

Image: Expedition Range, Central Highlands, Queensland. Source: Queensland Museum Image Collection

In Search of Ancient Queensland

YEAR 4 – EARTH & SPACE



QGC

FUTUREMAKERS



**QUEENSLAND
MUSEUM NETWORK**



**Queensland
Government**

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Glossary



Writing exercise



Group activity



Go! – hands on exercise



Check List



Need to know information



Watch a video



Take a photo

Future Makers is an innovative partnership between Queensland Museum Network and Shell's QGC project aiming to increase awareness and understanding of the value of science, technology, engineering and maths (STEM) education and skills in Queensland.

This partnership aims to engage and inspire people with the wonder of science, and increase the participation and performance of students in STEM-related subjects and careers — creating a highly capable workforce for the future.

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Australian Curriculum Links

YEAR 4

Science

Earth's surface changes over time as a result of (1) natural processes and (2) human activity (ACSSU075)

Science as a Human Endeavour

Science involves making predictions and describing patterns and relationships (ACSHE061)

Science knowledge helps people to understand the effect of their actions (ACSHE062)

Science Inquiry Skills

With guidance, identify questions in familiar contexts that can be investigated scientifically and make predictions based on prior knowledge (AC SIS064)

With guidance, plan and conduct scientific investigations to find answers to questions, considering the safe use of appropriate materials and equipment (AC SIS065)

Consider the elements of fair tests and use formal measurements and digital technologies as appropriate, to make and record observations accurately (AC SIS066)

Use a range of methods including tables and simple column graphs to represent data and to identify patterns and trends (AC SIS068)

Compare results with predictions, suggesting possible reasons for findings (AC SIS216)

Reflect on investigations, including whether a test was fair or not (AC SIS069)

Represent and communicate observations, ideas and findings using formal and informal representations (AC SIS071)

As this resource has been designed to complement classroom-based teaching and learning experiences, students are assumed to have developed knowledge about the following Earth and space sciences concepts from year three science:

Earth's rotation on its axis causes regular changes, including night and day (ACSSU048)

- recognising the sun as a source of light
- constructing sundials and investigating how they work
- describing timescales for the rotation of the Earth
- modelling the relative sizes and movement of the sun, Earth and moon

Introduction

Queensland has a diverse and complex geology that reflects the varying origins, many environments and different time periods that have helped shape the state's modern topography. Most of the world's major divisions of geological time are represented in the rocks and landforms that occur across Queensland.

Luck has played a big part in the discovery of many Australian dinosaurs. Fossils have been discovered by property owners out in the bush mustering cattle or working the land. Nowadays, palaeontologists search areas where dinosaurs have already been found, or where rocks of the right age have been exposed by wind and water erosion.

Hidden beneath Queensland's dry riverbeds and in our ancient rocks are secrets from the past 250 million years. They whisper their stories through fossils and footprints, giving us clues to an ancient time.

The [*Lost Creatures*](#) exhibition at the Queensland Museum is an epic Queensland story of the struggle to survive. You will meet strange creatures, our very own dinosaurs, giant marine reptiles and megafauna, and marvel at the diversity and immense size of creatures from our prehistoric past. It is also a cautionary tale of how species may become extinct.

Lost Creatures makes us think carefully about the consequences of global cataclysmic change. It reminds us of the urgent need to listen and respond to our environment.

Teacher Tips

It is recommended that these resources are used in conjunction with a visit to the Queensland Museum South Brisbane. Time Stack can be used as a pre-visit activity, *Lost Creatures* Trail is for use during your visit, Bones in the Black Soil and How Fossils are formed has been designed for use in the classroom.



*Image: The Richmond Plesiosaur from the Great Inland Seas of Queensland 110-100 million years ago.
Source: Queensland Museum Image Collection*

Between 110 and 98 Million years ago, in the Early Cretaceous Period, inland seas covered much of outback Queensland. In the shallow seas lived a wide variety of marine creatures including fishes, turtles, squid, ammonites and marine reptiles.

[Read more about Giant Marine Reptiles of ancient Queensland](#)

Activity 1: Time Stack

Queensland's fossil record stretches across some 1.65 billion years and it is preserved almost entirely in sedimentary rocks. Deep weathering and erosion has destroyed much of the fossil record and this is reflected through the variety of locations of fossil-bearing rocks across the state.

Did you know that the history of life on Earth is told through rocks?

Did you know that the history of the Earth's surface can be told by looking at the fossils that have been found from different time periods?

Over millions of years, sediments such as sand and silt were laid down and compressed to form sedimentary rock layers. These rock layers preserve a record of ancient landscapes, climates and life-forms.

Fossils are found in many, but not all, sedimentary rocks, including limestones, sandstones, shales and mudstones. They are not found in igneous rocks and rarely in metamorphic rocks.

Scientists often determine the correct sequence of sedimentary rock layers using the fossils found within them. They compare the fossils to figure out if two layers are from the same geologic time period, or if one layer is older than the other.



Task:

Reconstruct the layers of sedimentary rock on page 7 which contain a selection of some of ancient Queensland fossils. These fossils tell a story about what the landscape was like in ancient Queensland and how it changed over time. The Queensland time periods represented in this activity are indicated on each layer.



Instructions:

1. Cut out the six (6) layers.
2. Put the layers in correct order based on the most recent time period at the top, and the oldest at the bottom. *Clue: The most recent layer includes humans.*
3. Decide which layer comes next by looking closely at the life-forms. It will have some of the same life-forms as the older layer but will also include some new ones.
Hint: Life-forms do not disappear for a layer then reappear. Why?
4. Once you have the layers in order from newest to oldest, stick them down in order and check your answers. See *Teacher Notes* on page 22.

5. What do the fossils found in each of these layers tell you about the landscape of ancient Queensland?



6. Starting from the top, why are there so many differences between layer 1 & 2? and layer 3 & 4? What might have happened to the earth during these time periods?



Jurassic Period



Cretaceous Period



Quaternary Period



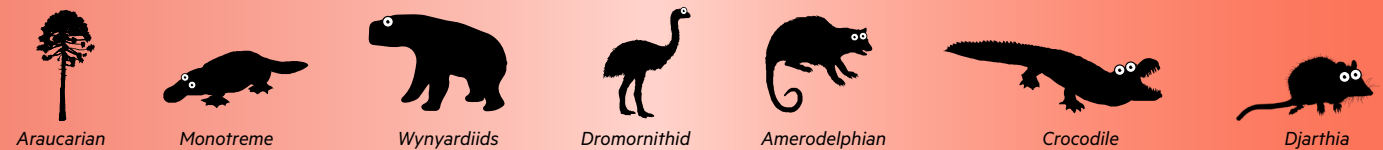
Triassic Period



Neogene Period



Palaeogene Period



Activity 2: *Lost Creatures Trail*

(During your visit to the Queensland Museum)

Fossils can tell us about changes in landscapes over geological time. This discovery trail through [Lost Creatures](#) exhibition will reveal how the Earth's surface has changed over the last 250 million years and how it continues to change.

You will:

- Uncover interesting facts about the fossils that have been found in ancient Queensland
- Explore how some of Queensland's most famous fossils were found and what they tell us about the landscape that once existed.

Instructions:

To complete this trail, you will need to visit the *Lost Creatures* exhibition on level 2 at the Queensland Museum, South Brisbane. Find each of the fossils below and record key information about each fossil. You can complete the worksheet in any order.

