
River Avon

O.S. 1 :50000 Sheet 65 Falkirk and West Lothian

B.G.S. 1:63360 Sheet 31 Airdrie

B.G.S. 1: 10560 Sheets NS 97 NE and NS 98 SE

Route: (Map 26)

Introduction

Access and Safety note 2022.

Bo'ness and Kinneil Light Railway (Scottish Railway Preservation Society) - Access to the railway line is now closed.

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This excursion illustrates the pattern of sedimentation within the Passage Group (Namurian) on the margins of the Kincardine Basin, a major depositional centre of Carboniferous sediments. The localities are situated on the gently dipping, eastern limb of the Clackmannan Syncline, mainly in natural sections in the River Avon gorge between Grangemouth and Linlithgow. Bedrock is covered by thick deposits of Late-Devensian till, with mounds and eskers of glaciofluvial sand and gravel. Marine outwash deltas of clay, silt and sand and raised tidal flats of Late-Devensian and Flandrian age flank the Forth. The whole area has been affected by isostatic uplift resulting in cutting of the gorge of the River Avon since the end of the last glaciation. The excursion also gives insight into underground mining methods and the problems that ancient mine workings can create in an urban area.

Birkhill Mine may be reached from Linlithgow via the A706 and from Bo'ness and Grangemouth via the A904. Leave the public roads at Upper Kinneil Farm [NS 974 793] and travel WSW down the metalled single track road. Continue SSE on to the unmetalled road into the former mine and park beyond the cottages at the mine buildings. Coaches can follow this route but the roads are narrow with few passing places. For access to the former mine, contact the custodian, preferably in advance, who will unlock the safety doors and escort visitors around. Hard hats, powerful torches and wellington boots are required. The main part of the excursion is compact and it is easy to walk to the localities from the mine buildings ((Map 26)). Locality 9, 1.5 km away, and locality 10 at Bo'ness, about 6 km away, are optional but of historical interest. There are plans by the Bo'ness Heritage Trust to preserve the Birkhill Mine as a mining visitor centre linked to Bo'ness by the Bo'ness and Kinneil Light Railway (Scottish Railway Preservation Society). The woodlands along the banks of the Avon are a botanical SSSI.

The sediments exposed in the gorge of the River Avon consist of a series of upward-fining cycles, between 1.5 m and 12 m thick (Figure 20), thought to have been formed by the migration of meandering rivers. Each cycle starts with a disconformity formed by an erosive river channel. The succeeding channel-fill sandstone becomes progressively finer-grained as it is traced upwards and grades into silty or clayey overbank, floodplain deposits. These muddy beds range in colour from black, through dark grey and pale grey to variegated lilac, dull red and ochreous yellow, the brighter colours reflecting partial oxidation during periods of lowered water table. The siltstones and mudstones are characteristically unstratified and contain stigmarian rootlets. The mudstones are commonly refractory fireclay, some containing more than 40% of alumina as kaolinite, after ignition. Read (1969) thought that the clay fraction may have been derived from an area of bauxitic weathering. The marine bands in the succession reflect widespread marine incursions into the dominantly fluvial environment.

1. Birkhill No.3 Mine

Note: the mine is now closed (2015)

From the old works, descend by the footpath opposite the former manager's cottage until it joins the old cable tramway and then cross the bridge over the river, built wide enough to allow fox hunts across. The mine adit is driven into the south side of the Avon valley at the outcrop of the Lower Fireclays. On entering the mine, in operation from 1932 to 1981, note the height of the roadway and galleries of four to five metres. Here the roof of the mine is formed by a very siliceous, medium to coarse-grained, white sandstone, over 6 m thick, a lithology which typifies the Passage Group. Powerful lamps reveal in the sandstone roof many fossilised tree trunks which collected together as log jams in the Namurian rivers. Stumps of large trees can be seen rooted in the fireclay and protruding upwards into the sandstone. About 125 m into the mine the roof of the roadway rises abruptly to about 8 m and a fault, trending westwards with a downthrow to the north of 3 m, may be seen. A little farther on, just before the waterlogged area of the mine, enter the side galleries to study the size of the rooms and the clay pillars left in to support the roof. This style of extraction is called stoop and room, or pillar and stall, working and about 40% of the seam is normally removed. The roof and floor of the mine are in good condition, the only noticeable erosion being where some blocks of clay have fallen from the walls.

