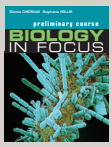
EVOLUTION OF AUSTRALIAN BIOTA

Chapter 2 The evolution of Australian flora and fauna

STUDENT ACTIVITY

Timeline changes in Australia



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Aim: To put into context the fossils that are studied in this module and how they provide evidence for changing Australian biota over the past 250 million years.

Task: Analyse the two-part table that follows, giving a chronological account of changes in landmass, climate, flora and fauna in Australia and evidence for these changes which are thought to have occurred over the past 250 million years.

- Part 1: 250 mya–130 mya. Read this information to develop an understanding of the topic, putting into context the relationship between the fossils you study and how they provide evidence for the various changes, both geological and biological, that have taken place.
- Part 2: 110 mya–present. Read the information in the table and the text in Chapters 1 and 2 of Evolution of Australian Biota in the textbook. Visit the 'geological time' section of the Lost Kingdom's website (**www.lostkingdoms.com/snapshots/geological_time.htm**) and any other secondary sources needed. Complete the table by answering the questions within the table and inserting illustrations where required.

Note to students and teachers

This part of the task may be completed in one of several ways:

- on an ongoing basis, as independent research, as you proceed through Chapters 1 and 2
- by reading ahead to Chapter 2, to give yourself an overview of what you will be studying and the type of evidence to look out for, as well as its significance, when doing fossil investigations
- at the end of Chapter 2, as a review of the content and to put what you have learnt into context.

Table CD2.2 Timeline table linking geological, climatic and biological change in Australia from 250 mya to the present

Part 1: 250 mya–130 mya

Time	Moving continents	Dominant flora (vegetation)	Evidence	Dominant fauna (animals)
250 mya (Permean period) 	■ Pangaea: one huge continent, made up of all the separate continents that we know today **Describe the climate:**	■ Ice age forests: *Glossopteris* dominates at first, but becomes extinct at the end of the Permean period (about 230 mya)	■ *Glossopteris* fossils found in glacial sediments that formed at the beginning of the period (280 mya) ■ *Glossopteris* fossils and Permean coals occur in South America, Africa, Australia and India, suggesting that these continents were joined at the time	■ Insects plentiful at the time—evidence of jagged holes in *Glossopteris* leaves where insects have eaten them ■ Evidence: 'insect beds' at Belmont on Lake Macquarie, New South Wales

continued . . .

Time	Moving continents	Dominant flora (vegetation)	Evidence	Dominant fauna (animals)
225 mya 	■ Pangaea begins to split into Laurasia (north) and Gondwana (south)	■ *Dicroidium*: fork-frond seed ferns are the common index fossils ■ Club mosses, *Cylomeia*: long, narrow leaves, either ribbon-shaped or hair like; grew on open plains	■ 220 mya Narrabeen shales—cliffs along Sydney's northern beaches (Harbord to Palm beach) ■ *Cylomeia* leaf and cone fossils	■ Insects plentiful
180 mya 	■ Parts of Gondwana begin breaking up (and parts of Laurasia break up)	■ Conifers and cycads (e.g. monkey puzzle trees, and kauri pines) ■ Seed ferns become extinct	■ Talbragar fish beds of New South Wales: conifers (e.g. Kauri pine trees (*Agathus*), monkey puzzles and podocarps)	■ Dinosaurs, pterosaurs (winged reptiles), early crocodiles and birds ■ Evidence: fossil feathers indicate birds were also around
130 mya 	Gondwana splits into 3 parts: ■ Africa and South America ■ Australia, Antarctica, New Zealand and New Guinea ■ India (already on a collision course with future South-east Asia)	na		
110 mya (80 mya—New Zealand separates)	**Describe the climate in Australia at the time:**		■ Tall conifer forests, with smaller gingkoes, cycads and club mosses forming beneath ■ First flowering plants appear	■ Dinosaurs (giant reptiles) dominate land ■ Flying reptiles share the skies with early forms of birds ■ Giant reptiles inhabit seas ■ Australia's first mammals (including relatives of the platypus) appeared
65 mya 	■ Australia begins separating from Antarctica	MASS EXTINCTION	**What theories are suggested by available evidence for this mass extinction?**	EXTINCTION OF DINOSAURS ■ Mammals dominate

continued . . .

