
Geology of Blackford Hill and the Hermitage of Braid

Lothian and Borders GeoConservation and the Friends of the Hermitage of Braid and Blackford Hill

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Front cover.

Map showing stops on the walk with inset map: Summary map: Bedrock geology.

The geology walk described in this leaflet follows a circular route around Blackford Hill, through the Hermitage of Braid and to the summit of the hill. It is a 5km circuit with 125m of ascent. The walk takes in important geological sites including Agassiz Rock and there are great views from the summit.

A landscape created by fire and ice

Blackford Hill is one of Edinburgh's Seven Hills. It is a Local Nature Reserve, the site of the Royal Observatory and a great vantage point. The Hermitage of Braid is well known to local people, a quiet, wooded gorge that is rich in wildlife.

But imagine the scene 410 million years ago, as the final lava oozes out of a local volcano. Scotland lies south of the Equator, part of a major new continent (Laurasia) that stretches for thousands of kilometres. On the horizon, the high 'Caledonian' mountains mark the collision zone where three continental fragments have come together to form this new continent.

Signs of violent volcanic activity lie all around: craters, lava flows, pumice and ash; there is no vegetation, and the atmosphere is hot and dry. But change is coming. The volcanic activity associated with continental collision is ending.

The geological story for the next 50 million years will be dominated by erosion of the mountains and the accumulation of red sandstone layers that will bury and preserve the volcanic remains. The volcanic rocks will then spend hundreds of millions of years underground, gradually approaching the surface again as erosion removes kilometres of overlying rock.

In the last 2 million years, great ice sheets have swept across this landscape, eroding softer rocks and grinding over and past the tougher lumps of volcanic rock, creating today's landscape of cliffs, hills and hollows.

This landscape contains clues to the varied natural processes that have created the character of the local area. From the summit of Blackford Hill you can see that these processes have acted over the wider area and shaped the landscape of central Scotland.

Visiting Blackford Hill & the Hermitage of Braid

Location & facilities

Blackford Hill is a prominent hill in south Edinburgh, 3km south of Edinburgh Castle. The wooded gorge of the Hermitage of Braid lies to the south-west. There is a Visitor Centre here at Hermitage House, which is also the headquarters of City of Edinburgh Council Forestry and Natural Heritage. Car parking is available at various entry points around the site, and several local bus routes pass nearby.

Safety & conservation

The geology walk described in this leaflet follows paths that may be rough in places. There are steep cliffs and water hazards including Blackford Pond and the Braid Burn. The site is a Local Geodiversity Site and a Local Nature Reserve. Agassiz Rock is a geological Site of Special Scientific Interest. Use of geological hammers is not permitted.

Find out more

The Friends of Hermitage of Braid & Blackford Hill help to conserve and enhance the wildlife, habitats and amenities in and around this area — <https://www.fohb.org/2018/index.htm>.

This is one of more than 20 leaflets about local sites available from Lothian and Borders GeoConservation as free downloads from <https://www.edinburghgeolsoc.org/publications/geoconservation-leaflets/>.

[Lothian Geology](https://www.edinburghgeolsoc.org/publications/geoconservation-leaflets/) gives more detail, available from the Edinburgh Geological Society at <https://www.edinburghgeolsoc.org/publications/geological-excursion-guides/>.

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Volcanoes in a desert landscape

The Pentlands, Braid and Blackford Hills are the eroded remains of volcanoes that were active about 425-410 million years ago. The volcanic activity was dominated by small, steep-sided strato-volcanoes with silica-rich magma of varied chemistry, resulting in a range of rock types, including andesite, trachyte and basalt. This was very different from the later eruptions at the Castle and Arthur's Seat (340 million years ago) where the magma was basaltic, resulting in low cones of ash and lava.

The work of ice...

The hills and valleys of today's Edinburgh exist because the bedrock has been eroded over hundreds of millions of years. Today's hills are formed of tough igneous rock, and the softer sedimentary rocks wear away faster to create valleys.

