

# FOSSIL PLANET

## Activity Guide

These pages outline activities associated with the Fossil Planet program at the Royal Tyrrell Museum. This activities-by-grade chart will help you decide which are the best activities for your class.

PAGE	ACTIVITIES BY GRADE	K	1	2	3	4	5	6	7	8	9	10	11	12
2	Colour and Find	X	X	X	X									
3	From Bone to Stone	X	X	X	X	X	X	X	X					
4	Tracks and Traces	X	X	X	X	X	X	X	X	X				
5	A Busy Day at the Beach			X	X	X	X	X	X	X				
7	Palaeosearch!			X	X	X	X	X	X					
8	Palaeo Crossword Puzzle				X	X	X	X	X	X	X	X	X	X
9	Sherlock Bones			X	X	X	X	X	X					
13	Fossil Hotspots				X	X	X	X	X	X	X			
16	Dinosaur Discovery				X	X	X	X	X	X	X	X	X	X

*\*Hint for Teachers: The answers for the **Palaeo Crossword Puzzle** are the same words in the **Palaeosearch**.*

## Activity 1

### COLOUR AND FIND

Recommended for Grades K - 3

Our palaeontologist has lost their tools! Can you help our palaeontologist find the missing tools by colouring them?

- Shovel
- Pickaxe
- Paintbrush
- Toothbrush
- Dental Pick
- Awl
- Hat
- Jackhammer
- Glue Bottle
- Water Bottle
- Sunscreen



## Activity 2

### FROM BONE TO STONE

Recommended for Grades K - 7

Bones are hard, but spongy. The interior is bone marrow, which is porous. Over time, minerals can get trapped in these spaces, and over millions of years, this can lead to the formation of a fossil. In this experiment, students will use a piece of porous sponge to mimic a piece of bone, and explore how minerals (salt) can permeate them.

#### Materials:

- Sponge
  - Scissors
  - Containers
  - Salt or Epsom Salts
  - Food Colouring
  - Water

**Methods:** Mix the salt into water until it is super saturated (extremely salty—salt cannot dissolve any more). Add a few drops of food colouring if desired. Cut your sponge into small quarter-sized chunks, to mimic cross-sections of bone or wood that will fossilize.

Place the segments of sponge into a container and pour the super salty water over them. Give the sponge a few minutes to absorb the salty brine. Fish out the sponge segments and let them dry. Have students write down what happened to the sponge.

**Explanation:** As water is absorbed by the sponge, the salt and other minerals dissolved in it are also absorbed. The water evaporates as the sponge dries up, but the minerals remain trapped within. The sponge may become stiff from the salt or change colour from the food colouring left behind. Permineralized fossils and petrified wood are formed in a similar manner when mineral-rich water flows through the pores of buried bones or wood.

## Activity 3

### TRACKS AND TRACES

Recommended for Grades K - 8

Explore different trace fossils with this hands-on activity. Trace fossils are evidence of animal behaviour. Examples include tracks, nests, and scarred bone. Students will create their own ancient scene and explore how trace fossils might have formed.

#### Materials:

- 3 to 4 toy dinosaurs (ideally with differently shaped feet).
- Play dough, plasticine, or clay.
- A small handful of sand and gravel.
- Empty seashells.
- Sticks and leaves

**Methods:** Each student is given a piece of clay and is asked to use a bottle or rolling pin to flatten it out into a disk about 1 cm thick. Sprinkle the gravel and sand mixture over the clay to create patches of rougher terrain. Each student can now use the dinosaur toys and seashells to try to create interesting fossils. Encourage the students to think about the different factors and conditions that might affect the traces. Are the traces different in parts that were covered by sand/gravel?

- Heavy vs. light animal?
- Wet vs. dry environments?
- Fast-running animal vs. a slow-moving one?
- Empty seashells.
- Sharp claws vs. round feet?

Have students analyze each other's work. What kind of dinosaur behaviour can we infer from the marks? Does the class have a similar interpretation of each slab?

**Explanation:** As animals travel through different substrates, they leave behind tracks that can be studied to interpret behaviours. The shape, quality, and depth of tracks can depend on material. A wet material with a more clay-like consistency tends to be ideal for tracks. A dry, grainy material like gravel will not work as well.

If we are lucky, we can sometimes find multiple tracks in a row, and we call this a "trackway." The longer the distance between each track, the longer the "stride" of the animal, indicating that animal was moving faster.