Time	Moving continents	Dominant flora (vegetation)	Evidence	Dominant fauna (animals)
55 mya	**How was Australia still connected to Antarctica?** **Describe the climate:**	**Identify the type of vegetation at the time:**		**List the animals:**
45 mya 	■ Australia becomes a separate continent: dry land, but great lakes remain in interior		■ Link between ancient and modern forms ■ Flowering plants bloom ■ Conifers and cycads decrease in importance	
20 mya	**In what direction did Australia begin drifting once it separated from Antarctica?** **How does this account for the climate becoming warmer at the time?** ■ Tectonic plate carrying Australia hits up against the South-east Asian plate	**Describe the type of vegetation:** lush rain forest **Insert a picture of a rainforest below:**		**Describe the animals:**
8 mya	■ New Guinea rises above sea level as northern edge of Australian plate crumples against Southeast Asian plate **Describe the climate change and give a reason:**	**Describe the type of vegetation and insert a picture of the type of vegetation:**	**Discuss the significance of the Nullarbor Plain as a source of fossils:**	**Describe the animals:**

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Time	Moving continents	Dominant flora (vegetation)	Evidence	Dominant fauna (animals)
4 mya	Describe Australia's position:	Describe Australia's vegetation:		Name some giant animals that evolved (these were called megafauna):
100000 ya				
60000–40000 ya				Arrival of humans?
10000 ya				
Present day		■ *Eucalyptus* (gum trees) and *Acacia* (wattles) dominate		

Answers

Table CD2.2 Timeline table linking geological, climatic and biological change in Australia from 250 mya to the present

Part 1: 250 mya–130 mya

Time	Moving continents	Dominant flora (vegetation)	Evidence	Dominant fauna (animals)
250 mya (Permean period) 	■ Pangaea: one huge continent, made up of all the separate continents that we know today **Describe the climate:** Hot dry interior because a majority of the land was away from the sea, little rainfall and great seasonal fluctuations	■ Ice age forests: *Glossopteris* dominates at first, but becomes extinct at the end of the Permean period (about 230 mya)	■ *Glossopteris* fossils found in glacial sediments that formed at the beginning of the period (280 mya) ■ *Glossopteris* fossils and Permean coals occur in South America, Africa, Australia and India, suggesting that these continents were joined at the time	■ Insects plentiful at the time—evidence of jagged holes in *Glossopteris* leaves where insects have eaten them ■ Evidence: 'insect beds' at Belmont on Lake Macquarie, New South Wales
225 mya 	■ Pangaea begins to split into Laurasia (north) and Gondwana (south)	■ *Dicroidium*: fork-frond seed ferns are the common index fossils ■ Club mosses, *Cylomeia*: long, narrow leaves, either ribbon-shaped or hair like; grew on open plains	■ 220 mya Narrabeen shales—cliffs along Sydney's northern beaches (Harbord to Palm beach) ■ *Cylomeia* leaf and cone fossils	■ Insects plentiful
180 mya 	■ Parts of Gondwana begin breaking up (and parts of Laurasia break up)	■ Conifers and cycads (e.g. monkey puzzle trees, and kauri pines) ■ Seed ferns become extinct	■ Talbragar fish beds of New South Wales: conifers (e.g. Kauri pine trees (*Agathus*), monkey puzzles and podocarps)	■ Dinosaurs, pterosaurs (winged reptiles), early crocodiles and birds ■ Evidence: fossil feathers indicate birds were also around
130 mya 	Gondwana splits into 3 parts: ■ Africa and South America ■ Australia, Antarctica, New Zealand and New Guinea ■ India (already on a collision course with future South-east Asia)	na		

continued . . .

