Continental Drift 41

1-2
40- to 50-minute sessions

ACTIVITY OVERVIEW

Students evaluate evidence related to continental drift. They first determine which statements constitute evidence, and they then identify the statements that support this idea of continental movement.

KEY CONCEPTS AND PROCESS SKILLS

(with correlation to NSE 5–8 Content Standards)

1. The continents are part of large lithospheric plates that have moved over geological time and continue to move at a rate of centimeters per year. (EARTHSCI: 1, 2)
2. Fossils provide important evidence about how life and environmental conditions on earth have changed over geological time. (EARTHSCI: 2)
3. Tracing the history of science demonstrates how individuals contributed to the development of modern scientific ideas, and reveals important interactions between science and society. (HISTORY: 3)

KEY VOCABULARY

continental drift

evidence

MATERIALS AND ADVANCE PREPARATION

For the teacher

- 1 Scoring Guide: UNDERSTANDING CONCEPTS (UC)
- 1 Scoring Guide: ORGANIZING SCIENTIFIC IDEAS (SI)
- 1 Transparency 40.2, "Puzzle Key"
- * 1 overhead projector

For each student

- 1 Student Sheet 41.1, "Analyzing Evidence: Continental Drift"
- 1 Student Sheet 41.2, "Writing Frame: Continental Movement" (optional)
- 1 Scoring Guide: UNDERSTANDING CONCEPTS (UC) (optional)
- 1 Scoring Guide: ORGANIZING SCIENTIFIC IDEAS (SI) (optional)

**Not supplied in kit*

Masters for Scoring Guides can be found in Teacher Resources III: Assessment.

TEACHING SUMMARY

Getting Started

1. Use the introduction in the Student Book to explain the concept of continental drift.

Doing the Activity

2. Students evaluate evidence on Student Sheet 41.1.

Follow-Up

3. Relate continental drift to previous activities.
4. (UC, SI ASSESSMENT, LITERACY) Students write a paragraph on continental drift.

BACKGROUND INFORMATION

Alfred Wegener and Continental Drift

The idea of continental drift was first proposed by German meteorologist Alfred Wegener. In December 1910, he wrote in a letter to his future wife: "Doesn't the east coast of South America fit exactly against the west coast of Africa as if they had once been joined? This is an idea I'll have to pursue." By 1915, he had published the first edition of *The Origin of Continents and Oceans*, a book in which he outlined his ideas about continental drift and described the evidence in support of it. In a revised third edition, published in 1922, he wrote:

> Geological evidence shows that about 300 million years ago, all of the continents were joined together. I will refer to this "supercontinent" as Pangea, meaning "all lands." It appears that Pangea began to break up about 200 million years ago.

Wegener relied on several lines of evidence described in the Student Book, including the distribution of fossils of the same geological age along different shores, similar rock layers along the edges of different continents, evidence of past glacial activity, and the relationship among mountain ranges on different continents (including similar rock strata and the presence of coal beds). He also noted the distribution of specific rock types, in order to determine the range of different climate zones in the geologic past. He found that these zones occupied different positions than today. For example, coral reefs indicate a tropical climate, and today coral reefs are distributed in a zone around the equator parallel to the poles. Evidence of coral reefs in geological history would indicate either that this tropical zone was not parallel to the ancient poles or that the continents themselves moved, leaving the climate zones parallel to the ancient poles. Wegener proposed the latter as evidence for continental drift.

Wegener's ideas about continental drift were not widely accepted during his lifetime. He suggested that the earth's spinning on its axis caused the continents to move and to plow through the ocean floor, and many geologists of the time were not convinced by this explanation of the mechanism of continental drift. They countered that the amount of force needed to overcome the resistance of rock layers found on the ocean floor made this mechanism improbable.

Since Wegener's time, advances in science have led to additional evidence that supports his idea that the continents have moved, and continue to move—and to the proposal of a more convincing mechanism for this movement. Some of these advances are described on Student Sheet 41.1. Other advances include new understandings related to sea-floor spreading and the magnetic properties of rocks. Today, elements of the idea of continental drift have become part of the larger theory of plate tectonics, which is introduced in the next activity.

REFERENCES

Hughes, Patrick. (April 1, 1994) "The Meteorologist Who Started a Revolution." *Weatherwise*, Vol. 47, p. 29. Heldref Publications, Washington, D.C.

TEACHING SUGGESTIONS

GETTING STARTED

1. Use the student introduction to explain the concept of continental drift.

Explain that the idea that the continents were once joined together was first suggested over 100 years ago by a German scientist named Alfred Wegener. He suggested that the continents were once joined in a single land mass that eventually broke apart into pieces that slowly drifted away from each other. This idea is known as **continental drift**.

