Royal Saskatchewan Museum

Saskatchewan
Ministry of
Parks, Culture
and Sport

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This booklet has been produced for use by teachers and students to research Saskatchewan's paleontological past.

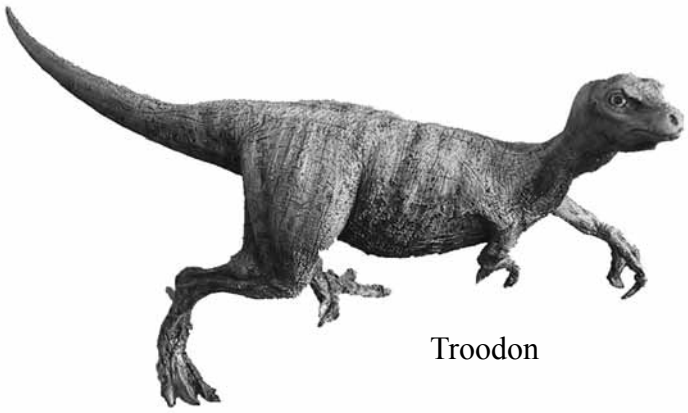
Information

What is a dinosaur?

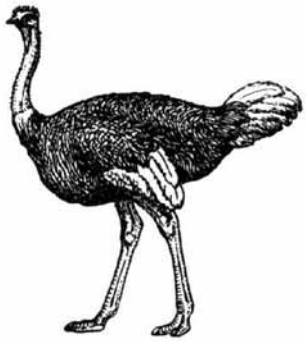
The term *dinosaur* was first used by Richard Owen, a British comparative anatomist and palaeontologist in 1842. It is derived from two Greek terms which Owen translated as *fearfully great lizard*. In the ensuing 150 years, scientists have come to understand that dinosaurs are not lizards.

Dinosaurs have two major differences from living reptiles. They always lived primarily on land (some species of reptiles live primarily at sea) and they walked upright.

What does it mean to walk upright? Simply put, it means that the legs support the weight of the body. Some dinosaurs walk on four legs – Triceratops, for example. Some walked on two, like T. rex. But all walked with their legs under their bodies. The four-legged dinosaurs walked like a rhinoceros, the two-legged varieties walked like birds – think of ostriches.



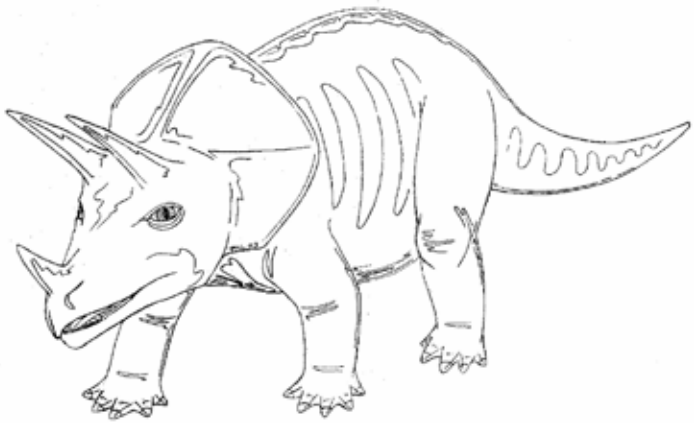
Troodon



Ostrich

Reptiles such as alligators and crocodiles suspend their bodies between the legs – like a hammock suspended between two trees.

Reptile Stance



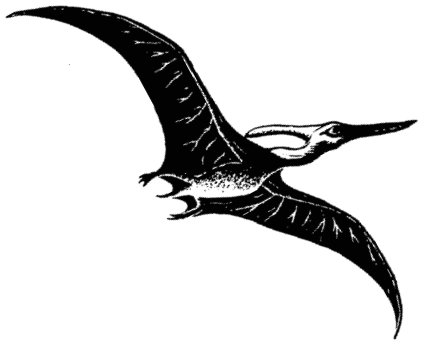
Dinosaur Stance

Other more subtle differences are still under discussion and study. These include warm-bloodedness, feathers and the structure of the heart. Today, many palaeontologists believe that the theropod dinosaurs are closely related to birds. If that is the case, their soft tissue features (structure of internal organs, brain and muscle) would have more closely resembled those of modern birds than of reptiles.

