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## 5 The Lower Carboniferous of Bewcastle and Gilsland

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### Purpose

The excursion describes the Lower Carboniferous rocks of the Northumberland-Cumbria border country around Bewcastle and along the River Irthing.

### Logistics

The itinerary (Figure 5.1) has been chosen to be easily accessible, and to be completed by car or minibus in one day; only Locality 4 is suitable for large parties. Refreshment and toilet facilities are available at Gilsland and in various pubs.

*Note:* Permission for access to Birky Cleugh (Locality 2) should be sought in advance from the Forest District Manager, Kielder Forest District, Eals Burn, Bellingham, Hexham, Northumberland (Tel: 01434 220242).

### Maps

O.S. 1:50 000 Sheet 86 Haltwhistle, Bewcastle & Alston; B.G.S. 1:63 360 Sheet 12 Bewcastle (solid and drift editions).

### Geological background

The area covered comprises a mixture of rolling agricultural land and peat covered moorland rising to 500 m above sea level. It is dominated geologically by Carboniferous sandstones, marine limestones and shales of the Lower, Middle and Upper Border groups, and the Liddesdale Group (Figure 5.1). These are unconformably overlain by Permian basal breccias and shales, and a thick blanket of glacial deposits.

The Carboniferous rocks of the area were deposited in a shallow trough bordered to the north by the subdued Caledonian Mountains of the Southern Uplands and, to the south, by the Alston Block. These upstanding margins of the trough were sources of elastic sediment during Lower Border Group times, but large drainage systems from the north and east dominated deposition through much of the later Carboniferous. At times of high clastic sediment input or lower sea level, extensive deltas, sometimes topped by coal-forming swamps, prograded into the shallow gulf-like sea which occupied the trough in this area. Periodically, reduced sediment supply or higher sea level led to northeastward transgression of marine conditions. Thus the sandstones, shales and limestones of the Lower and Upper Border groups encountered at the localities detailed below reflect the complex interplay of these fluviodeltaic and marine depositional systems.

During deposition of the Liddesdale Group fully marine conditions dominated the area. The Southern Uplands and Alston Block, until this time the margins to the basin, were finally breached by the sea and limestone was laid down in laterally persistent beds, some of which extended north into the Midland Valley of Scotland and south into Yorkshire. In mid-Carboniferous time thick sands prograded from the northeast (Millstone Grit). The late Carboniferous saw the development of swamp conditions and deposition of the Coal Measures. Regional tectonic compression during the late Carboniferous and early Permian resulted in uplift and prolonged subaerial erosion. The late Permian transgression, from the south, deposited the St. Bees and Kirklington sandstones, widely used in local buildings.

The present drainage systems were established during Tertiary uplift. Pleistocene glacial advance and retreat covered the area in thick till, overlain by sands and gravels, but in Holocene times the major rivers have re-located in their pre-glacial courses. Post-glacial climates favoured the formation of an extensive upland peat blanket.

More recent history is also of considerable interest. There are scattered signs of ancient British settlements throughout the area, and from about 120 A.D. Bewcastle was the site of the Roman fort of *Banna*. After Roman occupation the fort became an Anglo-Saxon settlement and a well preserved, carved sandstone cross, now located in the churchyard, dates from this period. Subsequent Norse occupation, for a time under the chieftain Beuth, gave Bewcastle its name. The church and castle which now stand on the site of the fort were built during the reign of Edward I in about 1291. The castle was destroyed by Cromwell's troops in 1641.

Further details of the geology can be found in Day (1970).

## Excursion details

### Locality 1, Ashy Cleugh [NY 565 770]–[NY 570 767]; (Figure 5.2)

Permission for access should be sought from Stockastead Farm. Park by the track, near the disused limekiln.

#### Locality 1a [NY 565 770]

Here the stream exposes the uppermost Lynebank Formation and the Bewcastle Formation. The lowermost unit of the latter, the 1 m thick Bogside Limestone Member, forms a series of small waterfalls and in the past has been quarried from this locality for lime. The Bogside Limestone is one of the thickest limestones developed in either the Lower Border or Cementstone groups over the area covered by this guide. It was deposited below normal wave base in a shallow marine environment. Thin bands packed with fossils were formed when occasional storms stirred up the sea floor and winnowed out the Shelly material in the muddy sediment. The fossil fauna is dominated by brachiopods (mainly *Antiquatonia teres*), brachiopod spines, and crinoid fragments. The thin shale horizon towards the middle of the unit contains a moderately diverse bivalve fauna.

Above the Bogside Limestone, shales with occasional sandstones and thin limestones, some of which are marine, crop out in the stream bed and banks (Figure 5.2). The persistent can reach Ashy Cleugh Locality 1b by following the stream through the trees.