Time:

60min

Student Worksheet 1: *Lost Creatures Trail*

FOSSIL 1

What is my Scientific Name?

.....



Describe where I lived
(on the land or in the water?)

Am I similar to any animals
that are alive today?

When was I discovered?

How was I discovered?

What time period am I from?

Put an X on the map to show where my
remains were found.



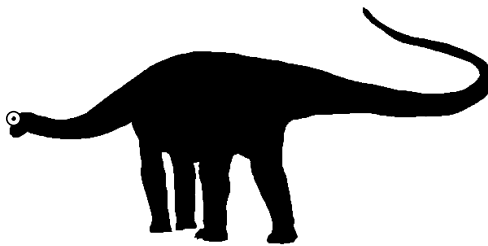
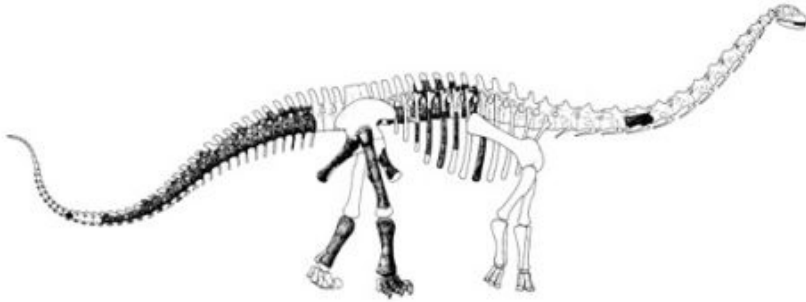
Describe what ancient
Queensland looked during
this time period.

Student Worksheet 1: *Lost Creatures Trail* (continued)

FOSSIL 2

What is my Common Name?

What is my Scientific Name?



**Describe where I lived
(on the land or in the water?)**

**Am I similar to any animals
that are alive today?**

When was I discovered?

How was I discovered?

**Put an X on the map to show where my
remains were found.**



What time period am I from?

**Describe what ancient
Queensland looked during
this time period.**

Student Worksheet 1: *Lost Creatures Trail* (continued)

FOSSIL 3

What is my Scientific Name?

.....



**Describe where I lived
(on the land or in the water?)**

**Am I similar to any animals
that are alive today?**

When was I discovered?

How was I discovered?

What time period am I from?

**Put an X on the map to show where my
remains were found.**



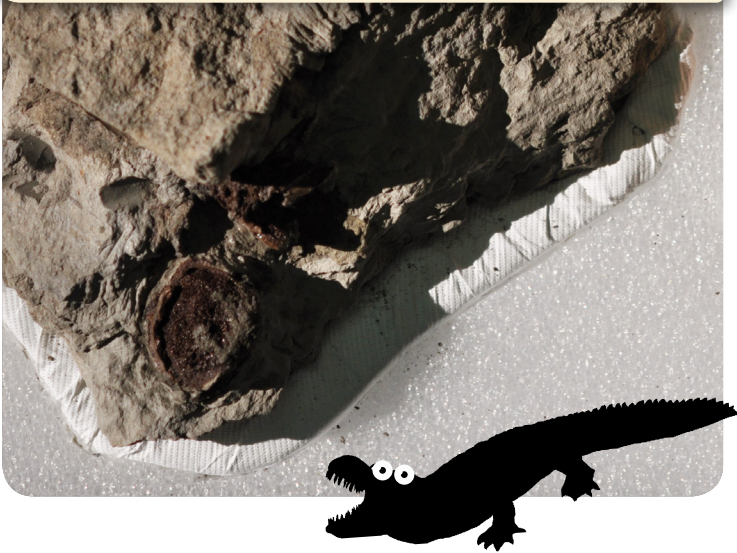
**Describe what ancient
Queensland looked during
this time period.**

Student Worksheet 1: *Lost Creatures Trail* (continued)

FOSSIL 4

What is my Common Name?

.....

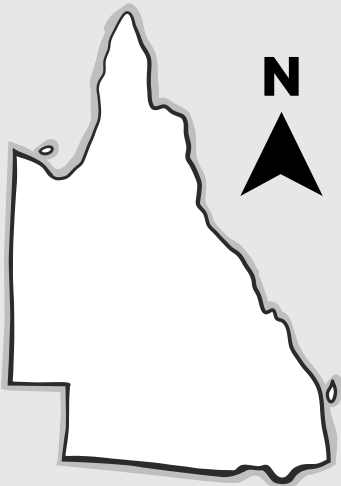


**Describe where I lived
(on the land or in the water?)**

**Am I similar to any animals
that are alive today?**

When was I discovered?

**Put an X on the map to show where my
remains were found.**



How was I discovered?

What time period am I from?

**Describe what ancient
Queensland looked during
this time period.**

Geebung Fossil Discovery

**Engineers unearthed a remarkable treasure trove
of fossils beneath Brisbane. Describe what else
they found:**

Student Worksheet 1: *Lost Creatures* Trail (continued)

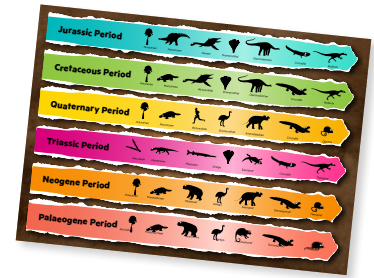
1. What was Gondwana? (Check out the screen animation on the Cretaceous Land console)

2. What evidence did you see from Queensland's past in *Lost Creatures* that indicates the surface of the earth will continue to change in the future?

3. Search the *Lost Creatures* exhibition for the information to complete the table below.
What major earth events occurred during each time period? Which one are you living in?

ANCIENT QUEENSLAND'S TIME PERIODS		
Correct order	Dates	Major Earth Events
1.		
2.		
3.		
4.		
5.		
6.		

**For the following questions,
revisit your completed 'Time Stack' puzzle**



5. Draw a circle around each of the fossils you discovered doing your *Lost Creatures* Trail.

6. Which life-forms became extinct? Why do you think this happened?

7. What organisms survived the mass extinction at the end of the Cretaceous Period?

8. Which organisms survived the longest? Why were they able to do this?

Science as a Human Endeavour

Question: What is a Palaeontologist?

(Click on the link for [Dr Andrew Rozefelds](#) to help you with your answer).

Interesting Fact!

Palaeontologists sometimes work with very small pieces of bone. A fragment of a large jawbone was enough for scientists to describe another species of Jurassic labyrinthodont. *Austropelor wadleyi* was found in the bed of the Brisbane river in QLD and named in 1941. Unfortunately no other specimens have been found.



STEM CAREERS IN REAL LIFE: Dr Alex Cook and Dr Andrew Rozefelds



Image: *In Search of Ancient Queensland* Principal Authors Dr Alex Cook and Dr Andrew Rozefelds. (December 2015)
Source: Queensland Museum Image Collection

Museum digs up ancient Queensland stories in latest publication

Queensland's ancient past is revealed in book, *In Search of Ancient Queensland*, the first significant publication about the state's geological and fossil history in 25 years.

