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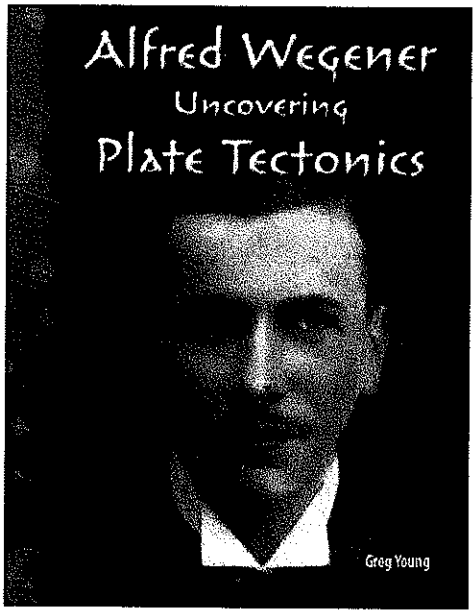
Science Readers

Lesson Plans for

Alfred Wegener: Uncovering Plate Tectonics



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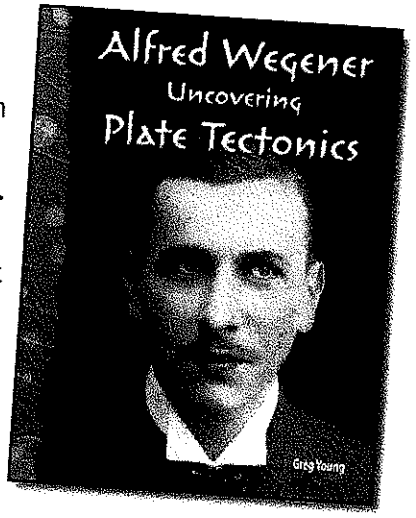
Alfred Wegener: Uncovering Plate Tectonics



Learning Objectives

Students will use strategies to monitor comprehension. (Nonfiction Reading Objective)

Students will use descriptive language to clarify and enhance ideas. (Narrative Writing Objective)

Students will explore concepts of plate tectonics. (Science Content Objective)

Materials

- writing paper and pencils
- *The Earth's Land Through Time* transparency
- *The Earth's Land Through Time* activity sheet (page 130)
- *The Geological Study of Greenland* activity sheet (page 131)
- *An Island Nation* activity sheet (page 132)
- materials for Lab (page 118)
- *Reader Quiz* (page 133)

Before Reading

Complete the Introductory Activity (page 114) with the whole class. Then divide the students into reading groups. The students who read this book should be reading on or below level.

Begin the lesson by asking students to discuss problems they sometimes have when trying to understand text they are reading. What do they do when they don't understand words or concepts?

Tell students that there are many strategies that can be employed to monitor comprehension and better understand what they read. Explain that understanding new vocabulary words is one way to assist readers. Spend time reviewing new words and concepts from the glossary on page 30.

Next, engage students in discussion about effective strategies for **monitoring comprehension**, such as asking questions, locating resources to clarify new concepts, and relating new information to prior knowledge.

Tell students that they should make efforts to be active readers. This means that they actively participate with the text by questioning, thinking of examples, identifying interesting facts, etc. Explain that readers often encounter things they don't understand. When this happens, a reader should ask a question such as, "What did the author mean by that?" or "How does that information relate to what the author mentioned in previous sentences or paragraphs?"

Before Reading *(cont.)*

Read aloud the first two paragraphs on pages 4 and 5. Then demonstrate the question-asking strategy by saying, "What does **expedition** mean?" Continue with the following self-talk: *Okay, what did the previous text say? It said Wegener loved to explore and that he wanted to explore Greenland. Then it said he went on a great expedition. Maybe expedition means that he went exploring. That makes sense, but I could also check the definition in a dictionary.*

Tell students that talking through the information can help them to make sense of the text and encourage them to try this when they read.

During Reading

Have students divide into pairs to read *Alfred Wegener: Uncovering Plate Tectonics*. Encourage pairs to work together to discuss words or concepts that are new or confusing to them.

Discuss how a theory becomes accepted as true. Reread pages 14 through 19 about Alfred Wegener's theory and why he was unable to prove it.

Display the data table on the *Earth's Land Through Time* transparency. Discuss the difference between an eon, era, and period. How many are shown on the table? For each period, read the changes to the Earth. How does the information in the table compare to the information they read in the book? What new information did the students learn?

