

THE HONG KONG JOCKEY CLUB SERIES

香港賽馬會呈獻系列



八大尋龍記

# THE BIG

Dinosaur Revelation



## Teachers' Guide

聯合主辦  
Jointly Presented by



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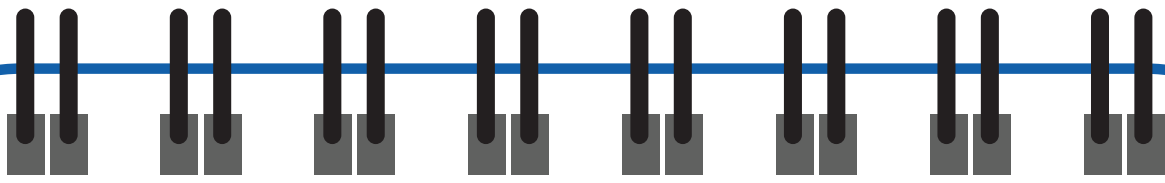


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### Learning Outcomes

- ✓ Practice science processing skills
- ✓ Understand organisms need to adapt to their habitats for survival

### Curriculum Links

- 📎 General study: People and Environment
- 📎 Biology: Organisms and Environment

**Adaptation** – a feature of the organism that helps it to survive and reproduce in its environment.

### Scientific inquiry idea

**Evidence** – data that come from direct observation or experiments, e.g. you observed that the *T. rex* had serrated teeth.

**Inference** – reasoning based on the evidence, e.g. meat-eating animals also have serrated teeth. You may infer that *T. rex* was a meat-eating dinosaur.

### Before the visit

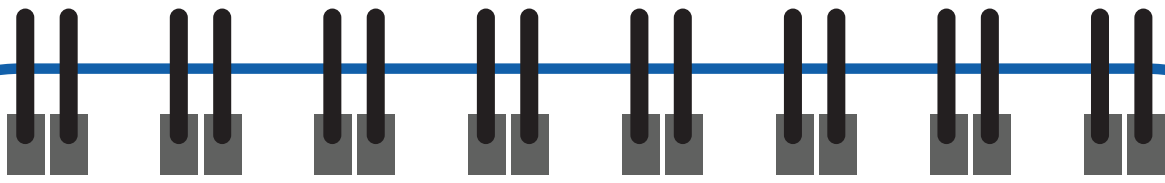
- Explain to your class that they are to choose a skeletal fossil specimen on display for this project.
- Remind your class that they have to sketch and describe the chosen specimen. They may take photos to record the specimen and any other information that they may need to use.
- Introduce the term “adaptation” to the class.
- Dinosaurs were highly diversified in body size and shape: some were as large as an airplane, while some were the size of a chicken; some walked on four legs and some walked on two. They had different adaptations to help them survive in different habitats, from the cool Arctic to the hot tropics. So it is not surprising that their fossils have been found on all of the continents.

### At the Museum

- Ask your class to observe the fossil skeleton of the chosen specimen carefully.
- Tell them to note down all of the observations made and to take photos if necessary.

### After the visit

- Ask your class where the chosen specimen lived (habitat) and what it ate (diet and feeding behaviour).
- Relate its mode of life to the body part adaptations and hence guide students towards thinking about how adaptations helped it to survive.
- Ask students to make a mini-presentation.
- You are welcome to share the work of your class with the Museum!



## Notes for Newbies

### Aims

- ✓ Basic information of the exhibition for teachers
- ✓ Brief explanation of the science concepts related to the exhibition
- ✓ Useful for a quick introduction during the ride to the museum
- ✓ Class questions to inspire students
- ✓ Extra information to raise students' interest

### Basic concepts to know

Teachers may explain the following concepts to students before the visit...

- what is palaeontology and why we have to study the past;
- what is a fossil and how is it formed;
- what is a dinosaur

### Class inspiration

What is Palaeontology?  
Why is it important to understand the past?

