Name:_____Date:_____Hour:_____

Alfred Wegener

Alfred Wegener was a man ahead of his time. He was an astronomer and a meteorologist, yet his greatest work was in the field of earth science. His theory of plate tectonics is widely accepted today. Yet, in 1912 when he proposed the idea, he was ridiculed. It took fifty years for other scientists to find the evidence that would prove his theory.

The young man

Alfred Wegener was born in Berlin in 1880. He was the son of a German minister who ran an orphanage. As a boy, he became interested in Greenland, and as a scientist, he went to Greenland several times to study the movement of air masses over the ice cap. This was at a time when most scientists doubted the existence of the jet stream. Just after his fiftieth birthday, he died there in a blizzard during one of his expeditions. Wegener graduated from the University of Berlin in 1905 with a degree in astronomy. Soon, however, his interest shifted to meteorology. This was a new and exciting field of science. Wegener was one of the first scientists to track air masses using weather balloons. No doubt, he got the idea from his hobby of flying in hot air balloons. In 1906, he and his brother set a world record by staying up in a balloon for over fiftytwo hours.

The search for evidence

In 1910, in a letter to his future bride, Wegener wrote about the way that South America and Africa seemed to fit together like pieces of a puzzle. To Wegener, this was not just an odd coincidence. It was a mystery that he felt he must solve. He began to look for evidence to prove that the continents had once been joined together and had moved apart. Fossils of a small reptile had been found on the west coast of Africa and the east coast of South America. That meant that this reptile had lived in both places at the same time millions of years ago. Wegener figured that the only way this was possible was if the two continents were connected when animals were alive. They could not have traveled across the ocean.

Geological evidence

There was also geological evidence. The rock structures and types of rocks on the coasts of these two continents were identical. Again, Wegener could find no explanation for how this could have happened by accident on opposite sides of the ocean. The rock structures had to have been formed at the same time and place under the same conditions. A study of climates produced other evidence. Coal deposits had been found in Antarctica and in England. Since coal is formed only from plants that grow in warm, wet climates, Wegener concluded that those land masses must have once been near the equator, far from their locations today.

Ridiculed and rejected

Wegener explained that all of the continents had been part of one large land mass about 300 million years ago. This super-continent was called Pangaea, a Greek word that means “all earth.” It broke up over time, and the pieces have been drifting apart ever since. Wegener compared the drifting continents to icebergs. Wegener’s peers called his theory “utter rot!” Many scientists attacked him with rage and hostility. Wegener had two main problems. First, he was an unknown outsider, not a geologist, who was challenging everything that scientists believed at the time. Second, he was not able to explain what caused the continents to drift. While there seemed to be evidence to show that they had indeed moved, he could not identify a force that made it happen. About fifty years after Wegener proposed his theory, a scientist named Harry Hess made a discovery about sea floor spreading that seemed to support Wegener’s ideas. As a result, the theory of plate tectonics was finally accepted by most scientists.

Harry Hess

Harry Hammond Hess was a geology professor at Princeton University and served many years in the U.S. Navy. In 1962, Hess published a landmark paper that described his theory of sea floor spreading. Hess also made major contributions to our national space program.

A globe-trotting geologist

Harry Hammond Hess was born in New York City on May 24, 1906. He first studied electrical engineering at Yale University, but later changed his major to geology. He received his degree in 1927. After graduation, Hess worked for two years as a mineral prospector in southern Rhodesia (currently Zimbabwe, Africa). He then returned to the United States to study at Princeton University. In 1932, Hess became a professor of geology at Princeton. Years later, his geological research took him to the far depths of the Pacific Ocean floor.

The Navy commander

Harry Hess was part of the Naval Reserve. In 1941 he was called to active duty. His first duty during World War II was in New York City where he tracked enemy positions in the North Atlantic. He later commanded an attack transport ship in the Pacific. Although he was a Naval commander, Hess seized the opportunity of being on a ship to further his geological research. Between battles, Hess and his crew gathered data about the structure of the ocean floor using the ship's sounding equipment. They recorded thousands of miles worth of depth recordings. In 1945, Hess measured the deepest point of the ocean ever recorded—nearly 7 miles deep. He also discovered hundreds of flat-topped mountains lining the Pacific Ocean floor. He named these unusual mountains "guyouts" (after his first geology professor at Princeton).

A ground breaking theory

After the war, Hess continued to study guyouts, midocean ridges, and minerals. In 1959, his research led him to propose the ground breaking theory of sea floor spreading. At first, Hess' idea was met with some resistance because little information was available to test this concept. In 1962, his sea floor spreading theory was published in a paper titled "History of Ocean Basins." Hess explained that sea floor spreading occurs when molten rock (or magma) oozes up from inside the Earth along the mid-oceanic ridges. This magma creates new sea floor that spreads away from the ridge and eventually sinks into the deep-ocean trenches where it is destroyed. Hess' theory became one of the most important contributions to the study of plate tectonics.
The sea floor spreading theory explained many unsolved geological questions. Most geologists at the time believed that the oceans had existed for at least 4 billion years. But they wondered why there wasn't more sediment deposited on the ocean floor after such a long time period. Hess explained that the ocean floor is continually being recycled and that sediment has been accumulating for no more than 300 million years. This is about the time period needed for the ocean floor to spread from the ridge crest to the trenches. Hess's theory helped geologists understand why the oldest fossils found on the sea floor are 180 million years old at most, while marine fossils found on land may be much older.

From the ocean to the moon

Harry Hess also played a key role in developing our country's space program. In 1962, President John F. Kennedy appointed Hess as Chairman of the Space Science Board—a NASA advisory group. During the late 1960s, Hess helped plan the first landing of humans on the moon. He was part of a committee assigned to analyze rock samples brought back by the Apollo 11 crew. Harry Hess died in August 1969, only one month after the successful Apollo 11 lunar mission. He was buried in the Arlington National Cemetery. After his death, he was awarded NASA's Distinguished Public Service Award.

Poster Directions

Front of Poster (each map is worth 3pts. for a total of 15pts.)

- Copy each map of the breakup of Pangaea
- Color each map
- Label each map with the period and how long ago the event occurred

Back of Poster (each question is worth 2pts. for a total of 22pts.)

- Answer question 1-6 about Alfred Wegener and 1-5 about Harry Hess
- The question needs to be written out and then answered.
- Highlight where you found the answers to the questions and what question number it is
- Attach the reading to this side of the poster

Reading reflection-Alfred Wegener

1. Explain the significance of Greenland in Wegener's life.

2. What world record did Wegener set in 1906?

3. Why could Wegener be called an interdisciplinary scientist? Identify the fields of science of which he was knowledgeable.

4. Explain how the fossil of a small reptile provided evidence to help prove Wegener's theory of drifting continents.

5. How did the discovery of coal deposits in England and Antarctica strengthen Wegener's argument?

6. What were the two main problems that Wegener faced when he tried to convince others that his theory of drifting continents was valid?

Reading reflection-Harry Hess

1. How did Harry Hess' career in the Navy contribute to his geological research?

2. What were some of the geological discoveries Hess made while aboard his attack transport ship?

3. Describe Hess' theory of sea floor spreading.

4. How did Hess' sea floor spreading theory explain why so little sediment is deposited on the ocean floor?

5. What were Hess' contributions to space research?