PRIMARY TEACHING

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INTRODUCING ROCKS

Initial Investigations in the Classroom

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Introduction

This is another celebratory issue, this time covering core information about rocks and revising earlier PESTs, now out of print. The investigation of rocks and their basic properties allows children to discover and understand the differences between various rock types and consider their suitability for a variety of purposes.

Background Information

Rocks are an accumulation of minerals (see issue 82). The minerals and how they are assembled determines the rock type and its properties.

- Igneous rocks consist of minerals which have grown together as crystals from molten magma or lava as it cools and solidifies. E.g. granite and basalt.
- Sedimentary rocks form at the Earth's surface by the deposition of loose sandy material such as minerals or broken fragments and grains of older rocks. They can also contain shells and fossils and may even be formed by tiny sea creatures or by precipitation. E.g. sandstone, mudstone, clay, limestone (including chalk).
- Metamorphic rocks are igneous or sedimentary rocks which have had their properties changed in some way by heat (baked), pressure (squashed) or usually a combination of both. E.g. marble and slate.

Six Common Rock Types

Full sets of rocks, including all the rocks named above and more, for class or individual investigation can be bought from ESTA but it is quite easy to collect and store your own samples. Garden centres and memorial masons can be helpful, but take care – not all rocks labelled 'granite' are actually granite and many marbles are polished limestones. The six recommended and contrasting rock types are granite, sandstone, slate, limestone, basalt and marble and these are the rocks on which the activities in this issue are based. See the table on page 2 which also gives the most obvious characteristics of each rock. A similar table can be produced to include other rocks, especially if there is distinctive local rocks which would be interesting for pupils to investigate.

Activity 1 - Sorting Rocks (KS1 or KS2)

Before doing any experiments on, or trying to name, your rock collections it is a good idea to do an activity to sort or group the rocks simply by their characteristics and differences. With minimal guidance pupils should work in small groups and choose their own criteria to sort the rock samples into 2 or 3 sets (perhaps placing each set on a separate paper sheet or disposable plate). They should record their descriptive words for their sorting criteria e.g. texture, colour, shape, shiny/dull, sparkly etc. When sorted the groups should explain their criteria to the rest of the class before sorting in a different way or subdividing their original sets e.g. a set of pale coloured rocks may subdivide into smooth and rough or shiny and dull. It may be useful to give more guidance and discuss possible criteria and descriptions before starting.

Activity 2 – Rock Identification (KS2)

Preparation:

a) For this activity it is a good idea to devise a recording sheet in the form of a table with enough spaces/cells for each of your rock samples. The cells should be big enough for pupils to draw different specimens, label specific characteristic and write any clues to identification (e.g. colour, crystal/grain shape) which they have found, with spaces for descriptive terms and the name of the rock to be written once deduced (e.g. fill one A4 sheet).

b) Copy the 'Rock Identiclue' tickets from the table below. By copying back-to-back or by sticking two sheet together so the rock names appear on the back of the clues. Cut up and staple together into booklets.

Investigation:

Working in small groups and using magnifying glasses pupils should look carefully at each specimen in turn and complete the recording sheet. If they work in pairs they can point out and discuss their observations before swapping rocks with other group members.

After the pupils have completed their own observations they should work through the clues on the printed 'Rock Identiclue' tickets to help them work out the name of the rock specimens.

Large crystals, different colours	Granite
Sand grains, rusty colour	Sandstone
Splits into layers, dark grey	Slate
Fossil shells, pale colour	Limestone
Small crystals, mostly black	Basalt
White, sugary crystals	Marble

Investigating some Properties of Rocks

The six named rocks provide contrasting examples so are ideal for comparing their properties and determining which rock would be best to use in a variety to situations (e.g. roofing).

Activity 3 – Hardness

Following on from the first two activities pupils can investigate the hardness of the rock specimens. This can take the form of a simple rubbing test to see if the rocks shed loose or dusty material, indicating a relatively soft rock. Testing the samples by seeing if they can be scratched with a nail would give more accurate results. The test results should be recorded and the samples placed in order of softest to hardest or *vice versa*. The differences in hardness give an indication of durability. With this in mind, possible uses for each rock could be discussed and listed either as a class activity or within their working groups.

