

Fascinating Fossils – Reconstructing animals from their fossil remains

Aim

To apply the processes palaeontologists use to reconstruct animals from their fossilised remains.

Instructions

Please handle all the specimens gently!
They include a variety of vertebrae from both extinct and modern-day animals.



Photo: vertebra, Australian Museum

A. Identifying some fossils using comparisons with modern animals

1. Examine the various vertebrae. In what part of an animal's skeleton are **vertebrae** found?

2. Look at the **human** vertebrae, the **snake** vertebrae and the **kangaroo** vertebra. Examine each vertebra to determine how they join to adjacent vertebrae.

	How does each vertebra join to the next one? (Circle the appropriate option for each.)		
human vertebrae	flat surfaces	OR	a ball and socket
snake vertebrae	flat surfaces	OR	a ball and socket
kangaroo vertebra	flat surfaces	OR	a ball and socket

3. Using your answers above, complete the following sentences:

- a) Mammals have vertebrae that have _____ where they join.
- b) Reptiles have vertebrae that have _____ where they join.

4. Look at Fossils A, B and C and complete the sentences below.

- a) Fossil **A** is from a _____ because it has _____

- b) Fossil **B** is from a _____ because it has _____

- c) Fossil **C** is from a _____ because it has _____

5. Look at the **Information Card** showing vertebrae illustrations to narrow down the type of animal that Fossil A and Fossil B has each come from.

- a) Fossil **A** is from a _____
- b) Fossil **B** is from a _____

B. Using a fossil to estimate the size of a snake

Scientists have worked out that it is possible to estimate the size of a snake's body from just a single vertebra.

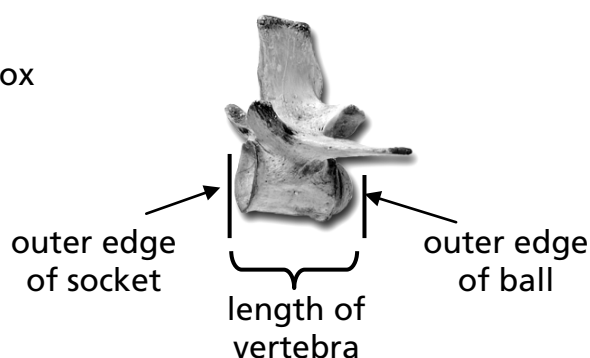
The calculation uses a simple ratio of body proportions.

Snake Ratio (vertebra length : body length) = **1 : 200**

This ratio means that for every one unit of vertebra length, the estimated full length of a snake's body is 200 times greater.

6. Follow the steps below to estimate the length of the snake from which Fossil A came.

- a) Accurately measure the length of the **specimen** of Fossil A in the Activity Box and write your measurement in the table below.



- b) Use the snake ratio (1 : 200) to calculate the estimated length of the ancient snake and complete the table below.
(Multiply your measurement of Fossil A with the ratio number for snake length.)

	Length of vertebra (cm)	Length of snake (cm)
Snake Ratio	1	: 200
Fossil A		

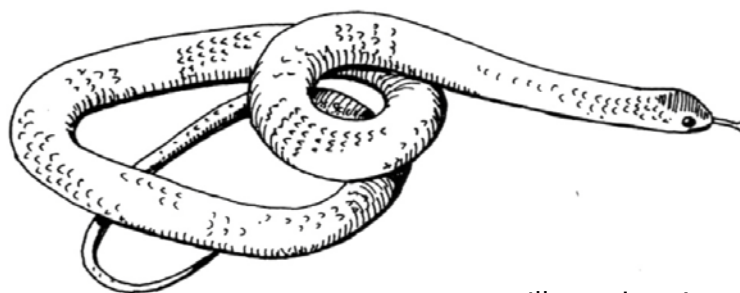


Illustration: Australian Museum.

C. Estimating the size of the Fossil C animal

7. Look at Fossil C again. Refer back to question 4 c), is it from a reptile or mammal?

8. Measure the length of Fossil C (front edge to back edge of central disc only) and write it in the table below. Then calculate the approximate size of the animal it came from, using the ratio provided below.

	Length of 1 vertebra (cm)	Total length of animal (cm)
ratio	1	: 72
Fossil C		

9. Look at the displays to find the animal that Fossil C belonged to.

What is the name of this extinct Australian animal? _____

D. Estimating more than one body dimension

10. Follow the steps below to estimate both body length and the distance between the front and back legs of an extinct large lizard.

