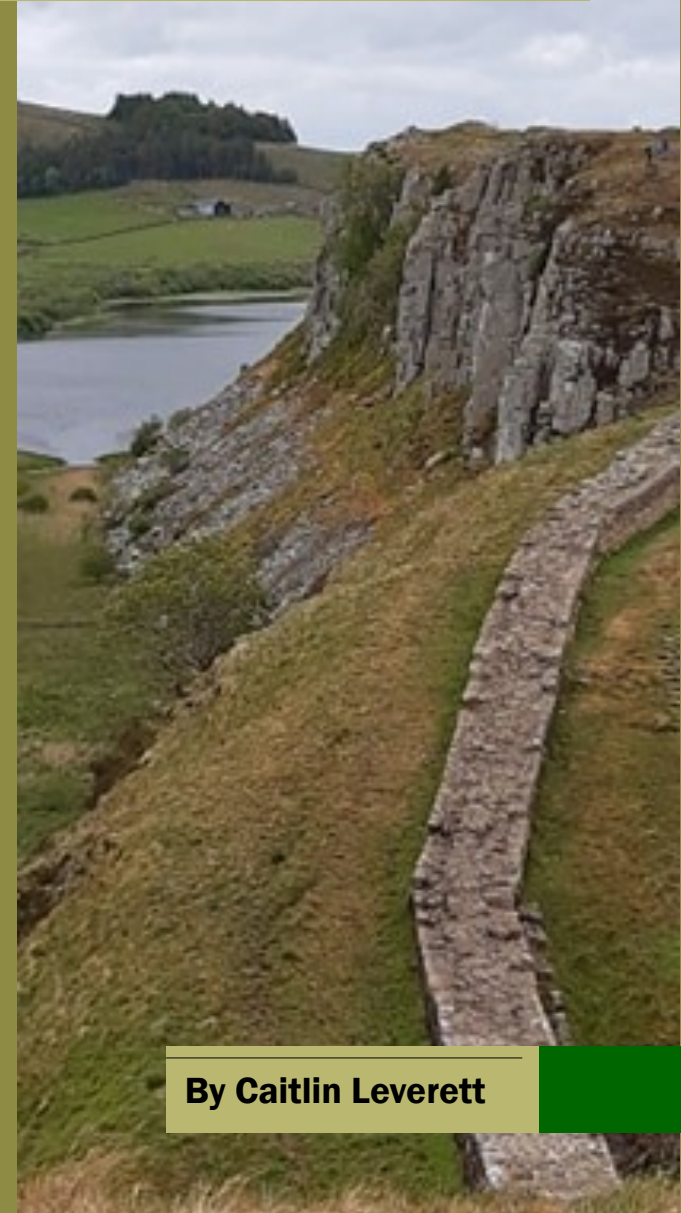


This guide explores the geology of the area surrounding Hadrian's Wall and The Great Whin Sill in Northumberland National Park

