

Read, Annotate, and Analyze: “A Continental Puzzle”

Directions: Read the following article. As you read, annotate it by adding comments and answer the embedded questions throughout. Try to use **each** of the following annotations with the symbols **at least once** as you read.

! Main Idea: Underline and add a “!” symbol for the sentence you think is the article’s main idea

? Question: Choose a word/sentence that you have a question about or is confusing. Add a comment, add the “?” symbol to the comment, and explain your question or confusion.

∞ Connection: Choose a word/sentence and add a comment with the ‘∞’ symbol when you make a connection. Explain your connection and remember that there are many types of connections but here are a few possible categories: (Types of connections: A- connection to self/world B- connection to the science/content)

★ Interesting: Add a comment with a “★” symbol when you read something that you think is interesting and explain why you find it interesting.

How to add a comment:

1. Highlight a word or sentence and click on the “+” symbol to the right to add a comment
2. Highlight and double/left click until  **Comment** option appears and click on it
3. Highlight the word/sentence and then click on “insert” then  **Comment**
4. Highlight the word/sentence and then use the shortcut “Ctrl+Alt+M” to insert a comment

**** **Add a symbol at the beginning of your comment.**

**** ***Make sure you save each comment***

→ **Finally**, answer the analysis questions embedded within, **and** at the end as you move through the article.



Alfred Wegener argued that the continents had changed their positions on Earth, but his claim wasn't accepted by other scientists until many years later.

A Continental Puzzle

For scientists, making big discoveries and sharing them with the public can be a big deal. Often, their discoveries come after years of hard work, and they finally get to see the results of what they've done. In some cases, their work is welcomed by other scientists, and can even make them celebrities! However, this is not what happened to Alfred Wegener (1880-1930). Wegener (VAY-geh-ner) was the German scientist who first argued that continents on the Earth's surface had moved over long periods of time. During Wegener's lifetime, other scientists thought his claim was too strange to be true. They also said that Wegener did not have convincing evidence to support his ideas. At the time, many scientists mocked Wegener's claims. It wasn't until many years after his death that other scientists came to accept his argument.

Question:

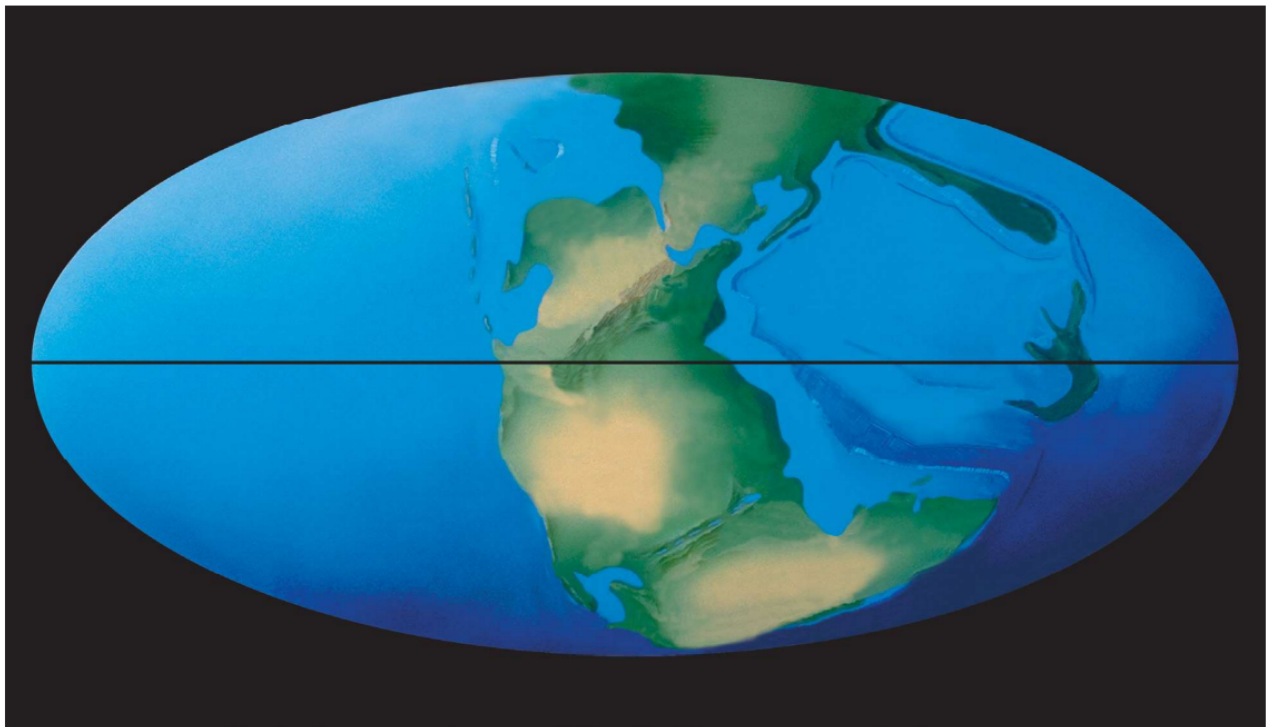
- What is a time in your life when others did not believe you?
I was not believed when I said that there were still clouds outside even when it was dark. (this was in 1st to 2nd grade so of course not everyone would know that)
- How did it make you feel?
I was sad that no one believed me but eventually, I showed others that it was true.

