# Evolving landscapes

Sedgwick Museum
of Earth Sciences

## Mini field trip guide

This activity will introduce you to rocks used in around the Storey's Field Centre, how they formed and why the architects chose them.

If we look closely, rocks tell us the story of their formation. The environment and conditions that a rock forms in reflects its physical properties. Architects choose rocks with specific properties that make them useful building stones. This activity will help you locate the different rocks types used in Eddington and to read the story of how they formed.

Produced by the Sedgwick Museum of Earth Sciences

# Storey’s Field Centre

This activity takes you out in the 'field' making direct observations of rocks and thinking about the properties of those rocks that make them suitable for their chosen use. Everything can be found outside the Storey's Field Centre.

Storey's Field Centre
Eddington Avenue
Cambridge
CB3 1AA

# Rocks and their uses

All of the rock types you will see are what architects and engineers refer to as ‘Building Stones’. These rocks have properties which make them more or less suitable for different types or styles of construction. Softer rocks are good for detailed carvings, whereas hard rocks with large crystals make an impressive polished façade. Some rocks have more than one name, depending on who is talking about the stone.

Builders, architects and quarrymen use trade names that often derive from medieval quarrying terms, whereas geologists use names relating to the age and formation of the rock.

# Rocks and their origins

All of the rocks on Earth fall into one of three groups, based on how they form.

**Sedimentary rocks** form the majority of the surface rocks of the British Isles. These rocks have been formed by the accumulation of ‘sediment’ (particles of rock, minerals or organic detritus) on land or in water. This process is called deposition. Once the grains are deposited the sediment is buried and compacted by the weight of new sediment building up above it. This causes the sediment to fuse together to become rock.

**Igneous rocks** are the solid remains of molten rock (lava or magma) that has formed deep inside the Earth and risen towards the surface through the Earth’s crust.

**Metamorphic rocks** have been changed by heat and pressure deep underground. They can be formed from igneous, sedimentary or even other metamorphic rocks.

Arenite sandstone - Beagle collection. Biotite granite - OU collection,
Garnet Pyroxene Gneiss - University of Glasgow collection. Virtual Microscope www.virtualmicroscope.org

Sedimentary

Sandstone - rounded quartz grains cemented together

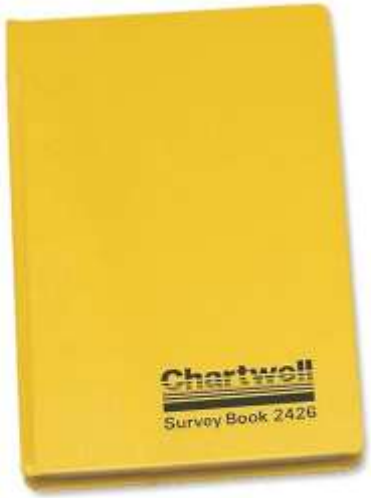
Igneous

Granite - randomly arranged mineral crystals

Metamorphic

Gneiss - banded mineral crystals

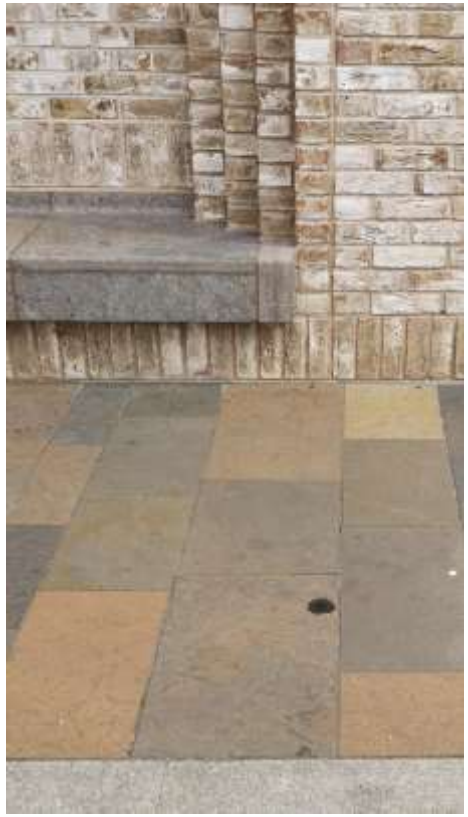
# What to take with you




- Hand lenses or magnifiers
- Ruler or tape measure
- Camera
- A way to take notes, make field sketches
- Appropriate clothing
- Hand sanitiser for when you are finished

You will be going out into the 'field' where there will be other pedestrians as well as road traffic so make sure you know how to stay safe and respect other people.

