



*Sandy's Creek  
Mudstone*

### For Teachers

The subject of this leaflet is likely to complement any work you are doing in relation to the study of the earth's crust. The content can take you into Third Level and Fourth level of Curriculum for Excellence. The references below indicate some of the potential links to the experiences and outcomes. Any field trip should allow you to make other links, for example, to literacy, numeracy and health and wellbeing.

You can, of course, adjust and adapt these materials to suit the needs of your learners and the context of any studies that you are undertaking. For example, studying the shapes of particular rock crystals, estimating volume and weight, studying the effect of forces such as friction and the properties of natural resources such as stone.

You will also wish to ensure that you follow your local authority and other appropriate advice on field trips.

### Curriculum for Excellence Links

#### Science

- SCN 2-17a
- SCN 3-17a
- SCN 3-17b
- SCN 3-15a

#### Maths/Numeracy

- MNU 2-10b
- MNU 3-08a
- MTH 3-11b
- MNU 4-11a
- MTH 3-16a
- MTH 3-17c
- MTH 2-19a
- MTH 3-19a

#### Health & Well Being

- HWB n-11a
- HWB 2-19a
- HWB 3-23a
- HWB 2-33a



### About Portencross Castle

Portencross has been inhabited for thousands of years. An archaeological dig found evidence of an Iron Age settlement on Auldhill, just behind Portencross Castle. The Iron Age lasted from around 800 BC to 100 BC.

Portencross Castle was constructed in three phases starting in 1360. It was the home of a branch of the Boyds. The lands around Portencross were given to the Boyds of Kilmarnock by King Robert I as reward for their help at the Battle of Bannockburn. A number of Royal Charters were signed at the castle and it had close links with King Robert II during that period.

After the 1600s, it was occupied by local fishermen. The roof was destroyed in a gale in January 1739. By the 20th century, the Adams of Auchenames owned the castle. It became a scheduled ancient monument in 1955.

### Friends of Portencross Castle

The Friends of Portencross Castle (FOPC) produced this leaflet. They were helped by a survey by the Strathclyde RIGS group.

RIGS (Regionally Important Geological and Geomorphological Sites) are landscapes or rock features that are valuable for education or tourism. Usually a local voluntary group identifies and explores the site. The groups let the local planning authority know about the site. RIGS are important areas and second only to other sites that the law protects (Sites of Special Scientific Interest).

Scottish Natural Heritage and the Geological Society of Glasgow supported The Strathclyde RIGS Group in its study of the area around Portencross Castle.

FOPC is a recognised Scottish Charity (No. SC028181) dedicated to conserving the castle and providing access to the building.

