Carboniferous of the Wear Valley and Derwent Gorge, County Durham - an excursion

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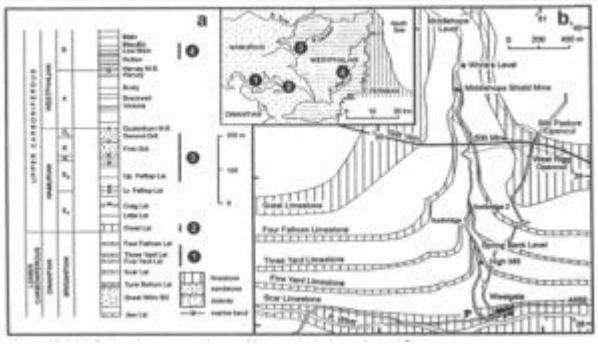

Figure 15.1 (a) Carboniferous succession, and inset geological map for mid Durham, showing sections described at localities 1-4. (b) Geology of Middlehope Burn, Westgate (Locality 1).

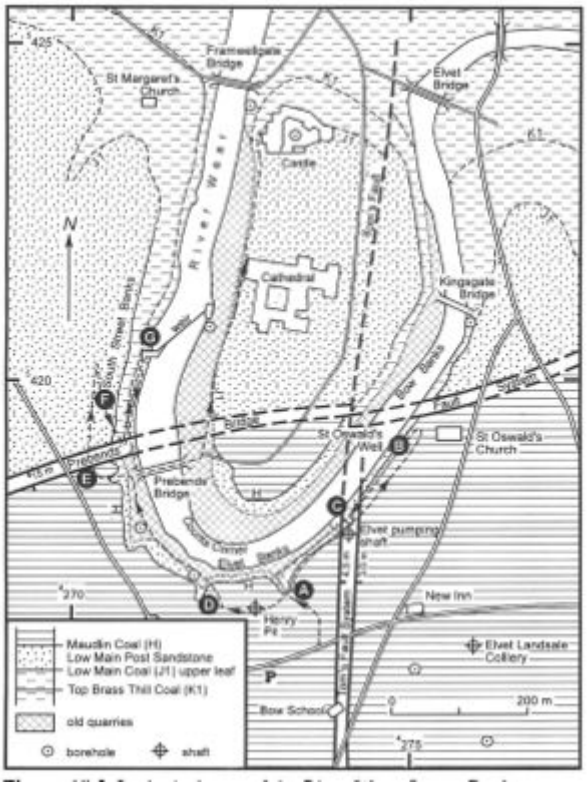

Figure 15.2 Geological map of the River Wear Gorge, Durham City. Details of

boreholes are given in Johnson and Richardson (1990).
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Purpose

To examine Carboniferous (Dinantian, Namurian and Westphalian) rocks at four localities in central and northern County Durham. The spectacular gorges of the River Wear at Durham City and the River Derwent at Muggleswick are important geomorphological features.

Logistics

This section was compiled in 2006 when the printed guidebook was published. Before visiting this site please ensure you have up-to-date contact and access information.

Localities 1 (Westgate), 2 (Frosterley) and 4 (Durham City) can be reached by public transport, but Locality 3 (Derwent Gorge) is best visited by car. Parking places are available at all localities. With transport, Localities 1, 2 and 3 can be visited in one day; Locality 4 will require an extra half day. Walking distance depends on the routes taken, but is not more than 4.5 km at Locality 1, 2 km at Locality 2, 4.5 km at Locality 3 and 1.5 km at Locality 4.

Prior permission for access to Harehope Quarry (Locality 2) should be obtained from Mr R. J. Huddleston, Tilcon Ltd, P.O. Box 5, Fell Bank, Birtley, Chester-le-Street, Durham, DH3 2ST, and for access to the Derwent Gorge (Locality 3A) from English Nature (Tel: 01661 845500).

Maps

O.S. 1:50 000 Sheets 87 Hexham & Haltwistle, 88 Tyneside & Durham, 92 Barnard Castle; B.G.S. 1:50 000 Sheets 20 Newcastle upon Tyne, 25 Alston, 26 Wolsingham; B.G.S. 1:63 360 Sheet 27 Durham.

