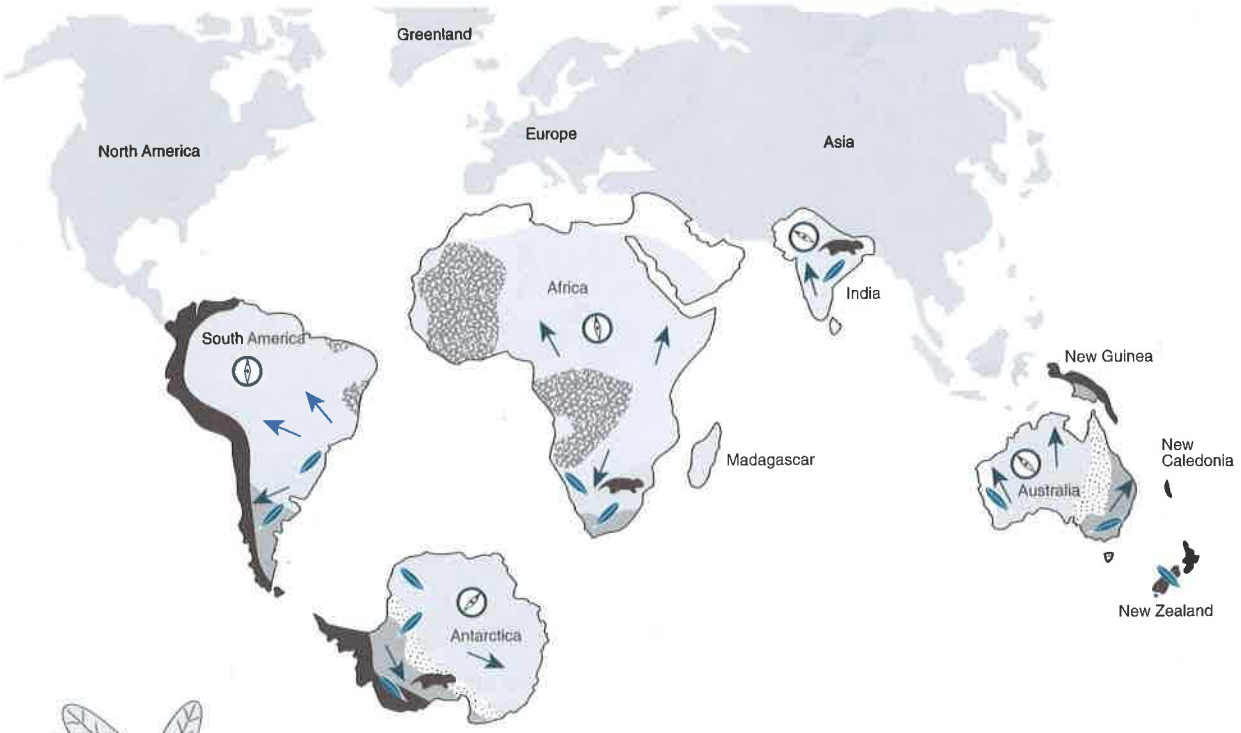
Name _____

Date _____ Period _

Continental Drift and Evolution

Continental drift is a measurable phenomenon; it has happened in the past and continues today. Movements of up to 2-11 cm a year have been recorded between continents using laser technology. The movements of the Earth's 12 major crustal plates are described by a geologic process known as **plate tectonics.** Some continents appear to be drifting apart while others are on a direct collision course. Various lines of evidence show that the modern continents were once joined together as 'supercontinents'. One supercontinent, called **Gondwana**, was made up of the southern continents some 200 million years ago. The diagram below shows some of the data that provide evidence of how the modern continents once fitted together.



Glossopteris is a hardy plant that grew adjacent to the glacial ice sheets of Gondwana some 350-230 million years ago

Lystrosaurus is a primitive therapsid (mammal-like) reptile 1 m long, that was widely distributed throughout the southern continents about 240 million years ago.

Key

Nothofagus:

