

Rock, rattle and roll

Investigating the resistance of rocks to erosion by shaking in a plastic container

Ask pupils why they think that some areas are hilly and others are low lying. Such differences in relief are often caused by the relative resistance to erosion of the rocks that make up these areas – more resistant rocks usually form higher areas.

Pupils can then test a variety of rocks, to see how well they might stand up to erosion, as follows: Take several “thumb-sized” pieces of the same rock type, place them into a **plastic** container and fix the lid. Shake the container vigorously for 20 seconds. Wait for the dust to settle, and then carefully tip out the contents onto a tray or a piece of paper. Keep the pile of dust on the tray, but put the recognisable fragments back into the container and shake for a further 20 seconds. Add the dust to the original pile.

Then choose one or more other types of rock to investigate, and repeat the activity as above, producing a separate pile of dust for each rock type.

Compare the sizes of the piles of dust from each rock type and put the rocks in order of their resistance to erosion by shaking: the rock that produces the least dust is the most resistant.

If there are no rocks locally available, the activity may still be carried out, using pieces of brick, or concrete etc. Although these cannot be related to the local landscape, the fragments will become rounded as a result of the shaking in the same way as natural rocks do. This is as much a part of erosion as is the wearing away of the landscape.

If a balance is available, the mass of the rock fragments may be measured before shaking and after each shake, and a graph of relative rock resistance may be drawn.

The indoor activity may be followed up by a visit to a local site where rocks or other materials are being eroded.



A rock shaker in vigorous use!:



The resistant sandstone forms crags in the foreground. Less resistant shales form the gentler slopes in the background. Stanage Edge, Derbyshire, England.

(Photos: P. Kennett)

The back up

Title: Rock, rattle and roll

Subtitle: Investigating the resistance of rocks to erosion by shaking in a plastic container

Topic: Shake a plastic container to erode rock fragments inside it. Use the differences in the resulting amounts of rock dust to compile a rank order of the resistance of the rocks to erosion. Follow up the activity with a local site visit where appropriate.

Age range of pupils: 10-18 years

Time needed to complete activity: 20 mins

Pupil learning outcomes: Pupils can:

- appreciate the need for a consistent approach to the investigation, e.g. shaking for the same time and trying to keep a uniform vigour of shaking with each set of rock fragments;
- observe differences in rounding of a range of materials after erosion;
- place results in rank order, based on visual inspection, or weighing;
- account for variation in relief (height) of the land where, as in most cases, this depends on the response of different rock types to erosion.

Context: This activity could be used to substantiate a geography lesson, or to examine the physical properties of a range of rock materials. Differences in rock resistance may explain variations in relief, but pupils should be

made aware that this is not the only factor. For example, many of the deep valleys of the Himalayas are the result of the rivers cutting down as fast as the mountains are uplifted, and there may be few differences in the rock types involved.

Following up the activity:

- Pupils may wish to experiment with one fragment of each of several different rock types together in the shaker, to test the action the fragments have on each other.
- The same process can be used to make rounded semi-precious gemstones for use in jewellery.
- It is possible to carry out the investigation with the container half-full of water, to imitate a river or the sea, (although it is difficult to measure the amount of eroded material, and it can be messy!).
- A field visit to a local river or beach would enable pupils to investigate the degree to which different fragments of rock are rounded by having been knocked together during transport.
- Pupils can be asked to comment on the likely shape of a coastline made of different rock types after many years of erosion by the sea.

Underlying principles:

- Erosion means “wearing away” (from the Latin erodere = to gnaw away)
- Erosion is **not** the same thing as weathering. Weathering involves the breakdown of rock material in place by atmospheric agencies, plant or animal action, and does not involve the removal of the resulting solid debris.
- As rock fragments are transported by water, ice, or wind, the fragments themselves are rounded by being knocked against each other. They also abrade the solid rocks beneath them as they are moved. Both such processes are part of erosion.
- The resistance to erosion of a rock fragment is controlled by the resistance of its constituent minerals; how the crystals of

crystalline rocks interlock; the strength of any cement holding sedimentary rock particles together and any preferred orientation within the rock, such as planes of bedding or of cleavage.

Thinking skill development:

- A pattern is established of the order in which different rock types may be eroded.
- A cognitive conflict occurs when pupils realise that the resistance of the rock type may not be the sole factor controlling the erosion of a landscape.
- Relating the results of the shaker activity to the landscape around them demands bridging skills in pupils' thinking.

Resource list:

- a **plastic** pot with close-fitting lid
- fragments of different rock types or of materials such as brick or concrete
- paper, or a tray for tipping out the dust
- if available – a sensitive balance

Useful links: Try the Earthlearningidea activity ‘Ganges in a gutter’, published 25th February 2008, which can be adapted to produce an erosional channel in sand.

<http://www.bbc.co.uk/scotland/education/geog/coastline/standard/physical/features/erosion/?topic=rock>

<http://www.apqj64.dsl.pipex.com/sfa/id87.htm> -

see lesson 4.

Source: ‘The Dynamic Rock Cycle’ workshop booklet published by the Earth Science Education Unit,

http://www.earthscienceeducation.com/workshops/rock_cycle/erosion.htm

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