## A. Palaeontology

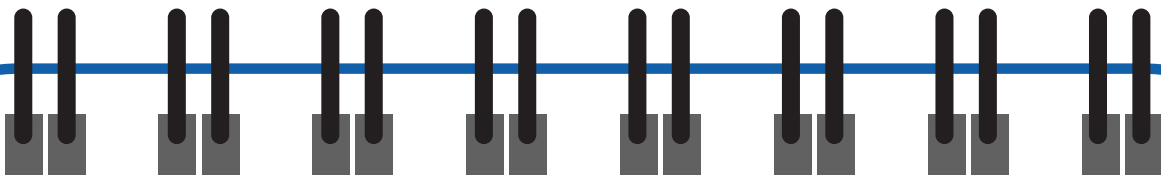
Palaeontology is the study of ancient life, ranging from the earliest microorganisms to the giant dinosaurs and also our human ancestors. The scientists studying palaeontology are called palaeontologists. They study the record of life left as fossils.



Studying ancient life allows us to understand the history of Earth in

- ▶ evolutionary (life-historical) and
- ▶ geological (earth-historical) context

As we work out how ancient organisms lived in their environments, we can predict how changes (e.g. climate changes) may lead to similar impacts on modern life. In this way, palaeontology is not only about the past but also about our future.



### Class inspiration

Can you name some examples of fossils?  
What can we know from studying body fossils and trace fossils?

## B. Fossil

### What are fossils?

The word fossil is derived from the Latin 'fossilis' meaning 'unearthed'.

Fossils are the magic stones that offer the greatest hints to the history of life through deep time. They are the preserved remains of organisms or their behaviour.

Fossils can be divided into two main types:

#### ► Body fossils

Parts of organism bodies, including bones, teeth, feathers, shells, leaves, wood, bark, etc. They tell us about the appearance of ancient life.

#### ► Trace fossils

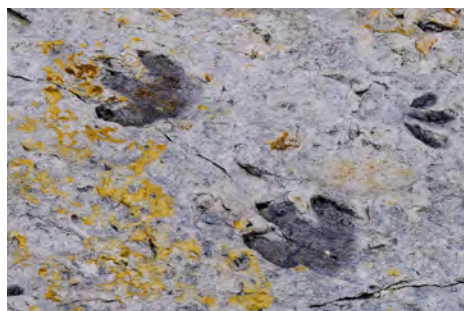
Anything made by or left behind by an organism, e.g. footprints, tooth marks, bodily waste, burrows, etc. They provide information about how the organisms interacted with the environment: how did they walk, what did they eat and where did they live?



▲ Bone fossil with feather imprint



▲ Fossilised shells



▲ Fossilised footprint



▲ Fossilised faeces of dinosaurs

## Class inspiration

Could I become a fossil and how?

Yes, fossilisation is a continuous process. Under the right conditions, a dead plant or animal could be preserved in the rocks of the future, just as they were in the past.

To become a body fossil, you will need to:

### 1. Have hard body parts

The hard parts of organisms, such as bones, shells and teeth decay more slowly than the soft parts.

### 2. Die in a suitable place

Somewhere close to water would be best, so your body has a high chance of becoming buried rapidly by sand and mud.

### 3. Wait for ages...

As the sediments build up above you, eventually the layer you are in will harden into rock and you will become a fossil! But be aware that this would be a very lonely process as it could take millions of years.

## What organisms can turn into a fossil?

Animals, plants, fungi and microorganisms can all be preserved under the right conditions.



