Funded by Defra's Aggregates Levy Sustainability Fund, administered by English Nature.

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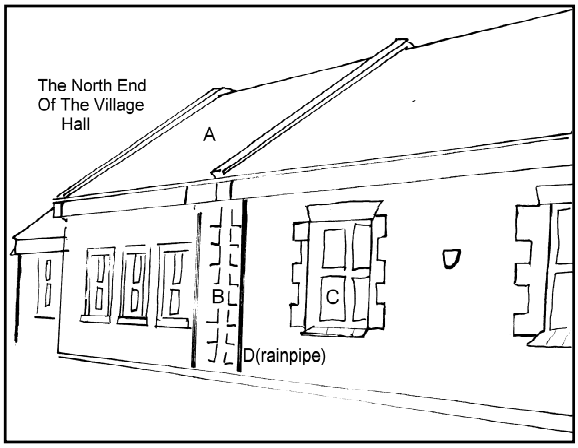
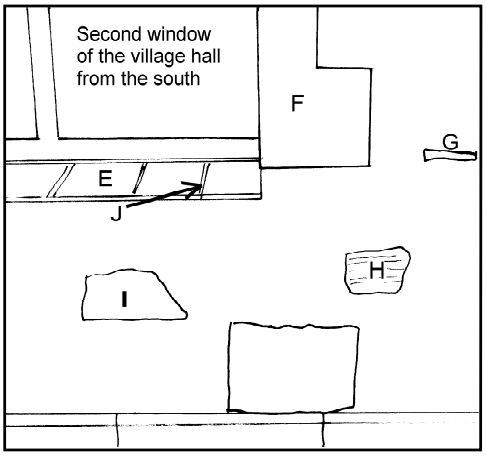
PUPIL WORKSHEET 1 PUPIL NAME .....

Mungrisdale Recreation Room





Find a safe spot away from the traffic to study the material used to make the lettered features (**A** to **J**) on your part of the village recreation hall. Name each material and decide why it has been used in this way. (e.g. easy to shape, decorative, strong etc). Then fill in the table below with your answers.

	Name of material used (e.g. marble)	Important properties of that material. (e.g. strength, shape, porosity etc.)
A	Slate	Waterproof (non-porous; non-permeable); easily split into thin, light sheets.
B	Red sandstone (sedimentary rock)	Easily cut into blocks, strong enough to support the wall and decorative.
C	Glass (fused silica sand)	Transparent, easily shaped and cut, weatherproof.
D	Metal, covered with plastic	Steel is easily shaped into tubes, and is strong. The plastic cover is weatherproof and protects the metal from chemical weathering.
E	Slate	Non porous (Water proof); easily split into flat sheets.
F	Red sandstone (sedimentary rock)	Easily cut into blocks, strong enough to support the wall and decorative.
G	Marble (This is **not** local material. All of the building materials have been re-used from elsewhere.)	Incorporated in the wall here as it was already cut flat.
H	Sandstone (bedded sedimentary rock)	Suitable shape, not needing much cutting, strong enough to bear the weight.
I	Igneous rock (interlocking crystals)	Strong enough to bear the weight of the wall and weather proof.
J	Cement / mortar) Made from limestone and other minerals)	Mixed to form a bonding material.

What was the lime from the lime kiln behind the site of the village hall used for?

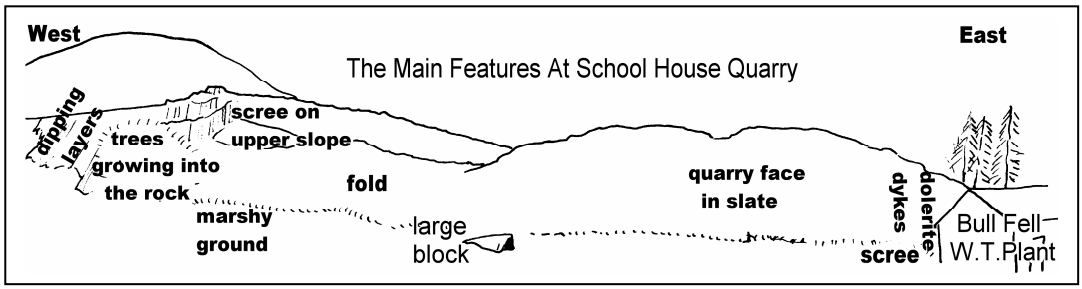
The lime was used for rendering stonework, whitewashing houses and for putting on fields that had acidic soils to make them more fertile. (Calcium carbonate is an alkali.)