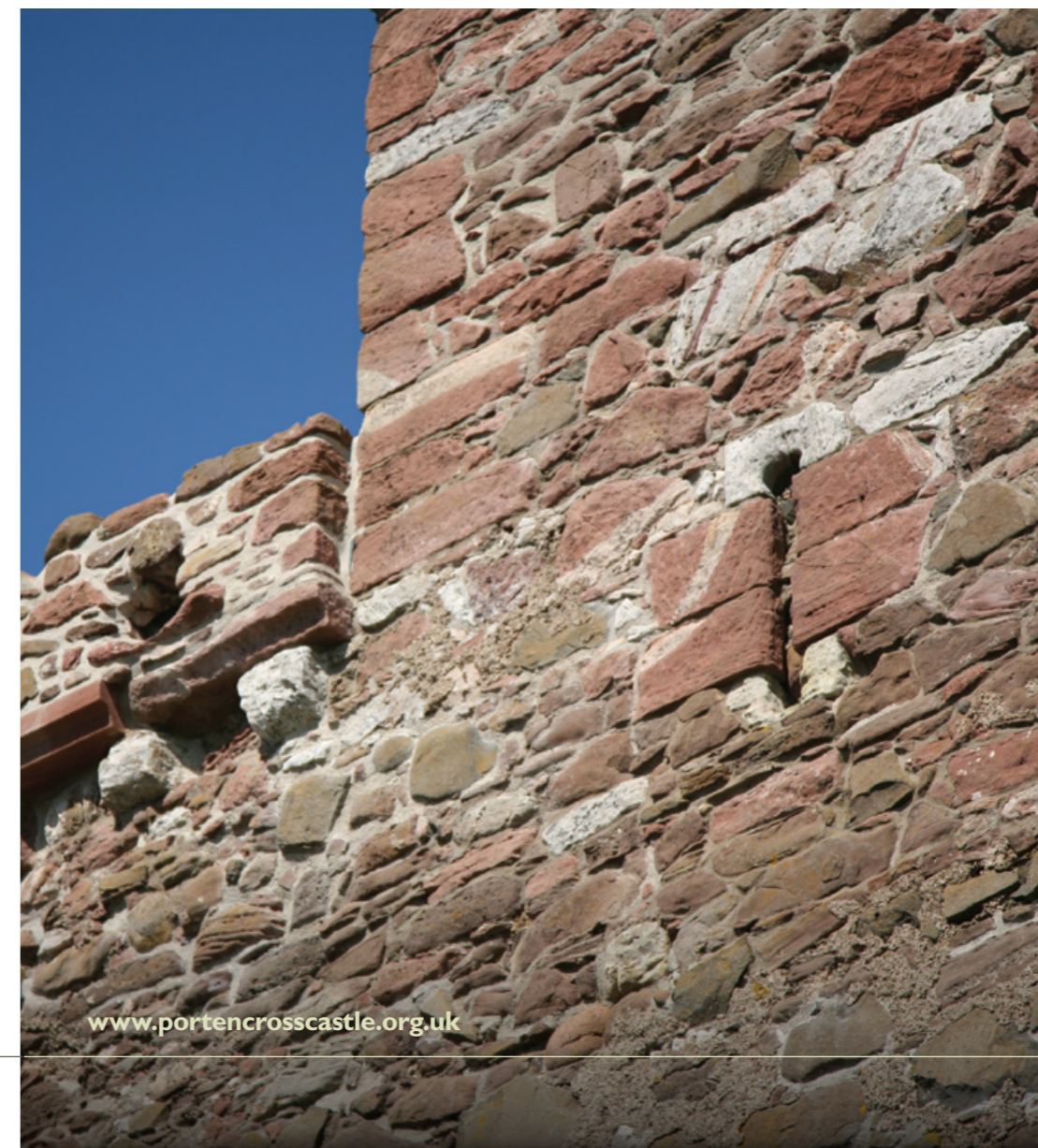
In 2007 FOPC was awarded grant support from The Heritage Lottery Fund, Historic Scotland and the Architectural Heritage Fund. With additional support from local charities, North Ayrshire Council and many individuals, FOPC was able to raise just over £1 million pounds for the costs of the project.

Grant support does not include maintenance. As a result FOPC has to raise costs for staff, maintenance, education materials, website and overheads. We will remain open with the help of donations and by having events and functions at the castle.

**Please donate if you can. You can become a Guardian of Portencross Castle. Find out more from our web site [www.portencrosscastle.org.uk](http://www.portencrosscastle.org.uk) or pick up details at the castle during opening hours.**



# GEOLOGY AROUND PORTENCROSS CASTLE



## 1. Station 1. South Side of the Car Park

**Activity**  
From the carpark, look closely at the rocks along the shoreline.

The rocks are made of brown and chocolate-brown sandstone. Sandstone is a sedimentary rock. Such rocks are made up of small grains of sand that have been compressed into a solid. If you scrape it with something hard, the grains will come off the surface.

The picture opposite shows that in some sandstone you can find stripes of quartz. These rocks are around 400 million years old.

Sandstone comes from sediments and is made up of grains of sand. The climate at the time these rocks formed was warm and dry but flash floods stormed down valleys, scraping the mountainsides. Scotland at that time was in a different part of the world. It was then south of the Equator. Today, that is the latitude where we find countries like Malawi. Geologists call this type of rock Lower Old Red Sandstone.

You can see layers in the rocks of Portencross. These layers were originally horizontal. However, on the shoreline you can see that the rocks are on a slope. The slopes show the many cracks (faults) and folds that formed in the layers over millions of years.

A major fault has broken the rocks at Farland Head with great force. Where this has occurred, you can see a wedge of grey/green mudstone called Sandy's Creek Mudstone. You can see some of it just at the carpark (see picture above and on the back of this leaflet). Modern geologists think that the mudstone is 410 million years old.



## 2. Station 2. The Castle

**Activity**  
Look closely at the stone that makes up the castle walls. Local people would have made the stones from local rock. Can you see any rocks that are much lighter in colour than the red or brown sandstone? What are these rocks used for in the castle walls? Can you find any of the sandstone blocks that are easy to recognise - such as the pattern of lines shown in the picture in the Station 1. guide above?

