

St. Abb's Head - an excursion

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Introduction



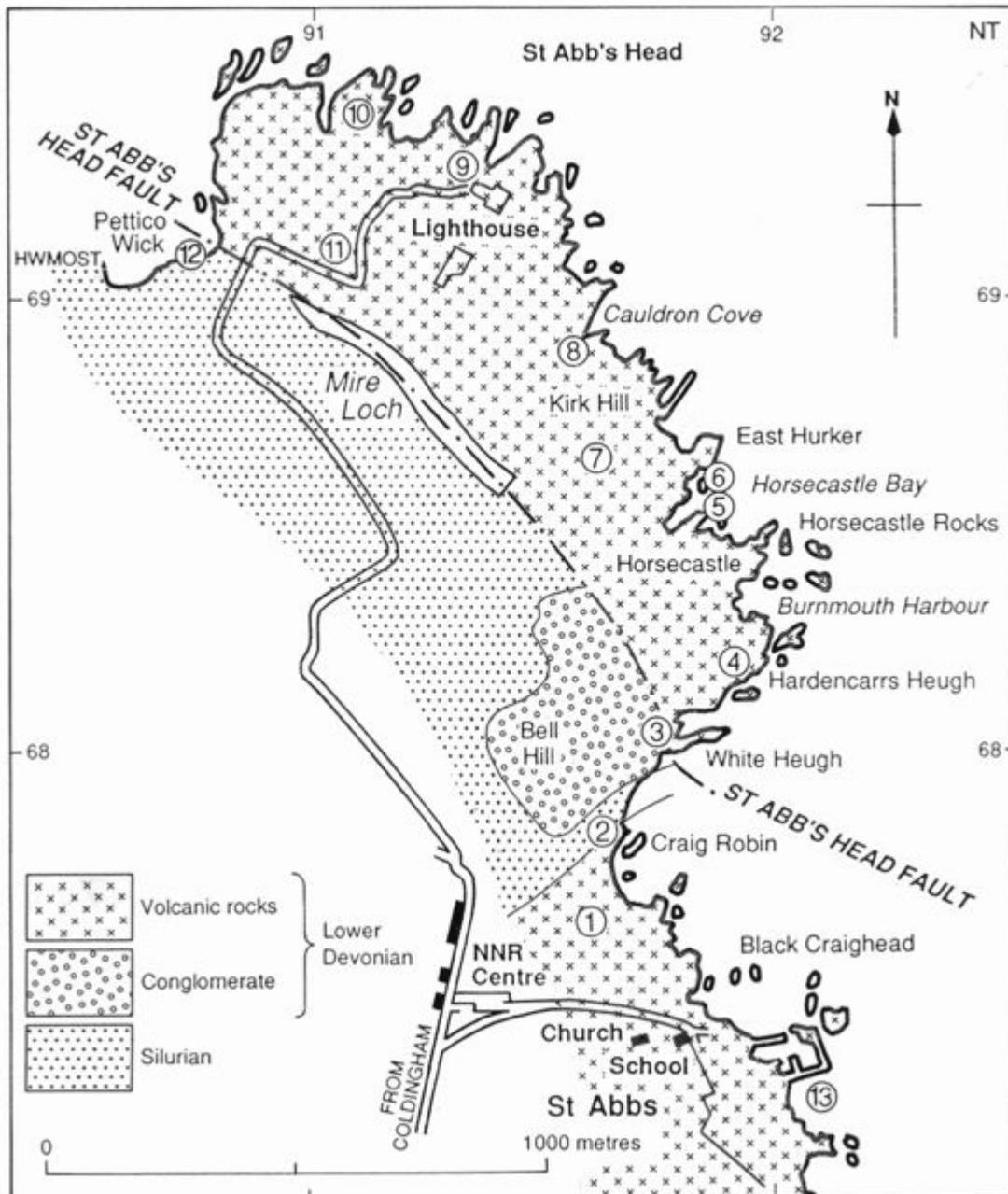
Oblique aerial view of St. Abb's from the east. Berwickshire. The rocks in the foreground are intrusive porphyrites and agglomerates. The rocks on the shore are intrusive porphyrites and unbedded agglomerates, probably within a volcanic vent, of Lower Old Red Sandstone age. Beyond the trees in middle distance the high ground is formed of Silurian greywackes and siltstones. The vent, while not clearly defined, is recognized as such by the chaotic distribution of igneous and pyroclastic rocks on the well-exposed shore and cliffs, and by the extensive occurrence of very coarse agglomerates unlike any of the bedded sequence of St. Abb's Head. P000813