Time	Moving continents	Dominant flora (vegetation)	Evidence	Dominant fauna (animals)
110 mya (80 mya—New Zealand separates)	**Describe the climate in Australia at the time:** ■ Cool and wet ■ Most of Australia under shallow seas		■ Tall conifer forests, with smaller gingkoes, cycads and club mosses forming beneath ■ First flowering plants appear	■ Dinosaurs (giant reptiles) dominate land ■ Flying reptiles share the skies with early forms of birds ■ Giant reptiles inhabit seas ■ Australia's first mammals (including relatives of the platypus) appeared
65 mya 	■ Australia begins separating from Antarctica	MASS EXTINCTION	**What theories are suggested by available evidence for this mass extinction?** Meteorite strike or huge volcanic eruptions or both formed a dust cloud and reduced sunlight, lowered temperatures, generated acid rain and killed off plant and animal life	EXTINCTION OF DINOSAURS ■ Mammals dominate
55 mya	**How was Australia still connected to Antarctica?** Via Tasmania **Describe the climate:** Global climate was warmer so Antarctica and Australia were free of ice and snow. Australia was wet and warm	**Identify the type of vegetation at the time:** Broad-leaved rainforests were replacing earlier conifer forests	■ Fossils from Murgon in south-east Queensland ■ Tooth of a placental mammal ■ Fossils of Australia's oldest marsupial ■ Fossils of frogs, bats and songbirds	**List the animals:** Dinosaurs, flightless birds, frogs, turtles, snakes and mammals (no more marine and flying animals)
45 mya 	■ Australia becomes a separate continent: dry land, but great lakes remain in interior		■ Link between ancient and modern forms ■ Flowering plants bloom ■ Conifers and cycads decrease in importance	

continued . . .

Time	Moving continents	Dominant flora (vegetation)	Evidence	Dominant fauna (animals)
20 mya	**In what direction did Australia begin drifting once it separated from Antarctica?** Northwards **How does this account for the climate becoming warmer at the time?** Further north is closer to the equator and warmer. ■ Tectonic plate carrying Australia hits up against the Southeast Asian plate	**Describe the type of vegetation:** lush rain forest **Insert a picture of a rainforest below:**	■ Fossils from Riversleigh, Queensland ■ 15 million year old platypus skull fossil ■ 'Thingodonta', whose skull and teeth differ from any known marsupials ■ Fangaroo—small kangaroo with enlarged canines	**Describe the animals:** ■ Marsupial lions, flesh-eating kangaroos ■ Many common ancestors and relatives of today's koalas, kangaroos, possums and platypus
8 mya	■ New Guinea rises above sea level as northern edge of Australian plate crumples against Southeast Asian plate **Describe the climate change and give a reason:** ■ Dry and cool ■ Sea levels fell as water began to freeze to form ice caps at the poles ■ Rainfall decreased as well	**Describe the type of vegetation and insert a picture of the type of vegetation:** ■ Open forests and woodlands spread ■ Rainforests decreased in size and became limited to the coastal regions	**Discuss the significance of the Nullarbor Plain as a source of fossils:** ■ The Nullarbor Plain became exposed as sea levels dropped ■ Fossils of animals from 8 mya provide evidence of the life forms at that time	**Describe the animals:** ■ Hopping kangaroos ■ Thylacines ■ Marsupial lions ■ Thunderbirds ■ Large wombat-like marsupials
4 mya	**Describe Australia's position:** Close to its present position	**Describe Australia's vegetation:** ■ Forests of mainly eucalypts (gum trees) and wattles	■ Fossils from Bluff Downs, Queensland	**Name some giant animals that evolved (these were called megafauna):** ■ Giant pythons ■ Giant crocodiles (salt water) ■ Giant koalas
100000 ya				
60000–40000 ya		■ Use of fire-stick farming changes the vegetation		**Arrival of humans?** ■ Indigenous people arrived by island-hopping from the north
10000 ya				■ Dingoes introduced ■ Tasmanian thylacine declined
Present day		■ *Eucalyptus* (gum trees) and *Acacia* (wattles) dominate		■ European settlers arrived 200+ years ago

