Plate Detectives: Putting Pangaea Back Together

Teacher		**Class**	Grade 8
Subject	Science	**Topic**	Plate tectonics
Date		**Room**	
Lesson length	60 minutes	**Country**	United States

Students analyze fossil, rock, shape, and seafloor clues for past plate motion. They rebuild Pangaea from paper clues and defend their reconstruction.

Curriculum links

- Analyze and interpret data on the distribution of fossils and rocks, continental shapes, and seafloor structures to provide evidence of the past plate motions.

Learning objectives

- Students will use fossil and rock matches to infer past continent positions.
- Students will use continental shape fits to support past plate motion claims.
- Students will explain how new seafloor forms at ridges and moves plates.

Success criteria

- I can match fossils and rocks across oceans to rejoin continents.
- I can describe how shape fit supports past plate movement.
- I can explain how seafloor data shows plates move apart.

What students already know

Show Slide 4 and ask: what do you notice about South America and Africa? Listen for puzzle-piece fit.

Key words

Pangaea	a very old giant landmass that later split into today's pieces [10]
continental drift	slow movement of landmasses away from each other over time [10]
fossil distribution	where the remains of ancient living things are found [4]
seafloor spreading	making of fresh ocean floor at a ridge that then moves sideways [10]
subduction zone	place where one sinking plate goes down under another plate [10]

Materials

- Slides 1-12 with projector and speakers
- paper continent cutouts, clue sheet with fossil and rock key, crayons, glue
- Worksheet Task E (Pangaea rebuild) and Task D (rank evidence), one per student
- rulers and pencils for sketching fit

Before the lesson

- Print paper continent cutouts, clue sheets, and Worksheet Tasks D and E for pairs
- Test Slide 6 with Video clip 1 (0:00-4:36) and Slide 8 with Video clip 6 (1:00-5:40)
- Set out crayons, glue, rulers and pre-match one edge for support sets

Lesson outline

0–8 min **Starter** 8 min · Whole class

Hook interest in shape fit and set up the Pangaea detective task.

YOU DO

1. Show Slides 1-2 and read the objectives for matching fossil and rock data.
2. Say the hook and show Slide 4: South America and Africa look like torn puzzle pieces.
3. Model a quick fit with two cutouts along the continental shelf edge [3].
4. Ask what the fit suggests and what else would convince them besides shape.

STUDENTS DO

1. Study the projected coastlines and call out where they match.
2. Turn and tell a partner one other clue they would need, like rocks or fossils.
3. Share predictions to stretch thinking before the videos.

Say: You are the scientist with only paper clues. Can you put the world back together? South America and Africa look like torn puzzle pieces. If shape matches, what other clues would prove they once moved?

Worked example: Fit South America into Africa: 1. Line up the bulge of Brazil with the bend of West Africa. 2. Try a tighter fit along the edges of the continental shelves [3]. 3. Notice coastlines match in places but not perfectly, so shape alone is not enough.

Ask: What do you notice about South America and Africa? (They look like they could fit together like puzzle pieces [10].) · If they were joined, what should we also see? (Fossils and rocks line up too across the join.)

Check understanding: Thumbs up if you can name the task: rebuild past positions from clues. If unsure, replay the fit slowly and point to the matching bend.

Support: Show the two continents already roughly aligned so students only adjust the fit. **Stretch:** Have students predict what other data they would need besides shape to be convinced.

Use: Slides 1-4

8–20 min **Fossil and rock clues** 12 min · Whole class

Teach that matching fossils and rocks prove past positions better than shape alone.

YOU DO

1. Show Slide 5 vote on strongest clue and collect quick hands.
2. Play Video clip 1 (0:00-4:36) on Slide 6 for fossil matches and rock matches.
3. Explain that using shape is one type of evidence, same rock types is another, and same type and age fossils is yet another [4].
4. Model claim with Brazil and West Africa matching rock formations and similar fossils [10].

STUDENTS DO

1. Vote on strongest clue and watch the video for fossil and rock matches.
2. Copy the three evidence types: shape, rock type and age, fossil type and age.
3. Pair-share why swimming across today's ocean cannot explain land fossils on widely separated continents.

