QUEENSLAND MUSEUM

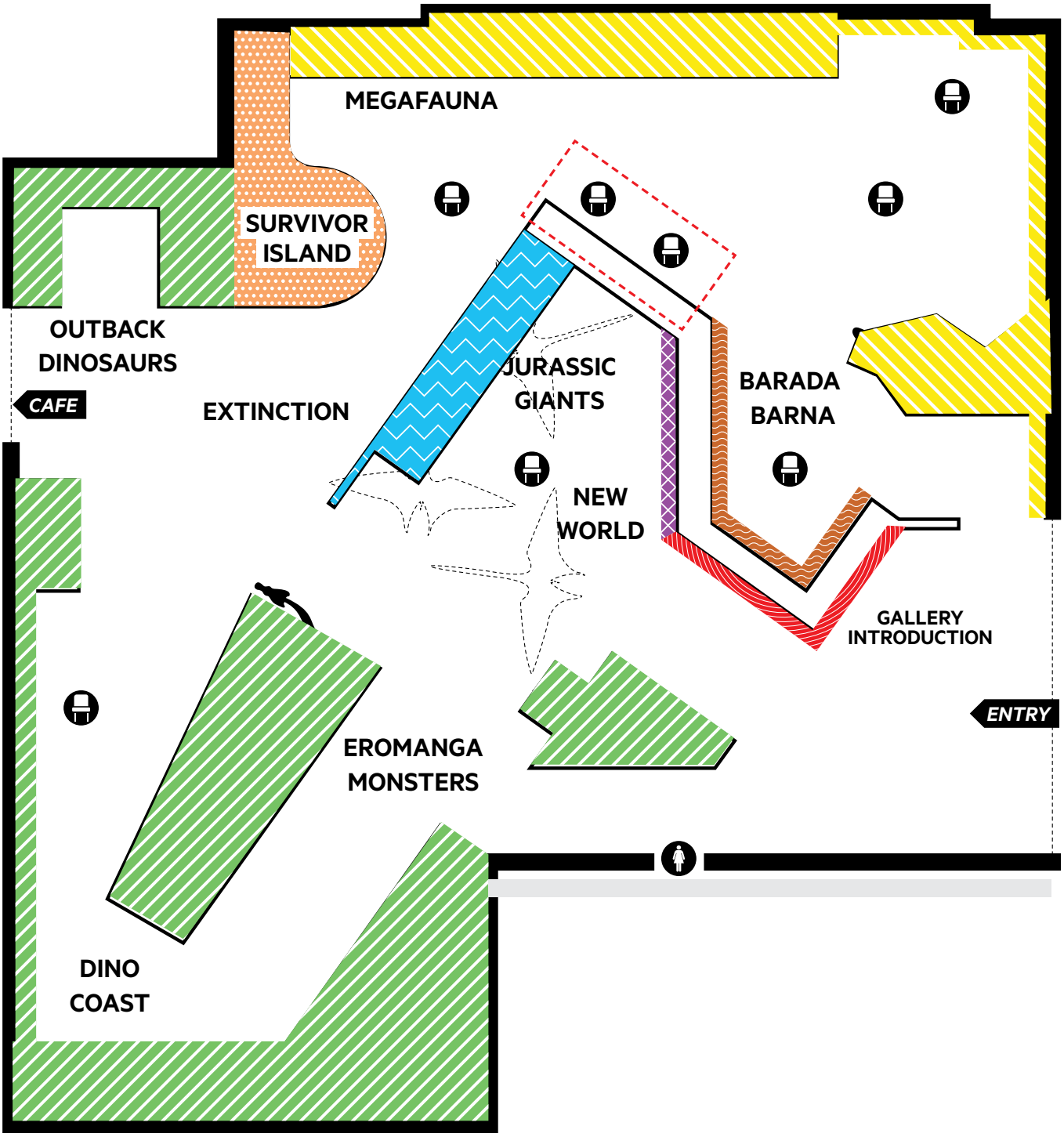
Part 1/2

DINOSAURS UNEARTHED

Explore Prehistoric Queensland

Large print guide

Introduction to Game Over


MEGAFAUNA
SURVIVOR ISLAND
OUTBACK DINOSAURS
CAFE
EXTINCTION
JURASSIC GIANTS
BARADA BARNA
NEW WORLD
GALLERY INTRODUCTION
ENTRY
EROMANGA MONSTERS
DINO COAST

Theme colour key

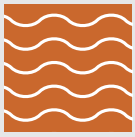
Triassic

Jurassic

Cretaceous

Paleogene
& Neogene

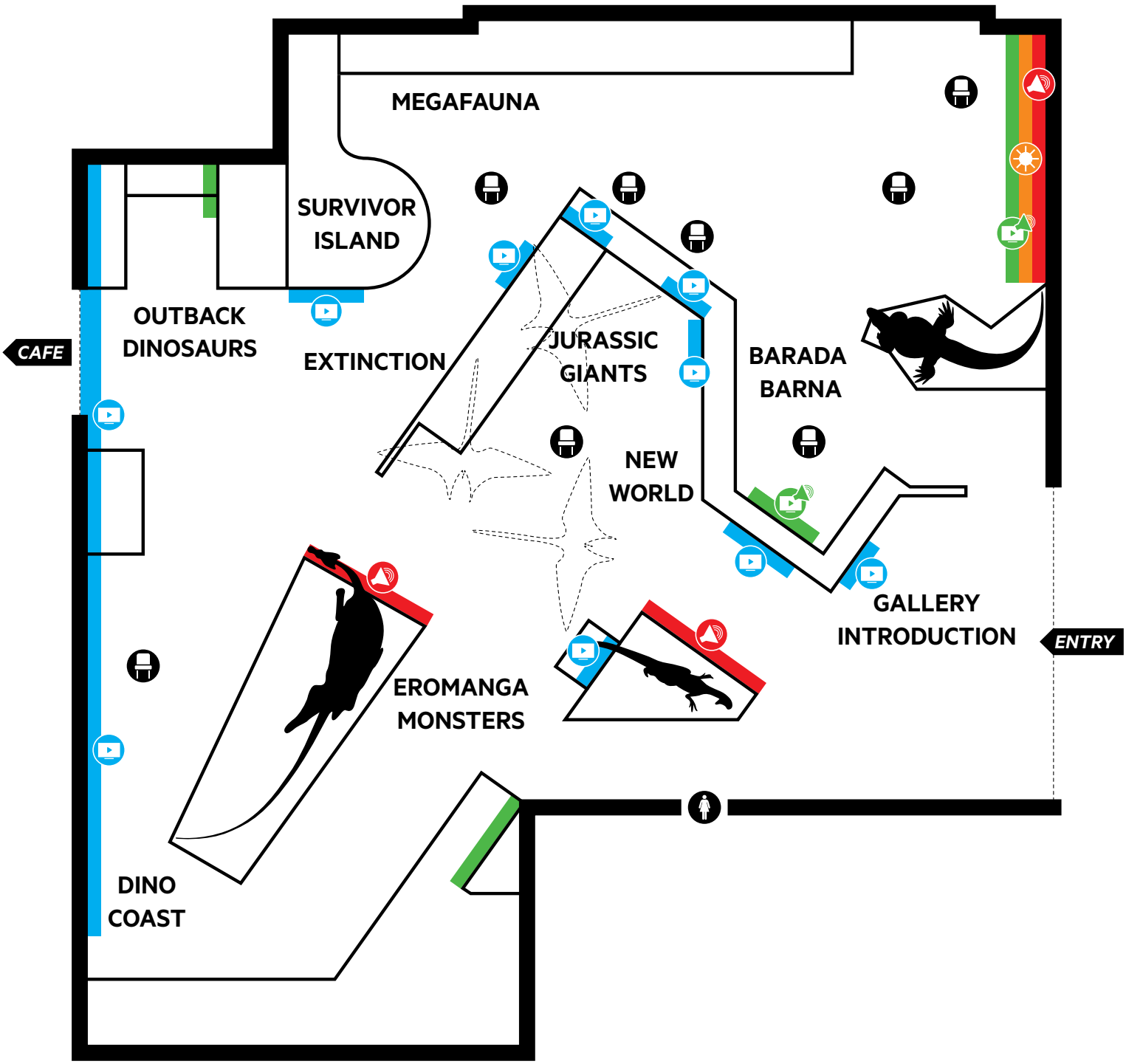
Quaternary



Timeless Land
(First Nations Focus)

Introduction

Palaeolab - Active Area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Sensory map key

This display has vision

This display has vision and sound

This display is bright and may flash

This display can be noisy


Queensland Fossil Record
Examples from the Queensland Museum Geosciences collection
Jurassic
Rhoetosaurus

Queensland Fossil Record

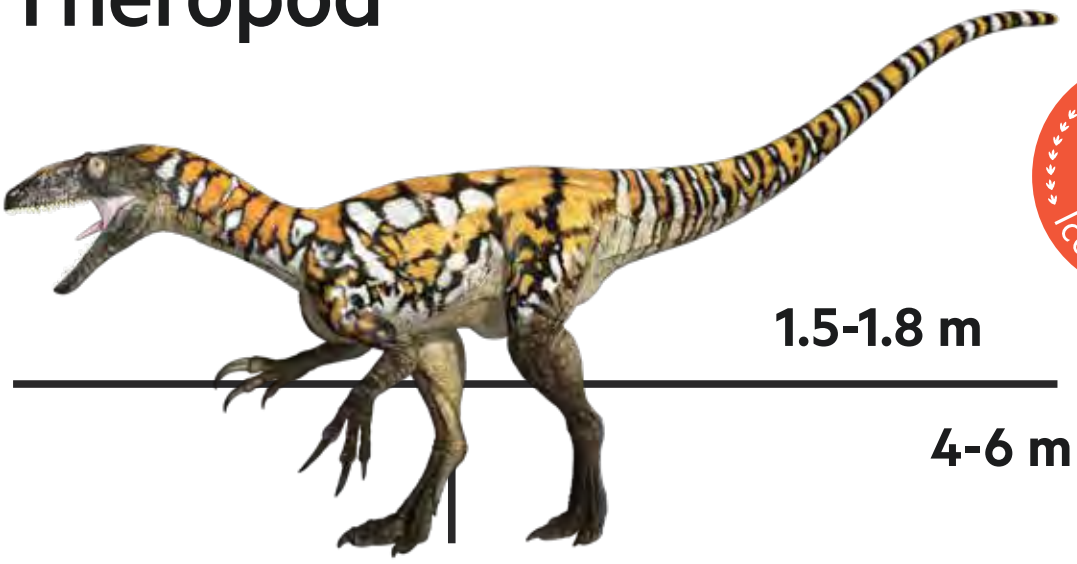
Queensland's fossil record is vast, stretching back at least 1.5 billion years. This animation maps the geological rocks of Queensland starting at the Age of Dinosaurs, 250 million years ago (mya), to the end of the Age of Megafauna, about 40,000 years ago. A selection of ten fossils from the Queensland Museum Geosciences collection is shown to demonstrate the great diversity of fossils found across the State.

Animation Duration: 1:55

8 Australovenator 3D print

Australovenator wintonensis

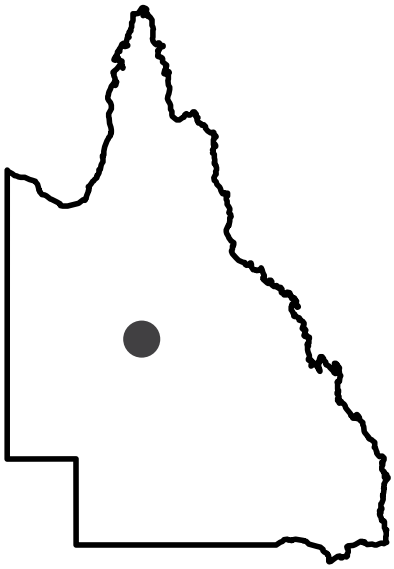
Theropod



1 of 30 Iconic species

This life sized 3D print of Australovenator has been scientifically recreated using 3D scans, sculpting and detailed painting.

Fossil location



Carnivore

Dinosaur

Dinosaurs Unearthed

Explore prehistoric Queensland

Journey through Queensland's rich and unique fossil record, spanning the age of dinosaurs and age of megafauna. It is a story of the past 250 million years – a past we all share.

Discover our most iconic **prehistoric species**

- Not all of them were dinosaurs.
- Who will be your most iconic Queensland prehistoric species?

Unearth our most precious **fossil treasures**

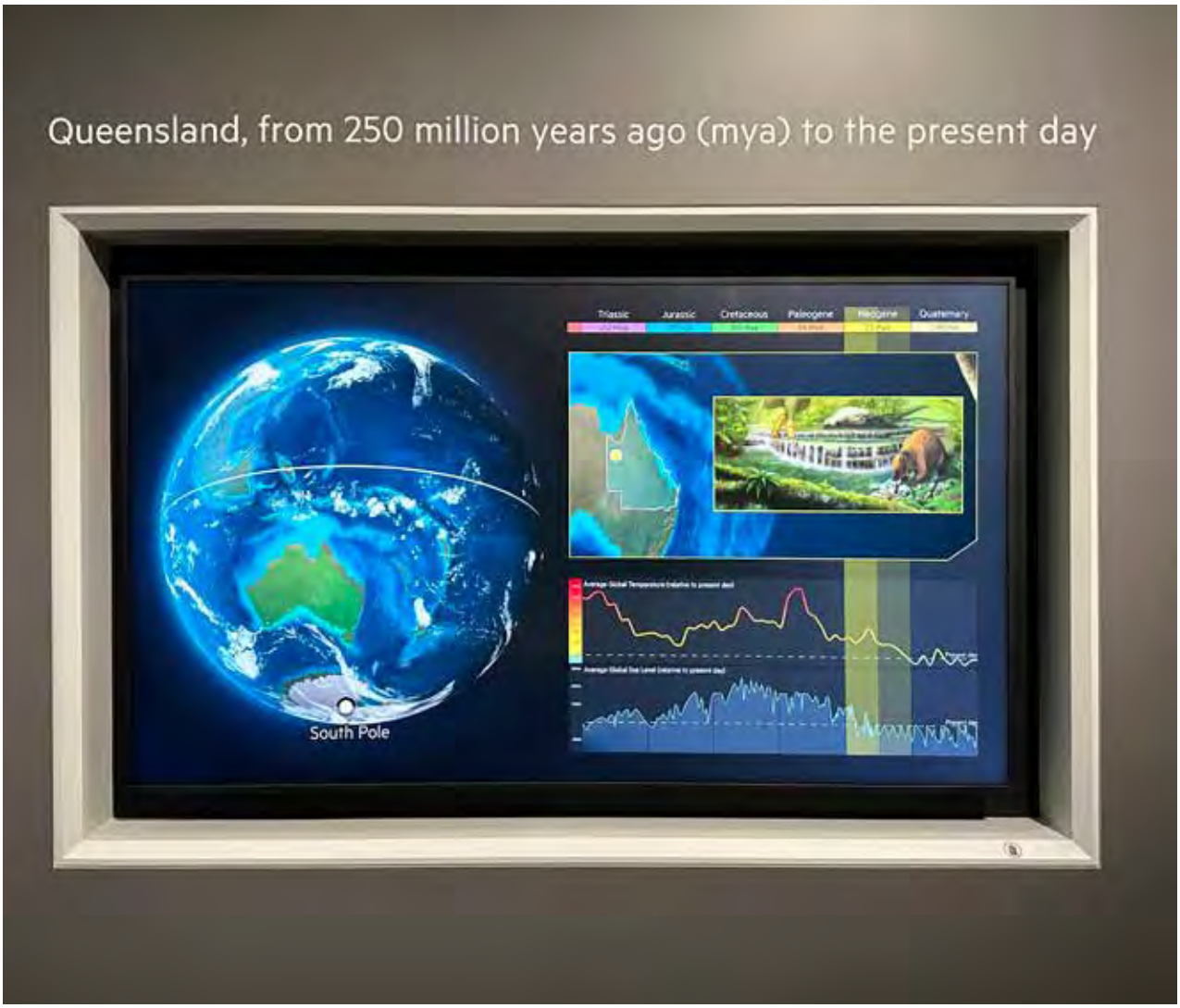
- Not all of them are big.
- What fossil treasures will you choose as the most precious?

Find the survivors of extinction

- Not all are obvious.
- Can you find a survivor that you might have seen living today?

Dig deeper

Find and scan QR codes to experience an online and virtual world of Queensland palaeontology.


