Sea floor spreading

See also Earth's magnetic field

Magnetic banding using cocktail sticks A P 10 min

Each pair of students has about 20 cocktail sticks half of which have been dyed black by being soaked in black ink. Students add the sticks in pairs of the same colour and change colour when the teacher calls "polarity change".

The sticks are always added to the centre of those already laid down.

Magnetic banding using pencils D

This is to show how the changing of the magnetic polarity causes the magnetic banding in the dykes. The pencils represent the dykes. Sharpened pencils are laid on the overhead projector with the point indicating the direction of the magnetic field. Two pencils are placed to start with both pointing in the same direction. Pencils are added in pairs and placed in the centre of the pencils already laid down. When the magnetic field changes the direction of the pencils changes.

Magnetic banding using paper D

An A4 piece of hardboard has a 16cm slit cut in it using a jigsaw. A piece of a paper 40cm long and 15cm wide has been covered with black and white bands each 2 or 3cm wide. The bands are symmetrically placed either side of the halfway point. The paper strip is folded in two and inserted folded end first into the slit in the hardboard. In class it is

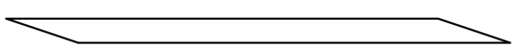
slowly pulled out of the slit and the paper (= lava) is seen to change polarity and to give rise to the symmetrically banded sea floor. By having several slits slightly off set one can show transform faults.

Moving oceanic crust *D*

Using strips of self adhesive polaroid acetate and a polaroid spinner the magnetic banding in the oceanic crust can be made to appear to move away from the ridge and towards the destructive plate margins on a section across an ocean. Or on a map of a ridge cut by transform faults the banding can appear to move away from the ridge. A Polaroid spinner is a disc of Polaroid which can be turned or is driven by an electric motor above the transparency on an OHP.

Injection of dykes *D*

This apparatus shows how the ocean crust is created and how the magnetisation of the dykes reverses. Build the model from 50mm by 100mm timber. The top pieces are loose but the lower ones are screwed to the red painted hardboard (=magma chamber) with a 3mm gap between them. 20 pieces of 3mm hardboard 50mm by 120mm are made to represent the dykes. Each has one long edge stained black and both ends are bevelled. The hardboard pieces are pushed in from the back and underneath. They are inserted in pairs. The first pair is pushed in between the wooden blocks and subsequent pairs are pushed in the centre of those already there.



Section through one of the pieces of hardboard to show bevelled edges.

Speed of movement *TE*
The plates on either side of the mid-Atlantic ridge are moving at about 2cm per year which is the same as the speed at which one's finger nails grow.

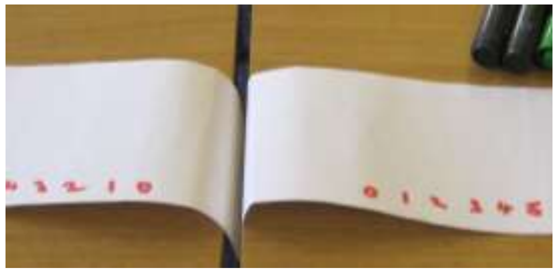
Relationship of the reversals found on land to the pattern on the sea floor. *D*
Three photocopies of the stratigraphic sequence of normal and reverse polarisation are made. Two are placed horizontally to show the pattern on the sea floor while the other is held up as the stratigraphic sequence so students can see the relationship. Further pairs of photocopies are made either reduced or enlarged and are laid out so students understand that it is the relative thicknesses of each band that is important.

Describing the pattern on the sea floor *A I 2 min*
Students are shown a diagram of the pattern of the banding on the sea floor and have to describe it. It always surprises me how many fail to see that the banding is symmetrical either side of the ridge.

Sea floor spreading simulation *A P 5 min each*
Each activity uses a 40cm by 10cm strip of paper folded in two and inserted in the slit between two adjacent desks. One student very slowly pulls the paper out so that it lies on the surface of the desks either side while the other student who sits on the opposite side of the desk writes or marks on the paper on both sides of the gap.