Distribute *Earth's Land Through Time* (page 130) to students. Read the beginning information and discuss the illustrations together. Then allow time for students to complete the activity sheet with partners. Following, discuss how scientists know about all the changes in the Earth. Might this information change as they learn more?

Ask the students the following questions:

- What was the most interesting information you read about Alfred Wegener?
- What were his science interests?
- How did he get started as a scientist?
- What is a theory?
- For what is Wegener best known?

After Reading

Review the information in the text and ask students what they would say to briefly communicate the message of the book. Note that the author presented a lot of information and big concepts. Explain that when conveying this information to others, it is important to use examples to assist others in understanding it.

Instruct each student to write a descriptive summary of the reader. Have each student highlight the most important pieces of information and to use examples to make the concepts clearer for readers.

Ask the students if they have ever explored an unknown place. Discuss Alfred Wegener's passion for exploring and compare his adventures to the students' treks. Have students scan pages 4 through 11 and 20-21 for the word "Greenland," then make notes on how this island nation is important. Allow time for students to share the facts they found from scanning.

Distribute *The Geological Study of Greenland* (page 131) to students. Review the facts and map and discuss the information. Then allow time for students to complete the activity sheet. (The first question asks students to calculate a percent. The class may need to review this skill before moving on.) Then discuss the last question: Who wants to explore Greenland?

Discuss how volcanoes are related to **plate tectonics**. Reread page 19 with students about volcanologists. Discuss how the study of volcanoes helps scientists learn more about the Earth and plate tectonics.

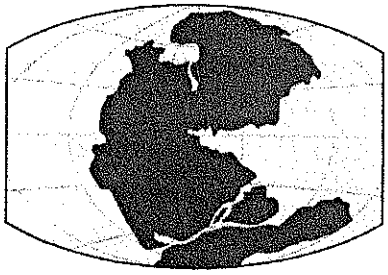
Distribute *An Island Nation* (page 132) to students. Review the information and map together. Allow time for students to complete the activity sheet independently. Following, discuss whether the students think they may hear of new islands formed from volcanic activity in their lifetime.

A short *Reader Quiz* is provided (page 133). Use this to assess your students' understanding of the reader.

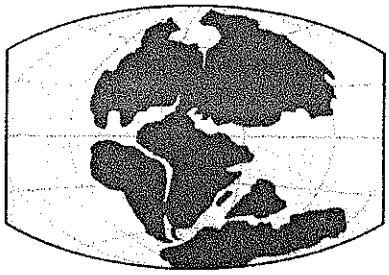
Finally, gather the students back together in a whole group to have them complete the lab activity (pages 117–118) and the Concluding Activity (page 115).

Earth's Land Through Time

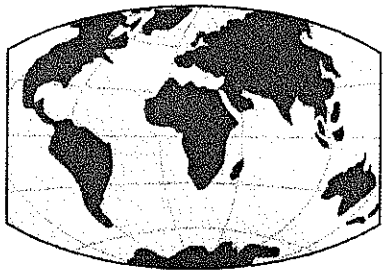
Alfred Wegener was the first scientist to state the theory that at one time all the Earth's land was connected. His theory was not proven until after his death. The illustrations show the changes in the Earth's landmasses over time.



PERMIAN PERIOD
225 MILLION YEARS AGO



TRIASSIC PERIOD
200 MILLION YEARS AGO



PRESENT DAY

Directions: Use the information in the table on the transparency and what you read in *Alfred Wegener: Uncovering Plate Tectonics* to answer the questions.