Queensland, from 250 million years ago (mya) to the present day
Triassic
Jurassic
Cretaceous
Paleogene
Neogene
Quaternary
South Pole

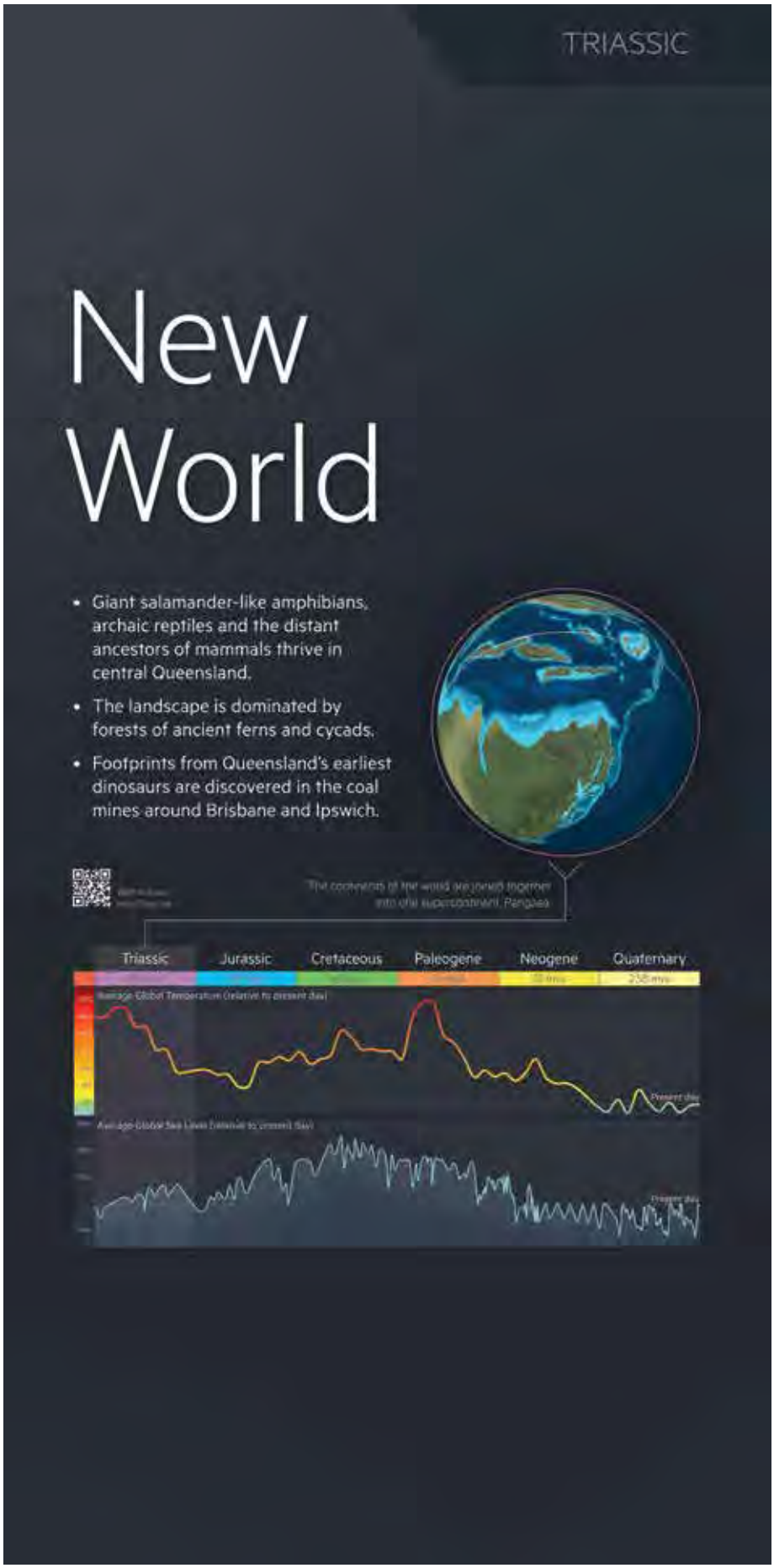
Queensland Through time

Queensland has travelled great distances throughout prehistory. Hundreds of millions of years ago Queensland moved from the northern hemisphere to the southern hemisphere, joining what became Eastern Gondwana. This animation presents the journey of Queensland, starting 250 million years ago (mya) and reaching its present position, close to the Equator. Each geological Period shows major changes to the environment and the evolution and extinction of Queensland's unique prehistoric fauna and flora.

Animation Duration: 2:40

Triassic

145 mya to 100.5 mya

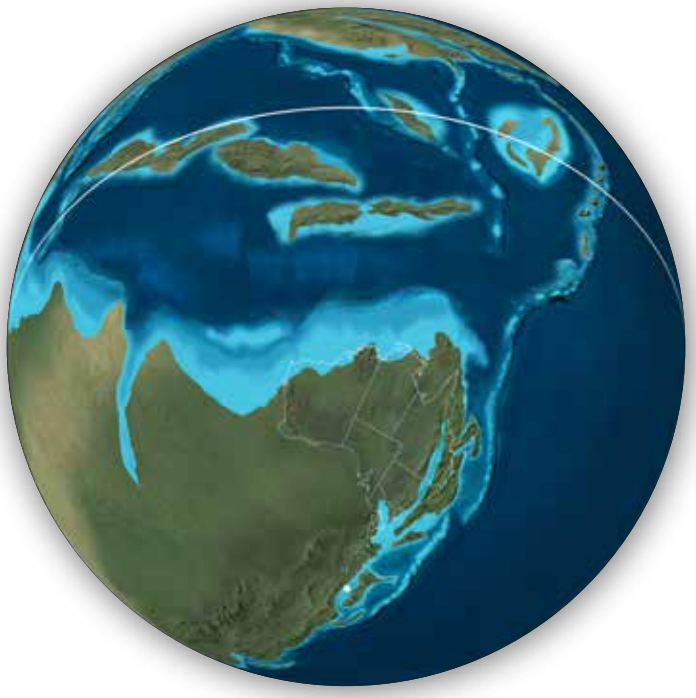

TRIASSIC
New World
• Giant salamander-like amphibians, archaic reptiles and the distant ancestors of mammals thrive in central Queensland.
• The landscape is dominated by forests of ancient ferns and cycads.
• Footprints from Queensland's earliest dinosaurs are discovered in the coal mines around Brisbane and Ipswich.
Triassic
Jurassic
Cretaceous
Paleogene
Neogene
Quaternary

Triassic
New World

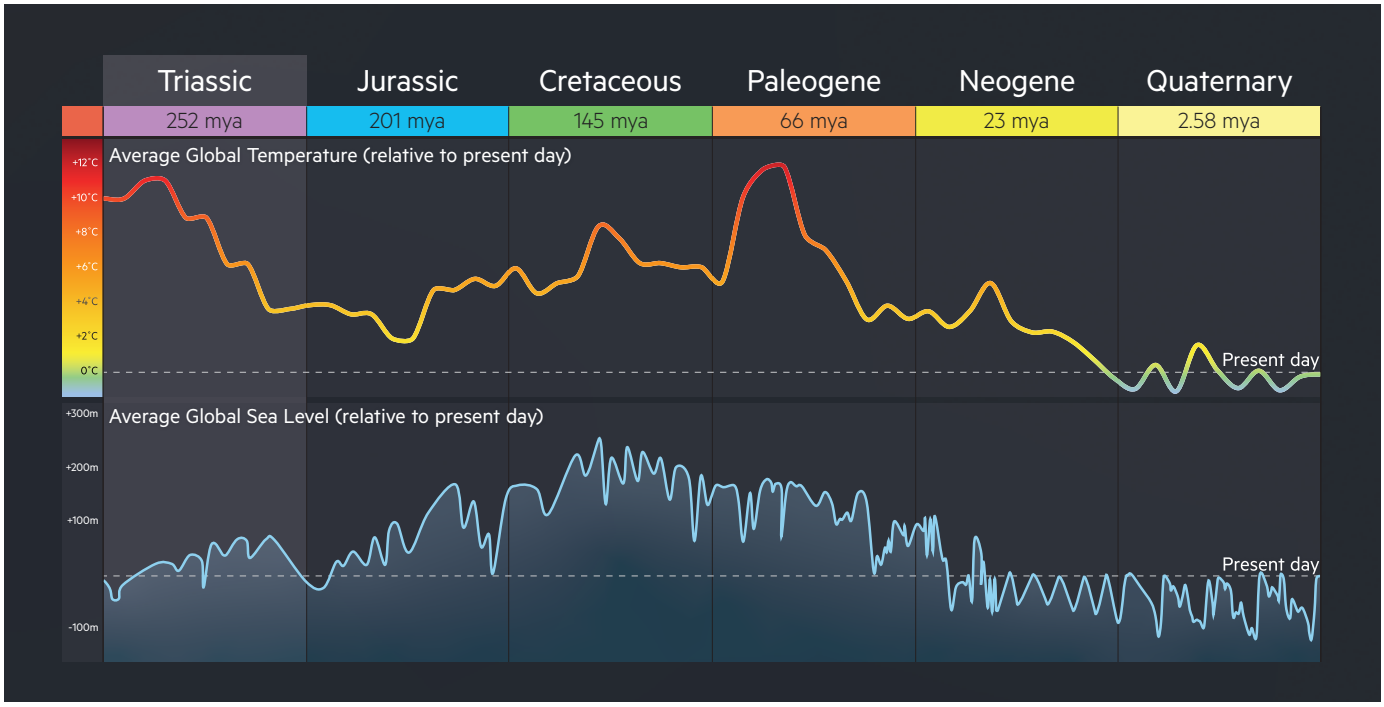
- Giant salamander-like amphibians, archaic reptiles and the distant ancestors of mammals thrive in central Queensland.
- The landscape is dominated by forests of ancient ferns and cycads.
- Footprints from Queensland's earliest dinosaurs are discovered in the coal mines around Brisbane and Ipswich.

Want to know more?
Scan me

It is the aftermath of Earth's greatest ever mass extinction. Amphibians stalk the rivers while reptiles hunt on land. Queensland's oldest dinosaurs are leaving their footprints.



The continents of the world are joined together into one supercontinent, Pangaea.



Life from the Crater, Triassic Queensland

An alien semiarid landscape, home to Queensland's iconic Triassic species

Foreground left: A decaying gar-like predatory fish, *Saurichthys,* has attracted two small temnospondyls, *Lapillopsis nana*.
Foreground right: *Xenobrachyops*, a predatory temnospondyl, slowly moves into position for an easy snack.

Centre left: Two procolophonids, *Eomurruna* move out from their burrow to find food.

Centre: The speedy reptile, *Kadimakara,* leaps for a juicy insect.

Background: drying waters encourage the lungfish, *Ptychoceratodus*, to move to a new pond.

Landscape: A semiarid floodplain with a vegetation cover of horsetails, *Dicroidium*, cycads and tall stands of *Pleuromeia* and *Rissikia*.

A Triassic Bug's life

Insects filled the skies and undergrowth.

These fossil insects were found near Ipswich.

Each insect wing and seed fern leaf has been 3D modeled based on real fossils.

They have all been enlarged ten times life size in this 3D colour print.

1 2 3 4 5

1 *Triassogrion*
Dragonfly

2 *Mesogereon*
Hemipteran bug

6 7 8

3 *Samaroblatta*
Cockroach

4 *Triassolocusta*
Locust

5 *Osmylopsychops*
lacewing

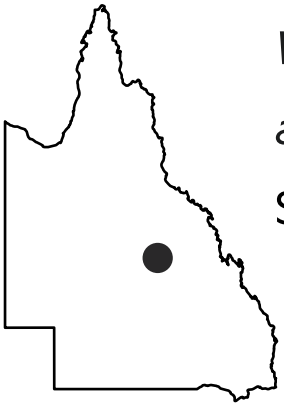
6 *Dicroidium*
Seed ‘fern’

7 *Archepsychops*
lacewing

8 *Ipsvicia*
Hemipteran bug

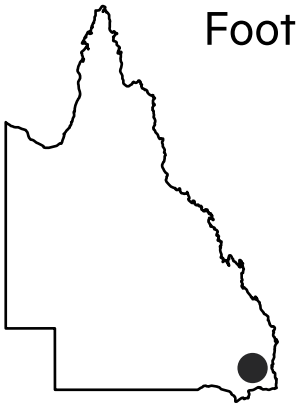
Temnospondyls

- Salamander-like amphibians with flat broad heads
- Rows of sharp ‘labyrinthodont’ teeth for holding their prey
- Webbed feet and a tail used to propel them through water

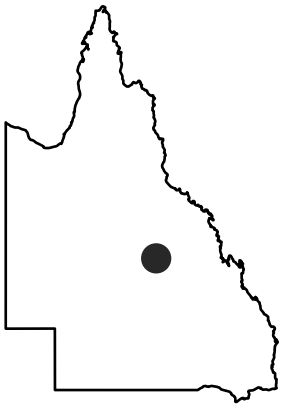


Warrenisuchus aliciae
Skull

Watsonisuchus rewanensis
Skull



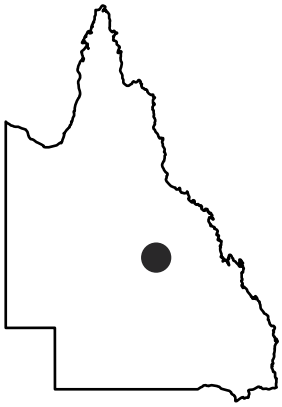
Footprint



Eomurruna yurrgensis

Procolophonid

Skull and articulated skeleton



Ptychoceratodus

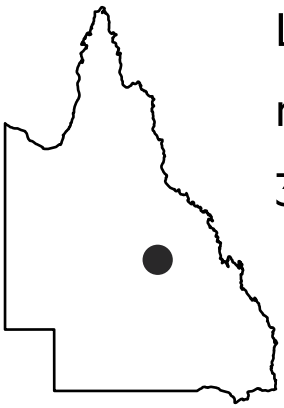
Lungfish

Tooth plates

Xenobrachyops allos

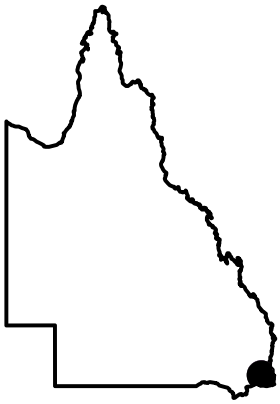
Temnospondyl

2 of 30 Iconic species



Life-like reconstruction, 3D model

Skull (cast)



Dinosaur footprint (cast)

The oldest fossil evidence of dinosaurs in Australia

Three-toed dinosaur footprint

Uncertain track-maker – either a sauropodomorph or a theropodan dinosaur

Footprint found in the Rhondda Colliery (coal mine), Ipswich, in 1964

Left image: Miners removing coal and rock revealed a layer above them that contained dinosaur footprints.
Right image: Queensland Museum preparator Malcolm E McAnna moulds a dinosaur footprint found in the roof of Rhondda Colliery, Ipswich in 1964. © Queensland Museum

Palaeotech

Modern CT (computed tomography) x-ray scans have allowed us to see inside this rock and reveal tiny details of a fossil skull and limb bone. The specimen is so tiny that removing it from the rock risks destroying it. Instead, we use x-ray scans to reveal the fossil digitally, and then 3D print the result.

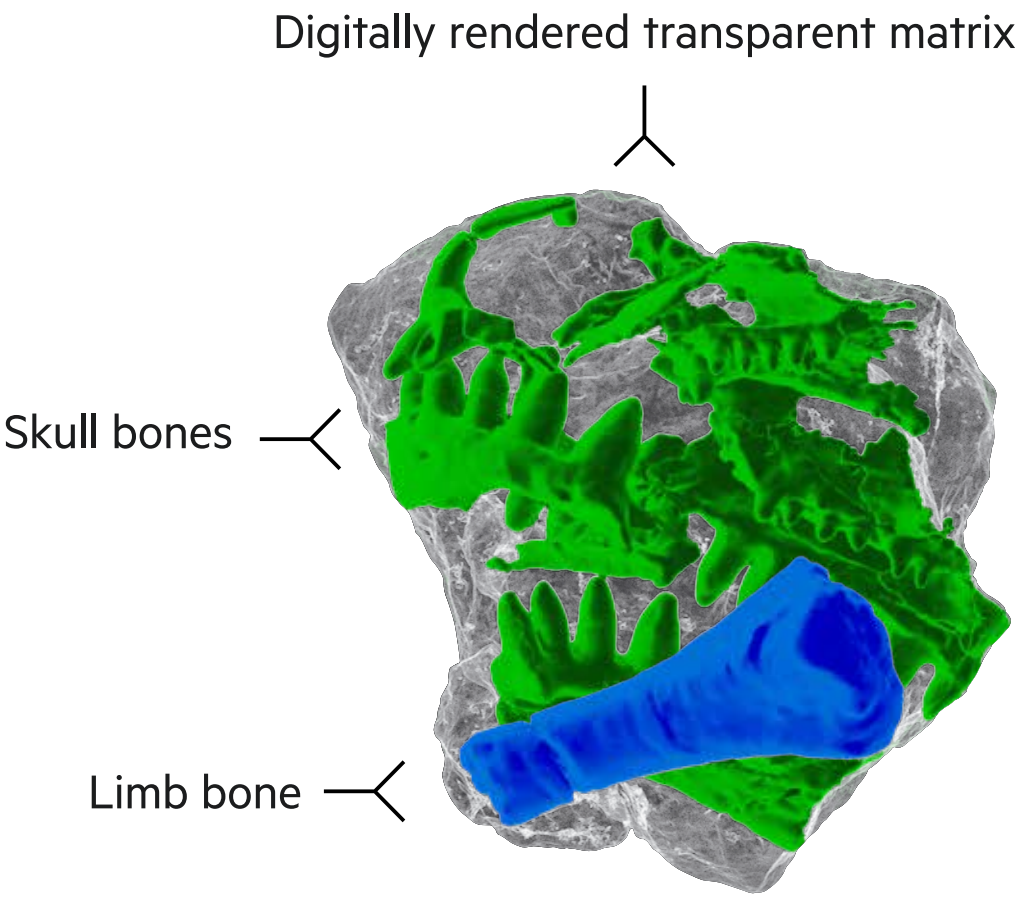


Image: Transparent render revealing a fossil limb bone (blue) and skull bones (green) © Queensland Museum, Hocknull with 3D model by Knutsen

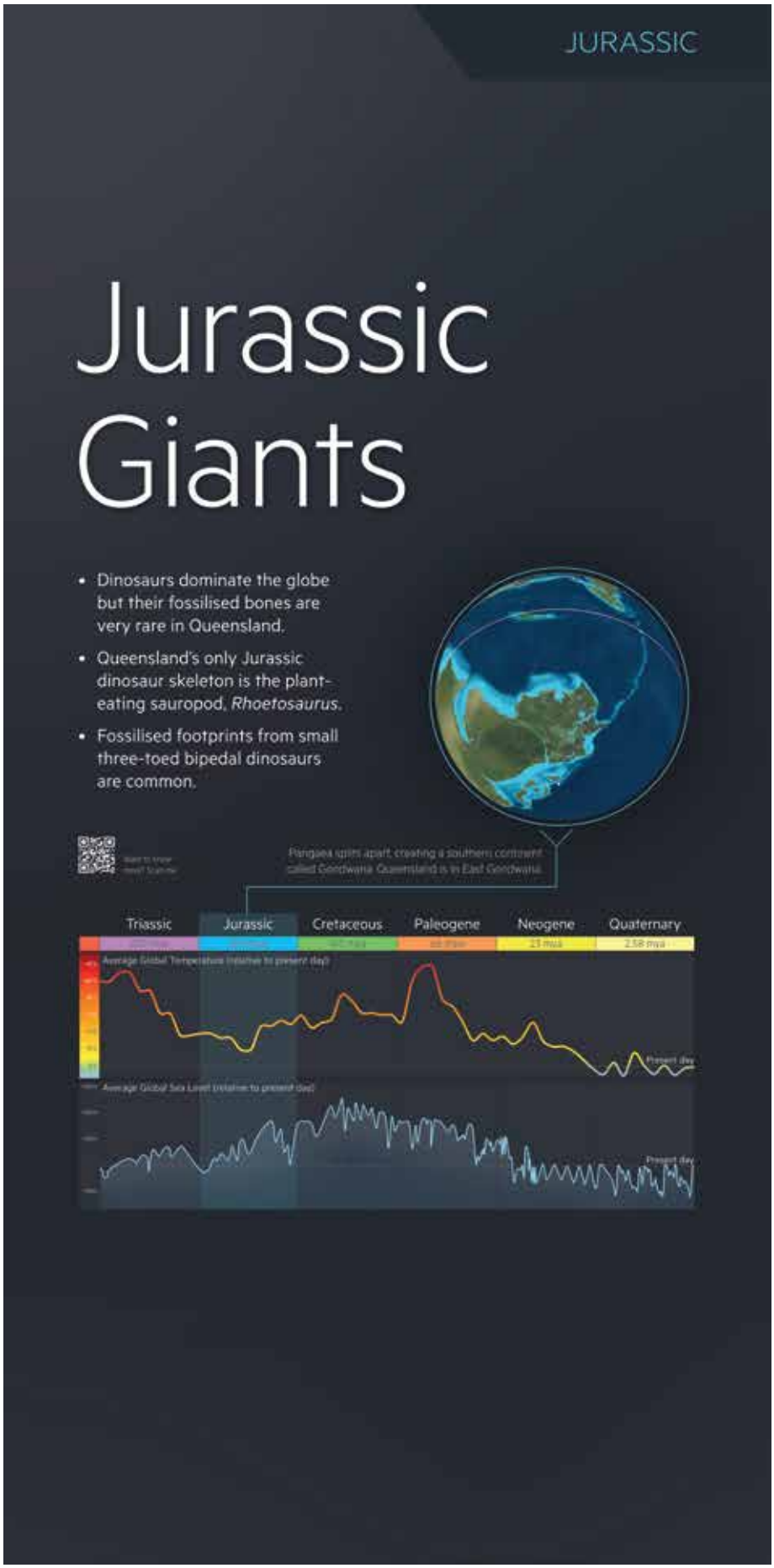
Mystery Fossil

A small rock, 245 million years old, contained a mystery fossil. Using the latest x-ray technology Queensland Museum palaeontologist, Dr Espen Knutsen, has revealed what is inside. It is the skull of an ancient reptile called a procolophonid.