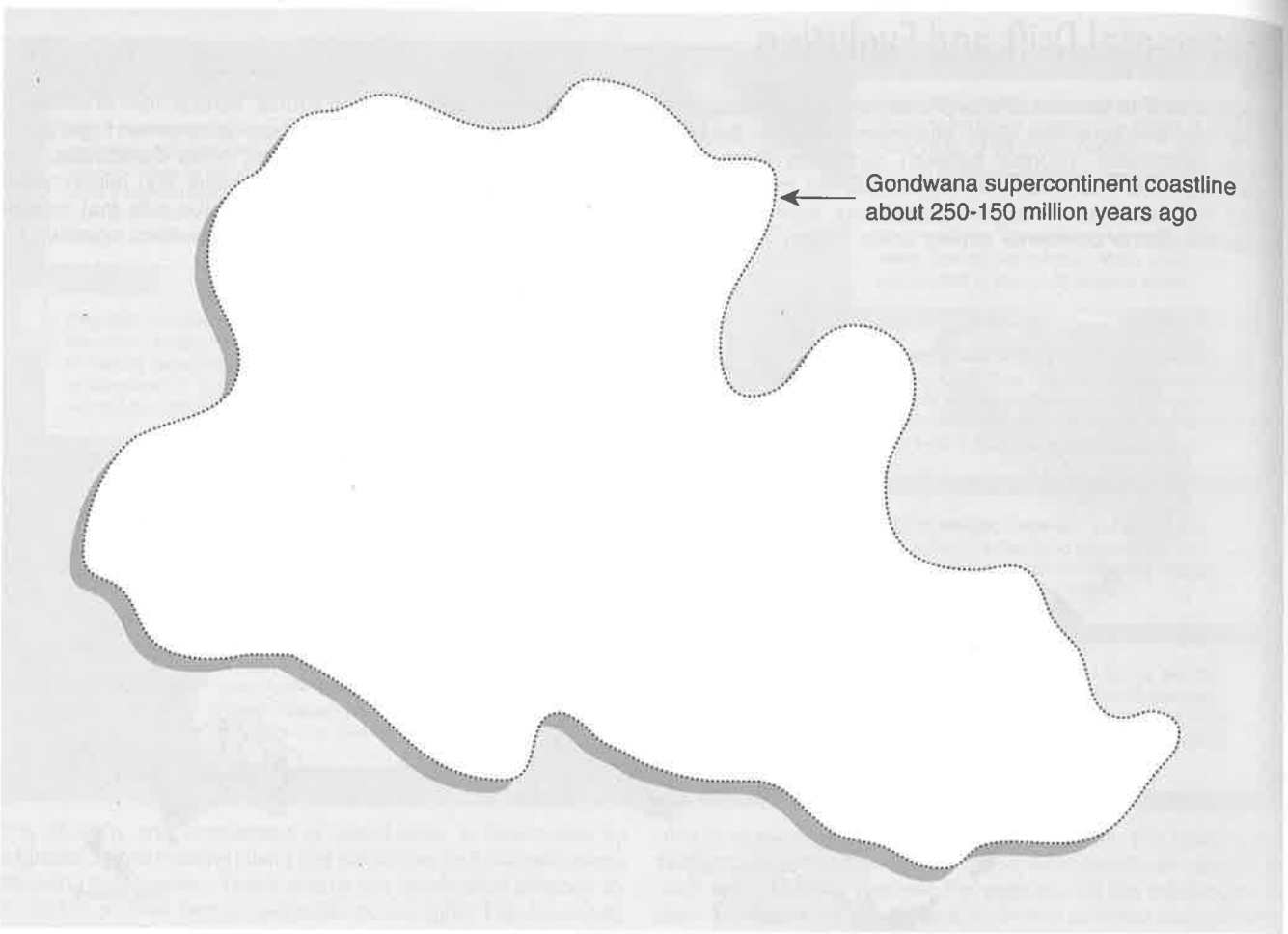
- Direction of ice sheet movement 350-230 million years ago
- Geomagnetic pole direction 150 million years ago
- Distribution of *Lystrosaurus*
- Distribution of *Glossopteris*
- Old Precambrian rocks (older than 650 mya)
- Precambrian basement rocks (650-570 mya)
- Early Paleozoic folding (570-350 mya)
- Late Paleozoic–Early Mesozoic folding (350-160 mya)
- Late Mesozoic folding (160-70 mya)

1. Name the modern landmasses (continents and large islands) that made up the supercontinent of Gondwana:

2. Cut out the southern continents on page 285 and arrange them to recreate the supercontinent of Gondwana. Take care to cut the shapes out close to the coastlines. When arranging them into the space showing the outline of Gondwana on the next page, take into account the following information:
   (a) The location of ancient rocks and periods of mountain folding during different geologic ages.
   (b) The direction of ancient ice sheet movements.
   (c) The geomagnetic orientation of old rocks (the way that magnetic crystals are lined up in ancient rock gives an indication of the direction the magnetic pole was at the time the rock was formed).
   (d) The distribution of fossils of ancient species such as *Lystrosaurus* and *Glossopteris*.

3. Once you have positioned the modern continents into the pattern of the supercontinent, mark on the diagram:
   (a) The likely position of the South Pole 350-230 million years ago (as indicated by the movement of the ice sheets).
   (b) The likely position of the geomagnetic South Pole 150 million years ago (as indicated by ancient geomagnetism).

4. State what general deduction you can make about the position of the polar regions with respect to land masses:



5. Fossils of *Lystrosaurus* are known from Antarctica, South Africa, India and Western China. With the modern continents in their present position, *Lystrosaurus* could have walked across dry land to get to China, Africa and India. It was not possible for it to walk to Antarctica, however. Explain the distribution of this ancient species in terms of continental drift:

6. The southern beech (*Nothofagus*) is found only in the southern hemisphere, in such places as New Caledonia, New Guinea, eastern Australia (including Tasmania), New Zealand, and southern South America. Fossils of southern beech trees have also been found in Antarctica. They have never been found in Africa or India. The seeds of the southern beech trees are not readily dispersed by the wind and are rapidly killed by exposure to salt water.

