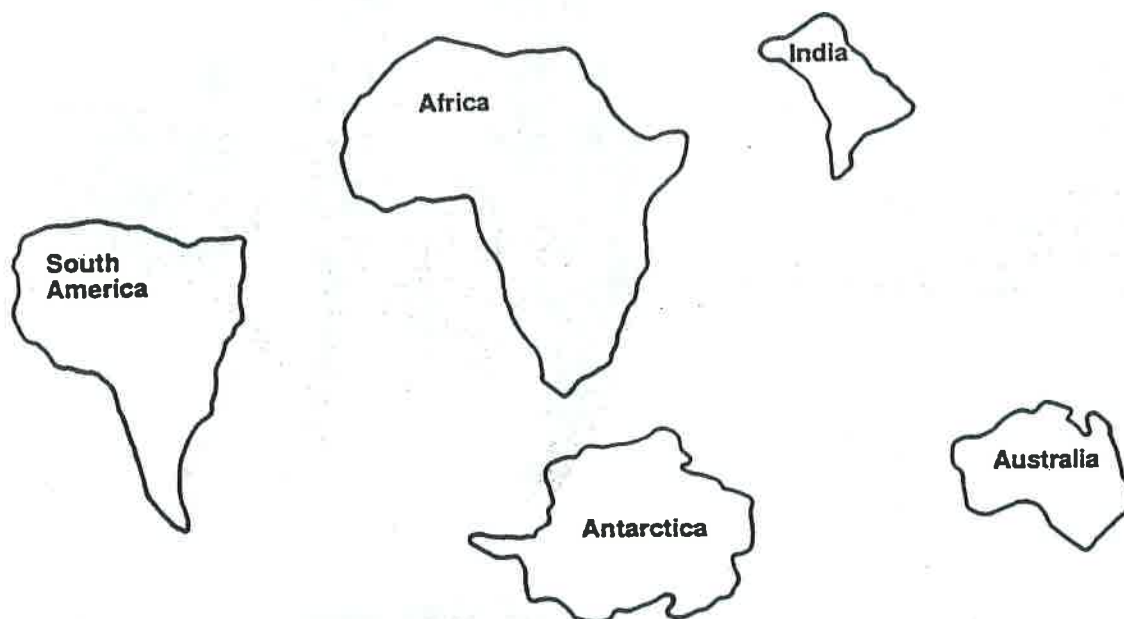


Name: _____ Period: _____

THE MYSTERY OF THE FAR-FLUNG FOSSILS

Investigating Plate Tectonics



Let's go on a fossil-collecting expedition to the continents of South America, Africa, Australia, Antarctica, and the sub-continent of India. In South America you will collect fossils in Brazil. You will explore the coal fields of Gondwana in southern India. Some of your African rocks are in a gorge near Capetown. In Australia you'll look at rocks on the southern coast. Your fossils of Antarctica occur mostly beneath glacial ice in the mountains on the western shores. Since each continent is now separated from the others by oceans and seas, you must travel between them by plane and by boat. You will look for fossils in sedimentary rocks of three ages.

Imagine that the five continents are each represented by a stack of sedimentary rocks on five tables around the room. The continents are in their natural geographical shape and their sizes are proportional. The blue, top layer represents modern times; and the pictures of the modern animals you see are native to the continent. The three lower layers depict sedimentary rocks of three past ages:

Green Rocks	-Late in the Age of Dinosaurs	100 mya*
Yellow Rocks	-Early in the Age of Reptiles	200 mya
Red Rocks	-The Coal Age	300 mya

Fossils can be seen in sedimentary rocks of each past age. These are some of the important organisms that lived on the continents at those times. To identify and learn more about each fossil, refer to the FOSSIL CATALOG on the following pages.

Detach the data sheet from the back of this packet. Record on your data sheet the names of the fossils you find in the rocks on each continent for the past ages. Also record the names of the animals now living on the present day continents.

