TEACHING PRIMARY

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CLIMATE THROUGH TIME – 1

Ancient Mountains, Igneous Intrusions and Volcanic Eruptions

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Introduction to this year's PESTs.

This year all four PESTs will be linked to the British Geological Survey (BGS) poster *Climate Through Time*, which is enclosed with this issue of PEST. They will include ideas of how the various areas on the poster can be used to enhance learning in a primary classroom. Although based on science and geography activities they will also suggest ways to include cross curricular work and take possible changes to the curriculum into consideration. The poster is available electronically from the BGS website (see page 4) to enable you to use it with a whole class. BGS say "Earth's climate has changed throughout the billions of years of our planet's geological history. Evidence for past climates can be found in the rocks around us." They hope the poster will enhance understanding of Earth's climate and geology as a dynamic system; how it has changed in response to past events and will continue to do so. Thus the poster provides a wealth of information which can be used within many topics related to not only climate change but many other areas. Extra ideas will be available on line at a later date, as we are unable to cover the whole poster within four issues. Meanwhile, have a look at the BGS website for further information.

This Issue.

This first issue will focus on the three ovals on the poster which cover processes and evidence; ancient mountains, igneous intrusions and volcanic eruptions. Some of the activities could be done by older children with minimal supervision; others will need close supervision particularly with younger children. Normal school safety procedures should be followed at all times.

ANCIENT MOUNTAINS.

Ancient mountains have been formed when two of the Earth's tectonic plates collide, the edges of the plates push together, buckle and fold to form mountains. The Himalayas are a good example of this. The rocks forming the original plates become changed by the intense heat and pressure involved. The time line of the position of the continents (on the left of the poster) helps to demonstrate how the earth has changed due to movement of the plates. Children can follow where Britain and Ireland were at different times during the past.

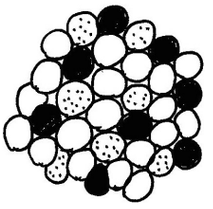
A simple way to demonstrate how the folds are formed is by placing a rectangular sheet of paper flat on a table, place your hands on either end and slide them inwards gently, the paper will form folds in the middle. This could also be shown by rolling out different colours of plasticine placing them in layers then pressing them gently together. Push firmly from each end and folds will form; try pushing more from one end to achieve a different effect. Look at what happens to the layers and describe this. Compare with photographs of mountains showing folds.

Metamorphic rocks

These are rocks that have been changed from their original form either by very high temperatures, immense pressure or a combination of both during tectonic activity, especially mountain building. Metamorphism tends to harden and strengthen rocks and usually leaves them with distinctive layering. Such layers can often be exploited, as in the splitting of slate (metamorphosed mud stone) into thin sheets. A good way to demonstrate these changes in the characteristics of a rock is to use a coloured modelling medium such as plasticine.

The following activity shows how a porous, sedimentary rock, such as sandstone, can be metamorphosed into a layered impermeable rock, such as quartzite. The same process turns mudstone into slate but the fine clay particles are not as easy to see.

Method



1. Cut strips of coloured plasticine into small squares (use at least 4 contrasting colours ~ 0.5cm^2) and roll into pea-sized balls to represent the separate sand grains. Make enough to form a tennis ball sized sedimentary rock when they are jumbled up and put together, with just enough pressure to make them stick to each other.
2. Pupils should be able to see that this 'sedimentary rock' has gaps between the grains (it is porous) and water could flow through (it is permeable).
3. Place this plasticine rock on a flat surface and apply some pressure, either with your hand or a piece of wood, to flatten it out to a disc about 2 cm thick.

4. Pupils should now investigate and describe the change in shape of both the rock and the individual grains (both should have been flattened into discs) and observe that the pore spaces have disappeared as the grains are now interlocking (it has become impermeable).
5. Cut the disc in half to reveal the typical layering that occurs in metamorphic rocks.
6. Apply pressure from the edges of the half discs to see the metamorphic rock layers bend and deform as often happens during tectonic activity.

Change by Heating.
To demonstrate the process of changing properties by heating, several different topics can be used. If your school has a kiln, look at a pot before it is baked when the clay is soft and pliable then again afterwards when it is hard and easy to break. Alternatively looking at bread or cakes such as shortbread or fruit cake before and after cooking can demonstrate how heat can change properties. This can include science and maths if actually made in school.

IGNEOUS INTRUSIONS

Cooking Rocks or Edible Earth Science!

Various cooking activities can be use to demonstrate the processes and appearance of igneous rocks. Obsidian is very fine grained and glassy – similar to toffee; grainy fudge can be used to show the texture of granite; honeycomb contains bubbles similar to pumice. These activities link science and design technology plus maths (measuring) and can also include descriptive writing. Normal precautions should be taken as with any cooking activity. The first three of these use simple ingredients and utensils but will need to be supervised. Remember cold can burn as well as hot!

Obsidian/toffee.
Grease a shallow metal baking tray and place in the freezer for an hour. Then heat 500 grams of sugar with a little water. Stir continually with a wooden spoon until the mixture is golden brown – hint, don't let it burn. Pour your "magma" onto the cold tray, so there is a thin layer, which will cool quickly. Once cold the toffee will be brittle and glassy, compare with a piece of obsidian (volcanic glass) if possible. Because the toffee has cooled rapidly it cannot form large crystals; which is what happens when obsidian is formed as this also has cooled quickly.

Pumice/honeycomb.
As above, grease a deeper metal baking tray and place in the freezer for an hour. Then heat 500 grams of sugar with a little water. When ready stir in a spoonful of bicarbonate of soda and immediately pour the "magma" onto your tray, the bicarbonate of soda will produce bubbles of carbon dioxide which burst to leave a honeycomb of holes. Compare with a piece of pumice if possible. Pumice forms in a similar way where there are gasses present and holes are formed.

