NTTI

NTTI Media-Rich Lesson

Lorrie D. Green

NAME

The Continental Slide

LESSON TITLE

5th Graders

GRADE LEVELS

120 minutes

TIME ALLOTMENT

OVERVIEW

The idea that continents, such as, South America and Africa, fit together like pieces of a jigsaw puzzle began with improved world maps. Little attention was given to this idea until Alfred Wegener, A German meteorologist and geophysicist, published *The Origin of Continents and Oceans*, in 1915. In this book, Wegener introduced his radical hypothesis of continental drift. Wegener suggested that a **supercontinent** he called **Pangaea** meaning "*all land*" once existed about 200 million years ago. This supercontinent began to break apart into smaller continents, which then "*drifted*" to their present position. Wegener and others collected evidence to support their claims. The fit of South America and Africa, and the geographic distribution of fossils, rock structures, and ancient climates all seemed to support the idea that these, currently, separated landmasses were once joined.

SUBJECT MATTER

Earth Science and Social Studies

LEARNING OBJECTIVES

Students will be able to:

- Explain the theory of continental drift and give four pieces of evidence to support it.
- Use the seven continents (puzzle pieces) to re-form a supercontinent/Pangaea.
- Simulate how geologic clues can be used to provide evidence for the theory of continental drift.
- Debate whether they think California is drifting towards Alaska.

STANDARDS

Georgia Quality Core Curriculum Standard #27: Explores and discusses change in the Earth's surface due to plate tectonics.

MEDIA COMPONENTS

Websites

Videoclip - Introduction to Continental Drift -
http://peachstar.unitedstreaming.com/login_peachstar.cfm (LOGIN REQUIRED)

Videoclip - History of Plate Tectonics -
http://peachstar.unitedstreaming.com/login_peachstar.cfm(LOGIN REQUIRED)

World Map - http://go.hrw.com/atlas/norm_htm/world.htm, **or Globe.**

Debate / Assessment - http://kids.earth.nasa.gov/archive/pangaea/conclusion.html
- Students participate in a debate about whether California is drifting toward Alaska.

How to get started with debate -
http://www.triviumpursuit.com/speech_debate/what_is_debate.htm
- Backgound information about debate.

Literature

Our Patchwork Planet. Helen Roney Sattler. Illustrated by Giulio Maestro and with photographs. Lothrop. 48pp. ISBN trade: 0-688-09312-4; library: 0-688-09313-2, $15.93.

Earth's Fiery Fury. Sandra Downs. Illustrated with photographs. Twenty-First Century Books/Millbrook Press. 64pp. Library ISBN 0-7613-1413-X.

MATERIALS for groups of 4 students

- One puzzle set – each of the seven continents on cardstock and cut-out
- Ziploc bags (one bag per group)
- Markers
- Tape
- Clay (6 different colors)
- 5-10 small (0.5 – 1.0 inch) animals(shells, feathers, bones) – four different kinds
- 5-10 small (0.5 – 1.0 inch) rocks – three different kinds
- 5-10 small (0.5 – 1.0 inch) plants – four different kinds
- large construction paper – a color that will contrast with the color of the continent pieces

TEACHER PREP

Prior to teaching this lesson, do the following:

Engage & Explain – Technology Prep

- Obtain a computer, projector, and screen.
  (Note: You may require speakers as well according to the volume of your projector)
- Bookmark the websites used in the lesson on each computer in your classroom.
- Download (or bookmark) the two video clips to all computers involved in the lesson.

Explore – Proving Pangaea

- Build a three-layer landmass using clay. Mold the clay into mountain ranges. Place similar "fossils" into the clay at various locations around the landmass. Form five continents from the one landmass. Also, form two smaller landmasses out of different mountain ranges and fossils. Place the five continents and two smaller landmasses around the room. (Before students enter the classroom.)
- Make a set of landmasses for each group. When several groups are participating in this activity, place a number/name on each landmass (seven pieces) that corresponds to the group number/name.

Explore - Pangaea Puzzle

- Obtain cut outs of the seven continents on cardstock. Place the pieces into a Ziploc bag.

Elaborate – Great Debate

- Review how to start a debate.
  http://www.triviumpursuit.com/speech_debate/what_is_debate.htm

INTRODUCTORY ACTIVITY (Engage) – Video clip

Step 1
Provide students with a **Focus for Media Interaction**, by asking students **"How do we know that the earth is constantly changing?"** Wait for them to respond and discuss their responses.

Step 2
Leave the lights on and direct students to view the **Introduction to Continental Drift** - *video clip*. **Play** the clip about continental plates, and **Stop** the video clip.

Step 3
Write your responses on Handout 1 – The Continental Drift Worksheet. Discuss information presented in the videoclip.