Animation Duration: 2:00

Jurassic

145 mya to 100.5 mya


JURASSIC
Jurassic Giants
• Dinosaurs dominate the globe but their fossilised bones are very rare in Queensland.
• Queensland's only Jurassic dinosaur skeleton is the plant-eating sauropod, *Rhoetosaurus*.
• Fossilised footprints from small three-toed bipedal dinosaurs are common.
Triassic
Jurassic
Cretaceous
Paleogene
Neogene
Quaternary
23 mya
Present day
Present day

Jurassic

Jurassic Giants

- Dinosaurs dominate the globe but their fossilised bones are very rare in Queensland.
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- Fossilised footprints from small three-toed bipedal dinosaurs are common.

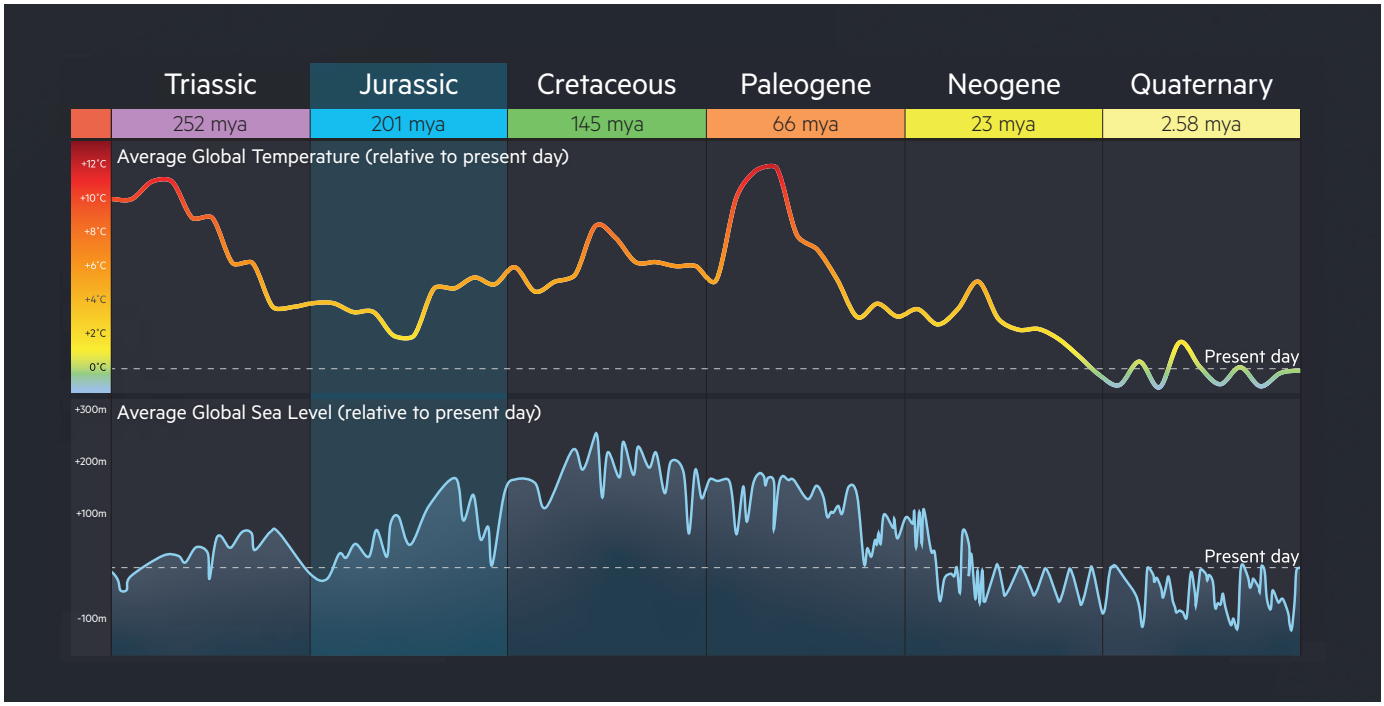
Want to know more?
Scan me

Next stop, Queensland's Jurassic world.

Meet *Rhoetosaurus*, Australia's oldest sauropod dinosaur.

Watch out, *Siderops* the giant amphibian, looks hungry.

Pangaea splits apart, creating a southern continent called Gondwana. Queensland is in East Gondwana.



Life in the Jurassic Period

A composite artwork with iconic species from the Jurassic Period of southern Queensland

Foreground: *Siderops kehli*, the giant amphibian, slides to a new watery hunting ground.
Background: *Rhoetosaurus brownei*, an early sauropod dinosaur, moves between conifer forests to feed.
Landscape: A riverine and swampy environment includes conifers, ferns and horsetails.

Siderops kehli

Giant temnospondy

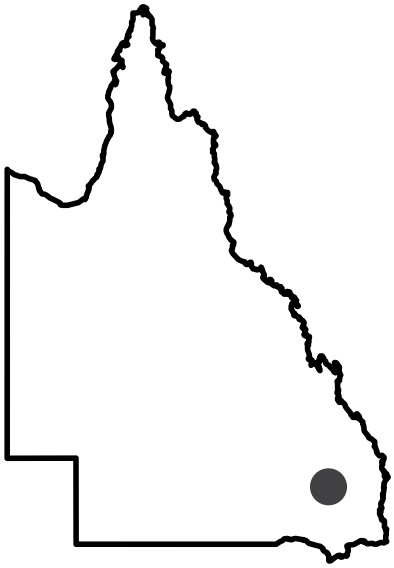
3 of 30 Iconic species

Fast fact:

The most complete Jurassic temnospondyl from Australia

3 of 20 Fossil treasure

Fossil location



Carnivore

Amphibian

Cladophlebis australis*

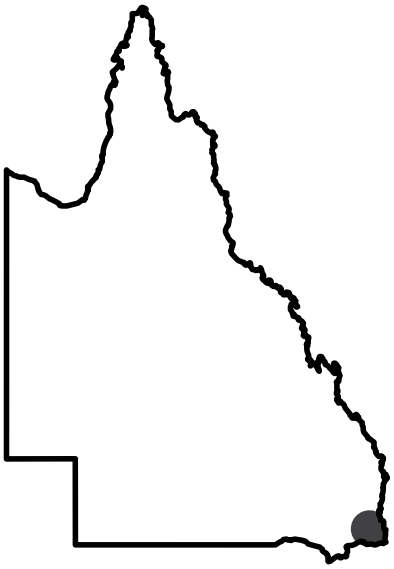
Ancient ‘royal fern’

Fronds up to 1 m in length

Fast fact:

Ferns are great survivors. Many families of fern appeared during the Mesozoic Era. Their descendants survive today in forests across the globe.

Fossil location



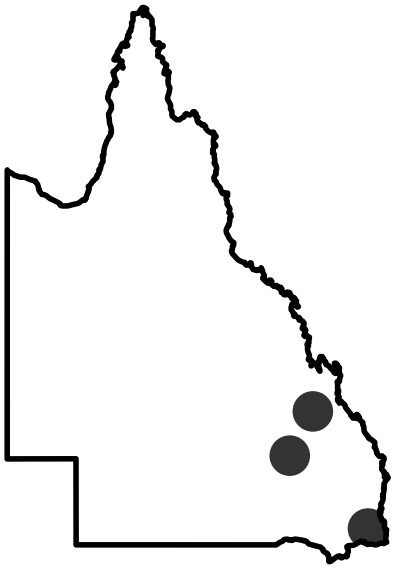
Modern crepe fern (*Leptopteris fraseri)*

Dinosaur Footprints

Fast fact:

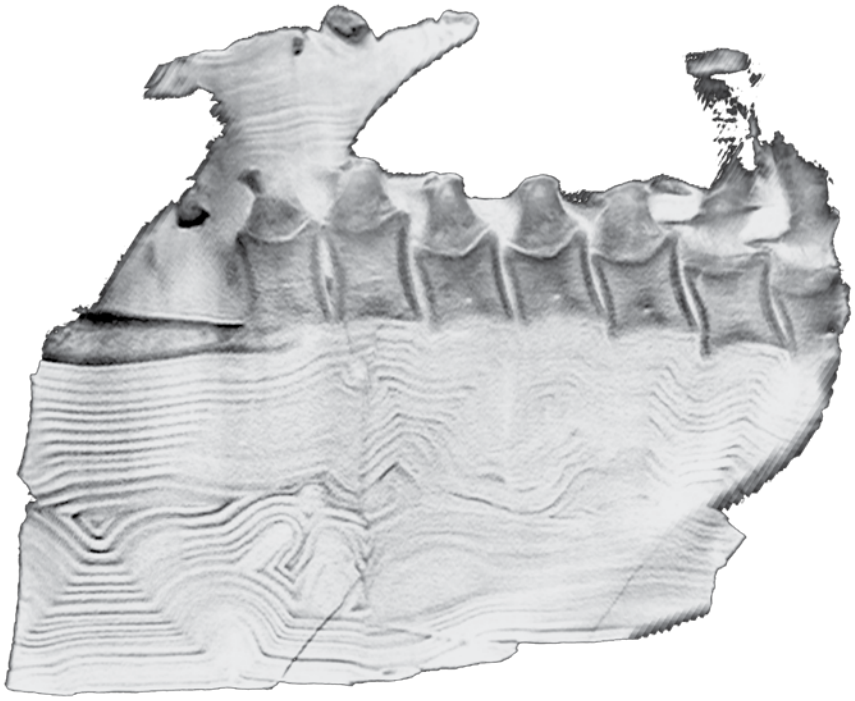
Most Jurassic-aged dinosaur fossils from Queensland are footprints. Dozens of small and large three-toed tracks have been found in central and southern Queensland.

Fossil location



Small dinosaur footprints from Carnarvon Gorge. Coloured areas show three-toed dinosaur footprints.

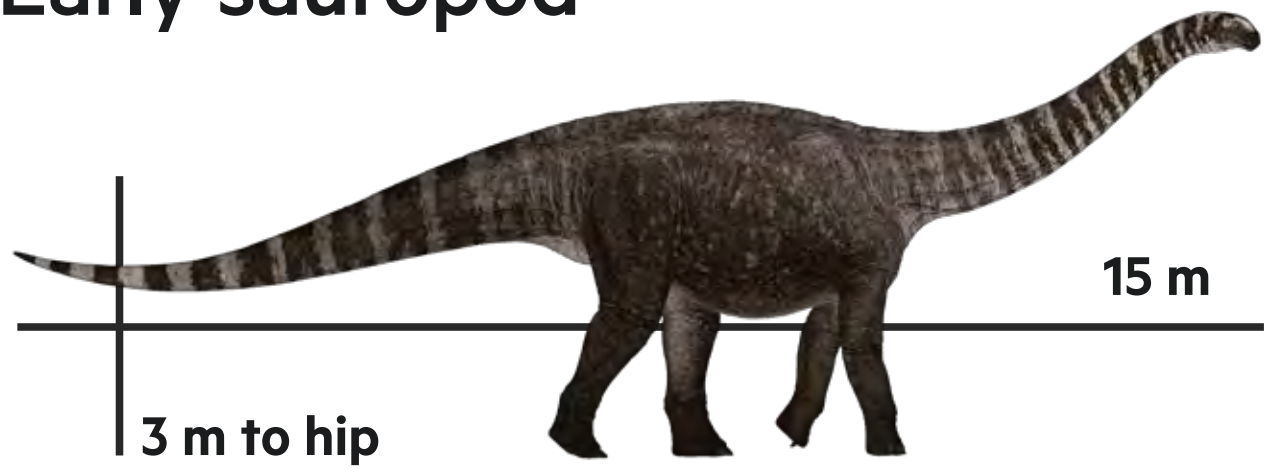
Palaeotech



Modern CT (computed tomography) x-ray scans allow us to see inside rocks and fossils. As if using x-ray vision, these scans can reveal to palaeontologists hidden secrets inside rocks and fossils.

Rhoetosaurus brownei

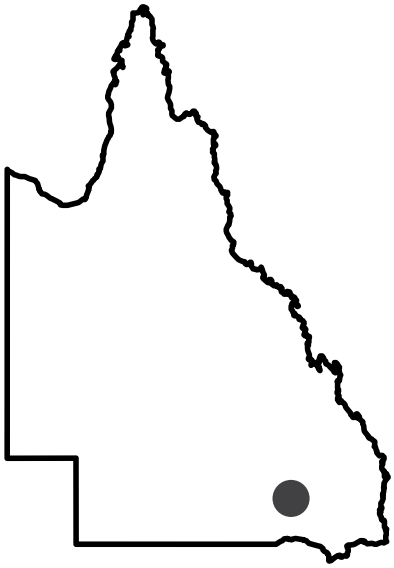
Early sauropod



Fast fact:

The most complete Jurassic temnospondyl from Australia

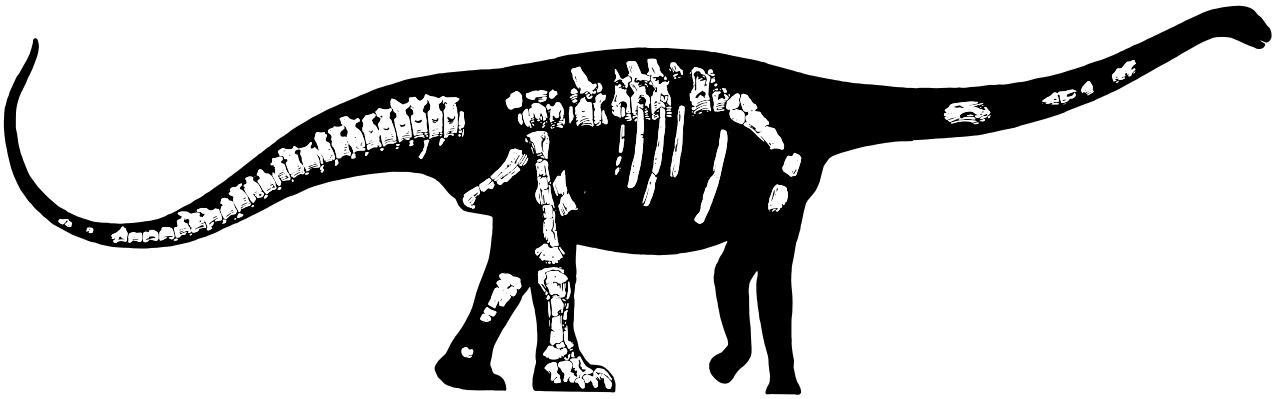
Fossil location



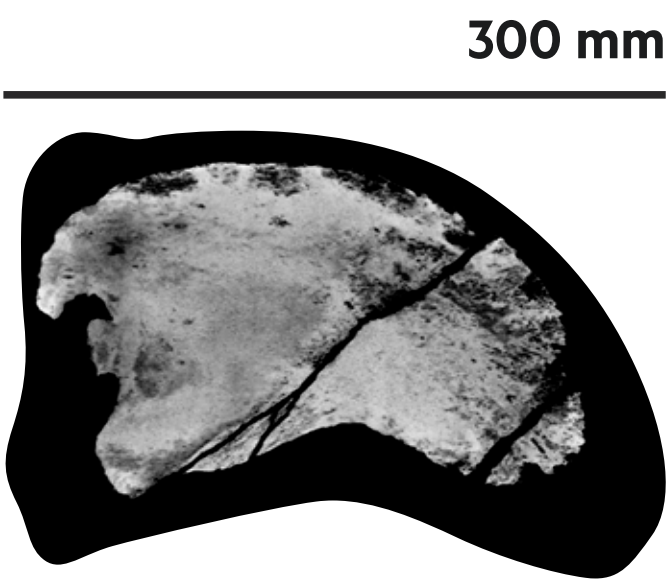
Rhoetosaurus brownei

Early sauropod

Drawing of *Rhoetosaurus* indicating the skeletal remains that were discovered.