Prehistoric animal tracks have revealed some interesting behaviours such as swimming, digging, hunting, nesting, and in one case, a possible dinosaur mating dance.

## Activity 4

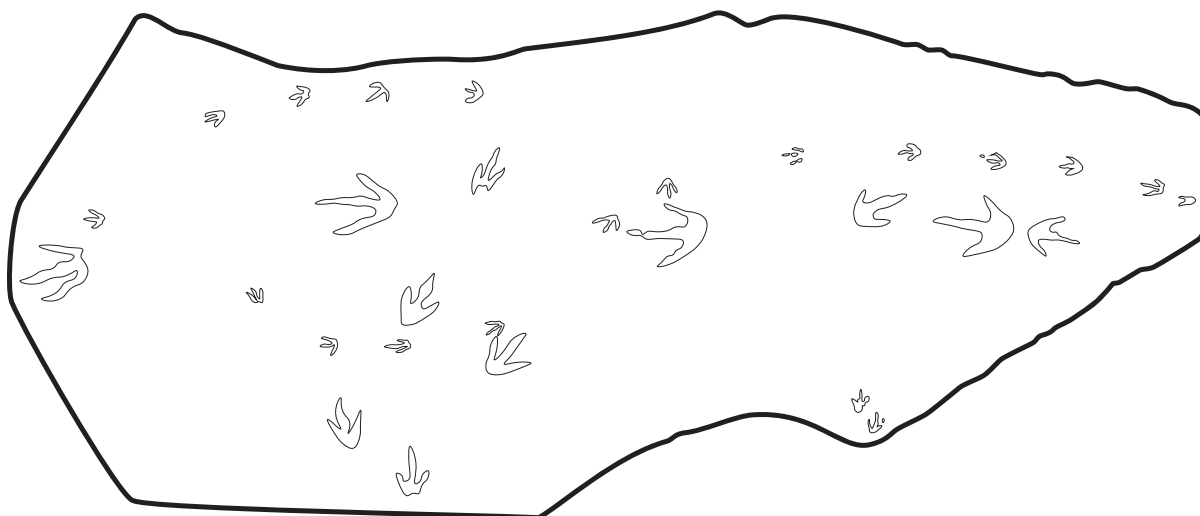
### A BUSY DAY AT THE BEACH

Recommended for Grades 2 - 8

This is an example of a trackway from St. Mary's River, Alberta. At first glance, you may see a few different types of tracks. In the Cretaceous Period, this would have been an ancient beach that was visited by many different dinosaurs.



When using specialized polarized lighting, a lot more tracks are visible and can be mapped.



Using a pencil or coloured pencil crayons, can you find the six trackways and add dashed lines to connect each set of footprints?

### Optional Hints:

- **Trackway A** – long trackway crossing the slab from right to left with 13 tracks; from a baby Tyrannosaurid.
- **Trackway B** – a short trackway at the top of the slab with 4 tracks moving right to left; from a baby Tyrannosaurid.
- **Trackway C** – 3 tracks travelling from the bottom to the top; from a medium sized Ornithomimid.
- **Trackway D** – a short trackway of 2 tracks at the bottom; from a baby Tyrannosaurid.
- **Trackway E** – trackway of 4 tracks crossing from right to left; from a medium-sized Ornithopod (herbivore).
- **Trackway F** – trackway of 4 tracks travelling from the bottom and turning to the right; from a medium-sized Ornithopod (herbivore).

## Activity 5

### PALAEOSEARCH

Recommended for Grades 2 - 7

Search for the palaeontology terms below. Good luck!

D V P C H H V Q N U O P Z C H U H A B C  
 P M I A M M O N I T E D A S C K K K V O  
 E A H V L R H N J S P T M Y D D W O A A  
 L I M O K A H T F H E Y A N X Z Y R L L  
 Y K C B K X E C Y K U W P E L F E J E S  
 T T L L E O I O C W K Y U F R V P B D H  
 E E Y Q E R P A N C J Z D O Y F S M M J  
 M R E R D Q J E A T E Q G S P O L K O W  
 E V B R A D M R S K O S T S R O Y T N W  
 R E L V L N T R M R H L P I L T S U T Y  
 U P B E X F N W T O F U O L S P P R O I  
 B E I C O P R O L I T E C G O R T V S N  
 P F B F D C E R S H B O Z T Y I J C A L  
 C A R B O N O Q X A Z O A V H N L O U L  
 O A M A O T X N I L U R M U L T W O R K  
 L G U U P E R X C Z E R K C P F R L U V  
 W J G A L S C I A C K G R I Z Q O L S I  
 E X R C H Y P X I M O S A S A U R U S B  
 X L O P T G D R H Y V G N J H S V P C A  
 L Q J O A U T A L B E R T O S A U R U S