LEARNING ACTIVITY 1 (Explore) – Pangaea Puzzle

Hands-On Activity:
Step 1
Tell students: "**Scientist believe that the earth's crust is made of similar "puzzle" pieces that were once joined together into one landmass. Do you believe that the continents were once joined together into one landmass?"**

Step 2
Begin by grouping students to complete this activity, and have available for each group a ziploc bag with the seven continent puzzle pieces in it. Direct groups to put the seven continents together to represent where the group believes they were connected.

Step 3
Label the continents and tape everything (the supercontinent) to a piece of construction paper.

Step 4
Ask students the following: **Can you think of other examples in which characteristics of objects are used to match them up with other objects?**
Allow time for students to prepare to present their landmass and explain their rationale to the class.

LEARNING ACTIVITY 2 (Explore) – Video Clip

Step 1
Give students *Handout 1 – The Continental Drift Worksheet* and have them preview the questions. Provide students with a **Focus for Media Interaction**, by asking students the following:

" Who developed the theory of continental drift?"
"What is Pangaea?"

"What evidence is there to support this theory of continental movement?"
Tell students: " **Let's find out and also see if we found similar results as another class."**

Step 2
Leave the lights on and direct students to view the **History of Plate Tectonics** –*start the videoclip.* **Play** the clip on Plate Tectonics and **Stop** the video clip.

Step 3
Ask students: **"Did the other classroom have similar results as us when they tried to pieces the continents together?"** Wait for their responses and discuss their responses.

Step 4
Have students answer the following questions, on *Handout 1 – The Continental Drift Worksheet*, and/or write the answers in complete sentences and put them on your poster.

CULMINATING ACTIVITY (Explain) - Proving Pangaea

Step 1
Say to students, "**Can you prove how the continents on Planet Shnitzel were once joined?**

Step 2
Have groups locate the drifted continents of Planet Shnitzel. Have them construct a drawing that shows how the continents were once positioned, and have groups provide evidence to support their drawing.

Step 3
Have groups present their drawing to the class, and identify the strategies they used to re-construct the original landmass?

ASSESSMENT ACTIVITY (Evaluate) – Continental Drift Concept Map

Step 1
Have individual students make a concept map that discusses the ***Evidence for continental drift*** using the following terms and phrases.

Continental edges	***mountains with similar features***	***same fossils***
Puzzles pieces	***continental ice sheets***	***on different continents***
Climate	***rock structures***	

Step 2

Review the concept map, *Handout 2 – Evidence for Continental Drift,* and any misconceptions about continental drift.

EXTENDING ACTIVITY (Elaborate) - The Great Debate

Step 1
Divide students into two groups and have students read background information on Continental Drift. Have students prepare a comprehensive bibliography, collect as much material as possible, and read and study the material discovered.

Step 2
Facilitate a debate between the two groups.

Step 3
Debate question: **California is drifting toward Alaska. Do you believe it or not?**

Step 4
After the debate, provide a **Focus for Media Interaction** by having students go to **Why Should Continental Drift Matter to Me?** (http://kids.earth.nasa.gov/archive/pangaea/conclusion.html) and compare NASA's results with yours.

CROSS-CURRICULAR EXTENSIONS

Language Arts
Pretend you are Alfred Wegener in the year 1912. Write a letter to another scientist explaining your idea about continental drift. Try to convince this scientist that your theory is correct.

Math
Movement of the continents is about 2.1 centimeters per year. If the continents continue to move apart at this rate, how far will they move in 1000 years? *21 meters*
In 15,500 years? *325.5 meters*

COMMUNITY CONNECTIONS

- A **lawyer** will provide real-life application for providing evidence to support a belief.
- A **scientist** will provide real-life application to using the scientific method to solve problems.
- A **forensic scientist or detective** will provide real-life application to using clues to solve problems.

STUDENT MATERIALS

NTTI Media-Rich Lesson Planning Guide

Title Continental Slide

Time Allotment 120 minutes

Grade Level(s) 5th grade

Overview
The idea that continents, such as, South America and Africa, fit together like pieces of a jigsaw puzzle began with improved world maps. Little attention was given to this idea until Alfred Wegener, A German meteorologist and geophysicist, published *The Origin of Continents and Oceans*, in 1915. In this book, Wegener introduced his radical hypothesis of continental drift. Wegener suggested that a **supercontinent** he called **Pangaea** meaning "*all land*" once existed about 200 million years ago. This supercontinent began to break apart into smaller continents, which then "*drifted*" to their present position. Wegener and others collected evidence to support their claims. The fit of South America and Africa, and the geographic distribution of fossils, rock structures, and ancient climates all seemed to support the idea that these, currently, separated landmasses were once joined.

Subject Matter Earth Science & Social Studies

Learning Objectives
Students will be able to:

- Explain the theory of continental drift and give four pieces of evidence to support it.
- Use the seven continents (puzzle pieces) to re-form a supercontinent/Pangaea.
- Simulate how geologic clues can be used to provide evidence for the theory of continental drift.
- Debate whether they think California is drifting towards Alaska.