First, work out a body ratio for large lizards. Use the X-ray of a modern-day goanna, measure the following and record your results in the table below.

a) On the goanna X-ray, measure:

- the **length of 1 vertebra** in the main part of the body,
- the distance between the **front and back legs** (following along the backbone),
- the **total length of the goanna** (nose to tip of tail).

	Length of 1 vertebra (cm)	Distance between front and back legs (cm)	Total length of animal (cm)
Modern Goanna X-ray			

b) Use the 3 goanna measurements above to work out your large lizard ratio and write it in the table below.

(Hint: Ensure that the first number in the ratio is 1 by dividing the first goanna X-ray number by itself. Then, divide the other goanna measurements by this same amount. If your divisions result in fractions, round off to the nearest whole number to make your further calculations easier.)

	Length of vertebra	Distance between front and back legs	Total length of animal
Large lizard ratio		:	:

11. Next, measure the fossil vertebra (Fossil B) from an extinct Giant Goanna called *Megalania*. Record your results in the table over the page.

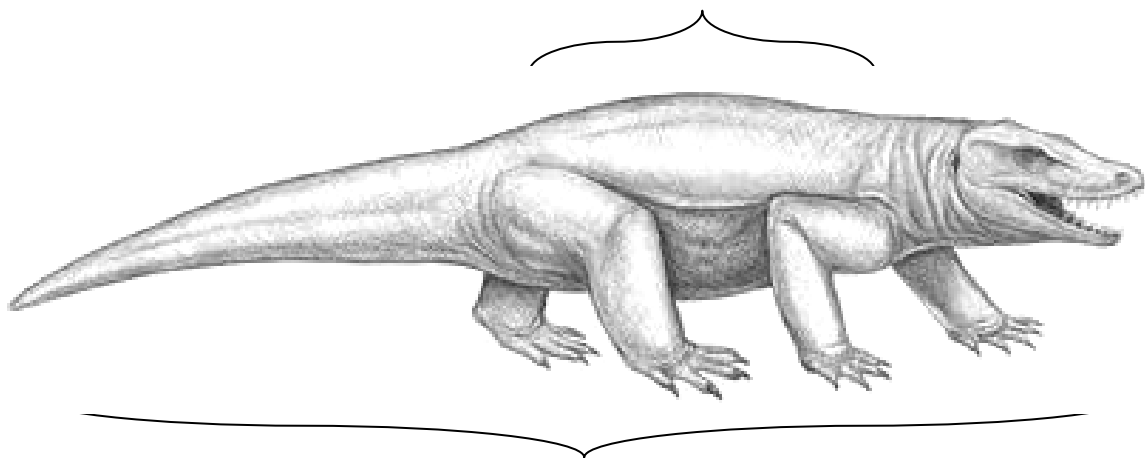
12. Now complete the table below by calculating the dimensions of the extinct Giant goanna, *Megalania* (multiply your Fossil B measurement with your large lizard ratio).

	Length of 1 vertebra (cm)	Distance between front and back legs (cm)	Total length of animal (cm)
Fossil B (<i>Megalania</i>)			

Calculations like these allow palaeontologists to reconstruct body sizes and proportions of the ancient Giant Goanna, *Megalania* and other extinct animals when they do not have complete fossilised skeletons to measure.

13. Transfer your calculated dimensions for *Megalania* onto the drawing of it below.

Distance between front and back legs = _____ centimetres



Total body length = _____ metres

Discussion

14. Tick any of the following statements that would make your investigations on body dimensions more accurate. We suggest you discuss the answers to these in class so you can explain why you agreed or disagreed with each statement.

- a) Use more than one vertebra from the animal and average the results.
- b) Use bones from other parts of the animal's body.
- c) One person measures many times and averages their results.
- d) Many people measure once and average their results.
- e) For each animal, use vertebrae from both males and females.
- f) For each animal, use vertebrae from both juveniles and adults.
- g) Create a ratio by measuring a mixture of vertebrae from different groups of animals.
- h) Measure actual specimens of goanna vertebrae instead of using an X-ray.
- i) Use the large lizard ratio to calculate the size of a large snake.
- j) Use an X-ray of a goanna lying in a straight rather than curved position.
- k) Use more precise measuring equipment.