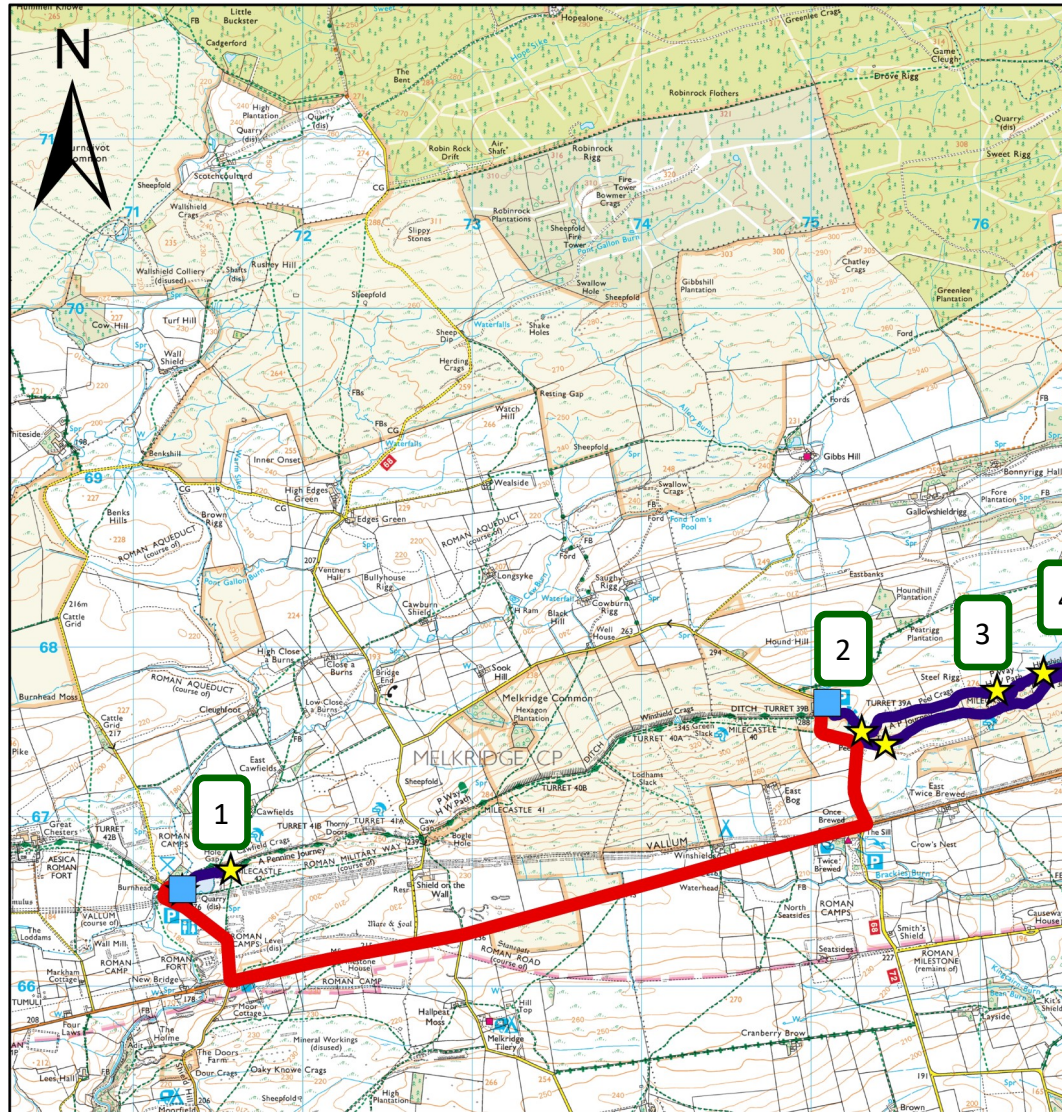
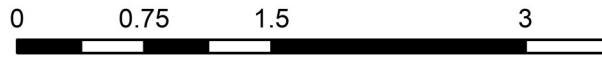