Say: Watch for fossil matches across oceans. Watch for rock matches across oceans. Listen for why shape alone is not enough. Wegener saw the same clues in far-apart places and said the lands must have moved.

Worked example: Claim that continents moved: 1. South America and Africa fit like puzzle pieces [10]. 2. Add matching rock formations in Brazil and West Africa [10]. 3. Add scattered fossils that form coherent patterns if continents are rejoined [4]. 4. Conclude lands were joined as Pangaea, which began to break apart 200 million years ago [10].

Ask: Why do matching fossils in Brazil and West Africa support past motion? (Same species could not cross a wide ocean, so continents were joined.) · Why is coastline fit alone not convincing? (Coasts erode and change, so we also need same rocks and same fossils.)

Check understanding: Mini whiteboards: name two fossil or rock facts that support joining. Reteach with the Brazil-West Africa example if many miss it.

Support: Give sentence starters like These rocks match because ___ with a labeled diagram to point to. **Stretch:** Ask students to explain why swimming across the ocean today could not explain land fossils on widely separated continents.

Use: Slides 5-6, Video clip 1 (0:00–4:36)

20–30 min **Seafloor proof** 10 min · Whole class

Show how new seafloor at ridges and old seafloor at trenches moves plates.

YOU DO

1. Show Slide 7 and have students feel 2 cm and 15 cm on rulers for yearly rate.
2. Play Video clip 6 (1:00-5:40) on Slide 8 to spot the ridge where new crust forms.
3. Explain conveyor-belt motion where rock cools, makes new crust, and spreads away from the ridge [10].
4. Contrast ridge creation with trench destruction where oceanic crust subducts and melts [13].

STUDENTS DO

1. Measure 2 to 15 centimeters to feel the yearly plate rate [10].
2. Track ridge and trench on the seafloor diagram and note youngest rock at ridge.
3. State to a partner where new crust forms and where old crust disappears.

Say: Spot the ridge where new crust forms. Notice oldest crust farthest from ridge. Plates creep only 1 to 6 inches per year, so small yearly moves add up to whole oceans over millions of years.

Worked example: At 2 to 15 centimeters per year [10]: 1. In 1 million years at 2 cm per year, new seafloor is 20 km wide. 2. In 100 million years, that is 2,000 km. 3. So slow motion can shift continents thousands of kilometers over millions of years. The mid-ocean ridge is 65,000 kilometers (40,390 miles) long and 1,500 kilometers (932 miles) wide [13] where magma rises and solidifies into basalt, forming new crust [13].

Ask: Where is crust youngest and where is it oldest? (Youngest at the ridge center, oldest farthest from the ridge.) · What happens to old ocean floor at a trench? (It subducts, melts, and cycles back into Earth [10].)

Check understanding: Fist-to-five on explaining conveyor motion. If low, redraw ridge with arrows outward and trench with one arrow down into a deep seafloor trench [13].

Support: Give a word bank with ridge, trench, new crust, and subduction to use in the claim. **Stretch:** Ask students to explain why the relatively young age of oceanic crust supports seafloor spreading [10].

Use: Slides 7-8, Video clip 6 (1:00–5:40)

30–50 min **Draw Pangaea From Clues** 20 min · Pairs

Reconstruct Pangaea from shape, fossil, rock, and seafloor clues in pairs.

YOU DO

1. Show Slide 9 and hand out cutouts, clue sheet, crayons, glue, and Worksheet Task E.
2. Model arranging two pieces using the key, then coloring matching fossil belts the same color.
3. Circulate as pairs fit South America and Africa like puzzle pieces [10] to make coherent patterns [4].
4. Stop at 15 minutes for two pairs to defend reconstructions with two evidence pieces.

STUDENTS DO

1. Arrange paper continents using the key for same fossils and same rock types.
2. Color matching fossil belts, glue best fit, and write a claim with two evidence statements.
3. Present reconstruction and defend it with shape, rocks, or fossils.

Say: In pairs, build a claim that continents moved using all four clues. Sketch Africa and South America fitted together. Color matching fossils the same color and label matching rocks, then be ready to defend your map.