A Special Note on Dinosaur Wanna-be's

Pterosaurs

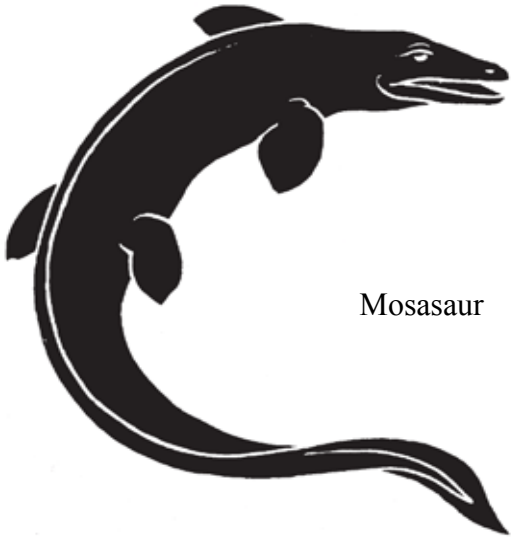
Pterosaurs are not flying dinosaurs. They are reptiles and are closely related to the dinosaurs that lived at the same time.. Very little is known about the lives of the pterosaurs. They seemed to have filled the same niche as birds and co-existed with birds for about 85 million years. Pterosaur species ranged in size from sparrow-sized to giants like Quetzalcoatlus which had a wing span of 10 – 11 m. They became extinct at the end of the Cretaceous. There have been no fossils of pterosaurs found in Saskatchewan, but fossils belonging to Quetzalcoatlus have been found in Alberta so we can infer that they probably soared the Saskatchewan skies as well.



Pteranodon

Marine Reptiles

Mosasaurs and plesiosaurs lived in the shallow inland sea that covered Saskatchewan for most of the Cretaceous Period. They were reptiles and therefore related to dinosaurs but remember, dinosaurs lived on land. Mosasaurs were fast, powerful, agile swimmers, while plesiosaurs relied more on endurance and could probably keep a fairly brisk pace for a long period of time. Both were carnivorous, and the structure of plesiosaur teeth would indicate they ate fish, although it is not known exactly which species they preyed upon. Elasmosaurs or long-necked pleisiosaurs were also endurance swimmers.



Mosasaur

When Dinosaurs Lived Here

Dinosaurs lived in Saskatchewan at the very end of the Cretaceous Period which lasted from about 144 to 65 million years ago. For most of the Cretaceous, Saskatchewan was covered by a shallow inland sea. This sea was warm and muddy and teemed with shellfish, fish and marine reptiles such as the plesiosaurs and mosasaurs. Because of these inland seas, the dinosaurs that lived prior to the late Cretaceous would not have been found here.

By the end of the Cretaceous (about 80 – 65 million years ago), the sea was receding, leaving dry land and space for dinosaurs, birds, reptiles, amphibians and small mammals. At that time, southern Saskatchewan's environment was open and included a broad river valley with forested lowlands. Plants such as palms, broadleaf trees, and conifers similar to Bald Cypress made up this forest at the end of the Age of Dinosaurs.

Dinosaur Species Found in Saskatchewan

The varieties of dinosaurs that lived in Saskatchewan included many of the better-known species. These included Troodon, Ornithomimus, Triceratops, Ankylosaurus, Edmontosaurus, Dromaeosaurus, Thescelosaurus, Chasmosaurus and of course, Tyrannosaurus rex.

Some species not found in Saskatchewan include those from the early Cretaceous and Jurassic periods.These include stegosaurs and apatosaurs.

How do we study Dinosaurs?

