

Name _____
GEOL 1: physical geology

Date _____

Evaluating the lines of evidence for plate tectonics

Good science means that we don't mindlessly accept ideas as true—we critically evaluate those ideas. As you know, that critical evaluation involves making **observations** and **interpretations**.

Plate tectonics, which you will investigate in detail this week, is the accepted idea in the scientific community about how the Earth works. It explains geologic phenomena such as earthquakes, volcanic eruptions, and mountainbuilding. However, it took decades of careful observations, interpretations, arguing, modifying ideas, etc. to develop this idea. Like any good geologist would do, I want you to spend some time evaluating the lines of evidence that were used to develop the idea that we now know as plate tectonics.

I. Evidence for continental drift

(1) Briefly, what does "continental drift" mean, and when was this idea proposed?

In preparation for today's class, you should have done some reading on one of the following lines of evidence that was used to support continental drift:

- Continental shapes and associated geologic features
- Distribution of fossils
- Glacial deposits in unusual places

Which line of evidence did you prepare for today? _____

(2) Using your knowledge and your groupmembers' knowledge, I want you to briefly:

- describe each line of evidence (that's the **observation**)
- explain *how* each line of evidence supports the idea of continental drift (that's the **interpretation**)

I've given you space to do this on the back side of this page. Some issues to think about:

- 1) What did Wegener observe about the shapes of continental coastlines? Give one example of a pair of continents that were used to support the existence of Pangaea.
- 2) What is a fossil? What was observed about the location of fossils that supported the existence of Pangaea? What types of fossils were observed?
- 3) How did characteristics (location, chemical composition, age) of certain rocks and mountain ranges support the existence of Pangaea?
- 4) What is a glacier? Which environmental conditions are necessary for glaciers to form? What is a glacial deposit? What does the presence of glacial deposits tell scientists about the past climate in a particular area? Where were glacial deposits observed that supported the existence of Pangaea? How did glacial deposits provide evidence that Pangaea had existed?

Evidence	Observation (explanation of what was observed)	Interpretation (how these observations support the idea of continental drift)
Continental shapes and associated geologic features		
Distribution of fossils		
Glacial deposits in unusual places		

II. Evidence for plate tectonics

As we will discuss in class next class, plate tectonics is a modified version of continental drift. Scientists made several observations that provided evidence for plate tectonics.

In preparation for today's class, you should have done some reading on one of the following lines of evidence that was used to support continental drift:

- Age of the seafloor
- Sediment thickness on the ocean floor
- Shape of the ocean floor

Which line of evidence did you prepare for today? _____

To facilitate your understanding of these three lines of evidence, I have provided you with four world maps. The red, orange, and yellow color map illustrates the age of the seafloor. The second map illustrates sediment thickness on the ocean floor. The top black and white map illustrates the location of mid-ocean ridges. The lower black and white map illustrates, among other things, the location of deep-sea trenches. Use the appropriate map(s) when thinking about these questions. **It would also be a great idea to look for patterns shared between the maps!!**

Shape of the ocean floor

(3) Is the ocean floor completely flat? If not, list four physical features found on the ocean floor and briefly describe what each looks like. You may make sketches if that helps you.

Age of the seafloor

(4) Which rock is the seafloor (oceanic crust) made of?

(5) The approximate age of the oldest oceanic crust is _____.

(6) The approximate age of the youngest oceanic crust is _____.

(7) Generally, where is the oldest oceanic crust found? Does this correspond to any of the physical features that you identified in question 3? If so, which?

(8) Generally, where is the youngest oceanic crust found? Does this correspond to any of the physical features that you identified in question 3? If so, which?

Sediment thickness on the ocean floor

(9) What is the difference between oceanic crust and sediment?

(10) Where does sediment on the bottom of the ocean come from?

(11) Generally, where are the thickest layers of marine sediment found? Does this correspond to any of the physical features that you identified in question 3? If so, which?

(12) Generally, where are the thinnest layers of marine sediment found? Does this correspond to any of the physical features that you identified in question 3? If so, which?