An Introductory Guide to the Geology of The Great Whin Sill and Hadrian's Wall








By Caitlin Leverett

Route Map



Legend

-  Parking
-  Points of Interest
-  Road Route
-  Walking Route

-  1 Cawfields Quarry
-  2 Steel Rigg
-  3 Milecastle 39

Base map sourced from Edina <https://digimap.edina.ac.uk> © C

References and Further Information



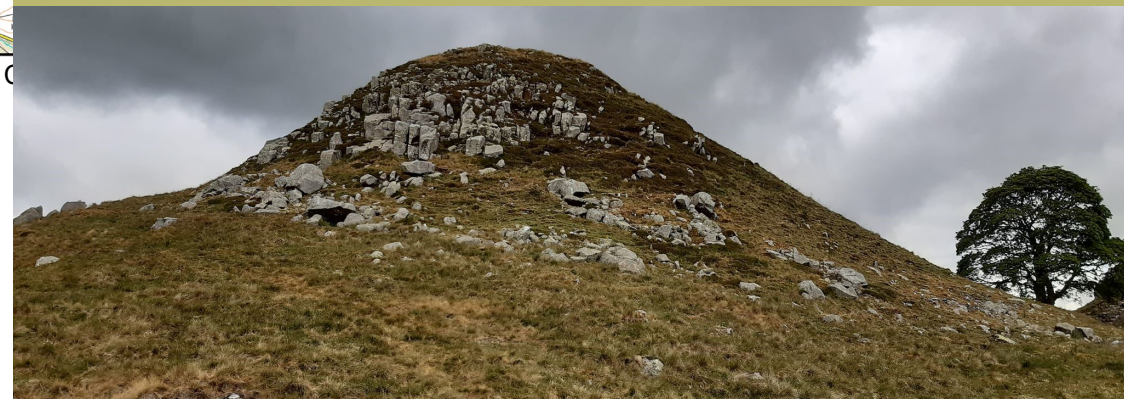
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Historic England. (2020) *Roman quarry inscription on Queen's Crags, 680m south east of East Hotbank*. Available at: <https://historicengland.org.uk/listing/the-list/list-entry/1017958> (Accessed: 8/06/2020).

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Unless otherwise stated all images by Caitlin Leverett



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Limekiln

Continue along the National Trail to Hotbank, then take the footpath to the left and bear right until reaching the limekiln to the left of the path [NY 77884 69027]. This limekiln was where locally quarried limestone would be burnt to produce quicklime. When mixed with water this became slaked lime and could be used to make mortar, as seen in Hadrian's Wall. The quicklime could also be used as a fertiliser. Most of the limestone quarries in this area gathered limestone for this use, and many limekilns can be seen around the area.



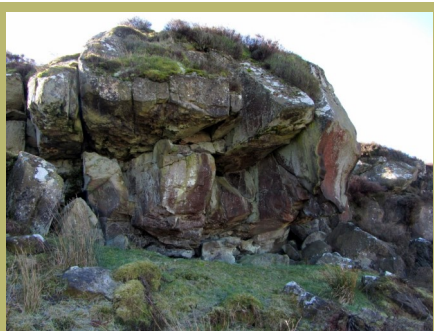
Lime kiln north of Hadrian's Wall
cc-by-sa/2.0 - © Mike Quinn -
geograph.org.uk/p/526733

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Sewingshields Crag

Continue along the footpath until it re-joins the National Trail at Hadrian's Wall. Turn left and continue to turret 35A.

Looking to the North West two outcrops of rocks should be visible. Queen's Crag, the nearer of the two, was the site of one of the many quarries used by the Romans to obtain sandstone for the construction of Hadrian's Wall. It is also one of the few surviving quarries with evidence of Roman use (Historic England, 2020). This shows how near the quarries were to the wall in this location however in other sections of the wall the Romans had to travel further afield to find sandstone for the wall.



