

Blackford Hill, Edinburgh

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THE UNIVERSITY
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Blackford Hill may be the northern continuation of the Lower Devonian volcanic rocks of the Pentland Hills, though Mykura (1960) considers that it is equally likely that the Blackford Hill rocks are younger and separated from the Pentland Hills by a contemporary fault. The [BGS Geology Viewer](#) gives both sets of volcanic rocks the same age range (410.8 – 423.6 Ma; latest Silurian to earliest Devonian). With 13 Ma available, they could be synchronous or not.

The area has typical topography of the Midland Valley, in that the hills are formed of igneous rocks (basic andesite and trachyte lava flows in this case). The surrounding low ground around the north and west of the hill, once farmland and now suburb, is underlain by sediments. These are red sandstones of Upper Old Red Sandstone facies, but may be of earliest Carboniferous age. Blackford Hill is a crag-and-tail formed by an easterly-flowing ice-sheet. The ice laid bare the rocky crags round the west side of the hill, and, deflected to either side of the hill, gouged hollows now occupied on the north side by Blackford Pond and on the south side by the Braid Burn. Observatory Road lies on the gently sloping tail on the eastern (leeward) side of the hill.

The excursion examines both volcanic rocks and glacial features and also looks at several buildings of geological and other interest. Two or three hours should be sufficient time unless tours of the buildings are included.

Logistics

The excursion can be accessed from the north, west and south-east sides, and the localities visited in any order. King's Buildings campus of the University of Edinburgh has free public access but public parking is limited to West Mains Road and surrounding streets which are usually busy on weekdays. Blackford Hill Local Nature Reserve has very limited parking at the main entrance at the junction of Cluny Gardens and Oswald Road. The dead-end Blackford Glen Road usually has parking available, and there is a small car park at the junction of Midmar and Hermitage drives.

Stratigraphic names are taken from the [BGS Geology Viewer](#). This recognises the Braid Hills Volcanic Member, a trachyte of 423.6 and 410.8 Ma (Silurian and Devonian); the Blackford Hill Member, an andesite and overlying olivine dolerite of the same age; and the younger Kinneswood Formation, a sandstone-dominated unit of 382.7 and 346.7 Ma (Devonian and earliest Carboniferous age). From the map, the topographically upstanding igneous units are almost an inlier, being largely surrounded by later sediments that must onlap onto a nonconformity, which is not currently exposed. The volcanic rocks of the inlier dip probably towards the north-east. This description of the geology follows that of Waterstone (1975) and McAdam (1996).

W	Coal Measures	Upper Coal Measures
		Middle Coal Measures
		Lower Coal Measures
N	Clackmannan Gp	Passage F ^m
		Upper Limestone F ^m
		Middle Limestone F ^m
		Lower Limestone F ^m
V	Strathclyde Gp	Aberlady F ^m
		Gullane F ^m
T	Inverclyde Gp	Clyde Sandstone F ^m
		Ballagan F ^m
		Kinneswood F ^m

Table 1: Carboniferous stratigraphy of East Lothian; Gp = Group; F^m = Formation. The red bar indicates the approximate position of the sedimentary exposures. From Browne et al. (1999). W = Westphalian; N = Namurian; V = Visean and T = Tournasian.

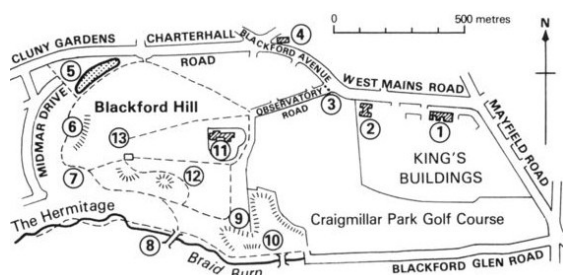


Fig. 1: Map of locations.