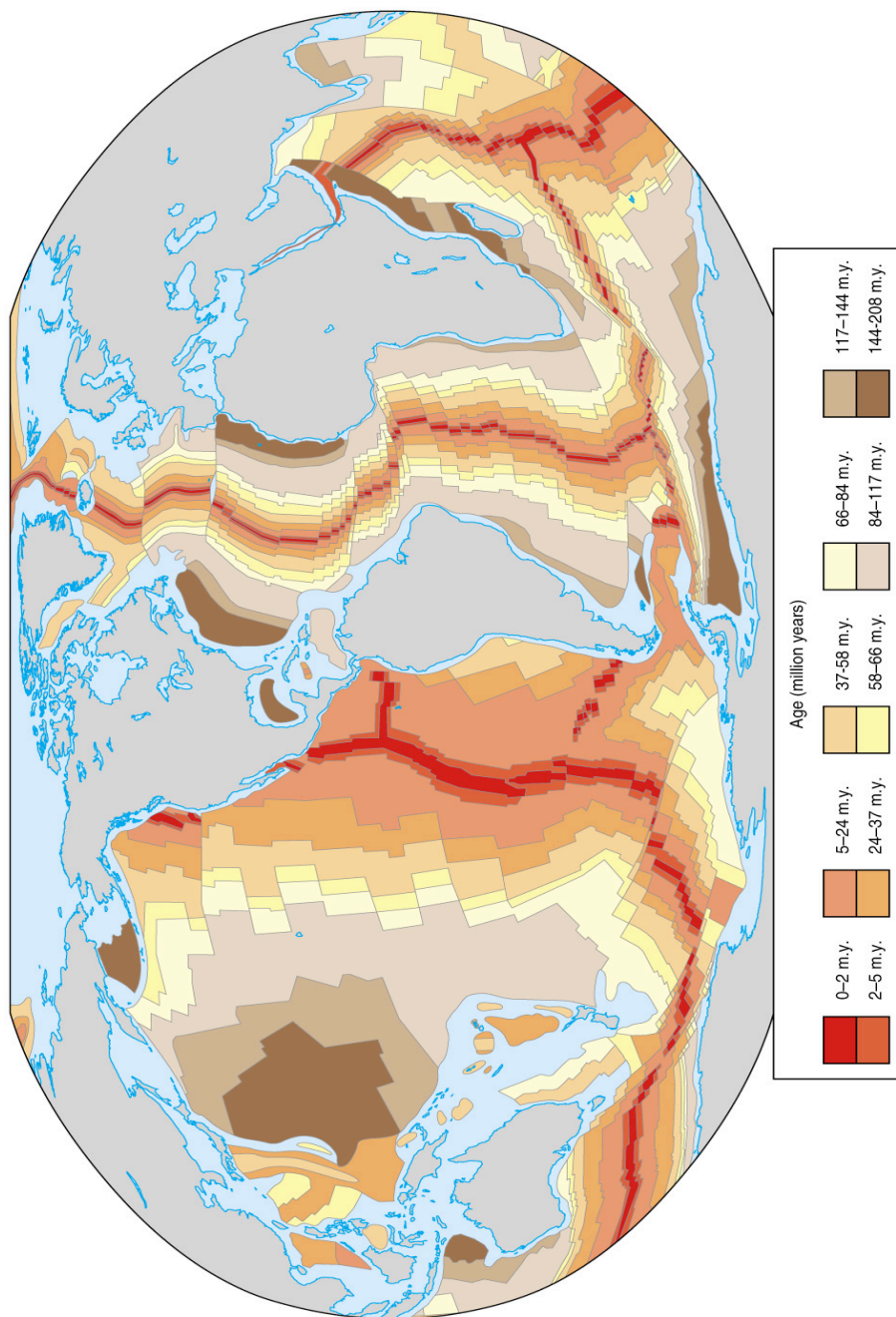
(13) Finally, I want you to use the data that you compiled in questions 3-12 and briefly:

- Summarize each line of evidence (these are the **observations**)
- ***come up with a hypothesis of *why* each line of evidence exists. Note that these are just hypotheses—it's OK to be incorrect. We will evaluate your hypotheses next class.

