

Durham County Council

**Killhope Museum  
Creative Science Programme**

**Key Stage 1 & Key Stage 2**

*“A zest for life combined with a will to experiment”*

**Revealing  
Rocks & Soils**

**Science Detectives Discover  
Killhope**

**Resources for Teachers**

**SMA**

Sue Millar Associates

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# Revealing Rocks & Soils

## Teachers Resource Pack Killhope Museum Creative Science Programme

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# **Killhope Lead Mine**

## **Background Information**

### **The 18<sup>th</sup> Century Boom**

Over 200 years ago the Killhope valley experienced a mining boom. New people moved into the area. Shafts, levels, 'hushes' and 'dead heaps' were scattered far and wide over the hillsides. Many of the scars of mining are hidden beneath the trees, but the landscape must have looked devastated. Nearly all the houses you can see in the valley were built during the boom times of the second half of the 18<sup>th</sup> century. The houses were not huddled together in a village, but scattered over the south-facing hillside. Each family was surrounded by land they could farm to add to the small income they got from the mines.

At Killhope the 'W B Lead' company worked the mines. This was a family business owned by the wealthy Blckett family (later through marriage the Beaumont family). The company leased the mining rights and most of the land in the valley from the Bishop of Durham. This meant that many miners had their bosses as landlords. With a tight grip on employment prospects the Blckett family was a powerful influence on the lives of the workers and their families.

### **Park Level Mine**

Until 150 years ago the area that is now Killhope Lead Mining Museum was field, open moorland and fell. In the 1850s a new mine was started. First, a tunnel was dug to reach the lead veins upstream, then the mineshop was built, and by the 1870s the Killhope Lead Mine was one of the most productive in the whole country. W B Lead's company supplied about one-quarter of the lead mined in England. They had a prestige product that sold at premium prices on the London market. Killhope's second boom had arrived.

W B Lead built the big wheel and buildings near it, to power and house brand new ore crushing and separating machinery. This plant, known as Park Level Mill, started production in 1878.

Shortly after this the price of lead fell by half, undercut by foreign competition. The Weardale Lead Company took over Killhope and prospered, but the mine was almost worked out. The last ore was brought out in 1910.

In some places in Weardale fluorspar mining took over from lead mining and saved many jobs but this did not happen in Killhope. Machinery was sold. Stone was sold off for building. Timber and metal were scavenged. Sheep were the new inhabitants.

### **A new beginning**

In the 1950s the Forestry Commission bought the land of the Killhope valley. The 'Weardale Forest' was planted as an experiment - the highest plantation in England. By chance, the Killhope water wheel had been left in its original location. In 1968 Durham County Council took a lease on Park Level Mill, its wheel and buildings, to develop as a picnic site. Then in the mid 1980s the County Council bought the site and adjacent woodland.

# Revealing Rocks & Soils

## Teachers Resource Pack Killhope Museum Creative Science Programme

### National Curriculum Science KS1 and KS2

**Revealing Rocks & Soils** - is part of the Creative Science Programme developed for Killhope Lead Mining Museum and Durham County Council.

**Revealing Rocks & Soils** teachers' resources offer a range of possible pre-visit and post-visit activities linked to the focus of on-site activities and experiments that pupils will be involved in at Killhope supported by the expert team of Information Assistants. These activities are in no way comprehensive and neither are they meant to be. But they do provide a selection of cross-curricular activities that will support pupils in preparing for their visit and ideas for follow up work.

As you will be aware, for the value of the visit to have the maximum impact good preparation is essential. Good preparation also gives children the confidence to allow their imaginations to work, giving full reign to their thinking skills in making connections and creating their own tests and experiments before, during and after their visit to Killhope Museum. On site they will experience the creative application of scientific principles in the context of a 'real life' situation – Killhope – a nineteenth century lead mine in the North Pennines, County Durham.

The science activities in the **Revealing Rocks & Soils** Killhope Creative Science Teachers Resource Pack both on and off site are centred on the requirements of the National Curriculum **Sc3 Materials and their Properties, KS1 and KS2** and relate only to QCA **Unit 3D Rocks & Soils**. They focus on the science principles and concepts that can be best explored at Killhope Lead Mining Museum.

There are two main reasons why **Revealing Rocks & Soils** is presented as a separate Killhope Teachers Resource Pack. First, the geology and landscape of Killhope are the *raison d'être* for the lead mine and its location. Second, Killhope offers unrivalled resources for a creative approach to the study of this National Curriculum science unit.

