



Wednesday 7 January 2015 – Morning

LEVEL 2 CAMBRIDGE NATIONAL IN SCIENCE

R072/02/1 How scientific ideas have developed

INSERT

Duration: 1 hour



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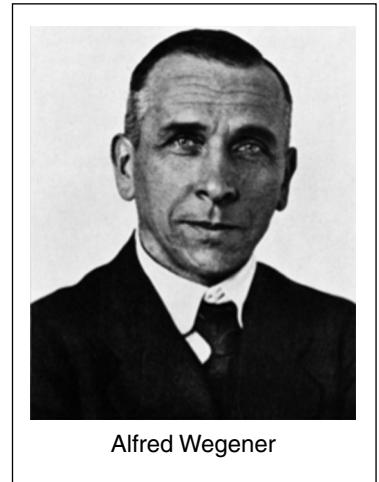
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Continental Drift

Alfred Wegener (1880–1930)

Wegener was an adventurous man who used a hot air balloon to go 'storm chasing'. With his brother, he achieved a world record flight in a balloon in 1906, staying aloft for 52 hours. He studied astronomy and trained as a meteorologist, but he was also fascinated by glaciers in the Arctic and risked his life several times working there. He became a leading expert on Polar meteorology and glaciation. He proposed the theory of 'continental drift'. Wegener died on an expedition to Greenland in 1930.



Explaining geology before Wegener

Before Wegener people wondered:

- why there were mountains
- why similar rock strata were found in different continents
- why fossils of the same animals and plants were found in different continents.

Table 1 gives the names of some fossils which were found on different continents.

Fossil	Continents
Mesosaurus (fresh water reptile)	South America and Africa
Cynognathus (triassic land reptile)	South America and Africa
Glossopteris (water fern)	Africa, India, Antarctica and Australasia
Lystrosaurus (triassic land reptile)	Africa, India and Antarctica

Table 1

Scientists before Wegener suggested these theories to explain the geology of the Earth:

- The Earth was very hot when it formed and has been cooling and shrinking ever since. Wrinkles formed as the Earth shrank. These formed the mountains and the oceans.
- Large land bridges (as shown in Figure 1) had once connected the continents allowing animals to cross the oceans.

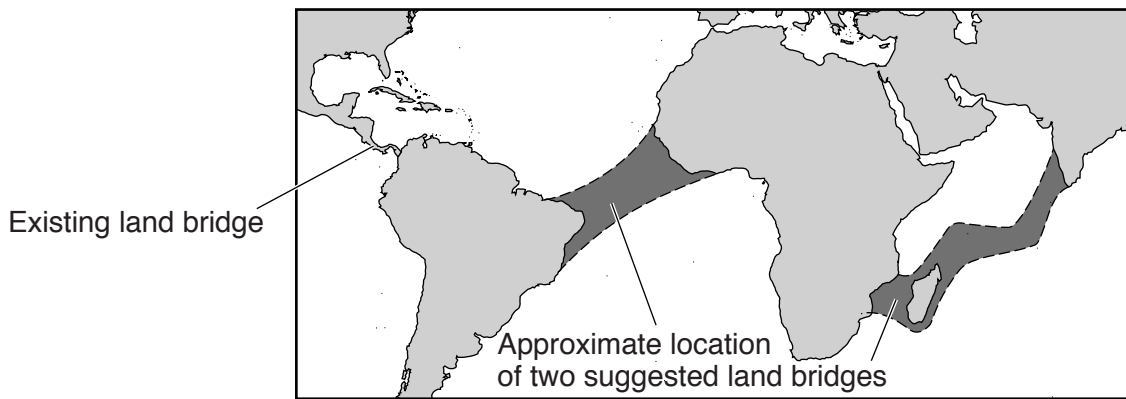


Figure 1

A narrow strip of land still joins North and South America. The sea now covers other suggested land bridges.

Wegener's theory

In 1912, Wegener surprised a meeting of geologists in Frankfurt with his radical theory of 'continental drift'. He proposed a grand vision of drifting continents and widening seas to explain how the continents could change their position. He rejected the idea of land bridges.

He noted that when you fit the continents of Africa and South America together, mountain ranges and coal deposits ran uninterrupted across both continents. He wrote:

"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 print ran smoothly across. If they do, there is nothing left but to conclude that the pieces were in fact joined in this way."

Wegener thought that all the continents had been joined in a super-continent about 300 million years ago. He called the super-continent Pangaea. He said it began to break up about 200 million years ago, when the continents started moving to their current positions. Wegener wrote:

"The continents are not connected to the Earth's core. They move like icebergs [of granite] on a sea of basalt. They float and drift, breaking apart and converging. Where they broke away, cracks, rifts, trenches remain; where they collided, ranges of folded mountains appear."

Wegener said that the rotation of the Earth created a force towards the equator. He called this the 'pole-fleeing force' as he thought that it had moved continents away from the North and South Poles. He thought that continents had drifted to the East or West because of the gravitational forces of the Sun and the Moon.

Some responses to Wegener's theory

In 1912, after Wegener proposed his theory five people, **A**, **B**, **C**, **D** and **E** made some comments:

A

"If we are to believe what he says, we must forget everything we have learnt in the last 70 years and start all over again."

C

"I have checked his work and the force caused by the rotation of the Earth is not enough to move a continent."

B

"I don't think Wegener's theory explains how continents can move."

D

"Wegener isn't even a geologist. He trained as a meteorologist and studied astronomy."

E

"The Moon's gravity can move water, but not continents."

A modern understanding

In 1929, Arthur Holmes suggested a theory to explain what causes continents to move. He said that the Earth's mantle is heated by the core and this produces convection currents.

Holmes' theory about convection currents received very little attention when he first suggested it.

About 30 years later, scientists started to explore the ocean floor and to find evidence to support Holmes' theory, such as mid-oceanic ridges (Figure 2). Scientists now accept that the Earth's crust contains moving tectonic plates. The movement of these plates can be used to explain continental drift and sea floor spreading.

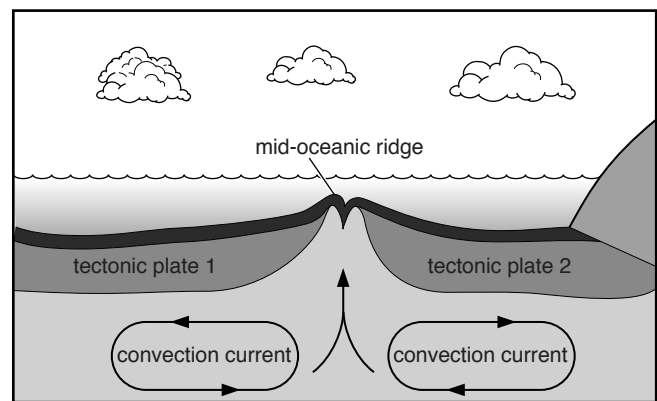


Figure 2



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