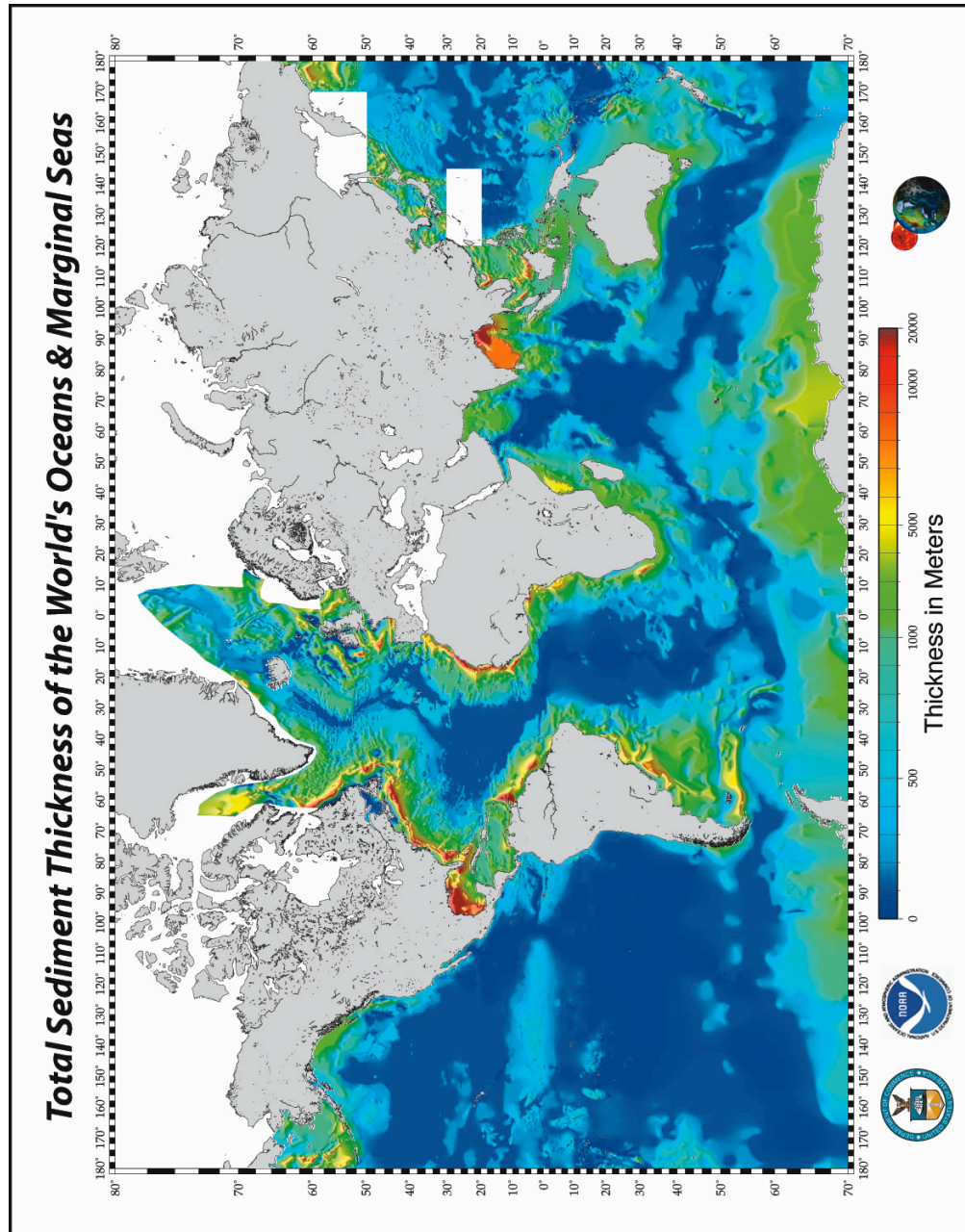
Example: observation—the thickest layers of sediment are located ____.

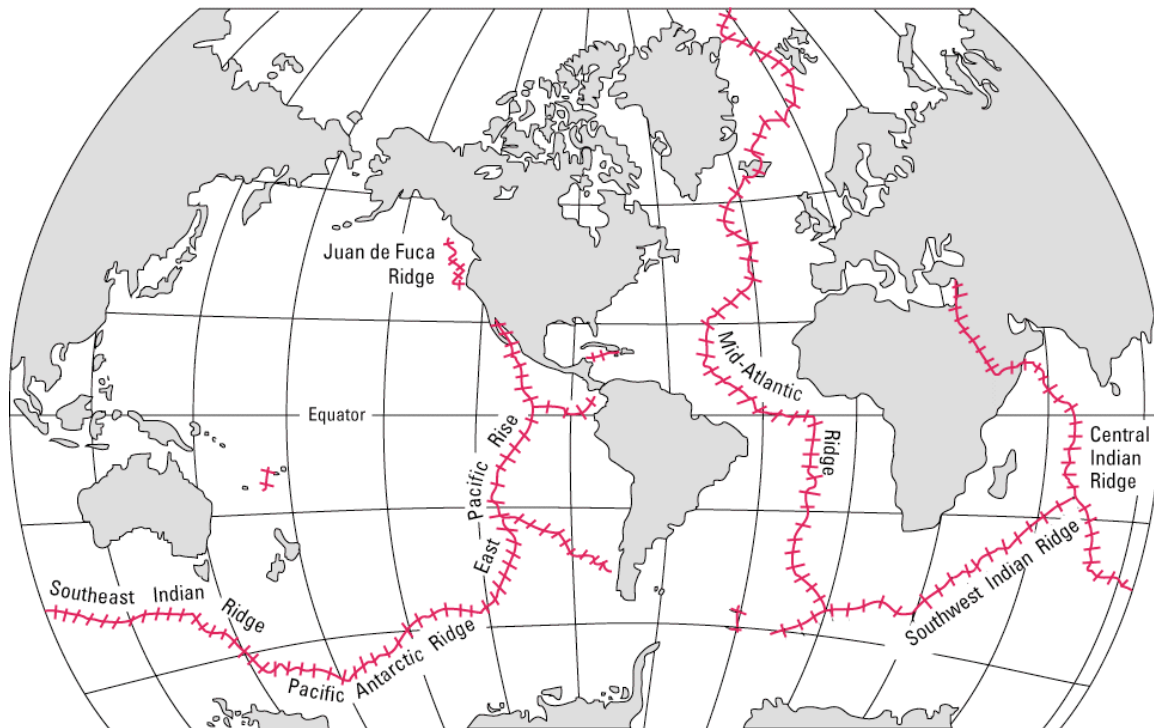
Hypothesis—the thickest layers of sediment are located there because _____.