*mya = million years ago

FOSSIL CATALOG

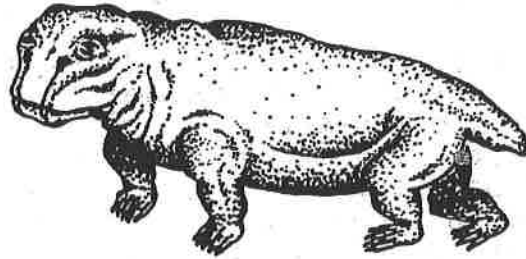
Early Glossopteris Flora

A group of 27 species of plants found in coal. Glossopteris is the genus name of one common seed fern.



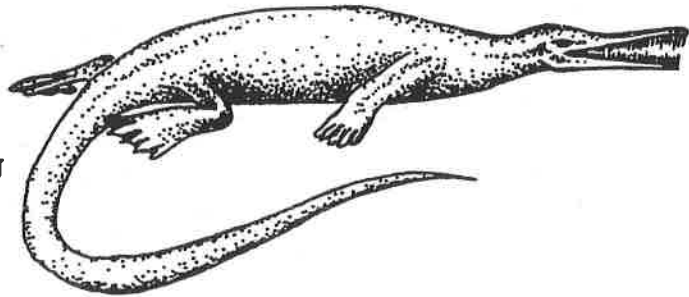
Lystrosaurus

A plant-eating mammal-like reptile with beak-like jaws and a body about one meter long.



Mesosaurus

A fish-eating, river-living reptile about 65 cm long.



Later Glossopteris Flora

Different but related species of the early Glossopteris flora.



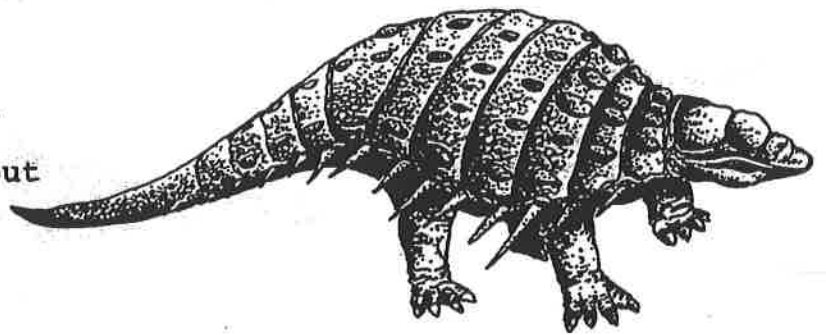
Dicroidium
Flora

A group of plants adapted to warmer conditions than Glossopteris flora, named after a genus of gymnosperms.



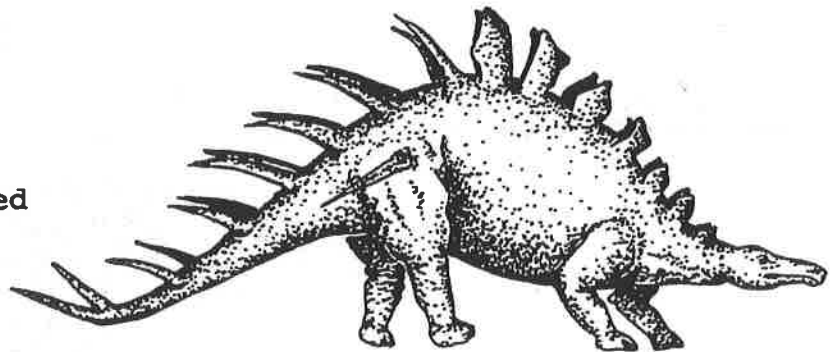
Minmi

A plant-eating, armored dinosaur built like a living battle tank, about two meters long.



