

Telling a Story from Evidence Activity

Purpose: This exercise is designed to help students think about how scientists examine historical evidence to determine when a species originated and where it migrated over time. The fossil record is rarely complete, so problem-solving skills and critical thinking are vital when making decisions about how evidence might be related and how to interpret that evidence.

Notes to the teacher: Students can work through this activity alone, in pairs or in small groups. Focus discussion on how evidence was used to support conclusions rather than on the details of each clue.

Background: This activity uses fictitious data about an unidentified primate. It is designed this way so students can focus on the process of examining data and deriving meaning from that data. Students need to know some basic geographical information (the names and locations of major landforms) and an understanding of chronology for this activity.

Materials for each team:

- 1 set of clues ([Blackline Master 2](#))
- 1 copy of the map ([Blackline Master 3](#))

Directions:

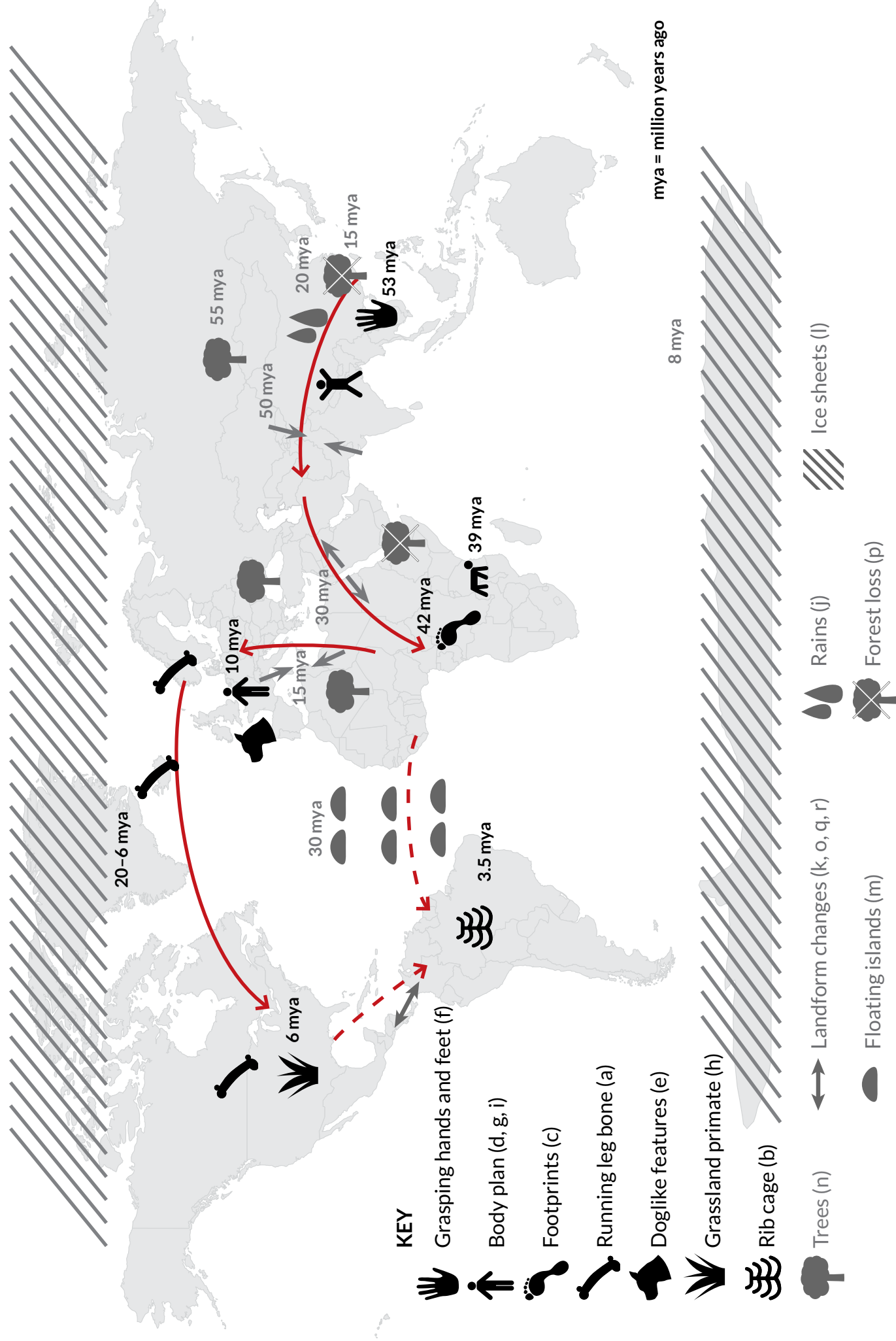
1. Access prior knowledge:
 - a. Ask students what they know about determining the age of a fossil. They might know that scientists look at the position of a fossil in rock strata to determine age, or they might know about radiocarbon and other forms of dating. A general discussion of these procedures might be useful if students have no background knowledge in this area. (Visit [this page about dating and human evolution](#) from the Smithsonian National Museum of Natural History for more information.)
 - b. Ask students what they know about plate tectonics and how the process has changed the positions of landforms over time. From middle grades, students might recall looking at the Americas and how they separated from what is now Africa as the Atlantic Ocean formed. Students might also know how mountains form when plates push against each other.
 - c. Ask students what they know about Earth's climate and how it has changed over time. They have probably heard about ice ages and they might know that there have been times in Earth's history when it was warmer than it is now. To learn more about large-scale climate changes, visit this [National Park Service page](#) on changing climate and the fossil record or [NOAA's page](#) on paleoclimatology.