Evidence	Observation (what did you notice? Were there any patterns?)	Hypothesis (why do these observations/patterns exist?)
Shape of the ocean floor		
Age of seafloor		
Sediment thickness on ocean floor		



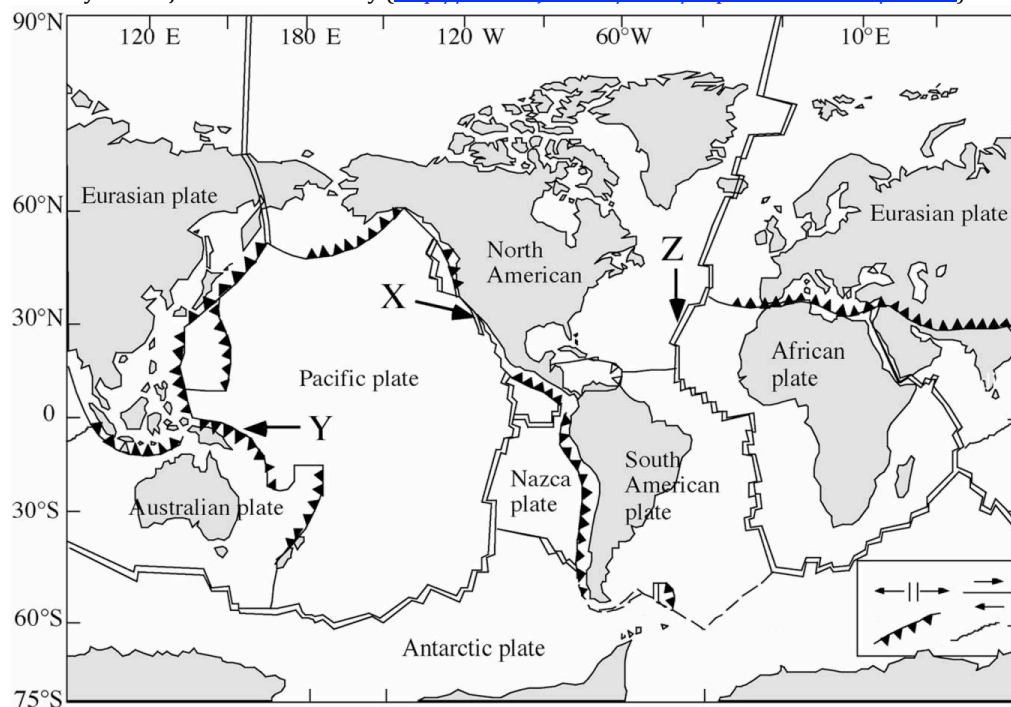
Marine sediment thickness—data courtesy of NOAA





Above: diagram illustrating the location of **mid-ocean ridges**.

Courtesy of San Jose State University (http://oceansjsu.com/105d/exped_boundaries/2.html)



Above: This map illustrates the location of different types of plate boundaries, which we haven't talked about in class yet. The purpose of you looking at this map is to notice the locations of **deep sea trenches**, which are illustrated using the "teeth" pattern. Ignore the X, Y, and Z. Image courtesy of Pima Community College.