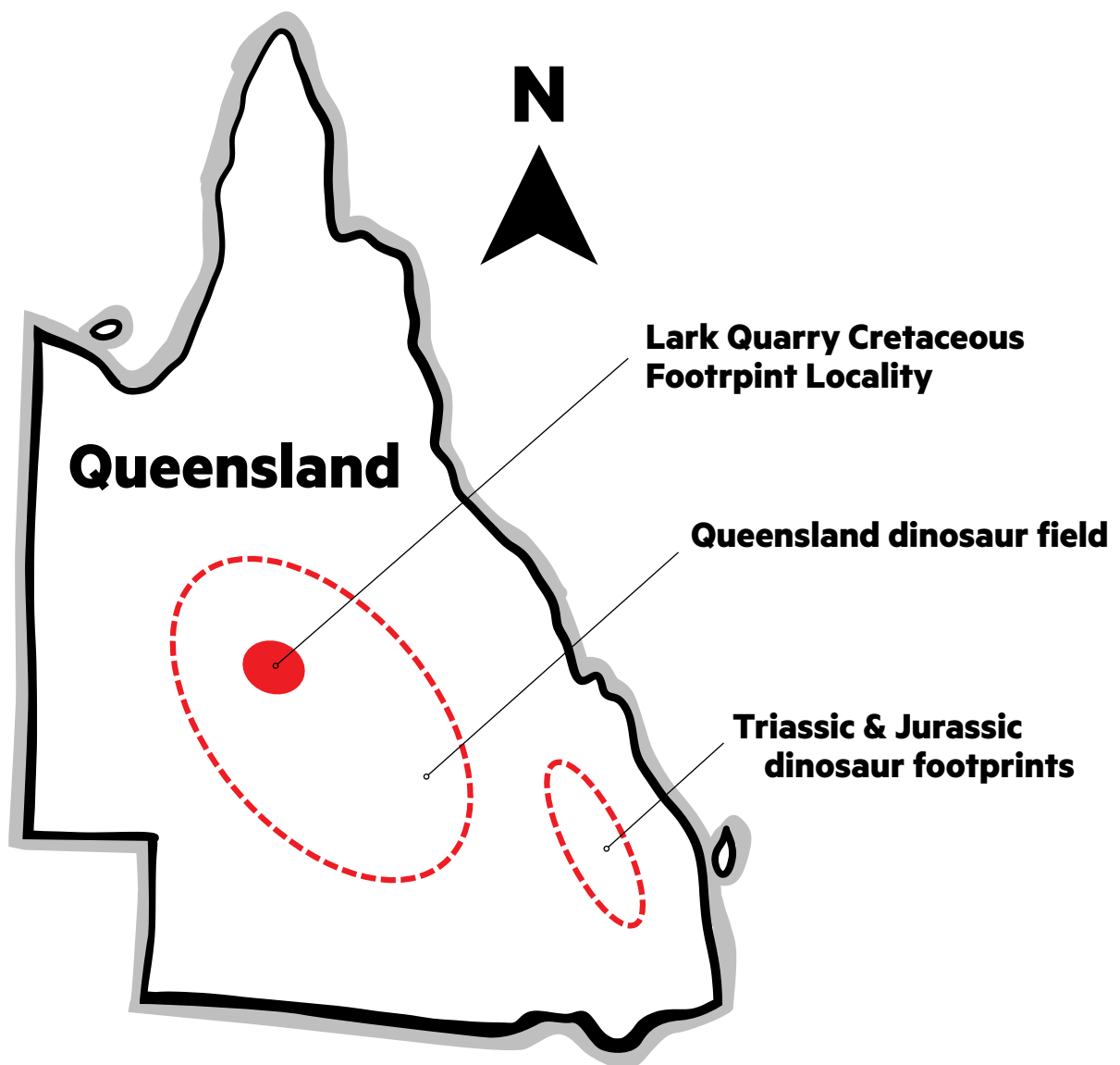
This Queensland Museum Discovery Guide tells a story through fascinating first-person insights into the state's remarkable geological and natural heritage, and shines a light on the museum's world-class fossil collection and research.

It's a journey 250 million years in the making and gives readers real insight into how Queensland's modern landscape was formed.

[Read more about ancient Queensland stories.](#)

Activity 3: Bones in the Black Soil

The black soil plains of outback Queensland are a rich hunting ground for Palaeontologists and other scientists studying life in ancient times. More than 25 dinosaur sites are known and these usually appear as patches of small bone fragments on the surface of a black soil plain. Black soil behaves differently in the wet and extreme heat. Black soils crack open when dry and have a large water-holding capacity. these soils are called the cracking clay soils of the Darling Downs and Central Highlands. This amazing natural process can help us understand how fossils have been revealed in outback Queensland.

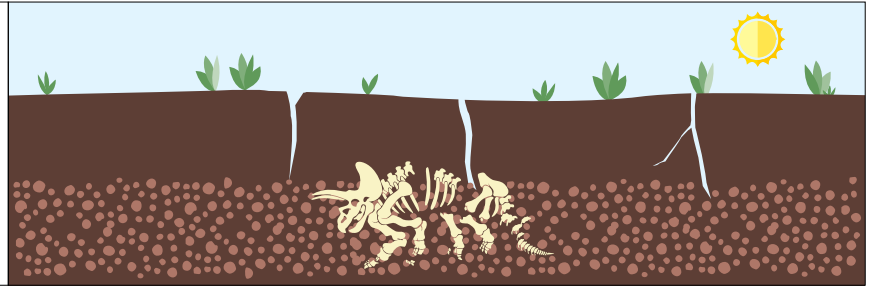




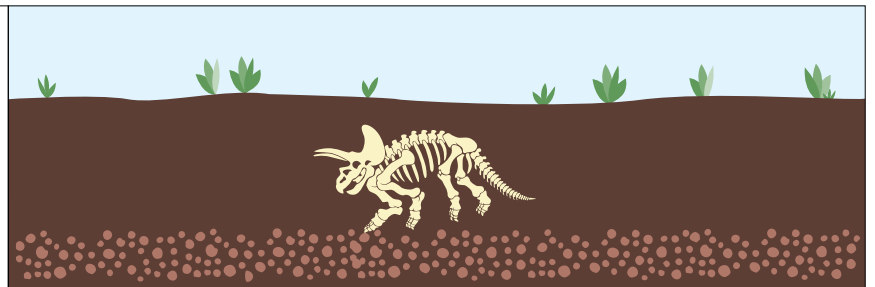
Instructions: The *Bones in the Black Soil* illustrated story is not in the correct order.

Read through each of the statements associated with each of the six (6) images, then cut them out neatly, and glue them down in the correct order.

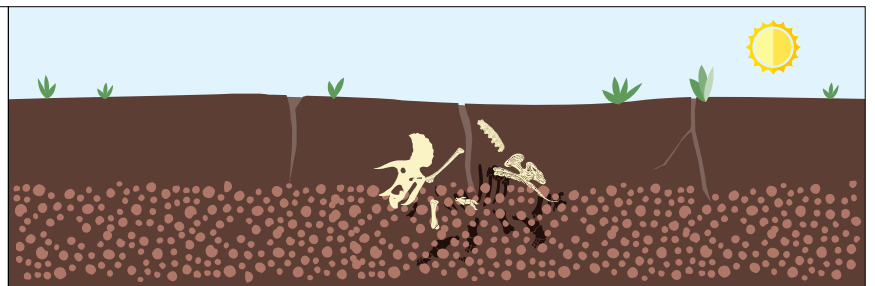
When the soil dries it forms big cracks and breaks the bones.