There is also a strong emphasis on poetry, art and photography as a way of introducing and starting to get children to engage in exploring and understanding the science and significance of rocks and soils to our daily lives. Our intention has not been to make cross-curricular links with Geography, although you may wish to do so in your own schemes of work.

The other three *Killhope Creative Science Teachers Resource Packs for KS1 and KS2* are

**Overground, Underground Sound  
Forces & Motion  
Materials Maze – Materials and their Properties**

It may be useful to cross-reference the experiments and activities in the **Revealing Rocks and Soils** with the **Materials Maze – Materials & their Properties** Killhope Creative Science Teachers Resource Pack. **Section 2: KS2 Gathering Evidence: Fitness for Purpose - Grouping and Classifying Materials** is designed to extend and complement the experiments and activities in this pack (or vice versa).

## Rocks & Soils in Context

### Visiting Killhope Lead Mining Museum

#### 'A safe and stimulating environment for learning'

At Killhope Lead Mine in Upper Weardale in the 19<sup>th</sup> century questions (and answers) about materials and their properties and in particular rocks and soils were fundamental to the establishment and running of a successful lead mining business and for personal survival in the isolated location and harsh climate of Pennine Hills.

Over 100 years later, Killhope is no longer a working lead mine but is a museum run by Durham County Council. The purpose of Killhope Museum is to care for and display buildings, refurbished industrial equipment and show life above and below ground in a nineteenth century lead mine in the North Pennines. Current features of the museum include: tours of the mine, refurbished working water wheel, displays in the miners' living accommodation, blacksmith's shop, and mineral displays, washing floor, jigger house, woodland areas, museum display areas and café, shop and toilet facilities.

Killhope Lead Mining Museum provides a safe and stimulating environment for educational visits.

Educational visits to Killhope have a very good reputation. Visiting teachers and pupils particularly value the involvement of trained staff from the museum during every visit, and the focus on hands on and participatory activities. This approach to site-based learning was commended recently in *The Guardian's* Education supplement. The newspaper reported that Killhope is "an inventive and vibrant museum with an excellent tour and educational package.....the Museum prides itself on being a worksheet -free zone: pupils are encouraged to 'do' rather than observe....."

The Killhope Creative Science Programme builds on the established reputation of Killhope Lead Mining Museum for 'hands on' and participatory activities, making full use of the expertise of the trained staff team. The Killhope Museum site and collection of buildings, machinery and artifacts in their original setting within the landscape of the North Pennine hills offer a unique opportunity to explore innovative approaches to science education at Key Stage 1 and Key Stage 2 especially *Rocks and Soils* both in the context of the National Curriculum Science Sc 3 *Materials and their Properties* and in the context of their role in establishing the historic lead mining industry.

The on-site activities and experiments are a central part of the *Rocks and Soils Killhope Creative Science Teachers Resource Package*. Visits are made with the Information Assistants to the Washing Floor, underground Lead Mine, Mine Shop, Mineral Room and Woodland.

# Creative Science at Killhope

## Inspiring learning through Creative Science

The concept of creative science is an exciting new approach to engaging pupils in learning about science supported by QCA. Creativity allows for greater flexibility in terms of learning opportunities. Thinking creatively means that science can be inspiring. Once the traditional boundaries between arts and science are broken the creative arts can also be a rich source of inspiration for science learning.

Other boundaries are crossed too. Links can be made to real life situations beyond the home/ school environment. Undertaking interesting, new scientific experiments relevant to a particular place and industrial practices enables pupils to gain a better understanding of scientific principles, their application and usefulness.

## Science Detectives

Detectives need to be equipped with a range of special qualities and some special equipment. Discuss with the class what these special qualities are and what equipment would be helpful in looking at different rocks and soils in detail.

When the class arrives at Killhope Museum, it will be divided into several groups to go on a tour of the site and look at how rocks and soils are used. When the class gets back to school one of the tasks will be for each group to report back to others in the class on their observations, the evidence they have found, the tests and experiments they have carried out and their experiences.

It is up to individual teachers how far they pursue the 'science detective' idea in the classroom. On site at Killhope for the **Rocks & Soils** visit the class will be encouraged to be 'Killhope Science Detectives'. It would be helpful, therefore, if each child could bring a small magnifying glass on the visit to Killhope. Digital cameras, video camera and tape recorders would also be useful.

