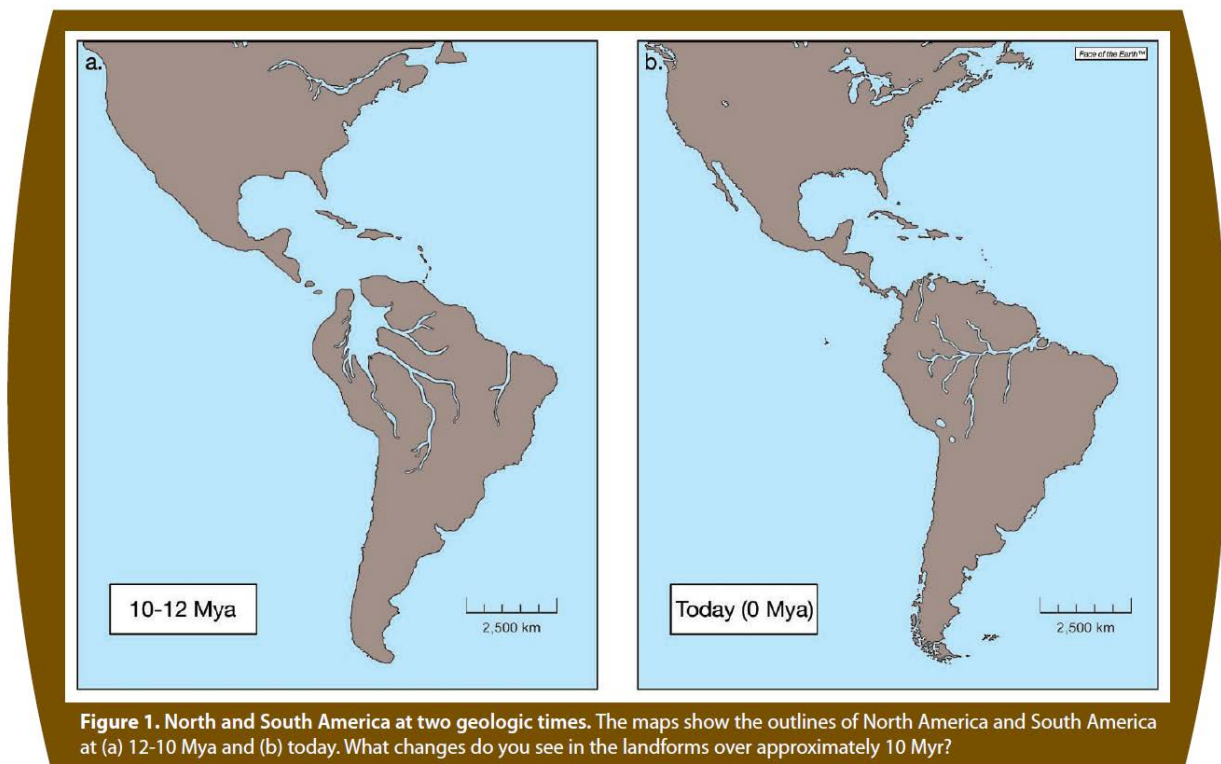


Biogeography of the Americas: Building Bridges

Biogeography is the study of where organisms live now and where they and their ancestors lived in the past. Scientists study past biogeography by analyzing the fossil record to track where ancient organisms lived and how their geographic distribution changed over time. Biogeography provides evidence for both the evolution of species and Earth's changing geography. Clues in the fossil record show that the continents move around the surface of the Earth over millions of years – this is called continental drift.

North America and South America used to be distinct land masses. Each continent carried its own collection of endemic species, or species that are native only to a restricted region. When the Americas were joined less than 12 million years ago (Mya), endemic species from North and South America were able to travel between continents and spread across both Americas.

Your objective is to use biogeography data to determine when the Americas were connected to each other. You will analyze real data from the fossil record to determine which species are present at different sites in the Americas and when different species appeared in the fossil record at different locations. Based on this evidence, you will construct arguments about which species are endemic to North or South America and when species migrated across continents for the first time. You will use these conclusions to determine when the Americas were connected.



Procedure

1. Study the two maps in Figure 1. List how the maps are similar and different.

Similarities	Differences

2. What are the main differences between the geography of the Americas today compared to 10-12 mya?
3. Figure 2 (last page) shows geologic strata, or rock layers, with fossil finds at six sites in North and South America. The sections span from today back to 12 mya.
 - a. Mark the locations of these six sites on your maps in Figure 1. If necessary, use a map or atlas online to estimate the locations.
 - b. At a given site, are older rocks found at a deeper or shallower position? Explain.
4. Compile a table that lists which mammals were found at each site in Figure 2. In Table 1, mark which mammals were recorded at that site.
 - a. Which sites have the most mammals?
 - b. Which sites have the fewest mammals?

Table 1: Mammal fossils found at six different locations in North and South America

Site (N/S America)	Mexico (N)	Arizona (N)	New Mexico (N)	Florida (N)	Colombia (S)	Argentina (S)
Armadillo (a)						
Cat (c)						
Camel (cm)						
Capybara (cy)						
Dog (d)						
Equid (Horse) (e)						
Glyptodont (g)						
Mammoth (m)						
Opossum (o)						
Porcupine (p)						
Rhinoceros (r)						
Sloth (s)						

5. Animals or plants that are restricted to a specific region are called endemic. Follow Steps 5a-e to evaluate claims about which animals were endemic to the Americas 12-10 Mya.
 - a. With your group, determine how to tell whether an animal may be endemic to a continent or region from the geologic record. Explain this strategy using an example from Figure 2.
 - b. Explain which sites you would study in order to list the mammals that were endemic to South America. What parts of the strata would you search (tops, bottoms, all)?