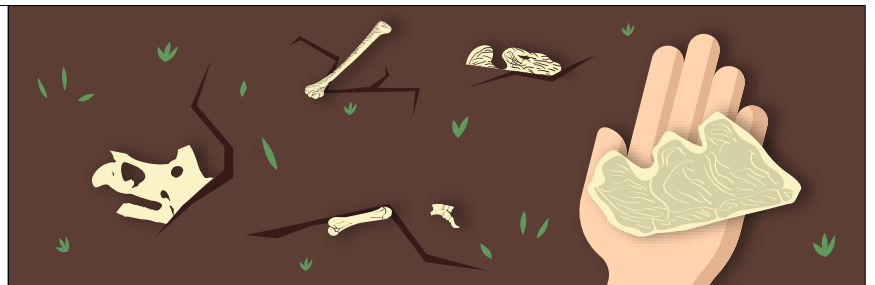
The dinosaur dies and is buried before the remains are completely destroyed.



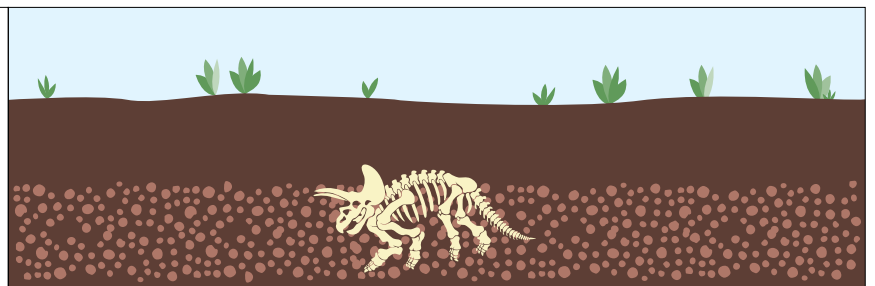
Every year the cycle repeats for millions of years and the bones get pushed up towards the surface.



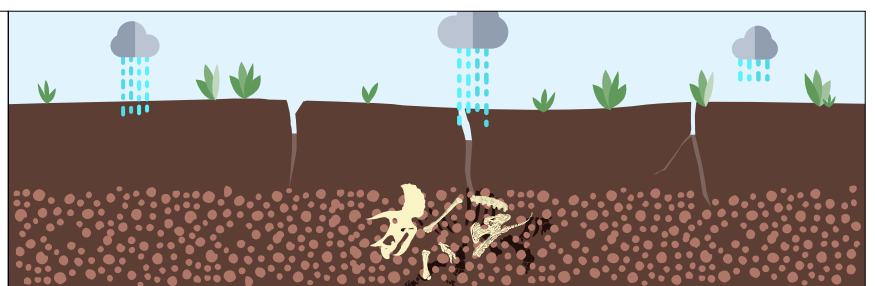
The fossils remain within the rock until uncovered through erosion or excavation. Hopefully someone finds a bit of bone on the surface and we start to dig and uncover a new dinosaur!



The dinosaur bones are preserved in sedimentary rock below the black soil.



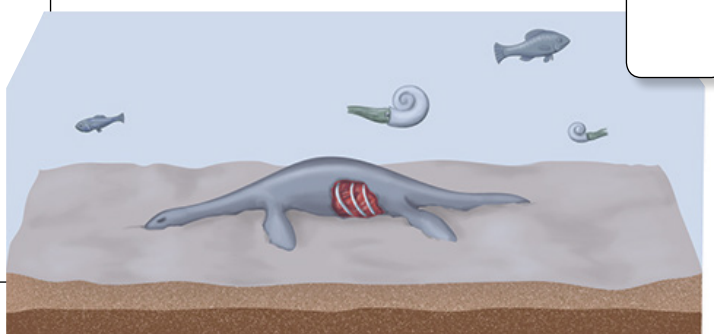
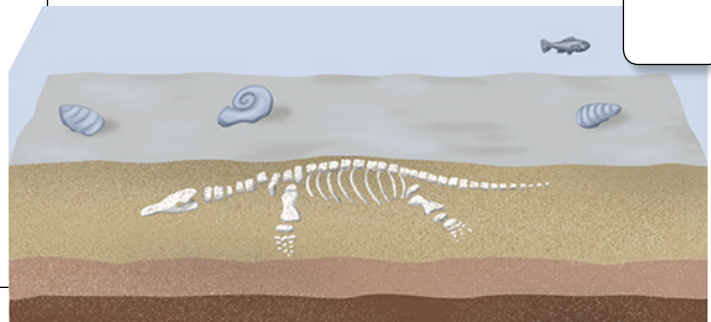
The next rainy season washes soil down into the cracks and under the bones.



Activity 4: How Fossils are Formed

Instructions:

These four images are NOT in the correct order. Put them in correct order by placing a number from 1-4 next to each image. Write a brief story that describes what is happening in each of the images.

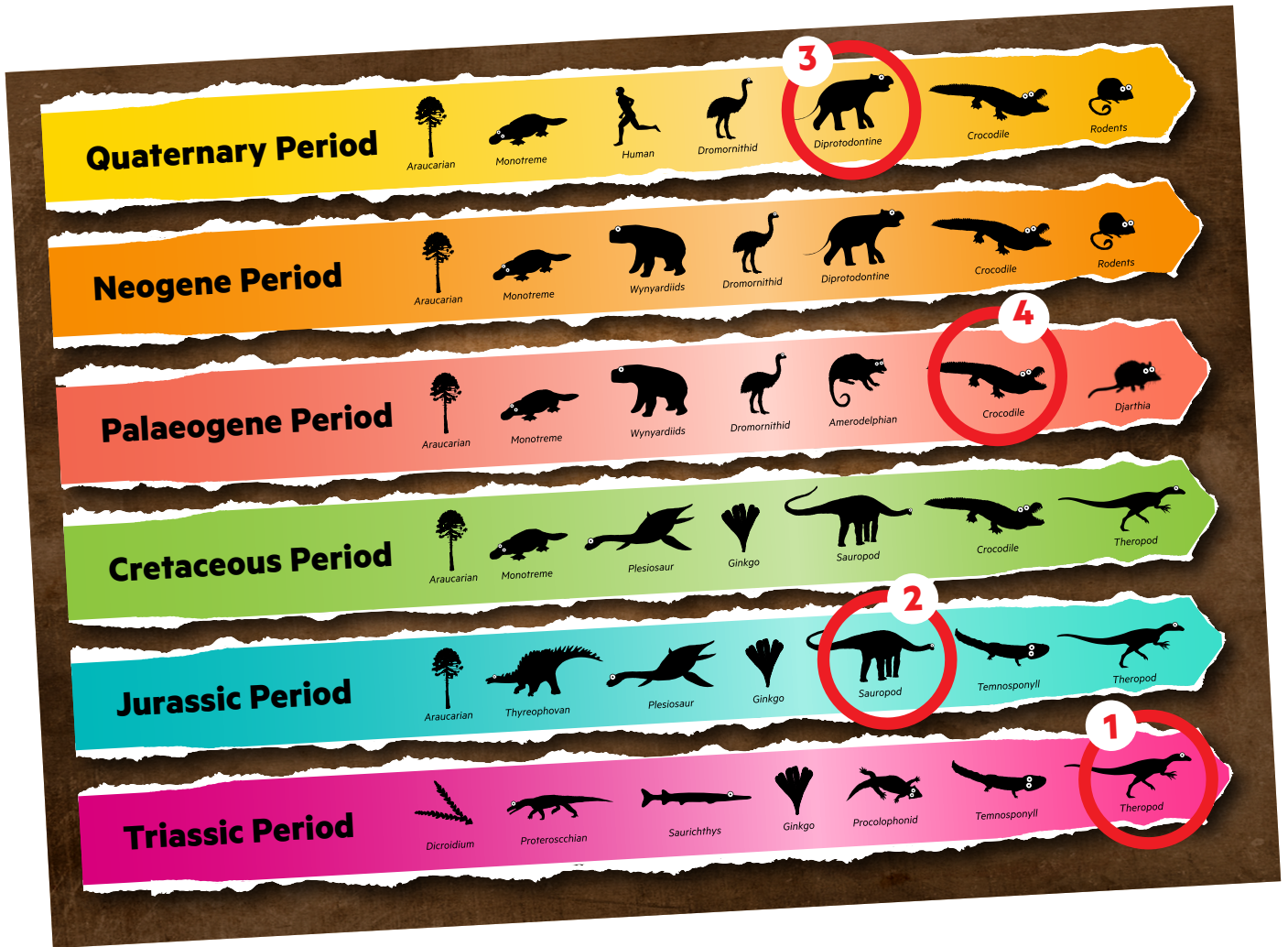


Teacher Notes

Activity 1: Time Stack



The red circle indicates fossils highlighted in Activity 2: *Lost Creatures Trail*