2. Birkhill No. 1 Mine

Note: Do not venture into this adit for the walls are in poor condition and the sandstone roof is fissured

Re-cross the River Avon, noting the sealed main entrance to No. 1 Mine on the north bank and walk up the tramway to the second entrance. On no account venture into this adit for the walls are in poor condition and the sandstone roof is fissured and some falls have taken place. The mine was worked between 1916 and 1928. The section at the entrance to the mine is:

	metres
Sandstone. medium to very coarse-grained, with quartz pebbles, cross-stratified	7.0
Seatclay, grey, traces of stratification, dark carbonaceous	
Root traces, many polished surfaces, ironstone nodules in top	2.4
Clayrock, pale grey, root traces. many polished surfaces, some ironstone nodules at base	2.4

3. Birkhill Railway Cutting: Netherwood Coal

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Ascend to the cottage, take the road out of the mine as far as the railway bridge and descend to the former track bed on the north-west side. At this bridge a section can be cleaned up to reveal:

	metres
Mudstone, soft, weathered, with productid brachiopods	0.45
Netherwood Coal, dull	0.15
Seatrock, sand and silt grade, pale grey	
Sandstone, fine-grained, white, traces of cross-bedding	

4. Sandstone Quarry

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In an old quarry 200 m to the south-east, and 20 m east of the cutting, is a section:

	metres
Sandstone, fine and medium-grained, cross-stratified; erosive base	1.65
Sandstone, fine-grained, planar and cross-stratified	0.22
Siltstone, Micaceous, sandy layers, plant debris	0.05
Sandstone, fine-grained, planar and cross-stratified	0.86
Sandstone, fine and very fine-grained, ripples	0.25
Sandstone, medium-grained, cross-stratified	0.48

The Lower Fireclays below the sandstone are exposed in the cutting walls for almost one hundred metres from the south end of the quarry.

5. Todsmill Cottage: No.2 Marine Band Limestone

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At the southern end of the cutting, just before the bridge, a section in the north face can be cleaned up to expose:

	metres
Sandstone. medium-grained, rooty, trough cross-stratified with sharp rolling erosive base	1.0
Mudstone. Grey, roots, traces of bedding	0.30
Viaduct Coal, mainly dull banded. sand-filled casts of horizontal tree trunks at top	0.18
Seatclay. dark and pale grey. some iron nodules. many polished	0.75
Mudstone. dark grey. fissile. packed with ironstone nodules	0.28
Roman Cement Limestone (No.2 Marine Band Limestone), dark grey, very muddy, many marine shells, mainly articulate brachiopods (exposed by trenching at trackbed level)	0.30
Mudstone. dark grey, bedded, iron nodules, some brachiopods	0.25

On a fine day, walk on to the Avon Viaduct for a view of the gorge eastwards to Linlithgow Palace. Before leaving the railway at Todsmill Cottage, pause to reflect that in 1916 the famous field surveyor, C. T. Clough of the Scottish Geological Survey, was run down and fatally injured by a goods train in this cutting. He died three days later but not before exonerating the driver from any blame. In view of the good visibility hereabouts, it seems likely that Clough's hearing impediment led to the tragedy.

6. Tod's Mill Weir

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Walk westwards from Todsmill Cottage to Tod's Mill, descend to the river bed on the north side of the ruins of the mill and pass through the remains of the waterwheel. Just upstream of the mill and on the east bank near the weir is the section:

	metres
Seatclay, dark grey, dark roots, many clayband ironstone nodules (known as the Curdly Ironstone)	0.45
Nodular ironstone and limestone, pale grey, brown weathered, large marine shells	0.12
Roman Cement Limestone, dark grey, Muddy, lenticular, packed with crushed marine shells, mainly articulate brachiopods	0.18
Mudstone, dark grey. Bedded, marine shells increase in frequency upwards, some iron nodules	0.40
Coal, dull banded, inferior	0.08
Seatrock, silt and sand grade, fining upwards, pale grey, dark roots	0.70
Sandstone, fine-grained, roots at top, cross-stratified; forms the weir across the river	2.4