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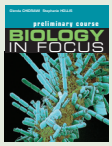
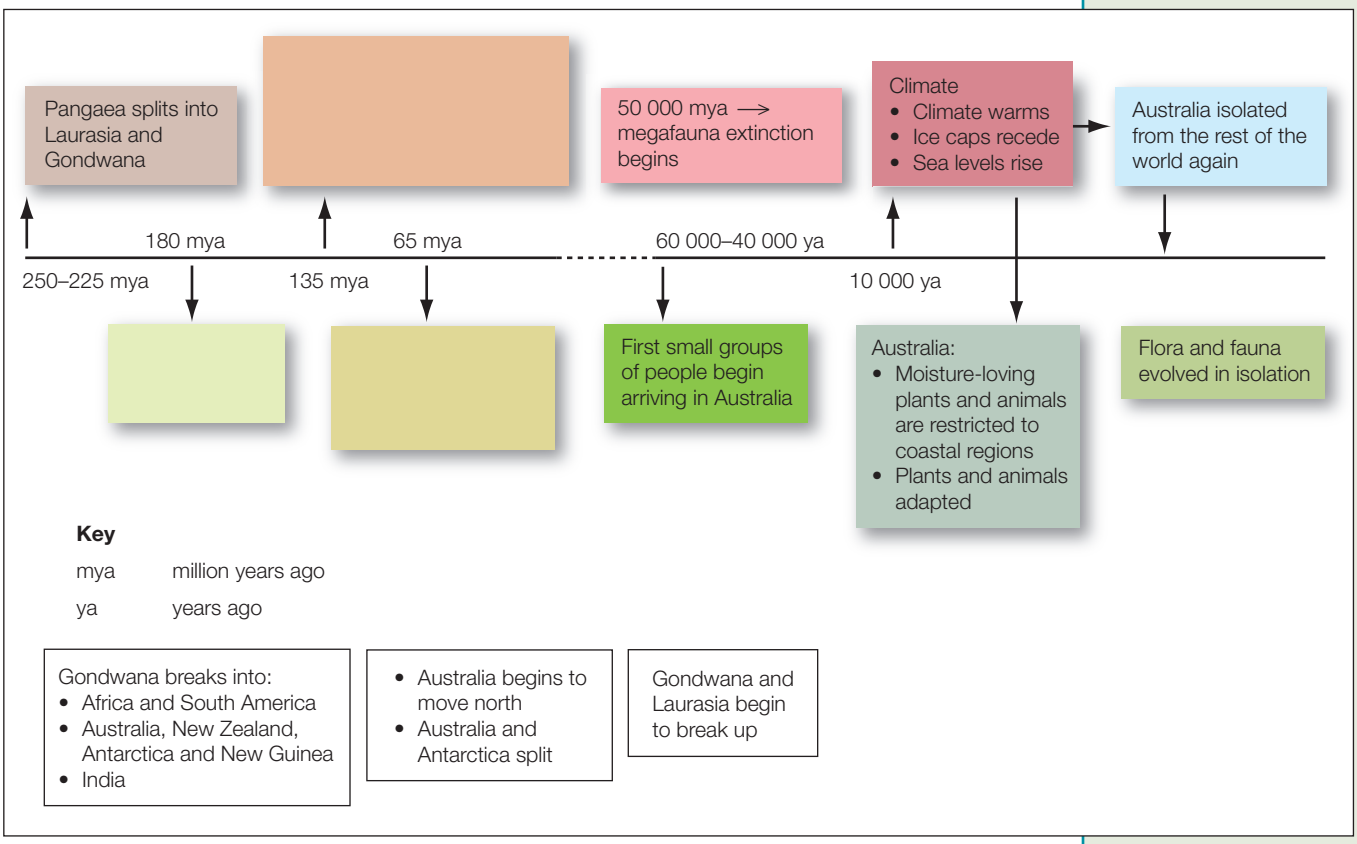
Chapter 2 The evolution of Australian flora and fauna