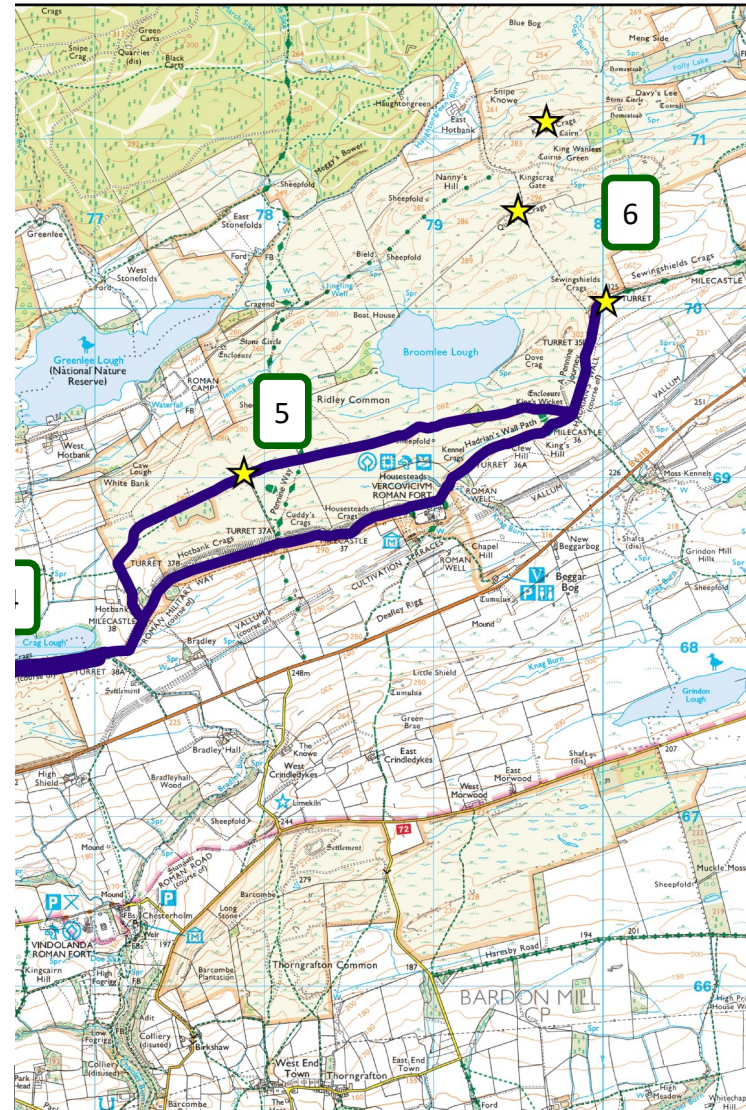
Site of Roman Quarry, Queen's Crag
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geograph.org.uk/p/3901290

Return along the National Trail until Milking Gap just before Crag Lough and take the left path, following the course of the Roman Military Way back to Steel Rigg. Where the path reaches the drainage valley at Steel Rigg it passes close to an outcrop of the Whin Sill, providing another chance to study the rock up close.

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Kilometers



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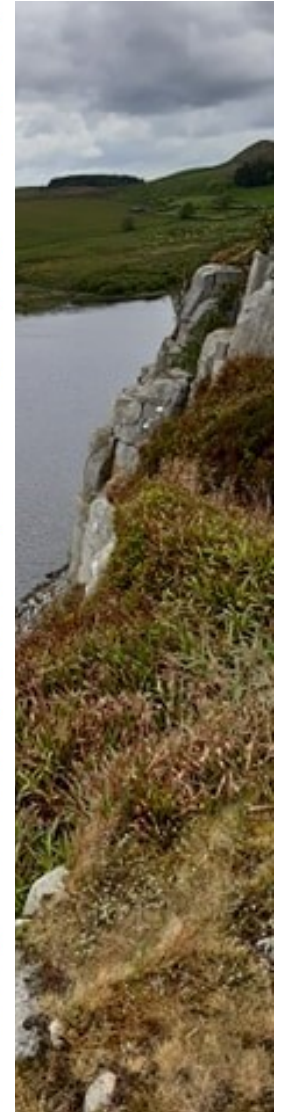
Highshield Crag & Crag Lough

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Limekiln

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Sewingshields Crag



- ⇒ This walk is approximately 14 Kilometres (9 miles) and it is expected to take around 3 hours to walk the full route.
- ⇒ The terrain can be challenging in places and may be dangerous in bad weather conditions. Ground may be rough or boggy in places, walking boots are advised.
- ⇒ The route largely follows the Pennine Way National Trail and includes a short drive from the first location to the second, although there is an alternate route along the National Trail to walk to the second location.
- ⇒ Parking is available at Cawfields Quarry and Steel Rigg, and is pay and display using card payment.
- ⇒ Public toilets are present at Cawfields Quarry.
- ⇒ Please follow the Countryside Code

Introduction to geological time

Here is a timeframe for the geological periods mentioned in this guide.