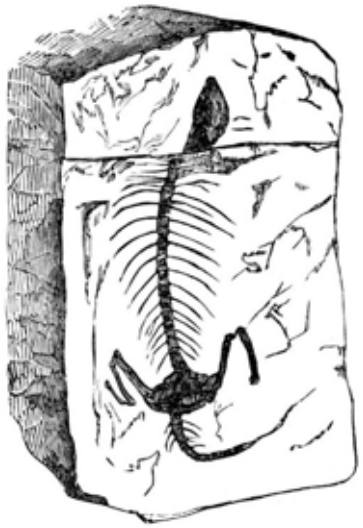
The study of ancient life is called palaeontology. Palaeontologists study both modern animals and fossils in order to better understand ancient animals and environments.

Fossils are the proof of ancient organisms. There are two main types of fossils.

1. Skeletal Fossils

Many fossils are formed from the bones and teeth of ancient animals, or the hard trunks of trees. When the organism dies, sometimes it is buried in mud or dirt before it is destroyed by natural processes. As it lies buried, minerals from the soil replace the original structure of the bone or wood. This type of fossilization happens when water can circulate through the bones to enable mineralization. It is best in a wet environment such as the bottom of a lake or slough, a slow moving stream, a quiet beach or wherever water is present.

These kinds of fossils show the structure of the animal – the way it was put together. The teeth show what it ate, and the structure of its bones gives clues to the animal's life habits, size, the environment in which it lived, and its genus and species.



2. Trace Fossils

Some fossils are not made from parts of an organism, but show traces left by the organism. A good example of a trace fossil is the impression of an ancient leaf or of skin. Trace fossils also include footprints and trackways, which tell us a great deal about the animal that made them. Palaeontologists can study these fossils to research the shape of the foot, the size of the animal, the weight of the animal, the way it walked, the length of its stride and its gait and sometimes how animals moved together – from single pairs to packs to whole herds.

A very special type of trace fossil is the coprolite. Coprolites are the fossilized droppings from ancient animals. They tell scientists what an animal ate, sometimes how it ate (did it gulp or chew?) and how long food stayed in the digestive tract. Usually, coprolites cannot be attributed to a species of dinosaur. However a very important coprolite was found in Saskatchewan. It is from a very large meat-eating dinosaur – a T. rex. This coprolite is being studied by palaeontologists to learn as much as they can about the eating habits of T. rex. Already we know that they ate young Triceratops or hadrosaurs from the fossil bone fragments found in the coprolite.
Another type of trace fossil is the gastrolith or stomach stone. Some species of dinosaurs, and plesiosaurs swallowed stones to help them digest the food they had already eaten – in much the same way as birds do. These rocks are not fossilized, but are smoothed by the grinding action and acids within the organism's stomach.

