

**QUEENSLAND  
MUSEUM**

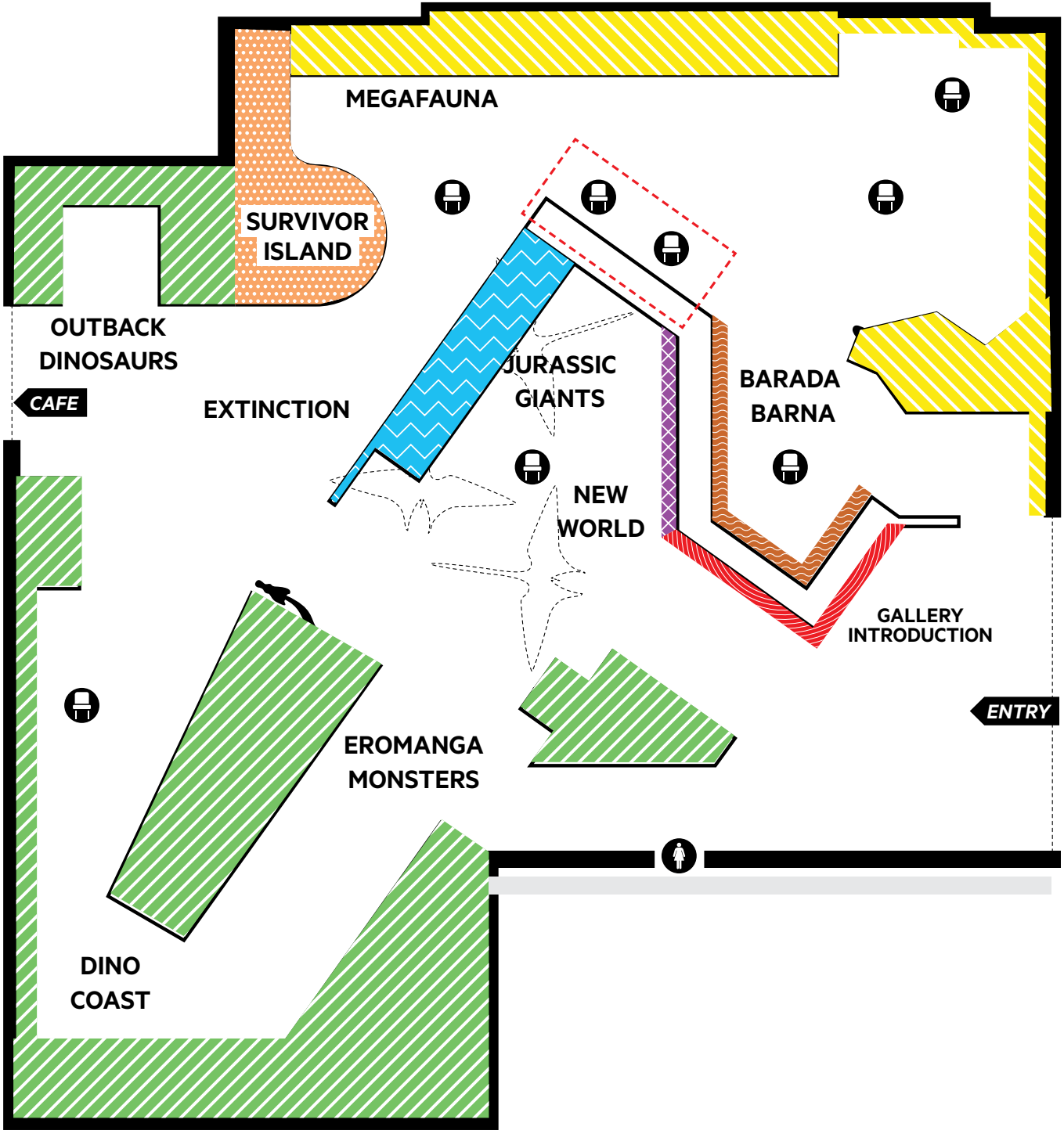


# DINOSAURS UNEARTHED

Explore Prehistoric Queensland

Large print guide

Survivor Island to Acknowledgements



# Theme colour key



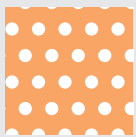
Triassic



Jurassic



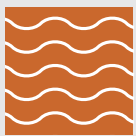
Cretaceous



Paleogene  
& Neogene



Quaternary



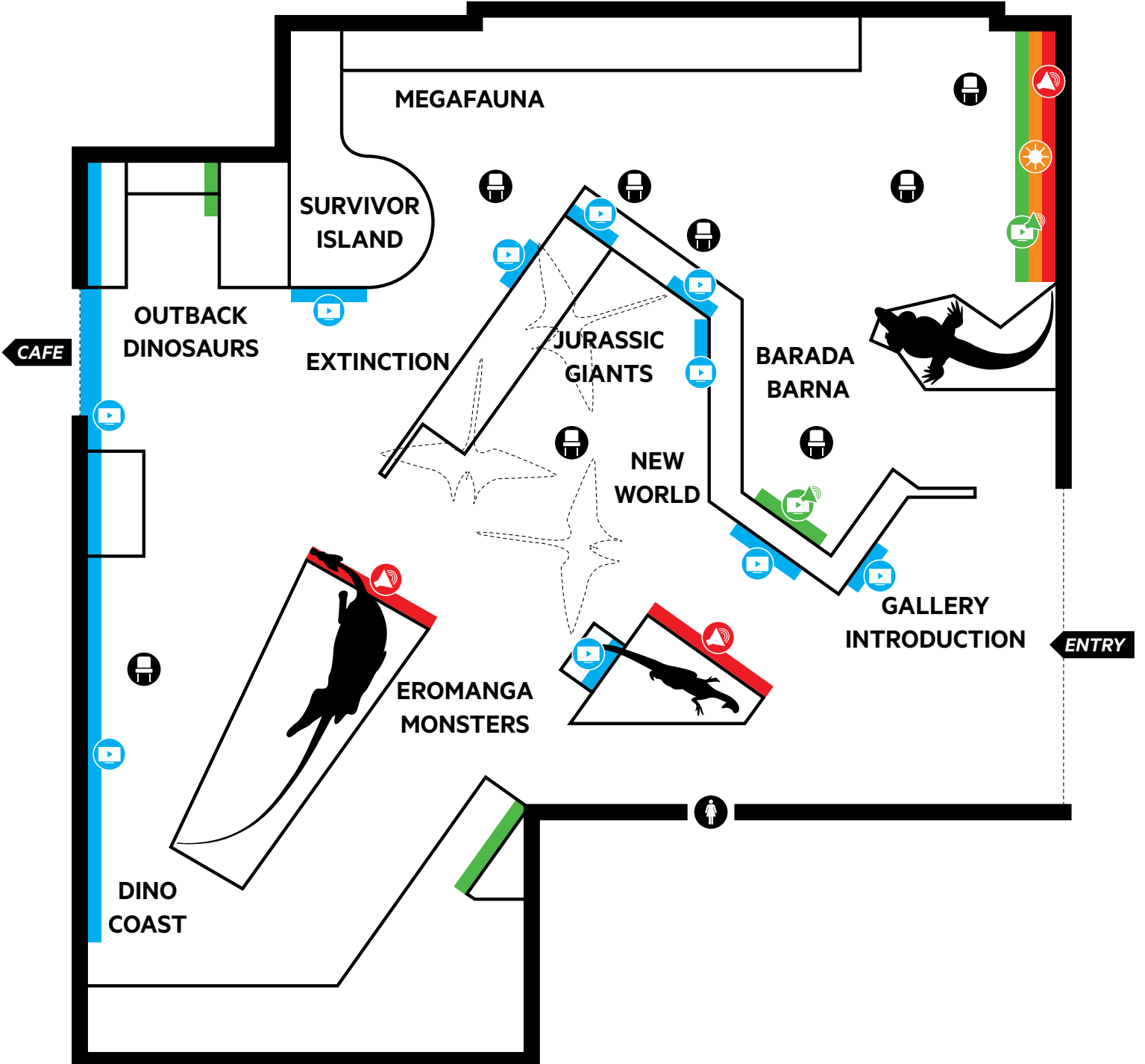
Timeless Land  
(First Nations Focus)



Introduction



Palaeolab - Active Area



# 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

# **Survivor Island**

**Paleogene 66–23 mya**

**Neogene 23–5.3 mya**

**Neogene 5.3–2.58 mya**

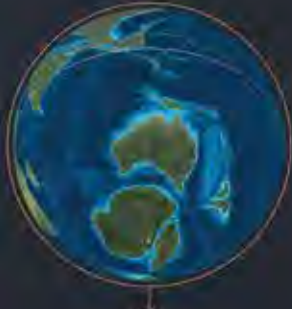
# PALEOGENE

## 66–23 mya

PALEOGENE  
66–23 mya

### An ancient rainforest with South American connections

- Life has rebounded after the mass extinction 66 mya.
- Great faunal exchange between Australia and South America occurs via an ice-free Antarctica.
- Newly discovered mammal and frog fossils from Geebung, Brisbane, are closely related to species from South America.



Australia completely separates from Antarctica




A cascading waterfall cuts into a recently extinct lava flow, providing nourishment for a lush Beech (*Nothofagus*) rainforest that teems with animal life.

**Foreground:** A male *Lechriodus* frog calls from a mossy rock to a spawning female. *Lechriodus* inhabit rainforests of Queensland and New Guinea today. A soft-shelled trionychid turtle hunts an unsuspecting leptodactylid frog. Leptodactylid frogs are only found in South America today. The snake, *Alamitophis*, whose relatives also live in South America, hunts a small marsupial carnivore.

**Midground:** A tiny species of marsupial carnivore looks for insects under an epiphyte. This species' closest relatives live in South America today. A small passerine (song bird) flies to a tree fern for shelter.

**Background:** *Kambara*, a crocodile, looks for an open area to bask.

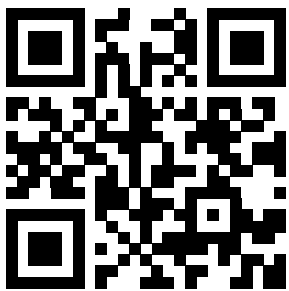
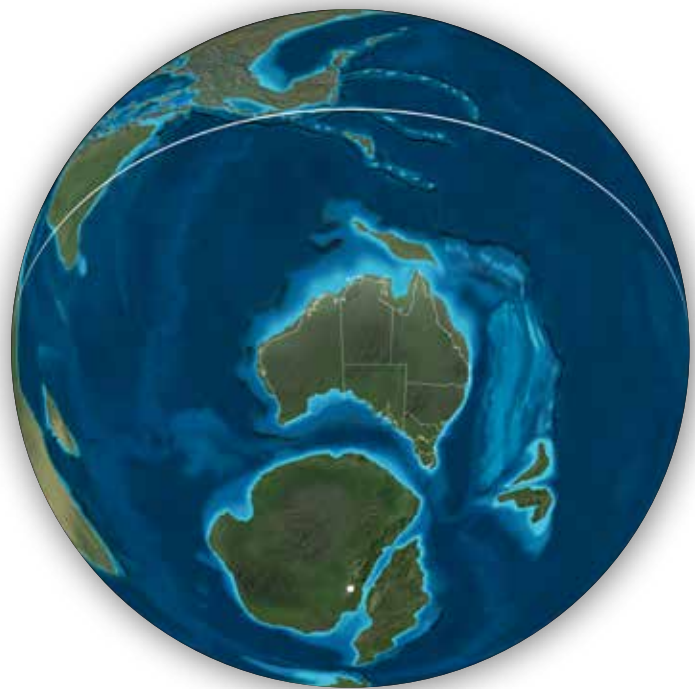


Geebung

# An ancient rainforest with South American connections

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Want to know more?  
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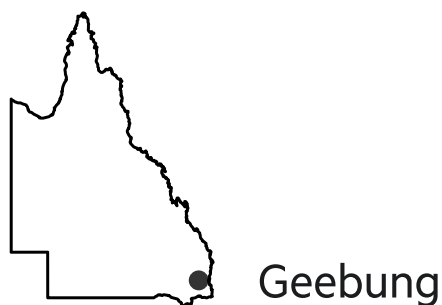
© Queensland Museum, Atuchin and Hocknull

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- All are new unnamed extinct species
- Each animal recreated at actual size
- Fossils 3D scanned and enlarged
- All 3D colour printed
- Missing parts reconstructed (clear)

### **Mysterious frog**

Pelvic bone enlarged x 8

### **Ancient insectivorous marsupial**

Lower jaw enlarged x 5

### ***Lechriodus***

Pelvic bone enlarged x 10

### **Ancient rainforest marsupial**

Skull enlarged x 5



◀ **Unnamed passerine**  
song bird

∧  
**Kambara**  
crocodile

**Ancient rainforest marsupial**  
new species  
∨



∧  
**Ancient insectivorous marsupial**  
new species

**Alamitophis**  
madstooid snake  
∨

∧  
**Lechriodus frog**  
new species  
∨

◀ **Trionychid turtle**  
soft-shelled turtle

∧  
**Mysterious frog**  
new species

# NEOGENE

## 23–5.3 mya

NEOGENE  
23–5.3 mya

### Modern Australia begins in the rainforest

- Australia slowly moves north as an island of evolution and, over millions of years, our modern fauna will evolve its globally unique character.
- Fossils found at the Riversleigh World Heritage Fossil Site in northwest Queensland include the ancestors of the platypus, koala, tree frogs, and Burdekin plum.
- The earliest global record of *Pandanus* occurs in central Queensland.



Antarctica is isolated and freezes over, plunging the globe into an icehouse.



© Collaborative Research, Australia and New Zealand



Riversleigh  
and Capella

Precambrian-aged limestone bedrock forms towering cliffs (karst) that hosts a megadiverse rainforest. Calcium-rich waters form spectacular mineral formations called tuffa dams that slow the water flow. This provides the perfect conditions for fossilisation. A fruiting *Pleiogynium* tree attracts several herbivores to its ripened plums.

