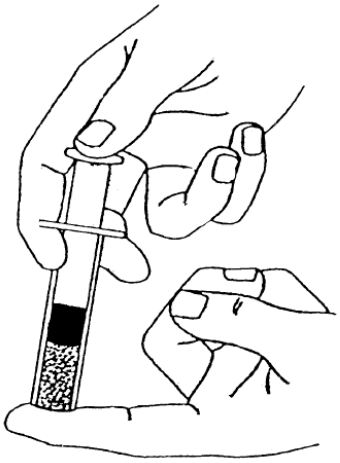
Making and testing rocks – compaction and cementation.

The aim of this experiment is to find out how loose sediment like sand can be converted into solid rock, using different cementing materials to bind grains together. You can follow this up by testing the strength of your laboratory "rocks".

<u>You will need</u>: Some sand, 3 plastic cups and a spoon for mixing, a syringe with the end cut off, a little petroleum jelly, some clay powder, and some Plaster of Paris. It may help to spread newspaper or use a plastic tray to avoid mess.

(i) Take about ¼ beaker full of sand and dampen it with a small amount of water to make a stiff mix. Be careful not to break the spoon!

(ii) Smear a little petroleum jelly on the inside of the syringe. It helps to have a paper towel to wipe your finger afterwards.



(iii) Fill the syringe with the damp sand and compress it on your finger or the palm of your hand as shown in the diagram to squeeze out any air.

(iv) Carefully push your pellet of sand out onto a piece of paper and leave to dry.

(v) Mix 3 parts dry sand with 1 part clay powder. Mix well and dampen with water as before. Then repeat steps (ii), (iii), and (iv) above.

(vi) Lastly, mix 5 parts Plaster of Paris to 1 part sand and repeat the whole process (steps (ii) to (iv)) once more.

You should now have three pellets or "rock", which you should label with your name and showing which is which. Leave them somewhere safe to dry out for a few hours or days.

If time is available, you could ask your teacher if you can try a different mix of sand with Plaster of Paris, or try another binding agent, such as salt or sugar.

<u>Follow-up: Testing your rocks.</u>

When you return next lesson, your samples will have had plenty of time to become cemented together to form "rock". Can you think of some ways in which you might be able to compare which of your "rocks" is the strongest/weakest? Discuss your ideas and plan out what you will do; you will also need to find out what equipment your teacher is likely to make available for you to use.

When you write about this experiment, see if you can include answers to the following questions:

What happened to the damp sand, and why?

Can sandstone be formed by pressure alone?

Which "rock" was the strongest, and why?

How are "real" sedimentary rocks cemented together?

Teacher/Technician Notes:

1. ***Background:***
   See web pages on Burial & Compaction.

2. ***Preparation for experiment:***
   Some introductory discussion/questions about how sediment becomes buried and converted to rock provides an obvious lead-in to the experiments; discussion can also mention “manufactured rocks” such as cement and concrete.

3. ***Apparatus & Materials:***
   These are generally straightforward (see “You will need” above), but require preparation of cut-off syringes (using a Stanley knife or hacksaw). Metal spoons may be better than plastic ones for mixing. Plaster of Paris is readily available from craft shops and chemists’ shops as well as lab suppliers. Thought should be given by the teacher to waste disposal, so as to avoid sinks being blocked!

4. ***Follow-up experiment:***
   Students can be encouraged, at the end of the main experiment, to devise their own ideas for testing their samples. Few will come up with a remotely quantitative test; but some ideas will be provocative, at least!

   A good test of the strength of the “rock” pellets is to stand each on end, on an electronic top-pan balance (to measure at least up to 2kg) and then press downward on the top of the pellet with your thumb, increasing pressure until the sample breaks – or the balance limit is exceeded. This actually mimics the standard compression tests used by engineers on rock and concrete samples, employing hydraulic presses. It may help if the teacher or technician prepares a nicely trimmed-off set of pellets beforehand – these could include a variety of Sand and Plaster of Paris mixes from, say, 20:1 down to 3:1.

   Lastly, this experiment provides an opportunity to introduce the time factor in Rock Cycle processes. Sediments do not turn into rocks overnight – indeed, many sediments take millions of years to turn into hard rock. Further information about geological time can be found in the web pages on Uplift.