- c. Complete Table 2 showing which animals might be endemic to North America and South America.
- d. Explain why you think the animals identified in Table 2 are endemic. Use evidence from Figure 2 to support your argument.
- e. Explain whether you think the case for an animal being endemic is stronger for animals in South America or North America. Use evidence from Figures 1 and/or 2 to support your argument.

Table 2. Animals endemic to North America and South America

North America	South America

6. Answer questions 6a-d for the animal groups endemic to South America 12-10 mya.
 - f. Make a claim about when you think South American animals arrived in North America. List specific evidence from fossils in Figure 2 and justify how this evidence supports your argument.

- g. How can you explain the arrival of South American endemics in North America?
 - h. Make a claim about when you think North American animals arrived in South America. List specific evidence from fossils in Figure 2 and justify how this evidence supports your argument.
 - i. How can you explain the arrival of North American endemics in South America?
7. Examine the geologic record of the rhinoceros in Figure 2.
- j. In what locations and time range are rhinoceros found?
 - k. What inferences can you make about the history of the rhinoceros in the Americas?
8. Use the data from Figure 2 to analyze the geologic record of the mammoth.
- l. Where are mammoth fossils found? What is their earliest appearance in the fossil record of the Americas?
 - m. How can you explain the sudden appearance of the mammoth?
9. Discuss with your lab group the concept of a land bridge.
- n. What do you think is the land bridge between North America and South America?
 - o. When do you think the land bridge formed? Support your argument with evidence from this activity.

- p. What animals did or did not use the land bridge? How did you reach these conclusions?

10. Explain how biogeography provides evidence for evolution.

Geologic Strata

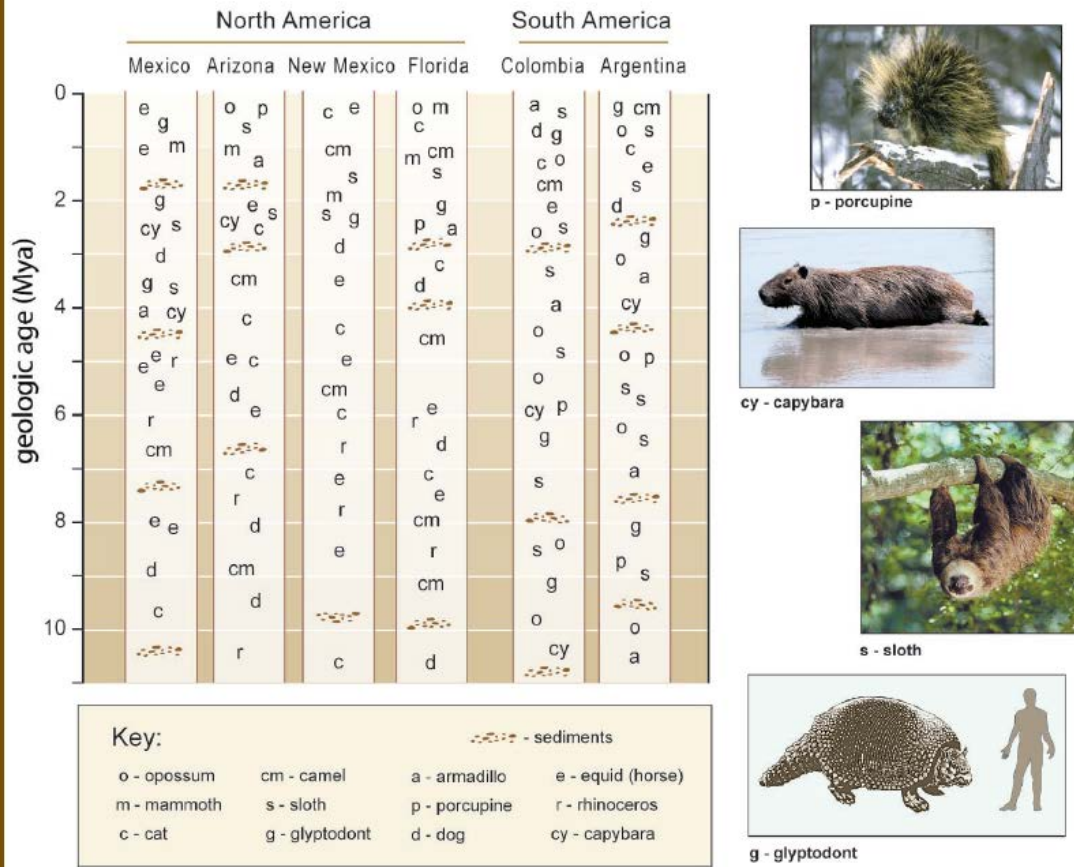


Figure 2. Six geologic sections from North and South America. The fossil finds from six locations are shown as a function of geologic age (left). The key lists 12 representatives of animal families from North and South America. Current examples (right) are the sloth, the capybara (a large rodent), and the porcupine. Glyptodonts are extinct.