The principal object of this excursion is to study the volcanic rocks of Lower Old Red Sandstone (Lower Devonian) age which form the peninsula of St Abb's Head, on the Berwickshire coast north of St Abb's and Coldingham. The excursion could occupy a full day, but as it does not cover a very extensive area it can conveniently be cut short as required. The complete circuit covers a distance of about 8 km, of which about 4 km is over hilly open pasture, 1 km over rough rocky seashore, and nearly 3 km on a surfaced hill-road. The steep grassy slopes above the precipitous cliffs of St Abb's Head demand sturdy boots. The excursion is affected by the state of the tide at only one or two localities, possibly requiring adjustments to the route

St Abbs lies 7 km south-east of Fast Castle and is reached by the B6438 road from Coldingham. The headland, just north of the village, is a National Nature Reserve, managed jointly by the National Trust for Scotland and the Scottish Wildlife Trust [NTS-SWT](#). Car and coach parking are located beside the information centre and coffee shop at Northfield Farm (NT 913 674), limited car parking is also possible near the Lighthouse (NT 913 692). The excursion is described as starting and finishing at the information centre, where an illustrated guide to the Reserve and other literature are available.

The lavas of St Abb's Head are generally andesitic, but the constituent minerals are so altered that classification is often in doubt. In thin section the feldspars appear, when fresh, to be mainly

oligoclase or andesine, and the ferromagnesian, usually altered to iron-ore, may show the crystal form of hornblende or augite. More basic rock, with labradorite and olivine, is quite common. Micas, particularly biotite, are often present and in some rocks are abundant. The rocks are generally microporphyritic, and under the microscope many show well developed flow-structure. The upper and lower parts of the flows are often highly amygdaloidal, the vesicles being filled with silica and/or calcite. In general type the lavas are similar to the mica-andesites of the Cheviot Hills (Geikie 1864^[1], 1897^[2], Greig 1988^[3]).



St Abb's Head

1. Northfield: Viewpoint

Follow the signposted footpath from the car park, which leads to the cliff-top north-west of Northfield House. From this point the precipice of White Heugh immediately catches the eye. A

small outcrop of Lower Devonian conglomerate forms the rounded grassy summit of Bell Hill and the red pock-marked cliff to the left of White Heugh. Silurian greywackes and shales form a narrow outcrop on the lower part of this cliff and on the foreshore to north-east.

2. Craig Robin: Silurian and Devonian Sediments on Shore

The foreshore can be reached from the path beyond locality 1. The large stack known as Craig Robin, is made up of closely veined and broken Silurian siltstone, locally weathered to a characteristic yellow colour. It lies within a NE-SW zone of similar breccia, 70 m wide, which marks the boundary between the extensive vent-breccia of St Abbs and the Silurian greywackes below White Heugh. The latter are exposed on cliff and shore between 50 and 100 m north-west of Craig Robin, where they are seen to be sheared and squeezed, but well bedded with a dip of 60° to NW. Beyond them, close to a prominent gully marking the St Abb's Head Fault, and above them on the cliff, lies an outcrop of breccia or conglomerate considered, from its content of greywacke fragments, to be of Lower Devonian age. The boundary between greywacke and conglomerate was thought by James Geikie (1887) to be a north-easterly fault. Beyond the gully, lava which forms White Heugh is seen to be underlain by Lower Devonian sediments ranging from fine-grained shaly sandstone to coarse greywacke-breccia. The base of the lava is irregular but follows approximately the bedding of the sediments, which dip to NNW at 50°. These last exposures can be examined with ease only near low tide.

3. White Heugh: St Abb's Head Fault

Climb back to the cliff-top to south-west and follow the path northwards to the landward end of White Heugh. From the col below the path a short descent to north-east affords a view of the detail of the St Abb's Head Fault. The steep grassy slope follows the dip in sandstones with shaly partings and mudstone pellets, part of the Lower Devonian sequence seen at the base of White Heugh and forming Bell Hill to the west. The cliff-exposure to the left is divided by near-vertical planes into four parts. On the left is a triangular wedge of irregularly jointed biotite-lamprophyre, an extension of a dyke exposed in a disused quarry 80 m to west, beyond the boundary fence of the Reserve^[4] This is followed to north-east by a zone 4 m wide of steeply dipping red shaly sandstones, which are taken to be part of the Lower Devonian basal sediments. Small bodies of breccia and intrusive rock occur at the margins of this zone. The third division is a vertical band of breccia 2.5 m wide, difficult to examine but probably largely of broken lava, the essential fault-zone between the Lower Devonian and Silurian sediments to south-west and the lavas to north-east. The lavas make up the fourth division of the exposure.