PUPIL WORKSHEET 2 PUPIL NAME .....

School House Quarry: On the sketch below:

i) Label the west and east ends of the sketch, then
ii) Draw in the dipping layers beyond the trees on the left.
iii) Complete the skyline at the other end of the sketch, and then
iv) Label the following features you have observed at the quarry.

scree, marshy ground, folds, dyke, trees growing into the rock



Fill in the table below to summarise the evidence for rock cycle events you have seen here.

Rock cycle events	Evidence seen. (Circle the correct answer(s), then finish the last section in your own words).
i) Deposition	**clay was deposited.**
ii) Deformation	Metamorphism / folding / tilting / dyke intrusion then occurred.
iii) Uplift, weathering and erosion.	**The evidence for uplift weathering and erosion of these rocks is:** The rocks are now about 240 metres above sea level. There are plants growing into the rocks (biological weathering). There are many fragments of slate broken from the exposure.

Mosedale Moss Quarry

Describe the rock at Mosedale Moss quarry.
Made of two different coloured minerals, black and white, which are interlocking. The crystals can be up to 5mm or more across. It is a coarse grained igneous rock.

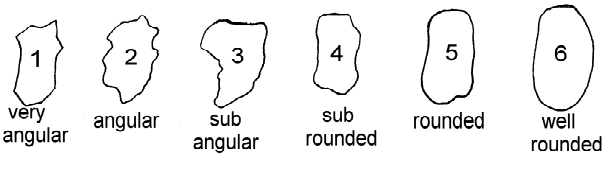
What is the evidence for weathering of the rocks at Mosedale Moss.
Physical weathering: Large angular fragments can be seen on the scree slopes.

Biological weathering: Trees are growing into the rock and lichens on the surface.

Chemical weathering: Broken pieces show the outside edge is stained by iron weathered from the rock.

PUPIL WORKSHEET 3 PUPIL NAME .....

Pebble Study: Stone Ends Quarry.



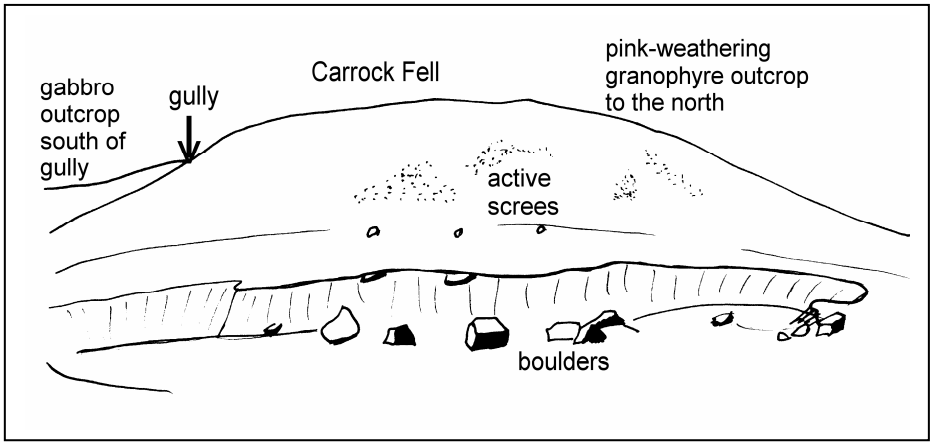
Roundness / Angularity scale for describing pebbles. Rounded and well rounded pebbles have been transported a lot by water. Angular ones haven't.

