Sedimentary Structures

Direction of transport cards ***D***

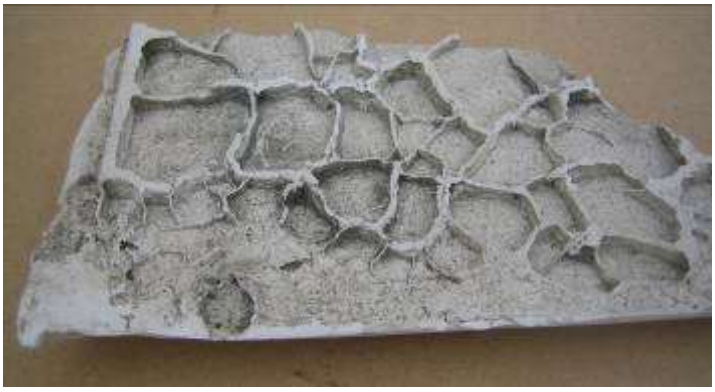
A5 cards with a sedimentary structure diagram on each are held up one at a time for students to work whether the direction is to the left or right.

Interpreting sedimentary structures ***A I 2 min per sample***

Samples of sedimentary structures or photographs are laid out for identification, for determining the direction of water flow, for determining way-up, and to suggest a possible of environment of formation.

Making mud cracks ***D***

Mud is spread on to a tray about 30cm by 20cm. The mud should be about 2cm deep. Allow to dry and crack but do not let it dry so much the pieces become separated. Show students then pour plaster of Paris over it making a layer 1cm thick. After setting this is removed and shows the pattern of ridges typically found on the underneath of a sandstone deposited on top of desiccation cracks. Mud can be made from cat litter.



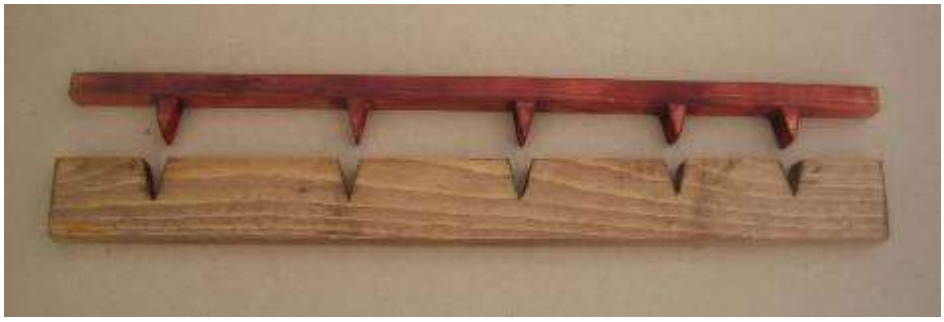
Plaster cast of mud cracks

Mudcracks ***E P F 40 min***

Make trays with different thicknesses of mud and after drying compare the spacing of the cracks.

Model to show formation of mud crack casts ***D***

A strip of wood is cut to show the pattern of mud cracks and another, representing the sand that fills into the cracks is cut to fit into the first.



Making symmetrical ripple marks ***D or P***

Use a trough or glass tank at least 50cm by 10cm by 10cm with a tea spoon (25ml) of fine sand (1/4mm) and 3cm of water. Damp sand beforehand otherwise it floats. Students shake the trough backward and forward and then ripples form on the base of the trough. Shaking at different speed results in different wavelengths.

Orbital motion of water under waves ***D***

To show the orbital motion of the water as a wave passes and the formation of symmetrical ripple marks use a glass trough 50cm by 10cm by 10 cm with 7cm depth of water, some fine sand and a cloth or board covering the end of the trough to stop splashes. Add a very small amount of food colouring about 2cm, 4cm and 6cm below the water surface using a pipette and then make gentle waves. The orbitals get smaller with depth and the sand moves backward and forward.

Wavelength and amplitude of ripple marks ***A P 5 min***

Students measure the wavelength and amplitude of samples of ripple marks using a ruler and a tyre depth gauge (see appendix) and transfer the actual shape of the ripples to their notes using a profiler which is available from hardware stores.

The shape of ripple marks A I 2 min
Students use a profiler which can be bought from a hardware store to copy the shape of ripple marks onto paper.

Way up of symmetrical ripple marks A P 2 min per sample
Students are provided with several samples of symmetrical ripple marks some which are the right way up and some are casts of ripple marks and are therefore upside down. They must decide which is which.