1: Grant Institute, King's Buildings

Edinburgh University has been renowned as a centre for geological research for over 200 years (Fig. 2). This tradition continues in the Grant Institute of Geology (NT 2669 7073), named after its benefactor, Sir Alexander Grant. The masonry of the main building, dated 1931, is grey Carboniferous sandstone from Blaxter Quarry, near Otterburn in Northumberland. The more modern extension on the east side houses state-of-the-art analytical equipment including ion probes and a micro-CT scanner.

A rather underwhelming plaque commemorating James Hutton is located to the left of the main entrance of the Grant Institute. It commemorates 'Geologist, chemist, naturalist, father of modern geology, alumnus of the University'.

The Institute also houses a large collection of [geological materials](#), only a very small part of which are on display on the corridors and the Cockburn Museum room. The museum holds the Currie Collection of around 5000 mineral specimens, many from Scotland, and several other nationally important historical collections. The building is open during business hours on weekdays.



Fig 2: The Grant Institute

At the west end of the Grant Institute (NT 2665 7073) there is a large (1 by 2m) glacial erratic of dolerite (Fig. 3) which was unearthed during the

building of the Poultry Research Institute (now demolished) on the site of what are now the FloWave (Engineering) and Scottish Microelectronics Centre buildings (Cockburn, 1956). The boulder is visible on [aerial photos](#) from 1954. The erratic was moved to its present site during building work in 2022. It was presumably originally derived from one of the local dolerite intrusions, though which one is currently unknown. There are numerous other erratic boulders around the site, mostly dolerite and sandstone.

The King's Buildings site is underlain by the Blackford Hill Member, which is an olivine-basalt according to the [BGS Geology Viewer](#). However, temporary exposures closer to [Harrison's Arch](#) (described by Cockburn; 1956) were of a basaltic porphyry which resembled the 'Carnethy porphyry' of the Pentland Hills to the SW. The rock was once common in the in the dry-stone dykes of the district, but these were presumably removed during urbanisation. No examples of this rock have been located amongst the numerous erratics currently exposed on the King's Buildings site. If one is located, please inform the author of this chapter.



Fig 3: Erratic of dolerite at the west of the Grant Institute, bicycle rack for scale!

2. Murchison House: University of Edinburgh

This modern yellow brick building lies at the west end of the King's Building site (NT 2642 7074; Fig. 4). It was built for the British Geological Survey, but taken over by the University of Edinburgh in 2015 and extensively renovated internally. It is named after Sir Roderick Murchison who was Director of the Survey when mapping started in Scotland in 1854. Inside the building, lecture theatre G.26 is named after [Charlotte Murchison](#), the wife of Sir Roderick and a very capable

geologist in her own right. There is a display outside the lecture theatre showing a diagram from one of Charlotte's notebooks. Murchison House allows reasonable public access during business hours on weekdays. Enter the building, turn left and follow signs for G.26 to the right. There is also a café and toilets.



Fig 4: Murchison House

3. Harrison's Arch

Walk westwards along West Mains Road, to the junction with Observatory Road which leads (unsurprisingly) to the Royal Observatory which is seen later in the excursion. A fine arch is constructed of red Permian sandstone from Dumfries (NT 2625 7082; Fig. 5) 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.



Fig 5: Harrison's Arch from the south

4. Reid Memorial Church

This church in the Gothic style was designed by Leslie Graham Thomson in 1933 (NT 2604 6710; Fig. 6). It is built of a pink Upper Old Red sandstone from Hawkhill Wood Quarry, Craigmillar, which is visible at the corners and window surrounds. The walls are faced with Doddington Stone, a pale Carboniferous sandstone from Wooler in Northumberland. It is apparent that the

Carboniferous sandstone is more resistant to the polluted air of the city.