1. During what eon and era did stable continents appear? _____ era, _____ eon

2. Pangaea was not the first supercontinent according to today's science. What was?

3. Besides the shape and location of landmasses, what else has changed over time for Earth?

4. When did the first supercontinent split?

5. When did Pangaea break apart? _____ period, _____ era, _____ eon

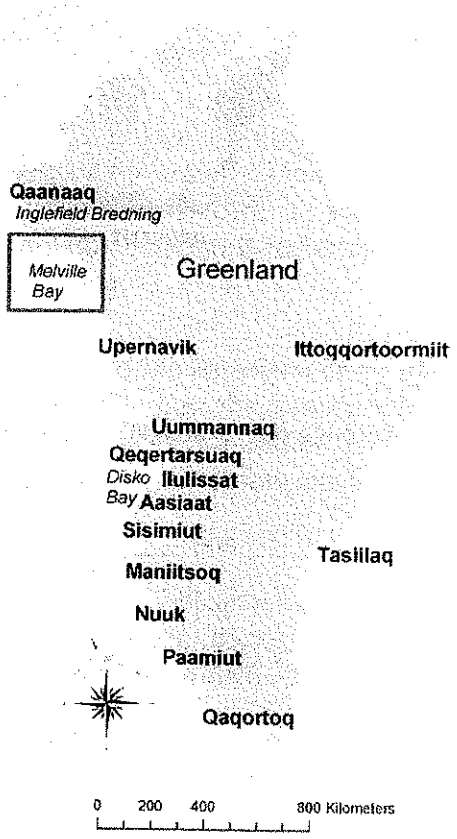
6. Why could Alfred Wegener not prove his theory of a supercontinent?

7. How many plates make up the Earth's crust today?

The Geological Study of Greenland

Alfred Wegener explored and studied Greenland. This helped him learn more about the Earth. Greenland is a large island. Much of it is covered with ice. Its rocks are very old and help scientists study the history of the Earth.

Directions: Read the facts and information below about Greenland. Use this information and what you read in *Alfred Wegener: Uncovering Plate Tectonics* to answer the questions.



- Greenland split from North America about 65 to 55 million years ago.
- Greenland is the largest island in the world.
- Its total area = 2,166,000 square kilometers.
- Only about 410,000 square kilometers are exposed rock.
- The rest is covered in ice, sometimes 3km thick.
- Greenland holds 10% of the world's fresh water.
- The coastline is always cooled by cold ocean currents.
- The ice on Greenland cools the land, as well.
- Greenland has the oldest rocks, dated 3,700 million years old.
- Most of the earth under Greenland is 1,600 million years old.
- Glaciers have shaped the land.
- Scientists have also found evidence of earthquakes, volcanoes, and mountains.

1. About what percent of Greenland is ice?

2. How can Greenland hold so much fresh water?

3. Why might scientists have found evidence of volcanoes and earthquakes as part of the formation of Greenland?

4. Why did explorers name this area Greenland?

5. What did Wegener learn by exploring Greenland?

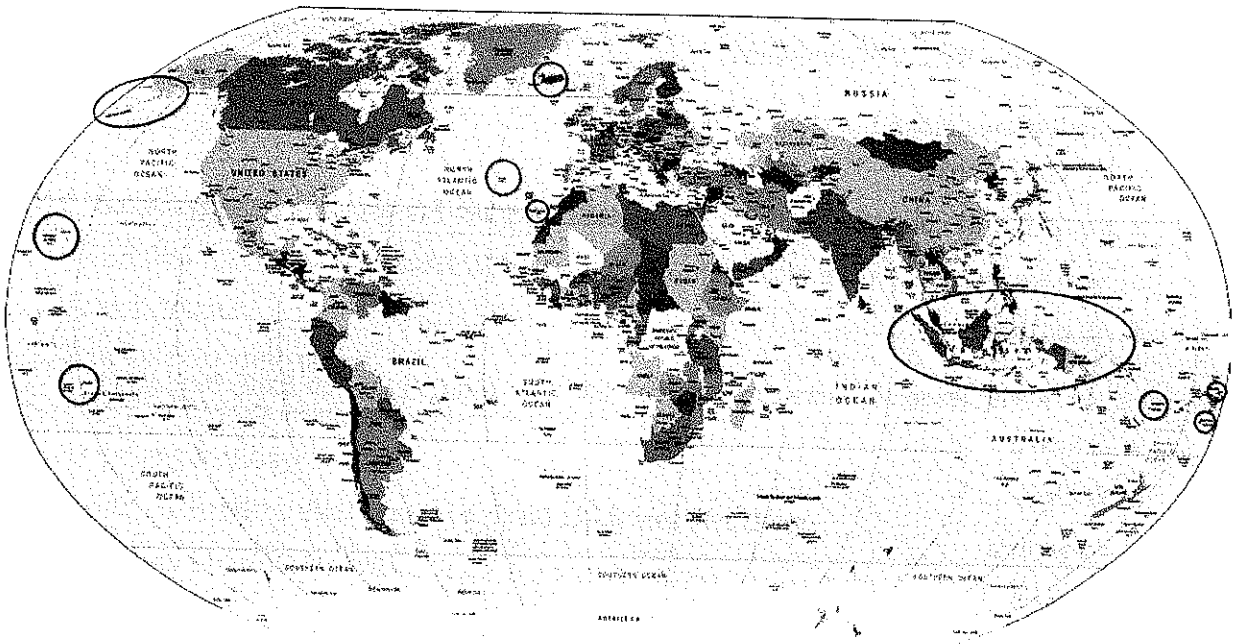
6. Why do you think Wegener was so determined to explore Greenland?

