From river sediment to stripey rocks

Modelling the build up of different layers of sediment as seen in sedimentary rocks

This activity is about rivers, how sediment is moved and how sedimentary rocks form.

Arrange the pupils into groups and give each group some gravel, sand, clay and broken shells and a transparent container.

Show the pupils a photo of a river in full flood, i.e. very fast flowing with water spread over its banks. If possible, use a local river that they know.
Ask them to put into their container some of the sediment that they think the river could transport in flood conditions. (Tell them not to use all of it as they will want more later).
A. It will be fast enough to move the gravel as well as some sand and clay. Any shells will be broken up and moved. Notice how muddy (caused by very fine-grained clay minerals) the water of the River Tweed is in the photo opposite.

Show the pupils a photo of the river with 'normal' flow, i.e. not in flood and not at low water, *(page 2).*
Ask them to put into their container the sediment that they think the river could now transport.
A. It will be able to transport some sand, mud and tiny pieces of shell but not the gravel.

Show the pupils a photo of the river at low water, *(page 2).*
Ask them to put into their container the sediment that they think the river could now transport.
A. It will be able to transport some mud but not the sand, shells or gravel.

Ask the pupils what organisms they think might be living in the river.
A. Fish, amphibia, mammals, molluscs, plants, bacteria.

Ask the pupils if they think any remains (bones, shells, twigs etc) of these organisms could survive in the water in the three conditions mentioned.
A. The remains of organisms could survive in the river in both normal and low water but the remains of most could not survive flood conditions. They would be broken up and most washed to the sides or out to sea.

Would any signs of these organisms survive in the sediment?
A. Broken bones, shells, plant fragments (photo opposite) may be incorporated into the mud and sand but will often be destroyed by the next flood.

Now give the pupils different scenarios until their containers are full.

Explain to them that all the sediment transported by the river will be deposited when its speed slows. These deposits give a record of the river's activity just like their jars of sediment. The sediment will eventually become compressed and cemented by naturally occurring minerals in the sediment and form sedimentary rocks. Clay minerals (mud) will be just compressed into mudstone. The rocks also record the river's activity. This is one way that geologists can work out what happened in the past.

River Tweed in flood, Berwick upon Tweed
(Ian Kille, Northumbrian Earth)

Pupils' sediment jar on the left. On the right, layers of sediment including coarse, medium and fine sandstone to siltstone and mudstone (dark bands). Sediment deposited by rivers c.300 million years ago, Rocks on Spittal beach, Northumberland.

Plant fragments (coal) in river sandstones
Rocks on Spittal beach, Northumberland.

River Tweed in normal conditions, Berwick upon Tweed, Northumberland *(Ian Kille, Northumbrian Earth)*

River Tweed at low-water, Berwick upon Tweed, Northumberland *(Ian Kille, Northumbrian Earth)*

Stripey river sandstones and siltstones Rocks on Spittal beach, Northumberland. *(Photos: Elizabeth Devon)*

The back up

Title: From river sediment to stripey rocks.

Subtitle: Modelling the build up of different layers of sediment as seen in sedimentary rocks.

Topic: This activity can be used in any science or geography lesson about the processes and products of the sedimentary rock cycle.

Age range of pupils: 8 - 12 years.

Time needed to complete activity: 20 minutes.

Pupil learning outcomes: Pupils can:
- realise that rivers transport sediments;
- appreciate that these sediments are deposited;
- realise that fast-flowing water will move larger grains, e.g. gravel, than slow-flowing water;
- see that the gravel, sand and mud reflect different velocities of water:
- appreciate that the record of organisms in the sediment is often poor because of subsequent flooding:
- realise that layers of sediment will slowly become compressed and cemented (or just compressed in mudstones) to form sedimentary rocks;
- recognise stripey patterns in some ancient sandstones as having been deposited by rivers;
- interpret the changing environment the stripes suggest.

Context:
Photos of normal and low-water flow on the River Tweed are shown opposite.
The activity is useful in consolidating knowledge about sediment transport and deposition by rivers. It helps pupils to interpret patterns they see in ancient river sandstones and to understand that the environment is constantly changing.

Following up the activity:
Gravel is the largest sediment size used in the activity. However, the force of floodwater can break down bridges and move large boulders. The pupils could use a search engine to discover some of the natural disasters that have been caused by floodwater. They could try the Earthlearningidea 'Flood through the window - what would you see, how would you feel?'

Other Earthlearningideas to try:-
'Mighty river in a small gutter',
'Rolling, hopping, floating and invisibly moving along',
'Make your own rock'.

Underlying principles:
- Rivers transport sediments of various sizes according to their velocity and depth.
- This sediment is deposited when the velocity of the river is slowed or where there is an obstacle.

- River sandstones, siltstones and mudstones contain very few fossils.
- Remains of organisms in rivers are often destroyed by fast flowing water.
- Sediments eventually become compressed and/or cemented to form sedimentary rocks.
- These sedimentary rocks give geologists clues about past environmental conditions.

Thinking skill development:
Filling the jar with the correct sediment involves construction. Discussion amongst the group about which sediment should be used is metacognition. Cognitive conflict is created by organisms flourishing in the river but their remains being lost. Relating the story about the river told by the sediment in the jars to a piece of striped sandstone is a bridging skill.

Resource list:
- transparent jars
- gravel, sand, clay, broken shells (enough for each group).
- photos of a river in flood, normal flow and low water.

Useful links:
http://www.earthlearningidea.com/PDF/Make_your_own_rock.pdf
http://www.earthlearningidea.com/PDF/River_in_a_gutter.pdf
http://www.earthlearningidea.com/PDF/230_Sediment_transport.pdf
http://www.earthlearningidea.com/PDF/Flood_through_the_window_2.pdf

Source:
Developed by Elizabeth Devon of the ELI Team from an idea by Dr. Ian Kille, Northumbrian Earth
http://www.northumbrianearth.co.uk/