▲ Microorganisms: Stromatolites



▲ Insects preserved in an amber

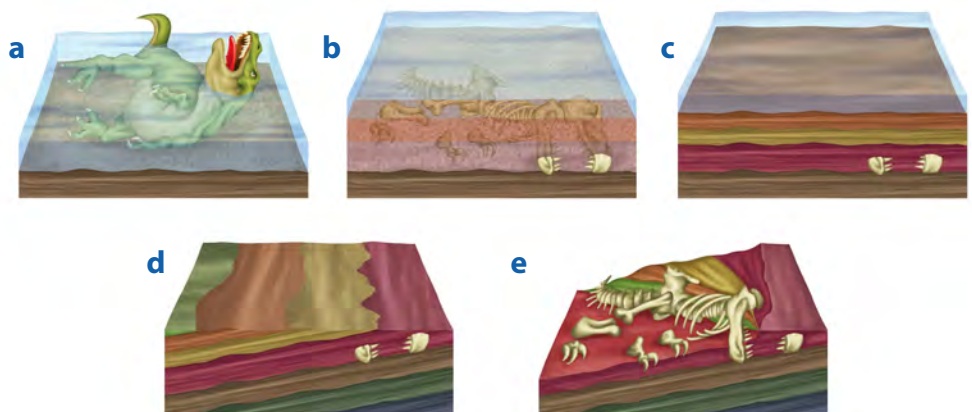


▲ Fossilised wood



▲ Animals with bones

## How does a fossil form?



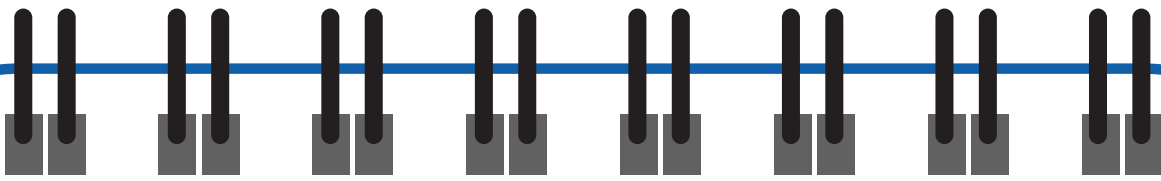
**a.** An organism dies and body tissue decomposes, leaving the hard bones behind.

**b.** Sediment buries the body remains.

**c.** More sediment layers accumulate, applying pressure on the lower layers. The bones gradually fossilise over time.

**d.** Over time, geological activities lift up the strata.

**e.** Weathering and erosion expose the strata containing the fossils.



## C. Dinosaur

### What are dinosaurs?

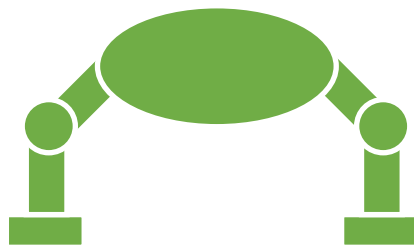
The word 'dinosaur' means 'terrible lizard' in Greek. Dinosaurs evolved from a more ancient group of reptiles roughly 240 million years ago in the Triassic, diversifying in shape and size before mostly dying out in a mass extinction event around 66 million years ago (Cretaceous-Palaeogene extinction).

### What makes a dinosaur a dinosaur?

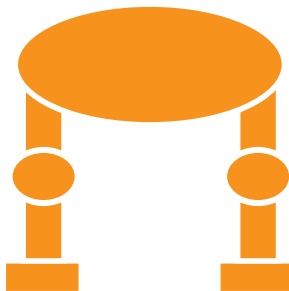
One of the most significant evolutionary features that helped early dinosaurs conquer the land was a simple shift in the position of their legs. Straight back legs positioned directly under their bodies allowed them to use less energy for locomotion and resulted in better weight support.

#### Class inspiration

Ask students to observe the hip and leg positions of the dinosaurs during their visit.



▲ Lizards: limbs extended from the sides of the body



▲ Dinosaurs: limbs positioned directly under the body

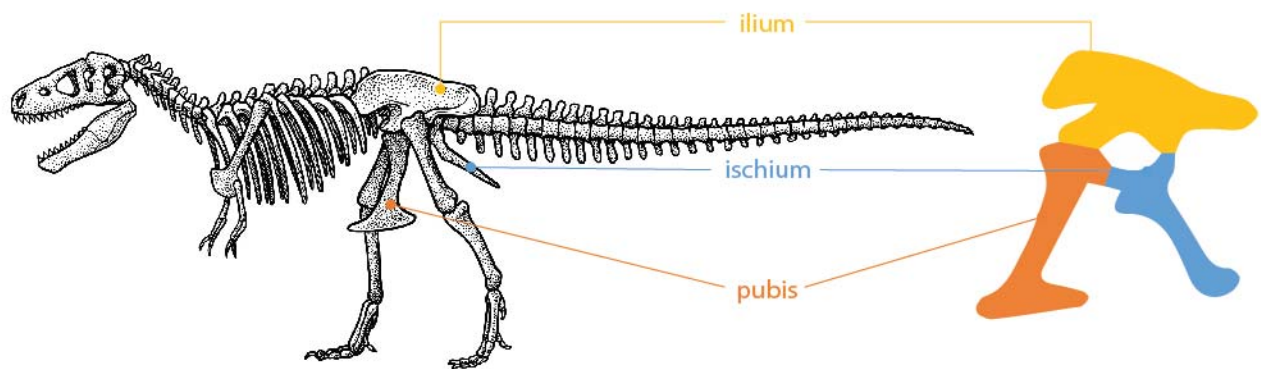
### Class inspiration

Ask students to observe and take photos of the dinosaur pelvises during their visit and try to classify them.