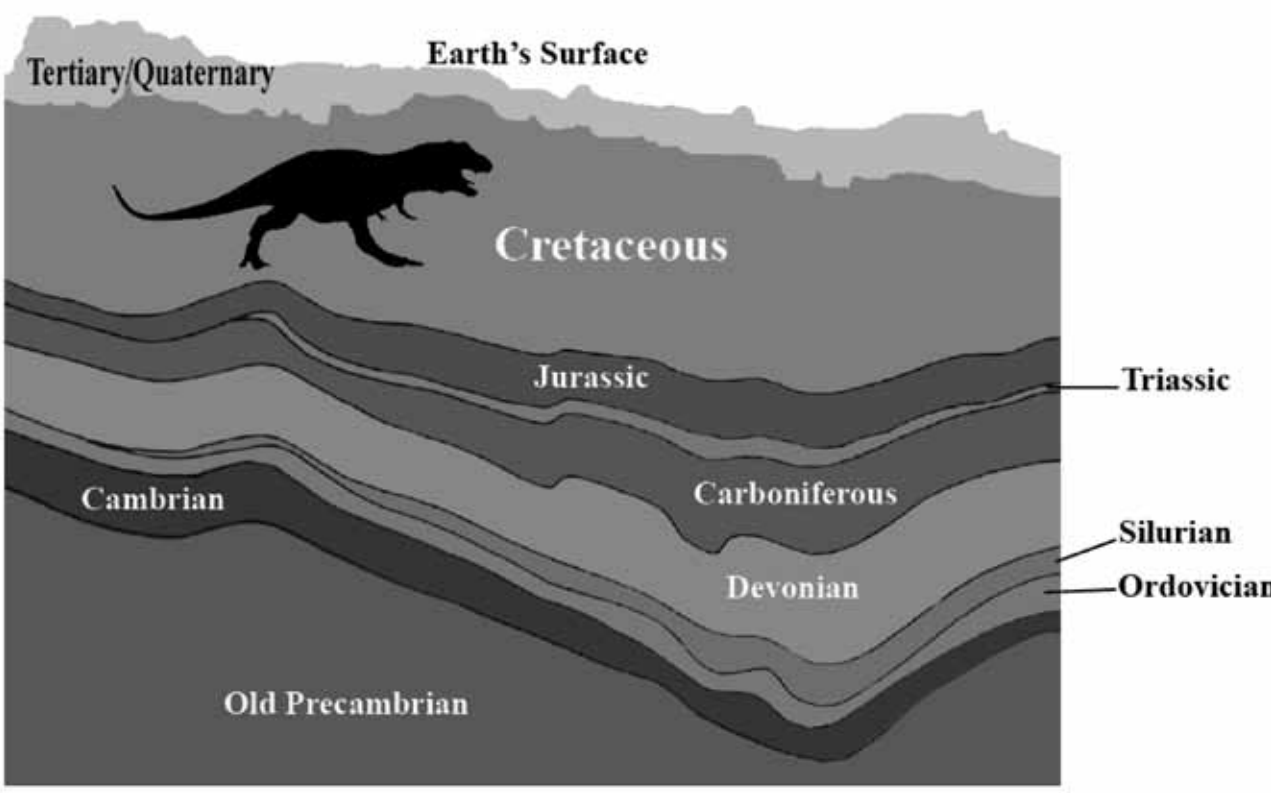
How do we find fossils?

It takes a great deal of study and knowledge to know where to hunt for fossils and some luck in actually spotting them.

Geologists and palaeontologists search for areas in which the correct fossil-bearing sedimentary rock layers are exposed. These layers are searched for exposed fossils. This is called prospecting. In some areas, the top of these layers is exposed, so fossils can be found scattered over a relatively large area. In other instances, the fossil-bearing rock is exposed on the side of a valley or hill, so only the side of the layer is exposed. Often palaeontologists will walk along the base of a slope that has exposed Cretaceous sediments looking for fossils that have eroded out of the layers and rolled to the bottom.

Fossils found exposed on the side of a slope must be uncovered by removing all the layers covering the fossils.

In most of Saskatchewan, the Cretaceous sedimentary layers that might contain fossils are usually deeply buried under sediments laid down after the end of the Cretaceous period. In some areas of the province, these layers are close to the surface and exposed. The Wood Mountain plateau and the Cypress Hills were never glaciated, so the Cretaceous layers are closer to the surface and often exposed.



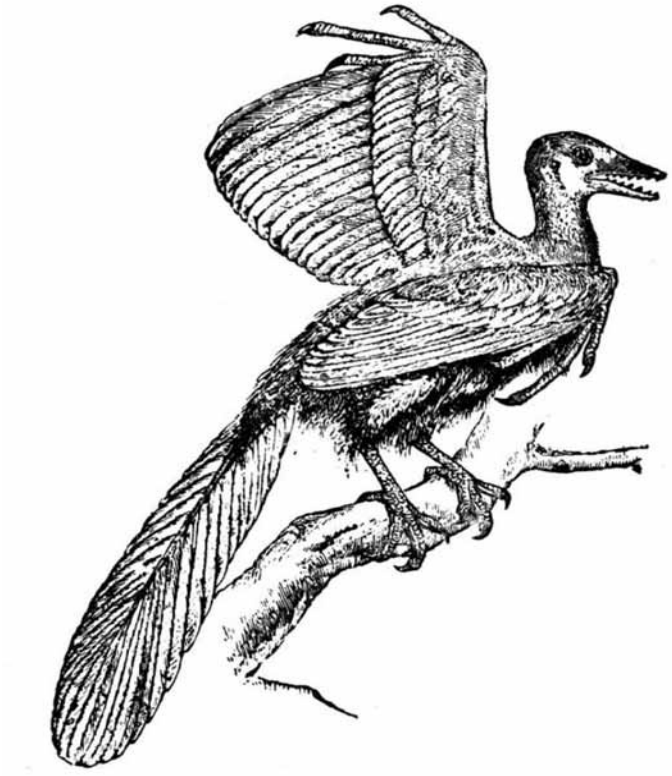
Where have all the dinos gone?

