

Environmental Management: Lithosphere practicals

From rock to clay

Aim:

To demonstrate how rock becomes stones, pebbles, sand and clay.

Equipment needed:

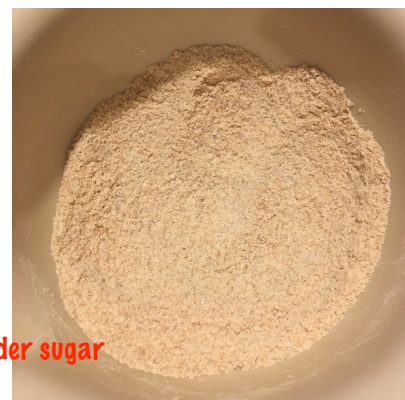
- sugar crystals (or cubes if your supermarket doesn't have any of the crystals)
- Pestle and mortar

Method:

1. Grind down the rock crystals/sugar cubes until you make granulated sugar.



2. Grind down the granulated sugar until you make castor sugar, and ground down the castor sugar until you make icing sugar.



Explanation:

Boulders are big bits of rock that were at one time attached to a much bigger bit of rock, e.g. a cliff. **Weathering** breaks these boulders away from the main bit of rock, and then either they continue to weather down into smaller pieces where they are, or they get **eroded** away from the site by such things as gravity, water, wind etc.

Weathering will break these boulders down into smaller and smaller bits. The smaller the bits are, the more easily they will be eroded away (for example, a sandy beach can be erode away by wind or tide much faster than a rocky beach).

Going down in size, it goes: boulders, stones, pebbles, gravel, sand, silt and finally clay particles (really, really, really fine rock particles - about the same size as icing sugar particles).
[Good picture showing classification by size here: https://www.globalspec.com/learnmore/engineering_services/geotechnical_services].

These smaller pieces of rock are what go on to form the layers in sedimentary rocks.

Weathering and erosion work together, e.g. chemical weathering may dissolve tiny bits of a rock away, creating a small chink. Rain falls into the chink and freezes in winter. When the water freezes, it expands, creating a crack in the rock. Further freeze/thaw (physical) weathering will make the crack wider, creating a weak spot in the rock. If this rock is part of a cliff, gravity is constantly trying to pull the rock down, and once the crack is of a certain size, gravity will be enough to pull the rock on the outside of the crack down into the sea, where the smaller bits of rock will get washed away by the tide (erosion), and the larger bits will erode away at a slower rate.

Weathering - Where the rock wears down where it is.

- Biological - plants and animals, e.g. walking over rocks, tree roots growing through rock etc.
- Chemical - e.g. minerals in rain water, CO₂ in air creating chemical reactions with the rock etc.
- Physical - temperature (freeze/thaw), wind, rain, waves etc.

<https://www.bgs.ac.uk/discovering-geology/geological-processes/weathering/>

Slide show: Weathering and soil formation - <https://slideplayer.com/slide/14610519/>

Erosion - Where chunks of the rock break apart and move away from the main piece of rock, due to:

- Gravity
- Wind
- Rain
- Rivers
- Oceans
- Glaciers

<https://www.bgs.ac.uk/discovering-geology/geological-processes/erosion/>

Further experiment:

- Add a teaspoon of water to a sugar crystal. Mix and watch to see what happens. Leave it and come back an hour or two later. Are there any differences?
- Try this with the granulated sugar, the castor sugar, and the icing sugar. How do the textures differ?



A bit too much water was added when we did it, but you can still see the general differences when water is added.



Results:

The bigger bits of sugar should stay as big pieces in the water. As you leave it, the sugar crystals will eventually dissolve. The icing sugar, however, will make a paste.

Explanation:

Although clay and icing sugar are very different substances and have very different characteristics (not least, sugar will dissolve in water, and clay particles won't), unlike sand and granulated sugar, clay and icing sugar both clump together when water is added, forming a sticky mass. The science that holds these particles together are different due to the different natures of the substances, but the overall effect is the same - sticky stuff that is fun to play with.