Short Performance Assessment: **HS-ESS1-5**
Grade Level: **High School**
Adapted from SNAP[1]

Title	**Updating Alfred's Argument**		
Designed by	**Paul Andersen**	Course(s)	**NGSS Earth Science**

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Performance Expectation	**HS-ESS1-5**: Evaluate evidence of the past and current movements of continental and oceanic crust and the theory of plate tectonics to explain the ages of crustal rocks. **Clarification Statement**: Emphasis is on the ability of plate tectonics to explain the ages of crustal rocks. Examples include evidence of the ages oceanic crust increasing with distance from mid-ocean ridges (a result of plate spreading) and the ages of North American continental crust increasing with distance away from a central ancient core (a result of past plate interactions). **Assessment Boundary**: none

Science and Engineering Practice	**Engaging in Argument from Evidence** • Evaluate evidence behind currently accepted explanations or solutions to determine the merits of arguments.
Disciplinary Core Ideas	**ESS1.C: The History of Planet Earth** • Continental rocks, which can be older than 4 billion years, are generally much older than the rocks of the ocean floor, which are less than 200 million years old. **ESS2.B: Plate Tectonics and Large-Scale System Interactions** • Plate tectonics is the unifying theory that explains the past and current movements of the rocks at Earth's surface and provides a framework for understanding its geologic history. (ESS2.B Grade 8 GBE) (secondary) **PS1.C: Nuclear Processes** • Spontaneous radioactive decays follow a characteristic exponential decay law. Nuclear lifetimes allow radiometric dating to be used to determine the ages of rocks and other materials. (secondary)
Crosscutting Concept	**Patterns** • Empirical evidence is needed to identify patterns.

Student Performance	1. Identifying the given explanation and the supporting evidence 2. Identifying any potential additional evidence that is relevant to the evaluation 3. Evaluating and critiquing 4. Reasoning/synthesis

[1] The Short Performance Assessment (SPA) and the Assessment Rubric adapted from the Stanford NGSS Assessment Project http://snapgse.stanford.edu/

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Name_____

Background:

During his lifetime (1880-1930) Alfred Wegener was a world-renowned meteorologist and polar explorer. However he is most famous as the first scientist to propose a theory of continental drift. Wegener died in an expedition to Greenland without ever learning how his ideas would shape modern geology. Many of Wegner's ideas are organized in his 1915 book *Die Entstehung der Kontinente und Ozeane* ("The Origin of Continents and Oceans"). However researchers have recently discovered early ideas that date back to 1912.



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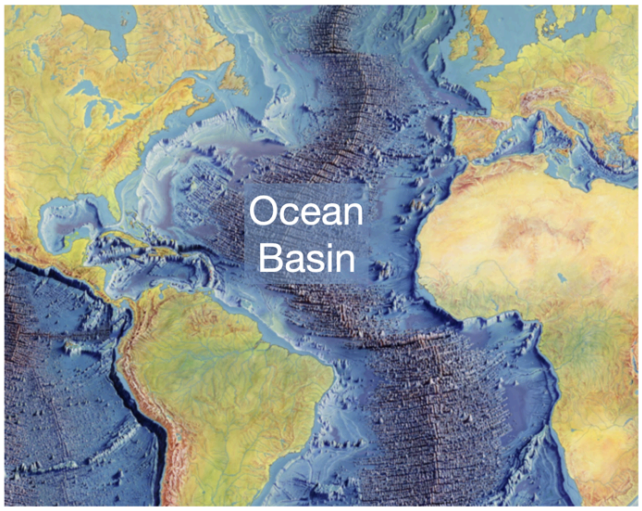


Figure 1

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In his first paper Wegener writes:

"We now seem to have a possibility of explaining the differences in ocean depth. It seems undeniable that freshly exposed rock layers, as the Atlantic and western Indian, maintain higher temperature (perhaps 100° in the uppermost 100km on average) than old strongly cooled sea floor. Such a temperature difference would probably suffice to explain the relatively minor differences of level in the large ocean basins.

The depth variation in ocean basins appears to suggest the Mid-Atlantic Ridge should be regarded as the zone in which the floor of the Atlantic, as it keeps spreading, is continuously tearing open and making space for fresh, relatively fluid and hot rock rising from depth. We cannot consider the Mid-Atlantic Ridge as a relic of the former land connections."