#### Locality 1b

From the limekiln, walk up around the south side of the quarry and along the edge of the small conifer plantation. Upstream from the edge of the plantation [NY 570 767] the upper part of the Bewcastle Formation, from the New House Limestone Member to the Junction Limestone Member (Figure 5.2), is exposed in the stream bed and in a series of low, shaley bluffs. This part of the formation is dominated by shales, with only a few sandstone and limestone beds, most of which are less than 1 m in thickness. Some of the shales are brecciated and probably represent the collapsed remains of evaporite beds, now leached away. Marine fossils are uncommon except in the 2.6 m thick Ashy Cleugh Limestone Member; its fauna is similar to that of the Bogside Limestone Member, although rather impoverished, and it was probably deposited in a similar environment. Occasional thin beds of oolite indicate high energy marine conditions, but the general absence of fully marine fossils from this part of the Bewcastle Formation, and the more common occurrences of bivalves, including *Modiolus*, ostracodes, vermiform 'gastropods', algae, and abundant fragmentary plant remains suggest that marine influence was limited at this time.

### Locality 2, Birky Cleugh [NY 588 754] – [NY 593 754]; (Figure 5.3)

Birky Cleugh is an S.S.S.I. and prior permission for access should be sought (see Logistics); *hammering is not permitted* but loose fossils may be collected. From Bewcastle church, take the road over the river past the Limekiln Inn. After 200 m go through the gate by the post-box on the left and take the right-hand track for about 2.5 km to High Grains House; park by the track. *Note:* The track to High Grains can be muddy and is very rough in places.

In the shallow gorge below the house the High Grains Sandstone Member of the uppermost Bewcastle Formation can be seen. Walk round the north side of the house and take the track down to the stream. Upstream from the point where the

track crosses Birky Cleugh [NY 588 754] the whole of the Main Algal Formation and the lower part of the overlying Cambeck Formation is exposed as a series of low bluffs and waterfalls. The prominent orange weathering limestone in the first bluff is Main Algal Limestone Member 1 (Figure 5.3), which contains small but well developed algal-vermiform 'gastropod' patch reefs. The thick limestone in the waterfall 150 m upstream is the Birky Cleugh Limestone Member. Most of the limestones of the Main Algal Formation are algal in character and well developed algal nodules and encrusting mats are exposed at various horizons in Birky Cleugh. At the time of their deposition this area was a warm, shallow marine gulf with fluctuating salinity and minimal tidal activity. The lower parts of the Cambeck Formation exposed in the higher reaches of the stream (Figure 5.3) contain a more fully marine shelly fauna dominated by the brachiopod *Antiquatonia teres*.

### **Locality 3, River Black Lyne — Oakshaw Ford [NY 513 766]**

Permission for access must be sought from Mr Drew at Clattering Ford cottage. This site is scheduled to become an S.S.S.I. so *outcrops should not be hammered*. The track down to the river passes made ground on the left. This is the remains of workings for the Oakshaw Coal. Though of poor quality and high ash content this was worked from the 19th Century to the late 1940s as a source of household fuel. On the south bank of the river a number of small quarries expose the Oakshaw Limestone. At the top of the limestone a thin bed of volcanic tuff (highly weathered to clay) is thought to be a much attenuated representative of the Glencartholm Volcanic Beds found further north in the Scottish borders. The 'Clattering Band', lies about 1 m below the Oakshaw Limestone and though now partially overgrown, is exposed on the opposite bank of the river. The Clattering Band is taken as the base of the Upper Border Group in the Bewcastle area and contains a shelly fauna originally described by Garwood. This includes colonies of the corals *Lithostrotion portlocki* and *Siphonodendron martini* in growth position. The brachiopods *Punctospirifer scabricosta* and *Stenosisma isorhyncha* are also common.

### **Locality 4, Irthing Gorge**

The Upper Border Group rocks to the north of Gilsland form part of the gently dipping eastern limb of the Bewcastle Anticline. A succession extending from below the Millerhill Limestone to above the Leahill Limestone is well exposed in the River Irthing between Gilsland and Shankend [NY 6877 7654]. This section is repeatedly cut by faults of the Gilsland Fault Belt. *Some of these localities are on M.O.D. land; heed the warnings posted along the road.*

### **Locality 4A, Gilsland Gorge [NY 635 680]**

Though the sections in the gorge are largely inaccessible they allow the opportunity to view the dominantly arenaceous, middle part of the Upper Border Group. Descend the steep path to the north of the car park of the Gilsland Spa Hotel. Follow signs to the Popping Stone, crossing two suspension bridges. The development of the gorge is controlled by a series of northwest striking, normal faults. The lowest exposed beds comprise calcareous sandstones [NY 6350 6904], overlain by approximately 35 m of mainly arenaceous strata. A sequence of Crammel Linn, Green Grove and Cohering Sandstones is exposed along the northern side of the gorge, where individual beds show marked lateral thickness variation. In the section west of the Popping Stone [NY 6350 6812] the upper part of the Crammel Linn Sandstone is almost entirely replaced by shales.

