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EDIBLE EARTH SCIENCE

Investigative Challenge

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Introduction

This years PEST's are focusing on creativity and fun linked to cross curricular work. Two of these will include investigative challenges, one in this publication and one in the next.
There have been previous issues based on food and cooking linked to Earth Science (18, 21, and 48); this one focuses on using investigation and challenges to aid learning. The following activities are based on ideas that have been developed for and used in our workshops.
The activities will need some adult supervision depending on the age involved.

KS1: Sorting

This can be linked to work on rivers or rocks and soils or as an introduction to erosion. It demonstrates that different rocks have different compositions and can be broken down into their various parts. It could be used as an introduction to any work related to sorting and /or a locality where work related to a river or stream is involved.
Use biscuits that have different components e.g. chocolate chip cookies and give them to the children to "dissect" and sort into the various components then compare the differences. You could use two different types of biscuits e.g. chocolate chip and fruit shortbreads, and contrast the results.
Other types of biscuit that could be used are the cereal biscuits or bars, such as "special K mini breaks". Ensure you have plenty of plates and lolly sticks to help with this. There are links here to maths and measuring.

KS2: Erosion, Transportation and Deposition - Introduction

These can be linked to work on rivers and coastlines, together with rocks and soils and follows on from the above using the analogy of food to help relate rocks and their properties to the children's own experiences. Biscuits (as above) can be used, but by introducing different types of cakes e.g. fruit, chocolate, plain, you can demonstrate how mixing different components together can result in a different end product with different properties. This can then be used to help understanding of erosion, transportation and deposition and why this may be different for different rocks and the various components within these rocks.
If the children actually make the food you can also link to cross-curricular work, e.g. Maths - measuring; science - melting and cooling, changes of state; Language – planning and reporting.
Erosion Rocks break down differently depending on their strength, hardness and/or internal "glue". Thus some components of some rocks are more readily available for –
Transportation This is dependent on grain size as well as velocity of flow. Rocks which break down into smaller particles more easily are more readily transported and are thus more readily available for –
Deposition Sedimentary rocks are formed when pre-existing sediments are deposited. These are often in layers depending on the type of sediment available which may be governed by the above in relation to water flow and source rock.

The Investigations - Getting Started
Start either of the following two activities by showing the children different rocks that erode at different rates, e.g. a sandstone which will erode easily and a harder rock. If possible demonstrate how the sandstone has no (visible) matrix (glue) holding the grains together, and how easily the grains can be knocked off. Then show how the other rock has a matrix and you cannot easily remove the grains.

Eroding Sedimentary Layer Biscuits
Suggestions for these first featured in PEST 21 where we used different biscuits to make visual layers of sedimentary rock; the different types of biscuits giving an appearance of different sedimentary layers of rock. The following development of this idea is a good introduction to the properties of different sedimentary layers, related to how they erode or wear away, to do before moving on to actual challenges with the children. Alternatively it could be used as a challenge.

Different types of biscuits stick together in different ways and thus demonstrate how the mixture of minerals in a rock can make a difference to the way that rock holds together and thus how much it is affected by erosion. By layering mixtures of various types of biscuits you can test their potential erosion by gently scraping across the layers and looking to see which is most easily broken back into crumbs of the biscuit and which holds together best.

The basic mixture:

- 75g butter or margarine (melted)
- 175g (approximately) crushed biscuits

The biscuits are mixed into the melted butter and then pressed down firmly into a tin with a loose base, a square or oblong one is best. Repeat with the other biscuits to form successive layers. Once all the layers are complete chill, then remove from the tin. Slicing through the resulting biscuit layers will give a fresh surface to test.

The types of biscuit that work best are digestive and the different varieties of chocolate chip cookies, one containing for example currants or sultanas can add further differentiation.

Children can help to prepare the mixtures and place them in the container, or the layers can be made as a demonstration. Always keep one of each type of biscuit for the children to look back at and see the differences that may have caused or resulted in the different properties of the layers. Three layers are ideal, but two will also work, and more than three give added dimensions.

- One version that has worked well is a layer of ordinary choc chip cookies first, with a layer of digestive biscuits on top and the third layer being double choc chip cookies. Here, you will find the digestive layer will break up quite easily, the double choc chip will stick together very well and the ordinary choc chip nearly as well.

<u>Predictions and Questions</u>
Challenge the children to predict which will be easier to “erode” and give reasons.
Can they work out that the chocolate in the biscuits is adding to the matrix (glue) holding the mixture together?
The ordinary choc chip has the chocolate in the chips and the double one will have it within the biscuit as well; hence it will hold together slightly better.

You might wish to work with this version and then challenge them to predict what would happen if a fourth type was used e.g. shortbread with currants. Follow this up by letting them test this out themselves.