Pupils will need to understand the importance of

- Close observation and examination of clues
- Gathering and sifting through evidence, then sorting it into different categories
- Carrying out investigations and tests
- Using different methods to solve a problem

## Subject links and cross-curricular learning

Across all four *Killhope Creative Science Teachers Resource Packs* art, drama and dance are used when appropriate as innovative approaches to experiential learning in primary science alongside 'hands-on', interactive practical sessions at the Museum.

Cross-curricular learning is encouraged, in particular the use of ICT and literacy.

In turn pupils of primary school age are inspired to explore experiment and gain an understanding of the need to understand and apply scientific principles in a 'real life' situation – lead mining at Killhope in the nineteenth century.

## Revealing Rocks & Soils – A Creative Experimental Approach

The approach we have taken to the design of the activities in the **Revealing Rocks & Soils** Teachers Resource Pack is quite radical creative and experimental.

### Rocks & Soils – Difficult Concepts for Children to Grasp; Difficult Concepts for Teachers to Teach

Feedback from teachers suggests that **Rocks and Soils** is a difficult unit to teach and also a difficult one for pupils to grasp conceptually. The standpoint taken here is that

- Investigating 'Rocks and Soils' involves studying natural materials that are around us and under us wherever we live
- 'Rocks and Soils' are part of our everyday lives. Many of the minerals produced within veins in rocks such as fluorspar (from which we obtain fluoride in toothpaste) are used daily by each one of us
- 'Rocks and Soils' are of fundamental importance
- Yet the rocks and soils in our landscapes and townscapes are disguised by natural and man-made '*clothes*'. They are usually covered by grass, trees, houses and roads, but they are still there
  - The type of rocks under our houses and flats determines the shape of the ground above
  - The type of soil – limestone, clay, sandy etc - influences what plants we can grow and what locally grown food we can eat
  - We need rocks, and stones
    - rocks to build houses on
    - stone pebbles gravel - for paths
  - We need soil
    - clay for house bricks and roof tiles
    - sand for mortar
- Rocks protrude occasionally '*bare faced*', '*bare bodied*' in amazing formations such as the Giant's Causeway in Northern Ireland and the craggy bank known as Falcon Clints, Teesdale and add to our enjoyment of 'planet earth'.

But do children get any of these messages?

Soil is often seen as 'dirt', reinforced by the detergent advertisements as much as by poems. Rocks are for climbing on (and being told off). Stones are for throwing (and being told off). Is this fair? Are children exposed to negative perceptions only of rocks and stones from a young age? Are traditional playground rhymes still used in personal defence against taunts and worse?

Sticks and Stones will break my Bones But Words will never hurt me
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## Creative Beginnings to Exploring Rocks & Soils

Creativity, therefore, is used here as one optional starting point *to get children to connect with the idea of rocks and soils*. You may prefer to use these activities after a visit to Killhope. In fact, most teachers will probably elect to use creative follow up activities. It is an open choice.

Using poetry, creative writing, painting and photography can be a stimulating starting point but only if you believe in it.

The creative approach taken in the **Revealing Rocks & Soils Pack** begins with the idea of what is familiar to children – playing in mud on the playing field, digging earth in the garden, grandparents growing plants and vegetables in different soils, climbing on rocks, looking at the buildings around the school and thinking about the shape of the land underneath the landscape or townscape when you *'take off their clothes'*. The science preparation for Killhope then follows.

On the moorland around Killhope Lead Mining Museum the picture of the landscape is clearer than in towns and villages. You can see outcrops of rock with 'Earth's heart-stuff laid bare' (*Ted Hughes*) more often than not exposed by the ravages of the extraction industries including mining for galena (lead ore) iron ore and quarrying for limestone. These activities have in themselves created a new kind of beauty - a cultural landscape - one influenced by the lives and needs of people.

The shape of the large scale hills and valleys of the Pennines have remained unchanged for thousands of years: the soil is *'dressed'* with mosses, grasses and sedges, some trees and scattered houses. What can we find out about this soil, these rocks and minerals at Killhope Museum? A visit to the site will reveal some answers.

## Scientific Beginnings to Exploring Rocks and Soils

The other optional starting point is the Science of Rocks and Soils. That is those aspects that will provide a preparation for a visit to Killhope Mining Museum (See: Contents):

**Exploring Soils**  
**What is in your Soil?**

Or

**Killhope Museum's Rocks and Soils Loan Box**

Perhaps the Killhope Creative Science Loan Box is your best option of all!

# Revealing Rocks and Soils

## Creative Science Resources & Learning Activities

There are Four Sections to the Rocks and Soils Creative Science Teachers Resources. Sections 1 and 2 are designed as both pre- and post-visit activities. (See the previous pages: *Revealing Rocks & Soils – A Creative Experimental Approach* – for further information on optional approaches to designing schemes of work for this science unit including a visit to Killhope Lead Mine).