4. Hardencarrs Heugh and Burnmouth Harbour: Lavas and Agglomerates

The northward continuation of the cliff path crosses a large body of fine-grained lava, which makes up most of Hardencarrs Heugh. It is well exposed on the northern (inland) face of White Heugh, where steep platy jointing is conspicuously developed. Between Hardencarrs Heugh and Burnmouth Harbour are many small exposures of red lava full of tiny amygdales, locally clearly forming a homogeneous agglomerate, but the distinction between that and unbroken lava is difficult to determine and may not be very significant. Some of the clean wave-washed rock at Burnmouth Harbour is very obviously agglomeratic.

5. Horsecastle Bay: Agglomerate, Brecciated Lavas, Lamprophyre Dyke



St. Abb's Head, Horsecastle Bay. View N. Grits and lava. Bedded tuffaceous grits overlie massive lava in the foreground, and are overlain on the headland by a later flow with a clearly irregular base. Such interrelations of bedded grits are not uncommon in the predominantly lava sequence of St. Abb's Head. Lower Old Red Sandstone. [P005893](#)

From Burnmouth Harbour follow H.W.M. for 200 m to a little embayment on the north side of the headland of Horse Castle, where the agglomeratic country rock is cut by 3-m dyke of highly micaceous lamprophyre. It follows a curved north-easterly course, is cut by faults, and has two thin offshoots on its south-eastern side. It could be the same intrusion as that noted earlier at White Heugh and on Bell Hill, and is the only minor intrusion so far recognised in the lava sequence. Most of the rock between Burnmouth Harbour and Horsecastle Bay is roughly bedded brecciated lava. Thin layers of unbroken lava are present, being clearly distinguishable on the stack of Horsecastle Rocks, and one at least 4.5m thick caps the cliffs at Horse Castle, near the lamprophyre dyke. Typical broken lava is well exposed on the south-eastern side of Horsecastle Bay, where many large tabulate or rounded fragments of lava lie parallel to the major bedding fractures. The rock is thought to result from the spasmodic solidification of lava during the continuing movement of the flow as a whole.

6. Horsecastle Bay: Tuffaceous Grits and Lavas

The beach of Horsecastle Bay is traversed by a fault trending north-east, which separates the brecciated lavas already seen from a thick series of well differentiated lavas and tuffaceous grits which occupies all the ground north-westwards to St Abb's Head and Pettico Wick. The exposures on the north-western side of the bay are particularly instructive and readily accessible. Tuffaceous grits form well defined planar beds from a few centimetres up to 2 m thick, and consist largely of small fragments of lava, like the rocks above and below, in a matrix in places highly siliceous but locally like a sericitic mudstone. No 'foreign' fragments have been recognised in any of the many developments of these grits. They are thought to be in the main the water-laid product of erosion of the lavas, but to some extent they appear to have a more directly pyroclastic origin, manifested by the development of a welded texture among the fragments. The major group of grits here is 27 m thick. At its base there is a gradual downward transition to unbroken lava through a small thickness of decreasingly fragmented rock. On the southern face of East Hurker, on the north side of the bay, the reddened top of the grits is seen to have been irregularly gouged by the next lava-flow. The 'col' which connects East Hurker to the main cliffs marks the line of a N-S fault, which can be clearly

seen to displace the grits and lavas along the western side of Horsecastle Bay. A westward downthrow of 6 m may be estimated.

7. Kirk Hill: Lavas with Agates

The prominent mass of Kirk Hill, rich in archaeological association, appears to be formed of one lava-flow, that which overlies the thick grits of Horsecastle Bay. Some 60 m of rock is preserved but the top of the flow may have been eroded away. Among the crags above the footpath, on the south-western face of the hill, the lava is locally rich in ovoid amygdales up to at least 50 mm long, among which moderately good specimens of agate may be seen.