- 
- |                 |                 |                |                 |
|-----------------|-----------------|----------------|-----------------|
| • Palaeontology | • Fossil        | • Field jacket | • Carbon        |
| • Amber         | • Footprint     | • Trackway     | • Coprolite     |
| • Tyrannosaur   | • Edmontosaurus | • Triceratops  | • Mosasaurus    |
| • Ammonite      | • Coal          | • Raptor       | • Albertosaurus |

## Activity 6

### PALAEO CROSSWORD PUZZLE

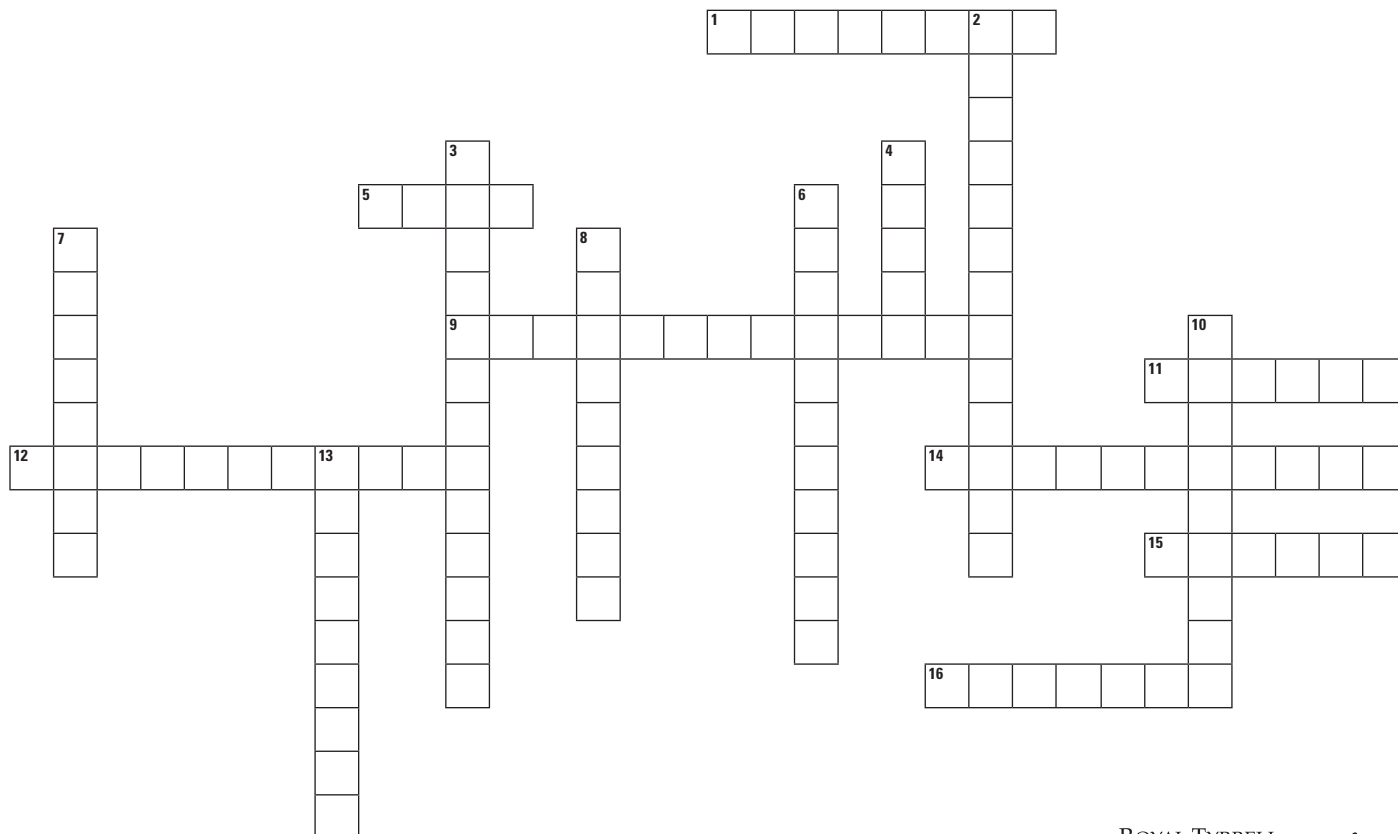
Recommended for Grades 3 - 12

#### ACROSS

1. A series of multiple footprints or tracks in a row that were made by the same individual.
5. This fossil fuel, formed from the remains of ancient plants, is traditionally burned.
9. This large duck-billed dinosaur shares its name with Alberta's capitol city.
11. The remains, traces, or imprints of a prehistoric organism preserved in rock.
12. A coating of plaster and burlap that wraps around a fossil to protect it during transport.
14. This dinosaur's name translates to "three horned face."
15. Carbonization happens when organisms are buried in a low oxygen environment and a thin film of \_\_\_\_\_ is left behind as a two-dimensional image.
16. This family of small meat-eating dinosaurs includes the fearsome *Velociraptor* from *Jurassic Park*.

#### DOWN

2. Found by Joseph Burr Tyrrell, this animal was considered the first meat-eating dinosaur found in Canada.
3. The study of ancient life by looking at the fossil record.
4. Fossilized tree resin that has hardened into a plastic-like material.
6. The family of large meat-eating dinosaurs that includes *Tyrannosaurus rex* and *Albertosaurus*.
7. The curly shell of this aquatic creature is sometimes mined and used to make jewelry.
8. A single track left behind where an ancient creature walked.
10. These giant marine reptiles ruled the seas during the Cretaceous Period.
13. The fossilized dung or feces of an animal.





## Activity 7

### SHERLOCK BONES

Recommended for Grades 2 - 7