7. Tod's Mill: River Cliff

Walk 30 m downstream of Todsmill to where the cliff reaches the river. At the waterwheel is the Tod's Mill Fault which throws 10 m down to the south. The section exposed north of the fault is:

	metres
Sandstone, fine and medium-grained, white, sharp base	3.00
Mudstone. dark grey, Carbonaceous, coal laminae	0.15
Sandstone. fine and medium-grained, roots at top, flat bedded and planar cross-bedded	.033
Seatrock, pale grey, clay grade	3.00
Mudstone. Bedded, dark grey, weathered, abundant Lingula, many marine shells in lower part	1.44
No. 1 Marine Band Limestone mainly dark grey, muddy, nodular in part, marine shells	0.48
Mudstone. dark grey. marine shells. sulphurous yellow weathered	0.96
Coal,. Dull, inferior	0.01
Seatrock, clay and sill grade, dark roots, hard iron top, large ironstone nodules, tuffaceous aspect with pale grey, angular tuff fragments	0.91
Ironstone, greenish grey, tuffaceous, pale greenish grey angular tuff fragments, sphaerosideritic	0.45
Seatrock, sill and clay grade, pale grey	0.45

8. Subsidence Hole

Retrace the way to Todsmill Cottage and follow the footpath north-west from the railway bridge towards Birkhill Mine for 200 m. The ground has collapsed 20 m west of the path to form a sit or crown hole where the sandstone roof of 19th century fireclay workings has failed. The cone of depression is 9 m deep and 4 m wide with the fireclay visible in the wall at the bottom. It is not advised to try to enter the old workings through the hole at the bottom. Clearly if such a collapse occurred in a built-up area the damage to property might be severe (locality 10).

9. Craigenbuck Mine [NS 959 700]

This locality is adjacent to the A904 Bo'ness to Grangemouth road at the west end of the wood at Water Inns. The section is:

	metres
Sandstone, fine-grained. off-white cross-stratified	1.5
Mudstone, dark grey, bedded, hard irony bands.	0.9
Carbonaceous, fish remains. Coprolites, Curvirimula	
Castleary Limestone, not seen, could be excavated, loose blocks are of pale grey dolomitic limestone with rare algal nodules	2.1

The bituminous mudstone roof of the limestone is interesting because it contains only non-marine fossils, a feature typical of the Castleary Limestone in central and eastern Scotland. Most marine limestones in the Upper Carboniferous sequence are overlain by mudstones with marine faunas. The limestone was used for mortar and flux at the former Kinneil Ironworks.

Following the southern field boundary westwards for about 200 m from the mine entrance, the ploughed soil indicates the existence of several Kitchen Midden sites at least three of which have been partially excavated. The middens locally are up to three metres deep and consist almost entirely of oysters, and a few mussels and periwinkles. The middens are probably about 6000 years old and date from the time when the Flandrian sea washed the foot of the marked bluff in this field. This conspicuous cliff line forms the Flandrian 'Main Postglacial Shoreline', a raised beach which has been recognised extensively throughout the Forth area and is associated with the estuarine deposits of the Carse Clay.