**Foreground:** The skull of *Trilophosuchus* (a crocodile) encrusts with calcium carbonate. Swarms of tiny tadpoles feed on the tufts of algae. *Obdurodon* (an ancient platypus) is about to surface. An early species of *Litoria* (a frog) searches for a brooding crevice.

**Midground:** The ground-dwelling marsupial, *Marada*, feeds on fallen fruit while above the arboreal marsupial *Nimbadon* reaches for a fresh snack...

**Background:** The ancient koala, *Litokoala*, climbs a strangler fig and is startled by the bellow of the dromornithid bird, *Dromornis*. *Nimbadon* will soon be evicted as *Dromornis* moves in.

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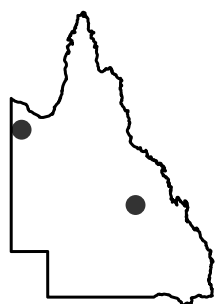
© Queensland Museum, Atuchin and Hocknull

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Riversleigh  
and Capella

***Ornithorynchus anatinus***

Modern Platypus skull



***Obdurodon dicksoni***

Ancient platypus 3D colour print



***plum .....***

Extinct plum 3D print

◀ ***Litokoala garyjohnstoni***  
ancient koala

^  
***Dromornis***  
giant flightless bird

^  
***Nimbadon lavarackorum***  
tree-dwelling marsupial

^  
***Marada arcanum***  
vombatiform

◀ ***Litoria***  
tree frog

^  
***Pleiogynium wannanii***  
fruiting tree

***Obdurodon dicksoni***  
ancient platypus



◀ ***Trilophosuchus* skull**  
crocodile



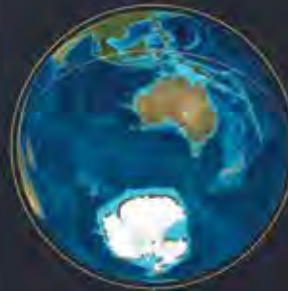
# NEOGENE

## 5.3–2.58 mya

NEOGENE  
5.3–2.38 mya

### The big dry begins as mega beasts take over

- Dry forests replace rainforest, driving the evolution of the first giant marsupials and reptiles.
- Reptilian predators dominate the Queensland landscape, including land-dwelling crocodiles, giant snakes and the Komodo Dragon.
- At the end of this Period, the age of Australia's megafauna begins.



Central Australian deserts expand as rainforests retract to the coast



© 2008/2009 MUSEUM AUSTRALIENSE/PAUL BRON



Chinchilla

A side branch of the ancient Condamine River hosts forest, open woodland, grasses and bracken. Exposed Jurassic sandstone provides perfect basking spots for Komodo dragons that lie in wait for unsuspecting prey.

**Foreground:** *Pseudomys* (rodents) take advantage of the drying climate and new grain-producing vegetation. A few million years have passed since the first rodents arrived on mainland Australia from Southeast Asia. In that time, they have diversified across the continent.

**Midground:** Two hungry Komodo dragons (*Varanus komodoensis*) calmly wait for the wading *Euryzygoma* (a diprotodont) moving toward them. An ancient blue-tongue skink, *Tiliqua wilkinsonorum*, warms itself.

**Background:** The unusual arboreal marsupial, Koobar, climbs toward the forest canopy, seeking refuge from the reptilian predators below. The stork, *Ciconia*, rests before returning to the shallows to hunt for fish.

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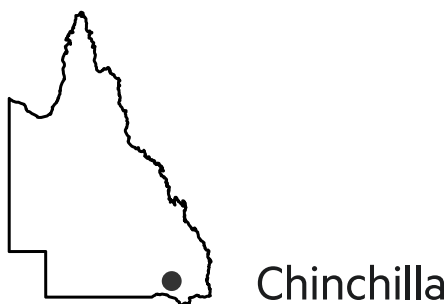
© Queensland Museum, Atuchin and Hocknull

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***Varanus komodoensis***

Komodo dragon

Actual size

The head of a Komodo Dragon (printed clear) with skull (white) and Pliocene-aged fossils (brown). Fossils include the maxilla, dentary, frontal, parietal, quadrate and supraorbital.

3D colour print



*Koobor notabilis* >  
extinct koala-like marsupial

< *Ciconia nana*  
extinct stork

^  
*Euryzygoma dunense*  
extinct giant marsupial

*Tiliqua wilkinsonorum*  
extinct blue-tongue skink  
v

^  
*Varanus komodoensis*  
Komodo Dragon

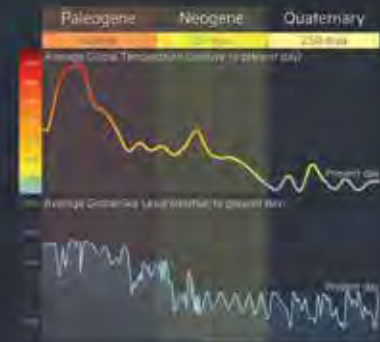
< *Pseudomys vandycki*  
extinct native rat



# SURVIVING THE ICEHOUSE

## Australia splits from Antarctica and moves northward as an island of evolution.

- For the first time in 250 million years, global temperatures plunge and the Earth enters an Icehouse.
- Life, including humans, exclusively evolve within Icehouse conditions, marked by fluctuating Ice Ages.
- Across Australia, Icehouse conditions result in aridity, the expansion of grasslands, and the spread of deserts.
- To survive the drying of the continent, survivors adapt.



### Surviving the dry

Cold ocean currents encircled Antarctica once Australia completely separated.

Over millions of years, Antarctica freezes over, locking away much of the Earth's fresh water.

Global temperatures and sea levels drop and the loss of fresh water drives aridity in Australia.

### Locations

Geebung  
Riversleigh  
Chinchilla



Paleogene  
66–23 mya



*Lecleroides* sp.  
Lecleroides ancestors evolve in ancient rainforests 55 mya.

Their descendants survive in small, wet rainforest refuges.



*Lullulaudon johnstoni*  
Several species of koala evolve in the ancient rainforests of Australia.

The surviving koala species evolves to eat drought-adapted Eucalyptus leaves.



*Ornithomyza wickhami*  
Platypus ancestors had teeth and ate large prey.

Modern platypus are smaller and survive in small, isolated streams.



*Pterodroma waimanu*  
The extinct *Pterodroma waimanu* closely resembles this modern species.

Modern *Pterodroma timoriense* are hardy and can tolerate drought.



*Varanus komodoensis*  
Varanus *komodoensis* (Komodo Dragon) evolved in Australia around 4.5 mya.

Komodo Dragons survived extinction on small, isolated Indonesian islands.



*Diposaurus vanderkooi*  
Rodents arrive in Australia from Asia around 5 mya.

Many species of rodents evolve in response to the expansion of grasslands.



*Lecleroides* sp.



*Lullulaudon johnstoni*



*Ornithomyza wickhami*



*Pterodroma timoriense*



*Varanus komodoensis*



*Diposaurus vanderkooi*

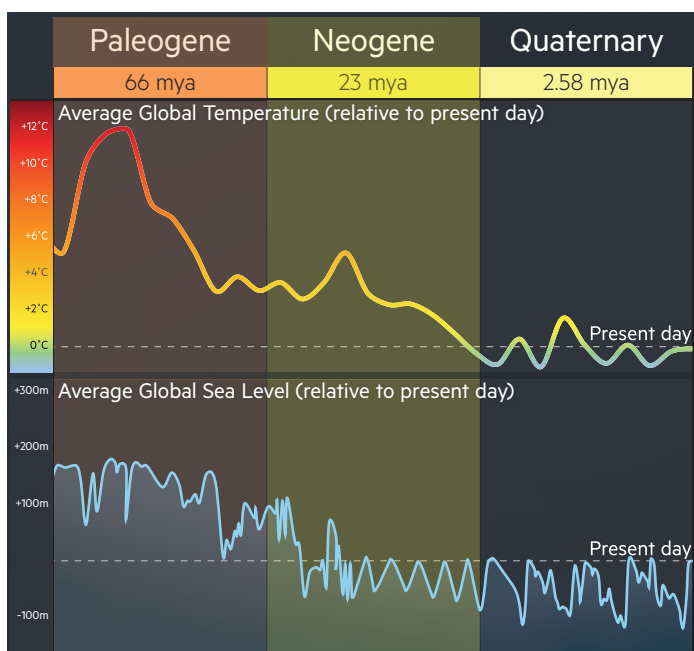
### CLOSEST LIVING RELATIVES

Top row: *Sarotherops*, *Lecleroides* sp., *Lullulaudon johnstoni*, *Ornithomyza wickhami*, *Pterodroma timoriense*, *Varanus komodoensis*, *Diposaurus vanderkooi*, *Quercus muhlenbergii*, *Arctomys* and *Hesperomys*. Bottom row: *Lecleroides* sp., *Lullulaudon johnstoni*, *Ornithomyza wickhami*, *Pterodroma timoriense*, *Varanus komodoensis*, *Diposaurus vanderkooi*, *Quercus muhlenbergii*, *Arctomys* and *Hesperomys*.

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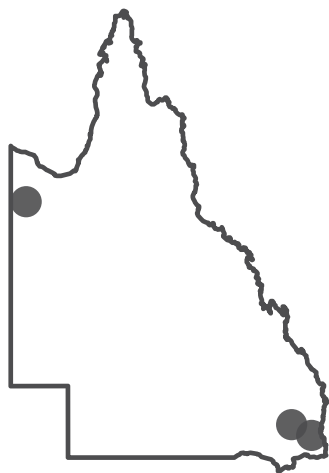


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Geebung  
Riversleigh  
Chinchilla

**Paleogene**  
**66-23 mya**

*Lechriodus* sp.\*



*Lechriodus* ancestors  
evolve in ancient  
rainforests 55 mya.



Their descendants  
survive in small, wet  
rainforest refuges.

**Closest living relative**

*Lechriodus* species



**Neogene**  
**23-5.3 mya**

*Lechriodus* sp.\*



Several species of koala  
evolve in the ancient  
rainforests of Australia.



The surviving koala species  
evolves to eat drought-  
adapted *Eucalyptus* leaves.

**Closest living relative**

*Phascolarctos cinereus*



**Neogene**  
**23-5.3 mya**

*Obdurodon dicksoni*



Platypus ancestors  
had teeth and ate  
large prey.

---

Modern platypus are  
smaller and survive in  
small, isolated streams.

**Closest living relative**

*Ornithorhynchus anatinus*



**Neogene**  
**23-5.3 mya**

*Pleiogynium wannanii*



The extinct *Pleiogynium*  
*wannanii* closely resembles  
the modern species.

---

Modern *Pleiogynium*  
*timoriense* are hardy and can  
tolerate drought.

**Closest living relative**

*Pleiogynium timoriense*



**Paleogene**  
**66-23 mya**

*Lechriodus* sp.\*



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**Closest living relative**

*Phascolarctos cinereus*



**Neogene**  
**5.3-2.58 mya**

*Varanus komodoensis*



*Varanus komodoensis*  
(Komodo Dragon) evolved in  
Australia around 4.5 mya.



Komodo Dragons survived  
extinction on small, isolated  
Indonesian islands.

**Closest living relative**

*Varanus komodoensis*



**Neogene**  
**5.3-2.58 mya**

*Pseudomys vandycki*



Rodents arrive in  
Australia from Asia  
around 5 mya.



Many species of rodents  
evolve in response to  
the expansion of grasslands.

**Closest living relative**

*Pseudomys* (many species)



Top row: Illustrations - *Lechriodus* sp., *Litokoala garyjohnstoni*,  
*Obdurodon dicksoni*, *Pseudomys vandycki*, *Varanus komodoensis* ©  
Queensland Museum, Atuchin and Hocknull

Bottom row: Images - *Lechriodus fletcheri*, *Phascolarctos cinereus*,  
*Ornithorhynchus anatinus*, *Pseudomys delicatulus* © Queensland  
Museum. *Pleiogynium timoriense* CC-BY Bean. *Varanus komodoensis*

CC-BY Kang

sp.\* new species

# Quaternary

2.58 mya to present day

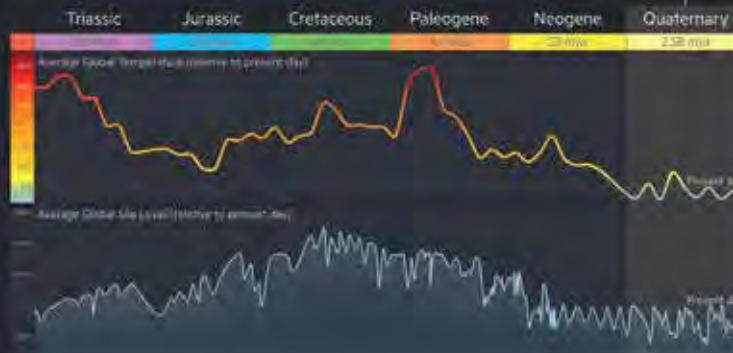
# Mega Fauna

- Queensland's biggest land animals are no longer dinosaurs. Instead, the 'mega' niche is filled by marsupials, lizards, crocodiles, flightless birds and armoured tortoises.
- But by 40,000 years ago, almost all of these megafauna are extinct.
- Dozens of small-sized species are driven to extinction by changing climate and intensifying aridity.



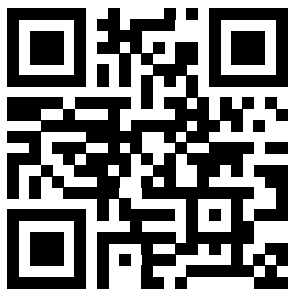
Search for more  
resources

Text below will describe Queensland with  
New Guinea as a land bridge for most of the Pleistocene.