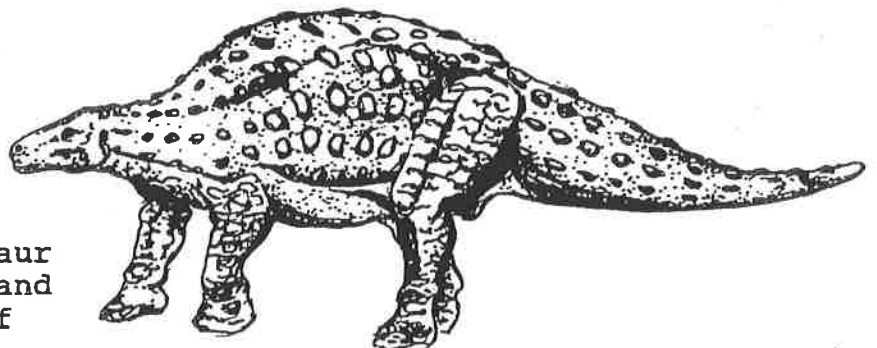
Kentrosaurus

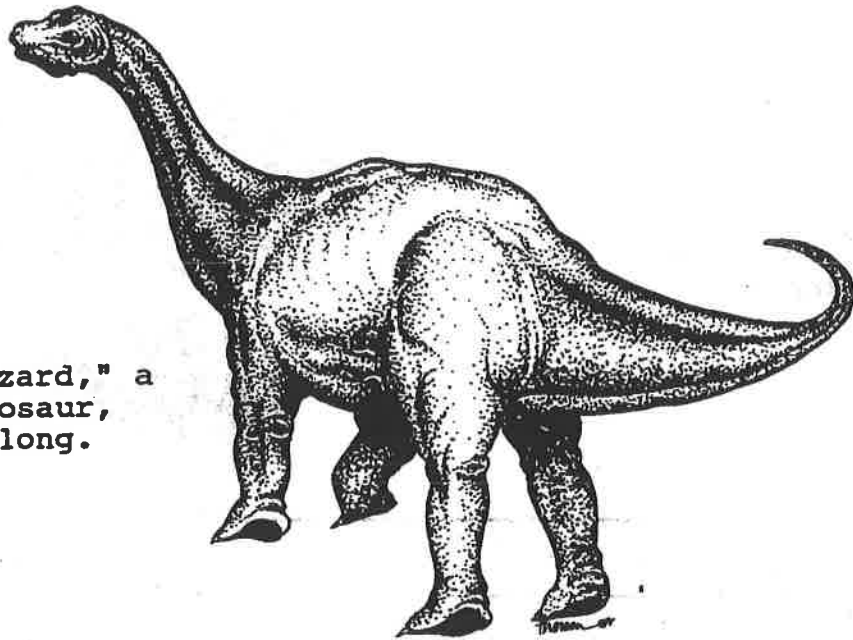
A plant-eating, plated dinosaur about five meters long.



Brachyopodosaurus

A plant-eating dinosaur about 5 meters long and covered with bands of bony nodules.



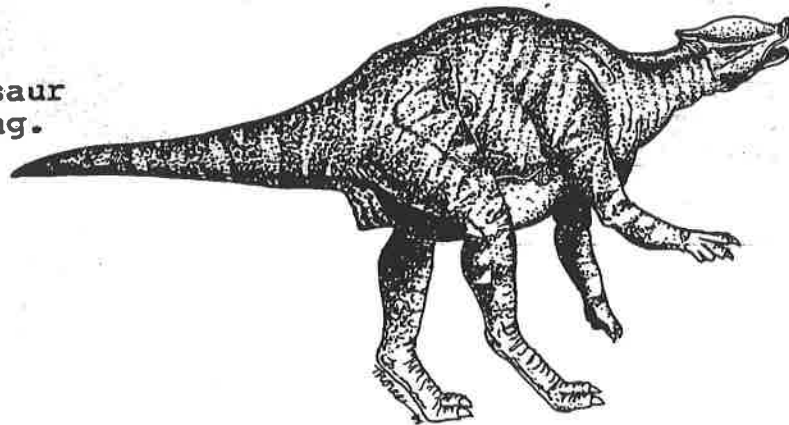


Austrosaurus

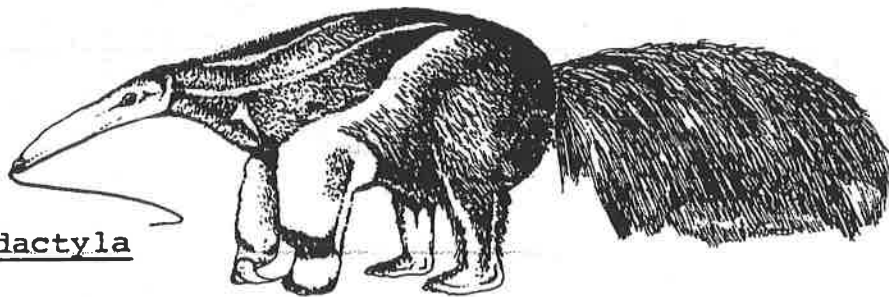
The "southern lizard," a plant-eating dinosaur, about 15 meters long.