Student Worksheet 1: Lost Creatures Trail

FOSSIL 1

What is my Scientific Name? Eubrontes (Theropod)
footprints



Describe where I lived (on the land or in the water?)

Land and meat eater (Carnivore).

Am I similar to any animals that are alive today?

Birds.

When was I discovered?

1950s Dinmore Ipswich SEQ.

How was I discovered?

Found deep below the surface in a coal mine.

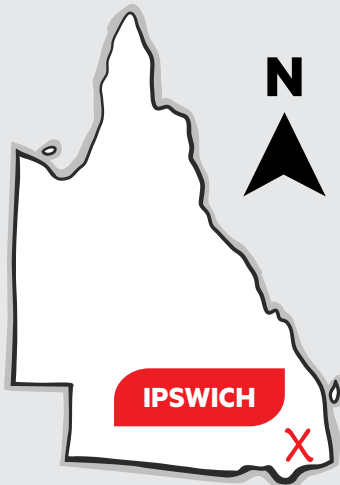
What time period am I from?

Late Triassic Period.

Describe what ancient Queensland looked during this time period.

During the late Triassic, extensive wetland areas formed in what is now northern New South Wales and south-east Queensland and there were also forests of conifers, cycads and ferns. Some of Australia's major coal deposits were formed within this ancient environment.

Put an X on the map to show where my remains were found.

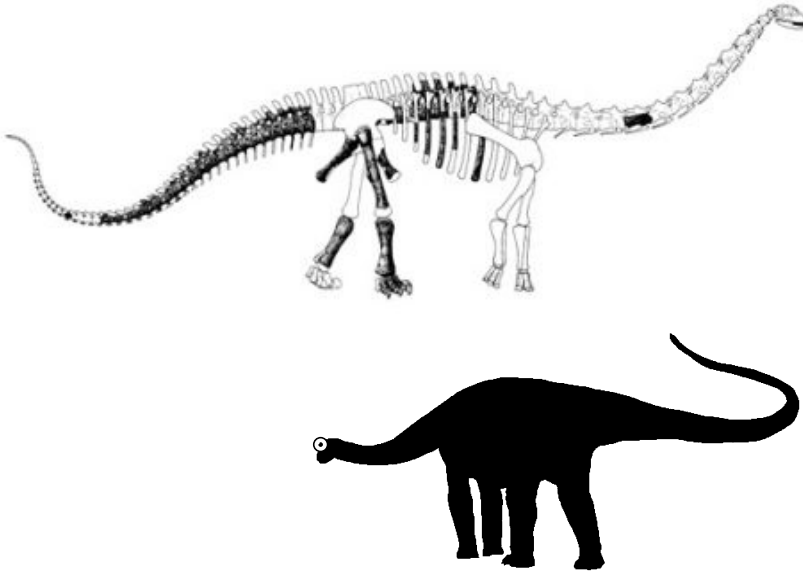


Student Worksheet 1: Lost Creatures Trail (continued)

FOSSIL 2

What is my Common Name? Sauropod

What is my Scientific Name? Rhoetsaurus brownie



Describe where I lived (on the land or in the water?)

Lived on land, plant eater / Herbivore (ate tall conifers).

Australia's oldest dinosaur. It was scientifically described and named by Heber A. Longman, the Queensland Museum Director at that time.

Am I similar to any animals that are alive today?

No.

When was I discovered?

1924. Durham Downs station owned by A.J. Browne near Roma.

How was I discovered?

Partial skeleton recovered from Walloon Coal Measures.

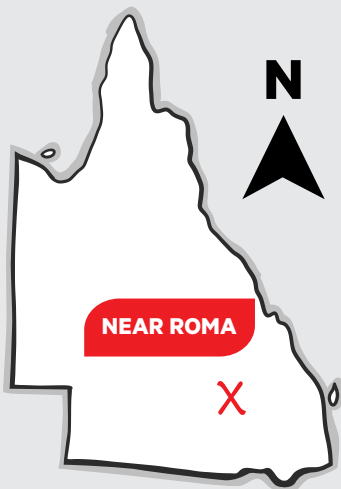
What time period am I from?

Jurassic Period.

Describe what ancient Queensland looked during this time period.

Massive networks of fast flowing rivers carrying sediment through deep valleys created a rich covering of vegetation throughout Australia.

Put an X on the map to show where my remains were found.



Student Worksheet 1: Lost Creatures Trail (continued)

FOSSIL 3

What is my Scientific Name? Diprotodon optatum



Describe where I lived (on the land or in the water?)

On the land. Diprotodons were the largest marsupials that ever lived and this fellow was around 2 metres high at the shoulder and weighed 2000 kilograms or more. Diprotodon was a plant eater (herbivore), feeding on low shrubs and grasses.

Am I similar to any animals that are alive today?

Wombat / Koala.

When was I discovered?

In 2011 in Gowrie Creek on the Darling Downs, uncovered through erosion on a creek bank after the floods.

How was I discovered?

Amazingly, a week after the skull was recovered from the creek bank, Gowrie Creek flooded again and the skull probably would have been destroyed.

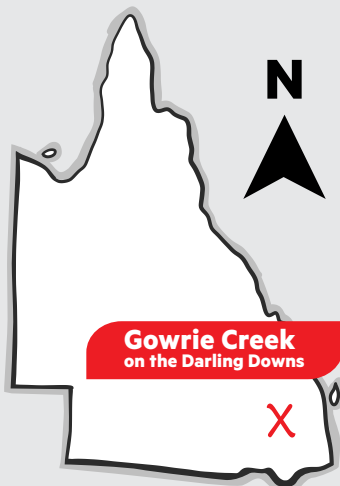
What time period am I from?

Quaternary Period. After the mass extinction at the end of the Cretaceous Period, which saw the demise of giant land-dwelling dinosaurs and ocean-going marine reptiles, a new wave of giants evolved on the planet. The "Megafauna" were giant versions of what we see today, from almost every animal group. Giant frogs, lizards, snakes, birds and mammals. Some megafauna live today, such as the elephant, rhinoceros, whales and crocodiles.

Describe what ancient Queensland looked during this time period.

Evidence of these extinct megafauna can be found across Australia as fossilised remains found in deep dark caves, eroding from river and creek banks, in ancient swampy peat bogs and dried-up salt lakes, and even eroding from old beach dunes.

