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In-school learning in preparation for field visit to the Ercall Quarries
List of the concepts needed
KS3 knowledge and understanding of geological processes should form the basis of the preparatory lesson(s) in school within the 1/2 weeks prior to the field visit.

KS3 geological processes **Time: 80 minutes**
In broad terms KS3 'geological processes' is the study of the 'Rock Cycle'.

Learning objectives for KS3
1. be able to describe and explain ways in which rocks are weathered
2. be able to observe and describe the key features of a rock specimen, including colour, texture and mineral content
3. be able to classify specimens of common rock types, using observed features, as igneous, sedimentary or metamorphic, and name such common rock types
4. be able to describe and explain how sedimentary rocks may be formed by processes including the erosion, transport and deposition of rock fragments
5. be able to make reasonable suggestions as to how a common sedimentary rock type they have described was formed, and how long the process took.

1. Weathering (10 minutes)
As the basis of a brief question and answer session, use photographs of rocks that have suffered weathering. Suggested images:
- boulder(s) showing onion-skin weathering
- boulder(s) split in half – e.g. Devil's Marbles
- jagged, broken rocks on mountain ridges, preferably with patches of snow still visible.

An internet search yields many possible images for classroom use. Examples:
http://www.geos.ed.ac.uk/undergraduate/field/holyrood/spheroids.html
http://academic.brooklyn.cuny.edu/geology/leveson/core/topics/weathering/picturegallery/display/newjerseygarret_mt_1.html
http://www.au.au.com/cameras/images/devils-marbles.jpg
http://www.thewalkzone.co.uk/Lake_District/walk_36/180203h.jpg

Some internet images provide useful background discussion about the weathering mechanisms involved. Tasks in small groups: show the pupils the photographs and give them one minute to come up with suggested causes of the weathering depicted in each image. There is probably no single 'correct' answer in any of these situations because weathering is rarely one process operating on its own. Weathering is usually caused by a combination of physical and chemical weathering processes. It is the pupils' suggestions and subsequent discussion generated that are important. If pupils do not suggest chemical weathering, the teacher may need to pump-prime the discussion by asking them whether chemical changes might be possible in any of these examples.

2. The rock cycle (35 minutes)
This session is based on the rock cycle. A simplified pictorial version of the rock cycle should be used in the session and this diagram can be downloaded from:

http://www.washington.edu/uwired/outreach/teched/projects/web/rockteam/WebSite/rockcycle.htm.htm

Activity 1: provide a set of six common rock types (sandstone, shale, conglomerate, granite, dolerite/basalt with crystals just visible, slate or schist or gneiss). Tasks in small groups:
- agree key features of each specimen (colour, texture, etc), and how the grains are held together (which allow them to identify whether they are sedimentary, or igneous or metamorphic).
- provide a set of name labels; groups have to decide quickly which label belongs to each specimen, and be able to justify (for able groups, provide more name labels than specimens!)
- plenary agreement on correct labelling and why the name label is appropriate.

Activity 2: teacher shows quick demonstrations of:
(1) sedimentation jar filled with water then 3 charges of different sediment (the last one being muddy to show slow fall of sediment)
(2) a volcano in a laboratory. This demonstration of a volcano uses wax and sand. Details are available from:
http://www.earthscienceeducation.com/workshops/rock_cycle/

(3) effects of pressure on rocks. This simulation of the distortion of fossils by metamorphism uses modelling clay and cockleshells. Details are available at:
http://www.earthscienceeducation.com/workshops/rockcycle/metamorphism.htm

Task for small groups using the rock cycle diagram:

- decide what part of the rock cycle each demonstration is modelling
- decide at which point in the rock cycle each specimen would have been formed
- agree on the rough timescale needed for each rock type to have been formed, including the difference, for sedimentary rocks, between time for deposition and time for a deposit of loose sediment to be turned into a hard rock, and also how that may happen.

Activity 3: How did sediment become hard rock? This can be modelled for sandstone, as shown on the JESEI website at:

http://www.chemsoc.org/networks/learnnet/jesei/sedimen/index.htm

3. Sedimentary processes (35 minutes)
Activity 4: pupils place cubes of sugar in a closed container and shake for 30 seconds and then observe changes to the shape and size of the cubes. Repeat activity at 30 second intervals, weighing & measuring the cubes at each stage. Tasks in small groups:

- decide what is the cause of the changes they have observed
- decide what part of the rock cycle is modelled in the experiment
- agree what will affect the degree of rounding and size reduction of rock fragments in the rock cycle.