Secernosaurus

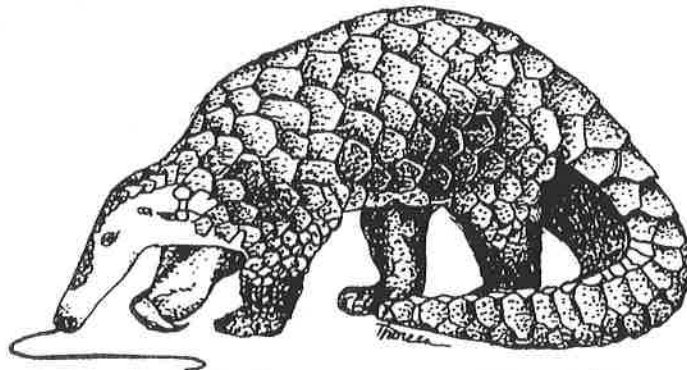
A small duckbill dinosaur about three meters long.



Modern Ant and Termite Eating Mammals
(Notice their pointed snouts and claws)



Giant Anteater
Myrmecophaga tridactyla
Order: Edentata

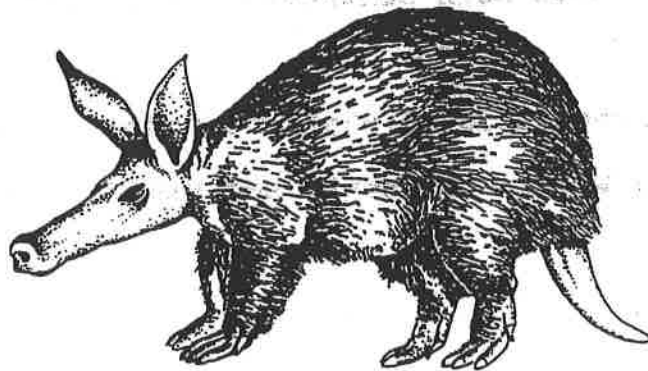


Pangolin
Manis crassicaudata
Order: Pholidota

Echidna
Tachyglossus aculeatus
Order: Monotremata



Aardvark
Orycteropus afer
Order: Tubulidentata



Earthworms

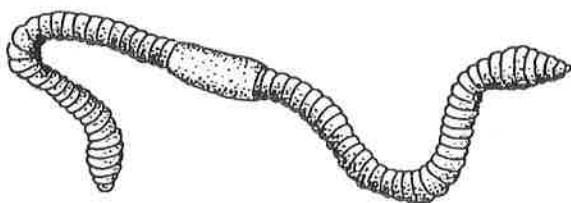
Genus #1 species #1



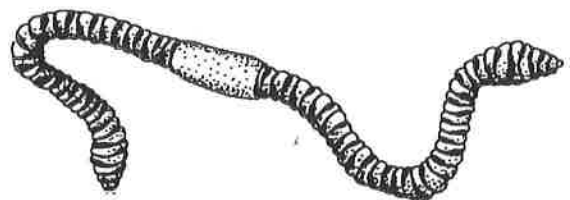
Genus #1 species #2



Genus #2 species #1



Genus #2 species #2



Analysis

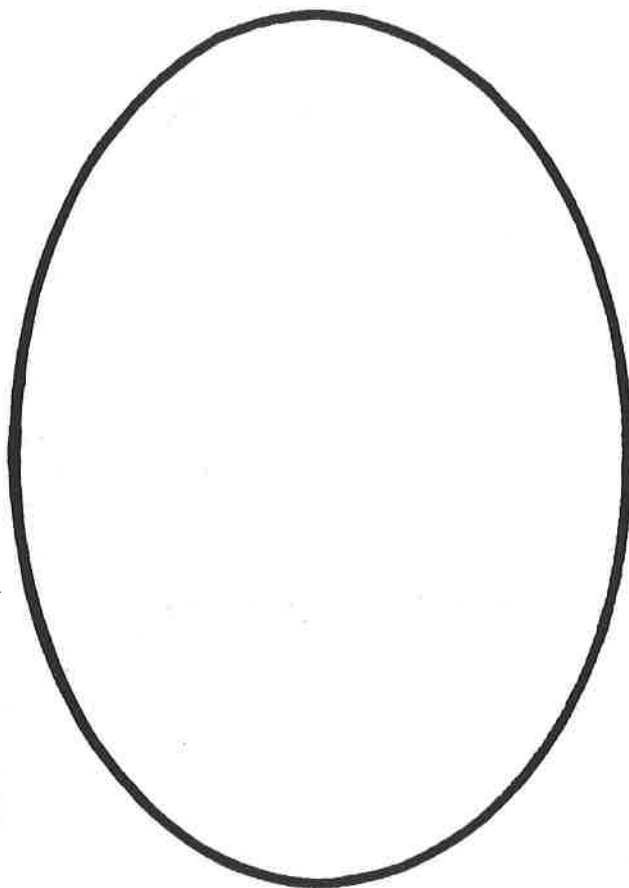
