

ACTIVITY 4: **Compaction and Cementation (sediments into rocks)** **(hundreds to millions of years)**

Topic addressed:

To explain that for most sediment to become rocks, the grains need to be squeezed together (compacted) and/or glued together (cemented). The extent of the compaction and the strength of the cementation affect the properties of sedimentary rocks.

Curriculum for Excellence Sciences and Social Studies Experiences and Outcomes:

SOCIAL SCIENCES		
FIRST LEVEL	People, place & environment	SOC 1-07a I can describe and recreate the characteristics of my local environment by exploring the features of the landscape.
	People in society, economy & business	SOC 1-18a I have participated in decision making and have considered the different options available in order to make decisions.
SECOND LEVEL	People, place and environment	SOC 2-07a I can describe the major characteristic features of Scotland's landscape and explain how these were formed.
THIRD LEVEL	People, place and environment	SOC 3-07a Having investigated processes which form and shape landscapes, I can explain their impact on selected landscapes in Scotland, Europe and beyond.
SCIENCES		
FIRST LEVEL	Materials	SCN 1-07a (Earth's Materials) By investigating forces on toys and other objects, I can predict the effect of the shape or motion of objects.
		SCN 1-15a (Properties and uses of substances) Through exploring properties and sources of materials, I can choose appropriate materials to solve practical challenges.
SECOND LEVEL	Materials	SCN 2-15a (Properties and uses of substances) By contributing to investigations into familiar changes in substances to produce other substances, I can describe how their characteristics have changed.
		SCN 2-17a (Earth's Materials) Having explored the substances that make up Earth's surface, I can compare some of their characteristics and uses.
THIRD LEVEL	Materials	SCN 3-17a (Earth's Materials) Through evaluation of a range of data, I can describe the formation, characteristics and uses of soils, minerals and basic types of rocks.

Pupil practical or teacher demonstration

Pupil practical

Time needed to complete the activity

20 minutes

Preparation and set-up time

10 minutes

Resource list:

- 2 plastic syringes (20cm³), with the nozzle cut off at the end of the barrel (with a hacksaw)
- Tray
- Safety goggles
- Disposable cups
- Plastic spoons
- Water dropper
- 250g of dry sand
- 10g of powdered clay
- 10g of plaster of Paris powder
- Water
- Apparatus for testing strength of the pellets, e.g. file, variety of masses, heavy ball-bearings

Note: Do not let pupils pour plaster of Paris down the sink.

There is no significant hazard with the use of small quantities of plaster of Paris.

Activity:

Carry out a risk assessment (see pages **Error! Bookmark not defined.-Error! Bookmark not defined.** at the end of this document).

Try this exercise to help to explain how sand becomes sandstone. **HINT - don't overdo the water!** Use a plastic cup for all mixing, before inserting the mixture into the syringe.

1. Put some damp sand in a syringe which has had the nozzle cut off.



© ESEU

2. Put the open end of the syringe on the palm of your hand and press the plunger in hard using your thumb to squeeze the water out.



© ESEU

3. Carefully push the sand pellet out of the syringe so it lies on its side on a piece of paper, label it and leave it to one side.
4. Mix three parts of damp sand with one part clay.
5. Repeat steps 1, 2 and 3 using the sand/clay mix instead of the sand.
6. Repeat the same three steps but this time use a mix of five parts of damp sand and one part of plaster of Paris powder.
7. Leave your "rocks" to dry (eg. overnight).
8. Which of the pellets is most like a rock? Plan an investigation which will give you evidence to show which is most rock-like.
9. Carry out your investigation.

Questions:

- Do your results support your conclusion?
- How could you improve your investigation if you could do it again?
- Do you think that sandstone can be formed from sand by pressure alone?

The compaction of sand and mud can be modelled with coins and matchsticks, respectively, which can be 'compressed' between two pieces of wood on an overhead projector.

Pupil learning outcomes:

- The extent of compaction depends upon the type of sediment.
- Little compaction takes place when sand is converted to sandstone.
- In muds and clays, water may initially comprise 80% by volume of the sediment; a great deal of compaction takes place when this is squeezed out.
- Sands become sandstones when natural cement crystallises in the pore spaces. The natural cement is formed from new minerals that crystallise from circulating waters.

Leading into the activity:

Sandstone was once loose sand. The grains of sand have become stuck together in sandstone. Ask pupils if they think something has happened to the sand, or has something been added to the sand? How has this happened?

Source of activity:

This activity is based on the Earth Science Teachers' Association's (1991) 'Second-hand Rocks' in Science of the Earth 11-14 series, published by Geo Supplies, Sheffield.