

INTRODUCTION

These fact sheets should be used as a general one page TIP SHEET for our guided tours. They are grouped according to our key guided tours @ Museum:

- DINOSAURS
- MINERALS
- QUEBEC BIODIVERSITY
- MUMMIES AND ANCIENT EGYPT
- HOMINID EVOLUTION

Each sheet starts with **key concepts OR educational message**.

Followed by **general facts for guides** (you can draw on this information when giving guided tours).

Then there is a section that bullets **key facts/props for kids**.

Each sheet ends with some **links or unifying concepts** that guides can use to help groups connect the different themes.

They also mention **the science/professions that have studied these objects/specimens** at the end under '**Who is the scientist?**

THE FAQ box gives answers to some of the Why? questions such as:

Why look at animal mummies? Why is there such large mineral diversity in Quebec?

The Dinosaurs

Where: 2nd floor, main gallery

KEY CONCEPTS:

1. The planet Earth has a long history of many living things, including dinos. Many of these living things are now preserved only as fossils.
2. Living things evolve through selection and adaptation. Organisms have the ability to adapt to specific conditions within their environments through natural selection. Natural selection takes place during long periods of time. It allows living things to retain the strongest genetic traits and features that allow them to survive, find food, and reproduce in certain habitats.
3. Extinctions happen.

GENERAL KEY FACTS FOR GUIDES:

Gorgosaurus libratus and cousin ***T. rex*** (cranium only of STAN on loan from Chicago Field Museum)

Gorgosaurus = 'fierce lizard' (IN LATIN)

- smaller, slightly older cousin of the famous *Tyrannosaurus rex*.
- a juvenile, probably equivalent to a human teenager, and is only two-thirds the adult size.
- a carnivore
- *Gorgo* could run fast for short distances, Triceratops did not move much

Dromaeosaurus = 'running lizard'

- relatively small size, very successful pack hunters
- retractable claw and large optic nerve
- long tails with ossified tendons were used to maintain balance while running/hunting
- could run fast for long distances

Archaeopteryx = 'ancient wing', world's oldest bird.

- Only ten fossils of this animal have ever been found, all from a place in Germany called Solenhofen

KEY FACTS/ PROPS FOR KIDS:

- Relate similar features /compare dino skeleton and ostrich/chicken skeleton and *Dromaeosaurus* skeleton
- Look at razor-sharp serrated tooth of Gorgo (a carnivore) compare to teeth and beak of herbivore skull (Triceratops)
- Let them feel how heavy dino fossilized bones are, compare them to modern bones such as deer, turkey, chicken. Show the hollow bone cells in the modern bone, compare to the mineralized filled-in fossil bones. Colour changes?, weight changes? Talk about burial, sedimentation, preservation. Excavation of Triceratops was in 2005. They brought 300 small pieces of fossilized skull back to the museum and it took 4 years to reassemble and make the cast or reconstruct the skull.
- Show Triceratops horn core with blood vessel channels, also on frill. Compare to your veins. Blood transports nutrients and oxygen to grow skeletons.
- Compare the *Archaeopteryx* fossil to the chicken skeleton.

The Dinosaurs

Where: 2nd floor, main gallery

LINKS OR UNIFYING CONCEPTS:

'You've just heard about dinosaurs and I'm about to tell you about hominids: can you tell me what is evolution?'

'If you think dinosaurs are old, well most minerals are much much much older'

WHO IS THE SCIENTIST?

Paleontologists work on fossilized remains of life. They prospect for sites that might have buried fossil animals or plants, they excavate the sites, examine and research all the details such as sediment, soil, disturbance etc. Open some of the drawers under the Triceratops to get an idea of excavation and preservation.

At the Redpath Museum the Paleobiology lab is run by Dr. Hans Larsson. You can learn about his scientific research work by checking out his website.

FAQs

Is it real? Most of the skeletons are casts, they are replicas made from epoxy resins or polymers. Real fossilized dinosaur bones are too heavy and fragile to be mounted in life-like poses.

What happened to the dinosaurs? Massive extinction event in Late Cretaceous period about 65.8 million years ago; a huge meteorite crashed into the Gulf of Mexico; significantly reduced incoming solar radiation for decades.

Why is dinosaur research important? Dinosaurs were around for a very long time, and so for any kind of study of evolutionary change or diversity over a long period of time, dinosaurs are the best subject. Coupled to the fact that birds are dinosaurs and we have the opportunity to study a truly incredible and important piece of evolutionary history – the origin of powered flight – and of course gain insights into the origins and changes of the birds (themselves an important and diverse group).