Now that the expedition is over, what sense can you make of your data?

1. On the basis of what you found in the red rocks,
 - (a) which continents had similar fossils?
 - (b) from this fossil evidence, which continents seem to have been connected 300 million years ago?

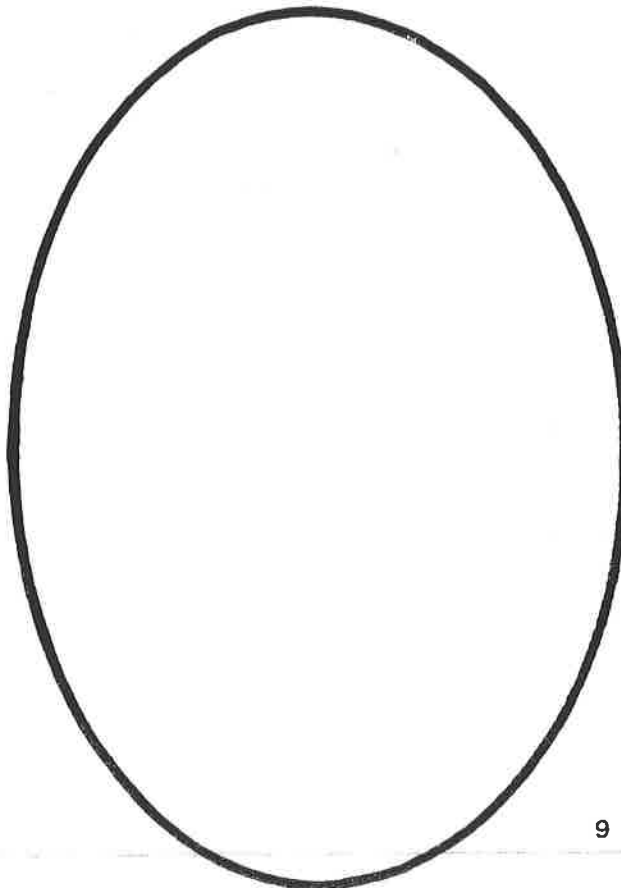
2. On the basis of what you found in the yellow rocks,
 - (a) which continents had similar fossils?
 - (b) from this fossil evidence, what can you tell about the connections of the five continents about 200 million years ago?

3. On the basis of what you found in the green rocks,
 - (a) which continents had similar fossils?
 - (b) from this fossil evidence which continents seem to have been connected 100 million years ago?