# Quaternary Mega Fauna

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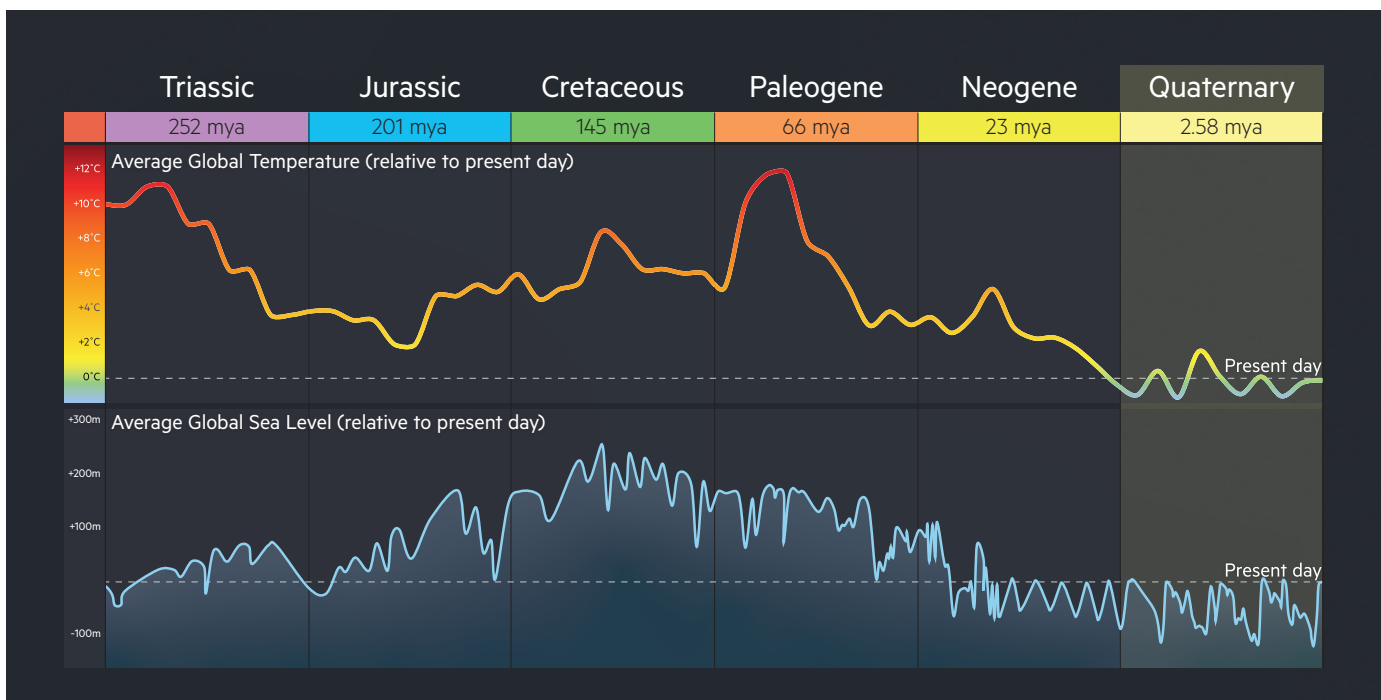


Want to know more?  
Scan me

We enter the Ice Ages, which means megadroughts for Queensland. Plant-eaters evolve into giants to survive the harsh climate. Beware – gigantic predators wait in ambush.



Sea levels fall, connecting Queensland with New Guinea via a land bridge for most of the Pleistocene.



# *Varanus priscus*

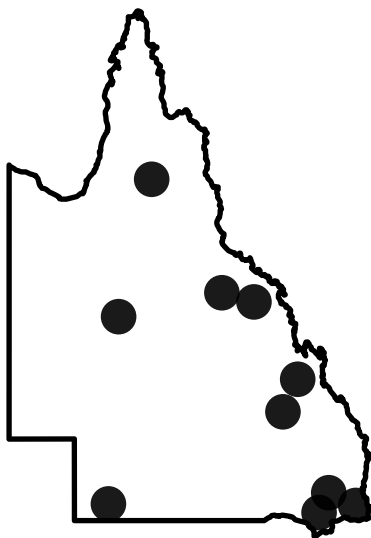
## Megalania



- World's largest lizard
- Extinct
- Carnivore



### Fossil location



© Queensland Museum, Konstantinov,  
Atuchin, Hocknull

# *Varanus komodoensis*

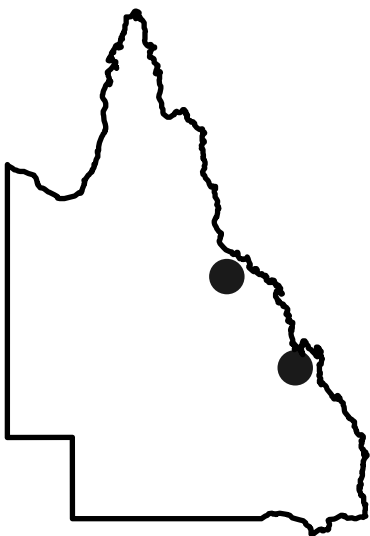
## Komodo Dragon

- World's largest living lizard
- First evolved in Australia
- Lives today in Indonesia (Komodo, Flores, Rinca Islands)



90 kg

### Fossil location



© Capricorn Caves, Atuchin,  
Hocknull, Lawrence

***Varanus priscus* (Megalania)**

3D colour printed, life-like reconstruction at 1/10th size.

© Queensland Museum,  
Konstantinov, Atuchin & Hocknull

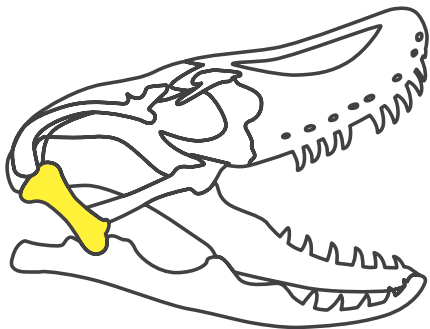
Maxilla (upper jaw)

Dentary (lower jaw)

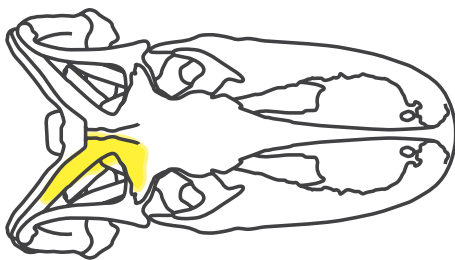
Teeth

***Varanus komodoensis***

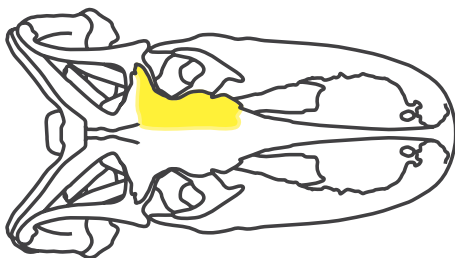
Komodo Dragon  
skull and mandible  
(cast)



Quadrate bone (skull)



Parietal bone (skull)



Frontal bone (skull)

***Varanus priscus***

Megalania

Fossil vertebrae

***Varanus komodoensis***

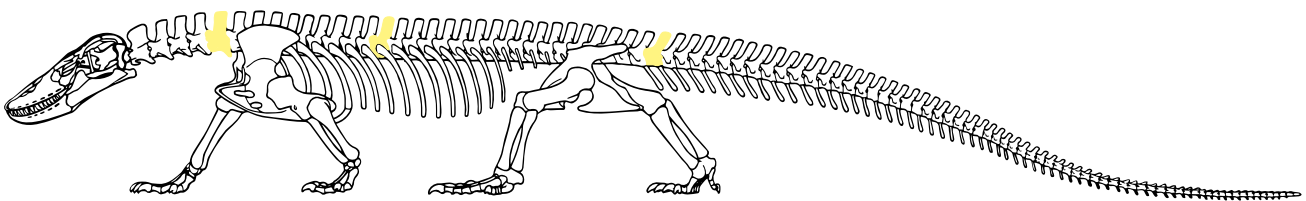
Komodo Dragon

Modern vertebrae (cast)

cervical  
(neck)

dorsal  
(body)

caudal  
(tail)



***Sarcophilus harrisii***

Tasmanian Devil

Modern skull

***Sarcophilus lanianus***

Prehistoric devil

Fossil skull

***Thylacoleo carnifex***

Marsupial 'lion'

Fossil skull



***Thylacoleo carnifex***

Marsupial 'lion'

Skull reconstruction (cast)

***Thylacoleo carnifex***

Marsupial 'lion'

flesh reconstruction

***Thylacinus cynocephalus***

Thylacine

Modern skull

***Thylacinus cynocephalus***

Thylacine

Fossil skull



***Thylacinus cynocephalus***

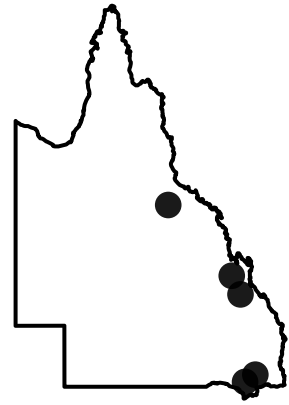
Thylacine

Modern skull

# *Sarcophilus laniarius*

## Prehistoric devil

- Extinct
- 70–80 cm long
- Bone-crushing teeth
- Scavenger



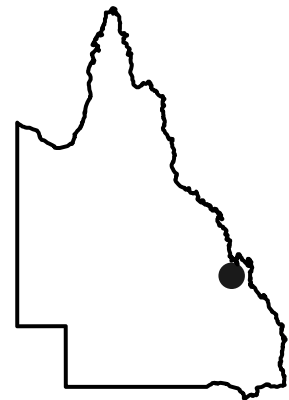
15 kg

© Queensland Museum, Allen

# *Sarcophilus laniarius*

## Prehistoric devil

- Living
- 50–65 cm long
- Bone crushing teeth
- Scavenger



8 kg

© PD Appel

# *Thylacinus cynocephalus*

## Thylacine

- Survived in Tasmania until 1936
- 100–130 cm long
- Wolf-like skull
- Carnivore



20 kg



© Queensland Museum, Atuchin, Hocknull, Lawrence

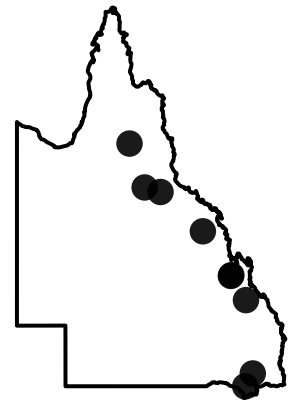
# *Thylacoleo carnifex*

## Marsupial 'lion

- Extinct
- Largest marsupial carnivore
- Bone-cleaving teeth
- Hypercarnivore



120 kg



© Queensland Museum, Atuchin, Lawrence, Hocknull

***Pallimnarchus/Paludirex***

Extinct freshwater crocodile

Fossil skull

***Crocodylus porosus***

Saltwater Crocodile

Modern skull



# ***Pallimnarchus / Paludirex*\***

## **Extinct freshwater crocodile**

\*uncertain taxonomy

- Extinct
- Hunted megafauna
- Heavy armour, broad snout, large teeth



**1200 kg**

© Queensland Museum, Atuchin, Hocknull, Lawrence.

