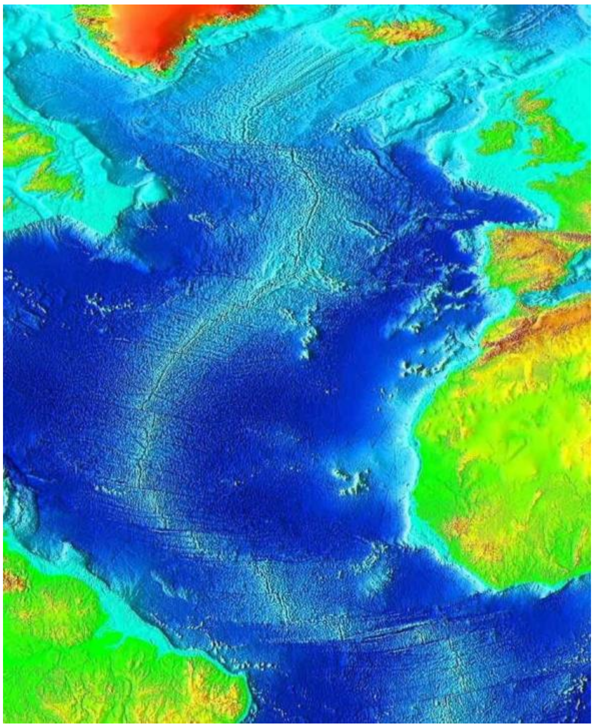
Model a spreading ocean floor offset at transform faults

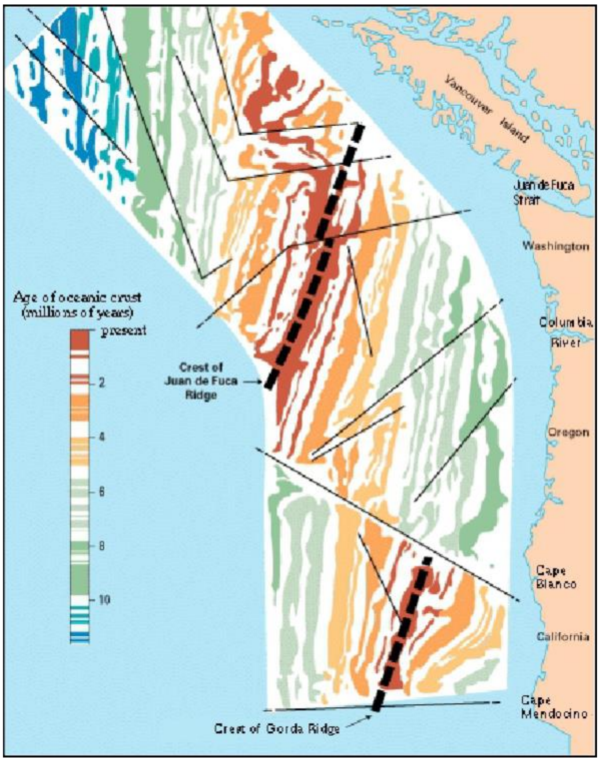
A model of the transform fault 'steps' in oceanic ridges and their magnetic stripes

Ocean floor maps, like this one of the Northern Atlantic Ocean, clearly show that oceanic ridges have a series of 'steps', called transform faults.



is in the public domain - it originally came from the U.S. National Oceanic and Atmospheric Administration.

The transform fault 'steps' can also be seen in the offsets of 'magnetic stripes' shown in this map of the oceanic ridges, off western Canada/USA.

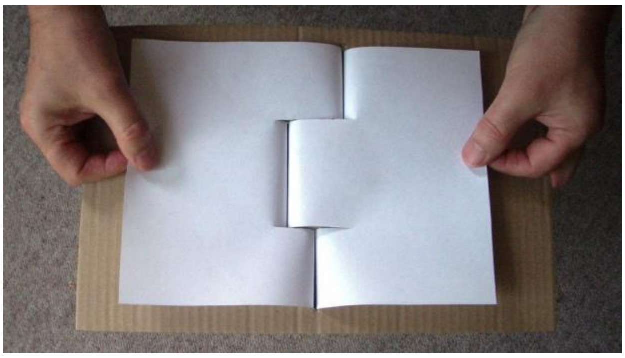


magnetic.html, with permission.

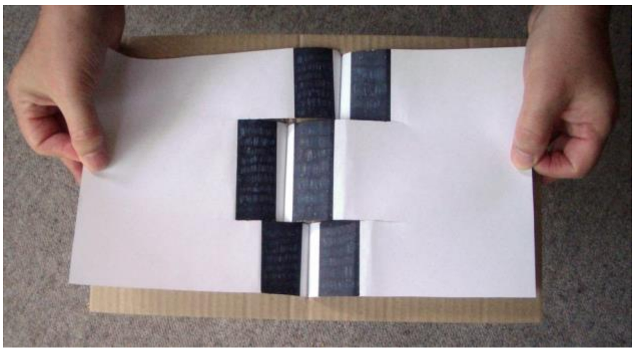
You can make your own model of a spreading oceanic ridge, offset at transform faults as follows:

- cut out a piece of stiff cardboard (eg. 25 x 35 cm);
- cut slits in the cardboard, each about 2 mm wide as shown (eg. 3 slits) – as shown here;

- place a piece of white paper on the cardboard and cut the paper so that flaps of paper can be pulled down into the slits; repeat this for another sheet of paper on the other side – as in this photograph;



- draw lines across each of the flaps at the place where they descend into the slits, and pull out the pieces of paper;
- draw black 'magnetic stripes' across each of the flaps at intervals (eg. we drew stripes that were, in order: black – 3m wide; white – 2 cm wide; black – 2.5 cm wide; white – 3 cm wide; black – 1 cm wide);
- replace the papers into the slits;
- finally draw the papers slowly and steadily out of the slits to simulate the spreading ocean floor, offset at transform faults.