Are the fragments cemented or un-cemented together?	**Uncemented**	What rock types form the fragments? (Igneous, metamorphic or sedimentary)	**Igneous (two kinds).**
Are the pieces all the same size, or is there sand present?	**Very different sizes**	Describe where the deposit is lying. (e.g. Close to the valley side, on a slope, on the valley bottom, in a river bed.).	**Close to the valley side at foot of steep slope.**
Is the deposit bedded or un-bedded?	**unbedded**	Explain how you think this deposit was formed? Remember to include weathering erosion and transport, followed by deposition and explain how these things happened.	**Physical weathering of two kinds of igneous rocks. Fragments falling from cliff above to form scree.**
Are the fragments more rounded or angular?	**angular**		

Field Sketch of Stone Ends Quarry. (Stand at the end of the track to the quarry)
On the field sketch below label the following features:

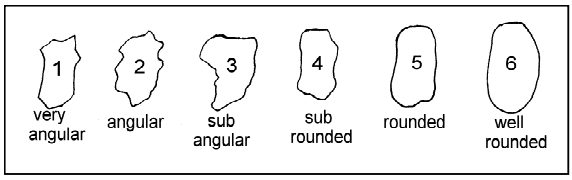
1) Carrock Fell. The north and south ends of your sketch;
2) Mark on and label some of the active screes you can see on Carrock Fell;

Draw in and label the face of the quarry.



PUPIL WORKSHEET 4 PUPIL NAME .....

Pebble Study: Long Hill.



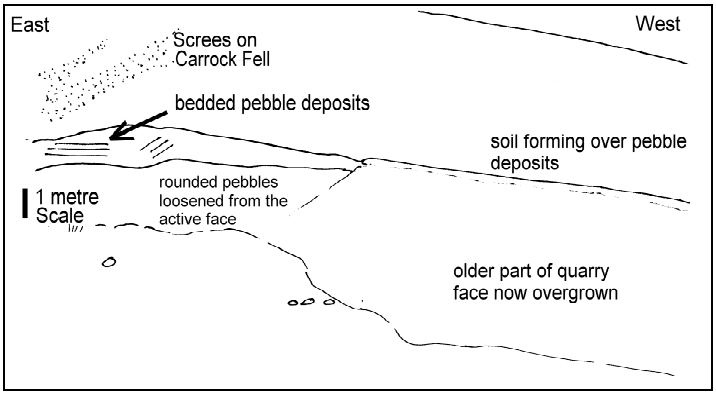
Roundness / Angularity scale for describing pebbles. Rounded and well rounded pebbles have been transported a lot by water. Angular ones haven't.

Are the fragments cemented together?	**No**	What rock types form the fragments? (Igneous, metamorphic sedimentary)	**Mainly igneous and metamorphic (some mineral fragments from veins).**
Are the pieces all the same size, or is there sand present?	**Pieces of different sizes. Some sand present**	Describe where the deposit is lying (Close to the valley side, on a slope, on the valley bottom, in a river bed.	**In a ridge along the valley floor, away from present river.**
Is the deposit bedded or un-bedded? Are the fragments mainly rounded or angular? (Use a scale of 1 to 6)	**Bedded** **Rounded**	Explain how you think this deposit was formed? Remember to include weathering erosion and transport, followed by deposition. How did these things happen?	**Physical weathering of pebbles, which fell onto glacier. Transported, and rounded by powerful meltwater streams through crevasses in the ice and deposited in an ice tunnel. When the ice melted the sides slumped, leaving the ridge.**
What length is the long axis of the largest **rounded** pebble you can find?	**330mm Long axis of Well rounded cobble**		

Complete the right hand side of the sketch of Long Hill. Draw in any bedding and label the following features:

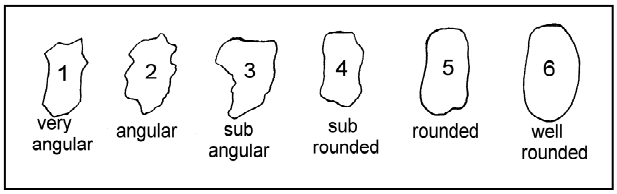
East and west sides of the sketch; the active quarry face; loose rounded pebbles; bedding; soil development over pebbles; old quarry face with vegetation.