Sandstone was collected locally to build the castle. The rectangular stone blocks were probably quarried from outcrops of rock around the castle. You can tell the original part of the castle because the blocks at the corner are made of much lighter-coloured sandstone. This white sandstone occurs two miles away in a quarry at Kaim Hill.

Some blocks are made of granite and look red blending into white with a blue/green tinge in places. This is Ross of Mull granite (centre of picture below).

Stone Engineering, the company that did the conservation work on the castle, used a number of different stones including light yellow buff, light red Corsehill and darker red St. Bees from Dunhouse Quarries.



For more information, you can get copies of our Architecture of Portencross Castle leaflet from the castle during opening hours or from our website.



# Portencross 400 Million Years of History

About 400 million years ago, the earth went through a period of mountain building. A huge mountain range formed that covered the northwest of Britain. It was similar in size to the Himalayas. The oldest rocks in Portencross come from these mountains. Over the following 40 million years, wind, weather, ice and rivers eroded the mountains. This process formed sediments. A sediment is the sand and mud that gathers at the bottom of lakes and seas. Some sediments are over 40 kilometres thick.

The map above shows where you can see a number of rock and land features around Portencross Castle. You can see these features without going near the water. Always watch your footing as the ground surface is uneven and may be slippery in places, especially during or after rain.

You can find advice about taking sensible precautions in the Outdoor Access Code on the Scottish Natural Heritage web site at [www.snh.org.uk/pdfs/access/knownCode.pdf](http://www.snh.org.uk/pdfs/access/knownCode.pdf).

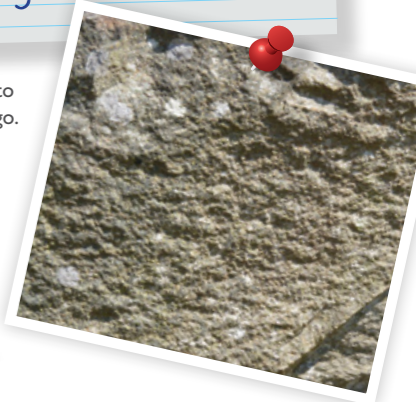
## 3. Station 3. The Road Cutting (Throughlet)

**Activity**  
Walk further north (upstream towards Largs) along the track past the concrete pier. Stop when you reach the road cutting. This spot is known locally as the 'Throughlet'. The rock was blasted at this point to allow the track to pass through.

You should be able to see a ridge running east/west from the cliffs to the sea. This is a 'dyke' and was formed around 300 million years ago.

The dyke is made of igneous rock. Igneous rock was once molten lava that cooled to form crystals (for example, granite). This rock is much harder than the surrounding sandstone and so it wears less easily. That is why the dyke forms a ridge on the landscape.

Look closely at the rocks here. Can you see the crystals?



Volcanos erupted here between 60 and 300 million years ago. Molten rock escaped through cracks in the sandstone and then slowly cooled and became solid.

The wide grey/green dykes around Portencross with rock crystals that are medium sized are dolerite and are around 300 million years old. The thinner, darker dykes which have finer-grained crystals are usually basalt and are around 60 million years old.

## 4. Station 4. North of the Road Cutting

**Activity**  
Look to the north (upstream towards Largs). You should be able to see flat ground ahead with cliffs to the east (your right). How do you think the flat ground was formed?



This flat ground is an example of a 'raised beach'. The sea used to wash along the bottom of the cliffs. It probably formed about 10,000 years ago. A sheet of ice would have covered the land here. The ice then melted, taking weight off the earth's crust. The land then rose up (or rebounded) as a result.

## 5. Station 5: Inlet

The rock type to the south of the Inlet looks similar to the rocks near the castle, except that they dip more steeply. To the north of the Inlet, however, the rock is different. It has a more gentle dip. As you walk on the path past the Inlet, you are walking across a 30 million year time gap! A crack or fault in the earth's crust caused the changes to the rock type that you see here.

Geologists call this second type of rock a 'conglomerate'. Locals call it 'pudding stone' because it is a mixture of coarse gravel, cobbles and occasional boulders all set in a solid sand mix. This rock was formed about 380 million years ago.



**Activity**  
Look closely at the boulders and pebbles. Can you see different types? Can you see the solid sandy part in which other kinds of rock are mixed? Do the boulders and pebbles look rounded? Why would they be rounded?