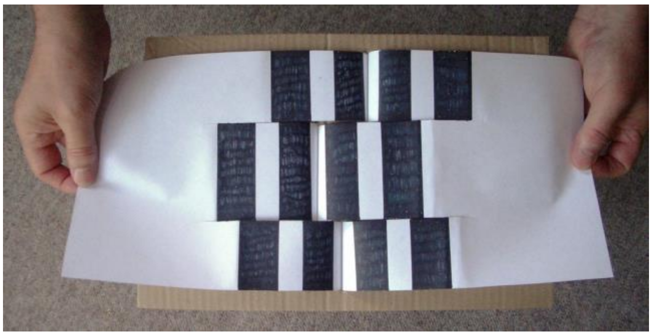


The back up

Title: Model a spreading ocean floor offset at transform faults

Subtitle: A model of the transform fault 'steps' in oceanic ridges and their magnetic stripes

Topic: Making a working model showing how sea floors spread, offset at transform faults. The fully 'spread' model looks like this:



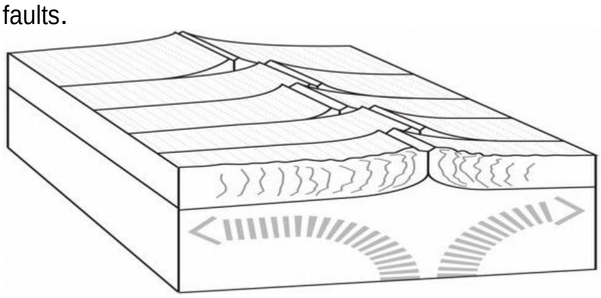
Age range of pupils: 14 – 19 years

Time needed to complete activity: It takes about an hour to make the model but only a few seconds to spread your own ocean floor.

Pupil learning outcomes: Pupils can:
- describe how the spread of ocean floors from oceanic ridges can be seen from the magnetic stripes;
- describe how the magnetic stripe pattern also shows offsets at transform faults;
- explain the 'mirror image' pattern shown by magnetic stripes;
- explain how the model represents reality.

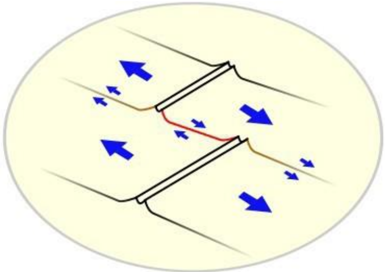
Context:
Transform faults are one of the three types of plate boundaries and are also called 'conservative plate margins' (the other two types of plate margin are the 'constructive/ divergent plate margins' that form oceanic ridges like the ones shown in the maps above, and 'destructive/convergent plate margins', where plates are subducted).

This diagram shows the oceanic ridges offset at transform faults.



Drawing of transform faults by Dave King.
Photos by Pete King.

Transform faults can be detected on the ocean floor by the offset topography of oceanic ridges and the offset magnetic anomalies. They are very unusual faults.



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The arrows on the diagram above show that in the area ***between*** the two ridges (shown in red), the two sides of the fault move in **opposite** directions relative to one another; however, ***beyond*** the ridges, the two sides of the fault move in the ***same*** direction. So the sense of movement is different in the three different segments of the fault. All other faults on Earth have just one segment – and so are different from transform faults.

Following up the activity:
Ask pupils to highlight the transform faults on an ocean floor map or diagram.

Underlying principles:
- As new plate material is formed at oceanic ridges, sea floors spread apart.
- Magnetic minerals in the lavas, and other igneous rocks that form the new oceanic plate, record the magnetisation of the Earth's magnetic field at that time.
- The Earth's magnetic field 'flips' from time to time, producing the ocean floor 'magnetic stripes'.
- Oceanic ridges and their magnetic stripes are offset at transform faults.
- Transform faults have special characteristics, as described above.

Thinking skill development:
Linking the cardboard model to the reality of a spreading oceanic ridge involves bridging.

Resource list:
- a piece of stiff card, eg. 25 x 35 cm
- two pieces of white A4-sized paper
- a knife to cut slits in the card
- scissors to cut the paper
- a ruler and black pen to draw the 'magnetic stripes'

Useful links:
The US Geological Survey has published a useful downloadable book about plate tectonics on its website, called '*This dynamic Earth: the story of plate tectonics'* available at: **http://pubs.usgs.gov/gip/dynamic/dynamic.html**

A more complex model showing sea floor spreading and subduction can be found at:
http://pubs.usgs.gov/of/1999/ofr-99-0132/

Source:
The model was first published in the course materials of the Open University Department of Earth Sciences.
These materials are now out of print.