Correcting for tectonic tilt A P F 5 min per sample
Students are provided with several sedimentary structures propped up so the bedding surface is at a steep angle. Students must work out the original direction of any linear features before the bed was folded using a protractor and a compass.

Ripple simulator ***D or P***

Students use a computer programme by Jon Mellor (1995) to alter the water speed, depth and grain size to see under what conditions different sedimentary structures form.

Formation of asymmetric ripple marks in a flume ***D***

Asymmetrical ripples marks can be shown forming if you have a small flume (see appendix) or by using circular motion in a large round flat bottomed transparent container with a beaker in the centre.

Formation of cross bedding in a flume ***D or A***

The formation of cross bedding and the movement of dunes and of the individual sand grains can be demonstrated using a flume (see appendix). Students draw the shape of the dune on the glass side and watch it advance.

They can also use dye to show the movement of the water over the dunes.

Making dunes ***D***

Fold a large piece of white paper (A1) so it makes a channel and put a pile of fine sand at one end. Blow on this with a hair drier and the sand will form into a series of dunes.

Orientation of pebbles in rock ***A P F 30 min***

Students are provided with a photograph of a bedding plane containing lots of pebbles e.g. Millstone Grit. They draw lines along the long axis of each pebble and then measure its orientation. The data are then plotted as a rose diagram. This can then be compared with other directional information from the bed such as cross bedding.

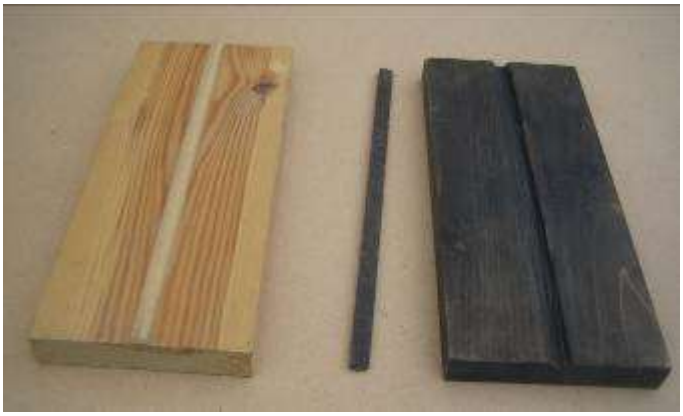
Way up photos ***A I 2 min per photo***

Close up photos of walls made of sandstone showing cross bedding. Whitby cathedral and other buildings on that coast are a good source of photos. Students determine which sandstone blocks have been laid upside down.

Model to show formation of a groove cast ***D***

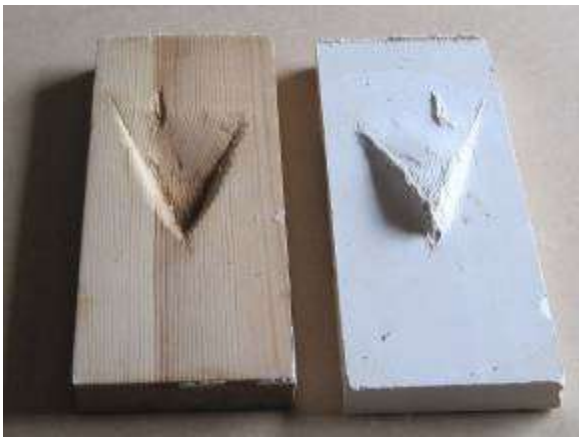
A piece of wood 20cm by 10cm by 2cm stained black to represent black mud with a semicircular groove cut in it lengthways. A piece of semicircular doweling (called half round) also dyed black fits into the groove. A second piece of wood the same size, unstained represents the overlying sandstone. This has a piece of another piece of half round doweling attached to it.

Show students the black shale (wood with groove filled with black dowelling), Remove the dowelling, this represents a stone scratching the mud surface. Place the white wood on top with the grooved now filled with the white dowelling, this represents a layer of sandstone filling in the groove and forming a layer above the mud. Remove white wood to show pattern on the underneath = groove cast