In 1915, Wegener shocked other scientists when he made the claim that the continents haven't always been where they are today. He argued that the continents had all been together in one large supercontinent, which he named Pangea. Wegener said the continents have since traveled

thousands of miles to their current locations, and will continue to travel thousands more. He concluded that these movements happen very slowly—but they add up over hundreds of millions of years. Scientists later accepted Wegener's claim as accurate and gathered additional evidence to support and build on his ideas. However, at the time, his argument was not well received at all!

Question:

- Why do you think it was difficult for people in the early 1900's to accept the idea that the continents on Earth used to be connected in the past? Respond using complete sentences. Perhaps scientists did not believe this because they may have not had the technology we have today to show that plates move. Another difficulty could have been that scientists may have thought that the Earth was flat.



Alfred Wegener argued that the continents had once been joined together in a supercontinent called Pangea. This map shows how Pangea may have looked hundreds of millions of years ago.

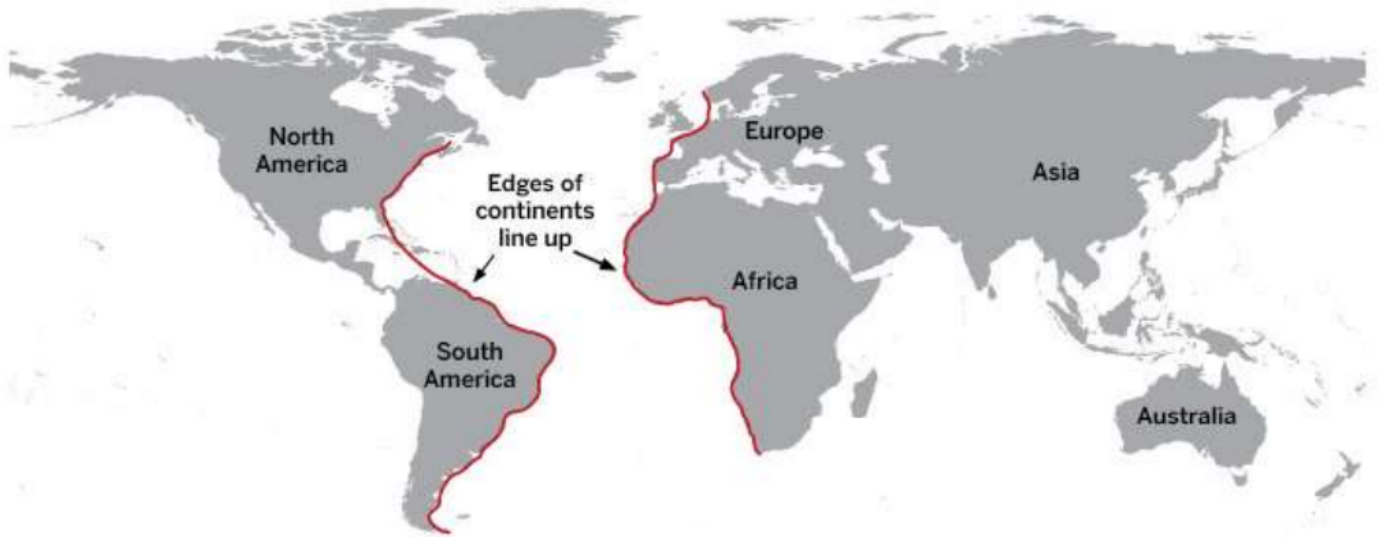
Evidence of Change on Earth's Surface

How did Wegener come up with the claim that the continents were once together, but have moved over time? Since humans didn't exist hundreds of millions of years ago, there's no written record of what conditions on Earth might have been like. To support his claim, Wegener turned to