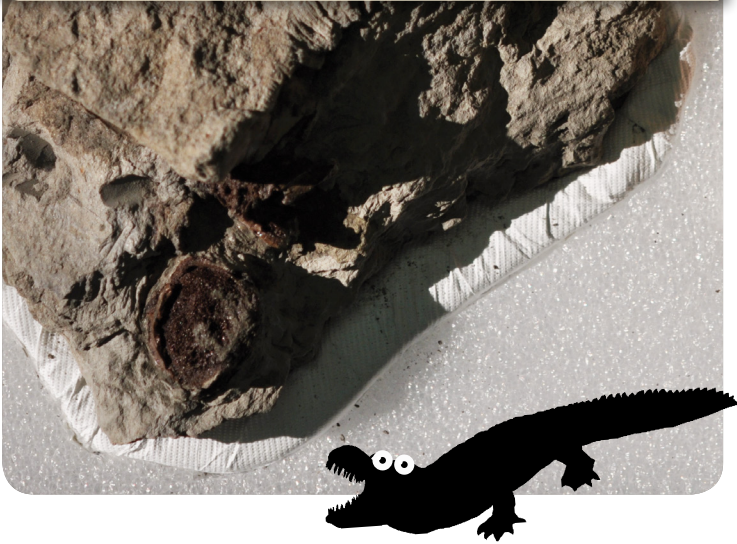
Put an X on the map to show where my remains were found.



Student Worksheet 1: Lost Creatures Trail (continued)

FOSSIL 4

What is my Common Name? Crocodile



Describe where I lived (on the land or in the water?)

In the water – freshwater lake. The fine sediments of Geebung indicate that this was once a freshwater, nutrient-rich lake.

Also found: Plant Impressions – Freshwater Algae; Freshwater Snail; Perch like fish; Crocodile vertebrae.

Am I similar to any animals that are alive today?

Crocodile.

When was I discovered?

In 2013 a number of fossils were found in the oil shale at Geebung in Brisbane.

How was I discovered?

Found during the digging of the foundations for an overpass bridge.

Core samples: The drill core is a sample of the oil shale from a depth of 19-25m at the Geebung site.

Engineers and geologists use the geological information in cores to work out how to build safe and secure foundations for buildings.

What time period am I from?

Palaeogene Period.

Describe what ancient Queensland looked during this time period.

Queensland's climate during this period can be described as a roller coaster between sweltering and freezing, and it was much wetter than today. Rainforests dominated much of the state.

Put an X on the map to show where my remains were found.



Geebung Fossil Discovery

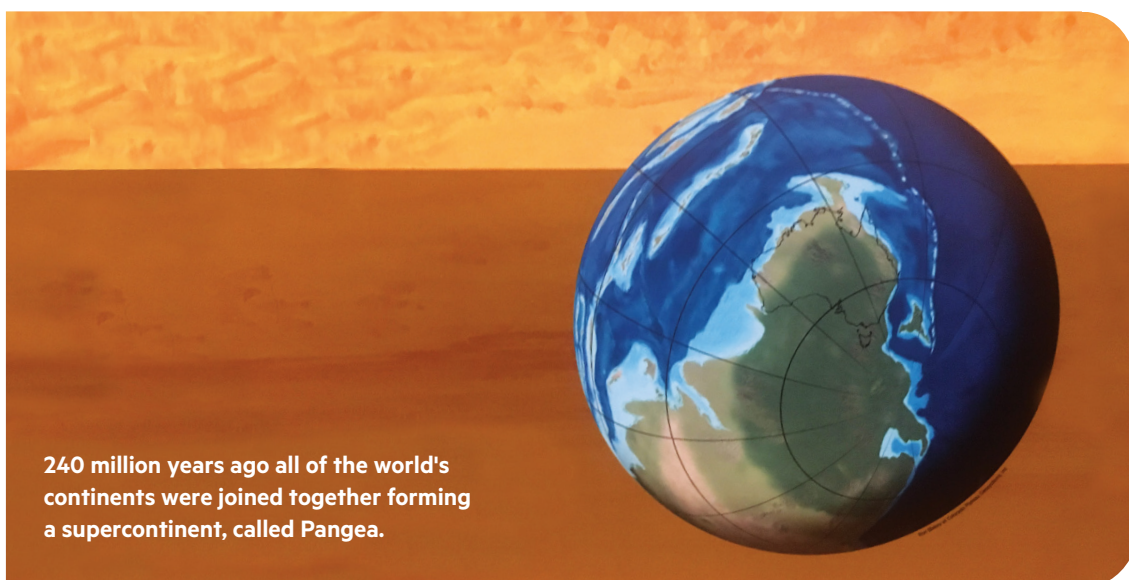
Engineers unearthed a remarkable treasure trove of fossils beneath Brisbane. What did the Engineers find in Geebung in Brisbane?

In 2013, a number of fossils were found in oil shale at Geebung, Brisbane. The fossils were discovered during the digging of foundations for an overpass bridge. They are from a time when Australia was still connected to Antarctica.

The Changing Surface of the Earth

Queensland has a diverse and complex geology that reflects the varying origins, many environments and different time periods that have helped shape the state's modern topography. Most of the world's major divisions of geological time are represented in the rocks and landforms that occur across Queensland, with the exception of the Archean Era (3800-2500 million years ago). During this very ancient time period, the Earth's crust began to stabilise and the primordial atmosphere and earliest oceans came into being.

Triassic Period—Queensland 252–200 million years ago



The Triassic Period was the beginning of the Age of Dinosaurs and it was marked by continuing climate and environmental change. On a global scale, the climate varied from hot and dry at the beginning of the Triassic to warm and wet in the later stages. However, Australia experienced cooler conditions because it was further south than it is now.

At this time, Australia was part of Gondwana and was joined to Africa, South America, Antarctica and India. In the early Triassic, erupting volcanoes continually reshaped the eastern edge of Gondwana. Inland, vast rivers flowed across the endless plains dotted with lakes.

During the late Triassic, extensive wetland areas formed in what is now northern New South Wales and south-east Queensland and there were also forests of conifers, cycads and ferns. Some of Australia's major coal deposits were formed within this ancient environment.

The first dinosaurs are known from this time and footprints of these animals have been found in eastern Australia. Amphibians and fishes lived in the lakes and streams and strange creatures who were the ancestors of mammals walked the land.

Jurassic Period—Queensland

200–145 million years ago



150 million years ago Australia was connected to Antarctica forming part of a new supercontinent, called Gondwana.

Gondwana was made up of the present day continents of Australia, New Zealand, Antarctica, South America, India, Africa and Madagascar.

A Time for Giants!

Australia still looked very different from the continent we know today. It remained part of the supercontinent of Gondwana, but Africa and South America started to break away.

The warm Jurassic climate and massive networks of fast-flowing rivers carrying sediment through deep valleys created a rich covering of vegetation throughout Australia. Thick pine forests with an understory of ferns and cycads sheltered dinosaurs and other animals. Horsetails, ginkos and other plants were common.

Dinosaurs were the dominant life form.