X-ray of the largest claw bone of *Rhoetosaurus* with an outline of the estimated size of the covering claw.



Dinosaurs Unearthed: Virtual Prehistoric Queensland

Scan the QR code to bring these creatures to life in augmented reality.

Australovenator wintonensis
Theropod

Rhoetosaurus brownei
Sauropod

Xenobrachyops allos
Temnospondyl

Siderops kehli
Temnospondyl

Palaeotech

Queensland Museum palaeontologists use new 3D imaging technology to scan a wide range of scientific specimens, from tiny fossils to whole field sites. They create digital replicas that can be shared online with researchers or used in displays and education. Digital replicas also prevent damage to the original fossils by reducing the need to handle them.



Photogrammetry

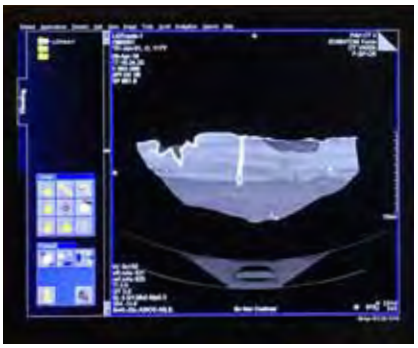
Photogrammetry takes hundreds or even thousands of overlapping digital images or video to reconstruct a cloud of pixels. A 3D shape is then created from this cloud of data. Palaeontologists use 3D scans to help reconstruct extinct species.

Photogrammetry © Queensland Museum, Bent & Hocknull

Surface Scanning

Surface scanners use light or lasers to measure millions or even billions of individual points on the surface of a fossil or site. Like photogrammetry, a 3D shape is created from this cloud of surface points. Accurate measurements can be taken without needing to handle fragile specimens.

Surface Scanning © Queensland Museum, Bent


X-Rays

Computed tomography (CT) scanners shoot X-rays through a fossil to produce hundreds or even thousands of individual x-ray slices of a fossil. These x-rays allow palaeontologists to see what the naked eye cannot. Computer software is used to peel away layers of information, to reveal what's inside.

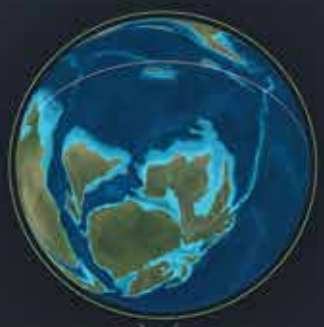
X-Rays © Queensland Museum, Lawrence & Bent

Cretaceous

145 mya to 100.5 mya

Eromanga Monsters

- An inland sea, called the Eromanga Sea, forms across northern and central Queensland.
- The sea is home to giant marine reptiles and sharks that rival dinosaurs in size.
- Invertebrates are dominated by giant squids and ammonites.



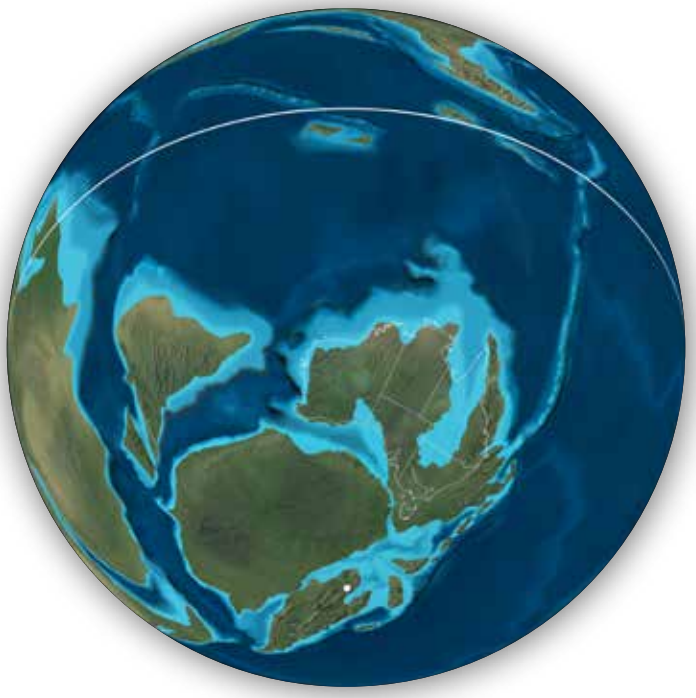
Australia lies further south than today and remains linked to a seasonally ice-free Antarctica

Cretaceous
Eromanga Monsters

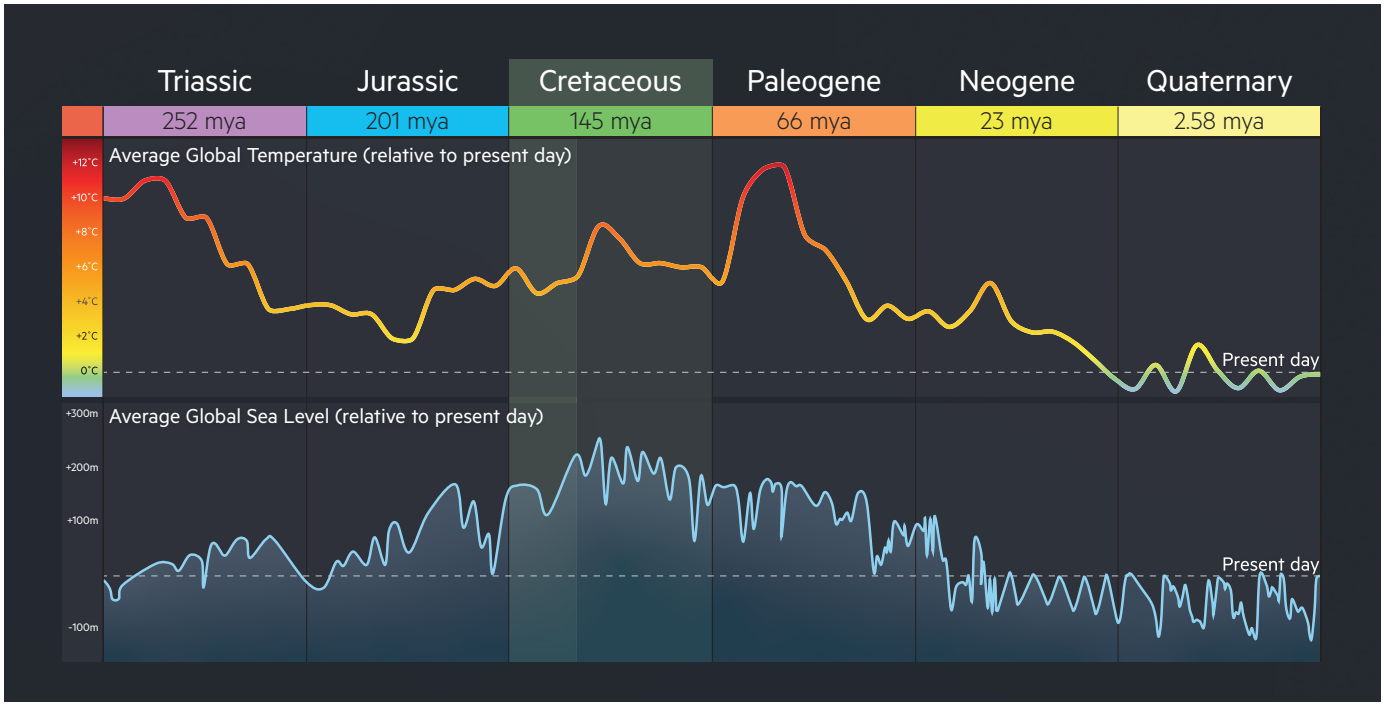
- An inland sea, called the Eromanga Sea, forms across northern and central Queensland.
- The sea is home to giant marine reptiles and sharks that rival dinosaurs in size.
- Invertebrates are dominated by giant squids and ammonites.

Want to know more?
Scan me

Welcome to the Eromanga Sea, a water world rich in life. Queensland's top predator is gigantic but it's not a dinosaur. Meet *Kronosaurus queenslandicus*.



Australia lies further south than today and remains linked to a seasonally ice-free Antarctica.



Dinosaurs Unearthed: Virtual Prehistoric Queensland

Scan the QR code to bring these creatures to life in augmented reality.

Muttaburrasaurus langdoni
Ornithopod

Platypterygius australis
Ichthyosaur

Eromangasaurus australis
Elasmosaur

Life in the Eromanga Sea

Iconic species from the Cretaceous Period of central Queensland

Far right: *Kronosaurus queenslandicus*, the giant pliosaur, attacks a polycotylid (new species).
Central: the shallow inland sea teems with invertebrate life dominated by ammonites, belemnites and squid.

Eromanga Monsters AV

Palaeontologists from Queensland Museum have reconstructed the plesiosaur *Eromangasaurus australis* and the ichthyosaur *Platypterygius australis* in 3D using a combination of photogrammetry, CT scans and 3D digital sculpting by palaeoartists. Plesiosaur fossils from Queensland include two skulls and several partial skeletons. Ichthyosaur fossils from Queensland include several adult skeletons with large skulls and the remains of baby ichthyosaurs.

Documentary 3:30

Eromangasaurus australis

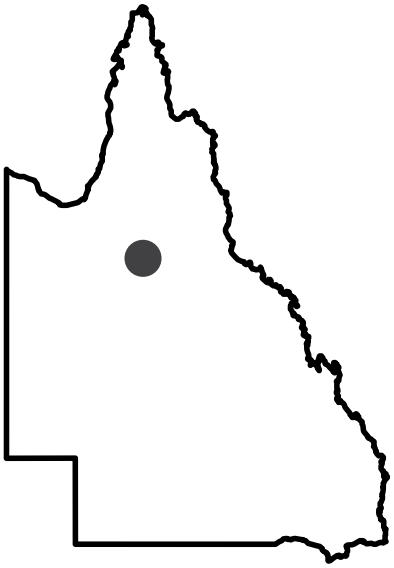
Long-necked elasmosaur

5 of 30 Iconic species

Fast fact:

Elasmosaurs swallowed stones (gastroliths) primarily to act as ballast and to help the animal dive.

Fossil location



Carnivore

Marine Reptile

Eromangasaurus australis

3D printed and painted, life-like reconstruction at 1/25th size.

Eromangasaurus australis

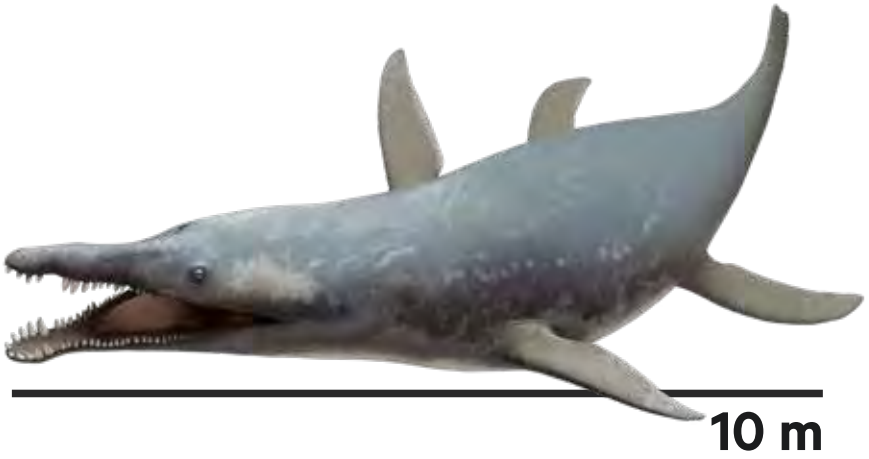
Long-necked elasmosaur

Crushed skull (cast)

*Kronosaurus** *queenslandicus*

Giant pliosaur

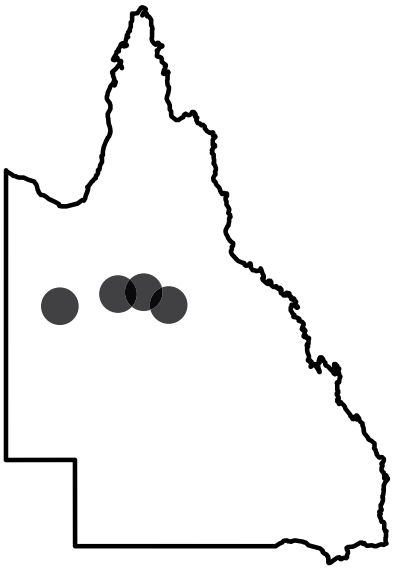
*uncertain taxonomy



Fast fact:

The rib cage of a *Kronosaurus* preserved the remains of its last meals: a turtle and a plesiosaur.

Fossil location



Kronosaurus queenslandicus

Snout with interlocking teeth (cast)

Kronosaurus queenslandicus

Pliosaur lower jaw outline

Kronosaurus queenslandicus

Giant pliosaur

6 of 30 Iconic species

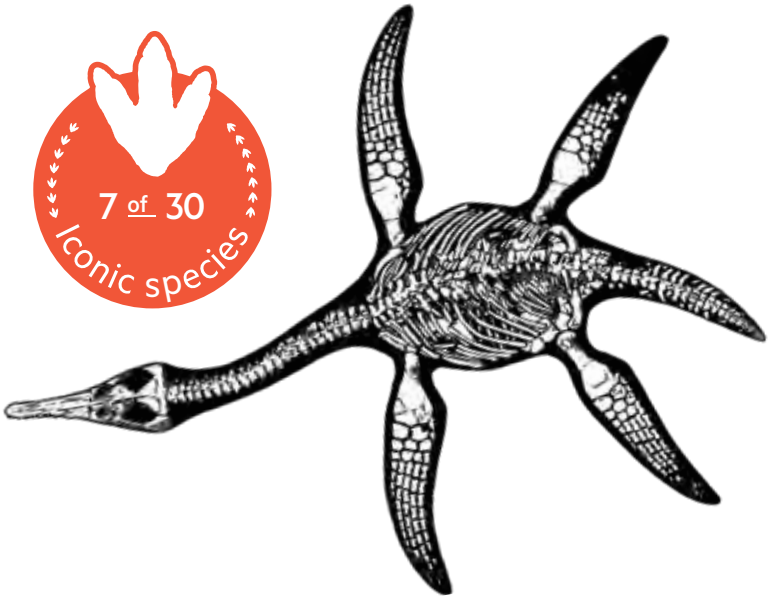
Eromangasaurus australis

Long-necked elasmosaur

New genus and species

Richmond polycotylid

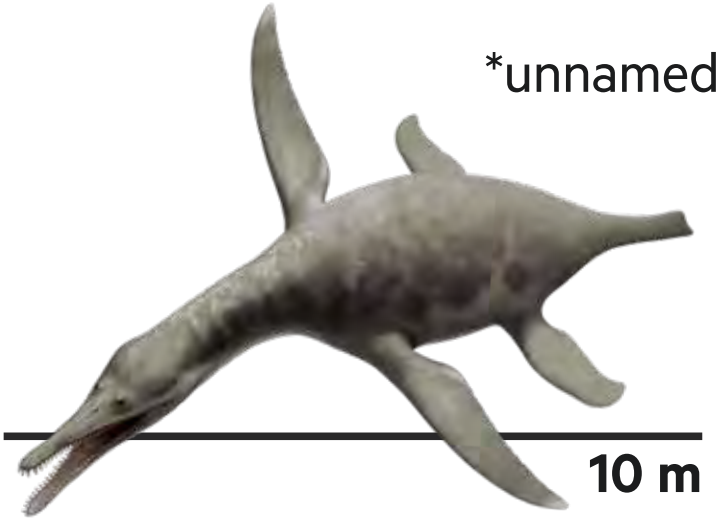
7 of 30 Iconic species



New genus and species*

Richmond polycotylid

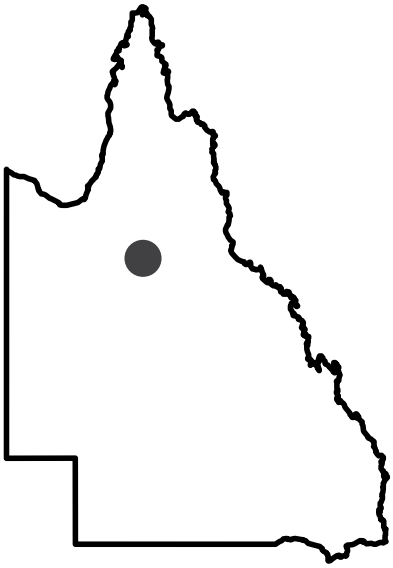
*unnamed, new to science



Fast fact:

The most complete marine reptile fossil in Australia

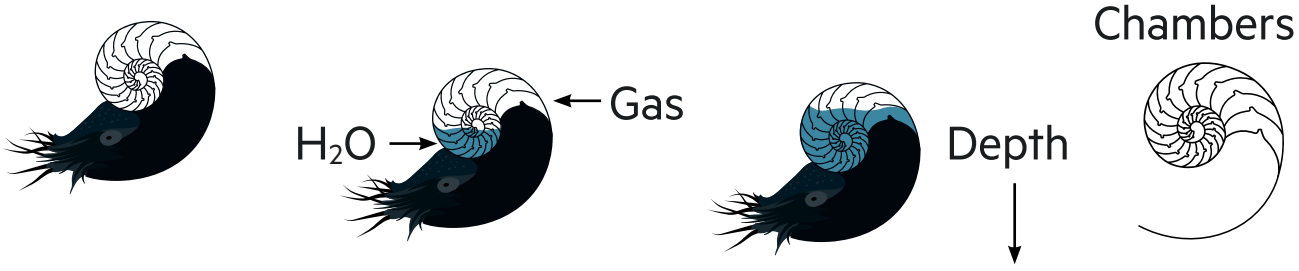
Fossil location



Ammonites and Nautiloids

- Looks can be deceiving. Ammonites and nautiloids look alike because they both evolved similar coiled, chambered shells.
- Nautiloids first appear 495 million years ago while Ammonoids evolve 80 million years later.
- Both are carnivorous and use their tentacles to capture prey.
- Ammonites are more closely related to octopus than nautiloids.
- Ammonites became extinct at the end of the Cretaceous Period, while nautiloids have a much longer prehistory and survive to the present day.

Ammonites and nautiloids trap gas and liquid in their chambers. Adding more gas makes them rise, while adding more water makes them sink.