Skull image: Queensland Museum, Hocknull

# *Crocodylus porosus*

## Saltwater Crocodile

- Living
- Generalist hunter
- Light armour, narrow snout, large teeth



**1100 kg**

© CC-BY. Skull image: Queensland Museum, Hocknull

# *Crocodylus johnstoni*

## Freshwater Crocodile

- Living
- Hunts fish and small vertebrates
- Light armour, slender teeth



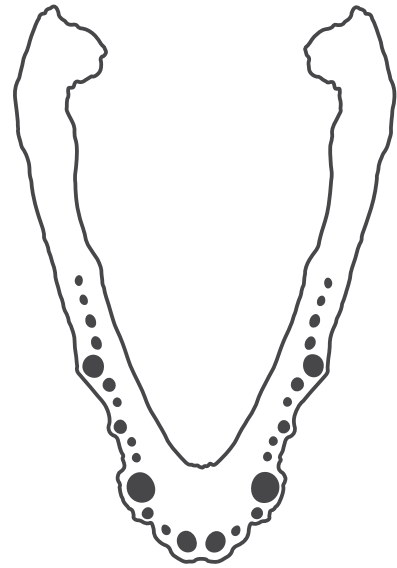
**90 kg**

© CC-BY. Skull image: Queensland Museum, Hocknull

***Pallimnarchus/Paludirex***

Extinct freshwater crocodile

Fossil jaw



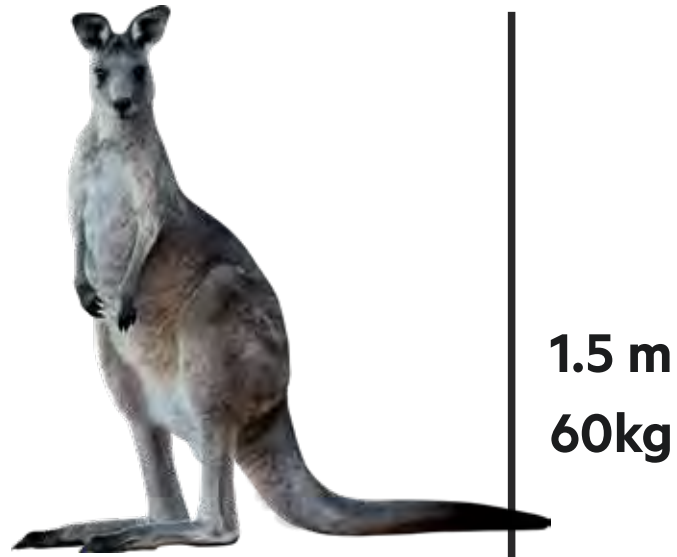
***Crocodylus porosus***

Saltwater Crocodile

Modern jaw

# ***Macropus giganteus***

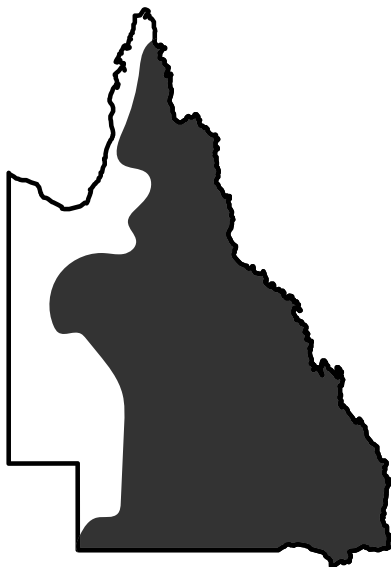
## Eastern Grey kangaroo



### **Fast fact:**

A living relative of *Macropus titan*

### **Fossil location**



Herbivore



Marsupial



© Queensland Museum, Konstantinov, Atuchin & Hocknull

# ***Macropus titan***

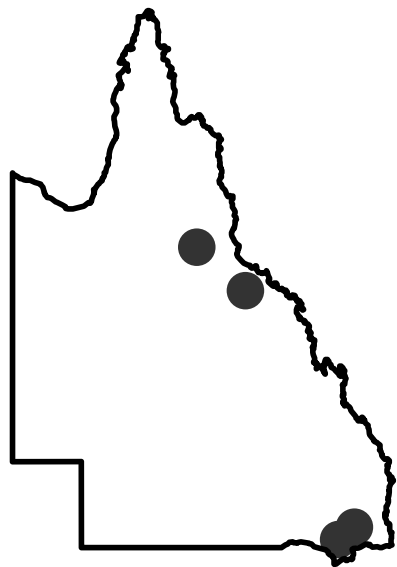
## **Giant grey kangaroo**



### **Fast fact:**

Related to the living grey kangaroo

### **Fossil location**



**Herbivore**



**Marsupial**



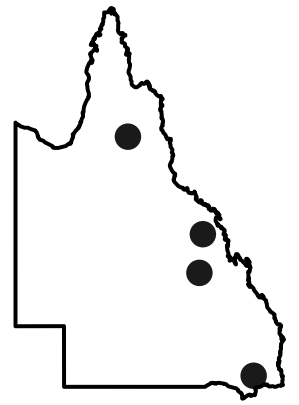
© Queensland Museum, Konstantinov, Atuchin & Hocknull

# ***Macropus sp.\****

## **Giant 'deer' kangaroo**

\*new species

- Extinct
- Largest-ever kangaroo
- Pointed toe claws
- Ate leaves



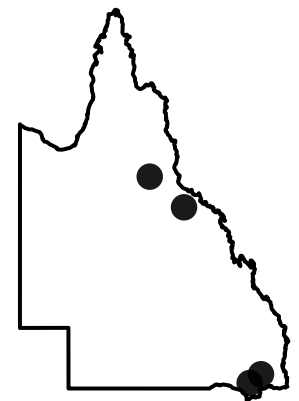
**275 kg**

© Queensland Museum, Konstantinov, Atuchin, Hocknull

# ***Macropus titan***

## **Giant grey kangaroo**

- Extinct
- Related to the living Grey Kangaroo
- Long snout
- Ate grass



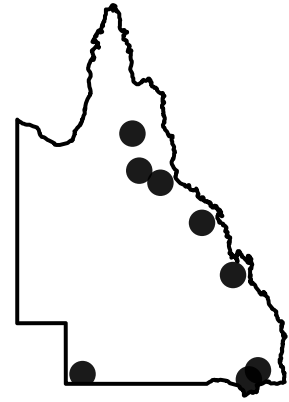
**230 kg**

© Queensland Museum, Konstantinov, Atuchin, Hocknull

# ***Protemnodon spp.\****

## **Giant forest wallaby**

\*multiple species uncertain



- Extinct
- Solid build
- Ate grass and leaves



**275 kg**

© Queensland Museum, Konstantinov, Atuchin, Hocknull

### ***Macropus giganteus***

Eastern Grey Kangaroo

Modern Skeleton

### ***Macropus titan***

Giant grey kangaroo

Fossil composite skeleton

### ***Protemnodon sp.***

***(new species)***

Giant forest wallaby

Fossil leg skeleton

Fossil mandible

### ***Macropus sp. (new species)***

Giant 'deer' Kangaroo

Fossil leg skeleton

### ***Macropus giganteus***

Eastern Grey Kangaroo

Modern leg skeleton

# Queensland megafauna

## ***Varanus komodoensis***

Komodo Dragon

Komodo Dragons lived in Queensland from 4.5 mya to 41,000 years ago.



## ***Pseudokoala sp\****

Giant ringtail possum

*Pseudokoala* is like a modern Koala but they are actually related to ringtail possums.



## ***Quinkana***

### ***fortirostrum***

Land-dwelling crocodile

Fossil of *Quinkana* have been found in caves throughout Queensland.

## ***Bohra sp.\****

Giant tree kangaroo

*Bohra* was first recognised from a fossil ankle bone found in northern New South Wales.

## ***Thylacoleo hilli***

Pygmy marsupial lion

The only fossils found in Queensland come from caves at Mt. Etna and Capricorn Caves.

## ***Casuarius sp.\****

Pygmy cassowary

The only confirmed fossils found in Australia come from Mt. Etna, Queensland.

## ***Thylacinus cynocephalus***

Thylacine

Thylacines were the second largest marsupial predator during the Pleistocene.

## ***Thylacoleo carnifex***

Marsupial lion

Marsupial lions were the apex marsupial predators during the Pleistocene.

## ***Pallimnarchus/Paludirex*\*\***

Giant freshwater crocodile  
Fossils have been found across inland Queensland, extending into west into South Australia.

## ***Macropus sp.\****

Giant deer kangaroo  
This new species of giant kangaroo dominated tropical Queensland during the Pleistocene.

## ***Protemnodon sp.\****

Giant forest wallaby  
Several species of giant forest wallaby lived across Queensland during the Pleistocene.

## ***Procoptodon goliah***

Giant short-faced kangaroo  
Recent studies conclude that these giant kangaroos walked and did not hop.

## ***Ninjemys oweni***

Giant horned tortoise  
*Ninjemys* is a giant armoured meiolaniid tortoise with horns and a tail club.



### ***Palorchestes azael***

Marsupial sloth bear

*Palorchestes* was peculiar marsupial with sloth and bear sloth-like features.

### ***Phascolonus gigas***

Giant wombat

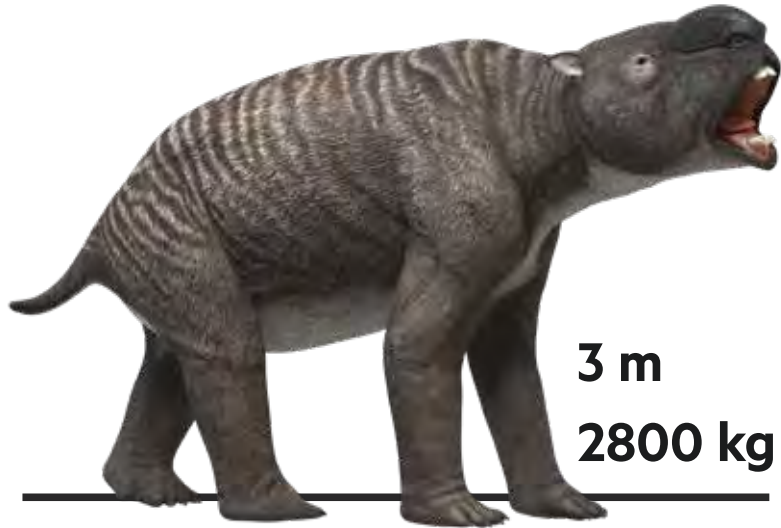
*Phascolonus* was the largest wombat to have ever lived.

Image credits starting from top left: *Varanus komodoensis* © Capricorn Caves, Atuchin, Hocknull, & Lawrence. *Pseudokoala* sp.\* © Queensland Museum, Atuchin & Hocknull. *Quinkana fortirostrum* © Capricorn Caves, Atuchin, Hocknull & Lawrence. *Bohra* sp.\* © Capricorn Caves, Atuchin, Hocknull & Lawrence. *Thylacoleo hilli* © Capricorn Caves, Atuchin Hocknull & Lawrence. *Casuarius* sp.\* © Queensland Museum, Atuchin & Hocknull. *Thylacinus cynocephalus* © Capricorn Caves, Atuchin, Hocknull & Lawrence. *Thylacoleo carnifex* © Queensland Museum, Atuchin, Lawrence & Hocknull. *Pallimnarchus/Paludirex*\*\* © Queensland Museum, Konstantinov, Atuchin & Hocknull. *Macropus* sp.\* © Queensland Museum, Konstantinov, Atuchin & Hocknull. *Protemnodon* sp.\* © Queensland Museum Atuchin, Lawrence & Hocknull. *Procoptodon goliah* © Queensland Museum, Atuchin & Hocknull. *Ninjemys oweni* © Queensland Museum, Atuchin & Hocknull. *Palorchestes azael* © Queensland Museum, Atuchin, Lawrence & Hocknull. *Phascolonus gigas* © Queensland Museum, Atuchin, Lawrence & Hocknull

sp. \* - new species sp. \*\* - taxonomy uncertain

# *Diprotodon optatum*

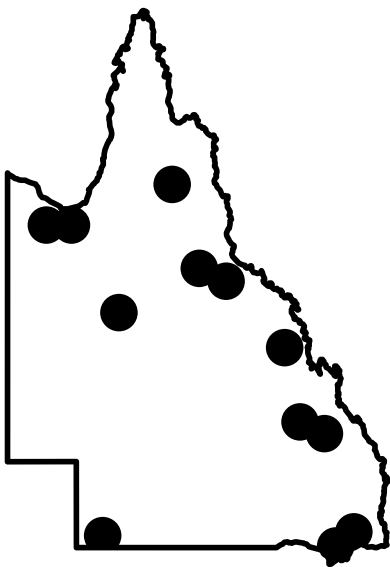
## Giant marsupial



### Fast fact:

World's largest marsupial

### Fossil location



Herbivore



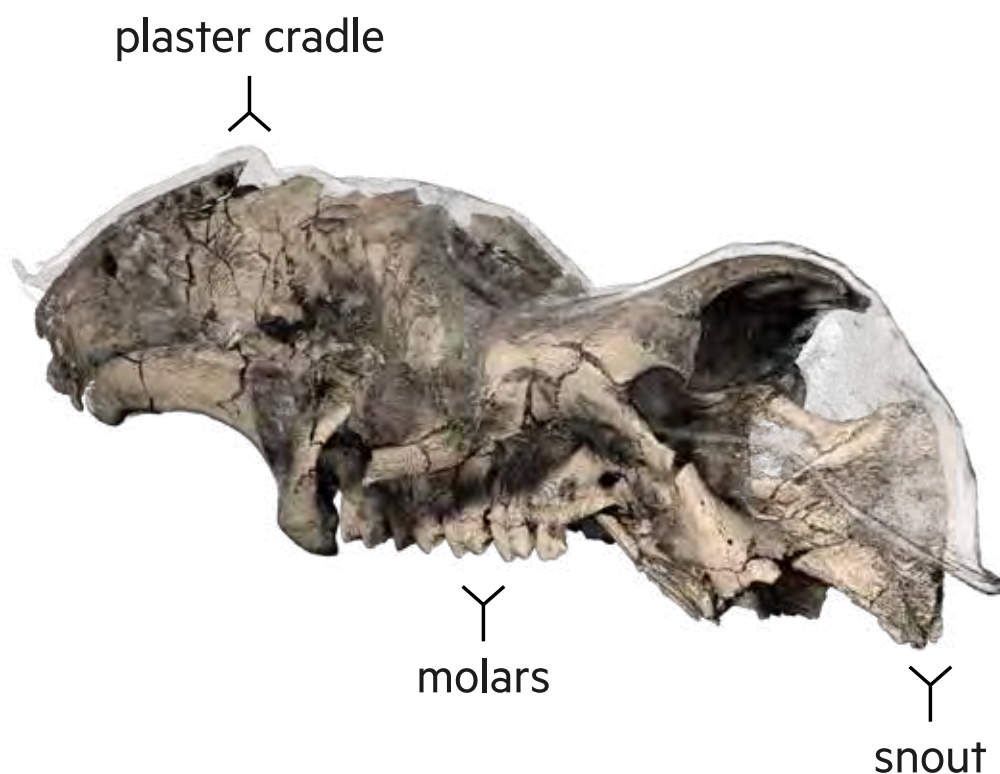
Marsupial



© Queensland Museum, Konstantinov, Atuchin, Hocknull

# Palaeotech

This is one of the best preserved *Diprotodon* skulls from the Queensland Museum Geosciences collection. It is very heavy and fragile so it has been placed in a collection cradle (coloured white). CT scans allow palaeontologists to view through the cradle and reveal the shape of the skull inside.