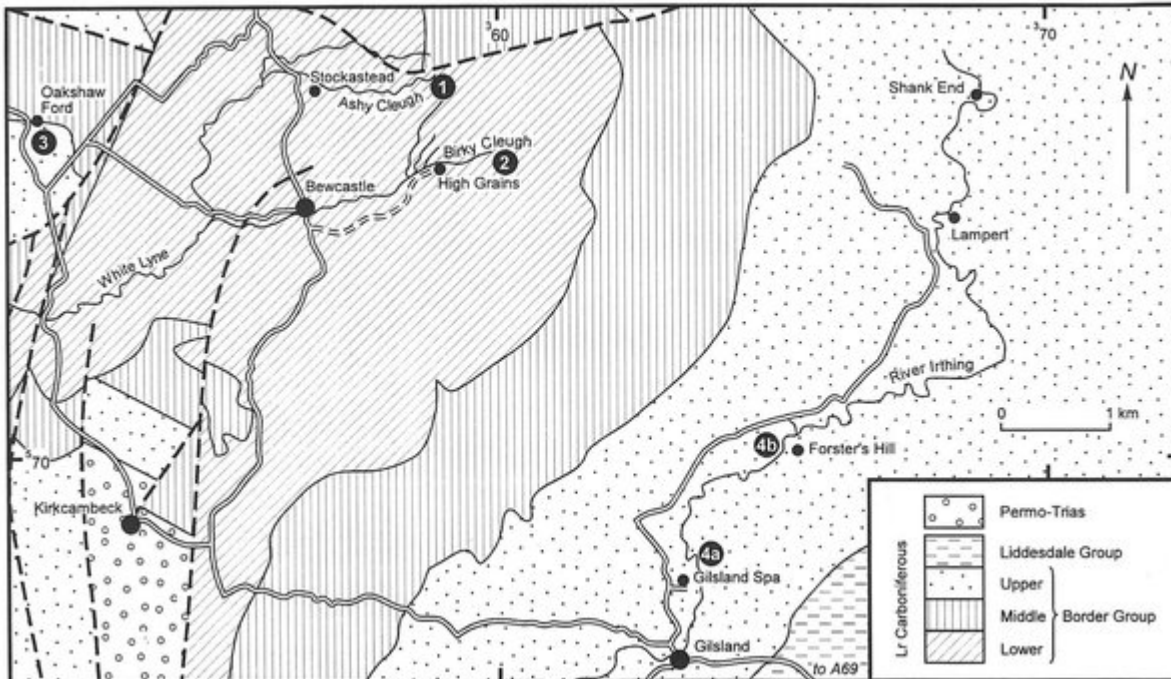
### **Locality 4B, West of Forster's Hill [NY 6525 7030]**

From the road [NY 64187 060] follow the deep gully of the unnamed burn southeastwards to the River Irthing. At the confluence, a series of isolated outcrops expose the 2 m thick, shale dominated sequence which lies below the Spy Rigg Sandstone. The Throssburnfoot Coal can be found about 1 m below the sandstone. Shales beneath the coal contain an abundant fauna including the freshwater bivalve *Naidites obesus* and primitive mollusc *Bellerophon* sp. This level represents the locally developed Irthing Shell Bed'. Thin calcareous shales within the section yield occasional brachiopods, gastropods and nautiloids.

