Clues Beneath the Waves

Use seafloor evidence to predict features at plate boundaries.

MAQ.3.2 "Develop an understanding of plate tectonics to predict certain geological features (e.g., sea floor spreading, paleomagnetic measurements, and orogenesis)."

NAME _____ DATE _____

1 READ AND MARK

Read it twice

YOUR JOB Underline two clues that ocean crust moves away from the ridge. Circle two clues that the Nazca Plate sinks beneath South America.

From Ocean Ridge to Mountain Range

1. A research ship crosses the East Pacific Rise, a long underwater ridge where the Pacific and Nazca plates move apart. Hot mantle rock rises into the gap and partially melts. The molten rock cools into new basalt at the ridge axis. Samples taken right at the axis have spent very little time on the seafloor, while basalt farther away has traveled outward with its plate. Scientists can estimate a sample's age by dating its minerals. Sediment also gathers slowly on exposed seafloor, so a long-exposed rock is usually buried under more sediment than a recent one.

2. Basalt carries another record of seafloor movement. Magnetic minerals align with Earth's magnetic field as molten rock cools. After the rock solidifies, its magnetic direction stays fixed even when Earth's field reverses. A ship's magnetometer records alternating bands of normal and reversed magnetism in the basalt. Along a survey line crossing the East Pacific Rise, scientists find bands in the same order on opposite sides of the ridge axis. Matching bands formed during the same intervals of magnetic polarity. These paired records help researchers reconstruct how the ocean floor moved after new rock formed.

3. Farther east, the Nazca Plate moves toward South America. Its oceanic crust descends beneath the continent at the Peru-Chile Trench, a process called subduction. The descending slab produces earthquakes along a dipping zone, with deeper earthquake origins farther inland. At the edge of the continent, compression folds and thickens crust. Magma generated above the sinking slab can also rise through the continent. The Andes stand along this active margin, with uplifted rock and volcanoes. Unlike the ridge, this boundary removes oceanic crust as the plates converge.

2 ANSWER WITH EVIDENCE

Use the passage

1. You collect basalt at the ridge axis and far from it. Which sample should be older, and why?

2. A magnetometer finds a reversed-magnetism band east of the ridge axis. What would you predict on the west side, and why?

3. If the Nazca Plate keeps moving beneath South America, what do you predict will happen to crust near the Andes? Use the passage to explain.

4. A ship records an earthquake near the Peru-Chile Trench and another farther inland. Which earthquake would you predict began deeper underground, and why?

3 YOUR TURN

Your own words

Imagine a different ocean ridge where a matching magnetic band is 80 km from the axis on one side and 120 km away on the other. In four to five sentences, predict what the distances suggest about seafloor movement, propose a rock measurement to test your prediction, and explain what result would support it.

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PART 1 · READ AND MARK

Underline two clues that ocean crust moves away from the ridge. Circle two clues that the Nazca Plate sinks beneath South America. Accept any marking that follows this job and points at the right text.

PART 2 · ANSWERS

#	QUESTION	ANSWER
1	You collect basalt at the ridge axis and far from it. Which sample should be older, and why?	**The sample far from the axis should be older because basalt forms at the axis and travels outward with its plate.**
2	A magnetometer finds a reversed-magnetism band east of the ridge axis. What would you predict on the west side, and why?	**A matching reversed-magnetism band should occur on the west side because basalt formed during the same magnetic interval moves away on both sides.**
3	If the Nazca Plate keeps moving beneath South America, what do you predict will happen to crust near the Andes? Use the passage to explain.	**The crust near the Andes should continue to thicken and rise as convergence compresses it.**
4	A ship records an earthquake near the Peru-Chile Trench and another farther inland. Which earthquake would you predict began deeper underground, and why?	**The inland earthquake should have begun deeper because the descending slab dips beneath the continent.**

PART 3 · YOUR TURN (SAMPLE ANSWER)

Because the matching bands formed at the same time, the side with the band 120 km from the ridge has carried its crust farther. I predict faster spreading on that side than on the side where the band is 80 km away. I would date basalt from both bands to test whether the rocks formed at the same time. Equal ages would support the idea that unequal distances reflect different spreading speeds rather than different formation times.

Accept equivalent explanations that connect rock age, magnetic bands, uplift, or earthquake depth to plate movement. For Your Turn, the proposed test should compare the ages of the matching bands.