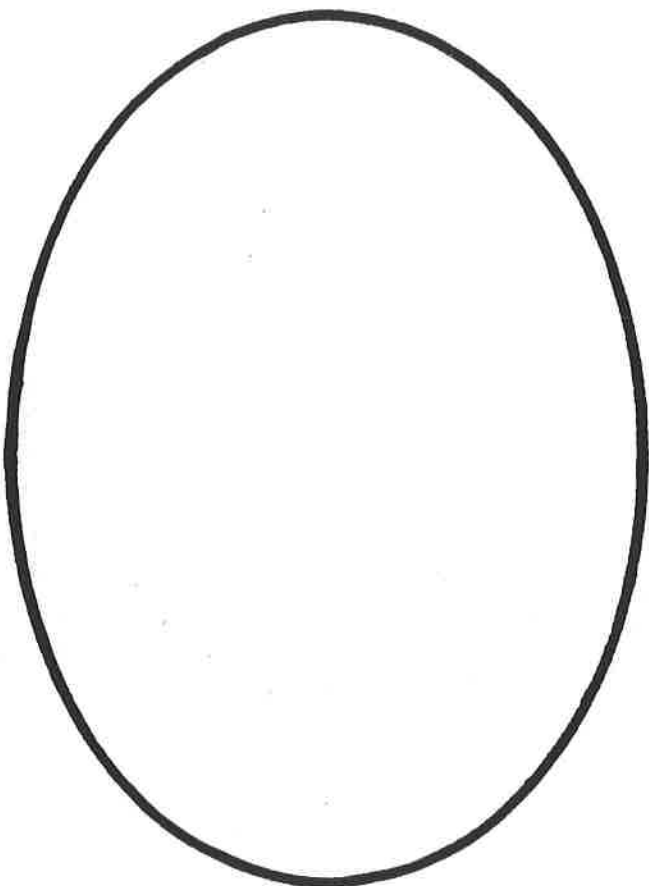
4a Arrange cutouts of the continents from page 15 according to where you think they were situated during each of the three past ages. Arrange them also as they appear in the present.