Student worksheet: timelines

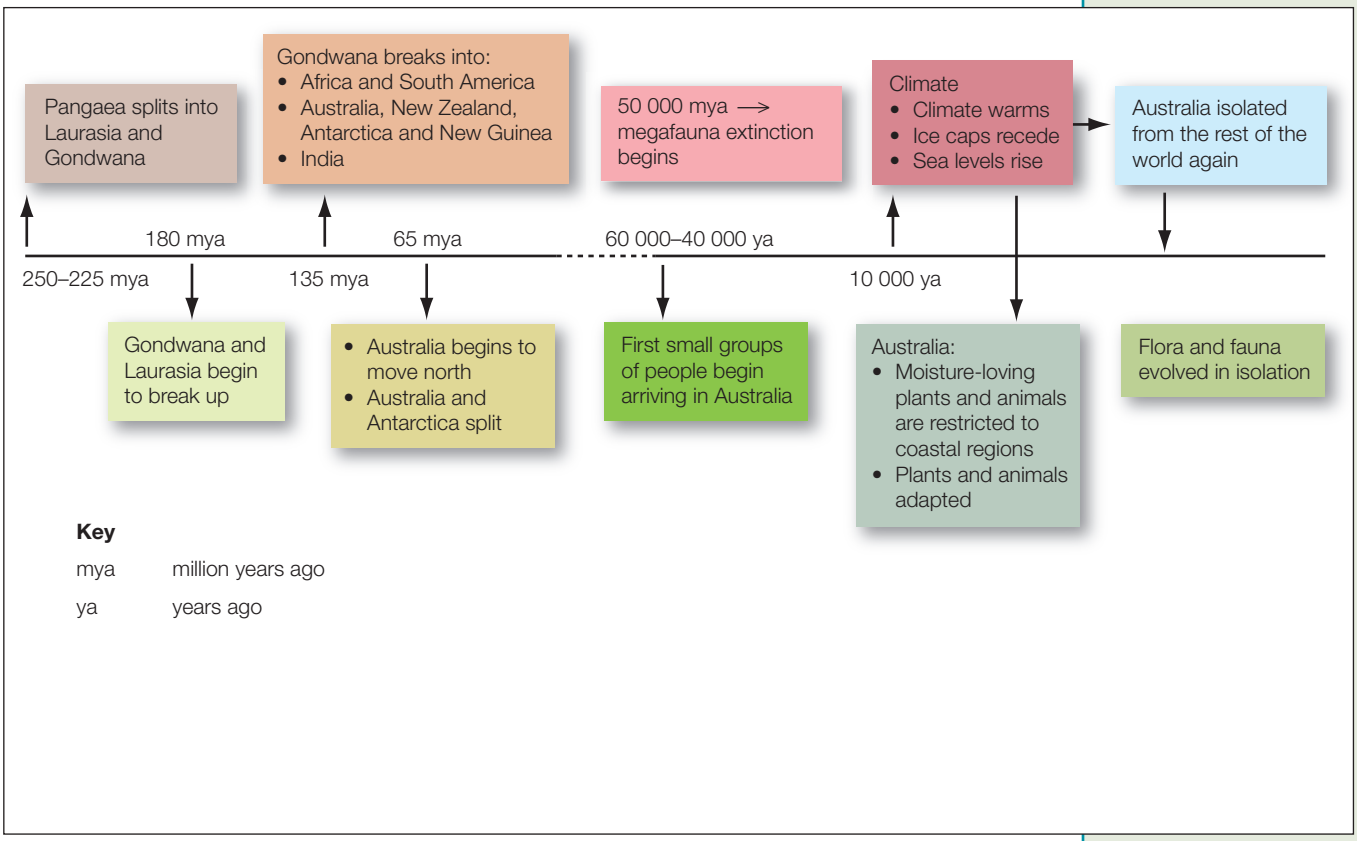


Linked to page 257

Fill in the missing information on the timeline. Select from the text boxes given below the timeline.



Answers


Pangaea splits into Laurasia and Gondwana
Gondwana breaks into:
• Africa and South America
• Australia, New Zealand, Antarctica and New Guinea
• India
50 000 mya → megafauna extinction begins
Climate
• Climate warms
• Ice caps recede
• Sea levels rise
Australia isolated from the rest of the world again
180 mya
65 mya
60 000–40 000 ya
250–225 mya
135 mya
10 000 ya
Gondwana and Laurasia begin to break up
• Australia begins to move north
• Australia and Antarctica split
First small groups of people begin arriving in Australia
Australia:
• Moisture-loving plants and animals are restricted to coastal regions
• Plants and animals adapted
Flora and fauna evolved in isolation
Key
mya million years ago
ya years ago