Cretaceous Period

145–166 million years ago (Queensland 110-100 million years ago)



The Great Inland Seas

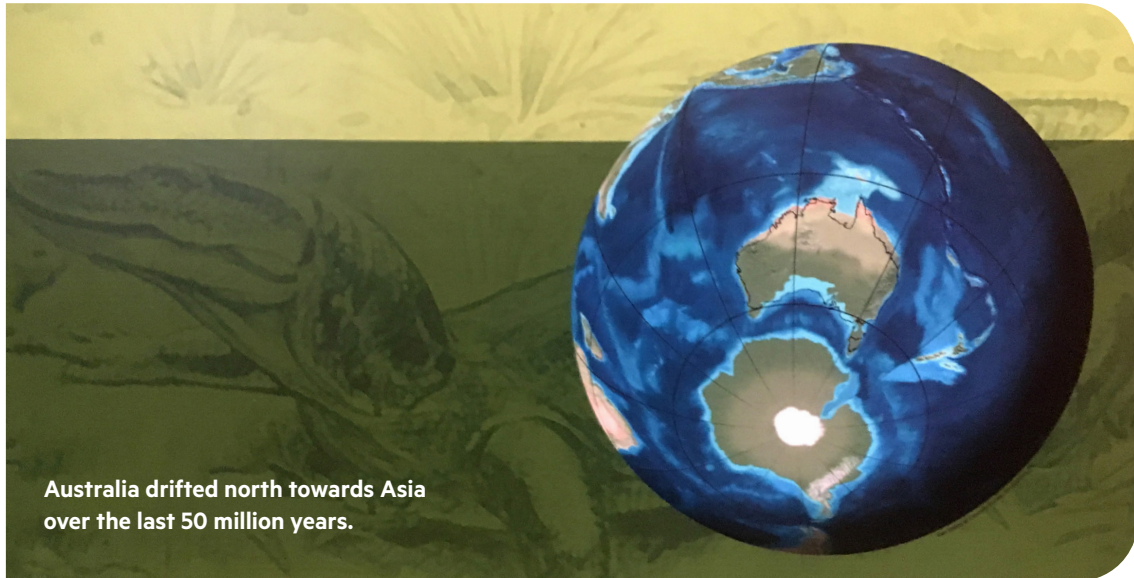
Australia was still well south of the equator, at latitude 55°S, but was slowly travelling north and rotating in an anti-clockwise direction. Violent volcanic eruptions and movements in the Earth's crust were tearing eastern Gondwana apart.

At different times during the Cretaceous Period, eastern Australia was inundated by five separate inland seas. The largest inland sea, about 110 million years ago, covered one-third of the land mass. The shallow waters of the inland seas supported marine reptiles, turtles, sharks and other fish. Giant squid up to 4m long roamed the depths and other squid like animals such as ammonites, belemnites and nautiloids darted through the cool waters. Beneath the surface, a wide muddy sea floor stretched for hundreds of kilometres.

Conditions were poor, but clumps of sponges, marine plants and oyster-like bivalves, with crabs and lobsters scuttling in-between, managed to survive. At the edges of this great sea, dinosaurs browsed on vegetation and pterosaurs hunted for fish. Occasionally, after they died, the bodies of these terrestrial animals were washed into the sea. Today they are found as fossils in the rocks of the Great Artesian Basin.

Palaeogene Period—Queensland

66–23 million years ago



First large mammals appear — 66–56 million years ago

Oligocene extinction event — 56–34 million years ago

Mammals are dominant — 34–23 million years ago

One result of the deep weathering during this period was the formation of most of Queensland's opal deposits. Opal is Australia's principal gemstone, with more than 95% of all the world's precious opal originating from the rocks of the Great Artesian Basin.

Neogene Period—Queensland

23 – 2.6 million years ago

The Neogene Period was a time of big changes for the earth. The climate became cooler and drier. Grasslands replaced forests. The animals had to adapt to these changing conditions or face extinction.

Grasses become widespread — 23–5.3 million years ago

Human ancestors (Hominids) appear — 5.3–2.3 million years ago

Quaternary Period—Queensland

2.6 million years ago – Today

Ice Age begins — 2.6 million years ago

Earliest humans appear — 2.6–0.0117 million years ago

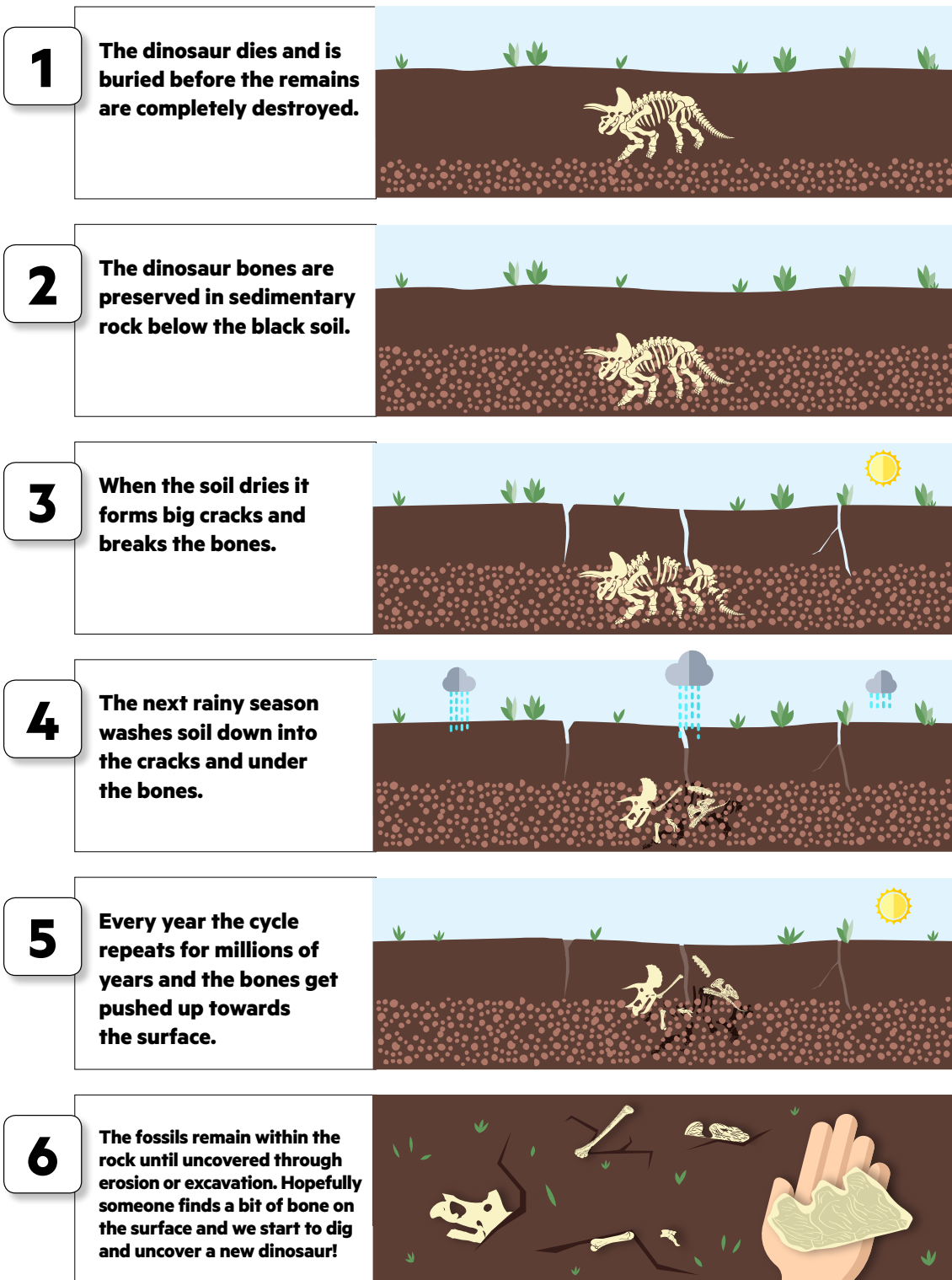
Humans are dominant — 0.0117 million years ago–Today