Rendered CT scan of the *Diprotodon* skull within its collection and display cradle, showing the bones inside. © Queensland Museum, Hocknull, Lawrence & Newman

***Diprotodon optatum***

Giant marsupial

Skeletal reconstruction

Fossil skull

(large individual)

Fossil mandible

(small individual)



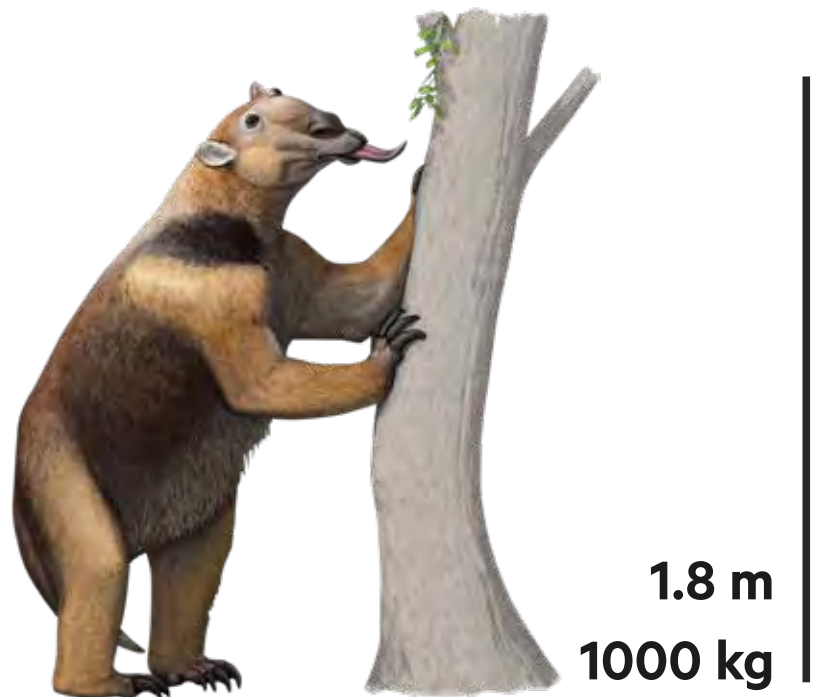
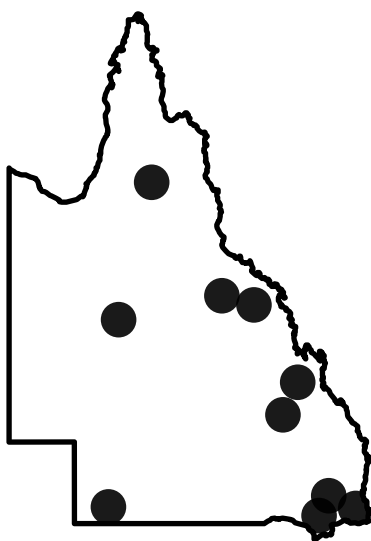
# *Palorchestes azael*

## Marsupial 'bear sloth'



- Largest claws of any marsupial
- Small eyes and protruding tongue
- Used claws to dig or break into rotten logs
- Herbivore
- May have also eaten grubs and fungus

### Fossil location



© Queensland Museum, Atuchin,  
Lawrence, Hocknull

## ***Palorchestes azael***

Marsupial 'bear sloth'  
hand bones (3D print)

Fossil claws



## **Palaeotech**

What a ripper!

The claws of *Palorchestes* were much larger than the bones that they attached to underneath the skin. Queensland Museum paleontologists have x-rayed these bones and will use this data to rebuild the paw of *Palorchestes* with claws. .



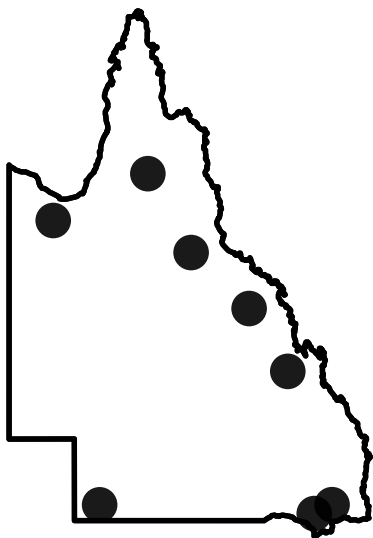
Claw of *Palorchestes*, approximately  
15 cm long © Queensland Museum, Hocknull

# *Vombatus ursinus*

## Common Wombat

- Living
- Continuously growing teeth
- Lives in burrows
- Ate grass

### Fossil location



30 kg

© Queensland Museum, Waddington

# *Lasiorhinus latifrons*

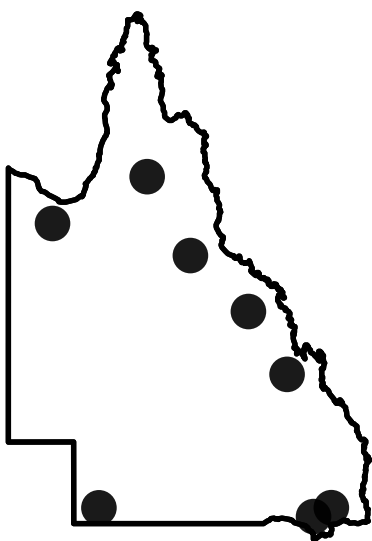
## Southern Hairy-nosed Wombat

- Living
- Continuously growing teeth
- Lives in burrows
- Ate grass

*Lasiorhinus latifrons*

Fossil skull

### Fossil location



35 kg

© CC-BY

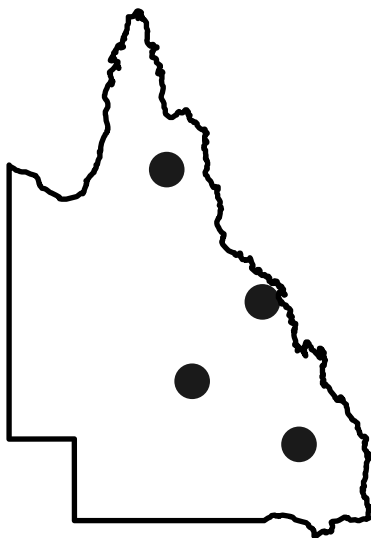
# *Phascolonus gigas*

## Giant wombat



- Extinct
- Continuously growing teeth
- May have lived in burrows
- Ate grass

**Fossil  
location**



**200 kg**

© Queensland Museum, Atuchin,  
Lawrence, Hocknull

## ***Phascolonus gigas***

Giant wombat

Fossil mandible

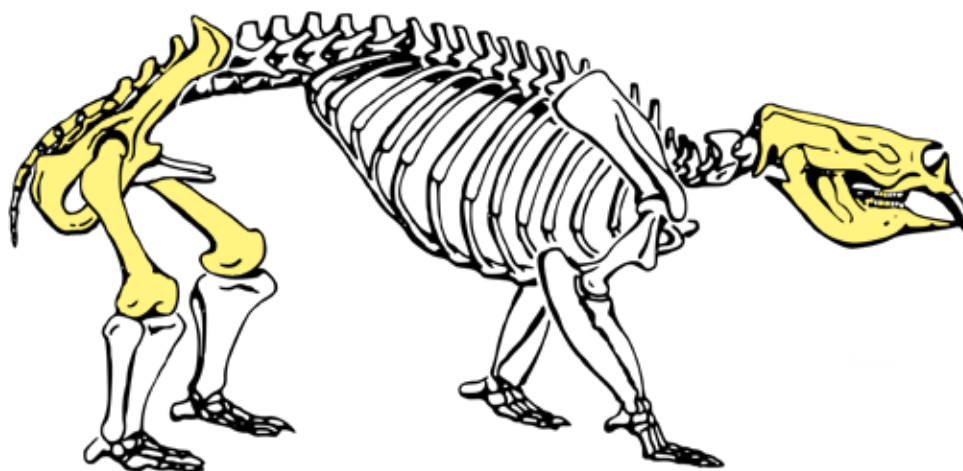
Skull (cast)

Modern skeleton

Fossil femora (thigh bones)

Fossil molars

Fossil pelvis and tail

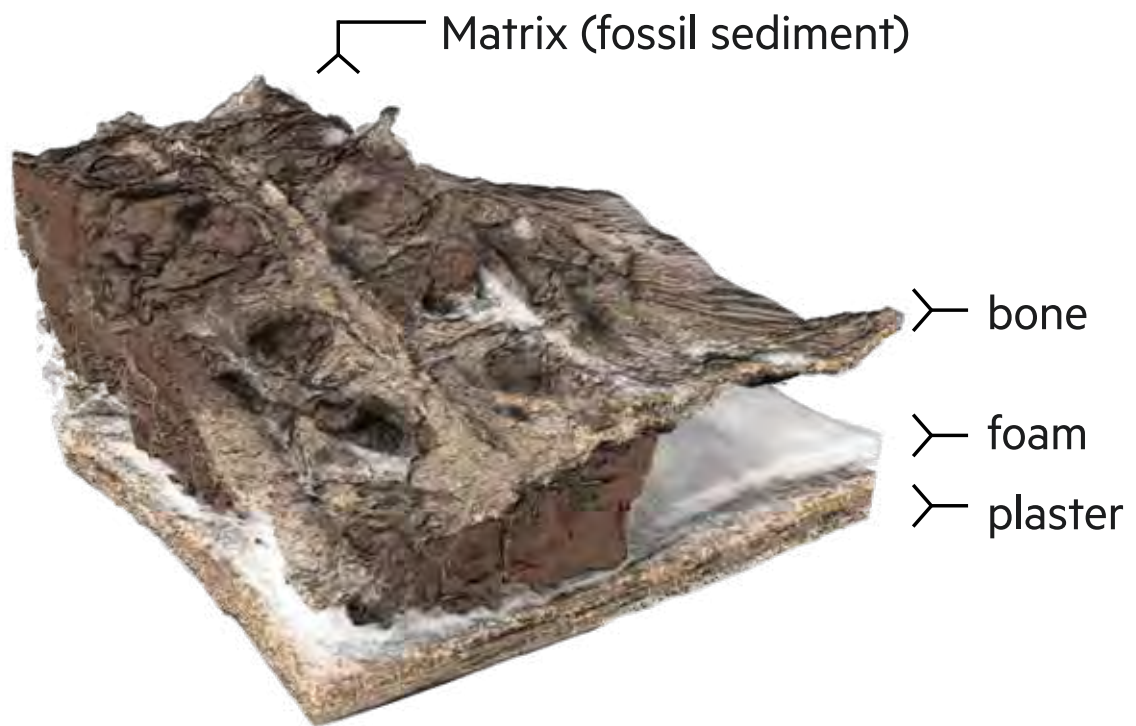


Yellow represents fossils on display

© Queensland Museum, Hocknull

# Palaeotech

This very rare and fragile fossil is from the pelvis and tail of the giant wombat, *Phascolonus gigas*. It is displayed here in a purpose built collection cradle (coloured white). Cradles are made to keep fragile fossils stable and safe for centuries.



CT scan image of the support cradle made for the *Phascolonus* pelvis showing fossil bone, matrix, plaster and foam. © Queensland Museum, Hocknull, Lawrence & Newman



# GAME OVER: CLIMATE KILLER

## Megafauna extinction

How and when Australia's megafauna went extinct is poorly understood.

Queensland Museum palaeontologists have focused their research on the megafauna from the Fitzroy River Basin, where climate change caused megafauna extinctions over the last 200,000 years.

## Locations

Mt Etna Cave  
Capricorn Caves  
Marion Quarry  
South Walker Creek



500,000-280,000 ya

280,000-205,000 ya

205,000-130,000 ya

130,000-70,000 ya

70,000-41,000 ya

41,000-36,000 ya

Lowland rainforests  
dominate the landscape



**Extinction window**

- High year-round rainfall changes to a seasonal dry climate, leaving few creeks.
- Rainforest cannot replace the sustained flow of water.
- At least 13 rainforest animal species go extinct, including 80 koalas, 8 possums and 12 frog species.
- 28 birds, 27 species, were present and 17 species went megafauna.

☒ Extinct megafauna



☒ Survivors



The Tipton's kangaroo is extinct in 1994.

Open and grassland habitat  
(isolates lowland rainforests)



**Extinction window**

- A major gap in the fossil record occurs for this period.
- Queensland Museum palaeontologists are searching for fossils to fill this gap.
- In 70,000 years, open and grasslands have been replaced by dryland (sclerophyll) forests.

☒ Extinct megafauna



☒ Survivors



Dryland forest megafauna  
expand and thrive



**Extinction window**

- Permanent waterholes become scarce as the climate finally dries.
- Fire and droughtiness from sea level, vegetation dominates the landscape.
- Loss of freshwater and stable food makes survival of most megafauna megafauna's dependent.
- Continental megafauna lose their primary food source and go extinct.

☒ Extinct megafauna



☒ Survivors



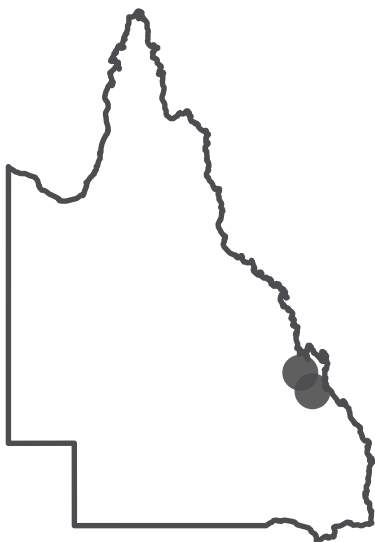
# GAME OVER: CLIMATE KILLER

## Megafauna extinction

How and when Australia's megafauna went extinct is poorly understood.

Queensland Museum palaeontologists have focused their research on the megafauna from the Fitzroy River Basin, where climate change caused multiple extinctions over the last 280,000 years.

### Locations



Mt Etna Caves  
Capricorn Caves  
Marmor Quarry  
South Walker Creek

# 500,000–280,000 ya

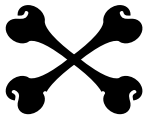


Lowland rainforests  
dominate the landscape

# 280,000–205,000 ya

## Extinction window

- High year-round rainfall changes to a seasonal dry climate, never to return.
- Rainforest cannot survive the sustained drop in rainfall.
- At least 113 rainforest animal species go extinct, including 85 mammal, 6 reptiles and 22 frog species.
- Of these, 27 species were possums and 17 species were megafauna.



## Extinct megafauna



*Sthenurine*



*Etnabatrachus  
maximus*



*Protomnodon sp.\**



*Varanus  
komodoensis*



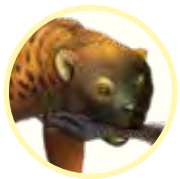
*Thylacoleo  
carnifex*



*Yurlunggur sp.\**



*Palorchestes sp.\**



*Thylacoleo hilli*



*Quinkana sp.\**



*Pseudokoala sp.\**



*Bohra sp.\**



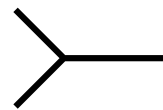
## Survivors



*Casuarius*  
*casuarius*



*Thylacinus*  
*cynocephalus*



The Thylacine was driven to extinction in 1936.