Students put their investigative skills to the test analyzing a dinosaur mystery. The Collections of the Royal Tyrrell Museum are home to many incredible articulated skeletons. However, the majority of fossils come from dinosaur bonebeds, where the bones are scrambled and broken. Taphonomy is the study of what happens to an organism after death. Does the body twist back into the “death pose”? Does it decompose and form a bonebed? In this activity, the students will create their own dinosaur dig site (quarry), and then challenge their peers to try to solve the mystery that led to this site’s formation.

- **Articulated**
  - The bones are connected in the same position as when the animal was alive.
- **Death Pose**
  - Characteristically found in theropod dinosaurs. The head and neck are thrown back and the tail curves towards them. The cause is a subject of debate. One theory is that the animal died in water, and with little resistance, the strong ligaments in the neck and tail contract the muscles into this dramatic position.



- **Disarticulated**

- The bones are not connected in anatomical position.

**Materials:**

- Dinosaur skeleton sheets
- Scissors
- Paper or a surface to glue the pieces to
- Glue stick
- Coloured pencils and markers

**Instructions:**

1. Distribute the dinosaur bone sheets to the students and have each student cut out the bones. They can keep some bones together if they wish.
2. Students can colour the bones to give them a more natural appearance or a weathered texture. Students can also add breaks, cracks, or bite marks.
3. Working independently or in groups, the students can attach/glue their bones to the poster page. Students should try to arrange the parts to create a "story" as to how this fossil came to be. Students may use markers to add footprints, bite marks, and trace fossils to help build the story.

4. Once the bones have been positioned, students should write a short paragraph that explains the story of their specimen's fossilization. They should be sure to mention whether the specimen is articulated or disarticulated, complete or incomplete, damaged or well preserved.
5. Have students exchange their fossil quarries with their classmates, but do not reveal the explanation paragraph. Challenge the students to interpret each other's scenes and see how close they can get to the answer.
6. Discuss the results as a class.