evidence from Earth itself, just as scientists do today. Wegener was interested in what Earth's climate was like before humans existed. His study of ancient climate led him to think about how the continents might have been arranged millions of years in the past. One type of evidence Wegener considered as he developed his ideas was the shapes of the continents and the landforms that appeared on them. He noticed that the edges of the continents matched, as if they had once fit together like puzzle pieces. Wegener wasn't the first to notice how similar the edges of the continents were, but he was the first to publicly argue that the way they appeared to fit together was evidence that they had once been connected. At the same time, he found that some identical landforms could be found on more than one continent. For instance, mountain ranges and areas made of certain types of rock that were found on the continent of South America could also be found on the continent of Africa. When scientists compared these similar mountain ranges and rocks on the two separate continents, they matched. Not only that: when people placed the matching rocks and mountains together, they appeared to fit perfectly, like two puzzle pieces.

Question:

- What do you know about jigsaw puzzles and how can they be used as a model to help us understand the claim that continents have moved over time? Respond using complete sentences.
Jigsaw puzzles can help us model that plates may have moved over time but originally, used to fit together.



Wegener noticed that the edges of some continents seem to match up like puzzle pieces.

Another source of evidence Wegener used to support his claim—and a type of evidence still used by scientists today—was the study of similar fossils found on different continents. Fossils are the remains and impressions of living things preserved in rock. They can tell us about life on Earth millions or even billions of years ago. By studying fossils and where they're found, scientists can tell when the organisms that formed the fossils lived and what conditions were like at the time. The oldest fossils on Earth are found in the hard, solid rock on land, because the plate material that makes up land is older than plate material that makes up the ocean floor. The plate material that makes up the ocean floor is much younger because the plates of the ocean floor are always being destroyed at convergent boundaries, while new plate material is being created at divergent boundaries. In fact, the oldest plate material on the ocean floor is only 180 million years old! That may sound like it's been around for a long time, but plate material on land can be much older: up to 4 billion years old! Fossils are an important source of evidence as scientists support ideas about where the continents were located hundreds of millions of years ago.

Connection:

- What specific information from the paragraph above helps you better understand the differences between continental versus oceanic crust? Respond using complete sentences. When the paragraph says "...plate material that makes up land is older than plate material that makes up the ocean floor", it states that continental crust is older than oceanic crust.

In Wegener's case, he noticed that the same types of fossils were sometimes found in very different parts of the world. The fossils were sometimes thousands of miles apart or in places where the organism that formed the fossil wouldn't be able to survive. For example, Wegener studied fossils of tropical plants that had been found in Antarctica, where the cold climate would have killed the warm-weather plants. This evidence led Wegener to the claim that the entire continent where the fossils were found had once been located somewhere warmer. He concluded it had traveled to its current position over millions of years.

Question:

- Explain how fossils can tell us about the Earth's past based on the reading above. Respond using complete sentences.

Fossils can tell us where continents may have been located or how they shifted in the past.



Fossils, like these trilobites, are one source of evidence that is still used today as scientists support ideas about Earth's history.

Wegener's Legacy

Wegener found evidence that the Earth's continents had moved apart over time, but he didn't explain how that motion happened—that's one important reason why the scientific community didn't accept his claims. Over the years other scientists collected additional evidence and made hypotheses, or claims, about how the continents moved apart. The evidence didn't support all of the claims, but those claims that were supported by the evidence became part of the accepted explanation. The work of many scientists, including Wegener, and a lot of evidence led to what we now call the "theory of plate tectonics." Scientific theories are explanations for an observable phenomenon that have a lot of evidence gathered over time. Although he didn't get credit for his research during his lifetime, Wegener is now famous for his contribution to the theory of plate tectonics.

Analysis:

- *Going against popular or accepted ideas is important for a civilization to move forward.*
Do you agree or disagree with this claim? Explain your answer using an experience you have had or using something you have learned about in the past (not from this reading). Respond using complete sentences.

I agree with this claim. Proof for this claim is shown because in the past, multiple experiences have led to people becoming famous. For example, not everyone believed in Albert Einstein because people believed that he wasn't as smart as he actually was. One proof was found, Albert Einstein was labeled as one of the smartest people on Earth.