Eutrephoceras hendersoni

nautiloid

Modern Nautilus shell (half)

Chambers

Modern Nautilus shell

Cretaceous Sea Life

- These marine invertebrate fossils were found in southern, central and northern Queensland.
- Marine fossils are evidence of a shallow sea, called the Eromanga Sea, that spread across inland Queensland during the Cretaceous Period (145–100.5 million years ago).
- The Eromanga Sea rose and fell several times over 40 million years.
- The marine fossils displayed here represent three different cycles of the Eromanga Sea.

Albian 113–100.5 mya

Myloceras auritulum
open-coiled ammonite

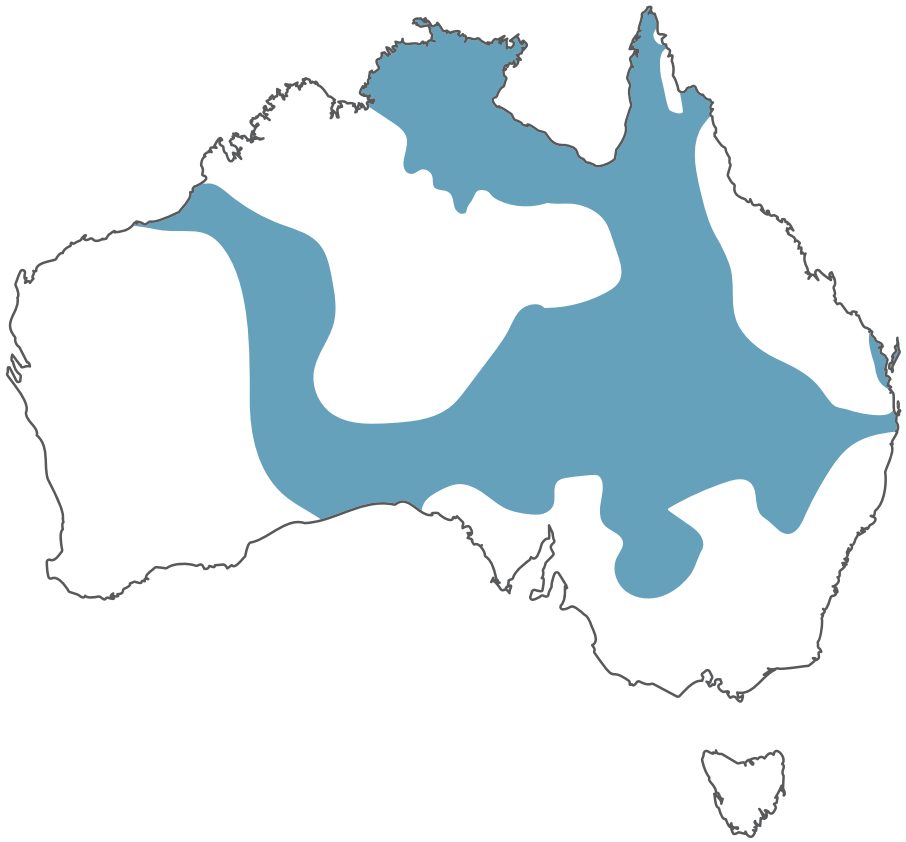
Homolopsis etheridgei
crab

Inoceramus sutherlandi
bivalve

Goodhallites goodhalli
ammonite

Beaudanticeras flindersi
ammonite

Aptian 121–113 mya



***Tonohamites** taylori*

ammonite* uncertain taxonomy

Eyrena palmerensis

bivalve

Unidentified species

Sea star

Tropaeum irregulare

ammonite

***Pinna* sp.**

bivalve

Tropaeum jackii

ammonite

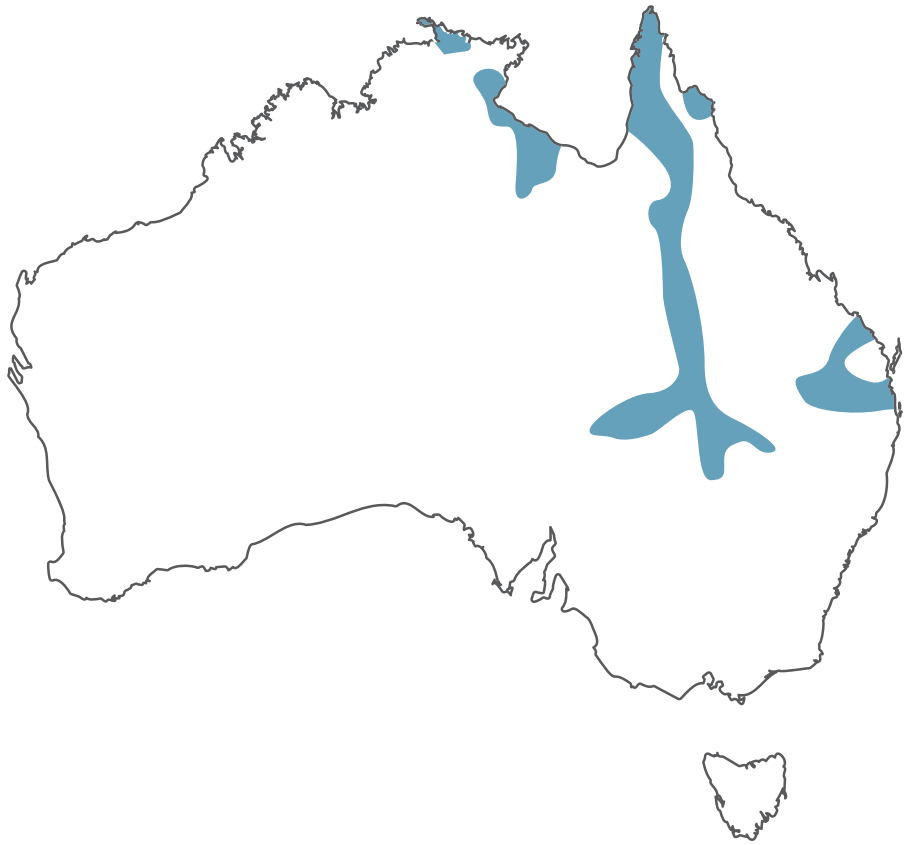
Maccoyella barkleyi

bivalve

Aconeceras walshense

ammonite

Berriasian 145–139 mya



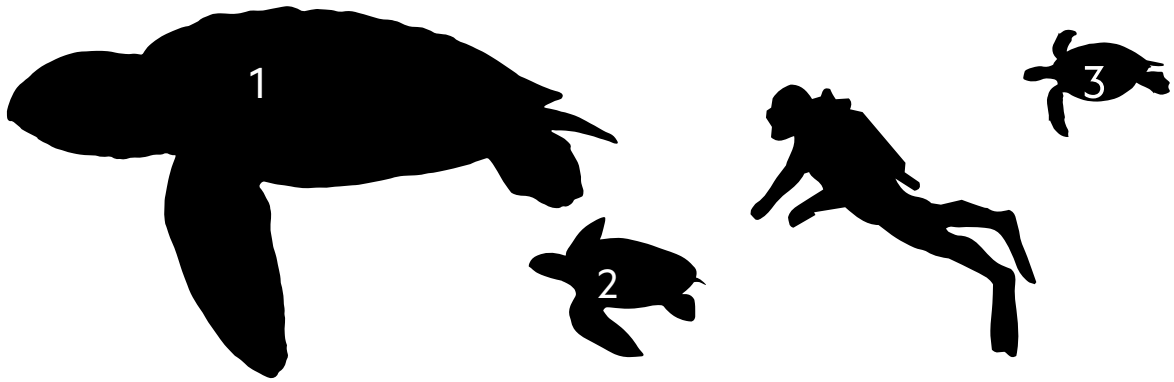
Hatchericeras lakefieldense

ammonite

Marine Turtles

- Marine turtles are survivors from the age of dinosaurs but the three Eromanga Sea species left no descendants.
- *Notochelone costata* and *Bouliachelys suteri* were small in comparison, similar in size to a modern green turtle.
- *Cratochelone berneyi* was the largest, about the size of a modern leatherback turtle.

At least three species of marine turtle lived in the Eromanga Sea: 1 *Cratochelone*, 2 *Notochelone* and 3 *Bouliachelys*.



***Notochelone* sp.**
skull

***Notochelone* sp.**
shell with bite marks

Notochelone costata
skull and lower jaw

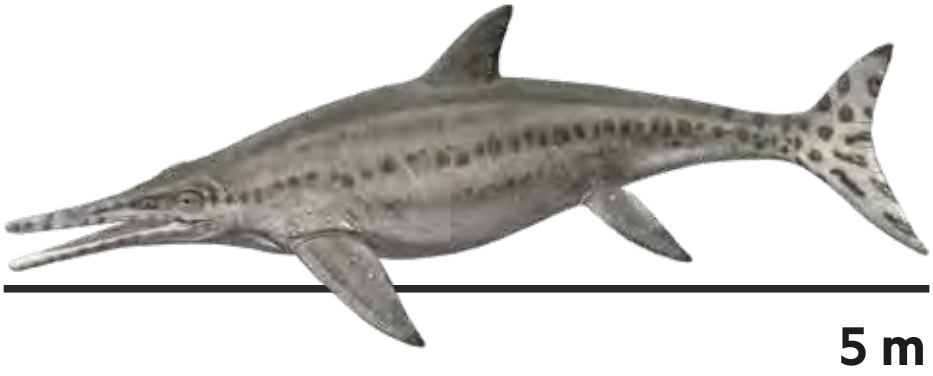
***Notochelone* sp.**
skull

Top right: Modern green turtle Chelonia mydas

Platypterygius australis*

Ichthyosaur

*uncertain taxonomy

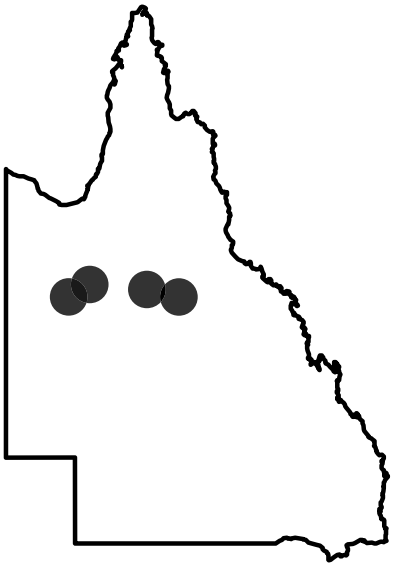


8 of 30 Iconic species

Fast fact:

Ichthyosaurs, like Platypterygius australis, gave birth to live young at sea.

Fossil location



Carnivore

Marine Reptile

Platypterygius australis

skull

Cooyoo australis

skull and skeleton

Cooyoo australis

skull

Flindersichthys denmeadi

skull

Cretaceous

145 mya to 100.5 mya


CRETACEOUS
Dino Coast
• *Muttaburrasaurus* and *Kunbarrasaurus* lived on land but the skeletons displayed here were washed out into the sea and buried.
• Soft mud entombed the dead, creating perfect conditions for excellent fossil preservation.
Mythunga camara
Anhanguerid pterosaur
Fast fact
Trachyteuthis willisi
Giant Squid
Fast fact
Queensland's inland Cretaceous coastline
Cardabiodontid shark*
Giant shark
Fast fact

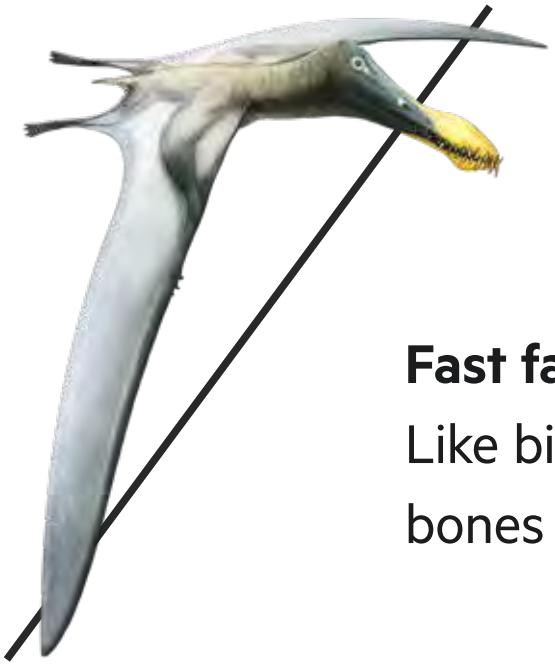
Cretaceous
Dino Coast

- *Muttaburrasaurus* and *Kunbarrasaurus* lived on land but the skeletons displayed here were washed out into the sea and buried.
- Soft mud entombed the dead, creating perfect conditions for excellent fossil preservation.

Want to know more?
Scan me

Mythunga camara
Anhanguerid pterosaur

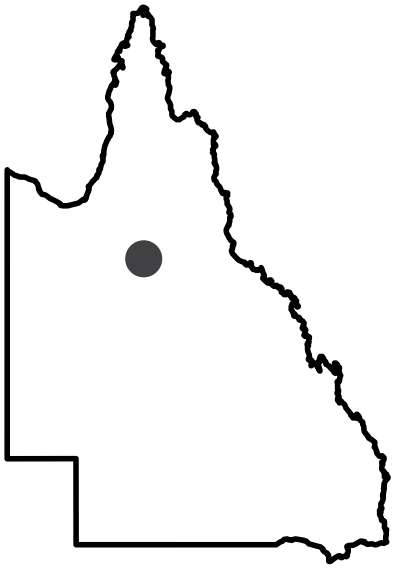
9 of 30 Iconic species



4-6 m

Fast fact:
Like birds, pterosaurs had hollow bones that kept their bodies light.

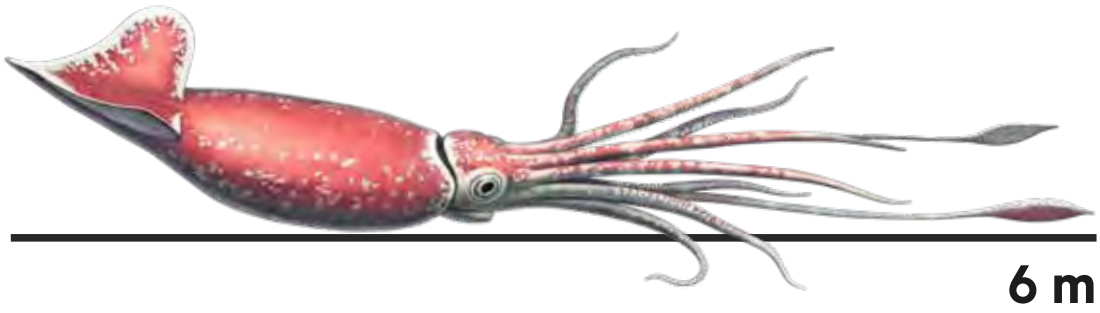
Fossil location



Fossilised snout with teeth of *Mythunga camara*

Trachyteuthis willisi
Giant Squid

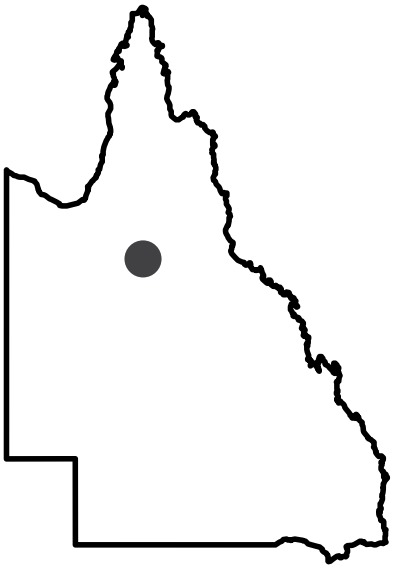
10 of 30 Iconic species

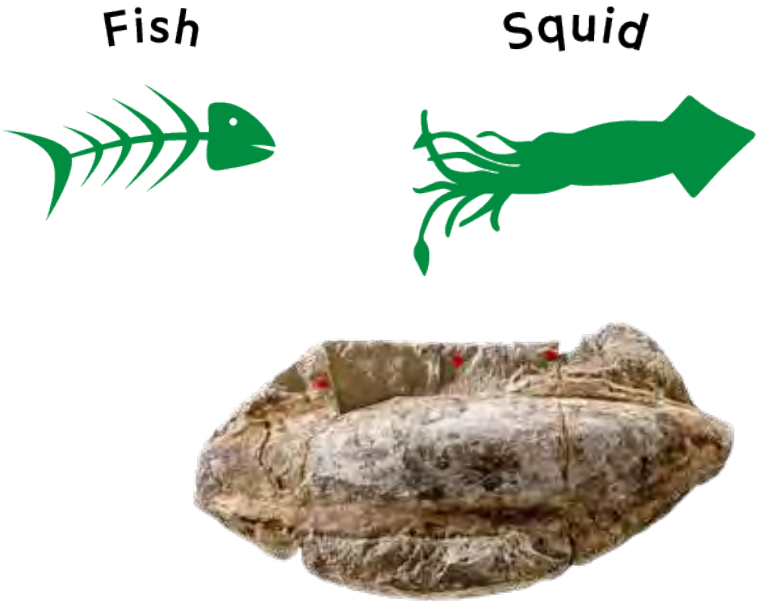


Fast fact:

Fossil squid are known from their hard internal part – the 'pen' (or gladius).