2. Tell students that, like the scientists they read about in the article, they are going to investigate a variety of clues, some from fossil evidence and some relating to events on Earth, to try to trace a primate's past. Students must start with the assumption that all these fossils represent one lineage. Their age and location in the fossil record provide some clues needed to understand where the primate originated and where it migrated over time.
3. Decide if students are working alone or in groups. Based on that decision, pass out copies of the hand-outs and read through the directions together if necessary. Give students time to work through Part 1.
4. Once students have put all their data on their maps, have them analyze the relationships between the clues. They should connect the data with arrows to show their proposed migration pathway. Students should be able to articulate why they came to these conclusions. They'll need to make inferences and incorporate prior knowledge.
5. Have students answer the questions in Part 2. Not all students will come to the same conclusions. Discuss and compare their differing ideas about the paths of migration and reasons for extinction. In the article, scientists relied heavily on genetic evidence. How might genetic information have helped students in this activity? What additional information might students want to know to make convincing arguments?

Sources:

- [University of California Museum of Paleontology](#)
- [Palomar College](#)
- www.nature.com
- Thanks to JR Jones, geologist at the Gulf of Mexico Foundation, for providing input and assistance

PART 1: POSSIBLE STUDENT RESPONSE



PART 2: POSSIBLE STUDENT RESPONSES

1. Can you determine where this primate likely originated? What evidence leads you to believe this?

The oldest bone fragments were hands and feet used for grasping, dating to 53 million years ago. They were found in southeastern Asia. This is the most likely origin of the lineage unless an older fossil can be located.

2. Where did this lineage migrate? How do you know?

The primate likely moved from Asia to Africa before 30 million years ago, then to Europe. There are two possible routes for its migration to the Americas: It could have come from Europe over the frozen ice sheets via Iceland between 10 and 6 million years ago and then to South America. Or, it could have arrived in South America via floating islands of vegetation from Africa. Have your students discuss and debate the most likely scenario.

3. Where is the last known location of this primate? What more data would you need to find out how this primate went extinct?

The last known location of this primate is in South America. Based on physical characteristics, the lineage is likely carnivorous or omnivorous. The species is adapted for running. To find out how this animal went extinct, we need to know more about the conditions in South America between 3.5 million years ago and today. What prey was available? What predators were there? What other species did the primate compete with? How did the environment change over time?

Telling a Story from Evidence Activity

Scientists examine fossils, artifacts, geological evidence and use computer modeling to understand the past. By examining the patterns formed from various sources of information, they attempt to piece together a picture of the past.

Directions:

PART 1: A number of primate fossils have recently been discovered. All appear to come from individuals belonging to the same primate lineage, but they are unlike any other primate studied to date. Read the information provided about each piece of fossil evidence. Also read the environmental clues. Once you have read the information, use the map provided to organize your evidence. Create a key and your own symbols to keep track of the information. Once all the details are marked on your map, analyze your map to determine when and where the species originated and what happened to it over time.

Evidence from artifacts:

- a. Leg bone fragments similar to those found in fast-running primates come from rocks unearthed in what is now Canada, Iceland and Norway. Single-celled organisms called diatoms indicate that the rock formed between 20 and 6 million years ago.
- b. Rib cage fossil fragments were found in South America dating to 3.5 million years ago. Such fossils suggest a primate with an expanded lung capacity.
- c. A 42 million-year-old trace fossil found in Africa shows footprints of a squirrel-sized primate. Prints suggest pairs of limbs on opposite sides of the body that touch the ground at the same time.
- d. Fragments of a 39 million-year-old skeleton found in Africa suggest four limbs of the same length.
- e. A primate skull about the size of a small dog's was found in Northern Europe. The shape indicates a short snout; long, sharp teeth; and forward-looking eyes.
- f. Bone fragments from hands and feet thought to be used for grasping objects and climbing in trees were found in southeastern Asia and date to 53 million years ago.
- g. A 10 million-year-old fossil found in Western Europe shows the connection between the head and the spinal column in a vertical orientation, like today's monkeys or lemurs.
- h. Fossils with long legs and large feet found in North America date to 6 million years ago. Such adaptations are found in primates living in grassland habitats.
- i. A fossil of a hind leg bone found in the Himalayas suggests a body plan similar to modern primates who leap between trees.

Evidence from the environment:

- j. By 20 million years ago, Asian monsoon rains shift to the east.
- k. Collision of the Indian and Asian plates begin to create the Himalayas around 50 million years ago. Uplift results in weathering. Temperatures begin cooling.
- l. By about 8 million years ago, polar regions are temporarily blanketed by ice.
- m. Around 30 million years ago, clumps of vegetation and soil float from Africa across the Atlantic Ocean and toward the Americas.
- n. Fossils of trees adapted to warm, moist climates are found in Asia, Europe and North Africa and date from around 55 million years ago. Temperatures on Earth were very warm at this time.
- o. By 3 million years ago, a land bridge connecting North and South America formed.
- p. East African and South Asian forests are replaced by woodlands and grasslands around 15 million years ago.
- q. The Red Sea formed as the Arabian and Nubian plate moved away from each other about 30 million years ago.
- r. Around 15 million years ago, changing plate positions and sea level lead to reestablished connections between Africa and Eurasia.

PART 2: Once all your clues are recorded on your map, study the clues and look for relationships. Draw arrows to show how you think the primate moved over time. Use the evidence and your analysis to answer the following questions:

1. Can you determine where this primate likely originated? What evidence leads you to believe this?
2. What migration path did this species follow? Why do you think so?
3. Where is the last known location of this primate? What more evidence would you need to find out how this primate went extinct?