*Exploring Soils* and *What is in your Soil?* from Section 3 are good introductory pre-visit activities to use if you want to ensure your pupils have a strong science focus from the outset.

### 1. Section 1: Pre-visit and Post-visit Follow Up: Poetry

- MUD - Polly Chase Boyden
- Franklin Hyde - Hilaire Belloc
- Earth- worm - Leonard Clark
- Hill Walls - Ted Hughes
- Links with Killhope

### 2. Section 2: Pre-visit and Follow Up: Landscape Painting & Photography

- John Arthur Dees (20th century)
- Peter Podmore (21st century)

### 3. Section 3: Pre-visit and Post-visit Follow Up: Soil Science

- Activity 1: Exploring Soils
- Activity 2: What is in Your Soil?
- Activity 3: Rocks & Minerals (follow up activity only)

### 4. Section 4: On-site Observations Experiments & Recordings

- Exploring and Testing Rocks & Minerals at Killhope
- The Killhope Experiments
- Investigating Rocks and Minerals
- Killhope Rocks & Soils Observation Record

# Revealing Rocks and Soils

## Section 1

### Pre-visit and Post-visit Follow Up: Poetry

#### *Some inspiration*

#### **MUD**

*By Polly Chase Boyden*

Mud is very nice to feel  
All squishy-squash between the toes!  
I'd rather wade in wiggly mud  
Than smell a yellow rose.  
Nobody else but the rosebush knows  
How nice mud feels between the toes.

#### **Franklin Hyde**

*(Who caroused in the Dirt and was corrected by His Uncle)*

*Hilaire Belloc*

**His Uncle came on Franklin Hyde  
Carousing in the Dirt.  
He Shook him hard from Side to Side  
And  
Hit him till it Hurt,  
Exclaiming with a Final Thud,  
'Take that! Abandoned Boy!  
For Playing with Disgusting Mud  
As though it were a Toy!'**

#### **MORAL**

**From Franklin Hyde's adventure, learn  
To pass your Leisure Time  
In Cleanly Merriment, and turn  
From Mud and Ooze and Slime  
And every form of Nastiness –  
But, on the other Hand,  
Children in ordinary Dress  
May always play with Sand.**

## Earth- worm

*By Leonard Clark*

Do  
  You  
    Squirm  
      When  
      You  
      See  
        An earth-worm?  
        I never  
        Do squirm  
Because I think  
A big fat worm  
  Is really rather clever  
    The way it can shrink  
      And go  
      So small  
Without  
A sound  
Into the ground  
And then  
  What about  
    All  
      That  
      Work it does  
      And no oxygen  
      or miner's hat?  
      Marvellous  
      You have to admit,  
      Even if you don't like fat  
      Pink worms a bit,  
      How with that  
      Thin  
      Slippery skin  
      It makes its way  
      Day after day  
      Through the soil,  
Such honest toil,  
And don't forget  
The dirt  
  It eats, I bet  
  You wouldn't like to come out  
  At night to squirt  
  It all over the place  
  With no eyes in your face  
  I doubt  
  Too if you know  
  An earth-worm is deaf, but  
  It can hear you go  
  To and fro  
  Even if you cut  
  It in half.  
  Do not laugh  
  Or squirm  
  Again  
    When  
      You suddenly  
      See .....a worm

## Hill Walls

By Ted Hughes - *Remains of Elmet*

It set out -  
Splendours burst against its brow  
Broke over its shoulders,  
The hills heeled, meeting the blast of space

The stone rigging was strong.  
Exhilarated men  
Cupped hands and shouted to each other  
And grew stronger riding the first winters.

The great adventure had begun -  
Even the grass  
Agreed and came with them,  
And crops and cattle -

No survivors  
Here is the hulk, every rib shattered.

A few crazed sheep  
Pulling its weeds  
On a shore of cloud.