Write in the approximate scale on the scale bar in metres.



PUPIL WORKSHEET 5 PUPIL NAME .....

Pebble Study: Carrock Beck Ford



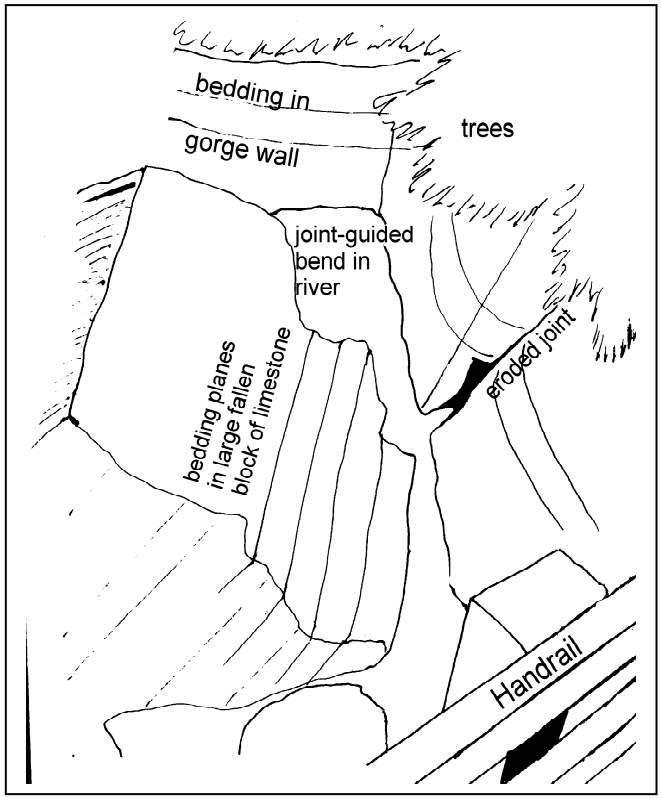
Roundness / Angularity scale for describing pebbles. Rounded and well rounded pebbles have been transported a lot by water. Angular ones haven't.

Are the fragments cemented together?	**No.**	What rock types form the fragments? (Igneous, metamorphic sedimentary)	**Mainly igneous and metamorphic (some mineral fragments from veins).**
Are the pieces all the same size, or is there sand present?	**Different sizes. Some sand present.**	Describe where the deposit is lying (Close to the valley side, on a slope, on the valley bottom, in a river bed.	**In patches in a river bed**
Is the deposit bedded or un-bedded? Are the fragments rounded or angular?	**Unbedded.** **Sub rounded.**	Explain how you think this deposit was formed? Remember to include weathering erosion and transport, followed by deposition. How did these things happen?	**Physical weathering of pebbles, or washing material from the till. Larger fragments not moved much. Pebbles rolled down the stream and become more rounded. Deposited when the current slowed down**
What length is the long axis of the largest **rounded** pebble you can find?	**90mm in the gravel. Largest boulder 800mm.**		

PUPIL WORKSHEET 6 PUPIL NAME .....

Rock Description at Howk Gorge

What is the colour of the rock?	**Grey.**
Is the rock bedded?	**Yes.**
Are the beds horizontal or not?	**Almost horizontal.**
Is the rock jointed?	**Yes.**
Is the rock made of grains or interlocking crystals?	**Fine grains of calcite (and larger fossils).**
Is the rock porous?	**No.**
Does it contain fossils?	**Yes.**
Are the fossils broken (washed around)?	**Washed around: lying on their side and broken.**
Does the rock react with dilute HCl?	**Yes.**
The rock name is:	**Sedimentary limestone.**
In what environment was it probably formed?	**Warm, shallow water, marine.**



Complete the left side of the sketch of the gorge from the footbridge and label:

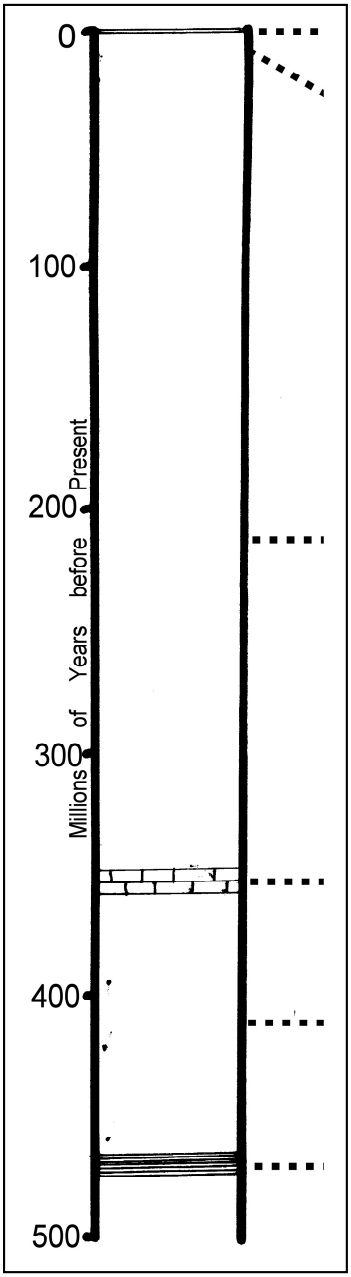
- **an eroded joint;**
- **sharp bend in river, guided by joints.**
- **Draw in and label the fallen block and its bedding planes.**

Estimate the depth and width of the gorge in metres:

Width 30 – 40 metres

Depth 50 – 60 metres

PUPIL WORKSHEET 7 PUPIL NAME .....



Present day weathering and river erosion.

Glacial erosion and deposition of moraines and meltwater deposits.

Uplift, weathering and erosion.

Deposition of limestone in warm shallow seas.

Metamorphism of shales to slate, with dyke intrusion, uplift, tilting, weathering and erosion.

Deposition of mud in deeper seas.

Write each of the sentences below in the correct box in the summary column above:

1) Deposition of limestone in warm shallow seas;
2) Deposition of mud in deeper seas;
3) Metamorphism of shales to slate, with dyke intrusion, uplift, tilting, weathering and erosion;
4) Glacial erosion and deposition of moraines and meltwater deposits;
5) Present day weathering and river erosion;
6) Uplift, weathering and erosion.

PUPIL WORKSHEET 8 PUPIL NAME .....

FIRST CYCLE: deposition. What can you say about the deposition of the older beds at School House Quarry? HINTS: Evidence for marine deposition; fossils, grain size etc.

The original deposit was fine grained mud, meaning it was deposited in quiet water conditions, below wave action. The fossil evidence (graptolites) from the site tells us it was a marine environment.

FIRST CYCLE: uplift and tilting. What can you say about the changes to the beds at school House Quarry cause by plate tectonics? HINTS: folding, metamorphism, intrusions etc..

The beds are tilted and have been metamorphosed by pressure into slates, showing compression from the south. This is considered to have been done by plate tectonic forces.

FIRST CYCLE: weathering and erosion. How long was the period of time between the deposition of the muds and the limestones?

About 80 million years

SECOND CYCLE: deposition. What can you say about the deposition of the limestones of Howk Gorge? HINT: Fossil evidence

The fossil corals and brachiopods tell us it was a shallow warm marine environment, with few rivers bringing in mud, as these filter-feeding animals do not survive in muddy conditions.

SECOND CYCLE: uplift and tilting. What can you say about the uplift and tilting of these limestones?

They have been uplifted, but they have not been very much tilted at this site.

SECOND CYCLE: weathering and erosion. What can you say about more recent weathering and erosion? HINT: glaciers, rivers, soils and quarrying.

The area has been eroded by glaciers and melt water streams. More recently the gorge at Howk has been cut by river action. Modern day weathering by plants and both physical and chemical weathering has formed soils. Humans have quarried the useful hard stone and gravels.