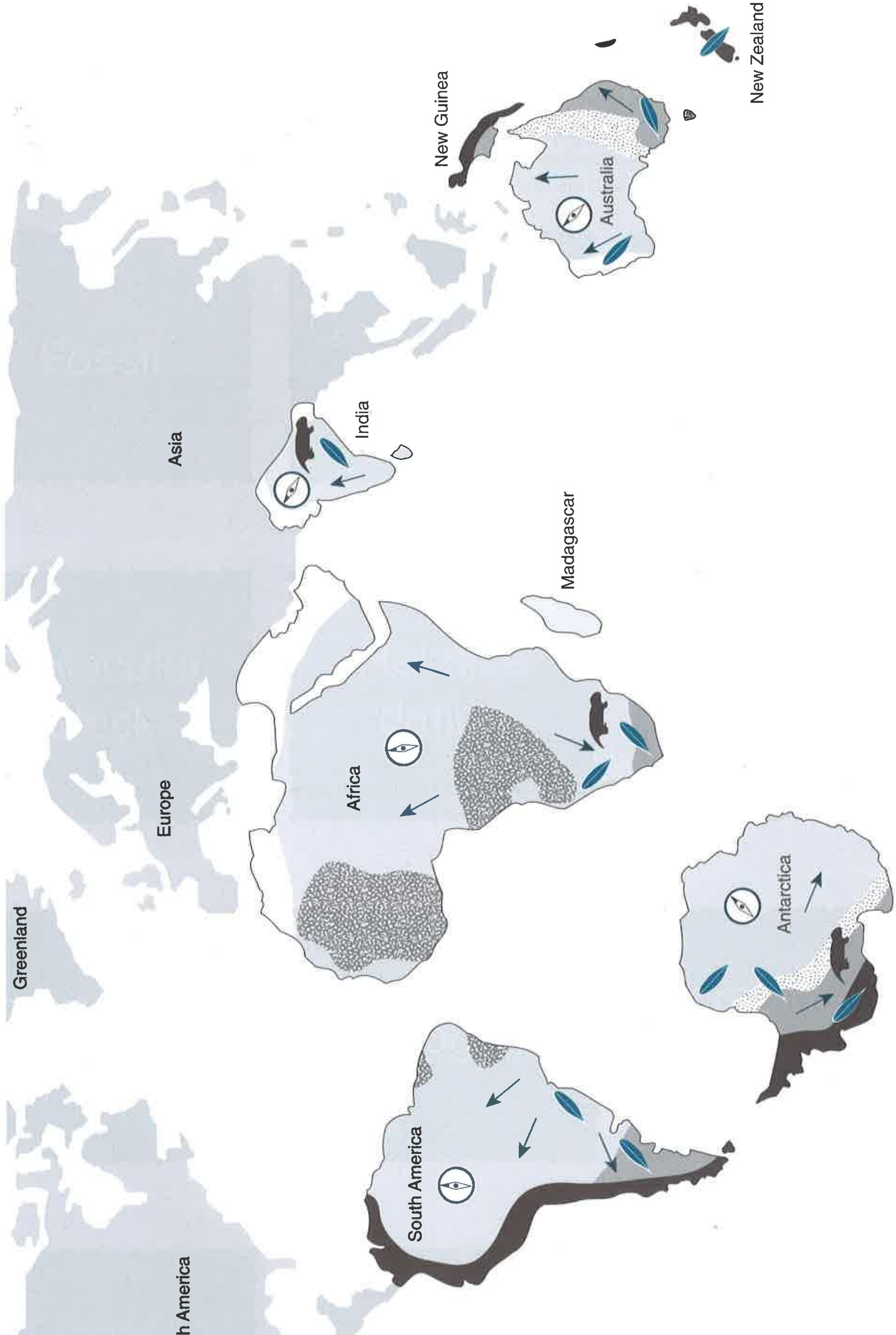
   (a) Suggest a reason why *Nothofagus* is not found in Africa or India:

   (b) Use a colored pen to indicate the distribution of *Nothofagus* on the current world map (on the previous page) and on your completed map of Gondwana above.

   (c) State how the arrangement of the continents into Gondwana explains this distribution pattern:

7. The Atlantic Ocean is currently opening up at the rate of 2 cm per year. At this rate in the past, calculate how long it would have taken to reach its current extent, with the distance from Africa to South America being 2300 km (assume the rate of spreading has been constant):

8. Explain how continental drift provides evidence to support evolutionary theory:



Cut out the continental land masses that make up the supercontinent of Gondwana and stick them into the space on the previous page