

# Ocean 11

## Plate Tectonics

The world ocean is a large interconnected body of seawater separated by continents into several ocean basins and marginal seas. The sizes and shapes of the ocean basins as well as their seawater contents are continually changing, consequences of a long history of geological vulcanism, seafloor spreading and plate tectonics, and extensive continental glaciation.

Video: Tectonic Cycles

Time: 46 min



### Plate Movement by Convection Flow

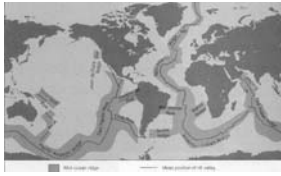
The theory of plate tectonics states that the Earth's outermost layer is fragmented into a dozen or more, large and small plates that are moving relative to one another as they ride on top of hotter, more mobile material.

"The earth is a living mobile thing". Both the earth's surface and its interior are in motion. Below the earth's lithospheric plates, at some depth, the mantle is partially molten and can flow slowly in response to steady forces for long periods of time.

Video: Ring of Fire

Time: 45 min





#### Plate Tectonics: Continental Drift Theory

Alfred Wegener was trained as a meteorologist to study weather. However, he was curious and made many observations. From his study of maps, he came to the conclusion that the continents were like pieces of a jigsaw puzzle. For example, if Africa were to be pushed over to South America, the edges of the continents would fit together. He called this land mass Pangaea. He thought that it had broken up hundreds of millions of years ago and the broken pieces had drifted apart, forming the continents.

This idea was suggested in 1912, based on fossil evidence. Remains of a particular kind of dinosaur were found in only two parts of the world... in eastern South America and western Africa. This suggested that the areas must have been one location.

He was wounded during World War 1 and wrote a book explaining his ideas, while recovering.

However, he died in Greenland without having his ideas accepted.

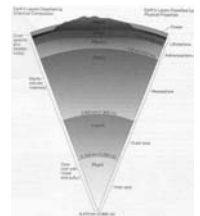


Reconstruction of Pangaea as it is thought to have appeared 200 million years ago.



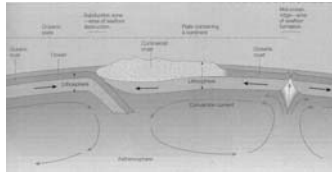
#### Questions:

1. Who was Alfred Wegener?
2. When did he develop his theory?
3. What was his proof?
4. How did he die?
5. What was his theory called?
6. What is the current belief of scientists?
7. What is the evidence for this idea?
8. What happens as the ocean floor is formed?
9. What does the word "tectonics" mean?
10. What is the term given to the ancient land mass?

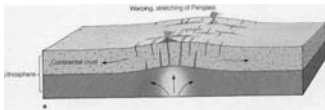


Solid rock when subjected to heat and pressure in the earth's interior over millions of years moves in a circular motion, somewhat like a pot of thick soup when heated to boiling. This is convection flow.

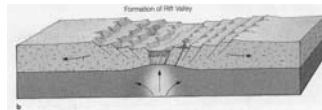
The heat comes from radioactive decay and the residual heat of gravitational energy, left over from the formation of the earth.



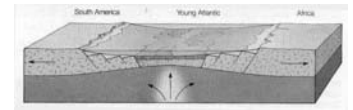
The formation of a new plate boundary: the breakup of Pangaea.



As the lithosphere began to crack, a rift formed beneath the continent, and molten basalt from the asthenosphere began to rise.



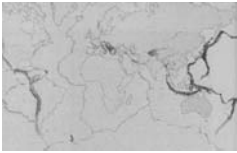
As the rift continued to open, the two new continents were separated by a growing ocean basin. Volcanoes and earthquakes occur along the active rift area, which is the mid-ocean ridge.



A new ocean forms.

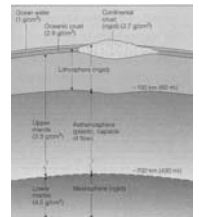
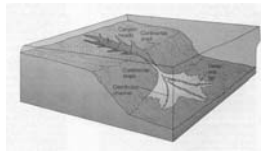
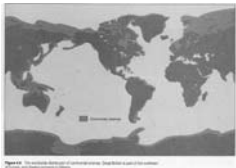
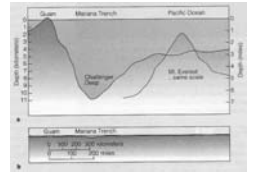


- The world's longest mountain chain stretches for 42,000 miles and is almost completely underwater. Known as the Mid-Ocean Ridge, it runs down the middle of the Atlantic Ocean, around the southern tip of Africa, through the Pacific Ocean and ends in the Sea of Cortez where it continues underground into California as the San Andreas Fault.
- Iceland straddles the Mid-Ocean Ridge and was produced by extensive underwater volcanism. It is the only area where lava from the Mid-Ocean Ridge breaks the surface.
- Less than three percent (3%) of the Mid-Ocean Ridge has been explored.



The global distribution of seismic events from January 1977 through December 1986.

The locations of earthquakes are coloured red, green, and blue to represent event depths of 0 to 70 kilometres, 70 to 300 kilometres and below 300 kilometres, respectively.



Far below the surface of the ocean, where no sunlight reaches, hot water laced with chemicals seeps out of cracks in the ocean floor. These cracks (hydrothermal vents) occur most often along the mid-ocean ridge, where Earth's crustal plates are spreading apart. Water reaching temperatures of four hundred degrees Celsius and chemical compounds such as hydrogen sulfide billow out from the vents.

At certain vents, as the hot, sulfide-rich water comes in contact with cold seawater, metal sulfides precipitate out. The chemicals pile up into structures that resemble chimneys, which scientists call "black smokers." Scientists have found one black smoker that is as tall as a fifteen-story building.

Can living things survive in such a place? The answer is yes.