## Activities

- Discussion – playing in the mud. Is it a pleasure today? Is it a problem today? Why is sand better according to the poem? Is this true?
- What good do earth-worms do for the soil? What makes good earth for the garden? Interview family members – grandparents if they are available.
- Test soil quality by planting beans in different containers filled with water/ newspaper, compost, sand, clay and different mixtures of all 4. Observe the different growth patterns. Observe the different textures, ‘feel’, ‘smell’ and colours of different soils
- Take one of the above themes and ask children to write a justification in a poem or prose. It could be humorous

*I like playing in mud because..... (describe the texture etc. The same for sand etc)*

*My Grandmother looks after the soil in her garden because then she can grow beautiful flowers. She does this by .....*

- Visit a Garden Centre. Ask for a talk from an expert. Find out what type of soil different flowers, grasses and shrubs like growing in. Take photographs. Use them as an inspiration for shape poems linking the flowers and soil together. Alternatively, ask someone from the local Garden Centre or a member of a Gardening Club to visit the school
- Use the poem *Hill Walls* by Ted Hughes in preparation for the journey to Killhope and looking out for dry stone walling from the coach. Ask the children to spot those that are falling down. Start the questioning process on where the stone comes from?
- Look at different landscapes/ townscapes around the school and on the journey to Killhope. Why are they like they are? Why are they covered with houses and streets, forests, cereal crops or animals? Consider the soil, the location and whether the land is hilly or flat. Think about why this might be so.

## Links with Killhope

- There are muddy places at Killhope even on a sunny day – inside and outside the mine, next to the stream and around the Washing Floor.
- Children will be provided with Wellington boots to wear in the mine. They might like to write MUD poems before and after the visit to Killhope.
- On a serious note the boulder clay is useful. Lumps of clay soil mixed with water were used by the miners to fix candles to their caps. The liquid clay also helped to 'harden' the woollen caps they wore underground.
- The clay soil also meant that it was easy to keep precious water needed for the mining process in large reservoirs that can now be seen in the woods above the mine itself. Just like making a clay thumb pot with air drying clay.
- Children will explore the qualities and uses of clay on-site at Killhope.
- The Garden Centre Activity exploring which plants grow on which soils will be developed at Killhope. Pupils will see the grassy moorland on their journey and at Killhope. Some of the flowers that grow at Killhope and on the surrounding moorland thrive in lead rich soil. They are described as being 'lead tolerant' and include Mountain Pansy, Alpine Pennycress, Common Scurveygrass, Moonwort & Spring Sandwort (known locally as Leadwort). You may see these plants around the site, but it depends on the time of year.
- Ted Hughes poem *Hill Walls* compares the dry stone walls built across the moorland landscape with the rigging of a ship. At Killhope your class will see expertly crafted dry-stone walling in the underground tunnel of the mine, holding up rock and soil to keep the mine safe and open. A stone mason was one of the permanent employees.

## Revealing Rocks and Soils

### Section 2 Pre-visit and Follow Up Landscape Painting & Photography

#### Landscape Painters

Landscape has always attracted painters and photographers past and present. Ted Hughes book of poems *Remains of Elmet* is accompanied by Fay Goodwin's photographs in black and white, including a photo of dry stone walling in disrepair.

#### North East Artists

**John Arthur Dees** – Gateshead – was painting during the 20<sup>th</sup> Century.



Upland Farm Middleton  
( in a neighbouring valley to Killhope – also a large lead mining centre)

Compare this with a modern painter's landscape painting.....

## Peter Podmore



Peter lives across the border in Northumberland and has his own website.

### Activities

- Discuss these landscape paintings and photographs of Killhope. Make comparisons. Notice the shapes of the hills. After the visit to Killhope invite pupils to make their own landscape paintings. If there is time on the journey you could plan a stop to take photographs or make sketches.
- Make an exhibition of photographs and paintings.
- Create a collage to show the different textures of the different 'landscapes' observed on the journey to Killhope and experienced at the Killhope Museum site. You could link this collage work to dry-stone walling and the Ted Hughes poem 'Hill Walls'.
- Remember to include developments of the sketches of rocks and minerals provided by Killhope Museum as part of an art/ science focus

- Think of sculptures as well if time and materials are available. Find examples of the work of Andy Goldsworthy, in particular. He specializes in using natural, often 'found' materials, to make permanent and temporary sculptures. Antony Gormley makes sculptures in lead as well as using iron and other metals.
- Charles Poulson created 'Lead Wrapped Tools' for Killhope. It is displayed on one wall of the Visitor Centre. Take a good look at this when you are at Killhope Museum. Make a record of the materials that are used and the images he has portrayed. Consider creating a similar looking piece of work back at school.

# Revealing Rocks and Soils

## Section 3

### Pre-visit and Post-visit Follow Up: Soil Science

Soil is one of the most important materials in the world. Nearly all plants need soil to grow and most animals depend on plants as the source of their food. If there was no soil, there would be almost no life on earth. There are many different sorts of soil.