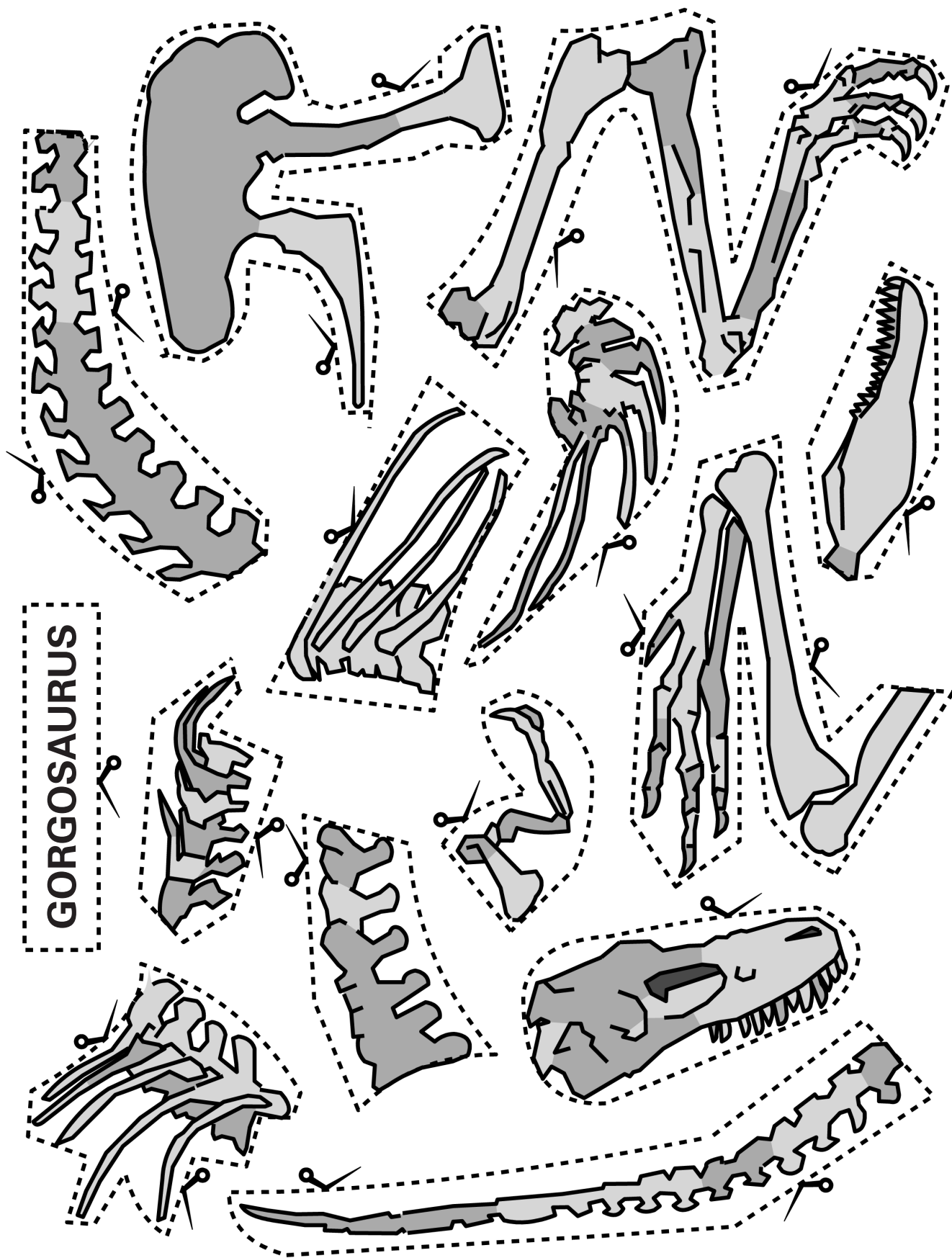
Have students analyze each other's work. What kind of dinosaur behaviour can we infer from the marks? Does the class have a similar interpretation of each slab?

**Discussion:**

- Ask the class which students had a disarticulated vs. articulated skeleton? What environmental factors can lead to the skeleton being scrambled?
- Ask the class which students had specimens with evidence of scavenging? What trace fossils can provide evidence of this?
- A fossil specimen that is disarticulated still has value and is worth collecting. What kinds of information can each type of quarry provide about the environment?
  - Weather, climate, and water table
  - Predator, prey, scavengers, and information on the food chain
  - Sediments, rocks, and geological factors
- How can fossils teach us about the decomposition of modern animals and even human remains in forensics?



# DISARTICULATED GORGOSAURUS



## Activity 8

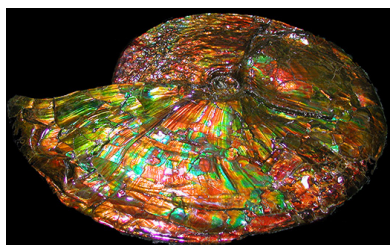
### FOSSIL HOTSPOTS

Recommended for Grades 3 - 9

Read the following descriptions.