# What to do



**Before you set out think about:**

- All the places you might find rocks used in the built environment
- Why might natural rock might be chosen over another building material?

Field trips are a great way to look at geology in action. You are going to be looking at rocks but instead of finding them in their natural environment i.e. where they formed, you are going to see how humans have used them as building stones.

Natural stone has been quarried from the ground, the only processing is to cut, shape and finish it i.e. not concrete or engineered stone that has been heat or chemically treated or bonded with resin.

Close observation is a really important geological skill, so get up close the rocks and use a magnifier if you have one.

**For each rock type answer as many of the following questions as you can.**

- Rock name
- Does it have grains or crystals? Grains = sedimentary, crystals = igneous or metamorphic
- Does it have fossils? Yes = sedimentary
- Is the surface natural or has it been tooled/polished? Why was that surface finish chosen?
- What is it used for?
- What is the most important property of the rock in this situation/for this use? What job does it need to do?

# Field sketches

Sketches in your notebook are observational drawings. They are not your best artwork, they help you to remember what you saw when you get home and they have labels of important features. It is also really important to include a scale. No ruler, what can you use? You could use your feet, hands or a fingernail as a length of measurement.

**Make sketches of:**

- A small area of detail
- The whole thing/bench/block
- A wide view of the area labeling each rock type

**Photographs**

You could also take photos, remember to include something for scale. For each rock type take:

- A wide view for context
- A close up of interesting details

# Caithness Flagstone

- Muddy sandstone
- Sedimentary
- Middle Devonian 370 million years old
- Highlands of Scotland

Used as the flagstones outside the Storey's Field Centre.

In the Devonian period Scotland was warm and dry with the occasional flash floods. Flooding eventually created a huge lake. The Caithness Flagstone was formed in the anoxic (low oxygen) part of this lake. As the water level rose and fell layers of mud and sand were deposited at intervals in the bottom of the lake. A bedding plane formed each time the deposition stopped. Bedding planes often have cracks or ripples on the surface.

Quarried since 1793 and exported across the world. It is a very hard rock that naturally splits into thin sheets. It is used in the steps of the Sedgwick Museum where you can see the layers edge on.

Caithness flagstone was chosen by the architects (MUMA) for its subtle colour tone and variation as well because it from the UK.

- Look for sedimentary features like infilled cracks and ripples on the surface of the flagstones. These are the bedding planes.
- What do cracks or ripples tell us about the environment the rocks was laid down in?

# Purbeck Marble

- Limestone
- Sedimentary
- Cretaceous 145 million years old
- Dorset coast

Used as the seating around the Storey's Field Centre

The Purbeck beds were laid down in brackish to fresh water lagoons. The water was never very deep so the beds of the Purbeck formation are thin. They are a mixture of limestones and shales. The harder limestones are often called Purbeck Marble by stone masons because they can take a fine polish. But, the beds are actually fossiliferous limestone not a metamorphic rock like a true marble.

The bed used in the seating is full of freshwater bivalves and some thin white veins. The veins were formed during a stretching event when the rock cracked and the cracks were filled in with the mineral calcite.

The Purbeck beds have been quarried since at least Roman times as a building stone. It has been used in columns and flooring in most of England's cathedrals.

It was chosen by the architects (MUMA) because it is highly durable and frost resistant English limestone, quarried in Dorset.

- Look at the fossils: are they whole or broken? What does this tell us about how they died?
- Look for calcite veins (thin white lines of crystals). What is the relationship between the veins and the fossils? Did the stretching that made the veins, happen before or after the rock was laid down?

# Granite

- Fine grained granite
- Igneous

Used as kerbstones and steps adjacent to the Storey's Field Centre.