8. Cauldron Cove: Faulted Grits and Lavas



St. Abb's Head, Cauldron Cove. View SW.
Grits and lava. Bedded tuffaceous grit (c. 27 m. thick) dips to left and overlies massive lava (lower left). The lava appears to be thrust over bedded grits in right foreground.
Lower Old Red Sandstone. P005892

Follow the base of Kirk Hill northwards and north-eastwards to regain the sea-cliffs at Cauldron Cove. On the south-east side of the cove 4.5 m of bedded tuffaceous grits form a crag at the top of a very steep grassy slope, close below the lava of Kirk Hill. Below these grits, beyond about 4.5 m of concealed strata, a further 18 m of thinly bedded grits are exposed, more massive towards their base, resting on massive lava. Keep well to the right in descending the steep grass here, to avoid the dangerous slopes overhanging the vertical cliffs which bound the inlet. The beds dip ESE at between 28 and 40°. This 27-m group of tuffaceous grits occupies the marked depression west of Kirk Hill, and can be traced to old workings at the south-eastern end of Mire Loch. Its postulated recurrence at Horsecastle Bay, despite the dip of the strata, is attributed to the effect of faults like that seen at the bay, which repeatedly step the beds upwards as they are followed down-dip. One or two of these faults may be recognised on the sea-cliffs of Kirk Hill. Cauldron Cove marks the line of a group of north-east faults, one of which, reversed and hading to south-east, coincides with a cave at the head of the inlet. The base of the 27- m grits is exposed on the south-east side of the fault; to north-west only higher beds of the grits are seen.

9. Lighthouse Cliffs: Lava-Tuff Topography

From Cauldron Cove climb the steep slope to west, essentially a dip-slope following the top of the lava beneath the 27-m grits, then continue by the cliff-tops to the Lighthouse. Bearing in mind the general south-eastward dip of the lavas it is possible along the way to observe on the cliffs below a

succession of thick flows and interbedded grits, the latter much thinner than the lavas and more readily eroded. The landward topography can be interpreted in terms of this succession, but there is much fault- complication. From the cliff-top just west of the entrance to the Lighthouse several steep faults are seen to cut the cliffs and stacks to the north. An extensive even slope seen below, falling eastwards to sea-level, marks the top of a lava-flow, on which there are some small outlying patches of the overlying tuffaceous grits. By a short detour to the west this slope can be followed to the inlet immediately north-west of the Lighthouse, where, at the base of the west-facing cliff, the grit is exposed to a thickness of 0.5 m, with lava above and below. From the cliff-top the upper lava is seen to form the apparently vertical basal part of the Lighthouse headland, and to be capped by a red band which is in places overhung by the succeeding lava. This red band reaches the cliff-top at a depression just west of (outside) the Lighthouse fence, where it is overlain by 0.5 m of boulder clay. If the depression is followed southwards a small working in tuffaceous grit will be readily located, just above the north-west corner of a walled garden. The flaggy rock, exposed to about 1m and dipping at 34° to SE is similar to the grits seen earlier and evidently forms the red band below the Lighthouse. The succession of lava-flows and grits seen on the cliffs provides a key to the topography of the area. In general terms the central parts of the lava-flows form lines of upstanding crags, whereas the amygdaloidal tops and bottoms and the inter-flow grits form intervening elongate depressions. The resulting characteristic trap-feature topography is however often obscured by the rounded weathering of the lavas, by the incidence of faults, or by the limited extent of rock units.

10. Nunnery Point: Viewpoint, Sea-birds

Follow the road westward from the Lighthouse gate for 150 m then continue north-westward by the cliff-tops. Near the headland to north-west are the rectangular foundations of a building, formerly described as a 'chapel', on the site of St Ebba's convent, but now thought to be mediaeval. Traces of buildings on the summit of Kirk Hill are more likely to indicate the site of the 7th-century convent. From the headland the view to the north extends in favourable weather to the conical plug of North Berwick Law, the Lomond Hills of Fife, the Bass Rock, Largo Law in Fife, and the flat profile of the Isle of May, all intrusive igneous bodies of Carboniferous age. The cliffs below, and towards the Lighthouse, largely composed of Lower Devonian lavas, are cut by several steep open fractures, some of which define the faces of the offshore stacks. In early summer the visitor cannot fail to be impressed by the vast numbers of sea-birds nesting on the cliffs and wheeling over the sea. The most abundant species are guillemots and razorbills, kittiwakes, herring-gulls, and fulmars. Shags are common on the lower rocks, and a few puffins may be seen.

