Intrusions

Working out relative ages   Pa I 3 min

Students are provided with a very simple map with 3 dykes intersecting. Each dyke and the country rock is given a letter. (The letters when put in the correct order can make a word or name). Students write the letters down to show the order of formation and intrusion.

Age relationships   Pa I F 20 min

Students work out the order of events from a schematic diagram of the Donegal Granite.

Order of intrusions and road works   A F

Students are shown a photograph of a road which has been dug up to lay pipes at several times. From the crisscrossing pattern they must work out the order of the excavations. This is the same process by which we work out the order of dyke intrusion. However the main purpose of this is so that when they see tarmac which has been dug up they will be reminded of dykes

Order of events   Pa P F 20 min

Students are presented with a series of samples or photographs taken from a single intrusion. They must use them to make a list of events in order of occurrence and give their reasons.

Dykes and tension   D F

This is a magnetic model to show the formation of a dyke and to show its cross-cutting relationship to the surrounding strata. An A4 card with the pattern of strata on cut in half. Half is stuck to an A4 sheet of red paper. Both are put together on a magnetic board. The loose side is pulled sideways to show the magma coming up.

Sills, transgressive sills and feeder dyke   D F

A magnetic model showing the formation of the feeder dyke, then the sill and then the sill jumping a layer.

Radial dykes   D

To show the pattern and explain the origin of radial dykes students are shown a piece of glass with radial cracks. This can be made from a 4mm glass sheet 30cm by 30cm with transparent film stuck on the back and

masking tape round the edges. Place this on sand and then fire an air gun at the centre. Discuss with the students what happens when a small stone is thrown at a window. The glass bulges and is stretched momentarily and then cracks. Radial dykes are caused by the crust bulging and stretching.

Stoping and net veining and xenoliths   D   F
Using a magnetic board it possible to show the intrusion of magma into cracks in the roof of a magma chamber and then blocks falling into the magma.

Cone sheets, ring dykes and cauldron subsidence   D
A block of wood 20cm by 30cm has had a cone cut out of the centre and half a cone cut from the edge using a jig saw. All the edges have been painted with the pattern of strata. Turn the board upside down to show ring dykes.
This block can be used for showing, both in plan and section, the pushing up or dropping down of the strata and the space made for the intrusion. By placing a second board on top one can show cauldron subsidence.

Magnetic cone sheets and ring dykes   D *F*
A card model can be used to show the formation of cone sheets, ring dykes and cauldron subsidence.

Actual shape of cone sheets and ring dykes   D
Use a plastic flower pot with the bottom cut off to show the actual shape of the igneous intrusion. For cauldron subsidence use an up side down flower pot with the bottom left on.

Off-set of strata by a dyke   A I 5 min
Students draw strata dipping at 45° cut by a vertical dyke. They nearly always draw the strata with individual beds in a line. Students the draw a second set of strata dipping a 45° and draw one vertical line crossing the strata. They cut along this line and then pull the strata apart 1cm as if a dyke was there. The strata are now offset.

Composite dykes   D *F*
This is model to show how the mechanism by which composite dykes are formed. Two liquids, representing viscous acid magma and runny basic magma, are forced into a narrow gap.

Magnetic model of the off-set of strata by a dyke   **D** *F*
A card showing strata dipping at 45° is cut vertically in half. The left side is stuck to a sheet of red paper. Magnetic strips are stuck to the back of both pieces. When the right side is pulled sideways the dyke appears and the strata are off-set.

Music and hexagonal columns   **TE**
Fingal's Cave Overture (Hebredes Overture) was written by Mendelssohn while visiting the cave in 1830.

Wax intrusion   **D**
This activity is to show the formation of magma, the volcanic neck and lava flows. Melt red candle wax so that it forms a layer 1cm thick in the bottom of a 500ml beaker and allow it to solidify. Sand is then put as a layer about 1cm thick on top of the wax. The beaker is then filled with cold water. Put the beaker onto a hot plate. The wax represents the magma/igneous rock and the water represents the crust. The wax will melt and rise up usually forming a column to the surface of the water where it will form a small volcano. Sometimes the wax does not reach the surface and forms an intrusion. Sand grains can be seen falling into the wax, these are the equivalent of pieces of rock falling into the magma.

Lava Lamp   D
Use a lava lamp to show the rise of magma diapers. Lava lamp must be plugged in about 2 hours before it is needed.

Rising magma   D
Put oil in a margarine container with a 1cm hole cut in the top and place it under water. The oil will rise in blobs to the surface.

Map of an intrusion   Pa I 10 min
To get students to recognise the evidence for intrusions on a map use a map showing a granite body with cut off strata whose dip has been altered by the intrusion and with a metamorphic aureole. Students list the evidence that the granite is intrusive. The map of the Isle of Arran in Scotland shows this.

Hexagonal columns   Pa I 3 min
To get students to think about the orientation of the columns show them a photo of horizontal columns. They must state, with reasons, whether the outcrop is part of a sill, dyke or lava flow.

How many sides to a basalt column   Pa P <u>F</u> 30 min
Students examine photos looking end on to basalt columns and count the number of sides each clearly visible column has, and then to work out the percentage of 3, 4, 5, 6, and 7, sided columns there are. Only about 60% are actually hexagonal.

Origin of igneous rocks   A P <u>F</u> 20 min
Students are given 12 samples which they must match to the names on the sheet and to the conditions of formation.