Alfred Wegener and Continental Drift

(1) The theory of plate tectonics holds that Earth’s surface, or lithosphere, is made up of about a dozen “plates.” These plates are large rigid slabs of rock that move very slowly, in part because of movements in the mantle below them. The plates move 2 to 5 inches a year, depending on their locations. While that may seem extremely slow, if you remember that Earth is very old you can see how small movements can add up over time.

(2) Many scientists have contributed to our current understanding of plate tectonics, but the person who started the revolution was the German scientist Alfred Wegener (1880-1930).

(3) In 1912, Wegener suggested that Earth’s continents might once have formed a single supercontinent, which he called Pangaea. (Pangaea means “all” and gaea means “Earth.”) Wegener argued that Pangaea began to break apart into the current, smaller continents around 200 million years ago; the continents then “drifted” until they reached their present positions. Wegener’s theory was known as the Theory of Continental Drift.

(4) Wegener knew most people would find it hard to believe that the continents were drifting, so he worked hard to collect evidence to support this claim. He looked at the shape of the continents, rock types, distribution of fossils, and ancient climates.

(5) Wegener pointed out that some of the continents looked like they could be fitted together like the pieces of a jigsaw puzzle. For instance, the eastern coast of South America and the western coast of Africa look like two matching pieces of a puzzle.

(6) But Wegener went beyond looking at shapes. He also looked at geological features such as valleys, canyons, and river channels. He found that the geological features along the western coast of Africa corresponded quite closely with those along the eastern coast of South America. Wegener said the geological features of the two continents fit together like the two halves of a torn newspaper. “It is just as if we were to refit the torn pieces of a newspaper by matching their edges and then check whether the lines of the print run smoothly across. If they do, there is nothing left but to conclude that the pieces were in fact joined in this way.”

(7) Wegener applied the same logic to other continents. He decided that if North and South America were once joined with Africa, Europe, and Asia, then there should be similar rock formations on these now disparate continents. Wegener did some research
and found that some rock formations were in fact similar. The Appalachian Mountains in North America were about the same age and contained the same kinds of rocks as the mountains in Scotland and those in Scandinavia. Looking at the current configuration of the continents you would not guess that these mountains have anything in common. They look like three completely distinct mountain ranges. But Wegener argued that the geological similarities showed that these mountains once made up a single, continuous mountain range.

Wegener also presented fossil evidence to support his theory. He pointed out that identical fossils could be found on continents that are now separated by vast expanses of ocean. For example, fossil remains of the Mesosaurus, a small crocodile-like reptile, are found on the coast of South America and also along the coast of Africa. The Mesosaurus is not thought to have been a good swimmer – certainly not good enough to have crossed the huge stretch of ocean that currently separates the two continents. The more likely explanation was that, during the age of the Mesosaurus, the two continents were connected.

Fossils of the fern Glossopteris provided Wegener with additional evidence about Pangaea. Glossopteris thrived in cool climates 200 million years ago. Fossil imprints of Glossopteris have been discovered in Antarctica, but also in South America, Africa, India, and Australia. Glossopteris fossils are found in climates that are now too warm for the fern to grow. Wegener argued that all these land masses were once joined together in a cool climate that allowed this ancient fern to flourish.

Wegener also pointed to data about ancient climates. Rocks in South America, Africa, India, and Australia showed signs of having once been covered with glaciers. But scientists found it hard to explain how warm areas far from the poles – places like Africa and India – could have been covered with glaciers. Wegener explained this by suggesting that millions of years ago these landmasses were part of Pangaea and were closer to the South Pole.
(11) Despite all the evidence Wegener gathered, he was not able to convince many scientists that continents drift. When he died in 1930, most scientists still scoffed at his hypothesis. One of the main objections to Wegener’s hypothesis was his inability to explain how continents move across the ocean floor. Wegener suggested that continents plow through the oceanic crust, much as an icebreaking ship cuts through ice. However, there was no evidence that the ocean floor was weak enough to allow the continents to plow through without breaking up the ocean floor in the process, nor could Wegener point to a force strong enough to do this.
(12) During the 1950s and 1960s, scientists used new technology like sonar and seismographs to study the Earth. They discovered that Wegener was right about continents moving but wrong when he hypothesized that moving continents plow through a stationary ocean floor. It turns out that the lithosphere is broken up into large tectonic plates containing both oceanic and continental crust. These plates, which Wegener was unaware of in his time, are constantly moving. The continents do not plow through the ocean floor; they are carried along with the oceanic crust, on larger plates. Today Wegener’s theory of Pangaea, the single supercontinent of 200 million years ago, and the idea of continental drift are well supported and accepted by almost all geologists.

Exercise A: Wegener found six pieces of evidence that he said proved his theory of continental drift. Put an X by each correct one below. (R1.5.3)

____ The fossils of similar human-like creatures were found in both western Africa and South America.
____ The geological features of the eastern part of South America and western Africa matched each other.
____ The South American and Africa continents looked like they could fit together like pieces of a jigsaw puzzle.
____ Two halves of a torn newspaper were found on several continents.
____ Mountain ranges in America and Europe were of similar age and had similar rocks.
____ The ocean floor showed where the continents had plowed through them over time.
____ The fossil remains of a small reptile were found on two continents.
____ An ancient fossilized fern was found in places it could not grow today.
____ Ancient civilizations had written texts and drawn pictures about Pangaea.
____ Wegener discovered that tectonic plates shifted and were constantly moving.
____ Rocks shaped by glaciers were found in warm areas far from the poles.
Exercise B: Look at each definition below and match it to the word in the article that means almost the same thing. The number in parenthesis is the paragraph where you will find the word. (RI.5.4)

1) not flexible (1)
2) solid proof (4)
3) matched (6)
4) reasoning (7)
5) separate (7)
6) arrangement (7)
7) areas (8)
8) statistics (10)
9) ridiculed (11)
10) not moving (12)

Exercise C: An inference is when you make a conclusion from evidence in the story instead of it being directly told to you. Read each inference statement below. If the inference given is correct write YES on the line in front of the question and explain why it is accurate. Write NO if the inference is incorrect and then explain why it is wrong on the line that follows. (RI.6.1)

1) _______ Alfred Wegener is more respected by geologists now than when he was alive.

2) _______ Wegener would have eventually discovered himself that the Earth’s surface is made up of tectonic plates.

3) _______ Maps of the continents in 200 million years will look very different from today.

Challenge: If a tectonic plate on Earth moves two inches in a year, how many miles will it move in one million years? (Hint: 12 inches = one foot and 5,280 feet = one mile)