11. Lighthouse Road: Amygdaloidal Lava and Intrusive Tuffs.

From the Lighthouse gate the road runs westwards for 150 m, then drops southward through a little valley which is thought to follow the outcrop of the scoriaceous top of a lava-flow and the softer tuffaceous sediment above it. Small exposures of the sediment are sometimes visible close to the road, and at the sharp right-hand bend above Mire Loch the underlying lava is exposed. Here it contains many vesicles, generally filled with greenish silica and some calcite, and often drawn out in various directions by the movement of the lava. This rock must be close to the top of the flow. Rock lower in the flow is widely exposed beside the road as it descends north-westward to Pettico Wick. It is mainly of purplish grey colour, is generally amygdaloidal in varying degree, and shows a distinct dip of between 30 and 50° to ESE. About half-way down the long straight the lava is cut by several brick-red ramifying dyke-like bodies, which under the microscope are seen to be composed of irregular fragments of highly amygdaloidal lava set in a finely crystalline siliceous matrix. They are thought to represent intrusions into the cooling rock of igneous fluids laden with rock fragments. Similar bodies are to be seen at several other localities on the peninsula.

12. Pettico Wick: Silurian Greywackes and Shales



Pettico Wick, St. Abb's. Looking westwards to Silurian cliffs. Berwickshire. The rocks are greywackes and siltstones of the Llandovery series folded by repeated broad flexures with an east-north-eastward trend. The complex syncline of Broadhaven Bay is well displayed on the left, the broad north-western limb continuing to the right, as the photograph suggests, across the two minor headlands. The foreground rocks are Lower Old Red Sandstone lavas of St. Abb's Head, separated from the greywackes by a north-west to south-east fault in the bay below.

P000817

The little natural harbour of Pettico Wick straddles the St Abb's Head Fault. Lower Devonian lavas of the St Abb's Head outcrop form the steep north-eastern cliffs, whereas the rocks on the south-western side of the bay are clearly well-bedded sediments, greywackes and shaly siltstones of Silurian (Llandoveryan) age, as seen in the narrow outcrop at locality 2. The exact position of the fault is obscured by superficial deposits, but its general line, along Mire Loch to south-east, is very clear.

At Pettico Wick the Silurian rocks are disposed in a complex multiple syncline with a horizontal north-easterly axis, best studied below half-tide. This syncline is typical of the many major folds of the Silurian outcrop, which extends on the coast effectively to Siccar Point and over a wide area inland to south-west. Graptolites have been collected from finer-grained bands on the descent to the beach, and just round the corner on the left near HWM. Sedimentation structures can be seen in places on the upper and lower surfaces of the greywackes, current-bedding is locally developed, and axial-plane cleavage is seen in some of the finer-grained rocks.

It is about 2 km from Pettico Wick along the road from the Lighthouse, to the car park at which the itinerary began. The walk affords fine views to east of the terrain traversed on the excursion. The rocks seen at a few places along the way are all within the greywacke outcrop. In general form and in local detail the topography displays the erosive effects of ice moving south-eastwards, most

conspicuously in the over-deepening of the Mire Loch.

13 St Abbs Harbour: Quartz-Dolerite Dyke

An instructive exposure of a quartz-dolerite dyke of Late Carboniferous-?Permian age occurs immediately south of the southern wall of St Abbs Harbour, 800 m from the NNR car park. For most of its length the Harbour wall stands on this dyke, which is about 14 m wide. The well-exposed southern margin of the dyke is fine-grained and shows banding, irregularity of detail, and in corporation of xenoliths up to 30 cm across.

References

1. [↑](#) Geikie, A. 1864. The Geology of Eastern Berwickshire. Mem. Geol. Surv. Scot.
2. [↑](#) Geikie, J.1897. Geology and Petrology of St Abb's Head. Proc. R. Soc. Edinb.14, 177-193.
3. [↑](#) Greig, D.C. 1988. Geology of the Eyemouth district. Mem. Brit. Geol. Surv. Hutton, J. 1795. Theory of the Earth. William Creech, Edinburgh.
4. [↑](#) The dyke-rock, which cuts Lower Devonian conglomerate, has been radiometrically dated at 400 Ma, close to the Siluro-Devonian boundary (Rock and Rundle, 1986)

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