

Boring chocolate! What can boreholes tell us about the Earth?

If possible, show the pupils the video clip filmed on Resolution, an ocean drilling research ship.

<http://joidesresolution.org/node/2038>.

This will explain the activity.



'Drilling' a borehole into a cake to obtain a core.

*Image taken from the video clip produced by JOIDES
(Joint Oceanographic Institutions for Deep Earth Sampling)*

If the video clip is not used, ask the pupils how do they think scientists and engineers know what is under the ground? How do they know where to mine for coal or where to drill a well to find water or oil and gas, when none of these resources can be found on the surface?

Explain that one of the ways geologists find out is by drilling a **borehole**, usually vertical, into the ground and through the rocks beneath. The drilling equipment may have a tube within it which becomes filled with the rock and sediment the bore is being driven through, and can be brought back to the surface. When the tube is opened it reveals a **core**. Show the pupils the photo, *page 2*, of a real core through the Hutton oilfield in the North Sea. Tell the pupils that by studying the rocks, and possibly fossils, in the core, geologists can find clues to show if a resource like oil or gas, water or coal could be present.

Show the pupils a cake or a variety of chocolate bars. (If you use the latter, make sure there are no distinguishing marks on the surface which the pupils may recognise.) Ask them to pretend that the surface of the cake or chocolate is the surface of the Earth so they cannot cut or bite into it. How can they find out what is inside?

The answer is to drill a borehole and extract a core. Pupils may have seen cheese-makers doing this to see whether or not the cheese is ready. We suggest using an apple-corer in this investigation but you could use any metal or hard plastic tube. However, you will need a piece of dowel that fits the

tube to push the core out. The result of a borehole through four different chocolate bars can be seen in the photo below.



Core from a 'borehole' through 4 chocolate bars

(Photo: Elizabeth Devon)

Ask the pupils to draw the cores, with accurate measurements, resulting from their boreholes. Were there any surprises? In a cake it is possible to hide a layer of cream or jam. Some chocolate bars reveal surprises too.

The back up:

Title: Boring chocolate!

Subtitle: What can boreholes tell us about the Earth?

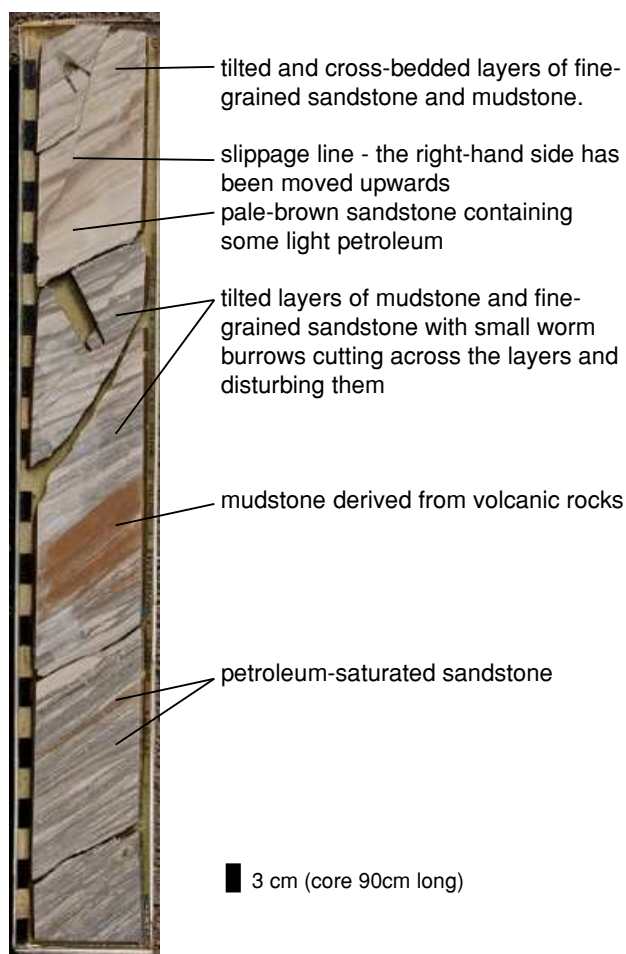
Topic: This activity can be used in any science or geography lesson about finding what is beneath the Earth's surface, including the search for natural resources and understanding past environments.

Age range of pupils: 7 - 14 years

Time needed to complete activity: 20 minutes

Pupil learning outcomes: Pupils can:

- describe that boreholes are holes drilled into the ground for a variety of purposes;
- explain that the borehole can be used to bring a core of the underground rocks to the surface;
- explain how, by studying the sequence of rocks shown by the core, scientists can gain a great deal of knowledge, not only about the resources that are present but also about past environments;
- explain that boreholes are relatively non-intrusive to the surrounding landscape and can be sealed over when no longer needed.



Core from the Hutton Oilfield, North Sea
supplied by Peter Craig, Earth Science Education Services
(Photo: Elizabeth Devon)

Context:

There will be much discussion about the need for boreholes. Most pupils will have heard about the controversies surrounding fracking, the hydraulic fracturing of shales to obtain the gas they contain. Many of our natural resources have been discovered as a result of drilling boreholes and taking core samples, without fracking. We have also learned a great deal about past environments from the evidence in the rocks they contain.

Following up the activity:

Using a search engine on the internet, pupils could investigate some of the uses scientists make of boreholes, e.g. in the fracking industry or in ice cores from Antarctica. The latter retain air bubbles from thousands of years ago which can be analysed to find the composition of the air and the temperature at that time.

Underlying principles:

- Several types of boreholes are used to investigate rocks below the surface.
- Some boreholes are drilled to bring cores of material to the surface. The rocks of these cores can then be studied in detail.
- Other boreholes allow specialist equipment to be lowered into the rocks. These instruments record e.g. hole diameter, gamma rays, resistivity, formation density, the results of which can be analysed to interpret the rocks beneath.

Thinking skill development:

Discussion about what the various chocolate or cake cores will reveal involves metacognition. There is cognitive conflict when the core does not contain what is expected. Relating the cake or chocolate cores to real cores is a bridging skill.

Resource list:

- cakes or chocolate bars
- apple corers or metal or hard plastic tubes. If the latter are used, pieces of wood which fit into the tubes will be needed to push the core out
- images of boreholes and cores (optional).

Useful links:

JOIDES Resolution research ship, science in search of Earth's secrets - <http://www.joidesresolution.org>
British Geological Survey - boreholes - <http://www.bgs.ac.uk/data/boreholescans/home.html>
British Geological Survey - cores - <http://www.bgs.ac.uk/discoverymetadata/13603048.html>

Source:

Elizabeth Devon of the Earthlearningidea Team.

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