

Dangerous Earth: a plate tectonic story

Ideas and Evidence in Science – a comprehension activity on **plate tectonics**

Learning objectives:

- several of the Earth's **tectonic plates** move at about the same speed as fingernails grow – around 35 mm / yr
- plates are made of **lithosphere** (**crust** plus the upper part of the **mantle**)
- beneath the lithosphere is the **asthenosphere**, part of the upper mantle that is **ductile** because it contains 1-10% molten material as films around the crystals
- the **Earth's magnetic field** has 'flipped' (the N pole becoming the S pole, and *vice versa*) many times over geological time
- rocks magnetised in the direction of today's magnetic field have **normal magnetism**, rocks magnetised when the field was the other way round have **reversed magnetism**
- as tectonic plates move apart, new rock is formed and this 'locks in' the direction of the magnetic field at the time
- reading and written communication skills

Timing: 30 minutes

Pupils are to read and answer questions on the following text:

Ideas and Evidence in Science

‘Dangerous Earth’

If you could sit in space and study the Earth you might see some strange patterns through the swirls of cloud. Many of the mountains are found in long chains; islands are found in long, curved chains; the coastline of South America fits the coast of Africa almost exactly. If you could probe beneath the oceans you would see even more patterns; a long ridge of underwater mountains in almost every ocean and deep sea trenches near the island chains.

The Earth isn't static. It hasn't always looked how it does today. The outer surface of the Earth is made of a thin, rigid sheet called the **lithosphere**, which is broken into pieces called plates. The lithosphere is made up of the **crust** and the upper part of the **mantle**. Underneath the lithosphere is a thin zone within the mantle called the **asthenosphere**. Because of radioactive decay deep in the Earth the asthenosphere is so hot that there are films of molten material between the crystals. This means the asthenosphere is solid but it can also flow. Slow convection currents in the asthenosphere carry the plates of the lithosphere so that they sometimes pull away from each other or crunch together. The movement is slow – commonly around 35 mm per year, or as fast as your fingernails grow – but it can have devastating effects.

As the plates pull apart, molten rock (**magma**) rises and solidifies to form new rock. As the rock cools under the oceans it is magnetised by the Earth's magnetic field. The Earth's field has reversed many times in the past, so rocks under the sea are magnetised in a series of stripes of normal and reversed magnetism.

If the plates crunch together one plate is carried down underneath the other, forming a trench. Some of the biggest **earthquakes** happen at these **plate margins**. As the plates are compressed together immense forces are set up until, eventually, the rocks break. This produces an earthquake. Sometimes two converging plates can crumple up rocks into mountain chains as continents are welded together.

This theory of how the plates of the lithosphere move (plate tectonic theory) was only developed in the 1960s, but the movement of the Earth's surface has been going on for much, much longer. It will continue as long as the Earth exists – though scientific theories such as plate tectonics may change in the meantime!

Questions:

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| <p>Q 1. There are patterns on the Earth's surface that seem to suggest that the Earth is continually changing. What patterns are mentioned in the article?</p> <p>Q 2. Explain Plate Tectonics briefly</p> <p>Q 3. The rocks on the ocean floor are magnetised in opposite directions. How does the article explain this?</p> <p>Q 4. What causes an earthquake?</p> <p>Q 5. What causes mountain ranges to form?</p> <p>Q 6. From the information in the article do you think a mountainous area might be prone to earthquakes? Explain your reasoning.</p> |
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