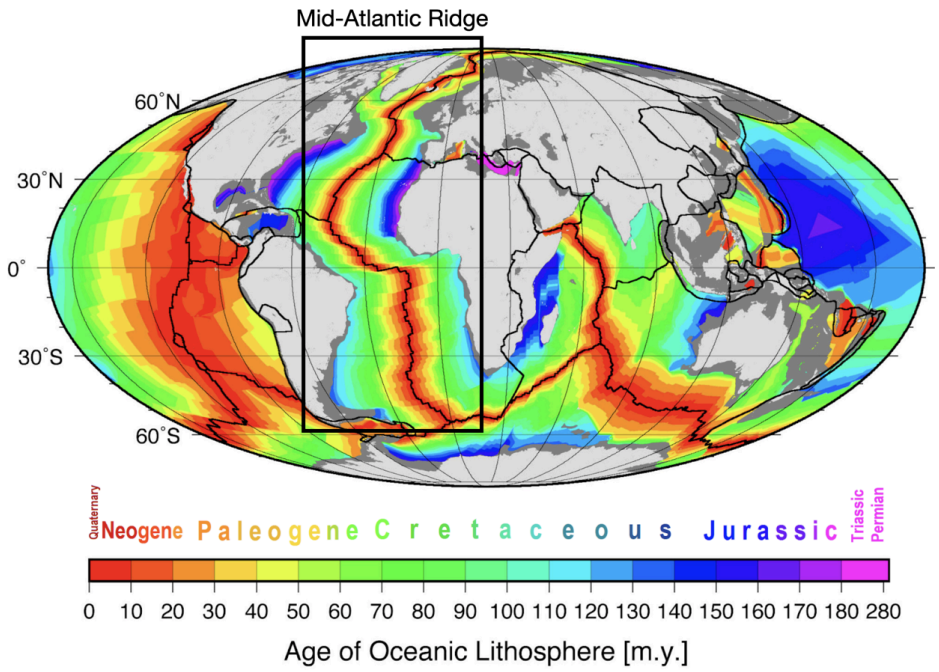
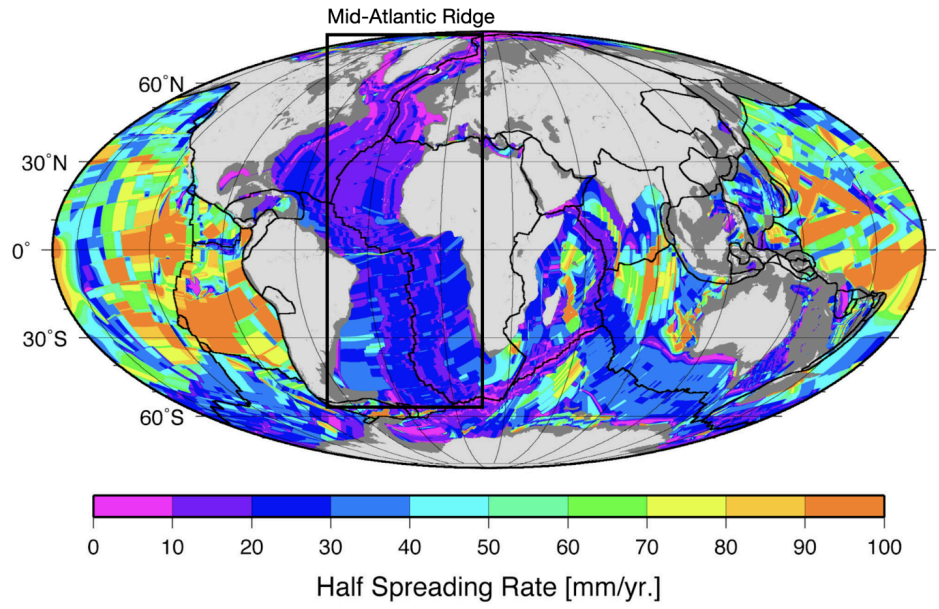
1. Identify the argument put forward by Alfred Wegener to explain the mid-Atlantic ridge shown in Figure 1.

Claim
Evidence
Reasoning

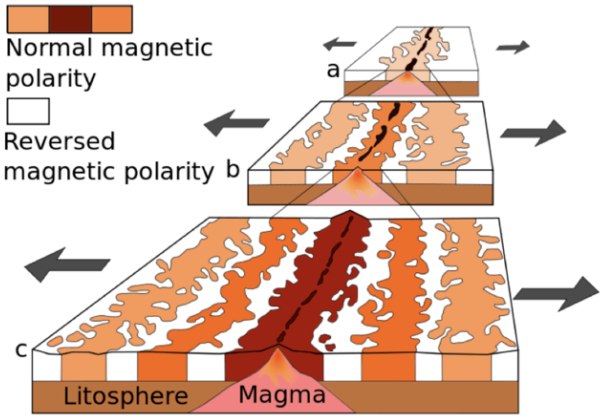
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Since Wegener's death additional evidence has been gathered to support the theory of plate tectonics. You will be analyzing some of this data to update Wegener's original argument about the Mid-Atlantic Ridge.

2. Complete the following graphic organizer using data from the following figures.

Figure	Evidence	What **patterns** do you see? **Support your answer with data related to the Mid-Atlantic Ridge**
Figure 2	Age of Oceanic Lithosphere (data source) 	
Figure 3	Crustal Half Spreading Rate (data source) 	

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Figure 4	Mid-Atlantic Ridge Magnetic Reversals (data source)  How to form magnetic striping: new oceanic crust forms continuously at the mid-ocean ridges. While it cools down, it records the magnetic field during its formation. The two parts of the oceanic plate are pulled apart, and magnetic stripes become older as they move away from the mid-ocean ridge. The figure shows the spreading ridge about 5 million years ago (a), about 2 to 3 million years ago (b) and nowadays (c). Courtesy of the U.S Geological Survey.	

3. Construct an explanation that could account for the formation of the Mid-Atlantic Ridge. Your explanation should include a cause, mechanism and effect . Use evidence from Figures 2-4 to support your explanation.

Explanation		
Cause	Mechanism	Effect

Evidence	
Describe specific evidence from the experiment that helps support your explanation.	

Reasoning	
Describe a chain of reasoning that connects the evidence described to your explanation.	

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Assessment Rubric* - Question 1				
	Emerging	Developing	Approaching Proficiency	Excelling
Description of performance				
Sample student responses				

Assessment Rubric* - Question 2				
	Emerging	Developing	Approaching Proficiency	Excelling
Description of performance				
Sample student responses				

Insert additional Assessment Rubrics (if needed) here.

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