- **Grande Prairie** – The mammoth was among the largest of the mammalian herbivores that lived during the Pleistocene ice age. These creatures might have gone extinct due to the climate warming and overhunting by humans.
- **Fort McMurray** – Many types of ichthyosaurs, or “fish lizards”, have been discovered in the oilsands of northern Alberta. This type of marine reptile is known for resembling a dolphin.
- **Edmonton** – Metasequoia is a type of fossil tree related to living Redwoods. This conifer is one of the most common fossils found in Alberta, which may be why petrified wood is Alberta’s provincial stone.
- **Banff** – Coral comprises tiny marine invertebrates that form colonies containing thousands of individuals. These fossils indicate that Alberta was once a shallow sea flooded by warm marine waters.
- **Red Deer** – The K/Pg Boundary is a section of rock that shows the accumulation of sediments that were ejected when a large asteroid hit the Earth 66 million years ago. This “boundary claystone” marks the end of the Age of Dinosaurs and the beginning of the Age of Mammals.
- **Drumheller** – *Ornithomimus* (meaning “bird mimic”) was the first feathered theropod dinosaur found in North America. Royal Tyrrell Museum staff found a juvenile *Ornithomimus* specimen with feather impressions near Drumheller in 2009.
- **Brooks** – One of the fearsome dinosaurs found in Dinosaur Provincial Park, *Gorgosaurus* is a close relative of its younger cousins, *Albertosaurus* and *Tyrannosaurus*. Along with other carnivorous dinosaurs, it was found in the “death pose”, where the neck and tail are curled toward each other above the animal’s back.
- **Calgary** – Found in 2013, the preparation of a large sandstone boulder revealed 24 gar fish. The specimens are three-dimensionally preserved and oriented upside-down, indicating they likely died in a shrinking pool of water.
- **Lethbridge** – Ammonites were squid-like creatures that lived in coiled shells. Over millions of years of heat and pressure, the surface of the shells changed to vivid colours that are often used in jewelry.

Match the images of the fossils below to their descriptions on the previous page and fill in the blank with the name of the location.