DOING THE ACTIVITY

2. Students evaluate evidence on Student Sheet 41.1.

Hand out Student Sheet 41.1, "Analyzing Evidence: Continental Drift." Explain to students that they have a three part task:

(1) Determining which statements constitute evidence;

(2) Identifying the pieces of evidence that support and the pieces that contradict the idea that continents have moved; and

(3) Explaining *how* each piece of evidence supports or contradicts this idea.

Students are instructed to decide what constitutes evidence and what does not. If students have difficulty with the concept of evidence, use everyday examples, such as the type of evidence used in a court of law. In some cases, evidence is direct (a person is observed trespassing, for example), while in other cases the evidence is indirect (a person left a unique shoeprint in the mud on the property). If students have difficulty deciding what is or is not evidence, work as a class to evaluate one of the statements.

After determining which statements provide evidence and which do not, students are instructed to cross out the statements that they believe are *not* evidence. While student responses will vary, Statements 3 and 7 do not provide any evidence and can be crossed out. Seven statements (1, 2, 5, 6, and 8–10) provide evidence in support of the theory.

Statement 4 is more challenging. It makes a claim about the size of the continents that is relative (they are large) in order to support the idea that the continents have never moved. Some students may agree, while others may dispute the claim by pointing out that Australia is a relatively small continent and it could move.

FOLLOW-UP

3. Relate continental drift to previous activities.

After students have completed the Procedure, use Question 1 to discuss how particular statements provided evidence for continental movement.

Display Transparency 40.2, "Puzzle Key." Discuss how the fossil and rock layers provide evidence for continental movement. You may want to refer to Statement 10 (about earthworm fossils) and go back to Procedure Step 5 and the Key to Symbols on the World Puzzle of Activity 40, "The Continent Puzzle," in the Student Book to review some of the fossil evidence that has been found to date. Note that this information will be presented again in the next activity.

4. (UC, SI ASSESSMENT, LITERACY) Students write a paragraph on continental drift.

Be sure to review Question 1 before assigning Question 3. Question 1 provides an opportunity to determine if students understand the evidence and how it supports continental movement.

When assigning Question 3, explain to students that they should write a complete paragraph. You may want to have them write a first draft and then continue to revise their work. If students need additional support, provide Student Sheet 41.2, "Writing Frame: Continental Movement." Student responses can be used to assess their understanding of the movement of continents using the UNDERSTANDING CONCEPTS (UC) Scoring Guide and/or can be assessed for clear and logical communication using the ORGANIZING SCIENTIFIC IDEAS (SI) Scoring Guide.

Name _____ **Date** _____

Analyzing Evidence: Continental Drift

Is it evidence?		Statements	Does it support the idea that the continents have moved?	
Yes	**No**		**Yes**	**No**
		1. 1858: Geologist Eduard Seuss points out that fossils of the *Glossopteris* plant are found in southern Africa, South America, Australia, Antarctica, and India.		
		2. Wegener examines the location of tiny rocks and the direction of grooves formed by large glaciers scraping across southern areas of Africa, South America, Australia, Antarctica, and India. He concludes that if all these places were fitted together, they would form a continuous ice sheet expanding outward in all directions.		
		3. *Frankfurt News*, January 6, 1912: Announcement that German scientist Alfred Wegener will speak at the Geological Association meeting.		
		4. *Popular Geology* magazine, March 12, 1912: "Continents are so large they must always have been where they are."		
		5. Wegener observes that a South American mountain range in Argentina lines up with an ancient African mountain range in South Africa when the two continents are placed together. He writes: "It is just as if we were to refit the torn pieces of a newspaper by matching their edges and then check whether the lines of print ran smoothly across. If they do, there is nothing left but to conclude that the pieces were in fact joined in this way."		
		6. 1927: Geologist Alexander du Toit observes rock layers on the western coast of Africa in the following sequence: basalt rock, shale containing fossil reptiles, coal layers containing *Glossopteris* fossils, rocks containing *Mesosaurus* fossils, and shale. He discovers an almost identical sequence of rock layers on the eastern coast of South America.		
		7. 1944: Geologist Baily Willis calls Wegener's theory a fairy tale. He says it seems impossible that the continents could move.		
		8. 1965: Geologist Edward Bullard uses computers to match coasts of South America and Africa. They match extremely well at an ocean depth of 1,000 meters.		
		9. 1980s: Satellites and lasers are used to measure the movement of continents. They continue to move at an average of about 2 cm (0.8 in) per year.		
		10. Fossils of *Megascolecina* earthworms are found in South America, Africa, India, and Australia, as well as the islands of Madagascar and New Guinea.		

Name _____ **Date** _____

Writing Frame: Continental Movement

Continental drift is the idea that _____

_____

_____

_____

This idea was first suggested by _____

in _____ (year). He called the single large continent _____.

Today, there are many different kinds of evidence that support continental movement. The evidence includes:

1. _____

_____

_____

2. _____

_____

_____

3. _____

_____

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