Geological background

The Carboniferous rocks of County Durham dip eastwards off the northern Pennines so that the Lower Carboniferous (Dinantian) crops out in the west followed by successively higher Namurian and Westphalian (Coal Measures) strata towards the east. Permian sediments overlie the Coal Measures in east Durham. Bedrock is masked by thick glacial drift in the eastern part of the county and natural exposures of the Coal Measures are relatively few and incomplete. Further west, the Namurian sequence forms the tops of the fells in west Durham and here almost continuous blanket bog limits the exposures of bedrock. The Dinantian crops out in the valleys of the Pennines where it can be seen in river and stream sections. Thick and continuous Dinantian limestone successions in southern England and the Midlands change northwards into sequences of limestone, shale and sandstone in northern England as the Carboniferous shoreline is approached. The most northerly of the thick Asbian limestones, the Melmerby Scar Limestone, becomes divided by elastic sediment and looses its identity in Durham. Clastic sediment increases in the overlying Brigantian where cyclic deposition of limestone, shale and sandstone is repeated ten times. This Yoredale facies is remarkably persistent over northern England from the Scottish Border southwards to the Craven faults. The sequence is controlled to an extent by the position of the Carboniferous shoreline. Marine limestones and shales increase in thickness seawards towards the south and west and thin and die out towards the shore to the north and east. Similarly, the deltaic and subaerial sandstones and coal seams thicken landwards and thin seawards. Durham lies almost midway across the broad area in which open sea and shoreline environments alternated and well developed cyclothems of marine and deltaic sediment are developed. A section of Yoredale cycles in Middlehope Burn is described at Locality 1.

The Great Limestone (22 m) is the thickest limestone in the Yoredale succession. It contains fossil biostromes including the Frosterley Marble, a band rich in solitary rugose corals (Locality 2). Index fossils collected from above and below the limestone indicate that the base lies near to the Dinantian/Namurian boundary. The Great Limestone cycle continues the Yoredale facies into the Namurian, but above this the limestone bands become thinner in a dominantly shale and sandstone succession. Towards the top of the Namurian thick, coarse-grained sandstones are widely developed. The upper part of the Namurian including the First and Second Grits can be seen at Locality 3.

In Durham the base of the Westphalian is believed to be at the level of the Quarterburn Marine Band. The upper Namurian coarse-grained sandstone facies continues into the Westphalian and rapidly gives way to a delta-top sequence of sandstone and shale with coal seams. These deposits, formed mainly in lakes and interdistributary bays, contain twenty major exploitable coal seams that formed the celebrated Northumberland and Durham coalfield. A Westphalian B succession can be seen at Locality 4.

Excursion details

Locality 1, Middlehope Burn, Westgate, Upper Weardale

The area is a botanical S.S.S.I. with access by footpath, but the land is private. Upper Weardale is

reached by the A689 from Crook in the east or from Alston in the west. Buses (Weardale Motor Services) travel up the dale from Crook and Bishop Auckland.

At Westgate park in the lay-by on the north side of the road just west of the centre of the village [NY 906 380]. Take the road to Rookhope north from the middle of the village and after 300 m turn left on the footpath past High Mill and along the side of Middlehope Burn (Figure 15.1). The stream gives fairly continuous exposures of Dinantian Yoredale cyclothems in the upper part of the Brigantian Stage. Sandstone and interbedded shale high in the Scar Cyclothem can be seen in the stream at the mill and it forms waterfalls up stream.

The Five Yard Limestone crops out above this sequence and forms a wide series of exposures in the bed of the stream [NY 907 385]. Spring Bank level on the right of the path is the drainage level of Slitt Mine. Shale and sandstone above the limestone can be seen in the stream with the thicker Six Fathom Hazle well exposed in waterfalls at the first bridge across the stream. Just above the second bridge the Three Yard Limestone crops out in the sides of the stream and the succession of shales and sandstone above the limestone can be seen up stream to Slitt Mine [NY 906 392]. Slitt Mine shaft lies on the west side of the stream and is capped by steel plates. It was sunk to 178 m, reaching the base of the Great Whin Sill here intruded into the Tyne Bottom Limestone. The mine worked Slitt Vein between 1818 and 1880 and produced around 100 000 tons of lead ore (Dunham, 1990). Small amounts of galena, siderite and fluorite can be found on the dumps and washing floors adjacent to the shaft. Although the mine buildings have long disappeared, level entrances, waterwheel pits, engine mountings, and bingsteads etc. can still be seen.

From Slitt Mine a path leads eastwards up the valley side past Slitt Pasture opencut to the Westgate-Rookhope road at West Rigg opencut [NY 911 392]. This is a shorter route that cuts out the higher part of the Middlehope Burn section.

