
Eyemouth

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O.S. 1:50 000 Sheet 67 Duns and Dunbar

B.G.S. 1:50 000 Sheet 34 Solid and Drift

Introduction

On this excursion the coastal exposures at Eyemouth are examined, over a distance of some 5 km, and an optional inland diversion covers some of the ground south of the town. Eyemouth lies about 12 km north-west of Berwick-upon-Tweed and is reached from the A1 road by the A1107 road from Burnmouth 4 km to the south-east from Ayton, 4 km to south-west or from Cockburnspath 20 km to the north-west. Cars and coaches may be parked on the esplanade, west of the river (busy in summer), or on the east side of the river near the harbour mouth and the golf course.

The coastal excursion falls into two parts separated by the town, and by the Eye Water, which follows approximately the line of a major NNE fault. The rocks to the west are Lower Devonian volcanics with an overlying outlier of Devonian-Carboniferous age, best examined when the tide is low, whereas those to the east are Silurian greywackes. The excursion as described begins and ends at the esplanade car park. The distances involved are:-

- west of the town — 3 km, mainly on roads and cliff-top paths, 1 km of it on rough rocky shore
- east of the town — 6 km divided about equally between roads and cliff-top paths, with short rocky traverses at the numbered localities; the Redhall diversion adds 1.7 km on roads and across fields

Excursion A. West of Eyemouth

1. Killiedraught Bay: Volcanic vent

From the car park follow the road westward for 300 m then turn right into Pocklaw Slap, through a modern housing estate. Continue in a north-westerly direction for 500 m to reach the cliff-tops, beyond the end of the road, in the southern corner of Killiedraught Bay. The rocks in the bay are considered to lie within a volcanic vent, and detailed exposures may be studied by descending a path from this point north-westwards to the shore. Otherwise the cliff-top should be followed northwards, to the right. The vent-rocks are agglomerates of variable coarseness, and igneous rocks which in some cases have the texture of extrusive andesite and resemble undoubted lavas to be seen nearby to the east. Their outcrop extends 700 m along the shore, north-westward to Callercove Point, and lacks any obvious internal pattern

2. Hairy Ness: lava and agglomerate

1 The headland of Hairy Ness may be taken as the first locality, reached by a shorter path along the seaward side of the large caravan site, between it and Eyemouth Fort.

The rocks forming the cliffs east of the bay, leading north-eastwards to Hairy Ness¹ appear to be mainly andesitic lava but coarse agglomerate is seen at many points. In places the two rock-types alternate in bands upwards of 3 m thick, but no consistent direction of dip has been observed. The lavas differ from those of St Abb's Head in the common occurrence of small phenocrysts of plagioclase feldspar. The altered ferromagnesian phenocrysts are most commonly after pyroxenes, but at the headland of Hairy Ness hornblende predominates, in unusually well-banded rock. The agglomerates are most clearly recognised on the clean sea-washed intertidal rocks, since, being made up largely of lava fragments, their clastic character is readily concealed at higher levels by weathering or the growth of lichen. Many of them are believed to be

auto-breccias, broken up by the irregular movement of the partly solidified lava-flow. The rocks are much faulted by fractures running ENE and, on the west-facing cliff, by others running NNE, parallel to the cliff-line. The development of the headland, and the absence of an extensive foreshore as in the bay to west, underline the difference between the more durable lavas and agglomerates and the heterogeneous and broken rocks of the volcanic vent, whose limit is drawn close to the foot of the cliff along the south-eastern end of the bay. Within 100 m or so south-west of Hairy Ness many fractures are seen in the lava, and at one point a north-westward dip is indicated by both flow-banding and the orientation of the apparent base of a flow. Just south-east of this point, on the east-facing cliff, is a rectangular exposure of agglomerate at least 20 m by 40 m in area. Calcite veins are common in the adjacent lavas. The intertidal platform south of Hairy Ness is composed mainly of lava, locally amygdaloidal, varying in hardness and resistance to erosion, locally closely jointed, and with pockets of agglomerate.