*Sthenurine* © Queensland Museum, Atuchin, Hocknull. *Rainforest Protemnodon sp.\** © Capricorn Caves, Atuchin, Hocknull, Lawrence. *Thylacoleo carnifex* © Queensland Museum, Atuchin, Lawrence, Hocknull. *Palorchestes sp.\** © Capricorn Caves, Atuchin, Hocknull, Lawrence. *Quinkana sp.\** © Capricorn Caves, Atuchin, Hocknull, Lawrence. *Bohra sp.\** © Capricorn Caves, Atuchin, Hocknull, Lawrence. *Etnabatrachus maximus* © Queensland Museum, Atuchin, Hocknull. *Varanus komodoensis* © Capricorn Caves, Atuchin, Hocknull, Lawrence. *Yurlungurr sp.\** © Capricorn Caves, Atuchin, Hocknull, Lawrence. *Thylacoleo hilli* © Queensland Museum, Atuchin, Hocknull. *Pseudokoala sp.\** © Queensland Museum, Atuchin, Hocknull. *Casuarius* © CC-BY Jones. *Thylacinus cynocephalus* © Capricorn Caves, Atuchin, Hocknull, Lawrence. sp.\* new species

# 205,000–130,000 ya

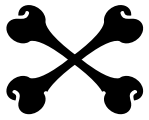


Open arid grassland habitat  
replaces lowland rainforests

# 130,000–70,000 ya

## Extinction window

- A major gap in the fossil record occurs for this period.
- Queensland Museum palaeontologists are searching for fossils to fill this gap.
- By 70,000 years ago, open arid grasslands have been replaced by dryland (sclerophyll) forests.were megafauna.



## Extinct megafauna



*Varanus komodoensis*



*Thylacoleo carnifex*



*Palorchestes*



*Diprotodon optatum*



## Survivors



*Osphranter rufus*

*Varanus komodoensis* © Capricorn Caves, Atuchin, Hocknull, Lawrence.

*Palorchestes* sp.\* © Capricorn Caves, Atuchin, Hocknull, Lawrence.

*Thylacoleo carnifex* © Queensland Museum, Atuchin, Lawrence,

Hocknull. *Diprotodon optatum* © Queensland Museum, Konstantinov,

Atuchin, Hocknull. *Osphranter rufus* © CC-BY Clarke. sp.\* new species

# 70,000–41,000 ya

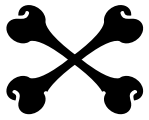


Dryland forest megafauna  
expand and thrive

# 41,000–36,000 ya

## Extinction window

- Permanent waterholes become scarce as the climate rapidly dries.
- Fire and nutritionally poor and toxic vegetation dominate the landscape.
- Loss of freshwater and edible food makes survival of most herbivorous megafauna impossible.
- Carnivorous megafauna lose their primary food source and go extinct.



## Extinct megafauna



*Palorchestes* sp.\*



*Diprotodon*  
*optatum*



*Protemnodon* sp.\*



*Varanus*  
*komodoensis*



*Macropus* sp.\*



*Pallimnarchus* sp.\*  
(uncertain taxonomy)



*Phascolonus*  
*gigas*



*Thylacoleo*  
*carnifex*



*Varanus priscus*



*Quinkana* sp.\*  
(uncertain taxonomy)

## Survivors



*Dromaius  
novaehollandiae*



*Crocodylus  
porosus*



*Osphranter rufus*

*Palorchestes* sp.\* © Capricorn Caves, Atuchin, Hocknull, Lawrence.

*Protemnodon* sp.\* © Capricorn Caves, Atuchin, Hocknull, Lawrence.

*Macropus* sp.\* © Queensland Museum, Konstantinov, Atuchin,

Hocknull. *Phascolonus gigas* © Queensland Museum, Atuchin,

Lawrence, Hocknull. *Varanus priscus* © Queensland Museum,

Konstantinov, Atuchin, Hocknull. *Diprotodon optatum* © Queensland

Museum, Konstantinov, Atuchin, Hocknull. *Varanus komodoensis*

© Capricorn Caves, Atuchin, Hocknull, Lawrence. *Pallimnarchus*

sp.\* (uncertain taxonomy) © Queensland Museum, Konstantinov,

Atuchin, Hocknull. *Thylacoleo carnifex* © Queensland Museum,

Atuchin, Lawrence, Hocknull. *Quinkana* sp.\* (uncertain taxonomy)

© Queensland Museum, Atuchin, Lawrence, Hocknull. *Dromaius*

*novaehollandiae* © Queensland Museum. *Osphranter rufus* © CC-BY

Clarke. *Crocodylus porosus* © CC-BY Imran.

sp.\* new species



***Etnabatrachus maximus***

Giant rainforest frog  
*Etnabatrachus* is the  
largest frog to have  
ever lived in Australia.



***Yurlunggur sp\****

Rainforest madtsoiid snake  
An ancient lineage of  
constricting snake found only  
in the Southern Hemisphere.

# Dinosaurs Unearthed: Virtual Prehistoric Queensland

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



*Varanus priscus*  
Megalania



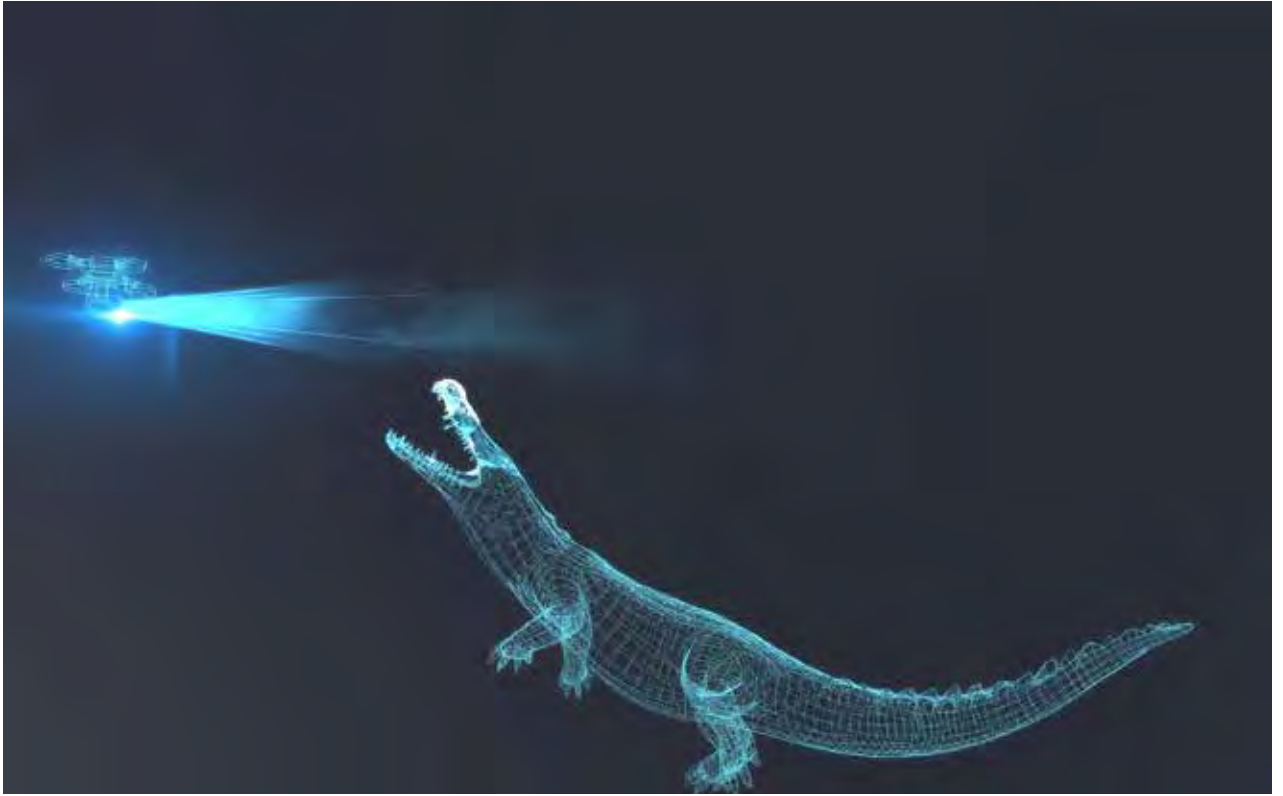
*Pallimnarchus*  
Giant Freshwater Crocodile



*Giant Macropus*  
Giant Kangaroo



*Diprotodon optatum*  
Giant Marsupial



# Tropical Queensland 41,000 years ago - animation

Research by Dr. Scott Hocknull, Queensland Museum palaeontologist, has been brought to life as a series of animations that represent life and death of megafauna in tropical Queensland, 41,000 years ago.

Location: Bidgerley (South Walker Creek)

© Queensland Museum, Hocknull and TPD, with models by Konstantinov, Atuchin & Hocknull and environment by Bargiel and Hocknull.

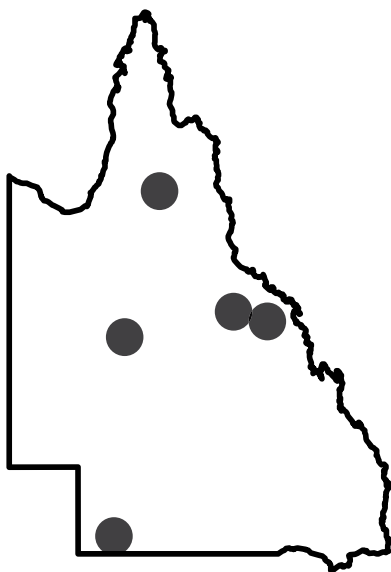
# *Varanus priscus*

## Megalania



This life sized 3D print of Megalania has been scientifically recreated from fossils, and includes shedding skin like lizards today.

### Fossil location



Carnivore



Lizard



© Queensland Museum, Konstantinov, Atuchin, Hocknull

**WARNING**

I hisssss and bite



**Do not climb**

**Do not touch**

# Palaeo Lab

Locked inside fossil poo and spew is the key to predicting our future.

## ‘Poo & Spew’

- Mt Etna and Capricorn Caves have been home to owls and ghost bats for over 500,000 years. These night hunters bring back prey to the caves to eat.
- Undigested remains, like bones and teeth, fall onto the cave floor as droppings (poo) or are regurgitated as pellets (spew).
- Over time this ‘poo and spew’ is buried by clay and fossilises.
- Palaeontologists collect, sort the fossil ‘poo and spew’, and identify the remains.
- Each species indicates what the environment was once like and how it has changed over time.

## Rainforest connection

During the Quaternary, Queensland was mostly connected to New Guinea, allowing species to move between these regions. The extinct lowland rainforest animals found at Mt Etna and Capricorn Caves are more similar to rainforest species in New Guinea than those in Australia.

## Ghost Bat (*Macroderma gigas*)

- Has the longest fossil record of an Australian bat species
- Currently endangered in Queensland
- Estimated living population of less than 50 individuals at Mt Etna

Ghost Bat (*Macroderma gigas*)

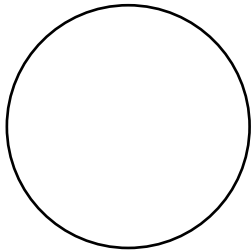
© CC-BY-NC Clarey



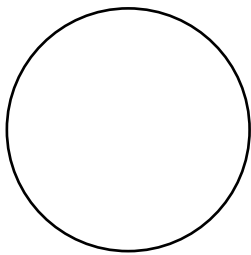
# Barn Owl (*Tyto javanica*)

Modern owl regurgitate (spew)

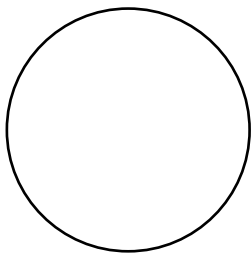
pallets



jaws and teeth



Over thousands of years they fossilise.



Bones and teeth are extracted by dissolving the rock in dilute acetic acid.



© Queensland Museum



A block of fossilised 'poo and spew'.

## ‘Poo and spew’ treasure

Thousands of tons of fossil-rich cave sediment was salvaged by Queensland Museum in cooperation with mine operators. It is now a **scientific reserve protected by a National Park**.



Mt Etna limestone mine in 2002 © Hocknull

# What can fossil ‘poo and spew’ tell us?

- Pictured below are tiny fossils from three time periods at Mt Etna and Capricorn Caves.
- The oldest group of rainforest species are replaced by arid zone species, and these are then replaced by dryland species. Abrupt changes in climate over thousands of years have driven the changes in species.