#### Activity 1: Exploring Soils

Soil is made up of grains of broken rock and 'humus' (mainly rotted plant material). A soil's type depends on

- the mix of the humus,
- the size of the grains of broken rock
- the different minerals in the grains of soil

#### Experiment 1

You will need

- 4 x identical polythene containers with several small holes in the bottom
- 4 x pieces of coffee filter paper (or equivalent) large enough to cover the base of the polythene containers
- Sufficient quantity of each of the following soils to half fill the containers
  - Sand
  - Loam ( mix of sand, clay and humus)
  - Clay
  - Peat
- 1 x measuring jug large enough to hold 1 litre of water
- 4 x bowls (Try to find bowls that allow the plastic containers to fit in them leaving space for 1 litre of water below)
- 1 x stop watch
- 1 x ruler
- Several magnifying glasses

Put the coffee filter papers (or equivalent) in the base of each of the four polythene containers. Half fill each of the containers with a different soil. Make sure you fill each container with the same quantity of soil. To do this you will need to make sure each container is filled to the same height. Use a ruler to measure the height of the soil you have put into the first container. Then mark the outside of the other three at the same height as the first. Fill each of the remaining three containers with a different soil.

Alternatively, make a funnel by cutting off the top of a large plastic screw top bottle. Place the top upside down in the base of the bottle to make a funnel with a bowl underneath. Put a small plug of cotton wool inside the funnel, and then fill it with a cup full of soil. Repeat this exercise three times, filling each of the four 'funnel and bowls' with a different soil.

The first option is more precise and therefore the test results should be more accurate.

## Observation and Tactile Tests

Examine the four samples of soil:

**Observation:** describe and record what each soil sample looks like. Include colour, texture, and size of grains. (You may like to use magnifying glasses here)

- Which soil has the smallest grains?
- Which soil is the darkest colour?

**Touch and Feel:** describe and record what each soil sample feels like. Include rough/ smooth, soft/ hard, heavy/ light, cold/ warm

- Which soil feels gritty?
- Which soil feels smooth?
- Which soil feels lightest (as opposed to heavy)?

## Recording and Comparing

Divide the class into groups. Ask each group to devise one chart or a set of charts to record and compare their findings. Ask each group to talk about what they have discovered to the others. Discuss where they have seen each of the different soils outside the classroom.

Link this science observation and tactile test on soils to work with the Garden Centre, Gardening Club or work with grandparents as well as the visit to Killhope.

## Experiment 2

### Permeability of Soil – Test

The amount of time water takes to drain through a soil is known as the soil's permeability. Some soils drain easily, others do not. How quickly a soil drains depends on the proportion of humus and of the size of the grains of rock.

#### Work in Groups

- Place each polythene container filled with soil inside a bowl (or use the funnel and bowl method)
- Put 1 litre of water into a jug (or use a cup of water with the funnel method)
- Pour all the water into the container
- Ask one child in the group to start the stop watch as soon as the jug or cup is empty
- Watch what happens
- Time how long it takes for the water to drain through each soil
- Measure the size of the grains of each soil

#### Record conclusions

**Complete a chart below and make a graph. There is an ICT opportunity here.**

Soil type	Size of Grain (in millimetres)	Time taken for 1 litre (or one cup) of water to drain through half a container (or one cup) of soil
Sand		
Loam		
Clay		
Peat		

Answer these questions:

- Which soil does water drain through most quickly
- Why is this?
- Which soil does the water drain through most slowly
- Why is this?

When you visit Killhope you will discover 'limestone' and 'sandstone' grains of rock as well as 'boulder clay' and 'peat'. You will be given samples of these soils to bring back to school. Repeat the permeability test.

### **Discuss**

- how 'boulder clay' is used at Killhope
- why the 'sandstone' and 'limestone' soils and rocks make problems for the boys working on the Washing Floor at Killhope Lead Mine during the summer months
- what peat is used for at Killhope & where we use peat today
- what clay was used for at Killhope & what we make with clay today
- what lime was used for at Killhope & what we use lime is used for today

You can consider linking these soil science explorations to creative activities e.g. making clay finger pots.

## Activity 2: What is in Your Soil?

### Experiment

For this experiment you will need

- A large clear plastic bottle with a screw top
- Dry Soil (taken in a narrow sample half a metre deep)
- Water

Fill a quarter of the bottle with soil from close to the school

Then add water until the bottle is two-thirds full

Screw on the cap and shake hard

Stand the bottle on a table and watch the different layers form as the soil settles.