3. Eyemouth Fort: Upper Old Red Sandstone

To the east the cliffs below Eyemouth Fort are capped by a brighter red rock, a coarse conglomerate with bands of sandstone, of the Devonian-Carboniferous Upper Old Red Sandstone. On a northward promontory near the western end of the outcrop 12 m of this rock is exposed, overlying slabby-jointed purple lava in the lower part of the cliff. The sediments consist largely of conglomerate, including angular fragments of purple lava and pale green sandstone, with a lenticular bed of cross-bedded sandstone between 2.5 and 5 m. from the top. The junction with the lavas is generally flat-lying, with local variations, as on the western side of the promontory, where it dips to south-east at 45°, and on the headland, where it rises abruptly to the north-East of the promontory the level of the base falls and conglomerate is extensively exposed on the rocky foreshore north of the cliffs. The process is interrupted by a 9-m NNE fault along the east side of the bay east of the promontory, which raises the lavas to the level of the base of the cliffs. Within a further 50 m to the east however the base of the conglomerate descends and swings across the foreshore to north, cutting off the outcrop of the lavas. For 75 m along the cliff, within 100 m west of the main headland, lava crops out in narrow inliers bounded to north and west by faults striking ENE and NNE, parallel to others seen farther to west. At most states of the tide it will be advisable, if not necessary, to retrace one's steps to the west, regain the cliff-top and descend on the south side of the Fort by a rough rocky path in the embayment 170 m south-west of the northwards headland. A scramble 80 m northwards among the very large fallen blocks of conglomerate at the foot of the cliff will bring one to a fine exposure of the unconformity of the conglomerate on purple lava. The conglomerate includes many clasts of pink 'porphyry' up to 0.6 m in size, as well as of green and brown sandstone, and there are a few lenticular bands of cross-bedded sandstone up to 1.5 m thick. Slabby jointing is a notable feature in the underlying lavas. Both rocks are cut by calcite veins, and secondary tufa has been precipitated at several points from the conglomerate. In this area the base of the conglomerate drops gradually northwards.

The lavas to the south are predominantly agglomeratic and include brecciated dacite, the most acid of all these St Abbs-Eyemouth rocks. It is well exposed on a minor promontory below the southern limit of the conglomerate, where it is developed as an accumulation of disoriented subangular blocks of rather soft greyish rock with prominent flow-oriented small feldspars. Small knots of malachite occur locally. This auto-brecciated lava is highly homogeneous, but the exposures scattered across the foreshore to south consist most commonly of blocks of lava embedded in an igneous matrix. At one point on the cliff the volcanic rocks are channelled by a sequence of gravel and sand 10 m thick, overlain by 3 m of boulder clay. The lower deposits, in part clearly stratified and showing some rounding of pebbles, are considered to mark the course of a stream prior to the last (Devensian) glaciation.

Excursion B. East of Eyemouth

For the part of the excursion east of Eyemouth vehicles may be most conveniently parked on the east side of the harbour, near its mouth and the old mansion of Gunsreen [NT 9475 6437], reached by turning left off the road to Berwick immediately after crossing the river. Gunsreen can be reached on foot from the town by following the quays round the harbour.

The Silurian rocks which occupy the coast between Eyemouth and Burnmouth are greywackes and siltstones of the Hawick Group, highly folded and faulted, occurring in beds generally less than 1 m

thick and notably thinner than in the Fast Castle Gala Group outcrop. The Hawick Group rocks are also on average more finely grained, have a higher proportion of quartz grains to feldspathic and lithic fragments, and are more commonly bound by a calcareous cement. Interbedded red mudstone is also a characteristic feature of the Hawick Group succession in the Eyemouth area. The folding of the Eyemouth rocks is more complex than the relatively simple succession of broad synclines and anticlines which characterises the northern outcrop. The dominant pattern of NW–SE (Caledonoid) compression continued, but superimposed on it was contemporaneous sinistral strike-slip shear vector; the combined effect was a system of fold hinges showing marked changes in plunge along their length. Some spectacular examples of hinge plunge variation are seen in the Eyemouth section. It should be stressed that they are not the product of two discrete superimposed fold episodes but rather record the variable interaction of compressive and strike-slip movements. However, there are some examples of steeply plunging hinges about which the cleavage and more gently-plunging hinges are folded. These steep structures are related entirely to the strikeslip shear event and usually have a sinistral sense. Sedimentation structures are similar to those described in the Fast Castle rocks, and the main source of sediment appears statistically to have lain to ENE. No fossils have yet been recorded from this outcrop, a feature which, added to certain lithological characteristics, reinforces the correlation with the Silurian Hawick Group of other parts of southern Scotland (Greig 1988).