The key processes in recent times have been ice and meltwater. Several times in the last two million years, Blackford Hill has been covered by thick ice sheets grinding slowly eastwards, creating a distinctive crag-and-tail shape to most of Edinburgh's hills, with steep slopes to the west and gentler eastern slopes, streamlined in the direction of ice flow.

Rocks used by people

Sandstone

The buildings on and around Blackford Hill demonstrate the range of sandstones used in Edinburgh's buildings. Hermitage House (below left and Stop 4) has an impressive front of smooth local sandstone blocks, called ashlar.

These light-coloured blocks came from a nearby quarry, perhaps Granton or Craigeith, and are typical of the local Carboniferous sandstone that is widely used in Edinburgh.

Similar rock was used in the Observatory, constructed in 1892 of stone from Doddington, Wooler in Northumberland and Hailes quarry in Edinburgh. The extensions added in 1967 are made of Woodkirk stone from Morley, Yorkshire.

In contrast, Harrison Arch (below right and Stop 10) is made of a red Dumfriesshire sandstone of Permian age, quite likely from Locharbriggs. It was completed in 1888 so is one of the earliest uses of red sandstone in the city.

Blackford Hill andesite: a tough, grey-purple rock that fractures easily and forms scree. Andesite has a silica content of 60%, intermediate between basalt and rhyolite.

Trachyte in the Hermitage of Braid: a hard, angular rock often brown or orange. Trachyte has a similar silica content to andesite, but a higher alkali content (potassium and sodium).

Corbie's Craig, viewed from the west, is near the summit of Blackford Hill. It is an excellent small-scale example of a crag- and-tail. Arrows show direction of ice flow.

About 20,000 years ago, the last ice sheet began to melt.

The style of volcanic eruptions varied, sometimes sticky lava oozed out, forming flows and domes. At other times there were violent explosions, probably creating fast-moving pyroclastic flows that covered the landscape in loose fragmented rock (blocks, pumice, ash). Since this material could be washed away, it is not as well preserved as the crystalline volcanic rock of the hills.

Andesite lava dome of the Soufriere Hills volcano, Montserrat in 1997. The lava dome had built up gradually for 18 months, with frequent sudden collapses that created pyroclastic flows.

Fast-flowing meltwater full of silt and rock particles is very abrasive and can create new channels such as the Hermitage of Braid, where the meltwater has cut through rock. This gorge would have formed very quickly: perhaps in just a few decades of water movement on a scale much greater than the present flow in the burn.

The Braid Burn in the rocky gorge of the Hermitage.

Aggregate quarries

Blackford Quarry on the south side of the hill was worked for andesite aggregate from 1826 to 1953. Much of the quarry has been infilled with waste and is now a community woodland with several paths.

Geology walk

Stop 1: Blackford Pond [NT 25446 70924]

Blackford Pond sits in a low hollow, with the steep, rocky slopes of Blackford Hill to the south and gentler slopes northwards towards Marchmont. The pond sits on the junction between the hard volcanic rock of the hill, and softer sedimentary layers that have been eroded. This contrast between igneous and sedimentary rocks is responsible for most of the scenery of Edinburgh and the surrounding area.

The pond fills a glacial scoop caused by ice squeezing past the hill. There are many low hollows like this next to Edinburgh's hills. The pond is still here because of human intervention that has stopped the hollow silting up and becoming vegetated.

Stop 2: Volcanic rock layers [NT 25307 70818]

Volcanic eruptions here around 410 million years ago left behind three different types of rock, and this small cliff is the only place where these are seen together. There is evidence of two lava flows with different chemical compositions, separated by an explosive episode that formed tuff, a softer rock made from volcanic ash.

Stop 3: Rocks in wall [NT 25332 70535]

Like most old dykes, this is made of local stone. Can you find these three stones? The square blocks are rough, dressed, sandstone. Run your fingers over the surface and you will feel the coarse sand grains. Look for more of these blocks of sandstone — why are they spaced regularly along the top of the wall?

Stop 4: Hermitage House [NT 25046 70299]

Hermitage House (built in 1785) sits beside the Braid Burn. The Visitor Centre is open most days and has toilets; there are also toilets in the nearby stable block.