What you will probably find from top to bottom is

- Top - humus
  - floating particles of clay
  - clay
  - silt (sediment deposit of fine sand)
  - sand
- Bottom - gravel

Repeat the experiment several times using different soil samples, including those you have collected on your visit to Killhope, if you are able to do so on the occasion when you visit.

## Post-visit Follow Up Activity ONLY

### Activity 3: Rocks & Minerals

#### Permeability of Rocks and Minerals

#### Experiment

#### Materials supplied by Killhope Museum

- |  |   |
|--|---|
| <ul style="list-style-type: none"><li>• 1 x lump of clay</li><li>• 1 x lump of limestone</li><li>• 1 x lump of sandstone</li></ul> | <ul style="list-style-type: none"><li>• 1 x piece of fluorspar</li><li>• 1 x piece of galena</li><li>• 1 x piece of quartz</li><li>• 1 x piece of shale</li></ul> |
|--|---|

#### Classroom equipment needed

- Low-rimmed baking trays
- Kitchen scales (metric scale)
- Jug/s of water

*If you want to convert your scale into Newtons, remember that on Earth 100g mass has a weight of 1N, so 250g mass has a weight of 2.5N and so on*

- Weigh the rock and mineral samples
- Record the results
- Place the rock and mineral samples in the baking tray.
- Make a drawing.
- Add written notes, or make an oral recording, of all the visual information you have found out looking through your magnifying glasses.
- Add written notes, or make an oral recording, of all the information you have found out by touching and feeling the sample materials.
- Then pour water over the rocks and minerals, enough to come half way up the side of the baking tray
- Leave the rock and mineral samples for at least 1 hour to absorb the water or not.
- Observe and record any changes that you can see. Use the magnifying glasses
- Lift out and handle each sample in turn. Observe and record any

changes to the 'feel' of the piece – texture (rougher/ smoother/ softer/ harder), weight (heavier/ lighter), etc

- Finally weigh each piece again
- Record the results

Invite the class to think about ways in which they can use their findings

- Devise charts and graphs on the computer
- Add the discoveries undertaken at Killhope including how hard or soft each rock or mineral is
- Create a Story Board Journey of a rock or mineral from Killhope - e.g. *Galena*. Start with a description of what it looks like, what it feels like and what makes it special. Then tell the story of lead 'underground.....mining.....separation...smelting.....metal – lead....uses'
- If you think your pupils are able to do so, link the results of their investigations as Killhope Detectives - both on-site and at school - to each stage of the Story Board Journey.

### **Discuss all the Rocks and Soils Experiments and the Killhope Detective Work with the class/ group**

Ask

- Why soils are important
- Why rocks are important
- Why minerals are important

Has the visit to Killhope Lead Mining Museum and their own detective work there and at school changed how they each think about

- The place *on which* they live
- How they are able to *stay alive*
- The *scenery* they see when they go out on a trip
- Would the children like to have been a lead miner or washer boy?
- What properties of some rocks and minerals would have made life difficult?
- What properties of some rocks and soils would have improved the workers' lives?

## Revealing Rocks and Soils

### Section 4

#### On-site Observations Experiments & Recordings

*On-site at Killhope, the class will carry out investigations and experiments under the leadership of trained Information Assistants. You are provided with the brief that the Information Assistants will follow so that you can organise follow up activities in the classroom. Remember, the programme may vary depending on the time available, the season of the year and the stage at which the pupils are in their study of rocks and soils when they come on their visit to Killhope.*

*Discuss with Killhope Information Assistants in advance whether you will bring copies of the worksheets, pencils and clip-boards for adult helpers to fill in or whether Killhope is in a position to provide them for you.*

*(Please note that the weather on the day of your visit may not be conducive to using worksheets at all. The weather at Killhope can be very wet and windy at times! So you may want to use alternative recording techniques)*

*You may like to make a video recording or take photographs.*

*A Killhope Loan Box of sample rocks, minerals and soils will also be available to support pre-visit and post-visit work*

# Exploring and Testing Rocks & Minerals at Killhope

## Briefing for Killhope Museum Information Assistants

### Initial Introduction

Killhope Museum Information Assistants (IAs) start by giving the whole group a short explanation about the particular piece of earth they are standing on; the earth visible across Killhope Museum site; and - more generally – the earth in the surrounding area. They choose any piece of rock off the ground.