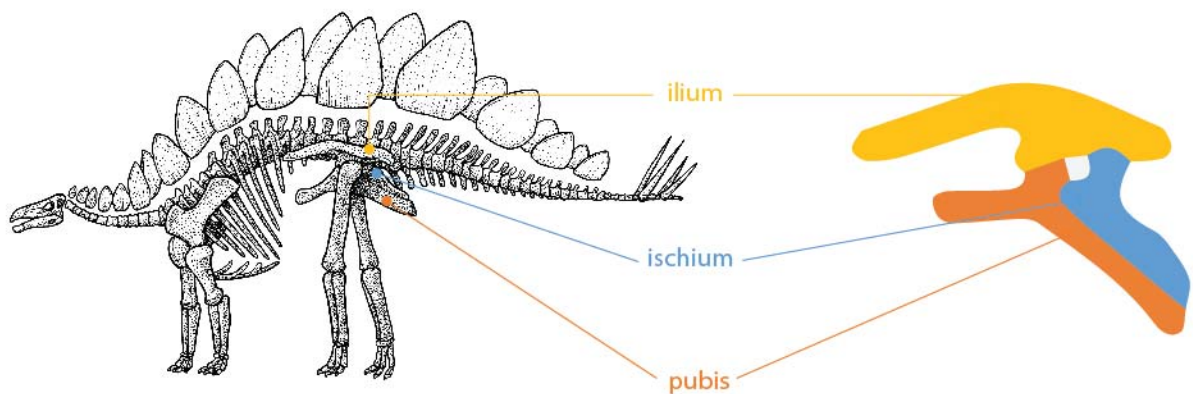
The fossil display at the exhibition include *Allosaurus*, *Diplodocus*, *Spinosaurus*, *Tyrannosaurus* and sauropod which are Saurischias; while *Triceratops* and *Hesperosaurus* are Ornithischias. (*Hatzegopteryx* is not a dinosaur!)

### Classification of dinosaurs

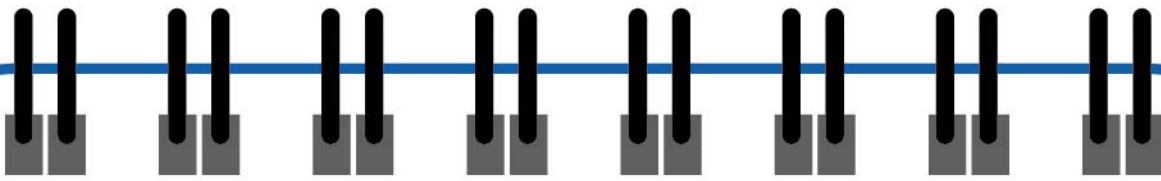
Palaeontologists divide dinosaurs into two main groups, based on their pelvis structure: Saurischia and Ornithischia. Saurischian pelvises resemble those of modern lizards. This group included mostly meat-eating dinosaurs and also some large plant-eaters. Ornithischian pelvis had a structure similar to that of modern birds and included mainly plant-eating dinosaurs.



▲ Saurischian pelvis (lizard-hipped)



▲ Ornithischian pelvis (bird-hipped)



### **Class inspiration**

Birds evolved from a group of meat-eating dinosaurs. Why were birds able to survive the catastrophic changes in the late Cretaceous?

## **D. Extinction of Dinosaurs**

Extinction means the dying out of a species. When there is a marked increase in the rate of extinction over a short geological period of time, it is called a mass extinction.

Throughout the history of Earth, scientists have identified five mass extinctions. All dinosaurs (except for birds) were wiped out in the Cretaceous-Palaeogene Extinction 66 million years ago. But who killed the dinosaurs?



One of the widely accepted causes behind this mass extinction is that an asteroid struck Earth at the Yucatán Peninsula in Mexico. Such a catastrophic event might have caused subsequent earthquakes, tsunamis and a global temperature change.

Prior to this asteroid crash-landing, Earth was experiencing a period of climate change and violent volcanic activities. This was making things harder for life on our planet. Organisms which could not adapt to the changes in the environment became extinct.