How have rocks formed and changed?

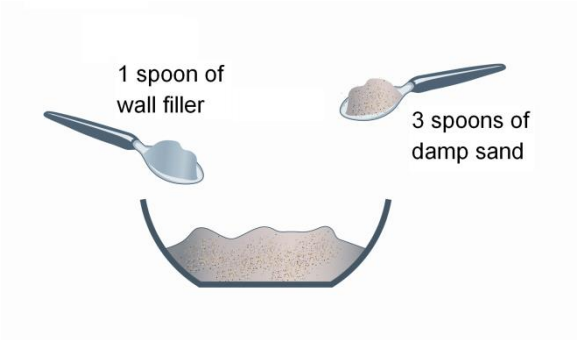
Activity 3: Rock Builder

Activity:
Through this activity, pupils simulate how sediments become sedimentary rocks by being compacted and cemented, and how fossils can be formed in sedimentary rock. The activity needs to 'dry' for a few days before the class comes back to it.

The following investigation can be done without the filler powder and the children will see coloured layers of sand and have fun. If done this way then sand layers will have to remain in the clear bottle/pot. However, if you want layers to solidify, to form a more rock-like structure then the filler should be used.

Follow these instructions:

1. Mix about three spoons of damp sand with one spoon of powdered filler in each bowl/tub of white sand and red sand.



'mix it all up in a tub/bowl' © ESEU

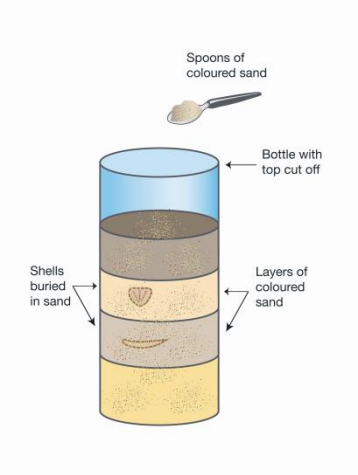
2. Smear some petroleum jelly on both sides of each shell using your fingers (it makes it easier to lift them out at the end of the activity) - then wash your hands.
3. Use the spoon to fill the bottle with alternate layers of the different coloured sands, putting the shells into different layers. If you place the shells at the edge you will be able to see them through the side of the bottle.
4. After each layer has been added, press it down to compact the sand.
5. Write down predictions for what will happen when your layered 'rock' is left in the bottle for a few days:

   What will the filler powder do that you couldn't do just by squeezing?

   What will happen to the sand in the bottle after a few days?

   What will happen to the shells after a few days?

Keep your predictions safe so you can see if you were right later.



'layered sand' © ESEU

Leave your layered rock to harden in the bottle for a few days; the plastic bottle can then be cut away. Were the predictions correct?
You can prise out some of the shells at the edge and look at the imprint as well as the 'fossil' itself.

Pupil learning outcomes:
- Sediment is the general name given to mud, silt, sand, pebbles and boulders.
- Sediments become sedimentary rocks by being compacted and cemented.
- Sedimentary rocks may contain fossils.

Curriculum for Excellence Sciences and Social Studies Experiences and Outcomes:
These are given in a grid on pages 38-41.

Pupil practical or teacher demonstration:
Pupil practical.

Time needed to complete the activity:
30 minutes on the activity day.
15 minutes on follow-up day.

Preparation and set-up time:
Plastic bottles required to be prepared in advance.
10 minutes.

Resources:
Per class on activity day:
- piece of sandstone
- file
- damp sand
- dry sand (a handful)
- pebbles (a handful)

Per group/pupil on activity day:
- spoon
- bowl
- plastic bottle (with the top cut off)
- shells
- damp white sand (damp but not sodden)
- damp red sand (damp but not sodden)
- powdered filler (e.g. Polyfilla^{TM})
- petroleum jelly

Per group/pupil on results day:
- damp sand
- scissors
- their simulated rock trials (dried and set)
- their predictions from the activity day

Note that: Plaster of Paris sets with an exothermic reaction and has been known to cause burns when used in large quantities. The amounts being used here are very small and there are, therefore, no recognized hazards in this context.

Ideas for leading into the activity:
Learners are reminded of their role of an Earth scientist and that they are going to use their Earth scientist's toolkit to investigate the formation of sedimentary rocks by setting up and carrying out an experiment which simulates this process.

Show the dry sand and pebbles. Explain that mud, silt, sand, pebbles and boulders are called sediment.

Rub a piece of soft sandstone with a file and study the grains produced. Discuss how sandstone might be made of 'stuck-together sand', and how the presence of sandstone might have meant that parts of Scotland were once covered by sand.

Suggest that we are going to try and turn sand into sandstone.

Get everyone to get a handful of damp sand. Ask them to try and squeeze it really hard to turn it into rock like the sandstone. *Did anyone manage to do this?*

Ask what else they might need to get it to stick. *Some kind of glue or natural cement.*

Explain that sedimentary rocks are made over millions of years from loose debris being squeezed and stuck together.

Ask them where they might see sedimentary rock today e.g. buried beneath the ground, in cliffs, road cuttings, in building stones and gravestones.

Ask what would happen to a shellfish (e.g. mussel, oyster, clam), or a fish, or even a cola can, that was buried in sand for millions of years. *The hard bits might be left behind as a fossil.*

You may want to bring in the idea here that the soft-tissues of animals usually decompose leaving the 'hard parts'.

Explain that they are going to investigate the processes of sedimentation and fossilisation by *simulating* them.

- Explore why we need to simulate these processes.
- Why can't we investigate them for real?

Ideas for following up the activity:
Ask pupils to describe, using observation and touching, what has happened to the sand that they tried to squeeze really hard to turn it into a rock compared to the damp sand they put into the bottle. *The sand in the bottle became hard, solid and dry.*

What caused this? *The sand was compacted (by being pressed into the bottle) and cemented by the filler powder.*

Pupils should break apart their rock to reveal the shell 'fossils' and their imprints (moulds). What might have happened to the fossil if more pressure had been used to make the rock? *It may have become flattened, crushed and broken up.*

How do we get fossils out of real rocks? *Chip away at them with a sharp hammer or chisel.*

Explore the idea of a simulation in science. Why did we have to investigate sedimentary rocks this way? Why not go out and watch them being formed? Is it right to collect fossils using a hammer/chisel (a discussion about conservation)?

Extension ideas for more able or faster pupils:
You may want to conduct a much larger fair test investigation around the excitement that fossils often generate as suggested below.

Using this activity as a base, pupils could design, carry out and report on a series of fair tests to find out what the best sedimentary rocks for preserving fossil imprints might be like.

Variables that could be explored include:

- the amount of filler powder (simulating natural cement);
- the amount of time it is left for;
- the amount of compaction (by putting heavy weights on top);
- the amount of water;
- the size of the sediments (sand comes in different "grades" and you could also offer small pebbles, or mixtures of sand and pebbles, or different layers of sands and pebbles);
- fossils are much more common in some Scottish rocks than others – why is this? (More organisms lived in some areas than in others, the conditions for preservation were better in some areas than in others, igneous rocks never contain fossils (Pompeii is very exceptional) and metamorphic rocks rarely do.

There is a lot of potential for a full report in a meaningful context (fossil preservation).

Source of activity:
Originally developed in the first Scottish writing workshop; Earth Science Education Unit.