The IAs are briefed to communicate to the following concepts:

- The earth's crust is made up of different types of rocks, interlocked together in 'plates' and 'layers'
- The different types and mixtures of rock underground create the rock formations and different shapes above ground. *Point out the topography around the site e.g. hilly, flat, uneven, smooth etc.*
- You are holding just one piece of rock, but there are many different types, all with different qualities. *Give brief description of possible qualities: Weight, colour, hardness, softness, etc.* The children will find out more about these as they investigate around the site. **This is the core of the visit.**
- Rocks are made up of different minerals, and we can get metals from some minerals.
- In the ground around Killhope, some of the rocks contain ore – the name of a mineral from which metals are extracted. We are going to find out more about the ore found in the ground around Killhope through on-site experiments and observation.

## The Killhope Experiments

### Science Detectives at Killhope Discover...

A brief list of the things the children should discover on site through their experiments:

- Close observation of different types of rocks, minerals and clay
- Basic understanding of how heavy or light they are
- Basic understanding of how hard or soft they are.

### On-site Organisation

Following an initial introduction by Information Assistants to the whole group using the above script, this larger group is split into smaller working groups.

#### **Killhope Museum Information Assistants**

The Museum Information Assistant will lead a discussion at various parts of the Killhope Museum site as you go around.

This will include:

- what possible uses the different rocks and soils may have for us;
- what different rocks and soils look like;
- where the different rocks and soils are found at Killhope in their natural state.

The Information Assistants will also look at how minerals or rocks - especially and particularly lead - have been separated, processed, shaped and used to improve the quality of life for people.

For example - lead for water proofing roofs; sandstone for roof slates and tiles to construct walls; fluorspar for toothpaste etc.

The groups will either work alongside each other or sequentially e.g. visiting the mine, reservoir, washing floor, mine shop and mineral room at different times.

**Each Museum Information Assistant will have a *Box of Rock and Mineral Samples* for the children to look at and experiment on at different places around the site.**

## Investigating Rocks and Minerals

### Materials supplied

<ul style="list-style-type: none"><li>• 1 x lump of clay</li><li>• 1 x lump of limestone</li><li>• 1 x lump of sandstone</li></ul>	<ul style="list-style-type: none"><li>• 1 x piece of fluorspar</li><li>• 1 x piece of galena</li><li>• 1 x piece of quartz</li><li>• 1 x piece of shale</li></ul>
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### Equipment supplied

- Sets of the attached worksheets & pencils (check if it is easier to bring your own)
- A number of unbreakable magnifying glasses
- A number of fairly large steel nails (or equivalent)
- Hammer (Bucker)

### The Experiments

These will be done at various places around the site on your tour.

Use the Observation Record Sheet to guide you.

The adult with the group will look after this and record the children's answers.

### Killhope Museum Information Assistants will

- Give each group: pencil, set of the equipment (as listed above) observation record sheet, and materials - rocks and minerals (as listed above).
- Identify the name of each rock or mineral

***In their groups the children will examine these rocks and minerals in order to find out about their identifying features and gather further information about them by answering questions 1 – 5 on the work sheet: Killhope Rocks & Soils Observation Record included at the end of this Section.***

## **'Hands-on Experience'**

### **Pupils will**

- Observe and examine the rocks/ minerals through hands-on experience – handling the object and closely examining it using the magnifying glasses.
- Taking great care – under supervision – they will try to scratch the rock or mineral with the steel nail. This will help them to decide whether the material is hard or soft. If it scratches easily it is soft. If it is difficult to scratch it is hard.

*The adult helper will record your pupils' findings. (Weather permitting.)*

- The children can make a detailed drawing back at school – as they will take their samples with them back to school.

*Include all the visual information the pupils' found out looking through their magnifying glasses.*

- When on the Washing Floor, the pupils take their rocks/ minerals to the 'knock stone' and, wearing goggles, attempt to break apart all the different rocks and minerals in turn.

*Record their observations.*

### **Killhope Museum Information Assistants will**

Give a 5 – 10 minutes recap about what all of you have found out at the end of the tour.

## Killhope Museum Rocks & Soils Observation Record

**Names of group:**

\_\_\_\_\_

**School:**

\_\_\_\_\_

**Name of rock or mineral:**

\_\_\_\_\_

**1. Colour of rock?** \_\_\_\_\_

**2. Write down three words to describe your rock or mineral:**

\_\_\_\_\_

\_\_\_\_\_

\_\_\_\_\_

**4. Is it easy to make a mark on the rock or mineral with a nail?**

Yes or No

**5. Is the rock or mineral easy to break up with a bucker? Yes or No**

**What uses does the rock or mineral have?**