Today there are no T. rex's roaming the Cypress Hills. No hadrosaurs browse the shores of Lake Diefenbaker for vegetation. So where did they go?

The best known theory is that an asteroid struck the earth in the vicinity of the Yucatan peninsula of Mexico. The resulting clouds of dust changed the climate drastically and quickly. Smaller animals including reptiles and mammals survived the disaster, but the dinosaurs did not. The evidence for an asteroid strike in Mexico is compelling. A huge underwater crater has been found and the layer of iridium at the Cretaceous/Tertiary boundary is of extraterrestrial origin. This is very strong evidence for an asteroid impact. However, the effects of the impact are debateable.

Scientists have long discussed the connection between dinosaurs and birds. The similarity of the anatomy of theropod dinosaurs and birds was first noticed in the 19th century. The theory that birds and dinosaurs were closely linked fell into disfavour through most of the 20th century. However, in the mid 1990s, Chinese palaeontologists found the fossils of two small theropod dinosaurs (Sinosauropteryx and Protarchaeopteryx) that showed structures that looked like feathers. In more recent years further finds have supported the idea that many dinosaurs (including possibly T.rex) had feathers and that birds are the decendants of theropod dinosaurs.

The implications of the bird-dinosaur theory on the study of dinosaurs are enormous. If birds are descendants of dinosaurs, the dinosaurs may have been warm-blooded like birds. Some palaeontologists take the relationship between birds and dinosaurs one step further and say that today's birds are a type of dinosaur which, if true, means that not all dinosaurs became extinct at the end of the Cretaceous period.



Archaeopteryx has been known for 150 years and is considered the oldest known bird.

Some Famous Saskatchewan Fossils

1. Scotty

As of 2002, Scotty is one of thirty partial T. rex skeletons ever found. The fossil is in very hard sandstone, and consequently, has taken over 10 years to prepare. Excavation of the fossil began in the spring of 1994 and by 2004 the head and most of the bones were prepared in the museum's Fossil Research Lab in Eastend, SK. A full cast was made of the specimen and it is now on display at the T. rex Discovery Centre in Eastend.

2. Coprolite

The coprolite found near Eastend is important because we know it belonged to a T. rex. It is one of a very few that we can identify with a species and the only T. rex coprolite in the world. It contains bits of bone that belong either to a young hadrosaur or Triceratops.

3. Triceratops

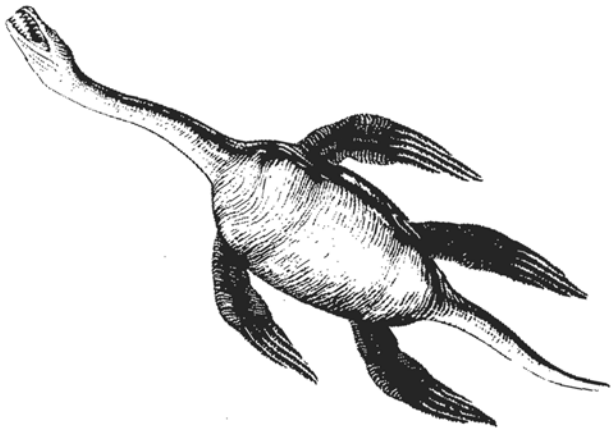
The RSM is home to a complete fossilized skull of a Triceratops. Triceratops roamed North America in large herds. Triceratops was a prey species for T. rex.