Dinosaurs also include the largest terrestrial animals of all time in their ranks and so provide interest for biomechanics, the evolution of large size, the structures of ecosystems and more.

Finally, dinosaurs have already attracted a lot of research interest over the years, which means we know more about them than many other groups so we already have a solid base of knowledge.

The Minerals

Location, 2nd floor, main gallery and Hodgson Gallery

KEY CONCEPTS:

- Minerals are a natural part of our solar system.
- All minerals must be: naturally occurring, inorganic, solid, and have a chemical formula. For Quartz it is SiO₂. The small “2” means 2 molecules of oxygen for each molecule of Silicon.
- There are a finite number of elements (chemicals) in the universe, yet they exist in a wide range of forms, colors, consistencies, etc., depending on the circumstances in which they were formed.

GENERAL KEY FACTS FOR GUIDES:

- At present, over 4,200 mineral species are known to science. Every year the list grows by about 30 new species.
- To date, about 215 mineral species have been discovered in Canada.
- Quebec accounts for about 95 of the new species (40%). Around 75 of those species were discovered within 40 km of Montreal. That means there are over 400 different species or kinds of minerals found very close to Montreal. This represent nearly 10% of all known mineral species. Why? Because the land surface under Quebec formed a long time ago, about 4.5 billion years ago, and many different kinds of rocks and minerals have formed here due to geological changes such as igneous intrusion (check the Monteregion Hills mineral [Petrographic Province] exhibit)

KEY FACTS/ PROPS AND INTERACTIONS FOR KIDS:

- Check out the diamond? Is this what you thought you would see?
- Check out the Dawsonite, the very first mineral to be described in Quebec and found on the McGill campus by the same person who created the Museum: Sir John William Dawson.
- Check out the many colours and crystal shapes of Quartz. Can you find your favourite? Why? What is the name?
- Check out the meteorite *beside Exhibit #1*

Canon Diablo meteorite landed in Arizona 50,000 years ago. It contains **small diamonds (along the right edge)**, and has a burn **hole** made by atmospheric friction during entry. Whole meteorite weighed 15,000 tons when it hit the earth, making a huge crater in the ground.

Shooting stars are actually not stars at all, but meteors, chunks of iron and rock hurtling into the earth's atmosphere from space.

Q: Have you ever seen a shooting star?

A: Those shooting lights are not stars at all, but meteors, chunks of iron and rock hurdling into the earth's atmosphere, and being burned up by the friction of the atmosphere that protects us. Most meteors never make it to the earth, but when scientists can get their hands on one, they study it carefully because meteors are thought to be made up of the same material as the core of our own planet (which we have never been able to reach, but know to be a ball of dense iron). This theory is based on the fact that all the planets in our solar system including the sun itself were made at the same time, and of the same materials, when the supernova that was to become our sun exploded. Meteors could be the crushed remains of planets or comets, which collided leaving debris floating around in space. Some meteorites are stony (aerolites), some are metallic (siderites) and some are a combination of both (siderolites).

The Minerals

Location, 2nd floor, main gallery and Hodgson Gallery

LINKS OR UNIFYING CONCEPTS:

Dinosaur fans may be unhappy to hear that a meteorite is blamed for their extinction. Some 65 million years ago, a meteorite collided with the earth, throwing clouds of dust and debris into the atmosphere. This blocked most of the sunlight, shortened the days, dropped the earth's temperature and started off a chain that led to the extinction of many plants and animals, among them the dinosaurs.

Maybe you know about the New Quebec crater, also made by a meteorite some 1.4 million years ago. You can see it on a map of Quebec shaped like a large crescent...

WHO IS THE SCIENTIST?

Mineralogists and geologists study rocks and minerals because they contain clues about what the Earth was like in the past. We can assemble a historical record of a planet and trace events that occurred long before humans roamed our planet. For example, in the Montreal area geologists studied the rocks and found out that 500 million years ago a coral sea covered most of the St. Lawrence lowlands. The grey Montreal limestone tells us that this was a warm tropical sea with many invertebrate animals. By studying how the Earth and other planets worked in the past, we can better understand how they are working today. This helps us understand our effects on the environment and its potential effects on us. For example, by understanding where earthquakes have occurred in the past, we have a much better idea of where they are likely to occur in the future and can be prepared for them. Second, by gaining an understanding of how planets work, we can better predict how the Earth will react to changes. For example, if we understand how the Earth and its life responded to temperature changes in the past, we might better understand the effects of the global warming that is happening today.