7. Is Greenland a place you would want to visit? Explain.

An Island Nation

The Earth's landmasses are always changing. Plate tectonics cause both earthquakes and volcanoes, which change the shape of the Earth. Many volcanoes have caused new islands to form. Some of the islands that volcanoes have formed are shown on the map below.

Directions: Look at the map below. Find the islands that have been formed by volcanoes. Color them red on the map. Use the information from the map and what you read in *Alfred Wegener: Uncovering Plate Tectonics* to answer the questions.



1. What pattern do you see from the islands formed by volcanoes?

2. What do scientists know about where volcanoes erupt?

3. Many other volcanoes erupt over land. How are these similar to the volcanoes that erupt in the ocean?

4. How can using wax help scientists study volcanoes?

5. How is Alfred Wegener's work a big help to volcanologists today?

Reader Quiz

Directions: Use what you learned from reading *Alfred Wegener: Uncovering Plate Tectonics* to choose the best answer for each question.

1. How did Wegener learn more about the Earth?
   a. He set a world record in a hot air balloon.
   b. He went to Greenland.
   c. He studied astronomy.
   d. He studied the Earth's weather.

2. How did Wegener share his ideas with others?
   a. He wrote books.
   b. He taught at college.
   c. He gave lectures on the movement of the Earth.
   d. All of these.

3. What did Alfred Wegener name the supercontinent he thought was on Earth long ago?
   a. Pangaea
   b. Rodinia
   c. Wegeneria
   d. Laurasia

4. Why was Wegener's plate tectonics theory not accepted by other scientists?
   a. The fossils on all the continents did not match.
   b. He didn't have enough evidence to support his theory.
   c. The gravity of the moon and sun were not powerful enough to support his theory.
   d. He was not a respected geologist.

5. What evidence of plate tectonics did other scientists find to support Wegener's theory?
   a. Plate tectonics explains volcanoes and earthquakes.
   b. There's a rift valley along the ocean floor.
   c. There is evidence of sea floor spreading.
   d. All of these

6. Compare Harry Hess's work to Alfred Wegener's work. Use details and examples from the book to explain your answer.

Alfred Wegener Answer Key

Earth's Land Through Time

1. Paleoproterozoic Era, Proterozoic Eon
2. Rodinia
3. The day is longer; glaciers have ended; the Moon was created.
4. Neoproterozoic Era, Proterozoic Eon
5. Triassic Period, Mesozoic Era, Phanerozoic Eon
6. He could not explain his idea with science.
7. 14

The Geological Study of Greenland

1. 1,756,000 ÷ 2,166,000 = about 81%
2. It is in the ice.
3. It is over tectonic plates.
4. It was greener than Iceland, where they came from.
5. Arctic meteorology
6. It was challenging terrain and he could study weather there.
7. Accept all justified answers.

An Island Nation

Check students' maps to be sure they colored the circles red.

1. They are in the oceans.
2. They are on the earth's plates.
3. They all form from lava under the Earth's crust.
4. They use it to experiment since the wax acts like lava and magma.
5. Answers will vary. Example: Alfred Wegener's work with the theory of plate tectonics helps scientists discover features beneath the Earth' surface that explain changes in the Earth's land.

Reader Quiz

1. d 2. d 3. a 4. b 5. d
6. Sample: Henry Hess taught geology. Alfred Wegener taught meteorology. Hess could do research at sea. Wegener had only the information he could get from land. Hess's work was accepted during his lifetime. Wegener died before he could see his theory accepted.

Lab Lesson Plan: An Eggsample Look Inside the Earth

Before the Lab

Review with students what they learned about tectonic plates and how they affect the layers of the earth.

Ask the students to summarize how earthquakes help scientists learn more about the earth as they relate to plate tectonics.

Introduce the Lab

Read the introductory paragraph with students.

Read the list of materials. Provide each lab group with the necessary materials, or have them ready to complete as a demonstration lesson in front of the class.