4. Skinny

"Skinny" is a partial juvenile hadrosaur skeleton found by the Royal Saskatchewan Museum. It is most important for a relatively large impression of skin included with the bones. This discovery shows the surface texture of the dinosaur, but not the colour.

5. Marine Reptiles

Mosasaurs and plesiosaurs were huge marine reptiles that hunted in the Cretaceous seas of Saskatchewan. There are a number of different species of both found in Saskatchewan. Some long-necked plesiosaurs (elasmosaurs) had over 70 vertebrae in their necks.



Plesiosaurus

6. Terminonaris
This crocodile lived 95 million years ago. The fossil excavated by the RSM is known as Big Bert, the Carrot River Crocodile. The fossil was found in the eroded bank of the Carrot River in east central Saskatchewan. These crocodiles lived near the shore of the inland sea.

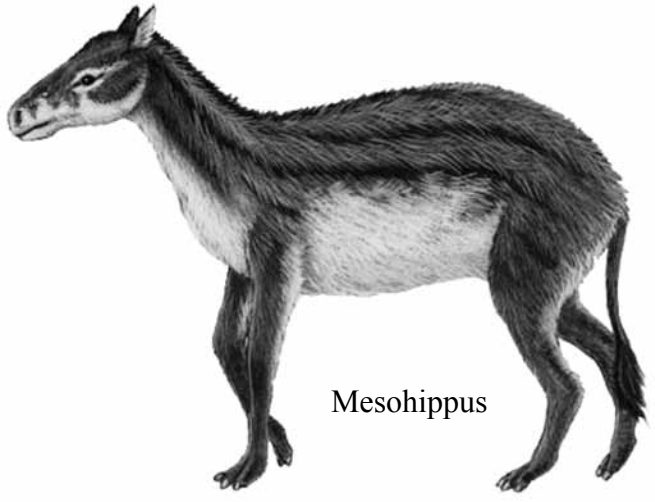
7. Hadrosaur Egg Fragments
Dinosaurs reproduced by laying eggs. The dinosaurs that lived here must have laid eggs, but only a few fragments of hadrosaur eggs have been found in Saskatchewan – no nests have ever been found here.

What Happened After the Dinosaurs?
During the 65 million years after the Cretaceous Period, many changes occurred on earth. In Saskatchewan, 45-40 million years ago, the climate began to cool slowly and changed from rainforest to open grasslands with a wet/dry season.

Throughout the Cretaceous, the small mammals managed to survive because they were small and probably most active at night. With the dinosaurs gone, there was an opportunity for the mammals to evolve and increase (in both numbers and size) and take over the empty niches left by the dinosaurs. Their story during the Tertiary (also known as Paleogene and Neogene) is one of adapting to the changing environment and changing opportunities. For this reason, the Tertiary is known as the Age of Mammals. Southern Saskatchewan has some important early and middle Tertiary sites where the deposits and rock layers laid down were not eroded away before the Ice Age or Pleistocene Epoch. Some Tertiary mammals found in Saskatchewan include the Brontothere (Megacerops), Mesohippus (Three-toed horse), Giant Pig (Archaeotherium), Sabre-tooth (Hoplophoneus), Giant Sloth (Megatherium), Bone-crushing dog (Borophagus) and Rhinoceros (Aphelops).

The Ice Age followed the Tertiary, starting about 2 million years ago. The Ice Age consisted of five continental glacial advances separated by interglacials or warm periods when the glaciers melted and disappeared in most of southern Canada.