So the basic point is that minerals help us to better understand our world.

At the Museum there are two mineral scientists: Dr. Peter Tarassoff and Dr. Jeanne Paquette.

Why are minerals important for life?

Quebec Biodiversity Exhibit

Location: Dawson Gallery, 2nd floor, at back wall

MAIN EDUCATIONAL MESSAGE:

All living things are essential, connected and important. They live in ecosystems which are threatened by climate change, habitat loss, invasive species, and resource exploitation.

KEY FACTS/ PROPS AND INTERACTIONS FOR KIDS:

Narwhal tusk (**NOTE: new information sheet!**)

elongated left incisor tooth. It is only present in males

curved in a spiral, creating these ridges but allowing the tooth to remain straight

lives in the Arctic Circle, and only descends into fjords and bays in the summer. Recently, narwhal numbers have declined due to hunting.

The Musk Ox

hunted almost to extinction in the early twentieth century

re-population program, their numbers have increased and Musk oxen have also been introduced to northern Quebec

has very keen eyes and sense of smell, which helps it to locate food in the dark winter months. Many visitors believe at first sight that the musk ox is a bison. They are in the same family.

The Polar Bear

largest land carnivore on Earth, and can weigh up to 900 pounds (= weight of pick-up truck).

can smell seal (its primary prey) up to 40km away.

Polar bears and global warming: as temperatures rise, fewer ice caps remain for polar bears to rest, hunt, and live on.

The Coyote

not a wolf! coyote is much smaller, but to compensate, it is much more versatile in adapting to its environment

can eat anything from rabbits to berries and will even resort to scavenging on dead animals to survive!

Coyotes have smaller paws compared to the wolf (compare the animal paws of both)

wolves are predators of coyotes, so the decline in wolf population has allowed coyotes to expand their range, even moving into backyards of suburbs and hunting small livestock like chickens

What is the Coywolf?

Many eastern coyotes (*Canis latrans* "var.") are coywolves, a canid hybrid, which despite having a majority of coyote (*Canis latrans*) ancestry, also descend from wolves, either the gray wolf (*Canis lupus*) or the red wolf (*Canis lupus rufus*).

Quebec Biodiversity Exhibit

Location: Dawson Gallery, 2nd floor, at back wall

Caribou

Look at different caribou antlers: fuzzy part is called velvet. It supplies oxygen and nutrient to the underlying growing bone. Once the antlers have finished growing, the velvet is lost (drops off) and the bone dies. Caribous shed their antlers every year. The female grow antlers as well as the male. However, they are smaller than those of the males and are not present in every population of caribou.

The Cross Fox (on top of the Arctic diorama)

has a long dark stripe from its head to the end of its back that is intersected by a stripe across its shoulder. The result is the shape of a cross (= +)
lives in northern boreal forest

The Passenger Pigeon

famous modern example of extinction, due to overhunting

1800s, there were an estimated **5 billion passenger pigeons** on Earth. They were very popular for hunters. The last passenger pigeon died in 1914, at the Cincinnati zoo.

The Atlantic cod

an endangered species.

cod fishing in Newfoundland started 1501. Atlantic cod populations declined drastically in the period of the 1960s to the 1990s, when 99% of the population was lost due to overfishing. In 2003, the cod fisheries collapsed, leaving the Atlantic cod endangered
cod are carnivorous and eat lobsters and crabs

The Wolverine

an endangered species.

very ferocious and vicious creatures, with very strong arms, which are used to crack open the frozen carcasses (including the skulls!) of the animals that they feed on.

FAQ: Are they real? All these animals are real taxidermied (stuffed) specimens. There are many different ways to stuff a taxidermy specimen, depending on whether you are preserving a bird, mammal, fish or reptile. Animal must first be skinned, which means the fur or outer covering is cut off skin is then preserved to remove the moisture. The eyes are removed and replaced by glass or plastic eyes. Use carved foam to create the shape of the animal. The skin would then be wrapped around the foam sculpture. Dried skin is then sewn onto the foam body shape to close all the openings.

LINKS OR UNIFYING CONCEPTS:

'We've talked about how different species have adapted to the different Quebec ecosystems: when you're exploring the galleries, take time to look at the shell collection and try to imagine for what reasons some shells might have evolved as they have.'