Fossil: Ammonite

Location: \_\_\_\_\_



Fossil: Coral

Location: \_\_\_\_\_



Fossil: Gar

Location: \_\_\_\_\_



Fossil: *Gorgosaurus*

Location: \_\_\_\_\_



Fossil: K/Pg Boundary

Location: \_\_\_\_\_



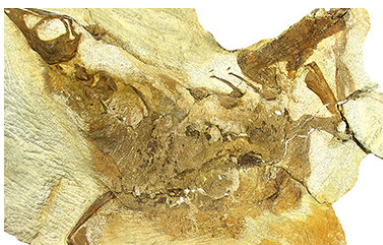
Fossil: *Metasequoia*

Location: \_\_\_\_\_



Fossil: Mammoth Tooth

Location: \_\_\_\_\_



Fossil: *Ornithomimus*

Location: \_\_\_\_\_

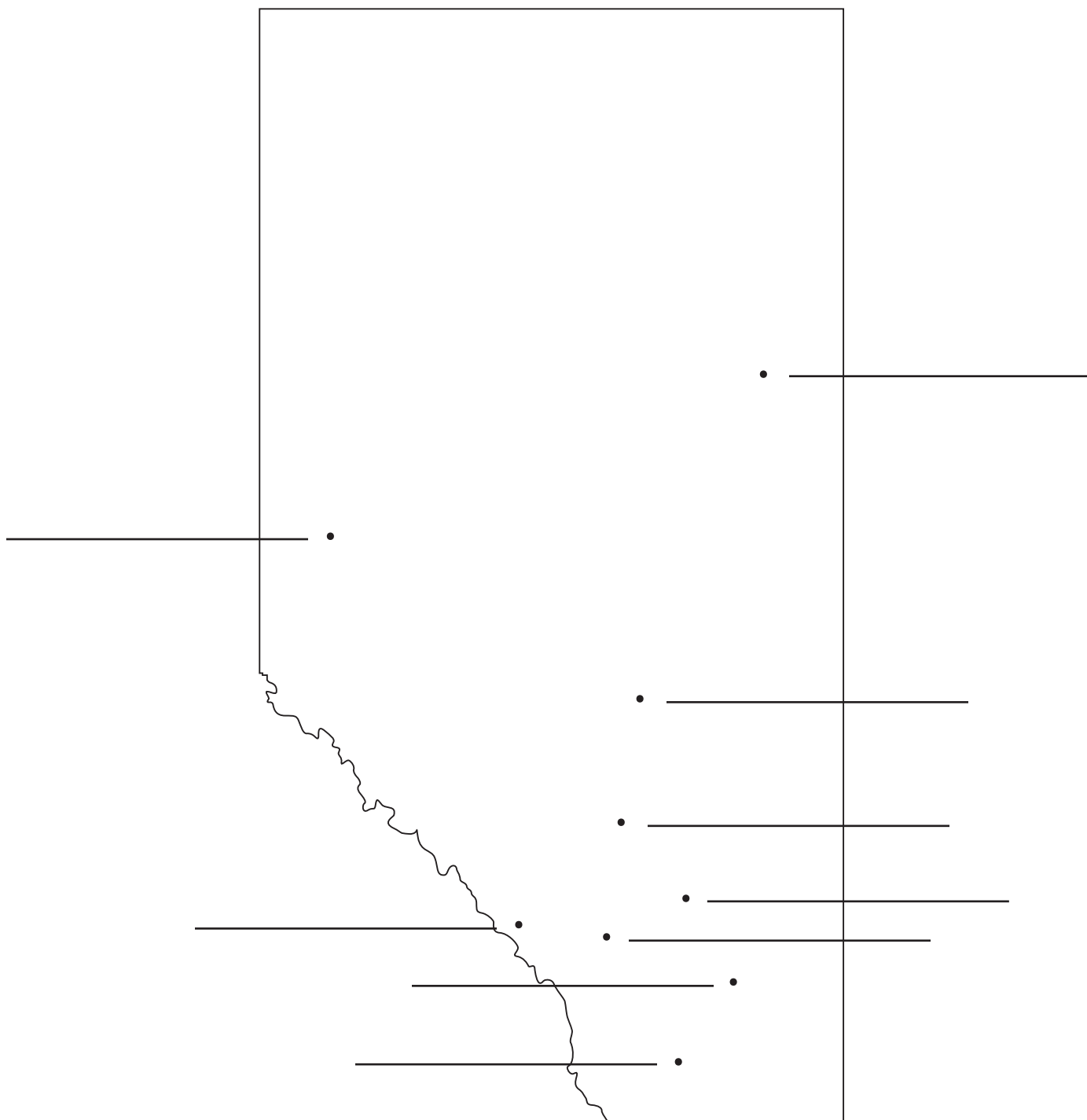


Fossil: *Ichthyosaur*

Location: \_\_\_\_\_

Fossils are found all over the province of Alberta. Label the map with the fossil sites listed below.

- **Fossil Sites** - Grande Prairie, Fort McMurray, Edmonton, Banff, Red Deer, Drumheller, Brooks, Calgary, Lethbridge.



## Activity 9

### DINOSAUR DISCOVERY

Recommended for Grades 3 - 12

Alberta is considered one of the best places in the world to find dinosaurs, with over 90 recognized species. During the early fossil hunting years of the 1900s, hundreds of dinosaurs were excavated from the province and sent to museums all over the world. Here are some of these fossil superstars!

#### HERBIVORES (plant-eating dinosaurs):

- ***Edmontosaurus***

- This giant is the largest dinosaur from Alberta. Some individuals measured up to 13 metres long and weighed over 8 tons (7.5 tonnes)!
- This duck-billed dinosaur (hadrosaur) has hundreds of tiny peg-like teeth in its jaws.
- *Edmontosaurus* was so common it has been nicknamed “the cow of the Cretaceous.” These dinosaurs lived in herds of tens to hundreds of individuals.

- ***Parasaurolophus***

- Parasaurolophus is one of the most recognizable duck-billed dinosaurs, with a large curved crest. This horn was hollow and might have been used to make sounds.
- This dinosaur is quite rare but was discovered in Alberta along the Red Deer River in Dinosaur Provincial Park.

- ***Corythosaurus***

- *Corythosaurus* is a crested duck-billed dinosaur with a round crest on its head that resembles a Corinthian helmet. This horn was hollow and might have been used to make sounds.
- There are some amazing articulated specimens from Dinosaur Provincial Park.

- ***Triceratops***

- This famous dinosaur is from the end of the Cretaceous Period. It is also one of the biggest ceratopsians at 9 metres long.
- Even though it is rare in the province, we do have some important specimens, including the “Calli” skull.