Fossil location





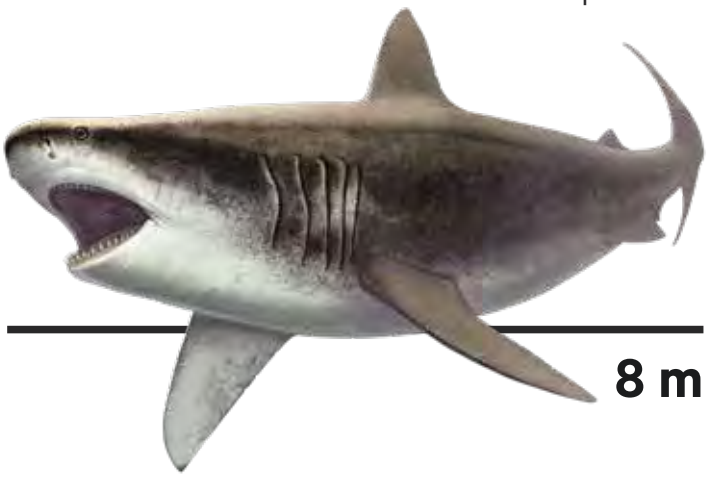
Fossilised squid pens of *Trachyteuthis willisi*, are up to 1.3m long

Cardabiodontid shark*

Giant shark

*new species

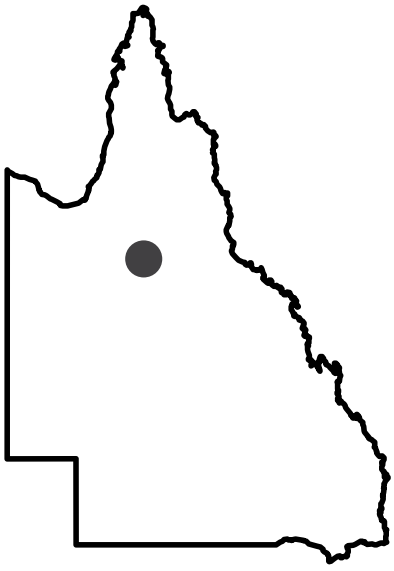
11 of 30 Iconic species

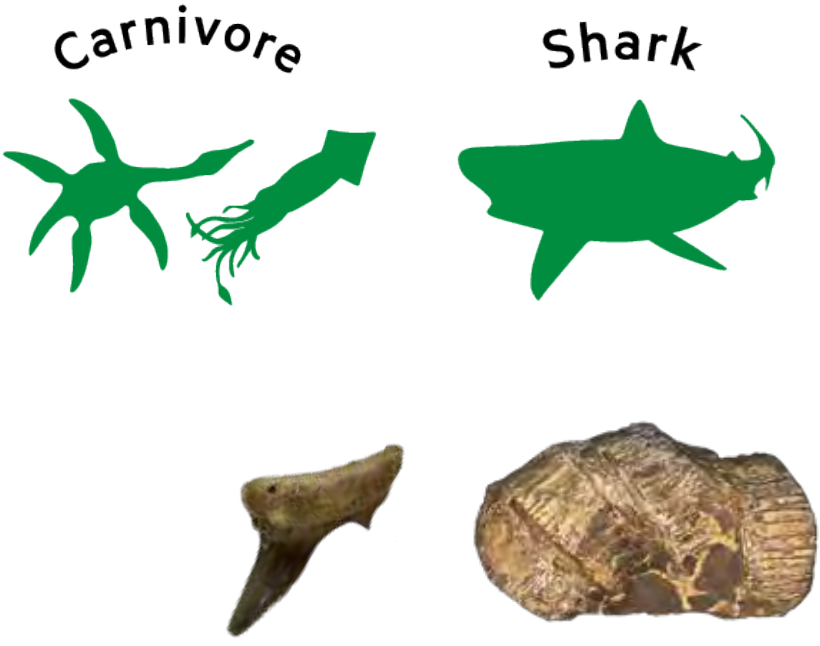


Fast fact:

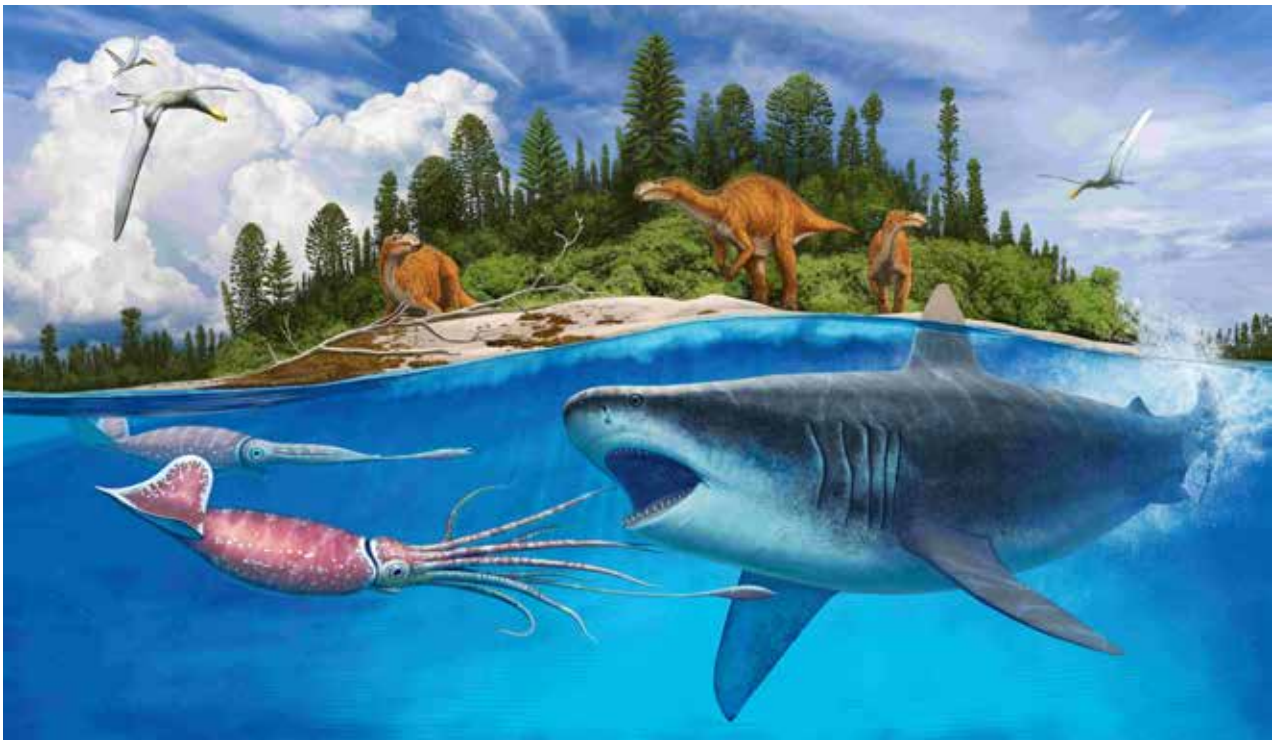
Fossil vertebrae suggest these sharks rivalled Kronosaurus in size

Fossil location





Isolated tooth and vertebrae



Queensland's inland Cretaceous coastline

The coastline of the Eromanga Sea is home to giants – in the water, on land and circling overhead.

Foreground: Two giant squid, *Trachyteuthis*, have come into the shallows to breed. They have entered the hunting grounds of the apex predator – the giant cardabiodontid shark. The shark and squid are both life sized.

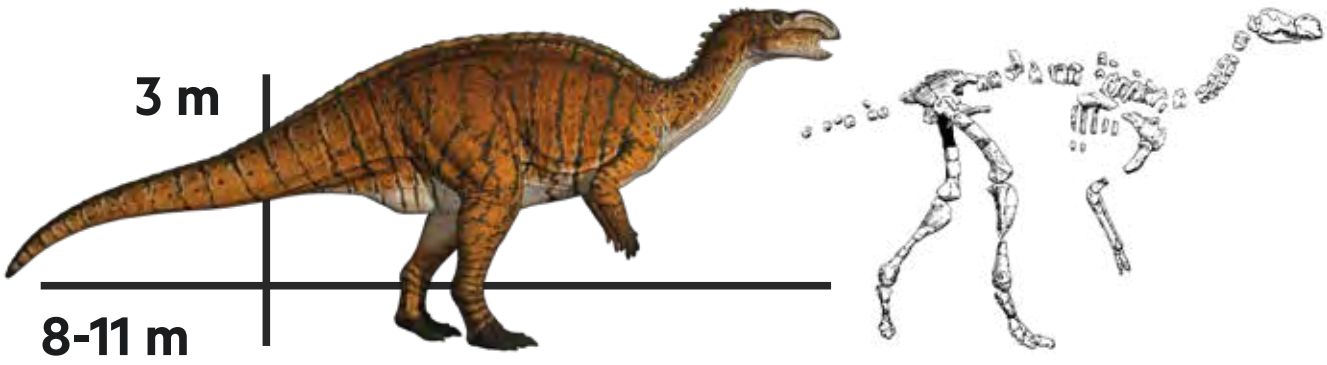
Midground: A small herd of *Muttaburrasaurus* are on high alert as they hear a predatory dinosaur close by. The dinosaurs are using the open coastline as a 'superhighway' as they search for fresh water and new plant growth to eat. *Mythunga* catch the coastal updrafts and glide above, hunting for shoals of fish.

Landscape: A small sandy point extends into the shallow Eromanga Sea, providing a safe vantage point for the dinosaurs. Backing onto the coastal beachline, stands of conifers and dense understory provide cover for predators. Coastal beaches encircle the inland sea, extending unbroken for hundreds of kilometres.

Muttaburrasaurus langdoni

Ornithopod dinosaur

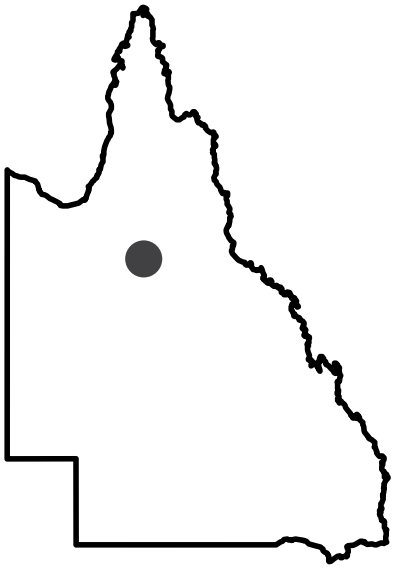
12 of 30 Iconic species



- *Muttaburrasaurus langdoni* was discovered in 1963 by Doug Langdon.
- Queensland Museum palaeontologists Dr Alan Bartholomai and Dr Ralph Molnar studied the skeleton, formally naming the dinosaur in 1981.
- It was named after the township of Muttaburra, central Queensland, and Doug Langdon.

Muttaburrasaurus langdoni skeletal outline © Queensland Museum, Beirne. Reconstruction Konstantinov, Atuchin, Hocknull.

Fossil location



Herbivore

Dinosaur

Fast fact:

It was first thought that *Muttaburrasaurus* had a ‘thumb spike’ like Iguanodon. It has since been shown not to have one.

Muttaburrasaurus langdoni

3D colour printed minature, life-like reconstruction at 1/18th size. © Queensland Museum, Konstantinov, Atuchin & Hocknull

Doug Langdon (1932–2014)

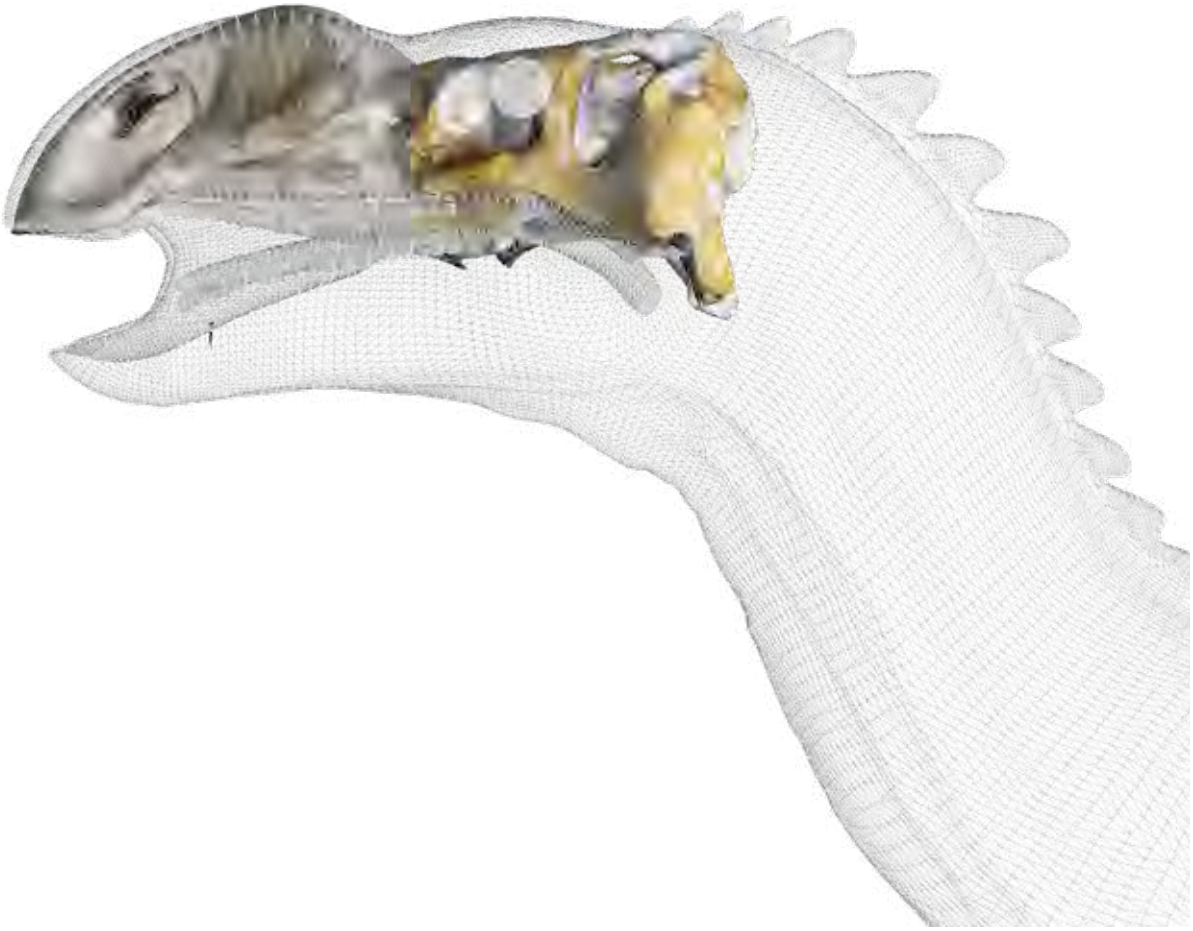
© Queensland Museum, Waddington

Palaeotech

Traditional sculpting methods have been used by artists for centuries to restore the skeletons of extinct species. The *Muttaburrasaurus langdoni* skeleton displayed here was first created in the 1980s using casts of the real fossils. Overtime, new scientific studies have refined the skeleton, and now CT scans of the skull are being used to reconstruct the head.

Mulitple tooth rows seen in x-ray

left: CT scan image of *Muttaburrasaurus* snout showing rows of grinding teeth. © Queensland Museum, Hocknull, Lawrence & Newman
Right: Fleshed out reconstruction of the *Muttaburrasaurus* head with skull model. © Queensland Museum, Hocknull



Muttaburrasaurus langdoni

Fossil skull (cast)

Muttaburrasaurus langdoni

Skull (reconstruction)

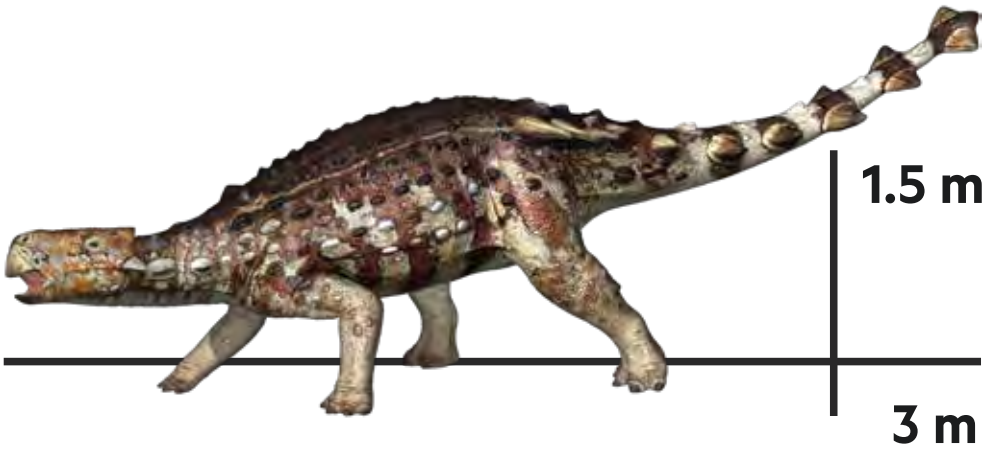
8 of 20
Fossil treasure

We emerge from the sea to find Kunbarrasaurus and Muttaburrasaurus. They live along the coastline that encircles the Eromanga Sea. This is the home of Australia's most iconic dinosaurs.

The armoured ankylosaur, *Kunbarrasaurus*, takes up a defensive pose against an oncoming threat. Having evolved scale-covered body-armour with neck and tail spikes, this small plant-eating dinosaur was the most heavily protected dinosaur of Queensland's Cretaceous coastline.