Standards
Georgia Quality Core Curriculum Standard #27: Explores and discusses change in the Earth's surface due to plate tectonics.

Media Components Video
None

Media Components - Web

Videoclip -Introduction to Continental Drift -
http://peachstar.unitedstreaming.com/login_peachstar.cfm (LOGIN REQUIRED)

Videoclip - History of Plate Tectonics -
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Prep for Teacher

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Explore – Proving Pangaea

- Build a three layer landmass using clay. Mold the clay into mountain ranges. Place similar "fossils" into the clay at various locations around the landmass. Form five continents from the one landmass. Also, form two smaller landmasses out of different mountain ranges and fossils. Place the five continents and two smaller landmasses around the room. (Before students enter the classroom.)
- Make a set of landmasses for each group. When several groups are participating in this activity, place a number/name on each landmass(seven pieces) that corresponds to the group number/name.

Explore - Pangaea Puzzle

- Obtain cut outs of the seven continents on cardstock. Place the pieces into a Ziploc bag.

Elaborate – Great Debate

- Review how to start a debate

Introductory Activity *(remember to number each step)* Materials
(Engage) – Introduction to Continental Drift -*video clip*.

Learning Activities *(remember to number each step)* Materials
(Explore) – Pangaea Puzzle

- One puzzle set – each of the seven continents on cardstock and cut-out
- Ziploc bags (one bag per group)
- Markers
- Tape

(Explore & Explain) - **History of Plate Tectonics** – *video clip.*

Culminating Activity *(remember to number each step)* **Materials**

(Explain) - Proving Pangaea

- Markers
- Tape
- Clay (6 different colors)
- 5-10 small (0.5 – 1.0 inch) animals – four different kinds
- 5-10 small (0.5 – 1.0 inch) rocks – three different kinds
- 5-10 small (0.5 – 1.0 inch) plants – four different kinds
- large construction paper – a color that will contrast with the color of the continent pieces

Assessment *(remember to number each step)* **Materials**

(Evaluate) – Continental Drift Concept Map

- Markers
- Large construction paper – a color that will contrast with the color of the continent pieces

Culminating Activity *(remember to number each step)* **Materials**

(Elaborate) - The Great Debate

- Research books, Internet, etc.

Cross-Curricular Extensions

Language Arts

Pretend you are Alfred Wegener in the year 1912. Write a letter to another scientist explaining your idea about continental drift. Try to convince this scientist that your theory is correct.

Math

Movement of the continents is about 2.1 centimeters per year. If the continents continue to move apart at this rate, how far will they move in 1000 years? *21 meters*
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Community Connections

- A **lawyer** will provide real-life application for providing evidence to support a belief.
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Student Materials


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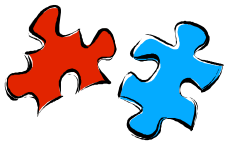
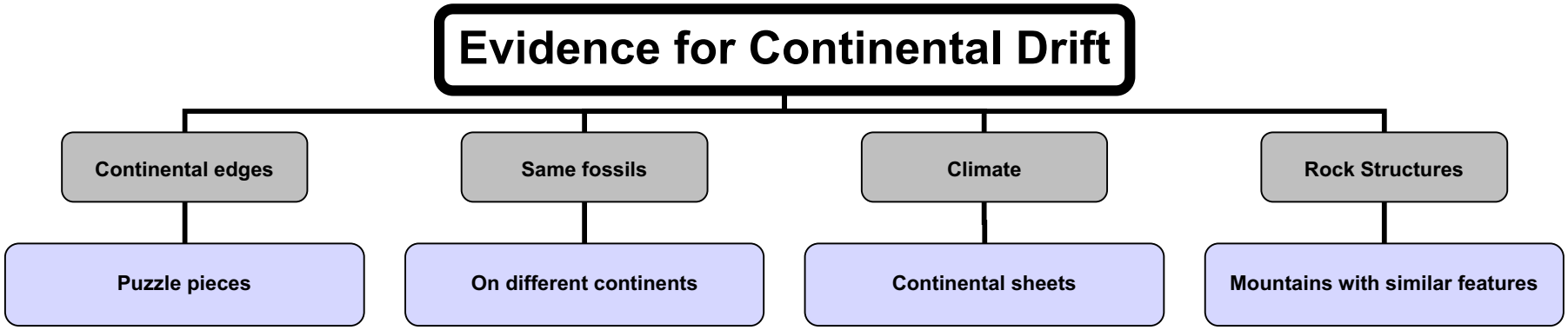
Handout 1
The Continental Drift Worksheet