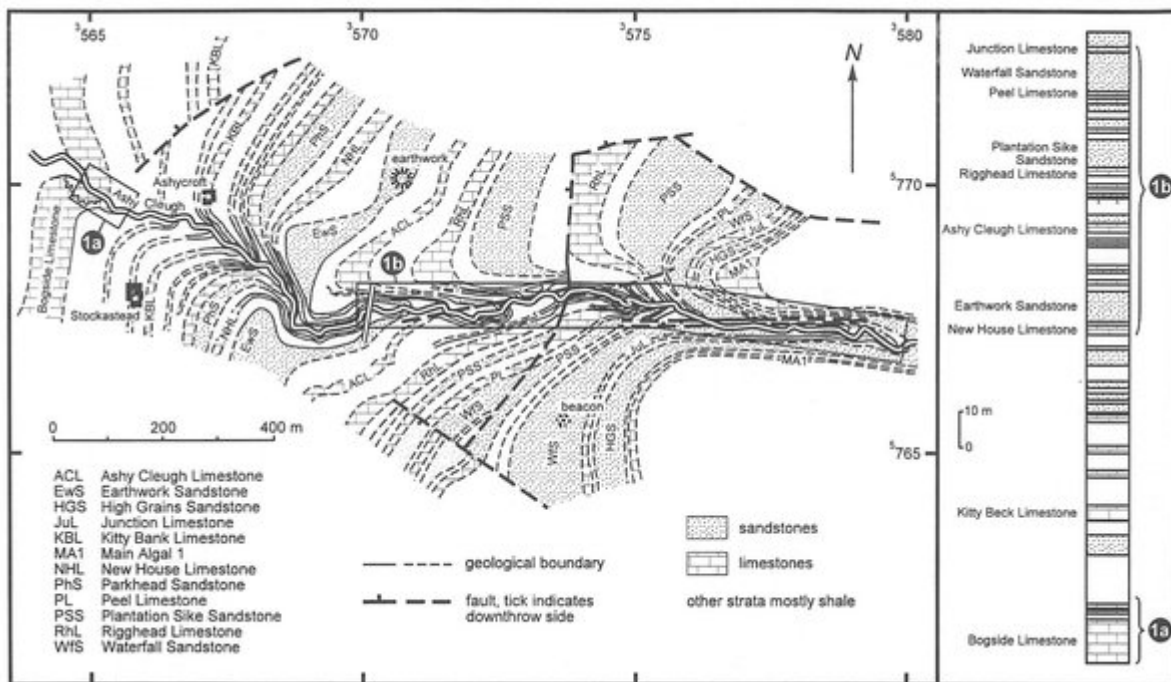
In cliff exposures room further downstream, [NY 65157 020] a pair of Tertiary, tholeiitic dykes 1–2 m thick incline to the southwest. Shales to the south are baked and cleaved. In the cliff a thin coal becomes anthracitic and cindery close to

the intrusion. At 1–1.5 m from the southern contact and parallel to it are bands of brecciated and decomposed dolerite. Occasional vesicles up to 0.5 mm in diameter are filled with clay minerals. The Spy Rigg Sandstone is well developed in the opposite bank where it is affected by a series of small faults.

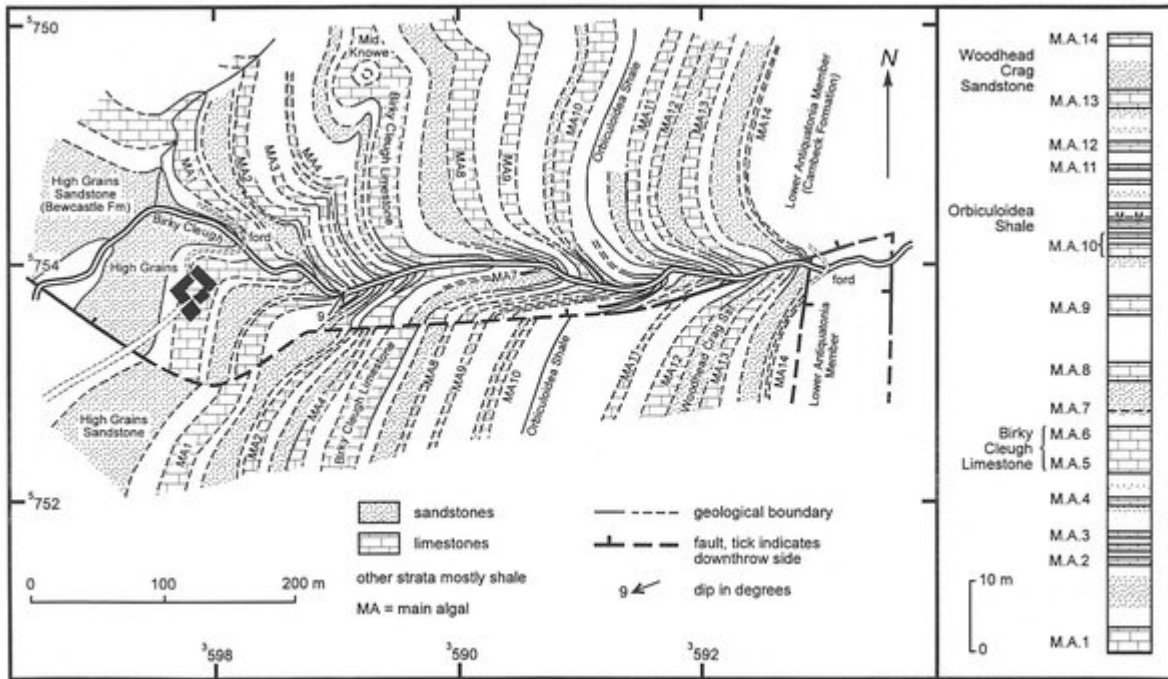
## Bibliography



(Figure 5.1) General geological map of the Gilsland–Bewcastle area showing localities described in the text.



(Figure 5.2) Geological map and section exposed in Ashy Cleugh (based on Day 1970, figs. 8(8),9).



(Figure 5.3) Geological map and section exposed in Birky Cleugh (based on Day 1970, figs. 13(6), 15).