

Leaves Under the Ice: Fossils Antarctica Should Not Have

Learning target: I can describe a puzzling fossil pattern, connect it to what I already know about climate and continents, and write a first explanation that I can test later.

Phenomenon exploration

About 25 min

Individual

MS-ESS2-3 · practice

discussion

writing

Name _____

Date _____

Period _____

Directions

Read the two descriptions and study the figure and the table. Write what you notice before you try to explain anything. There are no wrong answers in Parts A and B; your job is to think carefully and write your honest first ideas. In Part C, write an explanation you could test, and list the questions you would need answered to test it.

You will need: Pencil, This sheet

Antarctica today

Antarctica is the coldest, driest and windiest continent. An ice sheet about two kilometers thick covers almost all of it. Winter temperatures in the interior often drop below minus 60 degrees Celsius, and the coldest air temperature ever recorded on Earth, minus 89 degrees Celsius, was measured there. There are no trees and no land animals bigger than a tiny insect. The only plants are mosses, lichens and two small flowering plants that cling to the warmer coast of the Antarctic Peninsula.

What the rocks say

In February 1912, members of Robert Scott's expedition hauled 16 kilograms of rock across the Beardmore Glacier on their way back from the South Pole. The rocks held fossil leaves, tongue-shaped and as long as your hand, from a plant called **Glossopteris**. The same leaves are found in India, Australia, southern Africa and South America. Nearby, geologists later found seams of coal, which forms only from thick layers of dead plants, and fossil tree trunks with growth rings, which form when a tree's growth stops and starts again with the seasons. In December 1969 a team working at Coalsack Bluff in the Transantarctic Mountains dug up the bones of **Lystrosaurus**, a pig-sized, land-living reptile that could not swim across an ocean. Lystrosaurus bones are also found in South Africa, India, China and Russia. The Glossopteris forests grew roughly 250 to 300 million years ago; Lystrosaurus lived about 250 million years ago.

One continent, two stories

Antarctica now	Antarctica's rocks (about 250 million years ago)
Ice about 2 km thick over nearly all the land	Forests of Glossopteris trees with hand-sized leaves
Interior winters below minus 60 degrees C	Coal seams made from thick layers of dead plants
No trees, no land animals larger than insects	Tree trunks with growth rings: warm and cold seasons
Only mosses, lichens and two small flowering plants	Bones of Lystrosaurus, a pig-sized land reptile
Sits on the South Pole, dark for months each winter	The same plants and animals found on four other continents

The two columns describe the same place. The left column is what you would see if you visited today. The right column is what is preserved in the rock.

Where the same fossils are found (real distributions)

Fossil	What it was	Lands where it is found	Could it cross an ocean?
Glossopteris	Extinct seed plant (a tree) with tongue-shaped leaves; shed its leaves each year	Antarctica, Australia, India, Africa, South America	Its seeds were too large and heavy to blow across an ocean
Lystrosaurus	Pig-sized plant-eating reptile that lived on land	Antarctica, Africa, India, China, Russia	No; it walked, it did not swim long distances
Mesosaurus	Small reptile about 1 m long that lived in shallow coastal and inland waters	South America, Africa	No; it was built for shallow water, not the open ocean

Part A: Notice and wonder

1. Write three things you **notice** in the text, figure or table. Use only observations, not explanations. (Example of an observation: 'The same plant is found on five continents.')
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2. Write three things you **wonder**. Each should be a question that could be answered with evidence.

3. What do you already know about what trees need in order to grow? Name two things Antarctica lacks today that a *Glossopteris* forest would have needed.

Part B: What do you already think?

4. Right now, before any more evidence, which explanation seems **most likely** to you? (You will test your choice later in this chapter.)

- ☐ **A.** The whole Earth was once so warm that forests grew even at the South Pole.
- ☐ **B.** The land that is now Antarctica was once somewhere warmer, and it has moved.
- ☐ **C.** Seeds and animals crossed the oceans on floating logs or ice.
- ☐ **D.** The fossils were carried to Antarctica later by water or glaciers.

5. A plant fossil is a good clue, but scientists call the *Lystrosaurus* bones an even stronger clue. Using the table, explain why a land animal makes a stronger case than a plant.

6. Suppose a continent crept along at 2 centimeters per year, about the speed your fingernails grow. How far would it travel in 250 million years? Give your answer in kilometers and show every step of the unit conversion. (1 km = 100,000 cm.)

Part C: Your first explanation

7. Write your first explanation for how the same land plants and land animals ended up on continents that are now separated by thousands of kilometers of ocean, including one that is frozen. Your explanation must account for **both** the fossils and the tree rings (seasons).

8. What is one piece of evidence that, if someone found it, would make you **give up** your explanation? What is one piece that would make you more confident?

Sentence starters for Part C

If q7 is hard to begin, start with: 'About 250 million years ago, the land that is now Antarctica was _____. The same plants and animals could live on several continents because _____. The tree rings show that the forests had seasons, which means _____. Since then, _____.' Fill each blank with your own idea, then read the paragraph aloud to check that it makes sense.

Hold the explanation to a harder test

Explanation A in q4 says the whole planet was once warm enough for forests at the pole. The growth rings suggest part of that may be true: the trees grew in summer and stopped in long, dark winters, as trees near a pole would. But a warm Earth alone would not explain one detail in the table. Find that detail (hint: look at where *Lystrosaurus* and *Glossopteris* are found, and whether they could cross an ocean) and write a paragraph explaining why a warm Earth alone is not enough. Then describe what a scientist would have to compare in the rocks of Antarctica and the other continents to decide whether the lands were once joined.