How do we know that the earth is constantly changing?	**What is Pangaea?**
Why you believe or do not believe the continents were once joined together?	**What evidence for there to support the theory of continental drift?**
Can you think of other examples in which characteristics of objects are used to match them up with other objects?	**Can you prove how the continents on Planet Shnitzel were once joined? How?**
Who developed the theory of continental drift?	**Identify the strategies you use to re-construct the original landmass?**

Handout 2
Evidence for Continental Drift



Continental Slide NTTI Lesson

5E Model	Activities	Strategies	Resources	Time
Engage	**Focus for Media Interaction** **Introduction to Continental Drift** - Ask students **"How do we know that the earth is constantly changing?"**	Video clip	•	.05
Explore 1	**Pangaea Puzzle** **Why you believe or do not believe the continents were once joined together?** Cut out the seven continent pieces and assemble the supercontinent/pangaea. Label the continents.	Assemble puzzle	• Seven continent pieces • Scissors • Large construction paper	.15
Explore 2	**Focus For Media Interaction** **History of Plate Tectonics** – Have students answer the following questions, in complete sentences, and put them on your poster: **Who developed the theory of Continental Drift?** **What is Pangaea?** **Discuss three pieces of evidence for the theory of Continental Drift?**	Questioning skills	• Video clip	.20
Explain	**Proving Pangaea** Ask students, "**Can you prove how the continents on Planet Shnitzel were once joined?** Have students construct a drawing that shows how the continents were once positioned, and have groups provide evidence to support their drawing.	Hands-on	• One puzzle set – each of the seven continents on cardstock and cut-out • Ziploc bags (one bag per group) • Markers • Tape • Clay (6 different colors) • 5-10 small (0.5 – 1.0 inch) animals(shells, feathers, bones) – four different kinds • 5-10 small (0.5 – 1.0 inch) rocks – three different kinds • 5-10 small (0.5 – 1.0 inch) plants – four different kinds • large construction paper – a color that will contrast with the color of the continent pieces	.30
Evaluate	**Concept Map** Have students make a concept map that discusses the ***Evidence for continental drift***	Concept map • ***Continental edges*** • ***Mountains with similar features*** • ***Same fossils*** • ***Puzzles pieces*** • ***Continental ice sheets*** • ***On different continents*** • ***Climate*** • ***Rock structures***	• Markers or pens • copy paper	.20
Elaborate	**California is drifting toward Alaska?** Facilitate a debate between the two groups		• Research articles and books	.30

The Great Debate

Before you debate, follow these four steps:

1. **Read for background information about the subject.**
2. **Prepare a comprehensive bibliography.**
3. **Collect as much material as you can find.**
4. **Read and study the material discovered.**

Debate Question:

California is drifting toward Alaska. Do you believe it or not?

(Teacher Background)

How does the development of plate tectonics follow the scientific method?

1. Wegener gathered sets of observations on the distribution of rock types, fossils, glaciation, and climate zones. He searched for a common explanation to relate these diverse features and phenomena.

2. Wegener hypothesized that the present-day continents were in different positions in the geologic past. By reassembling the continents into a single supercontinent, he explained the distribution of rock types, glaciation, and fossils. The drift of the continents over the surface of the Earth with time explained the distribution of climate zones.

3. Wegener also proposed that continents plowed through oceanic crust. However, other geologists knew this to be impossible because of the strength of rock. Wegener's hypotheses, although satisfactory in many respects, could not explain all the observations. It was not until new methods of testing continental drift (and sea floor spreading) were introduced that plate tectonics gained acceptance. For example, it was predicted that the age of rocks increased away from mid-ocean ridges. Dating methods for rocks proved this prediction true.

4. Plate tectonics has been rigorously tested from numerous subdisciplines in geology. Most geologists accept these tests as verification of plate tectonics. Successful testing and widespread acceptance elevates plate tectonics from a hypothesis to a theory.

(Teacher Background)

Why Should Continental Drift Matter to Me?

Some scientists studying these rocks suspect that the Earth has had several supercontinents throughout time. These supercontinents all went through a cycle similar to pangaea's. Perhaps 200 million years in the future, people in America won't need to cross the Pacific Ocean to reach Asia. What can scientists predict about some of the features of the Earth existing today? Quite a lot. The Atlantic Ocean will continue to expand, while the Pacific Ocean (originally Panthalassa Ocean) will shrink. Eventually, the Mediterranean Sea (remnant from the Tethys Sea) will disappear, connecting Africa with Europe. India will continue to push into the southern Asian continent, pushing the Himalayas higher. Meanwhile the city of Los Angles will continue its journey north to join with the city of San Francisco. This will take several million years to occur. Maybe in another 200 million years there will be no need for a transoceanic trip from America to Asia. Let's all stick around to find out, ok

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Responsible NASA Official: Sharron Sample
Curator: SAIC Information Services


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