Fig 6: Reid Memorial Church

5. Blackford Pond: Ice Gouge and Erratics

Walk west along Charterhall Road, noting the gentle descent. At the entrance to the 'Hermitage of Braid and Blackford Hill Local Nature Reserve' (NT 2554 6710), note that Oswald Road climbs to the north, while Cluny Gardens climbs almost imperceptibly to the west. The park entrance is hence located in a shallow hollow, gouged out by ice deflected round the north side of Blackford Hill. The hollow is conventionally described as 'deep' despite having c. 10 metres or so of maximum relief at the surface. The [BGS Geology Viewer](#) shows alluvium in the area of the pond, so that the underlying bedrock may be eroded more deeply. The pond itself is very shallow and probably man-made, as it is absent from the earliest maps of the area, but shown as 'Waverley Curling Pond' on a [Bartholomew's map](#) of 1895-6. Two dolerite erratics, transported from one of the sills to the west, are embedded in granite sets near the Midmar Drive entrance (NT 2547 6709).

The north face of Blackford Hill is obvious here, and the landscape is worth a little thought. The surrounding low-relief areas are underlain by sediments of latest Devonian or earliest Carboniferous age. These lie unconformably around Blackford Hill on 3 sides. The few recorded dips of these sediments are very variable ([BGS Sheet 80, 'Edinburgh'](#)) but may be similar to the top surface of the underlying igneous rocks. The modern landscape may, hence, be similar to that of the latest Devonian or earliest Carboniferous age when dryland rivers were depositing red-bed facies sediments around the base of the upstanding lava dome / hill, which may have been more extensive to the SW. Later tilting to the NE, burial and exhumation and lastly glaciation may not have fundamentally changed the main

landscape elements. The weather is cooler and wetter though!

6. Quarry: Andesite Lavas

Above the path and almost opposite the west entrance to the pond is an overgrown quarry cut out of the western face of Blackford Hill (NT 2536 7087; Fig. 8). The lowest rock is a pale trachytic lava overlain by a thin agglomerate containing trachyte blocks (described as an 'ash' on a noticeboard in front of the face). Above this the main quarry face was cut into the single flow of dark fine-grained basic andesite which forms most of Blackford Hill. The contacts between the 3 units are not all that easy to trace across the exposure, but are irregular on a metre-scale, and the agglomerate / ash layer may be absent from the centre of the exposure.

Blackford Hill is apparently formed of a single lava flow (Mykura, 1960, p. 143-4), implying a thickness of at least 100m based on the topography and assuming a shallow dip. The exposure of the base of the lava flow on the northern edge of the hill is surprising, given the overall dip to the northeast. It implies that the lava flow thins significantly in this direction, suggesting that the viscous lava formed a contemporary dome of limited lateral extent.



Fig 7: The purple-weathering andesite (top) overlaying the agglomerate and (lower right) the trachytic lava.

7. Boundary Wall

Proceed west along the path that gently climbs and curves around the west end of Blackford Hill, with a stone wall on your right, which proves to be surprisingly interesting. Opposite the quarry of location 6 the wall is made of dressed pink and white sandstones, which could have been sourced from the sandstones of the Kinnesswood Formation which outcrops to the north. However,

19th Century maps do not show a quarry here, making a local source problematic (the andesite quarry at location 6 is shown). Further around the path, the wall is made of angular purple andesite blocks and the occasional rounded erratic. Roughly dressed blocks of a pale-yellow sandstone are set in the top of the wall at 2 – 3m spacings, into which posts (now removed) were set (Fig. 8). The sandstone is medium or coarse grained, porous and at least some of the blocks have what appear to be moulds of possible bivalves – which makes the local Kinnesswood Formation an unlikely source. The orientation of the bedding in the blocks is variable.



Fig. 8 – Vertical-bedded sandstone in the wall.

8. Braid Burn

The path descends into the valley now occupied by the Braid Burn, which is a misfit in such a large valley (NT 2565 7028). Originally the valley was carved out by ice deflected round the south side of Blackford Hill, but was then further deepened as the ice melted and spilled torrents of water from the Water of Leith at Colinton through the Hermitage of Braid (Fig. 9). The steep northerly side of the valley is cut in the andesite lava flow seen previously while on the gentler southern slopes the andesite lava is mantled by boulder clay. To view the glacial overflow channel of the Hermitage, walk west a little.



Fig. 9: The Hermitage of Braid overflow channel.