Brontothere



Mesohippus

Some of Saskatchewan's Dinosaurs

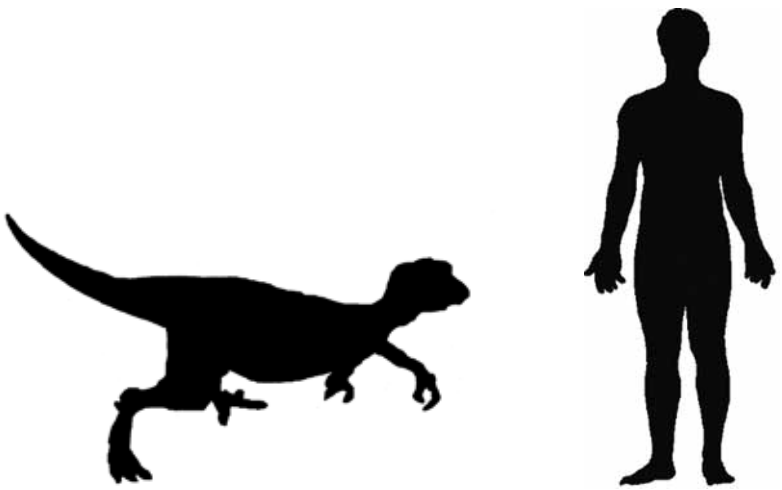
Troodon

1. Where Fossils Found
Frenchman River Valley
Grasslands National Park

2. What's in a Name?
Pronounced Troh - Oh - Don
Means *wounding tooth*

3. The Big Picture
2 m – 3.5 m long (6.5 ft - 11.5 ft), 1 m (3ft) tall
40 - 50 kg (88 lb - 110 lb)
Walked on two legs (bipedal)
Teeth curved, with serrations
Large number of teeth (96 - 122)
Carnivorous, probably ate small animals
Belonged to the theropod dinosaur group
Brain shape indicates they did not have a well developed sense of smell, but had good hearing and eyesight.
Fossils indicate a fast-moving, agile predator
Laid eggs in large clutches over a space of days or weeks – may have protected and/or incubated the nest.

4. Fascinating Features
Relatively large brain – one of the smartest dinosaurs
Had large eyes and stereoscopic vision for depth perception



Ankylosaurus

1. Where Fossils Found
Frenchman River Valley
Grasslands National Park

2. What's in a Name?
Pronounced AN - key - loh - saur - us
Means *stiff lizard*

3. The Big Picture
Approximate Size: Up to 10 m long (33 ft)
Gait: Walked on four legs
Teeth: Coarse, rounded lobes
Food: Soft plants
Family: Armoured Dinosaurs
When Lived: 67 – 65 million years ago.

4. Fascinating Features
Ankylosaurus was the last of the armoured dinosaurs. They had a huge club on the end of their tails to use as a weapon against attack and thick armoured plates on their backs for protection.

Scientists think they were herd animals because bone beds in some sites are all of Ankylosaurus.

Ratio of Ankylosaurus to human

Edmontosaurus

1. Where Fossils Found
Frenchman River Valley
Grasslands National Park

2. What's in a Name?
Pronounced Ed - MON - toe - saur - us
Means *Edmonton lizard* (Named for Edmonton, Alberta)

3. The Big Picture
Approximate Size: 13 m long (43 ft), 3.5 m tall (11.5 ft), 3400 kg (7496 lb)
Gait: Sometimes walked on two legs, sometimes on all four
Teeth: 1000 (one thousand!) cheek or chewing teeth
Food: Tough pine needles, cones and twigs
Family: Hadrosaurs (Duck-Billed Dinosaurs)
When lived: 67 – 65 million years ago

4. Fascinating Features
Hadrosaurs ate tough coniferous needles, twigs, and cones. A horny beak formed the "duckbill" and literally thousands of small cheek teeth were used to chew the tough food. Worn teeth were constantly replaced with new ones. Coniferous needles and twigs are not nutritious and the dinosaurs would have had to chew and eat huge quantities. Without strong teeth and jaws, a hadrosaur would soon die of starvation.

Hadrosaurs lived in herds. They had complex, large nasal cavities, which indicate they may have been very vocal.