Time period	Epoch	Age
Quaternary	Holocene	11,000 years ago — present
	Pleistocene	2 million — 11,000 years ago
Carboniferous		354 — 290 million years ago

(Earthwise contributors, 2020)



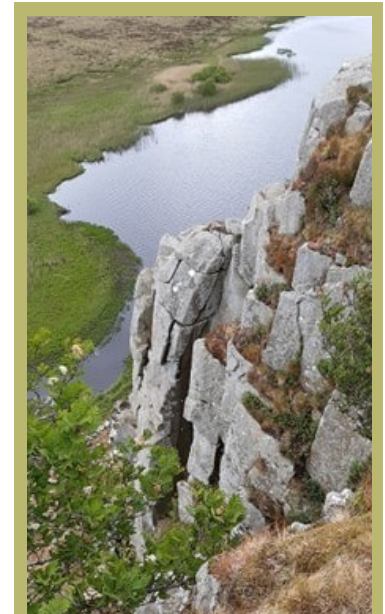
Outcrop of Whin Sill formed during the late Carboniferous period

Carry on past Sycamore Gap to Highshield Crag where the ridged landscape either side of the sill can again be seen. The whole area has a streamlined appearance which is a result of the last ice age.

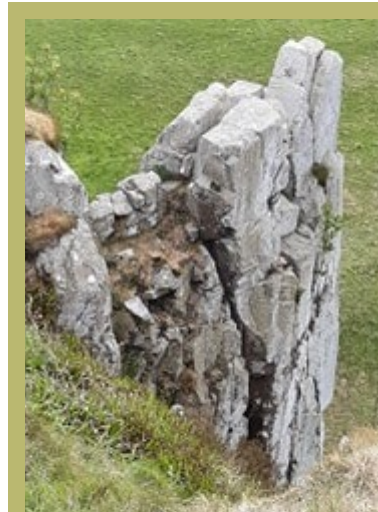
During the Quaternary period (2 million years ago) the area was covered by ice sheets, which flowed from East to West. Due to the movement of ice being parallel to the ridges, the ice sheet exaggerated the features of the ridges instead of flattening them. The ice smoothed out the ridge edges, giving the area a streamlined appearance.

Continue to Crag Lough, which is also a feature created by the Quaternary ice ages as the ice sheets eroded depressions into areas of softer rock.

When the ice sheets retreated at the beginning of the Holocene Epoch (11 000 years ago) these depressions were filled with water and became known as loughs. Crag Lough is what remains of the large body of water which was drained by the valley at Steel Rigg.



Outcrop approaching Crag Lough



Outcrop showing columnar jointing

At several points along the path the sill rocks can be seen on the surface and some of the outcrop to the side can also be seen from the top. Evidence of columnar jointing can be seen. This occurred as the rocks cooled after solidifying and contracted, forming vertical cracks which have then been widened by erosion.

Milecastle 39

Just before Sycamore Gap is Milecastle 39 where the building materials of the Roman wall can be observed further. Sandstone has been used as the material for the outer sections of the wall and milecastles, held together by lime mortar produced from the local limestones.



Section of the wall at Milecastle 39 showing outer sandstone blocks and lime mortar

Although the Whin Sill provided a strategic defensive position for the frontier of the Roman Empire, the rock of the sill was difficult to work with and could not be



Section of the wall showing infill and lime mortar

shaped into blocks for building. This meant that the Romans had to quarry the rocks for the wall from the nearest outcrops of sandstone at various sites along the wall. In this section of the wall these quarries were fairly close by, with the Romans only having to travel two to three kilometres to obtain the stone. However, some of the dolerite was used to fill in the walls as any available rocks were used.