- ***Centrosaurus***

- *Centrosaurus* is a medium-sized ceratopsian with a single big horn on its nose and a simple short frill. They are about 5 metres long and 2.5 tons.
- *Centrosaurus* is best known from Dinosaur Provincial Park where a giant bonebed of thousands of individuals has been found. This single site alone makes *Centrosaurus* one of the most numerous species in the province.

- ***Styracosaurus***

- *Styracosaurus* is one of the most impressive members of the ceratopsian family. It has a big flashy frill with giant spikes poking out like a crown.
- *Styracosaurus* is a rare dinosaur to find in Dinosaur Provincial Park.

- ***Pachyrhinosaurus***

- One of the most northerly dinosaurs ever discovered, ranging all the way into Alaska. There is a significant bonebed of these animals from Pipestone Creek near Grande Prairie.
- *Pachyrhinosaurus* doesn't have any pointy horns but instead has a thick lump of bone on its nose that would have formed a brick-like shape.

- ***Pachycephalosaurus***

- This dinosaur's name means "thick-headed lizard".
- The use of the enlarged dome on its head is debated, but fossils show us that as the animal grew, the dome grew thicker and larger, like the horns of a goat.

- ***Borealopelta***

- This large, armoured dinosaur was discovered in the oil sands near Fort McMurray. It represents one of the most significant discoveries in the last 20 years of palaeontology.
- Considered the world's best-preserved armoured dinosaur.
- Scientifically significant for the excellent preservation of osteoderms (armour), skin, and stomach contents.

- ***Ankylosaurus***

- The largest of Alberta's armoured dinosaurs, it lived in the Late Cretaceous, 68-66 million years ago.
- *Ankylosaurus* has an impressive defense of armoured plates and a huge club-like tail. This tail club might have been used for defense against predators or for combat within its own species for territory or mates.

## CARNIVORES (meat-eating dinosaurs):

- ***Dromaeosaurus***

- One of the best-studied members of the “raptor” family of dinosaurs.
- Although only about the size of a wolf, it was a fearsome predator and scavenger in ancient Alberta.
- Could hunt with its teeth and the terrifying “killer claw” on its feet.

- ***Albertosaurus***

- Found in 1884 by Joseph Burr Tyrrell, it was the first meat-eating dinosaur documented in Canada.
- Named in 1905 when Alberta officially became a province of Canada. It’s on the Alberta driver’s license!
- This dinosaur is an older (and smaller) cousin to the famous *T. rex*. It also has the diagnostic two-fingered hands.

- ***Gorgosaurus***

- One of the best-studied tyrannosaurs from Alberta. Dozens of specimens have been found.
- A specimen from Dinosaur Provincial Park, collected in 2009, was the first tyrannosaur found with remains of its prey preserved in its stomach cavity.
- Lived nearly 10 million years before its close relative, *T. rex*.

- ***Tyrannosaurus rex***

- Perhaps the most popular dinosaur of all time, *Tyrannosaurus rex* is also known as *T. rex* for short. It has made multiple appearances in cinema and pop culture.
- Despite its popularity, it is one of the rarest dinosaurs found. There have only been about 40 specimens found in North America.
- Two *T. rex* specimens from Alberta are on display at the Royal Tyrrell Museum.

- ***Ornithomimus***

- The body resembles an ostrich. It is similar to the *Gallimimus* that appears in *Jurassic Park*.
- Several fossils from Alberta have preserved evidence of feathers. One specimen shows short, downy feathers, while another specimen has attachment marks from larger feathers on the forearm.
- Many *Ornithomimus* skeletons are found “articulated” with all their bones still connected and in the “death pose.”

**Potential Activities:**

- Not all dinosaurs lived at the same time. It may be good idea to have students research when their dinosaurs lived and which other dinosaurs coexisted in its environment.
- Some dinosaurs were predators, others were prey. Have the students study the predator’s weapon and the prey’s defenses to determine a bit of their animals’ behaviour.
- Where are the sauropods (long-necked dinosaurs)? Sauropod body fossils have not been found in Alberta. Discuss with the students why that could be.
- Given that Alberta was once a tropical swamp (like the everglades of Florida or Louisiana), what modern animals might we have seen living alongside the dinosaurs? (crocodiles, alligators, turtles...)