Continuing up Middlehope Burn, the Nattrass Gill Hazle sandstone at the top of the Three Yard Cyclothem is well exposed above the path and shortly up stream the Four Fathom Limestone can be seen above the sandstone. The limestone crops out at path level a little further on. Extensive old buildings beyond this are all that remains of a waterwheel crushing mill and washing floors of Middlehope Shield Mine. Old dams and lagoons are still visible. White's Level, on the east of the stream at the top of the washing floors, is one of the mine entrances. Another entrance is Middlehope Level further up stream at [NY 904 402]. This mine produced some 15 800 tons of lead ore between 1818 and 1864 from veins to the east of the burn (Dunham, 1990).

Take the track east from Middlehope Level and turn right after a short distance on to a farm track that leads to the road at West Rigg opencut on Slitt Vein [NY 911 392] (Excursion 14). Return to Westgate down the hill by the road.

Locality 2, Harehope Quarry and Bollihope Burn, near Frosterley, Weardale

Access by footpaths only across private land. Travel by the A689 to Frosterley and park at the turning south, 700 m east of the village centre [NZ 035 369]. Cross the River Wear by the bridge and the railway by the level crossing and turn left on the road to Broadwood [NZ 038 366]. South of Broadwood a stile on the right of the road leads to a track running southwest near to the side of Harehope Quarry. The quarry shows fine sections of the Great Limestone and the overlying beds, but is private and permission to enter must be obtained in advance (see Logistics).

Proceed up the track to a quarry spoil tip at the crest of the slope and turn left on a footpath that leads to Wise Eel Bridge over Bollihope Burn [NZ 034 361]. Turn right, cross Harehope Burn by the bridge and continue up the side of Bollihope Burn on the footpath to the first field boundary wall [NZ

0315 3605]. Here the Great Limestone forms natural outcrops in the stream and the Frosterley Marble band, containing many solitary rugose corals, mainly *Dibunophyllum bipartiturn,* is well exposed on bedding planes and in sections. Permission has been given by the landowner for access to the stream section from the footpath. **Do not damage the outcrop by hammering and collecting**; loose fragments of Frosterley Marble can be found in the stream bed below the exposures. Return to Frosterley by the same route.

Locality 3, the Derwent Gorge, Muggleswick to Shotley Bridge

From Frosterley travel east to Wolsingham, turn left on the A68 at [NZ 131 355] and go north through Tow Law. At Castleside turn left again on a minor road to Healeyfield and first right for the Derwent Gorge.

Locality 3A, The Derwent Gorge and associated Muggleswick Woods

The Derwent Gorge and associated Muggleswick Woods, containing areas of ancient oak-birch-ash woodland, form an extensive National Nature Reserve run by English Nature. Prior permission for access is required (see Logistics). The River Derwent forms incised meanders east of Muggleswick with steep or precipitous sides deeply cut into the upper Namurian bedrock. Much of the gorge is heavily forested, but there is access by a footpath that crosses the river at Lead Mill Bridge [NZ 054 488]. On the south side of the gorge the footpath starts beside the road at NZ 05444877 where there is limited parking beside large wooden gates. The site manager may be able to offer parking at Crooked Oak [NZ 05504 976] which is at the north end of the footpath. Follow the footpath into the gorge and note sporadic exposures of upper Namurian sandstone and shale. The slopes above the river are much affected by landslips, but several bedrock sections are visible either at or above the Upper Felltop Limestone. A short way down stream a high cliff beside the river at NZ 058492 shows a fine succession of interbedded sandstone and shale with calcareous beds including limestone, assigned to the Upper Felltop, to m below the top of the section. The sequence shows rapid lateral variation. A section of strata here is appended to the Geological Survey six-inch sheet NZ 04 NE. This cliff section is one of the best continuous exposures of upper Namurian strata in this region. A short distance down stream ruins of buildings and an old shaft mark the site of Silvertongue Mines where lead ore was extracted from north-trending veins in the 1840s (Durham, 1990).

Locality 3B, Allensford, a County Geological Site

Allensford, a County Geological Site; access by footpath only. Return to the A68 and proceed to Allensford. Take the Consett road just south of Allensford bridge and after a short distance turn left into the picnic area car park [NZ 078 502]. Walk back and cross the A68 to the marked footpath that starts between houses and runs up stream beside the River Derwent. Cross the Warnley Burn by the footbridge where a fine view of the thick Durham First Grit (upper Namurian) can be seen with waterfalls and a steep sided incised channel. Further up stream the grit forms the striking vertical cliffs of Ravens Crag, more that 1 o m high, where massive coarse-grained and pebbly, cross-bedded sandstones are well exposed.