9. Blackford Hill Quarries: Andesite Lava

Return to the bridge and walk downstream (east) until Agassiz' Rock becomes visible on the left, then pass to the left of this and into one of the Blackford Hill quarries (NT 2588 7023; Fig. 10). Several faces expose andesite lava, much of it badly altered. Weathering to red or purple, the fresh andesite is dark grey and finely-crystalline with sparse phenocrysts of plagioclase, augite and biotite, set in a matrix showing flow texture. Veins of red jasper and green chlorite cut the rock. A newer quarry to the east has been infilled with refuse.



Fig. 10: Blackford quarry

10. Agassiz' Rock

Return to Agassiz' Rock (NT 2594 7021; Fig. 11). This cliff is a Site of Special Scientific Interest (SSSI), and is well described on the [GeoSites](#) and [GeoGuide](#) webpages. It is one of the localities where in 1840 the Swiss geologist Louis Agassiz identified the erosive action of ice in Scotland.



Fig. 11: Agassiz' Rock

Designation as an SSSI has not protected the rock from natural erosion, 'souvenir' hunting, rock climbing, the drilling of samples or even the placing of commemorative plaques directly onto the rock face (now removed)! The collections of the University of Edinburgh include a piece of striated rock removed by Sir Roderick Murchison, who we are obliged to excuse.

Agassiz identified striae along the base of the rock; it is extremely doubtful if even a single striation seen in 1840 is still in-situ. Many of the current 'striae' are on joint surfaces, and probably represent minor movement along joint planes – they are not slickensides which are mineral precipitates, which are absent. Regardless, this site still remains a landmark in the understanding of Scottish glacial geology.

11. The Royal Observatory

Return east by the Braid Burn and up the path which runs north-east from the bridge to the [Royal Observatory](#) (NT 2591 7061). The original stone building was constructed of grey sandstone from Doddington (near Wooler in Northumberland) and Hailes quarries in Edinburgh. Originally moved here from Calton Hill in 1896 to escape the city lights, the observatory now has telescopes as far afield as Australia and Hawaii. The wide range of astronomical research can be viewed in the [Visitor Centre](#).



Fig. 11: The old Royal Observatory building.

12. Corbie Craig: Crag-and-tail

Walk east and a little south. South-east of the main summit Corbie Craig (NT 2562 7084) forms a superb example of the glacial crag-and-tail feature. It demonstrates in miniature the form of Blackford Hill itself.



Fig. 12: The summit of Corbie Craig looking at the steep, ice-plucked west face

13. The summit of Blackford Hill

Immediately on and to the west of the summit (NT 2544 7064) are exposures of breccia, with both clasts and matrix of andesite. Assuming that these mark the top of the lava flow / plug then this could be taken as evidence that the present-day surface of the hill is close to the top of the original extrusive feature.

On a clear day the summit has panoramic views of central Scotland. All the nearby hills are formed of Carboniferous or Devonian igneous rocks, the intervening low ground being generally drift-covered sedimentary rocks. Dominating the view to the north-east is the core of the Arthur's Seat volcano, with the cliffs of the Salisbury Crags teschenite sill and the columnar basalt of Samson's

Ribs. To the north, Edinburgh Castle sits on a dolerite plug and forms a fine crag-and-tail feature with the Royal Mile. The hills of Fife across the Firth of Forth, and of East Lothian, are mainly Lower Carboniferous lavas and intrusions, and the hills to the west are mainly teschenite or quartz-dolerite sills.

Older, Devonian, volcanic rocks form the Pentland Hills running south-west from Blackford Hill and also the Ochil Hills across the River Forth to the north-west. In the west, flat-topped bings of spent shale from the once-thriving West Lothian oil-shale industry contrast with a more distant conical coal bing in the Central coalfield. To the south-east rounded Southern Upland hills are made of Lower Palaeozoic grey-wackes and shales. Together with southern Highlands hills of metamorphic Dalradian rocks, seen far to the north-west, they enable the full width of the Midland Valley to be appreciated.

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