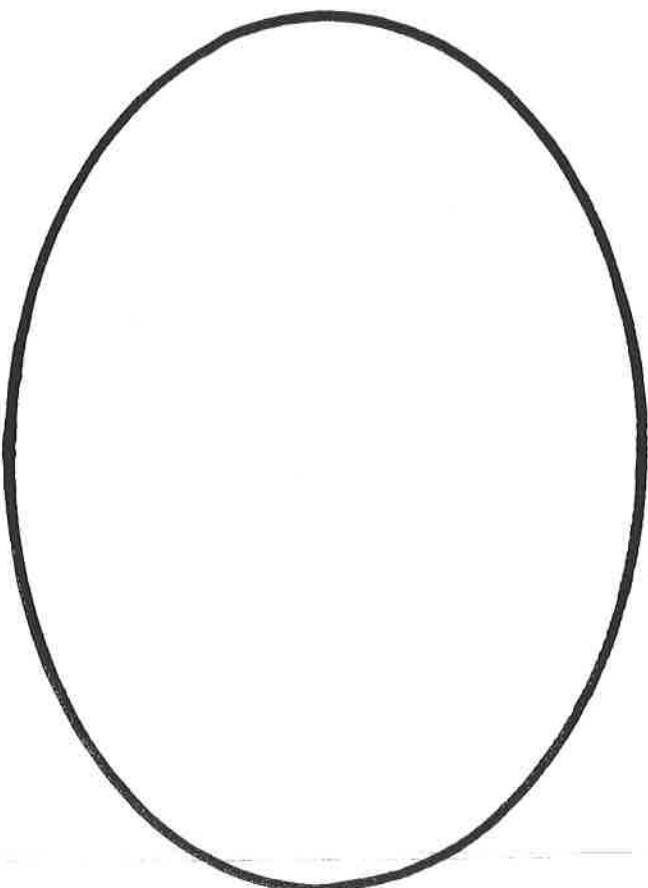
Southern Hemisphere
Present



Southern Hemisphere
100 million years ago



Southern Hemisphere
200 million years ago



Southern Hemisphere
300 million years ago

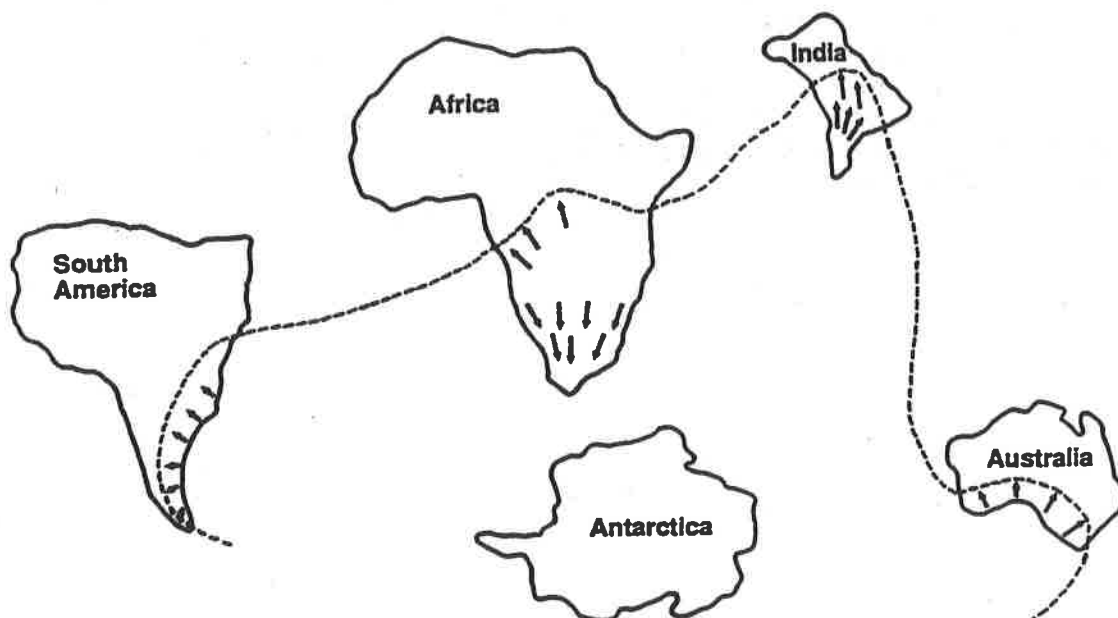
4b Explain your reasons for putting the continents together as you did for each time period.

300 million years ago.

200 million years ago.

100 million years ago.

5. Look at the black arrows on the red rocks of the continents. The arrows represent grooves in the rock. The grooves were carved by advancing continental glaciers about 300 million years ago. The arrows point in the direction the glaciers were moving.



- (a) Suppose you were the first person to have found the glacial grooves in south-eastern South America. From where would it seem the glacier came? _____

Could the glacier have come from the ocean? Explain your answer.

- (b) Why would the geologist who first found the glacial grooves in India be puzzled by the discovery?
- (c) How might the idea of continental drift explain 300 million year old glacial grooves on four separate southern continents?
- (d) Where was the probable spreading center of the glaciers? Make an "X" to mark this location on the map above. Where on the surface of the earth was the probable location of the "X" 300 million years ago? (Remember that a continental glacier tends to move out and away from its center, the North or South Pole - like a spreading mass of bread dough.)
- (e) Where would you look for glacial grooves in the 300 million year old rock of Antarctica? Draw arrows where you would expect to find glacial grooves in Antarctica on the map above.

6. Two species of living earthworms in the soils of southern South America and Africa were found to be very closely related (members of the same genus). Also, two species of living earthworms in soils of southern India and southern Australia were found to be very closely related (members of the same genus).

How was the theory of continental drift strengthened by discoveries of closely related earthworms on widely separated continents?

7. Examine the mammals pictured on the continents of South America, Africa, India, and Australia. These living animals are native on their continents. Each eats insects, and is a major ant/termite eater among all the mammals there. Each species belongs to a different order of mammals. These four mammals are very distantly related, even though each is highly specialized for eating ants and/or termites.

Explain in terms of continental drift and evolution how four very different kinds of ant/termite eaters could occur in India, Africa, South America, and Australia. (Remember, the Age of Mammals began on earth after Dinosaurs became extinct about 65 million years ago.)

Summary

8a List as many pieces of evidence as you can to support the theory of continental drift.

8b Why do you think it is so difficult for some people to accept the idea of continental drift?

DATA SHEET

FOSSILS AND LIVING ANIMALS FOUND ON THE FIVE CONTINENTS OF GONDWANALAND

Continent					
Time	South America	Africa	India	Australia	Antarctica
Present Day (blue)					
One hundred million years ago (green)					
Two hundred million years ago (yellow)					
Three hundred million years ago (red)					

Cut out these four sets of outlines of the five continents of the southern hemisphere. Place the cutouts on the globes found on page 9.