Kunbarrasaurus ieversi
Ankylosaurian dinosaur

13 of 30 Iconic species

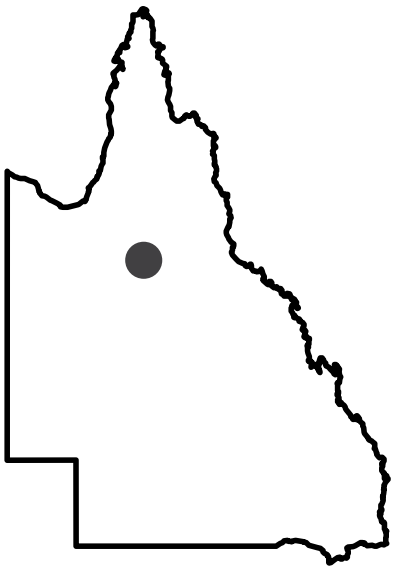


9 of 20 Fossil treasure

Fast fact:

Most complete Australian dinosaur fossil

Fossil location



Herbivore

Dinosaur

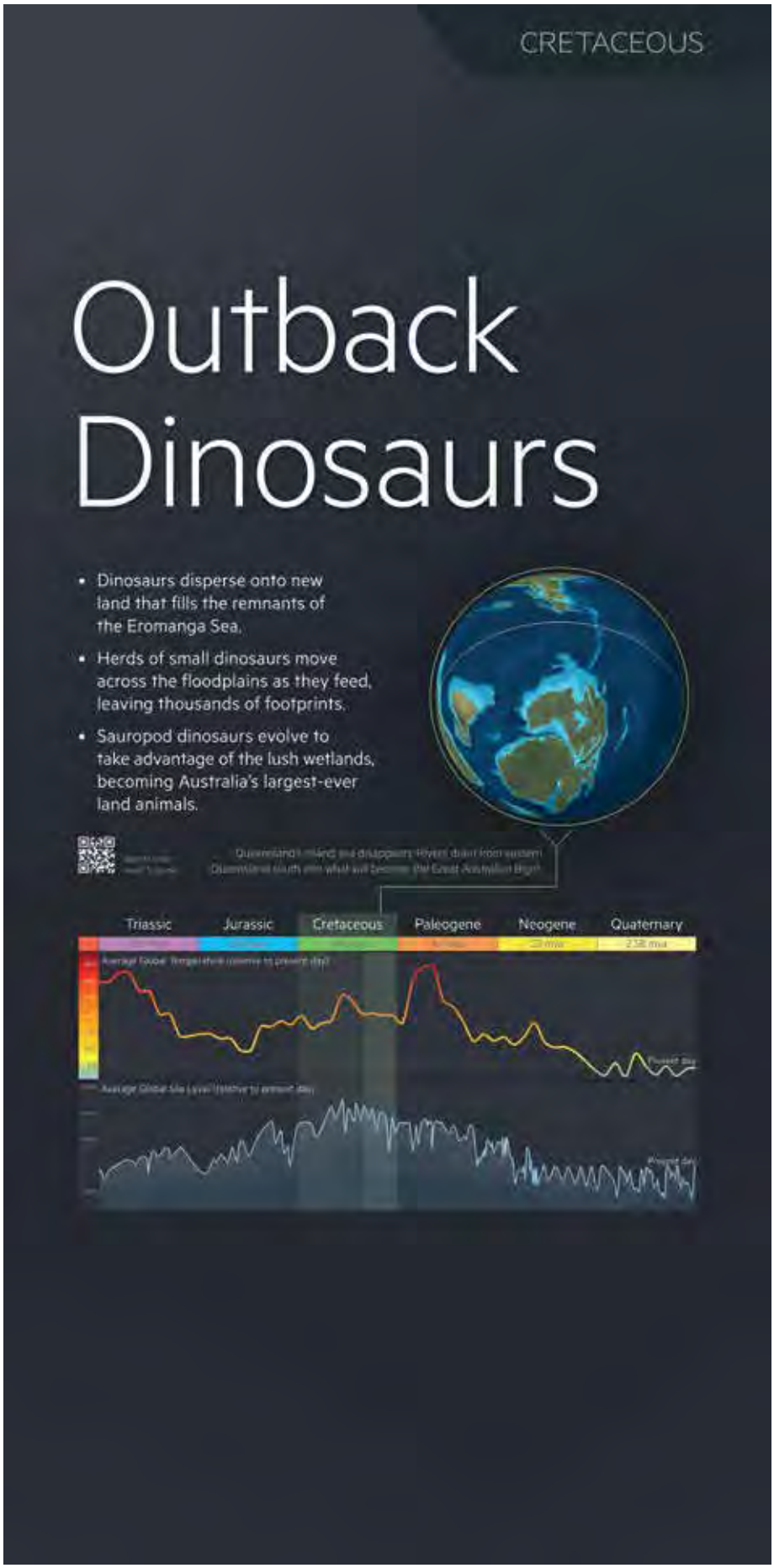
Kunbarrasaurus ieversi

3D printed and painted, life-like reconstruction at 1/25th size.

© Queensland Museum, Konstantinov, Atuchin & Hocknull

Cretaceous

100.5 mya to 66 mya


CRETACEOUS
Outback Dinosaurs
• Dinosaurs disperse onto new land that fills the remnants of the Eromanga Sea.
• Herds of small dinosaurs move across the floodplains as they feed, leaving thousands of footprints.
• Sauropod dinosaurs evolve to take advantage of the lush wetlands, becoming Australia's largest-ever land animals.
Triassic
Jurassic
Cretaceous
Paleogene
Neogene
Quaternary

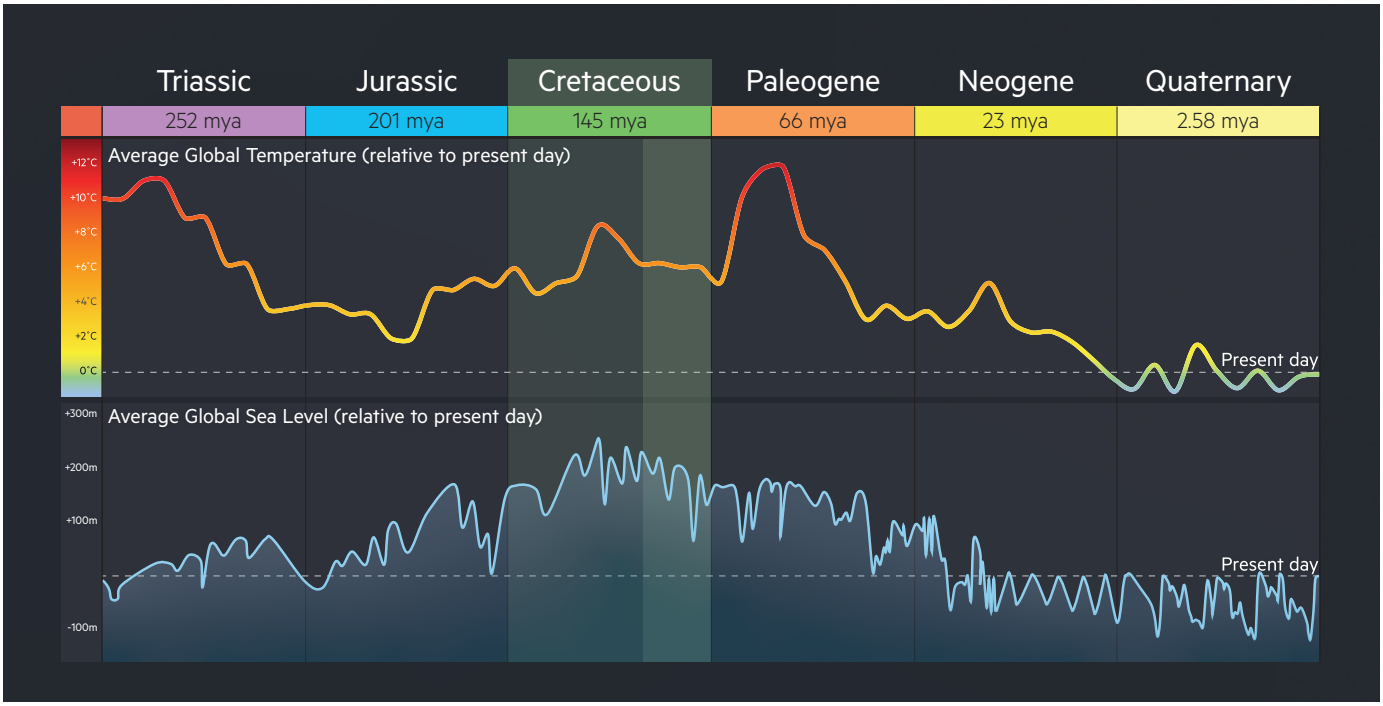
Cretaceous
Outback Dinosaurs

- Dinosaurs disperse onto new land that fills the remnants of the Eromanga Sea.
- Herds of small dinosaurs move across the floodplains as they feed, leaving thousands of footprints.
- Sauropod dinosaurs evolve to take advantage of the lush wetlands, becoming Australia's largest-ever land animals.

Want to know more?
Scan me

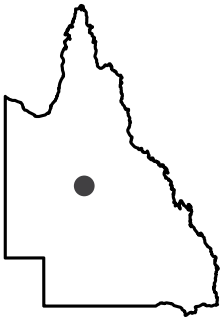
We arrive in outback Queensland, 93 million years ago. Dinosaur herds gather on the vast, lush floodplains. Heavy sauropods transform the soft land underfoot.

Queensland's inland sea disappears. Rivers drain from eastern Queensland south into what will become the Great Australian Bight.



Savannasaurus elliottorum

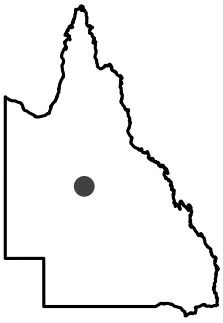
- Very wide and shallow pelvis
- Stocky, short-limbed sauropod
- Possibly semi-aquatic, like a hippopotamus today



16 m

Diamantinasaurus matildae

- Best preserved Cretaceous sauropod species
- Skull elements and teeth have been found
- Named after *Waltzing Matilda* and the Diamantina River



16 m

Wintonotitan wattsi

- Wintonotitan means ‘Winton’s Titan’
- Long limbs with a wide pelvis
- Specimen found alongside lungfish, crocodile and small dinosaur fossils

18 m

Australotitan cooperensis

- Largest dinosaur in Australia
- Name means, ‘Southern Titan from Cooper Creek’
- Found near the township of Eromanga

30 m

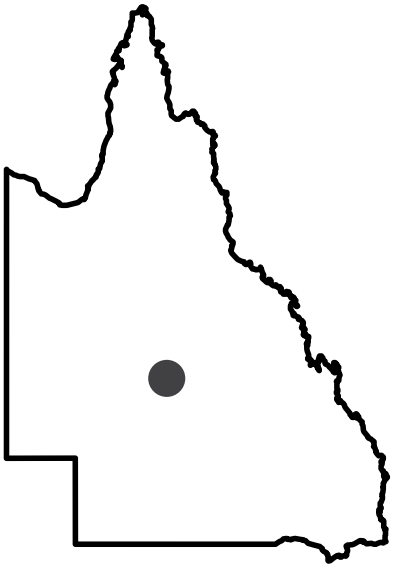
Colouration and body form of *Australotitan cooperensis* by Konstantinov, Hocknull & Mackenzie (Eromanga Natural History Museum)

Isisfordia duncani
Crocodile

Fast fact:

The most complete Cretaceous crocodile fossil from Australia

Fossil location



Isisfordia duncani

Crocodile skull

Isisfordia duncani

Crocodile head reconstruction 3D colour print

Isisfordia duncani

Articulated skeleton

Isisfordia duncani

Partial skull

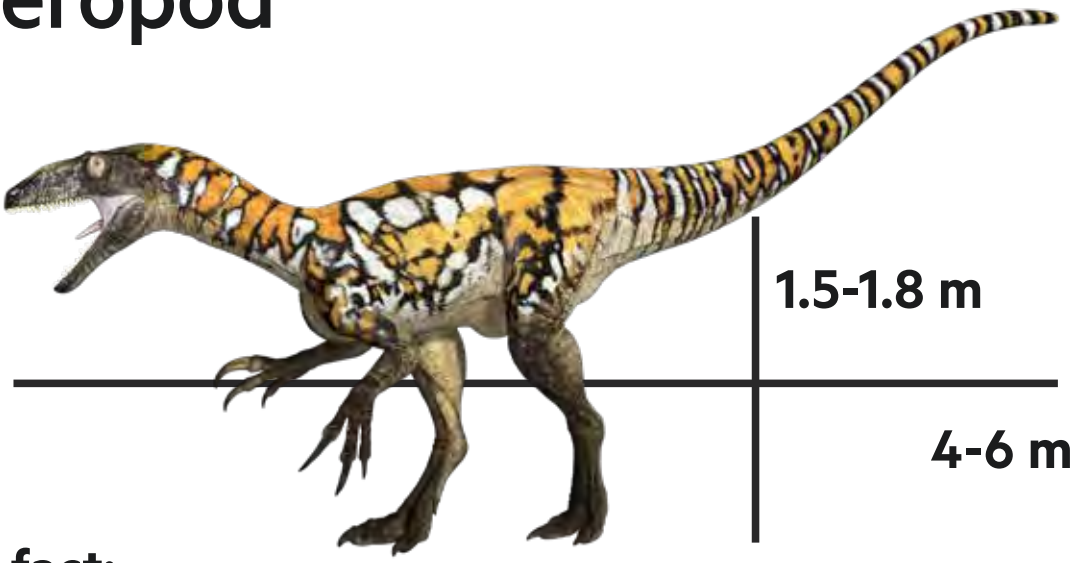
Australovenator wintonensis

Theropod

Hand skeleton (cast)

Australovenator wintonensis

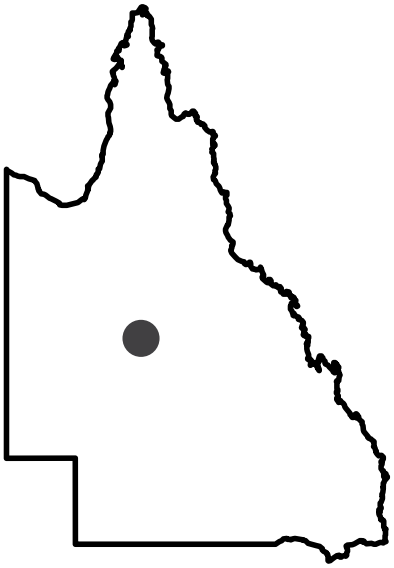
Theropod



Fast fact:

The most complete carnivorous dinosaur found in Australia

Fossil location



Angiosperm leaf

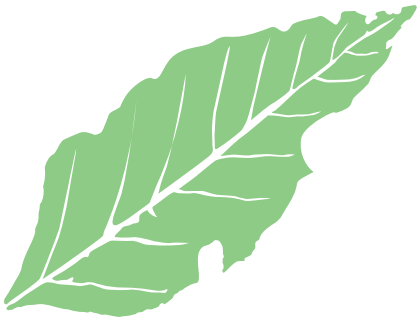
***Araucaria* sp.**

Foliage

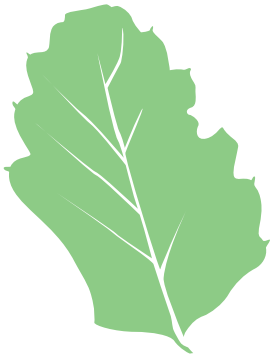
Flowering plant leaf and small conifer (*Austrosequoia*) cones

Dinosaur Food

- Fossil plants displayed here include the leaves from flowering plants and conifers.
- Flowering plants had large leaves with veins, suggesting they may have been deciduous.
- Fossil angiosperm leaves show possible signs of insect feeding
- Conifers are from the family Araucariaceae, that survive today in the southern hemisphere.
- Herbivorous dinosaurs likely evolved different body size, length of neck, and types of teeth, to help them reach and grasp the different plants available as food.



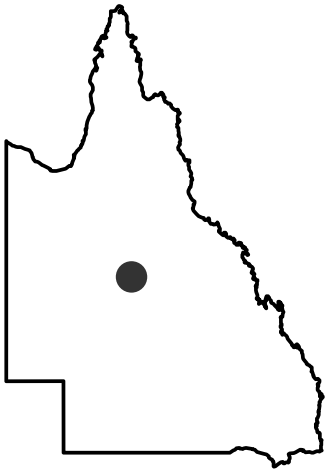
Angiosperm leaf with possible insect feeing (notches)



Angiosperm leaf showing serrated margin

Podocarp shoot

Araucarian branch



Palaeotech: a new Lark Quarry investigation

A new investigation of the trackways is underway by Queensland Museum palaeontologists.

Footprints from small dinosaurs and a possible crocodilian head in roughly the same direction.

Using scanning technology, they have discovered new, altered and hidden evidence that improves the interpretation of the trackways.

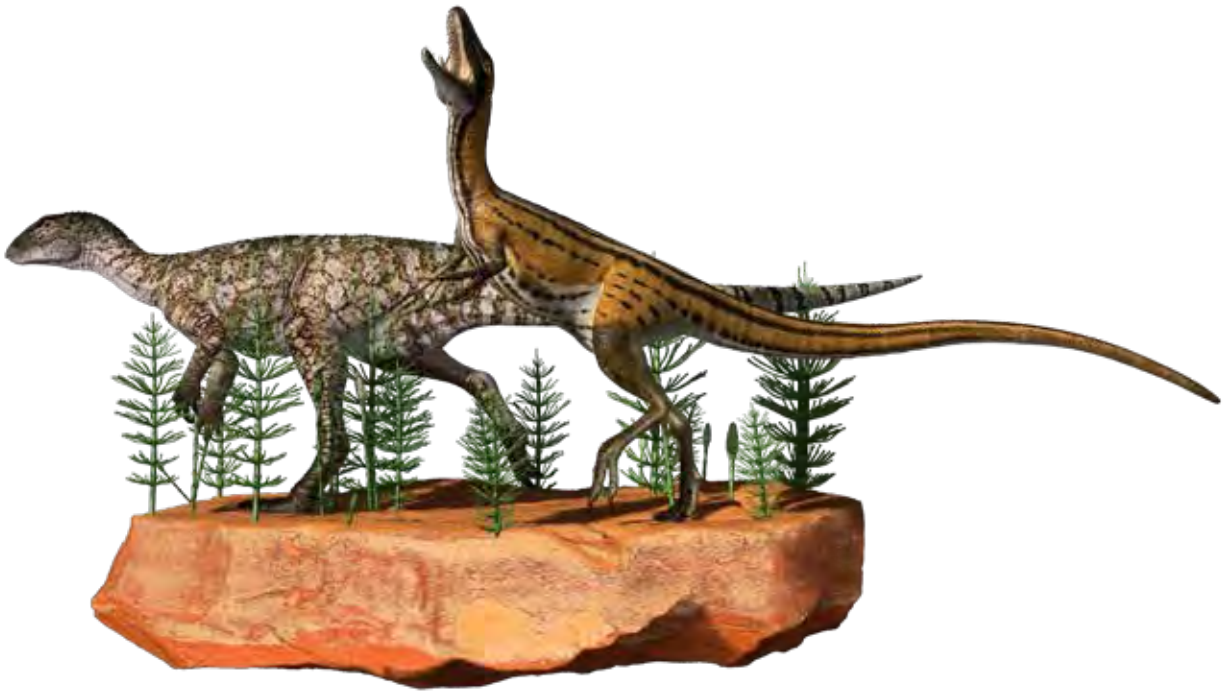
Seymour & Lark Quarry footprints: Ornithopods (green), small theropods (red) and a possible crocodilian (purple)

New Evidence

X-rays indicate that horsetails and shrub-sized plants germinated and grew in the open air before, during and after the dinosaur footprints were made.