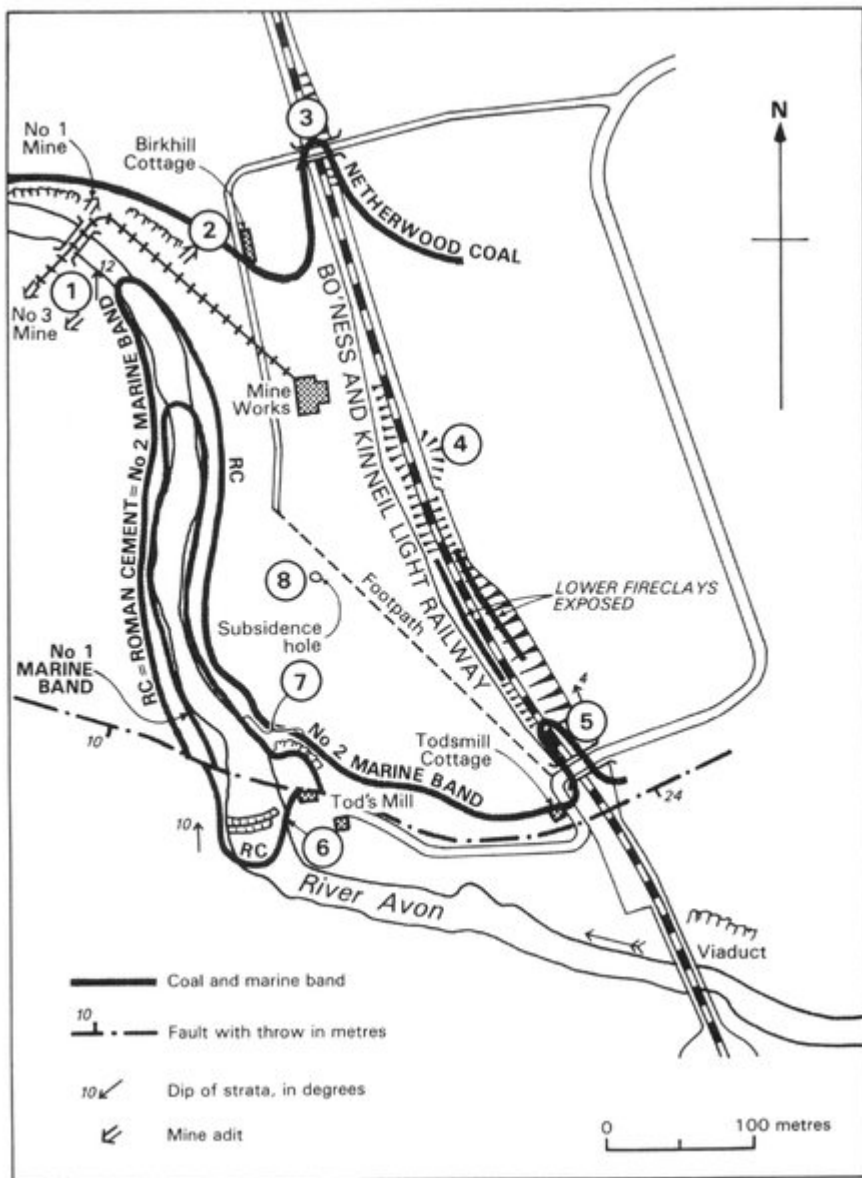
10. Bo'ness Bus Station [NS 998 817]: Subsidence

A sit formed in Bo'ness one Sunday in 1885 when the Town Hall subsided into old stoop and room workings in the stoop and room workings in the Wesler Main Coal (Limestone Coal Group) about 15 m below ground level (Figure 21). The site of the hall is now a landscaped area to the south of the Bus Station. No visit is complete without reading Cadell's account of the disaster (1925) and the text of the relevant biblical dissertation which was being delivered at the time (Luke, Ch. 13, v. 4) concerning the fall of the Tower of Siloam.