Cawfields Quarry

Starting along the south edge of the car park, an exposed section of the Great Whin Sill can be seen. This is a sheet of intrusive igneous rock that formed in the late Carboniferous Period (roughly 290 million years ago) when the formation of nearby mountain ranges stretched and formed cracks in the crust. Magma rose through these cracks and spread out between the existing layers of rock, cooling and hardening to form the Whin Sill. The rock forming the sill is Dolerite, a dark greenish-grey rock locally known as Whinstone, excavated here during the 19th century for use in road construction.

Roughly two meters from the top of the rock face small, round hollows can be seen.



Vesicles showing in the rock face at Cawfields Quarry

Known as vesicles, these were originally gas bubbles that were trapped in the magma as it solidified. Over time these hollows were filled in with calcite, however the calcite in the exposed vesicles has been mostly weathered away. The position of these bubbles suggests that at the time of their formation the top two metres of the sill had already cooled and solidified enough so that the gas bubbles could not pass through it.

Follow the footpath from the car park to Milecastle 42. Looking along the line of Hadrian's Wall, the disruption of the wall by the quarry can be seen. The quarrying of the dolerite destroyed this section of the wall and many of the bricks were used in local construction.

Exposed section of the Whin Sill along the South edge of Cawfields Quarry



Steel Rigg

From the car park follow the National Trail along Hadrian's Wall. From Steel Rigg an outcropping of the Great Whin Sill can be seen. The rock face shows long vertical cracks, a result of columnar jointing, and forms a high ledge across the area. The Romans chose to build their wall along the Whin Sill as it provided them with a natural defensive position. The valley just before the outcrop once drained a vast lake that lay along the sill.



Outcrop of Whin Sill at Steel Rigg and site of drainage channel

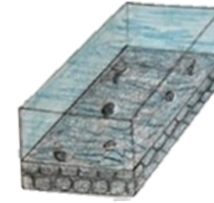
While walking along the top of the sill towards Sycamore Gap, note how the landscape either side forms smaller ridges and hills parallel to the sill, with one gently sloping side and one steep side.



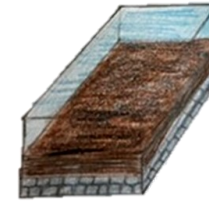
View of the parallel ridges of the landscape to the North of the sill

This landscape is influenced by the layering pattern of the rock in the area, known as the Yoredale Group formed during the Carboniferous Period.

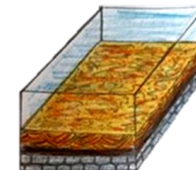
Formation of the Yoredale Group



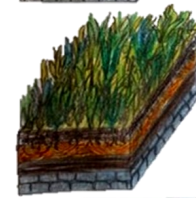
During the Carboniferous Period Britain lay around the equator and was mostly under water. The shallow, warm sea was the ideal environment for organisms such as corals to grow in and this led to the accumulation of limestone.



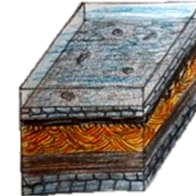
Over time, rivers deposited sediments into the sea and the limestone was covered over by layers of mud, eventually forming a mudstone layer over the limestone.



As the shoreline crept further seawards deposits of sand from the rivers accumulated, forming deltas and eventually layers of sandstone.



As vegetation grew on the deltas organic material built up on top of the sandstone, burying the sands under a layer of peat. This peat would later become coal seams.



Changes in sea level caused the flooding of the coastal forests, which became buried by marine sediments that then built up and formed layers of limestone.

This cycle occurred repeatedly during this period leading to a repetitive sequence of limestone, mudstone, sandstone and coal layers.

These layers of rocks vary in hardness, resulting in different rates of erosion and the formation of the landscape seen around Hadrian's Wall. This type of landscape is often referred to as a Cuesta landscape (Lawrence & British Geological Survey, 2007).

Based on an illustration by E. Pickett.