Ice Age Ends

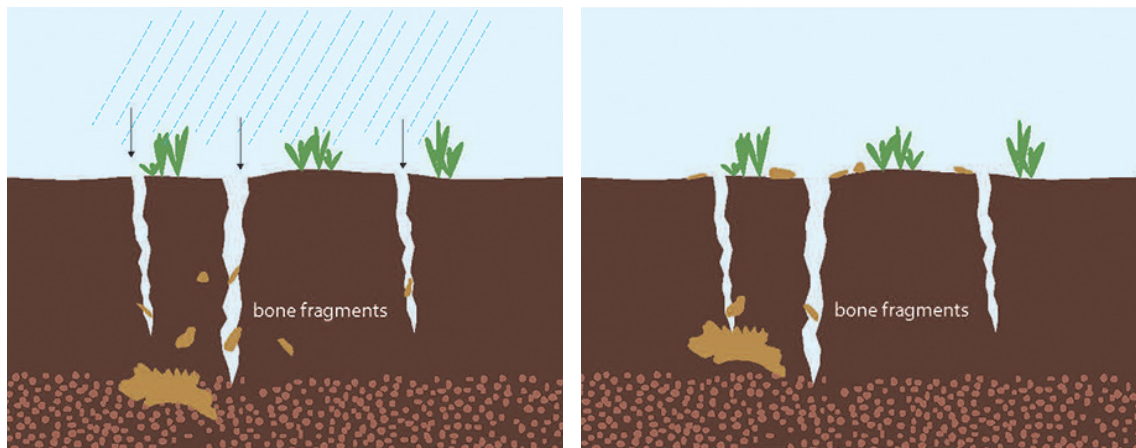
Extinction events are important to the history of life because they allow new forms of life to develop. They are part of the natural cycle of the Earth.

Activity 3: Bones in the Black Soil

Solution to Bones in the Black Soil Activity



The black soil plains of outback Queensland are a rich hunting ground for palaeontologists and other scientists studying life in ancient times. For the most part, the swelling clay soils exist on the Cretaceous-age sediments of the Eromanga Basin. Soil profiles are generally 1-4 m thick, but when wet, the clays in the soil can increase in volume by up to 10 times. Although the surface soils themselves are only a few million years old, they are constantly being formed by disaggregation of the Cretaceous rocks beneath.



Source: Queensland Museum Image Collection

Above: Fossilised bones are often found on the surface as fragments, which have travelled up through the soil profile. The seasonal cycle of wetting and drying means the black clay soils ‘self-mulch’, or turn over. Sometimes, extreme dry weather allows deep cracks to develop down through the soil into the upper layers of weathered rock. This process continues over the next wet season. Moisture closes the cracks and ‘squeezes’ the bone fragments up to the surface.

At each field site, the location and abundance of bones on the surface is precisely mapped so that palaeontologists know exactly where to undertake further excavation.



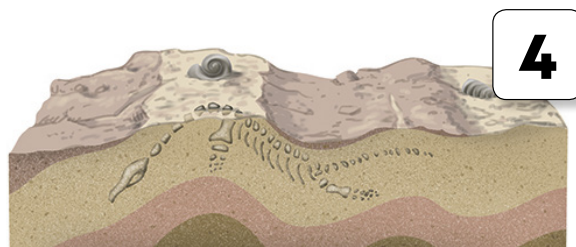
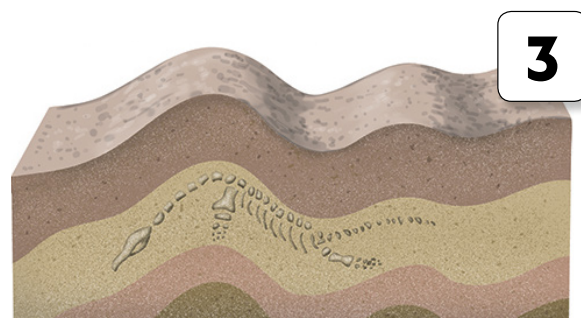
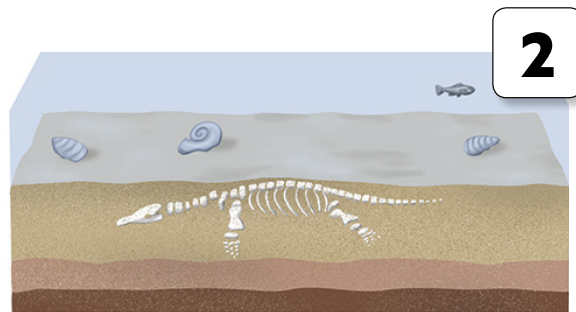
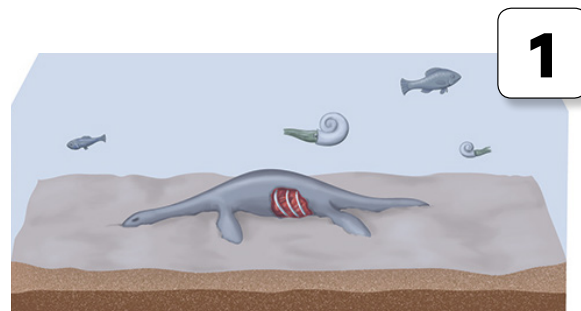
Source: Queensland Museum Image Collection

Above: Some of Australia’s most important dinosaur discoveries have been made on the black soil plains of western Queensland. The seemingly flat plains are actually undulating over large distances, and for this reason, are known as rolling downs. This photograph shows a team from the Queensland Museum and the Australian Age of Dinosaurs working on the excavation of the large titanosaur, nicknamed “Elliot” in 2001-2004.

Many major discoveries have been made by local property owners while mustering stock and more bones have been found on properties that run sheep. This anomaly is probably due to different ways sheep and cattle are mustered and, hence, how much of the ground is closely observed.

Activity 4: How Fossils are Formed

For a fossil to be produced, the remains of the animal or plant must be covered quickly before decay begins and before they are disturbed by other animals or natural forces, such as wind and water. As the loose sand, mud or other particles turn to rock, the fossils also undergoes chemical change and becomes part of the sedimentary rock.



Source: Queensland Museum Image Collection

Queensland Museum STEM Videos

Recreating Lark Quarry footprints

<https://www.youtube.com/watch?v=whGwvnlmTI>

Managing the Ancient Environments collection

https://www.youtube.com/watch?v=rjwP1fer6_8

Paleontology research in the field and in the lab

<https://www.youtube.com/watch?v=4mBBJCmrUC4>

Bibliography



Cook, A., & Rozefelds, A. (2014),
In Search Of Ancient Queensland
Queensland Museum: Brisbane, Queensland

Much of this information has been sourced from the book '*In Search of Ancient Queensland*' which can be purchased from the Queensland Museum shop in-store or [online](#) (ISBN: 9780977594306). More information and fossils from ancient Queensland can be seen in the Queensland Museum's Lost Creatures exhibition, South Brisbane.



Hocknull, S., & Cook, A. (2006),
Amazing Facts about Australian Dinosaurs,
Steve Parish Publishing. Brisbane, Queensland

This book has been published by Steve Parish Publishing and was written by Dr Scott Hocknull and Dr Alex Cook, senior curators in Geosciences at Queensland Museum.