Granite/fudge.
Place 500 grams of sugar in a saucepan with a little water and heat carefully without letting it burn or turn black, stir slowly to aid this. Once the mixture is brown add a little milk. Mix this in carefully then leave the mixture to cool slowly. Tiny grains or crystals will appear within the mixture, once it is cool feel the texture and compare this if possible to a piece of granite. Because the mixture has cooled slowly these crystals have time to form and grow in the same way that granite is formed when magma cools slowly.

Granite Scones.
This is an idea from a previous PEST (18). Although these scones are not made using the processes involved in the formation of granite they can be used to illustrate the appearance of e.g. shap granite which contains large pink crystals of plagioclase feldspar and small black mica crystals as well as white quartz. Year 3 children have successfully made these granite scones, which involves maths (weighing and measuring) and literacy when comparing the scone with an actual rock and assessing how near the scones are to resembling the real thing.

Make up a basic scone mixture – rub 50 grams of fat into 225 grams self raising flour then add 25 grams of sugar. Before you add any milk add about 50 grams each of roughly chopped cherries and currants. Add about 150 ml of milk and knead lightly to form a dough. Add more cherries, so that the mixture will just hold together. Divide the mixture into small piles on a baking tray. Cook at 450F 230C or gas 8 for 10 to 15 minutes. By not using cutters you get a rougher, more rock like appearance on the outside. Cut through to see the granite type structure. Compare the scones with pieces of granite assess how near the appearance is and record this using descriptive text.
This can be used as a competition to see which group can produce the scone nearest in appearance by deciding how many more cherries to include. The trick is not to include too many so the mixture doesn't stick together, whilst still having enough to demonstrate the rock type.

Geysers.
The poster mentions geothermal areas and geysers. Well known areas for these are Yellowstone National Park in the USA, New Zealand and Iceland. Geysers are found where hot rocks lie near to the surface in volcanic areas. Underground water is heated until it boils and shoots steam and hot water up to the surface and into the air. These fountains of steam and water occur at regular intervals as pressure builds underground and is then relieved. Probably the best known geyser is Old Faithful in Yellowstone which erupts about every 70 minutes. These spectacular events can be demonstrated using video clips and web sources, (see page 4) but to actually make their own geyser can be more exciting and result in better understanding.

A geyser in the classroom.
This activity involves very hot water and will need adult help to prepare the bottle top.
To construct your geyser:-
Take a small bottle with a screw top, which has had a hole made in the top, about the size of a nail. Use food colouring to colour some cold water and half fill the bottle with this. Place the top on the bottle and put a straw though it so the bottom of the straw is in the water. Make a seal around the hole in the lid so that the straw is very secure and there are no gaps (modelling clay is a good idea for this if available). Take another small piece of clay and wedge it into the top of the straw, so this is also sealed, finally, using a pin, make a tiny hole in the clay in the straw, ensuring it goes right through it. This then represents the underground water within a confined space, and tube or crack that reaches the surface but only has a very small outlet.
Erupting your geyser (adult help). Place a flat bottomed bowl of very hot or boiling water on a firm, protected surface. Stand the bottle in the water and wait for the water to push up and out through the straw.

A few questions to work on:-
Is the erupted water hot or cold? As it is the air in the bottle that warms first this will not be steam and hot water erupting. How long does the effect last? If you repeat it does it last the same length of time? Could it be made to last longer? What difference would it make if you warmed the water in the bottle first? (e.g. between your hands).

VOLCANIC ERUPTIONS

Lava Flow

Lava is erupted out of a volcano but there are various types of lava depending on the different minerals present. Some are more viscous than others so some flow fast, further and more thinly while others flow very slowly and can build up into greater depths.
Demonstrate the varying rates of flow of different lavas by the use of everyday liquids to simulate the different types. You can show how the consistencies of a substance can affect the rate, distance of the flow and area covered. This can be done as a demonstration or investigation depending on the age of the children and amount of help available.

You will need some everyday liquids of differing consistencies. For example - washing up liquid; salad cream; shampoo, honey, liquid cake mix (with or without currents) and treacle.
In addition you will require the following everyday utensils for each group:-
A tray; disposable plastic plates (2 for each liquid used); teaspoons; cup or container for warm water; stop watch.

1. Place a plate on a tray (to prevent drips on the desk top).
2. Use a measured amount of one the liquids e.g. a level tea spoon.
3. Pour the liquid from a measured height onto the plastic plate, and time the flow.
4. Measure the area of the flow when it has stopped moving; a good way to do this is to draw the shape and exact area onto squared paper and count the squares.
5. Using the same liquid take a second measured amount, the same as for the first test.
6. Fill the cup with warm water and place the teaspoon onto the top of the water and hold it there for a measured amount of time, i.e. 30 seconds
7. Pour this liquid onto a clean plate from the same height as the first; again time the flow and measure the area of the flow.
8. Compare the two flow times and the areas covered.
9. Do the same with the other liquids collected for comparison.

Results can be recorded in a variety of ways depending on the age of the children – pictorially; charts; graphs (maths). Descriptive writing can also be used as well as report writing.
Alternatively, different groups could each use two different liquids, compare these and report back to the whole class.

Useful Web Sites.

Yellowstone Park website, good information and video links. www.nps.gov/yell/index.htm
New Zealand information. www.teara.govt.nz/en/hot-springs-mud-pools-and-geysers
Icelandic information and how geysers got their names. www.wyojones.com/icelandlinks.htm
BGS web site with electronic poster, other information and activities
www.bgs.ac.uk/climatethroughtime

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