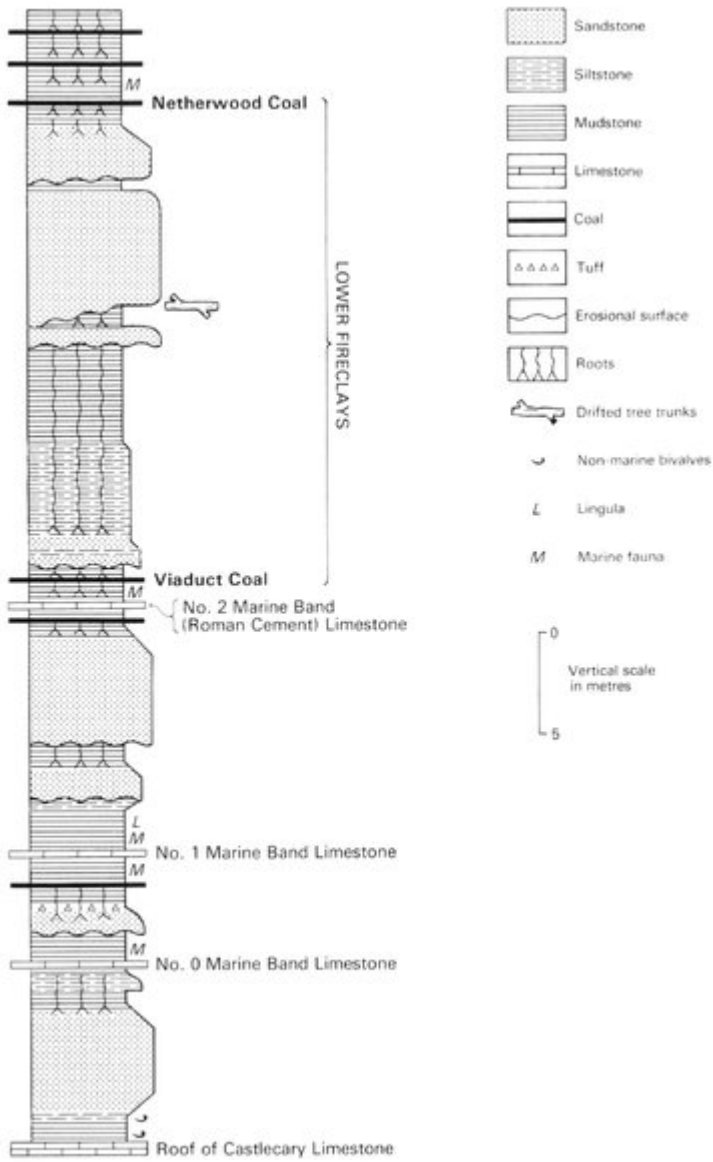
Acknowledgements

Without the unpublished, detailed field surveying of W.A. Read and J.M. Dean (BGS) prior to 1967, this account would not have been possible. The sections included herein are transcribed verbatim from their notebooks.

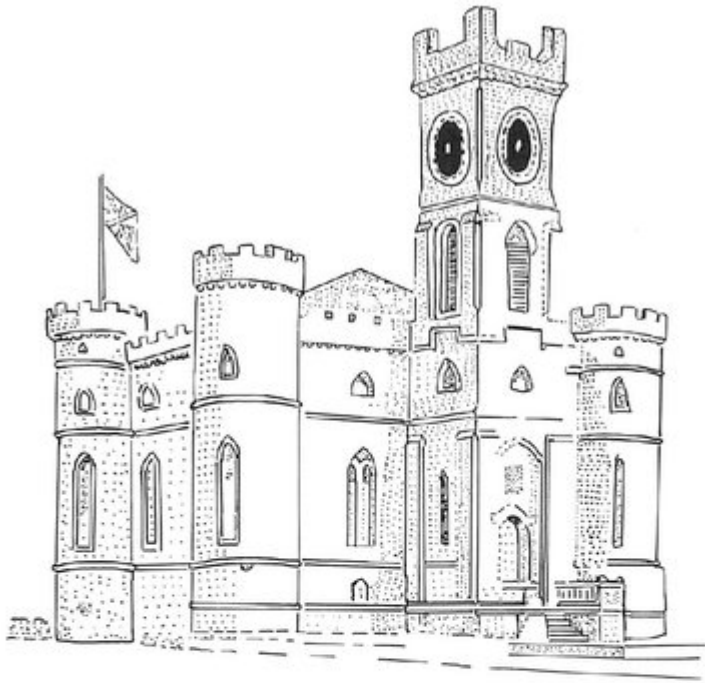
[References](#)



(Map 26) River Avon.



(Figure 20) Section in Passage Group by R. Munro.



(Figure 21) The Old Town Hall, Bo'ness, and stoop and room workings in the Western Main Coal 15 m below the Old Town Hall, after Cadell 1925.