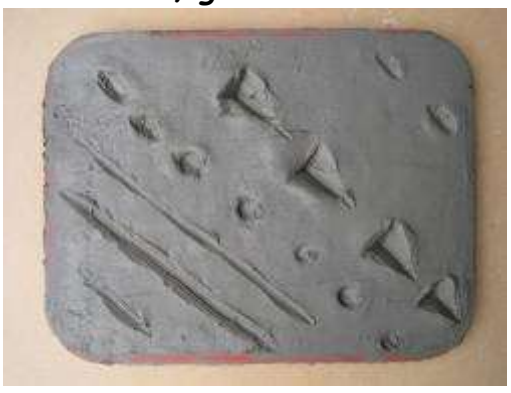
Flutes and flute casts ***D***

Students sometimes find it difficult to visualise the shape of a flute from diagrams. Provide them with a 3D flute and flute cast by chiselling out the shape of a flute from a piece of wood. Make a cast of the flute in plaster of Paris. Alternatively make a flute cast out of plasticine and then cover it with plaster of Paris to form the flute.

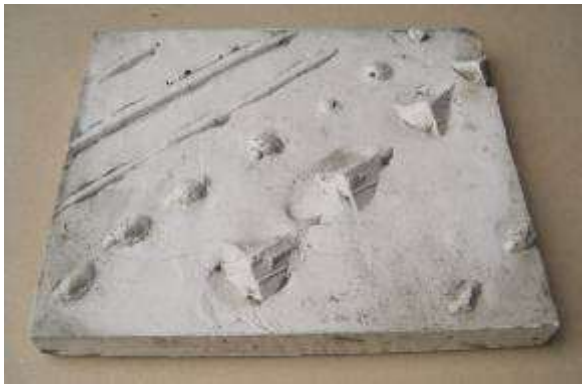


Flutes, grooves and bounce marks D or A

Fill a shallow tray with clay. Students take it in turns to make a groove, a flute and a bounce mark. The mud is then covered with plaster of Paris 1cm thick. After drying for a day the clay is removed and you have flute casts, groove casts and bounce casts.



Clay



plaster cast

Making Imbrication E P F 20 min

You will need a piece of flat bottomed guttering 1m long. Cover the bottom with glue and stick 1cm diameter pebbles to it. Fix a stop end to the top end of the guttering and support it on a 5cm high block. Put 20 plastic counters in the top end of the guttering and pour water behind them. The counters will move down the guttering and most will come to rest sloping up stream.

Interpreting imbrication *P 1 minute or 10 min*
Students examine photographs of stream banks and of ancient river deposits to work out which way the water was flowing.

Making rain prints *D or A F 25 min*
These can only be made by real rain. You will need clay about the consistency of yogurt in a tray. Place the tray outside in the rain on a stool for a few minutes until there are clear prints. A second tray can be left outside to see what happens if many drops fall on it.

Making graded bedding *D or A P 10 min*
Students take a desert spoonful of poorly sorted sand and tip it into a 250ml cylinder ¾ filled with water. This is repeated several times. This will result in several clearly graded layers. Alternatively as a demonstration use a 2 litre measuring cylinder and pour in 100cc of sediment.

Making salt pseudomorphs *D*
Cover a tray with 1cm of clay. Sugar cubes are pressed partially into the clay. This represents the growth of the salt crystals. Remove the cubes after a few min. This represents the solution of the salt crystals. Place a frame 1cm deep and 20cm by 20cm on top of the clay and pour plaster of Paris onto the clay to form a layer at least 1cm thick and allow it to set. Remove the plaster to see the salt pseudomorphs on the underside.

Clay with sugar lumps

Plaster cast

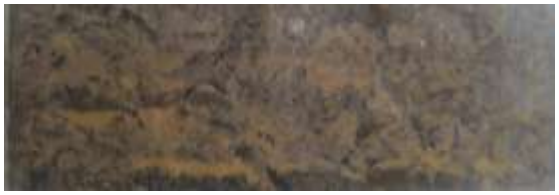
Chemical banding = leisegang structures ***D or A P 5 min***

Put a drop of ink on blotting or filter paper and watch it separate out into bands to show how leisegang patterns develop in sandstones by the migration of chemicals.

Burrows and bioturbation ***D***

Place a thin tube vertically in a jar or a wormery. Crumble some dry soil and put a layer about 1cm thick in the jar. Add a layer of light coloured sand on top. Then add more layers of sand and soil, it is difficult to get them completely separate and horizontal. Place some grass on top. Use the tube to add enough water to dampen the soil. Finally add some worms.

Before adding worms



After two weeks

Sedimentary structures photo cards ***I 2 min per card***

Photos of sedimentary structures are stuck onto cards. There are questions beneath each photo. Students must describe the photo and make deductions from it and answer the questions.