The front of the house is made of expensive dressed ashlar blocks from a single quarry. This is a yellow weathering, blonde sandstone.

The side of the house has smooth ashlar blocks around the windows and edges, but the rest is rubble construction with a variety of rocks from different sources. These include red sandstone (possibly from Craigmillar) as well as local volcanic rocks and even rounded stones that might have come from the burn.

Stop 5: Gorge [NT 25314 70338]

Follow the Braid Burn downstream through the gorge. The rocks on both sides are trachyte lava, which extends from here south to the Braid Hills. Look out for a man-made hole on the right, this is a trial adit following a mineral vein of baryte. The vein was formed by hot water circulating through the rock. Perhaps the landowner was hoping to find copper ores.

Stop 6: Changing nature of the burn [NT 25652 70288]

Compare the views up and downstream from the bridge. Downstream, the valley is more open and the slopes on either side are less steep. You are entering an older valley, the open glacial scoop carved by the ice sheets that have been diverted past Blackford Hill. Originally the trachyte behind you would have been higher, but the gorge has been cut into it by glacial meltwater.

Stop 7: Agassiz Rock [NT 25943 70211]

In 1840 the Swiss geologist Louis Agassiz was brought here by Charles Maclaren, editor of The Scotsman newspaper and amateur geologist, and Agassiz made the bold proclamation, "That is the work of ice!". Two years earlier he had suggested that ice had an important role in shaping the landscape in areas across the northern hemisphere that are now free of ice. This explained the presence of till, erratic boulders and other features that had previously been ascribed to Noah's Flood. His tour of Scotland in 1840 confirmed the importance of glaciation in creating Scotland's landscape, and made headline news in The Scotsman.

Agassiz Rock is an exceptionally important outcrop: although evidence of ice striations is now less distinct than it once was, this location is celebrated for its role in a great leap forward in understanding processes that shaped the Earth.

Stop 8: Corbie's Craig [NT 25617 70470]

On your way to the summit of Blackford Hill, admire the crag-and-tail shape of Corbie's Craig to the south.

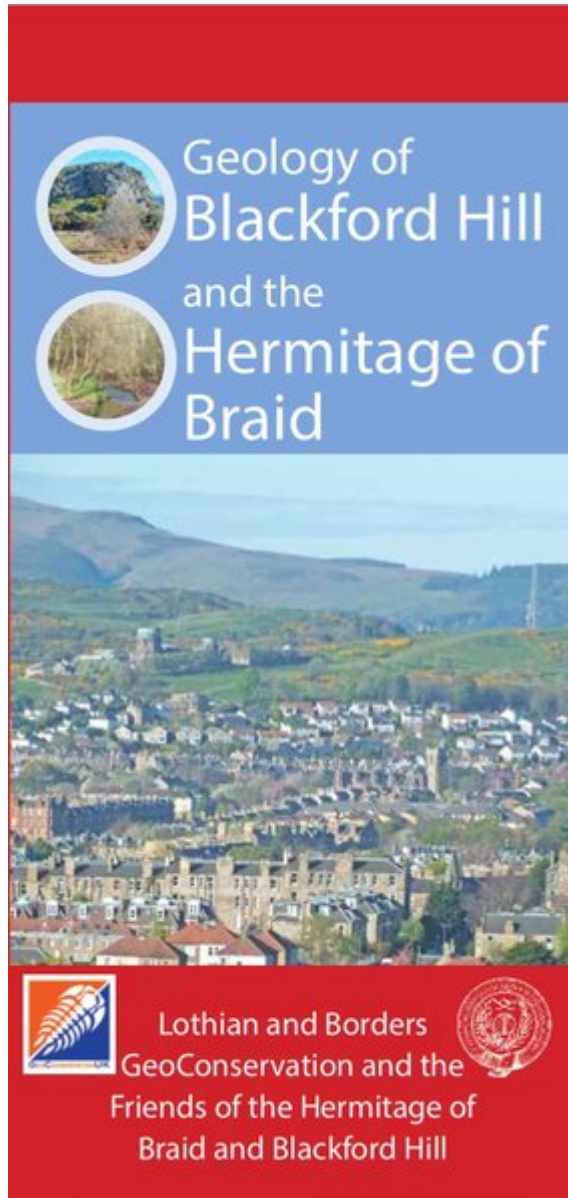
Stop 9: Summit of Blackford Hill [NT 25418 70633]