**5,000–60,000 ya**

**Dryland-adapted rodents and burrowing frogs**



**70,000–205,000 ya**

**Arid-adapted bandicoots and lizards**

————— **Fossils** —————

Chaeropus

Macrotis

Tympanocryptis

————— **Closest Living Relatives** —————

Pig-footed Bandicoot

Bilby

Earless Dragon

**280,000–500,000 ya**

**Rainforest-adapted possums and frogs**

————— **Fossils** —————

Pseudochirops

Nyctimystes

Dactylopsila

————— **Closest Living Relatives** —————

Woolly Ringtail Possum

Tree Frog

Triok possum

Fossil images © Queensland Museum, Hocknull. Rabbit Rat © Capricorn Caves, Konstantinov, Atuchin, Hocknull, Lawrence. Wide-mouthed Frog © Queensland Museum, Cranitch. Burrowing Frog © Queensland Museum, Wright. Pig-footed Bandicoot CC-BY Gould. Bilby CC-BY Gould. Earless Dragon © Queensland Museum. Woolly Ringtail Possum © Queensland Museum. Tree Frog © Queensland Museum, Wright. Triok Possum © Queensland Museum

# DINOSCOPE



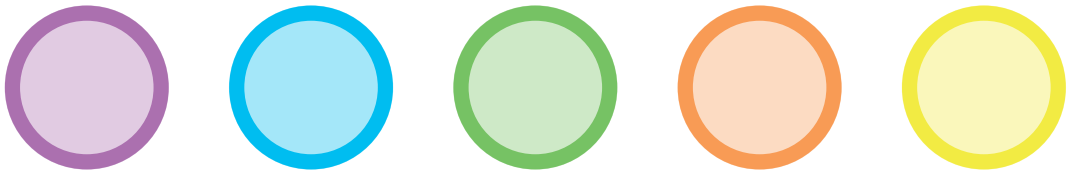
# Dinoscope

Discover Queensland fossils under the microscope

Rotate the stage



Match the correct time period colour



Zoom in and focus

Zoom



Focus



Learn about the microscopic fossils



Next time period

Triassic

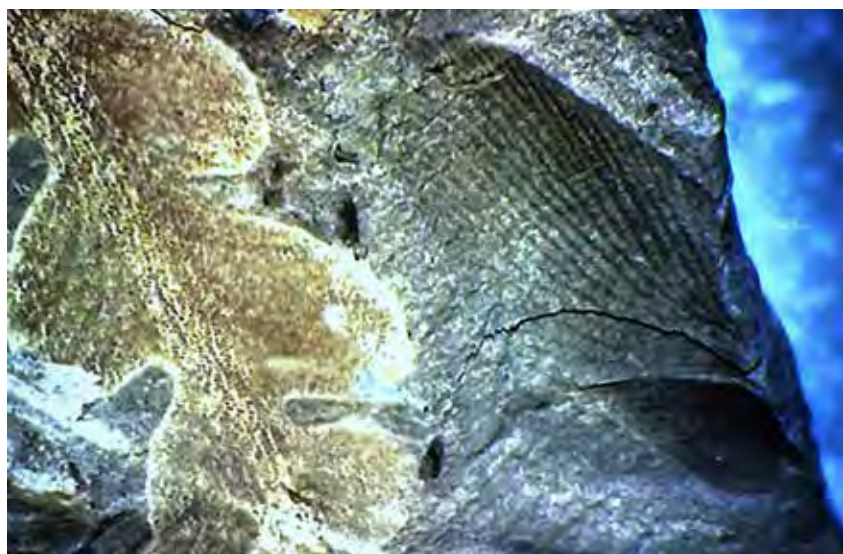
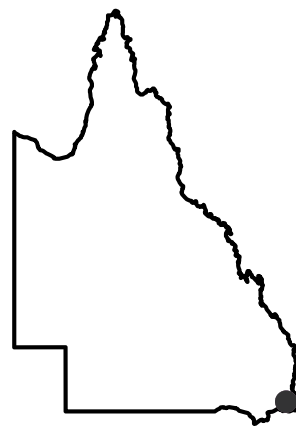


# Triassic

## Insect wing

230 million years old

Ipswich, southeast Queensland



Dicroidium  
seed fern

Cockroach  
wing



Modern cockroach  
wing

Since 1890, over 190 insect species have been identified from Triassic rocks around Ipswich.

© Queensland Museum, Hocknull

Modern cockroach wing © Queen Victoria Museum Maynard CC-BY

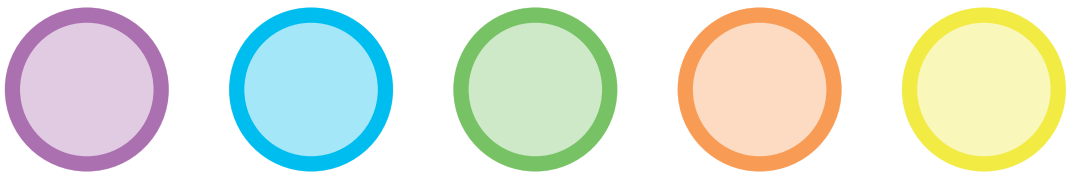
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Next time period

Jurassic

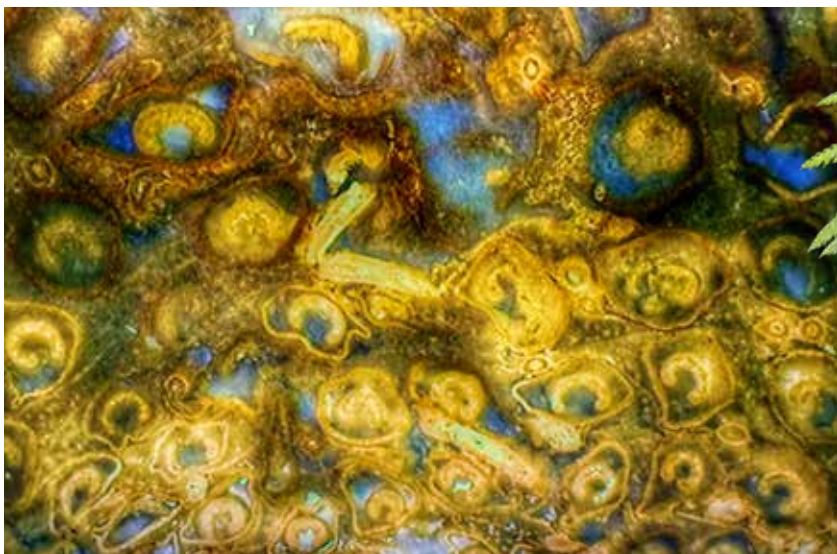
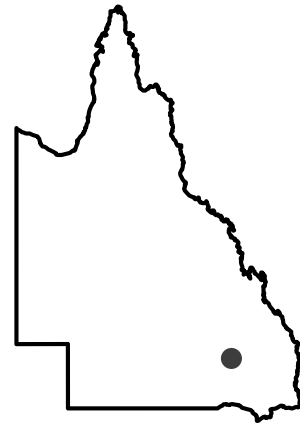


# Jurassic

**Petrified fern**

**160 million years old**

Miles, southern Queensland



Petiole  
Leaf stalk



Osmundaceae  
fern

The cells of the fern have been filled with silica creating an opalescent preservation.

Image © Queensland Museum, Hocknull.

Artwork © Queensland Museum, Atuchin

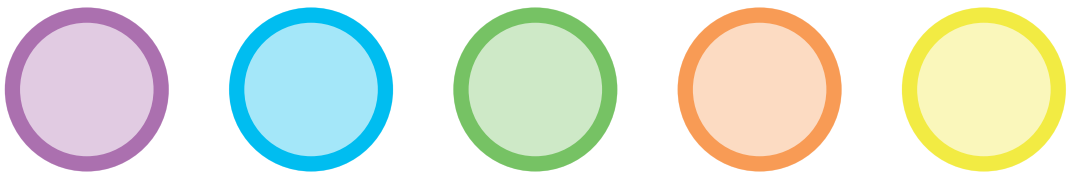
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Zoom in and focus

Zoom



Focus



Learn about the microscopic fossils



Next time period

Cretaceous

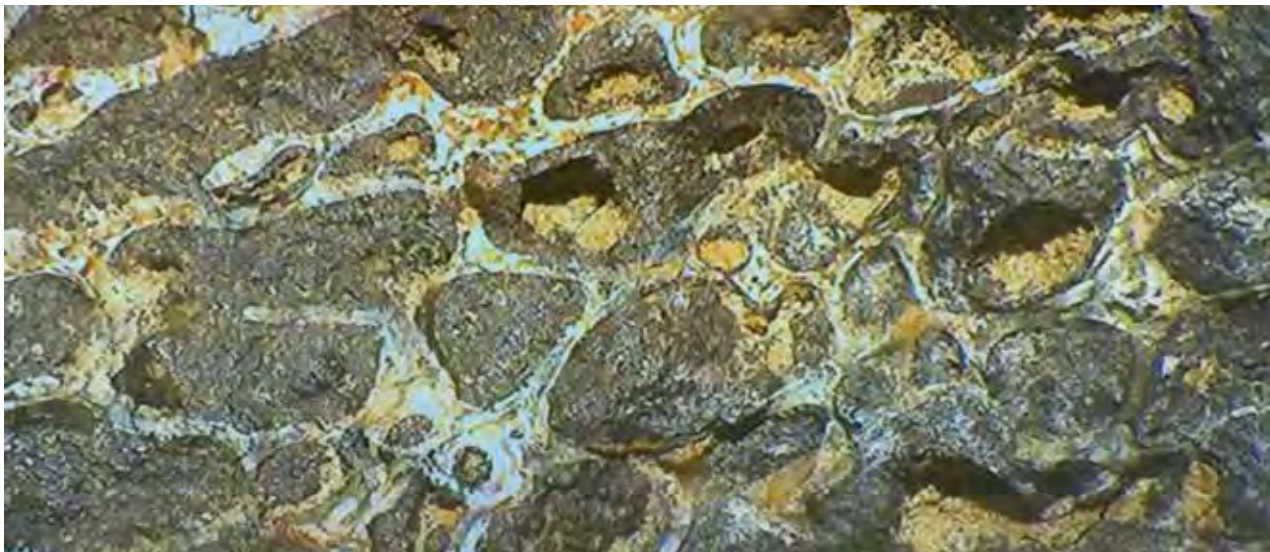
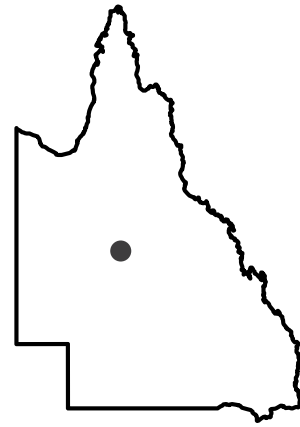


# Cretaceous

**Dinosaur bone**

**93 million years old**

Winton, central Queensland



Iron oxide  
marrow infill

Osteon and  
trabeculae  
(bone marrow)

Secondary iron  
oxide replacement



Sauropod dinosaur

The mud and iron oxide between the bone marrow makes fossilised dinosaur bones much heavier than they were in life.

Image © Queensland Museum, Hocknull.

Artwork © Queensland Museum Atuchin & Hocknull

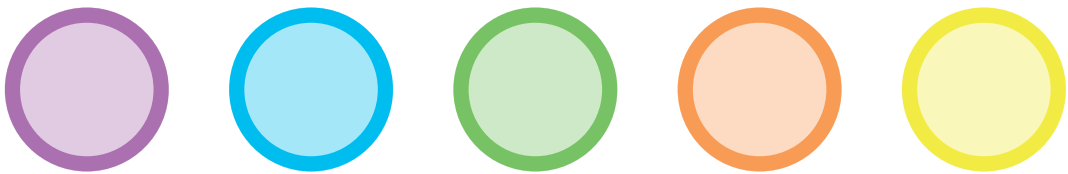
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Match the correct time period colour



Zoom in and focus

Zoom



Focus



Learn about the microscopic fossils



Next time period

Paleogene

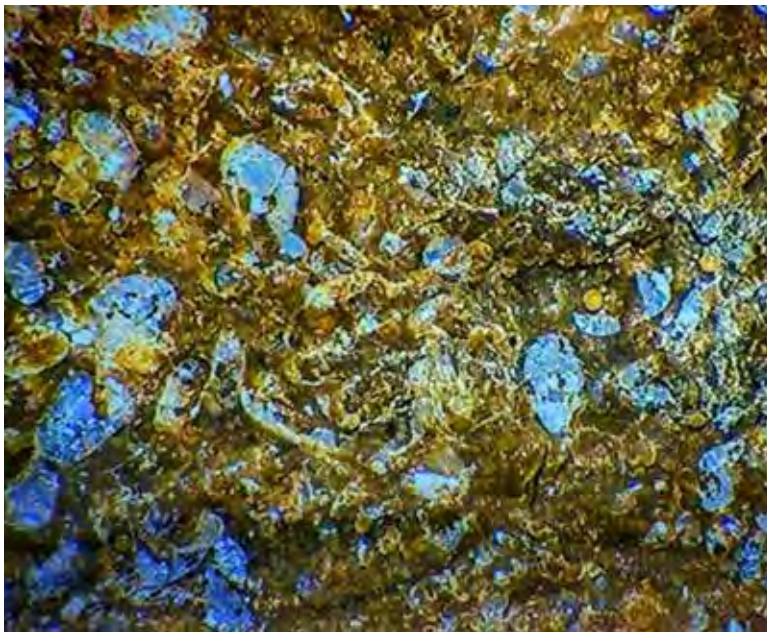
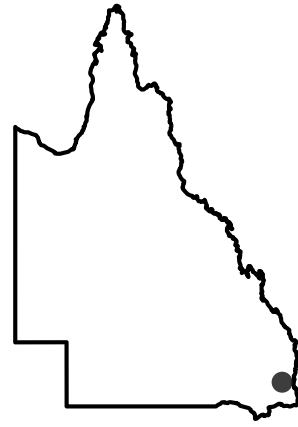


# Paleogene

## Ostracods

55 million years old

Geebung, southeast Queensland



Ostracods  
Seed Shrimp

Ostracods can live in freshwater and saltwater environments as well as on land.

Tiny fossil ostracods indicate that the past environment ranged from freshwater to estuarine.

Image © Queensland Museum, Hocknull.