Worked example: Rebuild: 1. Fit South America to Africa along shelves [3]. 2. Color same fossil belt green on both sides so it connects when rejoined [4]. 3. Mark same rock type brown across the join. 4. Draw seafloor ridge between them where new crust later formed. Claim: fit plus same fossils and same rocks show past motion; ridge shows how they separated.

Ask: How does your fossil lineup support past motion? (Separated fossils line up into one belt when rejoined, so lands were connected.) · What seafloor clue fits your map? (New crust at the ridge pushed the pieces apart to present positions.)

Check understanding: Collect maps: coherent fossil belt plus one rock label equals ready. Give pre-matched starter edge to any pair stuck after 5 minutes.

Support: Limit the puzzle to four continents and give one edge already matched as a starter. **Stretch:** Have students draw arrows showing which way each piece moved to reach its present-day position.

Use: Slide 9, Worksheet Task E

50–60 min **Plenary** 10 min · Whole class

Agree the big idea that moving plates carry continents and check learning.

YOU DO

1. Show Slide 10 and state that continents are passengers on tops of much thicker plates [3].
2. Show Slide 11 mystery and reveal the 40,390-mile ridge where new rock forms.
3. Run Slide 12 quiz and Worksheet Task D ranking evidence strongest to weakest.
4. Collect exit answers and preview how plates interact at boundaries [3].

STUDENTS DO

1. Choral-read the big idea and answer the mystery ridge question.
2. Rank evidence types in Task D and write 1-2 sentences for top choice.
3. Answer three exit questions on fossil match, ridge, and shape limits.

Say: Continents ride like passengers on moving plates. Most earthquakes and volcanoes occur where the moving plates interact along their boundaries [3]. Rank which clue convinced you most and tell why in one sentence.

Ask: What carries continents to new positions? (Large plates of crust and stiff mantle moving over softer mantle [3].) · What seafloor feature shows plates moving apart? (Mid-ocean ridge, a divergent boundary where magma makes new ocean crust.)

Check understanding: Exit tickets plus Task D top-choice sentence. If shape-only answers dominate, restate that rocks and fossils are needed too.

Support: Provide Task D starter ranking with strongest and weakest filled to complete middle. **Stretch:** Have students add seafloor evidence to the argument, such as new crust at divergent boundaries.

Use: Slides 10-12, Worksheet Task D

Common mistakes

Mistake	How to spot it	How to fix it
Thinking a good coastline fit alone proves continents moved.	Claim uses only shape with no fossils or rocks.	Require two clues: same rock types and same type and age fossils are added evidence [4].
Thinking the mantle is liquid water that continents plow through.	Drawing continents floating alone or pushing through mantle.	Show continents are passengers on tops of much thicker plates moving over softer mantle [3].
Thinking new and old ocean floor are the same age.	Labeling ridge rock as oldest or trench rock as newest.	Restate youngest forms at ridge and spreads in conveyor-belt motion, so ocean crust is relatively young [10].

Support

- Limit the puzzle to four continents and give one edge already matched as a starter.
- Color-code fossil card backs and pre-mark ridge center lines to continue patterns.
- Provide sentence starters and word banks for claims in every stage.

Stretch

- Have students draw arrows showing which way each piece moved to reach its present-day position.
- Have students calculate seafloor width after 1 million years at 2 to 15 centimeters per year [10].
- Have students propose another evidence type to search for to solve the puzzle.

For the LSE or teaching assistant

Stay with the Pangaea rebuild pairs; help align the pre-matched edge, match colors for fossil belts, and prompt two-evidence defenses.

Check for understanding

Question	Answer
Why do matching fossils in Brazil and West Africa support past motion?	Same species could not cross a wide ocean, so continents were joined.
Where does new oceanic crust form and what happens there?	At the mid-ocean ridge, magma rises and solidifies into basalt, forming new crust [13].
Why is continental shape alone not enough to prove past motion?	Need same rock types and same type and age fossils plus seafloor data [4].

Homework

Finish Worksheet Task D explanation: which evidence is strongest for past motion and why.

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