

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

Carry out a risk assessment (see pages 103-105 – available at workshop delivery).

All sediment was once loose. To become rock, the grains need to be squeezed together (compacted) and/or glued together (cemented). The amount of the compaction and the strength of the cementation affect the properties of sedimentary rocks.

Try this exercise to help to explain how sand can become 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.



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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.



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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 (e.g. overnight).
8. Which of the pellets is most like a rock?
9. Plan an investigation which will give you evidence to show which is most rock-like.
10. 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?
- Be ready to tell the rest of the group about the investigations and your results.

The compaction of sand and mud by pressure of the mass of overlying sediments can be modelled with coins and matchsticks, respectively, which can be 'compressed' between two pieces of wood.

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.

Curriculum for Excellence Sciences and Social Studies Experiences and Outcomes:

These are given as a grid on pages 94-99 (available at workshop delivery).

Pupil practical or teacher demonstration:

Pupil practical.

Time needed to complete the activity:

20 minutes.

Preparation and set-up time:

10 minutes.

Resources:

- 2 plastic syringes (20cm³), with the nozzle cut off at the end of the barrel (with a hacksaw)
- Tray
- Eye protection
- 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

Notes:

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.

Ideas for 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 taken from 'How the Earth Works' by [Peter Brannlund](#) (1995) Geological Society of London.