Scans reveal insect burrows and trails that were made in shallow, drying mud puddles when dinosaurs left their footprints.

Earlier layers also preserve footprints with shallow or deep footprints indicating hard or soft mud.



A life-like reconstruction has been 3D printed above using scan data of the real piece displayed here. © Queensland Museum, Hocknull

Altered Evidence

The new study has found that the footprint layer dried hard, cracked up, and was later eroded by water.

Erosion of the large footprints from the central trackway has produced broad-toed footprints like those made by a plant-eating ornithopod. While the least altered footprints resemble the narrow toes of a meat-eating theropod.

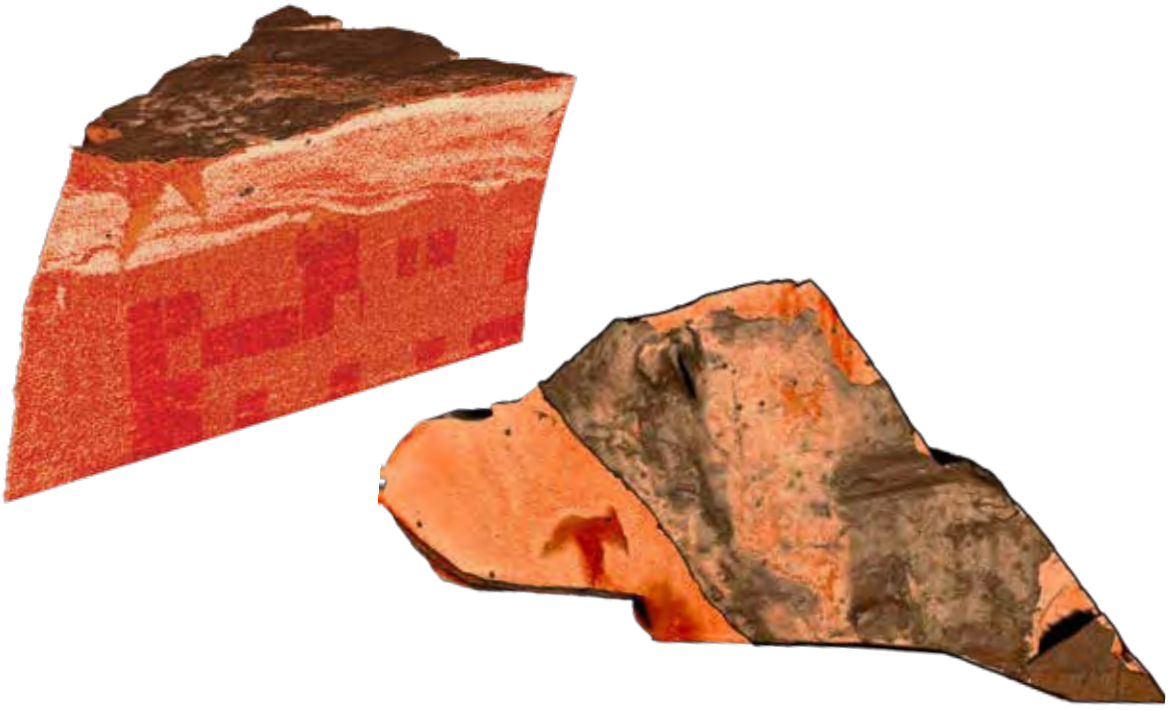
The type of dinosaur that made the central trackway may never be resolved.

Australovenator (theropod) toe bones placed within the best preserved large footprint at Lark Quarry © Queensland Museum, Hocknull

Hidden Evidence

After burial, multiple layers of iron-oxide grew between the dinosaur footprints and the sand layer that covered them. CT scans reveal that these iron layers have significantly altered the shape of the footprints.

The iron layer partially or completely covers many footprints, meaning that there are more footprints preserved than you can see with the naked eye.



Top: Scan of track showing iron-oxide (dark brown layer) covering infilled footprint (red) Bottom: Iron-oxide layer digitally removed showing three-toed footprint underneath. © Queensland Museum, Hocknull

Lark Quarry: new evidence

Dr Scott Hocknull, Queensland Museum palaeontologist, takes you through the new evidence he has discovered while investigating dinosaur footprints at Lark Quarry. X-rays of the fossilised footprints have revealed new and exciting evidence about what happened at Lark Quarry before, during and after the footprints were made, around 93 mya. Listen to a recreated soundscape of the open floodplain teeming with dinosaurs.

Documentary 3:48
Soundscape 3:30

Lark Quarry, dinosaur footprints

This is a portion of Lark Quarry, a dinosaur trackway site south of Winton in central Queensland.

Palaeontologists have made different scientific interpretations of the small tracks.

Were the dinosaurs stampeding together, swimming or, migrating over time?

What do you think?
View the monitors to learn more.

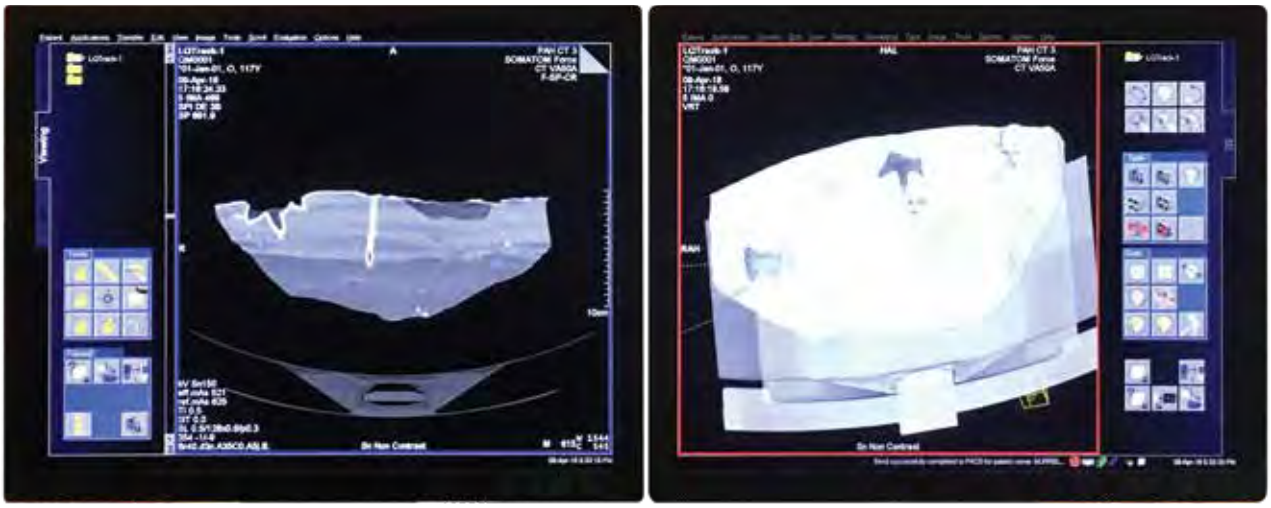
Left: Excavation of the Lark Quarry dinosaur trackway site (late 1970s). Right: Hundreds of dinosaur footprints were uncovered. © Queensland Museum

A cautionary tale

A fibreglass replica of the trackways was made for research and display. Replication created shrinkage ripples, fake cracks, and artificial bulges around the large footprints.

- The site has also been damaged and restoration has altered the surface
- Palaeontologists must consider missing or altered evidence in their scientific interpetations

Left: A silicon rubber mould is made of the trackways. Right: The fibreglass cast of the trackways shows artificial surface ‘ripples’ and bulging footprint ‘rims’. © Queensland Museum



X-ray vision

Queensland Museum palaeontologists have X-ray Computed Tomography (CT) scanned these dinosaur trackways. They have discovered:

- Earlier layers of footprints that also head in the same direction
- Plant roots and insect burrows in the sediment that indicate vegetation cover and insect life
- A dried, cracked, and eroded surface after the last footprints were made

A block of Lark Quarry is CT scanned to see inside the fossil trackway.

Lark Quarry comes to life

Cold skies indicate a drying season. Fields of horsetail plants cover a vast floodplain.

Left: a theropod fails to intercept a straggling ornithopod.

Centre: mixed herds of plant and insect-eating dinosaurs feed on the last green shoots and insect swarms.

Back right: a solitary titanosaur surveys its territory.

3D models by Konstantinov, Atuchin & Hocknull

Dinosaurs Unearthed: Virtual Prehistoric Queensland

Scan the QR code to bring these creatures to life in augmented reality.

Kunbarrasaurus ieversi
Ankylosaur

'Skartopus'
track maker at Lark Quarry

'Wintonopus'
track maker at Lark Quarry

Lark Quarry: scientific interpretations

View three simplified scientific interpretations of Lark Quarry here and projected onto the Lark Quarry replica above.

‘Stampede’ interpretation:

- Large footprints made by a large meat-eating dinosaur (theropod).
- Small footprints made by a mixed herd of small dinosaurs (ornithopods and theropods) as they stampede across an open mudflat.

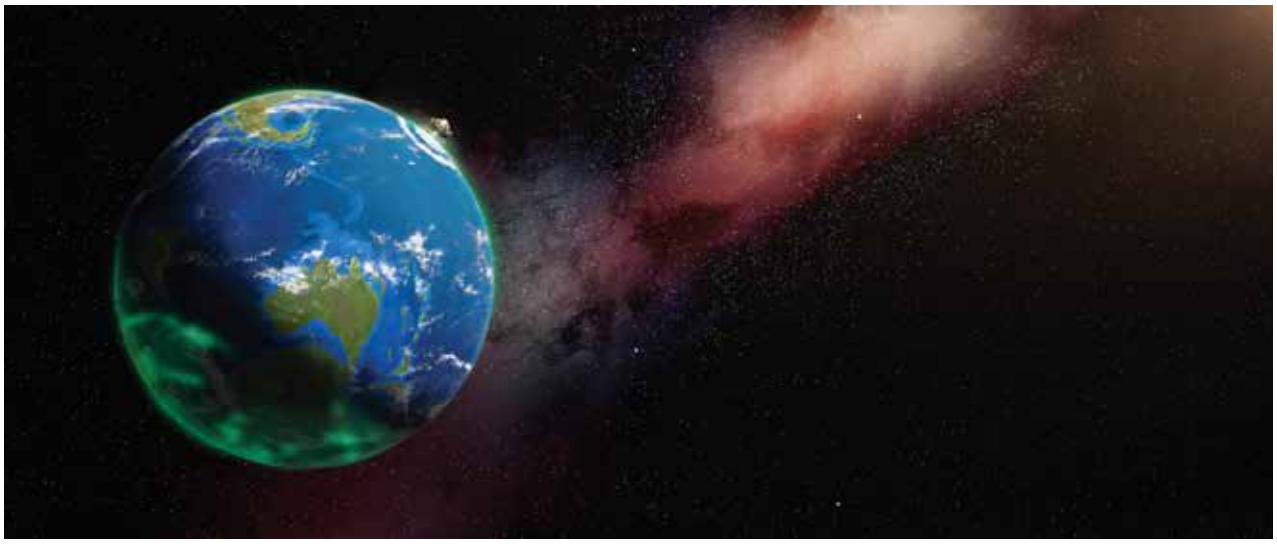
‘Swimming’ interpretation:

- Large footprints made by a large plant-eating dinosaur, like Muttaburrasaurus.
- Small footprints made by swimming ornithopods.

‘Migration’ interpretations (a new study underway by Queensland Museum):

- Small footprints made by migrating mixed herds of plant-eating ornithopod and insect-eating theropod dinosaurs.
- Dinosaurs attracted by lush plant growth and swarming insects. Small footprints made over weeks to months.
- Large footprints made by a medium-sized theropod, like Australovenator, as it hunts. An interaction between this theropod and a small ornithopod may have occurred.

Monitor animation Duration: 7.34
Projection animation above: 3.56



Game Over
Mass Extinction 66 mya

The impact of an asteroid ends the reign of the dinosaurs.
A global ecosystem collapse drives extinction.
Life will rebound, but the Age of Dinosaurs is over.

- An asteroid approximately 10 km in diameter slams into Earth near today's Yucatan Peninsula.
- Tsunamis swamp the coastlines, wildfires spread across the globe, and smoke and dust fill the atmosphere and block out the sun.
- Life suffers, ecosystems collapse, and major groups of animals and plants are driven to extinction.

A global catastrophe seen from the south.

A reconstructed view of Earth from the south pole, 66 million years ago. It is Spring in the northern hemisphere, much of the south is dark. Australia is still joined to Antarctica as the last pieces of the once super continent Gondwana. An asteroid impact, thousands of kilometres to the northeast, sends shockwaves around the globe. Ecological collapse and species extinctions do not spare the south.

Planet Killers: asteroids and meteorites

66 million years ago (mya) an asteroid hit the Earth, ending of the reign of dinosaurs. A global catastrophe followed, with tsunamis, forest fires and species extinction. Over millions of years major changes to the planet have occurred due to asteroids and comets impacting Earth. However, on an almost daily basis, meteorites fall to Earth. Astronomers search for the next Planet Killer.

Animation Duration: 2:07

Planet killers: meteorites

- Meteorites fall to Earth every day, but are mostly small (less than 1 kg).
- Iron meteorites originate in the cores of asteroids.
- Stony (chondrite) meteorites are some of the oldest objects in the solar system (about 4.5 billion years old).
- Tektites are solidified droplets of melted Earth that rain back down after an asteroid impact.

Stony meteorite
700 g | L6 Chondrite
Tenham, Queensland

Iron meteorite
800 g | IVA octahedrite
Gibeon, Namibia

Stony-iron meteorite
90 g | pallasite
Imilac, Chile

Iron meteorite
17.6 kg | IAB Octahedrite
Gladstone, Queensland

Stony meteorite
1.3 kg | H Chondrite
Cunnamulla, Queensland

Australites
10 g | tektites
southwest Queensland

Iron meteorite
3.6 kg | L6 Chondrite
Northern Territory

Iron-troilite meteorite
1 kg
Georgetown, Queensland

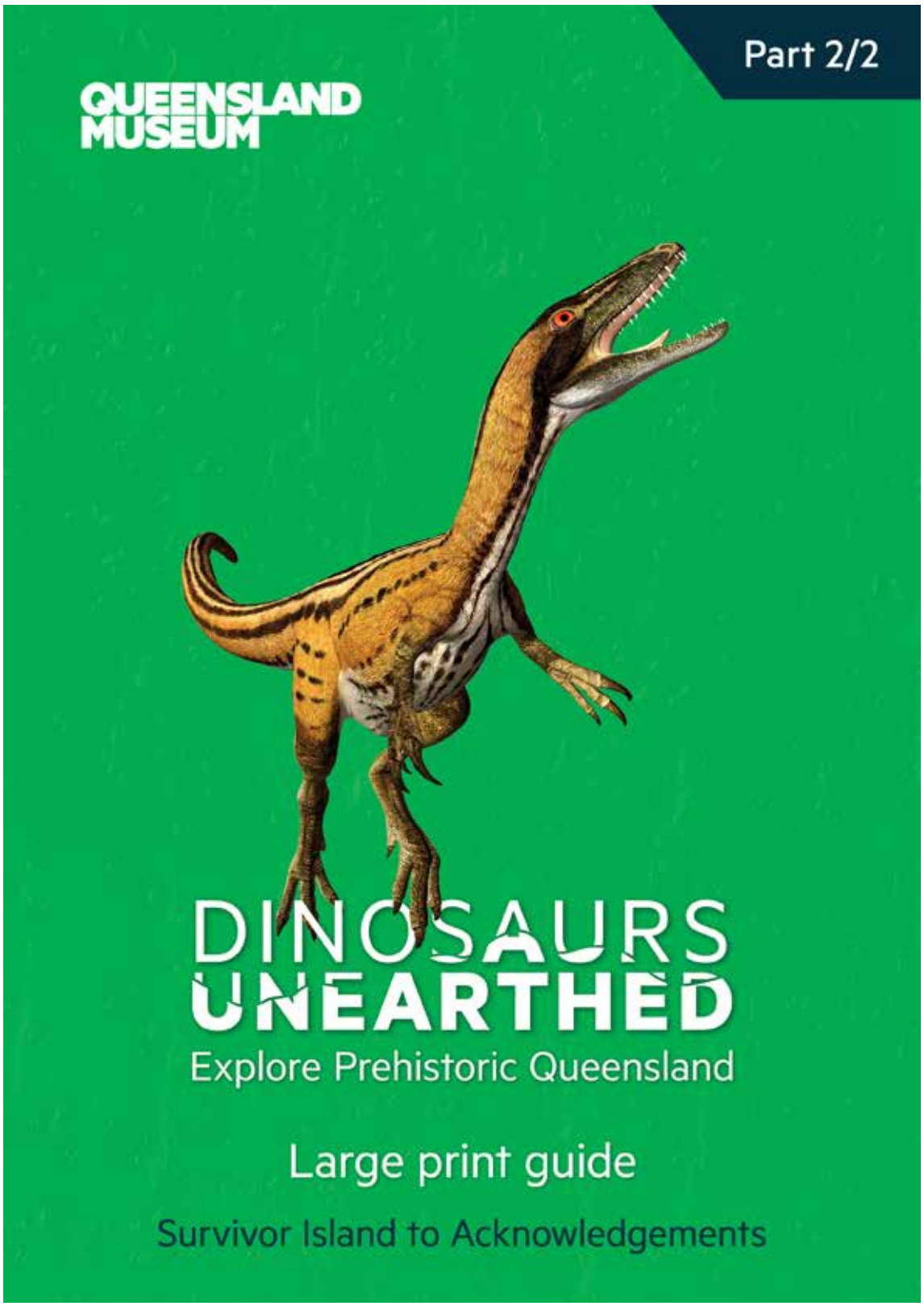
Indochinite
90 g | tektite
discovered in China

Stony meteorite
400 g | H6 Chondrite
Winton, Queensland

Iron meteorite
40 kg | ungrouped
Glenormiston, Queensland

Stony meteorite
cast | H Chondrite
Cunnamulla, Queensland

Part 2 of the *Dinosaurs Unearthed: Explore Prehistoric Queensland* large print guide is available at the cloakroom on level 2.



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