Crispie Cake Challenge

This investigation is based on a cake that is often made in school, but normally just to provide a fun way of making an easy cake, often for Easter - chocolate crispie cakes. In PEST 18 we suggested using crispie cakes to demonstrate how rocks consisting of grains can be held together by a matrix - the crispies being the grains and the chocolate the matrix.

This activity takes this idea one step further to illustrate how and why it can be used to show that rocks erode at different rates and in different ways and turning it into an investigative challenge.

When making crispie cakes, the more chocolate included in the mixture in relation to the crispies the firmer the cake and thus less easy to “erode” and vice versa. By changing the ratio of the two ingredients you can produce different consistencies; in the cakes with less chocolate the crispies will be knocked off (erode) easier.

Depending on the age of the children this challenge involves not only science but also maths and language at the appropriate level. Older children can use ratios, and percentages, younger ones fractions and very young basic counting. Recording what they do makes use of language skills. It also includes planning, investigating and testing skills.

Divide the children into groups. Provide each group with some cake cases, rice crispies plus chocolate, together with a saucepan and a heat source to melt the chocolate.

Challenge the children to produce two crispie cakes, one that is as easy to erode as possible, one that is as difficult to erode as possible. You will need to specify how much of the “rock” actually needs to be the “grains” in relation to the latter so they don’t produce ones that are almost wholly matrix (chocolate) with no grains (rice crispies).

Depending on the age group you may need to give them as little or as much help as possible. This could include:-

- Discussions on how to approach the challenge at an appropriate level and dependent on what you want them to learn and achieve.
- Guidance relating to how to test their cakes for erosion - by gently rubbing with a spoon or similar.
- Giving them the amount (s) of chocolate (or crispies) to use as a basis (in squares for younger children, weight for older ones).

The challenge includes 3 areas, which could be done at different times, or during one session, with all being recorded in an appropriate form.

1. Planning how they will do the challenge, possibly dividing the group in two, each to focus on one of the aspects; together with deciding what range of amounts they will use.
2. Testing the various quantities they have decided upon to find which is best.
3. Reporting back and showing their best efforts to see who has produced the most appropriate examples.

This final area can include a discussion on what they have seen and relating it back to the two types of rock they looked at before they started. Ask them to think about why it is useful to have different types of rock, which could lead into work on types of soils.

Shortbread Fudge Chocolate Slices or Sedimentary, Metamorphic and Igneous layers
In PEST 21 we suggested how you could use different types of layering to demonstrate how these layers of rock are formed, e.g. a "sedimentary" biscuit base covered by a layer of "igneous" toffee; "metamorphic" shortbread covered in a layer of "igneous" toffee and topped by a layer of "igneous" chocolate.

This kind of layering can also be used to demonstrate the varying properties of rocks, not just their potential for erosion. You can do this by either making the second suggestion above, with the three layers or buying a packet of the same type of cake/biscuit which is sold in most supermarkets. These are often in the form of slices but some (e.g. Morrisons) have them in small squares in a tub. These can then be given to the children and they can investigate the properties of each layer in relation to erosion, pliability and brittleness.
They will find that:-

a. erosion can be tested by gentle scratching - if the layer crumbles easily then it will erode easily (the biscuit or shortbread layer);
b. pliability by gently pushing the layers above to see if the one below moves – if the layer slips or slides then it is pliable (the fudge or toffee layer);
c. brittleness by tapping, or trying to cut with a knife to see if the layer breaks rather than crumbles (the chocolate layer).

These properties can then be related to rocks, where softer rocks will crumble and erode easily and harder rocks will break up. The middle layer demonstrates how rock can move and slide when it is soft and sticky and could be related to mud slides in soft rocks, or rock movement in heated rocks.
If you are able to also show the children rocks that have these properties and demonstrate the related properties using them, for example:-

- Sandstone is a good example of **a**, show how it can be eroded quite easily as grains often fall off as you handle it
- Mud, which can become mudstone is an example of **b**, place some between two hard surfaces and show how the top one will slide across the mud;
- Any hard rock can be used for **c**, if you are able to safely, do demonstrate how it can be split by hitting with a hammer then use slate as its layers separate without too much difficulty.

Rules

All the above activities require basic hygiene and health and safety rules to be observed.
Remind the children:-
Before – hair, hands, cuts, jewellery. During – clean and careful. After – clear, wash, tidy.

Forthcoming Events. Full information is available from the respective web sites.
ESTA Primary Team Members will be providing practical workshops, resources and information at:-
GA Conference. Guilford. April 15th – 16th April 2011. www.geography.org.uk/ Physical Geography related cross curricular workshops.
ESTA Conference Durham, 17th – 19th July 2011. www.esta-uk.net/ Primary INSET Saturday 18th – practical workshops on minerals, rocks, soils, rivers and coasts with an emphasis on cross curricular themes.

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