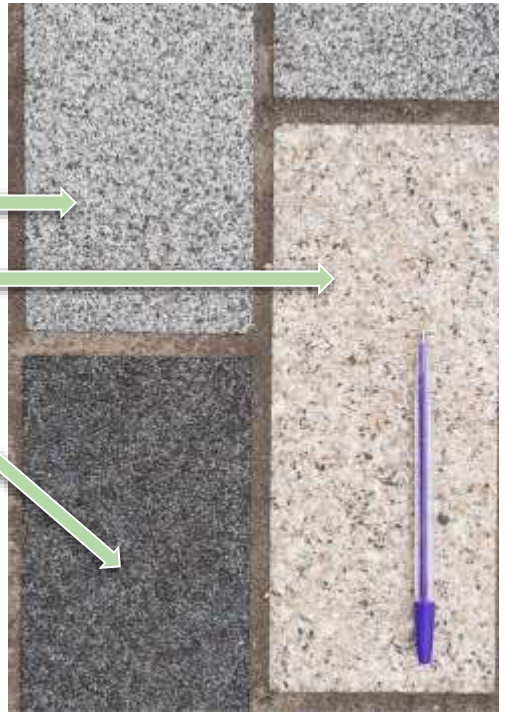
We don't know exactly where this granite came from so we don't know the age. But we do know that granite forms when a liquid magma cools slowly, deep underground. Slow cooling means there is plenty of time for each mineral ingredient of the magma to form crystals large enough to see without a microscope. The crystals in igneous rocks fit tightly together like a jigsaw puzzle, making granite a very tough, hard non porous rock.

Granite is highly durable and stable making it hard wearing building stone. But because it is so hard, it is difficult to work and carve. It has been quarried from around 2590BCE in Egypt. It was used in the Great Pyramids and is often used for gravestones and memorials.

- Look for a chipped, fresh face to see the crystals clearly. How many different minerals (crystals) can you ID by their colour?
- Look at the different ways the granite has been tooled/finished. How many different finishes can you find?
- Why were different surface textures chosen?

# Granite, dolerite and basalt blocks

- Fine grained dark basalt
- Coarse grained granite and dolerite
- Igneous




Used as blocks around the base of the trees and the central reservation.

We don't know exactly where these rocks came from so we don't know their age. Igneous rocks form from cooling, liquid magma. The granite and dolerite cooled slowly, deep underground so the crystals had time to grow large enough to see. Basalt cooled quickly from lava erupted at a volcano. Because it cooled quicker, the crystals are tiny and can only be seen with a microscope.

The interlocking crystals of igneous rocks make them very durable. Their mineral composition makes them resistant to chemical weathering making them a good choice for paving. Being very hard makes them difficult to cut, which might be why the blocks are all small.

Granite, dolerite and basalt are often used today in construction as aggregate and for the base of roads. The Romans used basalt pavers for road surfaces and the ‘bluestone’ pillars of Stonehenge are dolerite. Over 4,000 yrs ago, the ‘bluestone’ pillars were transported 240 miles from the Preseli Mountains of southwestern Wales to Salisbury plain.

- Why do you think three different rock types were used?
- Why did the architects chose natural stone not concrete?
- Do some statistics. How many of each rock type is used? Have a look at the base of other trees in the area, is the spread of rock types the same or different?

# Round up

Uniform bonded gravel (top) versus the tonal colours of Caithness sandstone

**Why was natural stone used by the architects of Eddington?**

- Prestige of the University. Natural stone is considered more valuable and can even add value to a property.
- Granite is highly resistant to chemical erosion like acid rain, making it a good choice for flooring.
- Aesthetics. Natural stone colours are subtle and more varied. Look at the bonded gravel in front of the bike racks for comparison.

**Why not concrete?**

- The process of quarrying natural stone is more environmentally friendly than the concrete manufacturing process. The concrete manufacture involves incredibly high temperatures, which pump out a large amount of CO2 into the atmosphere. This is a growing and important realisation; that stone has the lowest carbon footprint of almost all construction materials, even compared with engineered timber.
- Natural stone is more frost resistant than concrete and easier to clean.

**Where is it from?**

Before the 1800s, building stones in Cambridge town centre were unlikely to have come from more than 100km away. Today's road and rail network mean architects can chose stone from Scotland and Dorset because it is ‘local’ to the UK.

Next time you're walking outside look around for natural stone. You might be surprised at how much stone is used in the buildings around you.