Video still image © Science to Images CC-BY

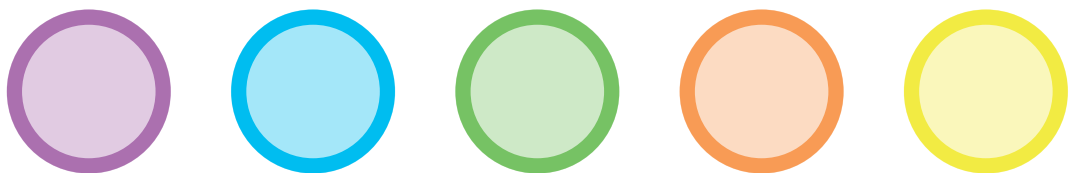
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Rotate the stage



Match the correct time period colour



Zoom in and focus

Zoom



Focus



Learn about the microscopic fossils



Next time period

Neogene

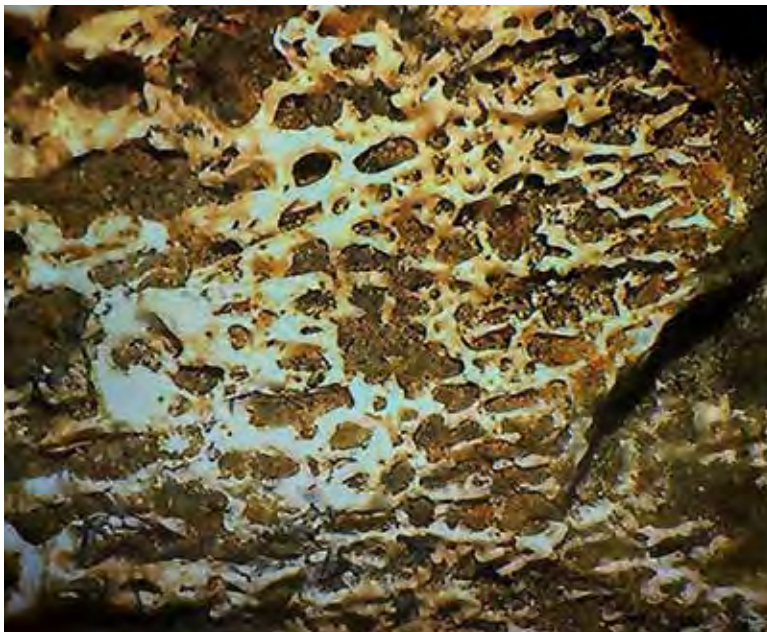
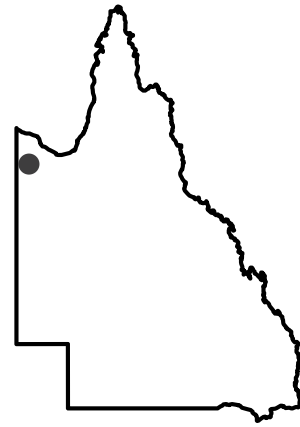


# Neogene

**Megafauna bone**

**18 million years old**

Riversleigh, northern Queensland



Trabeculae  
(bone marrow)



Large mammal like  
*Nimbadon*

Fossil bones found at Riversleigh are so well preserved in limestone that they resemble modern bone.

Image © Queensland Museum, Hocknull.

Artwork © Queensland Museum, Atuchin & Hocknull

# **First Nations**

## **Focus**

**Barada Barna**

# Timeless Land

- In 2008, we discovered fossilised bones while conducting a cultural heritage survey on Country at a place called Bidjerley.
- Queensland Museum palaeontologists confirmed that the fossils belonged to extinct species of megafauna that lived at Bidjerley 60,000–41,000 years ago.
- These fossils have been preserved and displayed here because they are a link to the past that can be shared with future generations.



 Barada Barna country



# First Nations Focus

## Barada Barna

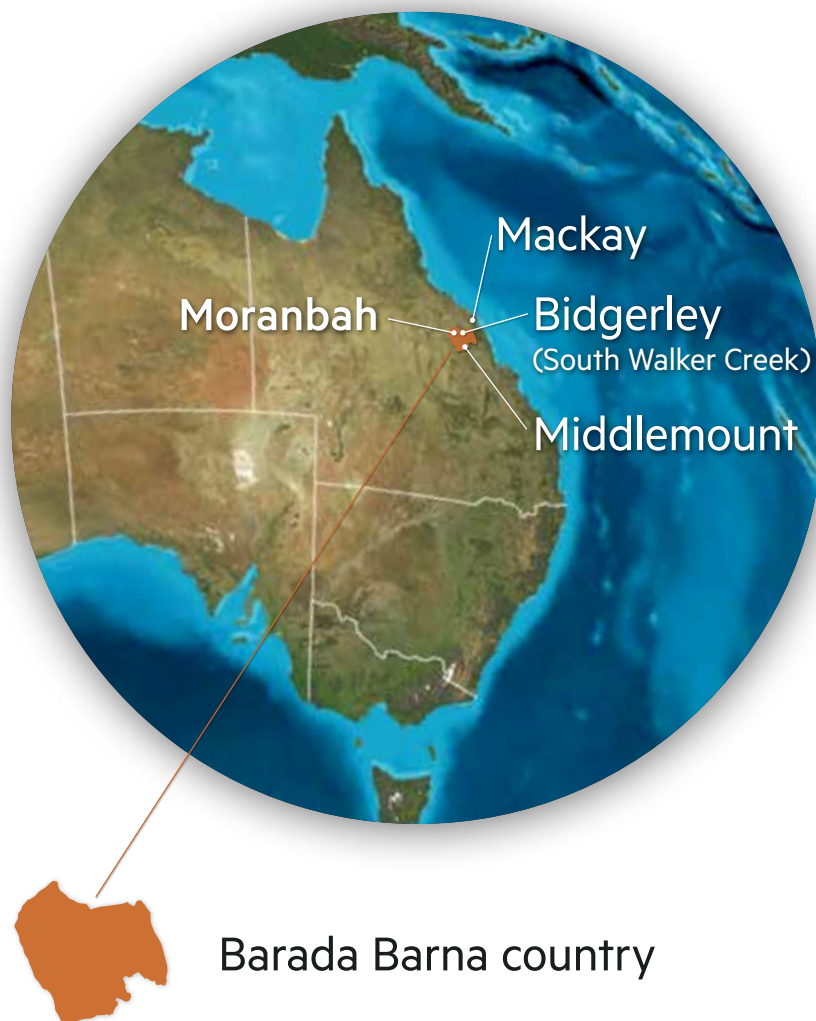
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Want to know more?  
Scan me

For over 50,000 years we have been custodians of this land. Our connection to it is strong and deep. We are a part of it, and it is a part of us.



# *Pallimnarchus / Paludirex*\*

## Extinct freshwater crocodile

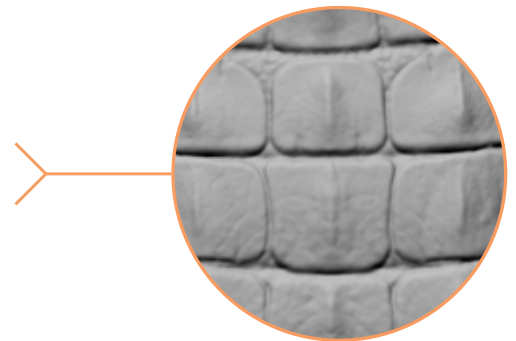
\*uncertain taxonomy



Osteoderms - 'bone skin'

An osteoderm is a protective bone that sits within the skin and is covered by a keratinous scale.

Flat and plate-like osteoderm



Fossil osteoderm

Fossil osteoderm

*Pallimnarchus / Paludirex* © Queensland Museum, Konstantinov, Atuchin, Hocknull. Osteoderm credit © Queensland Museum, Konstantinov, Atuchin, Hocknull

# *Crocodylus porosus*

## Saltwater Crocodile



Circular and keeled osteoderm



Modern osteoderm

Fossil osteoderm

*Crocodylus porosus* © CC-BY Ghiazza. Osteoderm credit © Queensland Museum, Konstantinov, Atuchin, Hocknull

# ***Macropus sp.\****

## **Giant ‘deer’ kangaroo**

\*new species

- Two pieces of the same fossil bone discovered 10 years apart
- Bone without fused epiphyses, making it a sub-adult or juvenile
- Puncture marks left from a crocodile attack

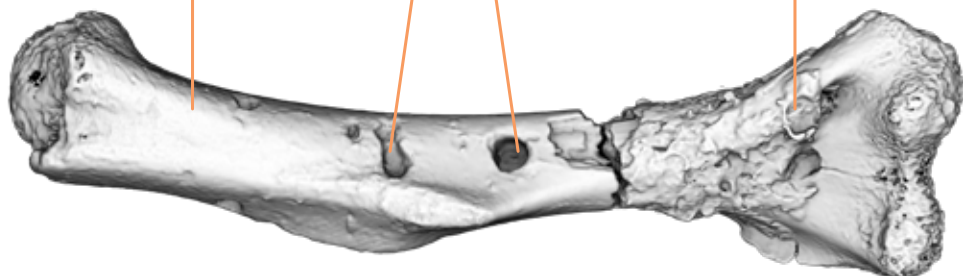
Unfused  
epiphysis

- Puncture marks

Unfused  
epiphysis

Discovered  
in 2008

Discovered  
in 2018



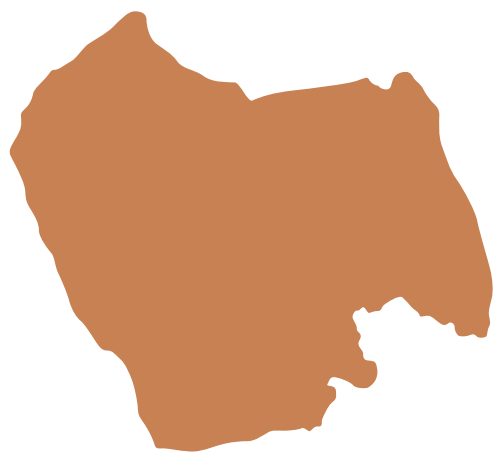
© Queensland Museum, Konstantinov, Atuchin, Hocknull

You are on Jagera Country and we would like to acknowledge their land, Ancestors and Elders past, present and emerging. On Barada Barna Country, in the Birra Gubba language of our Ancestors, we say *Wadda Moolie*. This means ‘welcome’.

The story of these fossils is one of many found on our Country. The fossils you see here have been preserved by the land because they are precious. Just as the earth preserves its natural history, it helps us preserve our cultural history.

Our Country gives us everything. Our journey and culture are written in the land and carved into its rock. We invite you to learn more about our story.

Barada Barna people





## **Back on Country**

I'm back on Country again  
Where my Ancestors once walked  
The women gathering bush tucker  
Speaking our words as they talk  
The men coming back carrying a kangaroo  
Maybe a porcupine or goanna too  
What a way to live – to be back  
That's why it feels so great to be  
back on Country again.

It leaves me in wonder and amazement  
As I envy to live back in those days  
Sitting down to men's business  
Learning culture from the old men about  
the dreamtime ways  
What a privilege has been taken away  
No chance of getting that back again  
All I can do is wonder and dream of  
a way back when

Daniel Davis

# Timeless Land

Aboriginal and Torres Strait Islander viewers and listeners are advised that the following video may contain images and voices of people who have passed.

In this video you are welcomed by Barada Barna community onto their country of Bidgerley (South Walker Creek). View this stunning and ancient landscape which holds great and powerful connections that span generations and millennia.

In 2008, Barada Barna Traditional Owners discovered megafauna fossils at Bidgerley (South Walker Creek) during a cultural heritage survey and clearance of the South Walker Creek coal mine. This discovery led to a decade long relationship between Barada Barna Community and Queensland Museum, and instilled a deeper appreciation of Country by those working in the region.

## Speakers in order

Graham Budby

Luarna Dynevor

Melanie Kielly-Terare

Jeff Smith

Eileen Brown

Amy Lester

Karen Wood

Jade Smith

Midha Gundi (Black Magic) Barada Barna Dance troupe

Video Duration: 12:13

Film-Maker: Sam Davison

Includes original footage filmed by Pete Wallis



# Rock art cave hands painting

Near Lake Elphinstone, Barada Barna Country.

© Queensland Museum, Gary Granitch

We preserve our culture by conducting surveys of the land. We inspect different types of landscapes on our Country and then record the artefacts that are found.

Cultural heritage survey work is very important to our people. It shows us our history – that we've been here for so many thousands of years and that we're still here, protecting.

It also gives us an identity and connects us to our people. When we're onsite, we feel our ancestors and we feel connected to our Country.

# Cultural Heritage

We would like to show you some of our cultural heritage and tell you about its significance to us.

The stone tools you see here are 3D colour printed replicas of original artefacts we found on our Country.

Each item was 3D surface-scanned using a process called photogrammetry which turns a detailed set of photographs into a 3D digital replica. Full-colour 3D printing was then used to recreate the artefacts you see here. They have also been treated by a museum preparator, using oil paints to help colour-match the artefacts accurately.

The original artefacts have been returned to Country so that they can retain their cultural energy and connection to Country.

© Barada Barna with assistance from Queensland Museum Pyle,  
Waddington & Douglas

# Grindstone and *mulla*

A handheld top stone is called a mulla and is ground against the stationary bottom stone called a grindstone. Grindstones are most often used to make flour by crushing seeds and water together to form a paste which is then cooked to make flat breads. Grindstones are also used to process ochre for painting and ceremony.

1. Grindstone
2. *Mulla*

# Hammerstones and cores

Different raw stone materials are needed to make the various stones tools you see here. Large blocks of stone, called cores, are struck with a hammerstone to create flakes. These flakes are then carefully worked to produce custom-made cutting and scraping tools.

3. Hammerstone
4. Core
5. Tertiary Flake
6. Tertiary Flake

# Grindstone and *mulla*

Axes are sharpened by grinding their cutting edge into a sharp tip on sandstone which produces grinding grooves. Axes are used in everyday life and traded with other communities. Spearheads and scraping tools are made by carefully shaping the side of flakes into sharp blade-like edges.

7. Arrowhead
8. Axe
9. Flake
10. Flake

# Acknowledgements

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FrogID Australian Museum

Nature Sound

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Interspectral

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QUT Creative Industries Faculty

QUT - Visualisation and

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## 3D Printing

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Diamanta Michalas

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Arfa Noor

Glenn Price

Christine Robertson

Matt Sansom

Ebony Say

Peter Tonkin

Bridget Wall

Jessica Walters

Karla Warner

Birgit Willadsen

Catherine Yeoman

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*Dinosaurs Unearthed: Explore Prehistoric Queensland* is an exhibition that showcases the unique and rich natural and geological heritage of Queensland. It tells the story of Queensland's prehistory, through the voice of science and traditional knowledge with the use of new technology.

In our changing world, Queensland Museum Network experts continue to uncover our past and understand our present, to better inform the future.

We thank our sponsors, collaborators, donors, supporters and staff for their help in bringing this grand story to life.



Part 1 of the *Dinosaurs Unearthed: Explore Prehistoric Queensland* large print guide is available at the cloakroom on level 2.