1 Ages of basalt on the sea floor

This is to demonstrate why the rocks get older away from the ridge. The teacher calls out 100 million years ago, 90 million years ago, 80. 70 etc. and the student writes the number down on both sides while the paper is being slowly pulled out.



2 Magnetic banding of sea floor

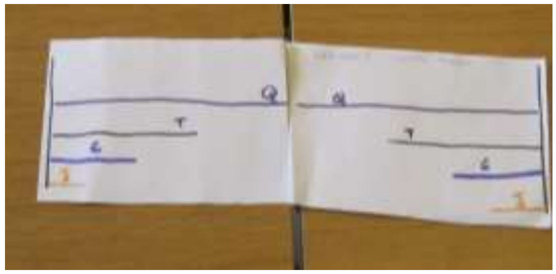
Using a thick felt tip pen or highlighter one student moves it up and down along the gap between the desks marking the paper both sides as the other student slowly pulls the paper out. When the teacher calls out polarity change the student stops marking. He starts again when the teacher calls out polarity change again. This is repeated several times by which time the symmetrical banding typical of the sea floor will have been made.

3 Magnetic banding of lavas

This activity is to explain why the boundaries between rocks of different polarity do not form sharp straight lines. One student pulls the paper out very slowly while the other draws arcs on the paper, representing lava flows. The arcs should not be continuous but randomly spaced along each side of the gap. When the teacher calls out "polarity change" the student changes to a different coloured pen. On the second call the student changes back to the first pen.

4 Thickness of sediment on the sea floor

The end 2cm of the paper are coloured and marked "continental crust". The remainder is oceanic crust. One student slowly pulls the paper out while the other draws a line with a felt tip from the gap to the continental crust at the end of the paper on one side and then on the other side. This line is labelled Jurassic or Jur. The first line should be on the edge nearest to him and subsequent lines should be above this. He then changes colour and draws another line from the gap to the end and writes on Cret. This is repeated for the remaining periods, Tertiary, Quaternary and present by which time a section through the sediments will have been build up.



Thickness of sediment using felt pieces D

To demonstrate that the thickest sequence of sediments and the oldest sediments will be furthest from the ridge. Two strips of carpet or sheet 1m long and 10cm wide represent the oceanic crust. Attached to one end of each is a block of wood 15cm by 5cm by 10cm which represents the continental crust. You will also need pairs of strips of felt, each pair being a different colour. The strips of felt should be 20cm, 40cm, 60cm, and 80cm long. Place the ends of the carpet down the gap between two desks and slowly pull them out. As soon as 20cm of carpet is above the desk on each side place the 20cm strips of felt on either side. Continue pulling and adding felt as space comes available.

Hotspot islands and plate movement D or P 5 min

To show how the line of volcanoes form over a hot spot you will need two desks with a gap between them of 5cm, a red felt tip pen (the magma source), and a strip of blotting paper (the plate) 40cm long and 5 cm wide (toilet tissue or other absorbent paper will do). Write on one end of the paper "oldest" and an arrow pointing towards that end. Place the paper over the gap with the oldest end just on one side and the rest on the other side. One person pulls the paper slowly while the other holds the red pen against the underneath of the paper. As the paper is moved the pen underneath tilts and stays in contact with the paper. Once the pen has reached the other side of the gap it is quickly moved back the *vertical position without touching the paper. You should end up with a series of red dots representing the volcanoes.*

Rules of sea floor spreading ***A P [F](#) 15m***

This activity has two aims: to find out what factors determine the amount of displacement of the ridge axis along a transform fault and to demonstrate the relationship between the movement of a continent and the orientation of the ridge and the transform faults. Students are given a piece of A4 card which has been cut in half along an S shaped line. The two halves represent a continent that is splitting. They are placed about 5cm apart on a piece of white paper. Students follow a set of rules to mark on the position of the transform faults and the ridge axis.

Modified from D. Bates