The Mummies and Ancient Egypt

Location: 3rd floor

MAIN EDUCATIONAL MESSAGE:

To learn about mummification, early writing and Ancient Egyptian beliefs.

KEY FACTS/ PROPS FOR KIDS:

- Talk about mummification: basic stages including preparation of body, canopic jars, coffins, tombs, pyramids.
- Use the teaching props such as child-sized organs, the pyramids model, the linen strips, handle the papyrus and salt. Adapt timeframe to the audience.
- Talk about wrapping of the mummy: basic mummification, carried out on even the poorest member of Ancient Egyptian society. The more money someone had, the more elaborate their mummification. One mummy here is in a real Egyptian coffin. Some coffins were placed inside a stone sarcophagus and the richest and most powerful people (i.e., kings) were entombed in pyramids.
- Talk about reconstructed heads: scientific analyses and 3D scans of mummies done here in 2012. Match the heads with the mummies, talk about artistic facial reconstruction using tissue depth markers.

GENERAL KEY FACTS FOR GUIDES:

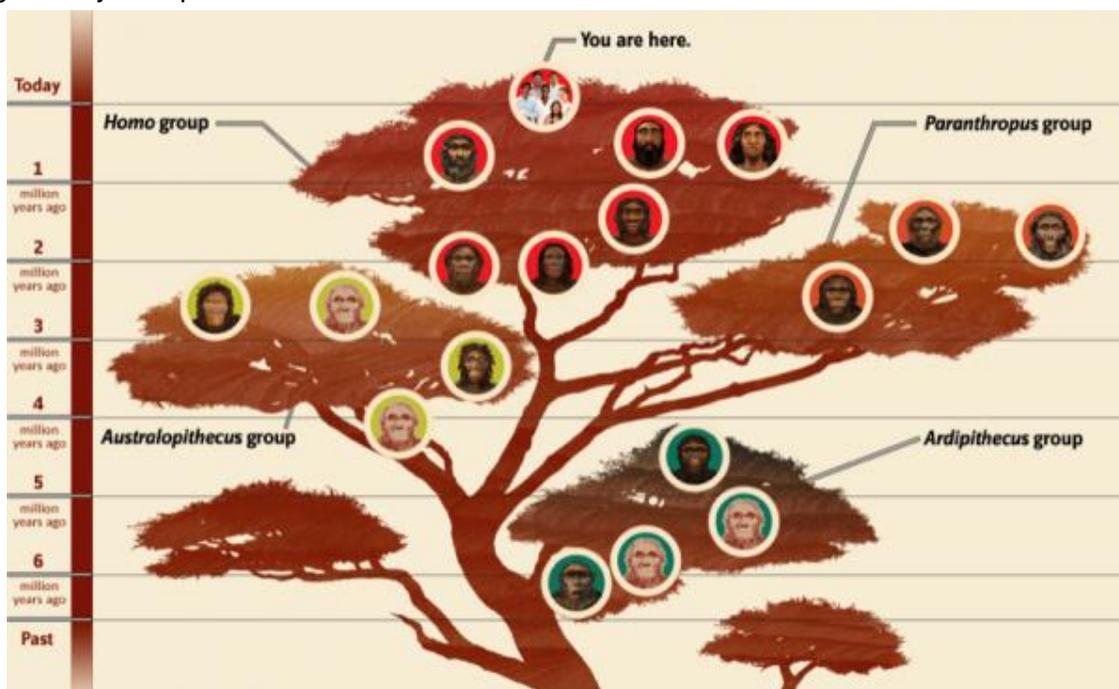
- Mummies at the museum are just over 2000 years old; mummification was an established practice for about 600 years. The Redpath Mummies are from the end of the period when mummification was 'it'. The reconstructed heads have Roman features and hairstyles as featured on Roman coins. They were purchased in Egypt about 150 years ago and shipped to the Museum.
- process of **embalming was developed around 2575 BC**, and in the beginning only the rich and powerful could afford to be mummified
 - *Look at the 4 canopic jars:* stomach, liver, lungs and intestines each had a different jar, each jar's lid featured a God to protect each organ such as: Duamutef, the jackal, guarded the stomach; Qebehsenuf the falcon kept the intestines; Imsety, with the human head, kept the liver; and Hapy, the baboon preserved the lungs.
- *Look at the 5 Animal mummies-* identify each one (cat = happiness, two baby crocodiles = strength and power)
- *Look at the jewellery and amulets:* note the many scarabs. The Egyptians believed that Scarabs were associated with the Egyptian god, Khepri. It was Khepri that pushed the sun across the sky. The scarab beetle became an ancient Egyptian symbol for rebirth, the ability to be reborn. When the Egyptians mummified a body they would remove the heart and put a scarab in its place.
- *Look at the small cotton packages on exhibit and the pack of rock salt in the prop box.* Mummies were dried with **natron, a naturally occurring desert salt**. This helped to dry out the tissues and it also worked as an antiseptic. (This is because salt absorbs water – *ask where/how we use salt today?*)
- *Look at the preserved pomegranate, fruit and flat bread in basket and shabtis:* Some tombs have been found with **food and drink for the dead**, pottery, toys, combs and jewellery.
- **Hieroglyphics:** picture writing or pictograms. Show hieroglyphic alphabet on papyrus sheet **in prop box**. Egyptians wrote with a system of pictures called **hieroglyphics**. What *pictograms or pictures do we use today?* (See *stop sign, washroom signs in prop box.*)