Activity 4 – Porosity

Porosity is a measure of the pore spaces (gaps) between the grains making up the rock specimens and can be measured by seeing how much water a rock sample can hold. Although porous rocks can also be permeable, if the pore spaces are well enough connected, the two terms should not be confused. Permeability is the flow of water through rocks and is measured in metres per second. Non-porous rocks are impermeable (water cannot flow through them). Also, some normally porous rocks, such as some sandstones, may have a high proportion of their pore spaces blocked up by other minerals so may not be as porous as expected. Copy the following instructions and table onto a separate sheet for each pupil.

Testing for Porous Rocks

Equipment: Water dropper (demonstrate use), rock samples and paper towels.

Method: Test one rock at a time. Place one drop of water on each rock specimen.

Results: Observe what happens to the water on each sample, deciding whether the water soaks into the rock or just stays on top or runs off. If the water soaks in, place a tick or write ‘yes’ in the relevant column of the results table. Record the results for the non-porous rocks in the same way.

ROCK		POROUS	NON-POROUS
Granite	(large, coloured crystals)		
Sandstone	(red grains)		
Marble	(white, sugary crystals)		
Slate	(grey/purple, hard)		
Basalt	(black, tiny crystals)		
Chalk	(white, smooth)		

Compare the results with those from Activity 3, Hardness. Discuss the possible uses for each type of rock tested. Does the porosity of the some rocks change your thoughts on some of their possible uses?

Erosion and Weathering

Following your investigations into the hardness and porosity of certain rocks it is a good idea to then find out how those properties affect the rocks' erosion by physical processes.

Activity 5

This activity uses sugar cubes and boiled sweets as analogies for soft (sedimentary) and hard (igneous) rocks. It demonstrates how such rocks are eroded in an environment such as a beach where they are pounded and knocked together by waves. Working in 3 groups would be ideal.

Aim: To determine the effect of mechanical erosion on hard and soft rocks and compare how the different materials erode.

Equipment: 3 sweet or small biscuit tins or sturdy screw-top plastic containers. Sugar cubes and hard boiled sweets (pineapple chunks are best as they are cubed). Camera.

Preparation: Place 8-10 sugar cubes in the first container, 8-10 boiled sweets in the second and both, 4-5 sugar cubes and 4-5 sweets, in the third container. Save one or two examples of each for comparison after the activity.

Method: Work in 3 small groups. For a fair test each container needs shaking for the same amount of time or number of shakes. First decide whether to time with a stopwatch or count the shakes so that each group does the same (counting is popular as all the group can join in). In turn, each child should shake the container for the agreed number of times (suggest at least 10 times).

The lid should then be removed for the group to observe any changes: Have any cubes changed shape or broken? How have they been eroded? (Splintered/rounded.) Is there any 'sediment' in the bottom? It is a good idea to take a photograph at each stage to aid later discussion and comparison. After each child has taken a turn the cubes/sweets should look quite different from how they were at the start.

Conclusion: Which eroded most easily? Was there a difference in the way they eroded in the mixed container? What does this tell you about how real hard and soft rocks are eroded? What does it tell you about the durability of real hard or soft rocks?

Activity 6

Physical erosion also occurs by rocks expanding and contracting with heat and cold. They can also be broken apart by ice in a process known as freeze-thaw. This can be tested over a period of a week or so. Soak 2 or 3 spare samples of porous sandstone or oolitic limestone in water until completely saturated. (You may see bubbles rising as the air in the pore spaces is displaced by the water.) Do the same with a non-porous rock for comparison. Place them in a freezer compartment on plastic trays or in open ice-cream tubs. Freeze overnight. Remove and allow to thaw on the tray. Record your observations and take photographs. Repeat several times.

How does repeated freezing and thawing affect the rock?

Are the porous rocks and the non-porous rocks affected in the same way or as much?

This issue was revised and updated (from the original by Sue Pryor and John Reynolds) by Tracy Atkinson. It was edited by Geoff Selby-Sly. ESTA Primary Team members.

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