Activity 5: provide three piles of sediment (one of gravel, one of soil and one of sand) and watering cans for pupils to use to pour water over the sediments to see how far the water spreads the sediment. Tasks for pupils work in small groups:

- agree what needs to be done to ensure the test will be a fair test
- pour 2 litres of water slowly over each pile of sediment
- observe what happens and measure how far the water spreads each pile
- agree which type of material was spread further
- predict what would happen if they poured 4 litres of water over each pile of sediment.

Activity 6: teacher shows demonstrations of river erosion, transport and deposition using a child's slide extension or a very long tray covered with a sand and gravel (pea-sized) mixture.
Tasks for pupils in small groups:

- decide how the different types of sediment are moved along the river bed in this model
- agree where erosion takes place and what evidence shows that erosion has occurred here
- agree where deposition occurs and why deposition occurred at this place
- decide what different results they could expect to see if (a) the slope of the tray is increased and (b) a greater volume of water is poured into the tray.

Activity 7: teacher shows a demonstration of the formation of ripple marks using a fish tank (approximately 100cms long, 50cms deep and 50cms wide) and two wooden cylinders 3cm diameter and slightly longer than the width of the tank
Put clean, well sorted sand of fine to medium grain size into the tank, sufficient to line the floor of the tank to a depth of several cm. Place the tank on the wooden rollers, and fill the tank with water to a depth of 15-20cm. Gently and rhythmically rock the tank back-and-forth in an oscillatory motion until ripples form on the sediment surface. (This does not take long, but there is the potential for disaster if the tank is rocked too vigorously!).

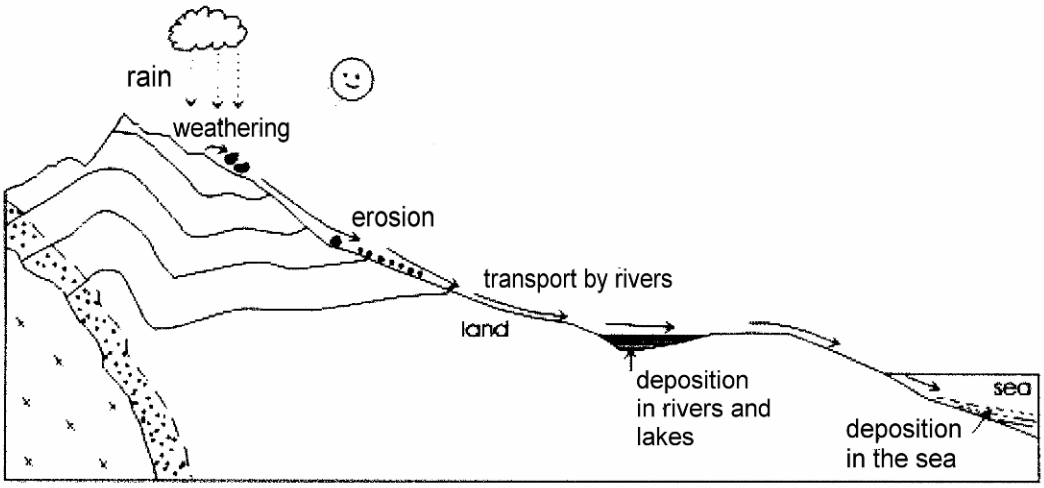
Details of **Activities 5 and 6** (and of related practical activities) are available at:

http://www.kented.org.uk/ngfl/subjects/geography/rivers/Teacher%20Plans/whatiserosionanddeposition.htm

Follow up Homework Sheet
A completed Follow up Homework Sheet can be found at the beginning **of ERC9 Teachers' Notes**

KS3 Follow – Up Homework Sheet Ercall Quarries.

Here is a simple diagram of part of the Rock Cycle.



The sedimentary section of the rock cycle

key

sedimentary rocks

igneous rocks

metamorphic rocks

You will have seen the evidence for some parts of this cycle in the quarries at The Ercall. This homework is to help you to identify which parts of the cycle you have seen.

1. Where in the quarries did you see an igneous rock? What did it look like? Draw a sketch if it helps.

2. In the quarries you saw two sedimentary rocks. What are they called? What did they look like? Draw sketches if they help you to explain.

3. What evidence have you seen for erosion taking place now in the quarries?

4. What evidence is there that erosion took place in the distant past? (Hint: think about where one type of rock lies on top of another type.)