Hominid evolution

Location: 3rd floor

MAIN EDUCATIONAL MESSAGE:

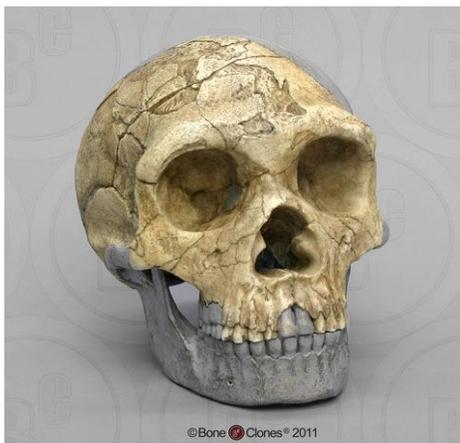
- Humans (we) are primates and are closely related to other primates
- This does not mean that we evolved directly from primates
- We share a common ancestor with chimpanzees and bonobos
- Human or Hominid evolution started about 6 million years ago
- Some 15-20 species compose the human family tree. The fossils of early humans who lived between **6 and 2 million years ago come entirely from Africa.**
- All the species have gone extinct, only modern humans are a surviving species. This human family tree from the Smithsonian human origins website: <http://humanorigins.si.edu/evidence/human-fossils> shows the generally accepted view of hominid evolution.



There are 4 main groups in the human family tree (Australopithecus, Ardipithecus, Paranthropus and Homo). We have plastic skull reproductions that can be handled and examined with visitors:



1. **Lucy: *Australopithecus afarensis***, the smallest skull. She ate a mix of foods, including ripe fruits, nuts, and tubers from both the forest and the savanna. Incisor teeth are typical for biting. Compare size between the brain case and the face and prominent front of the mouth with incisors.



2. ***Australopithecus africanus***. One of the earliest defining human traits, bipedalism — the ability to walk on two legs — evolved over 4 million years ago. Other important human characteristics — such as a large and complex brain, the ability to make and use tools, and the capacity for language — developed more recently. Many advanced traits, including complex symbolic expression, art, and elaborate cultural diversity, emerged mainly during the past 100,000 years.
3. ***Homo erectus***. Made the first stone tools like axes and used fire to cook and/or intimidate predators. Cooked meals provided different nutrients than raw foods. There is a feedback loop between big brains and nutrients. This might have triggered bigger brain development in future species.

Show the skull, and compare it to the others. Do the teeth look bigger or smaller? What about the face and brain case?

4. ***Homo neanderthalensis***. The nose and the eyebrows are wider and their bodies bulkier than ours, they lived in a cold climate, their diet was meat-rich, plant foods were also consumed but difficult to find because of weather. Their brains were relatively the same size as ours. They practiced burial of the dead. They had tools like chipped stones and sewing needles.
5. **Modern human species: *Homo sapiens*** (*white plastic skull in the teaching props and on exhibit with the reconstructed Egyptian heads*)

Click here to learn more about early human species:

<http://humanorigins.si.edu/evidence/human-fossils/species>

Travel and movement of early hominids:

Early humans first migrated out of Africa into Asia probably between 2 million and 1.8 million years ago. They entered Europe somewhat later, between 1.5 million and 1 million years. Species of modern humans populated many parts of the world much later. For instance, people first came to Australia probably within the past 60,000 years and to the Americas within the past 30,000 years or so. The beginnings of agriculture and the rise of the first civilizations occurred within the past 12,000 years.