4. Elgy Rocks: folded greywackes

From the east side of the harbour climb up to John's Road, at the left-hand end of a modern housing estate, then follow to the east a vehicle track along the landward side of playing fields. These fields occupy gravel flats which can be topographically linked with fluvial terraces along the course of the Eye Water, laid down when drainage was impeded by the presence of thick sea-ice. Continue on this path to the cliff-top, then turn northward for 200 m to the headland of Elgy Rocks. On this short traverse many folds will be seen. These are generally tight structures whose limbs dip steeply to NNW and more steeply to SSE, the fold axes plunging at 45° to WSW. Northwards, open folds are more common and their axes plunge less steeply. For example, Elgy Loch, the inlet immediately south-east of Elgy Rocks, follows the hinge line of an anticline with limbs dipping at 65° to NNW and 57° to SSE and an axial plunge of 25° to WSW. Synclines similarly oriented are developed at 10 m distance to NNW and SSE. The headland of Elgy Rocks is cut off from the mainland by a narrow fault-gully at right angles to these structures. On its landward side is seen the broad crest of an anticline, which forms the south-eastern side of the headland, some of the beds being modified by transverse-current ripple-marks which happen to coincide in direction with the fold axes and have in consequence been exaggerated to form prominent mullion-like structures 10 cm wide. At most states of the tide there is little difficulty in scrambling across the gully to Elgy Rocks, (but beware of being isolated for an hour or two by a rising tide). A plethora of folds is developed, similar in orientation to those noted on the cliffs to south. The development of folding varies along the strike, one series of 11 folds in a 15-m traverse being represented 75 m to south-west by a single open syncline. Near the headland 18 folds occur in a 50-m traverse. Exceptionally spectacular folding is displayed on a seaward rock-face just north-east of the gully. The major feature here is a near-isoclinal anticline inclined steeply to NW, apparently thrust up from NW across strata in which two vertical isoclines are developed. The thin beds to south-east of the major fold are less tightly folded but all dip to NW, in sympathy with the overthrust movement.

5. John's Roads and Agate Point: folded greywackes

From Elgy Rocks return southward along the cliff-top. From a point nearly opposite the end of the playing field track an open anticline can be seen on the shore below in which both limbs are nearly vertical and the hinge plunges steeply northwards. The angle between the bedding and the axial-plane cleavage in some of the beds is maintained across this fold, the cleavage being related to the widely prevalent WSW-plunging folds, which in this example seem to have been refolded by the strike-slip shear event. Southwards for 100 m, to the head of the inlet south-west of John's Roads, a general anticlinal structure may be followed on the foreshore, with steep plunge both to north and, downward-facing, to south. This north-south line of folding, with associated faulting, marks the western limit of a zone of complicated structure which extends 160 m to east, to Agate Point, whence a parallel fault, sinistral or reversed, can be traced southwards to

an inlet 180 m west of Whalt Point. On the minor headland west of Agate Point the spectacular structures result from interference of essentially ENE–WSW (Caledonoid) compression and penecontemporaneous strike-slip shear. Later faulting causes further complications. At the seaward end of the headland at least 6 folds are seen, plunging to NE at 25°, which, by a study of grading in the greywackes and few ill-defined under-surface structures, can readily be shown to be downward-facing. A cross-strike fault cuts these folds within a few metres to south-west, beyond which point concentric fold axes are seen, varying in plunge from south-westward through vertical to north-eastward. Different parts of this variation are seen on opposite sides of the promontory. The prima facie interpretation is that the downward-facing folds, plunging to NE, have been overfolded along their axes from SW to NE. If however the inversion of the folds and the overfolding are ascribed to one stage the direction of overfolding is seen to be from NE to SW.

These structures were first described in detail by Dearman and others (1962, p.279), as were those at Agate Point, 100 m to east, where a close series of folds on NE axes also exhibits extreme and locally abrupt variations in plunge. Where the plunge is to NE the folds are seen to be downward-facing, in contrast to upward-facing folds which plunge towards SW. Vertical fold hinges are locally prominent, and faults are abundant both, across and parallel to the fold trend. As at John's Roads, and more obviously here, the secondary overturning of the folds is from NE to SW. At neither locality are the details of structural complexity immediately apparent. Towards the south-east side of Agate Point, and for 200 m to the south, several intrusions of porphyrite or lamprophyre may be seen. They vary between 30 cm and 1 m in thickness and some are not readily distinguishable from the greywackes, being approximately concordant with the bedding.