Locality 3C, Shotley Bridge, County Geological Site

Shotley Bridge, County Geological Site; access by footpaths. From Allensford car park, turn left along the minor road to Consett. Turn left at the junction with the A691, continue to the bottom of the hill and turn sharply left into Shotley Grove Road [NZ 090 524]; limited parking is available beside the road. The River Derwent has cut a sharply incised channel into the Durham Second Grit (upper Namurian) from Shotley Grove down stream to the B6287 road bridge over the river in the centre of Shotley Bridge. The shallow, almost vertical-sided gorge can be seen at many places on

both sides of the river, but is best viewed from the foot bridge [NZ 089 523]. The brown, coarse-grained, cross-bedded standstone is best examined at the south end of the section near to Shotley Grove.

Although only two coarse-grained sandstone bands are distinguished at the top of the Namurian in the Derwent valley, elsewhere in County Durham three or even four grit bands are present in this part of the succession.

Locality 4, the River Wear Gorge at Durham City

River Wear Gorge at Durham City; Coal Measures, Westphalian B (Johnson & Richardson, 1990). Access is by path through woodland owned mainly by the Dean and Chapter of Durham and Durham University. There are car parks near Durham city centre, but during the university vacations it is convenient to park in Quarry Heads Lane on the south side of the river [NZ 27304 154] (Figure 15.2). Cross the road and walk east towards the New Inn. Before the traffic lights a footpath on the edge of playing fields leads to the wooded banks of the River Wear. Descend towards the river and take the first footpath on the right over the stream by a small bridge. Above the path (A) is the Maudlin Sandstone overlying the thin Maudlin Coal (Figure 15.1), (Figure 15.2). Continue on this path to St Oswald's Church where it joins the lower path on the river bank. A short distance back along the lower path, a narrow way leads down the river bank to St Oswald's Well (B) where the Maudlin Sandstone is exposed in a low cliff The well is at the base of the sandstone and the thin Maudlin Coal can be seen at water level with clay seatearth below. Interbedded sandstone and shale are exposed under the wellhead. Continue down the river by the lower path to the white bridge (C) where the Maudlin and underlying Low Main Post sandstones can be seen. Behind the bridge a conduit drains the abandoned pumping shaft of Elvet Landsale Colliery, marked by a ring of masonry 50 m south of the bridge. Near the bridge two small faults take the Maudlin Sandstone to the top of the river bank on the west (Figure 15.2). A short distance further down river the Low Main Post Sandstone can be seen beside the path in an old quarried section. Past the next tributary stream, take the path up the river bank and the first path on the right to the flat wooded top of the bank. Another circle of masonry here marks the site of the shaft of Henry Pit, an early t 9th century colliery working the Hutton Coal on the south side of the river. Follow the path to the steep descent down the river bank (D) where the brown Maudlin Sandstone and succession below are well exposed and the Low Main Post can be seen low down on the other side of the gulley. These ancient sandstone quarries date from mediaeval times; one that worked both the Maudlin and the Low Main Post sandstones can be seen a little further along the path.

At Prebends' Bridge, the brown Maudlin Sandstone with conspicuous cross-bedding is seen in the track side leading to the bridge with the Maudlin Coal below the overhang at the base of the sandstone. A blocked adit entrance above the sandstone exposure is a drainage level from another early x gth century colliery. Slightly north, the Prebends' Bridge Fault, downthrowing 15 m south, crosses the gorge (Figure 15.2) and steeply dipping sandstone adjacent to the fault can be seen above the path to the right of the drainage level (E). On the north side of the fault all the Low Main Post Sandstone has been quarried at the top of the river bank leaving a hollow below South Street (F). Traces of the Low Main Coal, 0.45 m thick, are found below the quarry. Extensive exposures of shale and sandstone beside the mill (G) on the left bank of the river are near the Brass Thill coals, and the Brass Thill Shell Bed can be found in the shale.

On the right bank of the river, ancient quarrying for sandstone has been extensive from Framwellgate Bridge almost continuously to Elvet Bridge and these old workings are now deeply buried in spoil and rubbish (Figure 15.2). The Low Main Post Sandstone is seen directly below the City Wall and the Galilee Chapel, beside the high path under the Cathedral. This sandstone, 10 m thick, has been the sure foundation of the Cathedral for goo years.

Glossary

Bibliography

> At all times follow: Countryside code and Code of conduct for geological field work

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