Ratio of Edmontosaurus to human

Triceratops

1. Where Fossils Found
Frenchman River Valley
Grasslands National Park

2. What's in a Name?
Pronounced Try - SAIR - a - tops
Means *three-horned face*

3. The Big Picture
Approximate size: 9 m long (30 ft), 3 m tall (10 ft), 5500 kg (12 125 lb)
Teeth: Horny beak and shearing teeth
Gait: Walked on four legs
Food: Herbivorous, tough palm leaves, leafy shrubs
Family: Ceratopsians (horned dinosaurs)
When Lived: 67 – 65 million years ago

4. Fascinating Features
Had a large bony frill that covered its neck; lived in herds.

Ratio of Triceratops to human

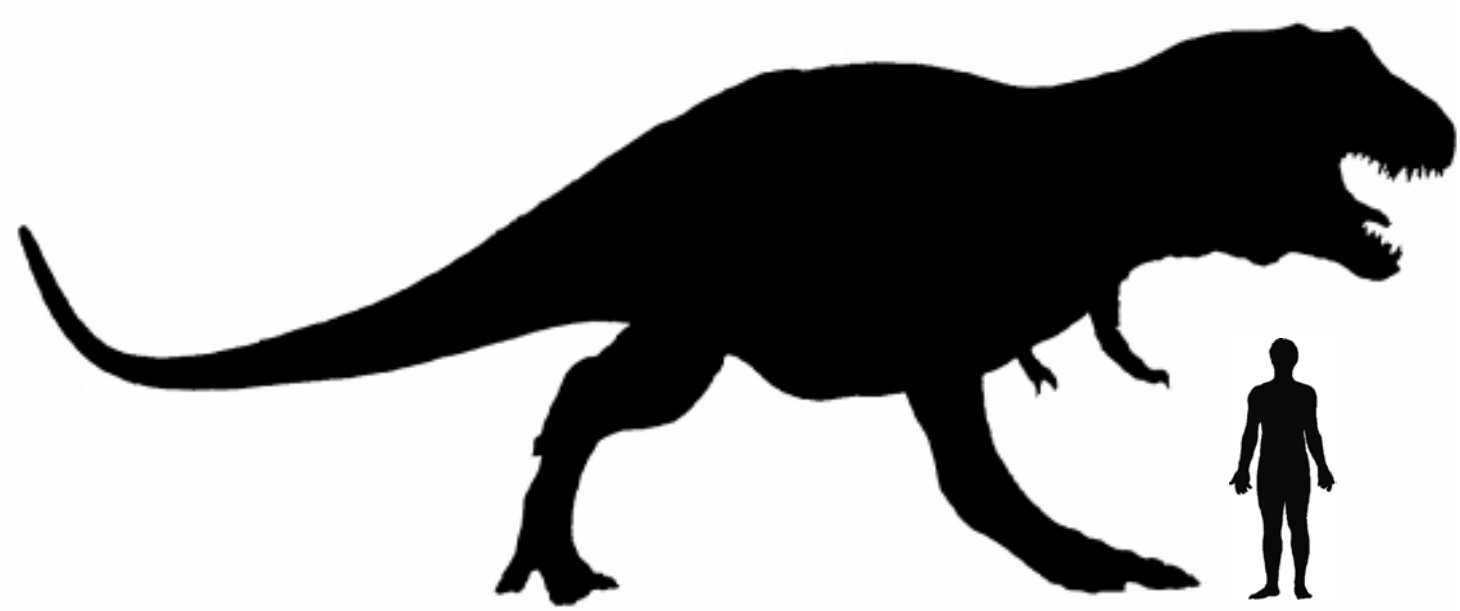
Tyrannosaurus rex

1. Where Fossils Found
Frenchman River Valley, Saskatchewan

2. What's in a Name?
Pronounced Ta - ran - o - SORE - us Wrecks
Means *king tyrant lizard*

3. The Big Picture
Approximate size: 12 m long (39 ft), 5.6 m tall (18 ft), 7000 kg (15 432 lb)
Teeth: 60 teeth, pointed, serrated (knife-like) edges
Food: Meat eater – the coprolite from Eastend has bits of hadrosaur or Triceratops bone.
Gait: Walked on two legs

4. Fascinating Features
T. rex could not reach its mouth with its front limbs.
Palaeontologists are still trying to determine how they lived – did they scavenge or hunt?



Ratio of T. rex to human