6. Whalt Point–Dove Cave: folded greywackes

Southwards from the complexities of Agate Point to Whalt Point the strata are more regularly folded, with hinge plunges between 75° SW and vertical. These folds can readily be studied by descending the steep cliffs south of Whalt Point, where the strata, mainly dipping into the cliff, offer good holds for hands and feet, and only a modicum of agility is needed to attain the tide-line. Folding is repeated at close intervals, on average every 3 or 4 m, the NW-facing limbs being rather wider and less steep than those facing SE, the respective dips being around 70° NW as against 90°, or overturned in some cases. The folds plunge consistently to WSW at between 40° and 70°. The total effect is of a succession of asymmetric anticline-syncline fold pairs in beds dipping generally at a high angle towards the north-west. In any one fold pair the anticline is to the north of the syncline; the folds are therefore often described as south-verging. Most of the beds have been folded without change of thickness, in a parallel manner, but in many cases the thinner, finer-grained members have been distorted near the fold axis, by extenuation along the axial plane or by multiple folding. Axial-plane faulting seems to be of little significance, but some beds of greywacke are conspicuously brecciated near fold axes. These conditions can be readily examined between Whalt Point and Dove Cave and are known to persist as far as Fancove Head, beyond which point the structures are obscured by igneous intrusions.

7. Scout Cave: dolerite dyke

From the cliff-top near Whalt Point the southward traverse is resumed for 500 m to the headland above Scout Cave, at which point the Silurian rocks are cut by a quartz-dolerite dyke, 40 m wide. The massive rock, locally very deeply weathered, is readily distinguished and is exposed in places to WSW for 300 m. (Its position on the cliffs below is marked by a cave, not discernible from the land.) This dyke is one of a suite of Late Carboniferous or Permian age which occurs widely in central and south-eastern Scotland, other local examples occurring at St Abbs harbour and in the Burnmouth district.

8. Hurker's Haven: porphyrite sills

Some 700 m south of Scout Cave, at Blaikie Heugh, a small old quarry lies just below the cliff-top, its landward face defined by a sill-like intrusion of porphyrite, 1.5 m thick. The 12 m of greywackes and shales within the quarry, are purple-stained and unusually red-weathered. Another porphyrite sill is exposed at Hurker's Haven, to the east. The shore of the Haven can safely be reached down steep grass on its southern side. An acid porphyrite sill, 6.7 m thick, forms a minor promontory in the middle of the beach and a similar thinner intrusion is seen 50 m to west, close to the western corner of the bay, over a distance of at least 150 m above and below H.W.M. These sills, like those near Agate Point, belong to the Siluro-Devonian suite, oriented between N and NE, which has been noted in the St Abbs and Coldingham

areas and is particularly profusely developed in this area, from Agate Point to Lamberton Moor (96 59). The sediments in Hurker's Haven and eastward to Fancove Head exhibit the repeated fold pairs noted at Whalt Point. Good examples occur of flute-casts, groove-casts, and transverse-current ripple-marks, and minor faults are clearly displayed. From the cliff-top the return to Eyemouth may be varied by following a field-track from behind the quarry at Blaikie Heugh for 600 m to the A.1107 road. The car park at Eyemouth is 2 km further by road. Good exposures of convoluted fluvio-glacial sands and clays were seen near the road junction [NT 943 629] south of Netherbyres when the A.1107 was re-aligned.

9. Redhall cutting: dykes

An additional diversion may be made from this junction along the road to the Redhall Cottages, thence north-westward to the disused railway line. In the cuttings to north the greywackes are seen to be cut in places by rather leucocratic sill-like intrusions several metres thick. Examples occur 60 m, 150 m and 300 m north of the footbridge west of the cottages. The last of these intrusions is in contact, to the north, with a 30-m quartz-dolerite dyke, thought to be that at Scout Cave. (This dyke forms the prominent bluff of Kip Rock [NT 9395 6265] just to west, where it is well exposed in the bed of the Ale Water 500 m further west). From this point on the railway line the road 150 m to east can be reached for the return to Eyemouth. To the north the fields west of the road occupy a series of well-defined fluvial gravel terraces, of the suite noted at the playing fields (locality 4).

[References](#)