The view from the summit takes in the older volcanic rocks of the Pentland Hills to the south. The andesite lava flow of Blackford Hill is one of the final chapters of this episode of volcanic activity. To the west, north and east, the lava flows are buried under younger sedimentary rock, accumulated during a quieter period as Scotland drifted north towards the Equator. About 70 million years later, in the Carboniferous Period, a different style of volcanic activity began, with basalt

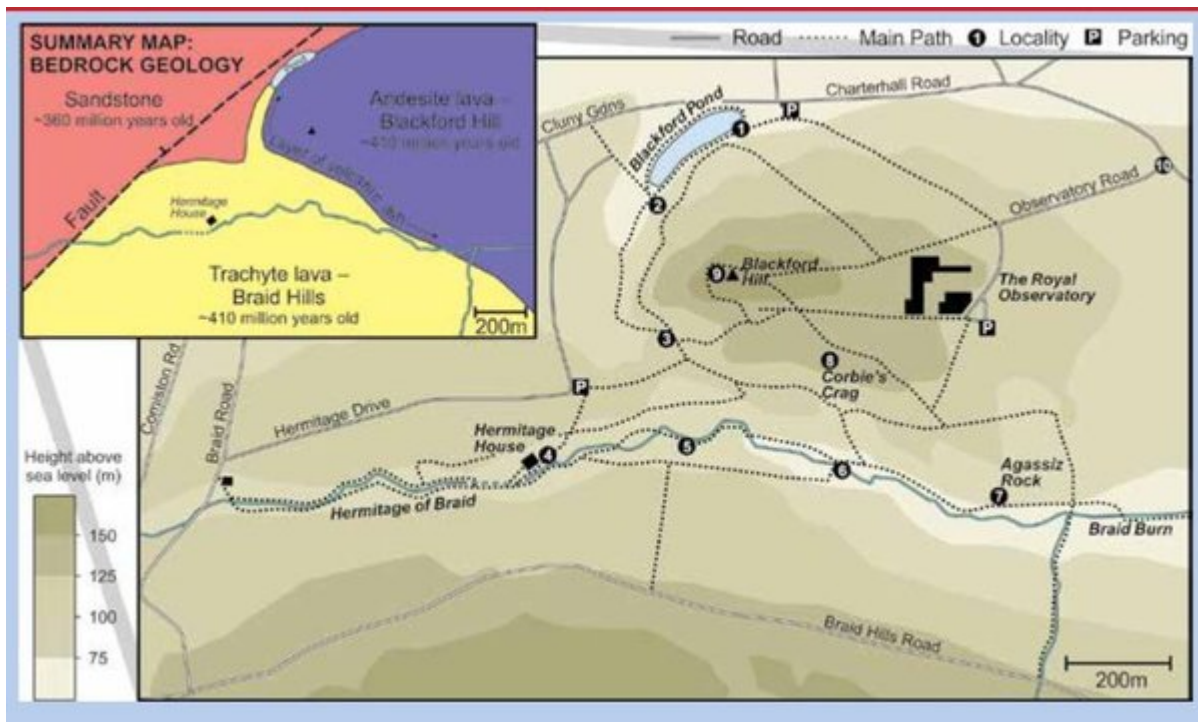
lava and ash building low cones on a flat coastal plain. The remains of these volcanoes form most of the other hills of Edinburgh, laid out before you — Arthur's Seat, Calton Hill, Castle Rock and Craiglockhart Hill.

Stop 10: Harrison Arch [NT 26252 70824]

This red sandstone arch commemorates Sir George Harrison (1812–85), Lord Provost of Edinburgh from 1882-85. He negotiated the deal to purchase Blackford Hill for the public from Col. Richard Trotter for £8,000.



Front cover.



Map of stops on the walk with inset map: Summary map: Bedrock geology.