JOE?

Let's learn more about Joseph Burr Tyrrell! Where did he live? Where was he born? What were his interests? Look up information about Joseph Burr Tyrrell and see what you can find out.

Suggested references:

Inglis, Alex. Northern Vagabond: *The Life and Career of J.B. Tyrrell*. Toronto: McClelland and Stewart, 1978.

Robertson, Heather. *Measuring Mother Earth: How Joe The Kid Became Tyrrell of The North*. Toronto: McClelland and Stewart, 2007.

http://www.mininghalloffame.ca

http://www.nrcan.gc.ca

(Keywords: Canadian Mining Hall of Fame, Joseph Burr Tyrrell, Geological Survey of Canada, *Albertosaurus sarcophagus,* Great Canadian Dinosaur rush)

2. BONE HUNTERS

After Joseph Burr Tyrrell left the valley, many fossil hunters followed, finding amazing and never-seen-before dinosaur specimens. Find out about these famous fossil hunters and some of their historic finds:

- Barnum Brown
- The Sternberg Family (Charles H. Sternberg and his sons George, Charles M. and Levi)
- William E. Cutler
- Lawrence Lambe

Suggested references:

Royal Tyrrell Museum. *Finders: A Century of Fossil Hunting in Alberta*. Drumheller, 2005.

David Spalding, *Into the Dinosaurs' Graveyard; Canadian Digs and Discoveries*, Doubleday Canada, Toronto, Ontario. 1999

(Keywords: Great Canadian Dinosaur rush, Bone Wars, Barnum Brown, William E. Cutler, Lawrence Lambe, Sternberg)

3. OTHER THAN THAT FOSSIL…

Trace fossils are fossils that represent the activities of ancient animals. They are geological records of biological activity. A coprolite (fossilized poop) is an example of a trace fossil. What other trace fossils exist?

Find out about these trace fossils and what could have left them behind:

- ichnites
- gastroliths
- molds
- casts
- burrows
- trackways

POST-PROGRAM ACTIVITIES

4. MORE FIELD JARGON

Jargon is another word for specialized language used in a job. Sometimes the words seem strange and are hard to figure out. Find out what these terms mean in the palaeontology world:

- sinkhole
- irill
- igulley
- icoulee
- islump
- ilithify
- iholotype
- iparatype
- itaphonomy

5. YES, THIS IS RESEARCH!

You can learn a lot from dinosaur movies. They can help to give the audience an idea of the latest scientific finds, or they can point out misunderstandings from the past. If you can get a hold of some old dinosaur movies, watch them and see if you can pick out what is fact and what is fiction!

For example, *Jurassic Park* is a great series of movies, but they are scientifically inaccurate. What facts can you find that are incorrect?

Some resources to use:

The Internet Movie Database: http://imdb.com/

Berry, M.F. *The Dinosaur Filmography*. North Carolina, McFarland & Company, Inc., 2002.

Sanz, J.L. *Starring T.rex! Dinosaur Mythology and Popular Culture*. Indiana, Indiana University Press, 2002.

Scotchmoor, Judith, et al. *Dinosaurs – The Science Behind The Stories*. Alexandria, VA., American Geological Institute, 2002.

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ONLINE RESOURCES

University of California, Berkeley
http://www.ucmp.berkeley.edu

Website on evolution and dinosaurs
http://www.pbs.org/wgbh/evolution/extinction/dinosaurs/

Includes links to dinosaurs and geology
http://en.wikipedia.org/wiki/paleontology

Bristol University
http://palaeo.gly.bris.ac.uk

Website for younger grades
http://www.enchantedlearning.com/subjects/dinosaurs/

Smithsonian Institute
http://paleobiology.si.edu/index/html

National Geographic
http://www.animals.nationalgeographic.com/animals/prehistoric/

The Discovery Channel (current dinosaur discoveries)
http://www.dsc.discovery.com/tv-shows/curiosity/topics/paleontology.htm

Up-to-date scientific reports on dinosaur science
http://www.bbc.co.uk/sn/prehistoric_life/dinosaurs/

American Museum of Natural History, New York
http://www.amnh.org/exhibitions/permanent-exhibitions/fossil-halls

Natural History Museum, London
http://internt.nhm.ac.uk/jdsml/nature-online/dino-directory

Walking with Dinosaurs
http://www.abc.net.au/dinosaurs/dig_deeper/faq.htm#five

Links include videos, sound buttons, virtual tours, interactive quizzes, databases and timelines
http://www.dinosaur.dkonline.com

Up-to-date information on all aspects of science, including geology and palaeontology
http://www.sciencedaily.com

Links to Other Websites

Links to websites are provided solely for your convenience. The Royal Tyrrell Museum does not endorse, authorize, approve, certify, maintain, or control these external Internet addresses and does not guarantee the accuracy, completeness, efficacy or timeliness of the sites listed.