Read through the procedure with the class at least once completely before having students engage in the lab. Check for understanding of the required steps.

Have students predict how the core sample will look once it is pulled from the egg, and how it will compare to the egg when they cut it open.

Conduct the Lab

Allow time for lab groups to conduct the lab, or follow the steps as a class if conducting a demonstration lab.

Instruct students to illustrate their predictions (Step 7).

After the Lab

Instruct students to write a summary sentence comparing their core sample prediction with the actual egg.

Discuss how this simulation is similar to and different from the data scientists obtain from studying earthquake data.

Lab: An Eggsample Look Inside the Earth

Geologists dig deep to get an idea of what Earth looks like inside. Unfortunately, they cannot dig all the way to the core. However, geologists can use earthquakes to help them "see" inside Earth. When an earthquake happens, it sends shock waves through the planet. Earthquake waves travel differently when they pass through liquids and solids. A geologist can tell if it was solid or liquid material that the waves passed through when they receive earthquake data. By recording a number of earthquakes, geologists have a pretty good idea of what our Earth looks like inside. A core sample would be more accurate, but is not possible today. To get an idea of a core sample, try this experiment. You will drill core samples from an egg to see what it looks like inside.

Materials

- hard-boiled egg
- clear plastic drinking straw
- plastic knife
- scissors

Procedure

Crack and peel the shell off the hard-boiled egg.

Hold the egg in one hand and insert the straw into the top of the egg with your other hand. Slowly but firmly, press the straw through the center of the egg and out the other side.

When the straw exits the other side of the egg, you will see parts of the egg in the straw. This is your core sample. As you continue to push, you will see a part of the straw that doesn't have any egg in it. Cut the straw at this point.

Pull the remaining part of the straw out of your egg. You can dig another core sample from a different location on your egg with the rest of the straw. Try entering the egg from a different angle.

Again, when the straw exits the egg, cut it off when you no longer see any core sample inside it.

Use your scissors to cut open your straw pieces. Examine your core samples.

Draw a picture of what you think your egg looks like inside, based on your core samples.

When you have drawn your picture, slice the egg open with the plastic knife to see how close your drawing is to the actual egg.

Alfred Wegener: Uncovering Plate Tectonics

Earth's Land through Time

Notable Changes to Earth	Period	Era	Eon
A dwarf planet named Theia crashes into the Earth; debris forms the Moon. Meteorites fall on Earth constantly.			Hadean (4500–3800 Ma*)
Mantle cools; tectonic plates form.	Eoarchean (3800–3600 Ma)		Archaean (3800–2500 Ma)
	Paleoarchaean (3600–2500 Ma)		
	Mesoarchaean (3200–2500 Ma)		
	Neoarchaean (2800–2500 Ma)		
Continents stabilize. Oxygen-producing bacteria appear.	Paleoproterozoic (2500–1600 Ma)		Proterozoic (2500–542 Ma)
Supercontinent of Rodinia forms.	Mesoproterozoic (1600–1000 Ma)		
Length of day = 18 hours; Rodinia breaks up; Pannotia forms.	Neoproterozoic (1000–542 Ma)		
Complex organisms appear.	Cambrian (542–488 Ma)	Paleozoic (542–251 Ma)	Phanerozoic (542 Ma – present)
Ice age begins.	Ordovician (488–444 Ma)		
Earth's climate becomes stable.	Silurian (444–416 Ma)		
Supercontinent Pannotia splits into Laurasia and Gondwana.	Devonian (416–359 Ma)		
Tectonic plates collide, creating mountain ranges.	Carboniferous (359–299 Ma)		
Supercontinent of Pangea forms.	Permian (299–251 Ma)		
99% of all life dies in the Permian-Triassic Event.	Triassic (251–199.6 Ma)	Mesozoic (251–65 Ma)	
Pangea breaks apart into North America, Europe, and Gondwana.	Jurassic (199.6–145.5 Ma)		
Gondwana breaks into South America, Antarctica, and Australia.	Cretaceous (145.5–65.5 Ma)		
Rocky Mountains and Himalayas form.	Paleogene (65.5–23.03 Ma)	Cenozoic (65 Ma–Present)	
Land bridges between Alaska and Siberia; End of last major glaciers. Modern humans first appear.	Neogene (23.03 Ma–present)		

*Ma is the abbreviation for mega-annum or one million years.

Geological Timescale