
Chapter 10 The Central Belt — continued. Black Shale Bands east of Peebles and Selkirk

Along the south-eastern margin of the Silurian Tableland, the Silurian rocks are buried under younger Palaeozoic strata mainly of Upper Old Red Sandstone age. Indeed, the red sandstones and conglomerates of the latter formation stretch nearly across the tableland in Lauderdale, where, as already indicated, they fill an old Palaeozoic valley. Further east, between Long-formacus and Dunbar, a narrow belt of similar strata steals across the Silurian territory. Hence, the Tarannon Rocks between Lauderdale and St. Abbs Head form isolated areas separated from each other by Upper Old Red Sandstone.

Throughout the eastern portion of the Llandoverly and Tarannon belt few axial folds expose representatives of the Moffat series. Those which do appear are not very satisfactory, as the order of succession and the relations of the strata are not very clearly defined. Nevertheless, there is important evidence to prove the intercalation of grits and other sediments in the Birkhill division of the Moffat series, near Innerleithen, in the Lugate Water, and in the Gala Water near Fountainhall.

There is one section, however, where some of the sub-divisions of the Moffat series still preserve the lithological types of the Moffat region, viz.: in the Rhymer's Glen, near Melrose.

Rhymer's Glen, Melrose. — [NT 52743 32796] The stream flowing through this romantic glen rises on the slopes of the Bowden Moor, about half a mile to the east of Coldshiels Loch, and runs in a northerly direction towards Huntlyburn House. In the lower part of its course it traverses volcanic tuff of later date than Silurian time (probably Carboniferous), of which a fine section is exposed in the channel of the stream, where it contains large bombs of trachyte. At its southern limit the tuff is mainly composed of angular blocks of greywacke. The junction of the two rocks is visible in the stream, a few yards below the point where it is joined by a small tributary on the west side. Here the greywackes and shales at the side of the footpath on the west side of the stream are truncated by the tuff. Some of the bands of shale are silky, resembling the grey shales containing *M. Sedgwicki* in the Upper Birkhill division of Moffat. Crossing the small tributary, and following the footpath southwards, we may still trace greywackes and shales on the west bank of the stream and at the side of the footpath. They are succeeded by grey mudstones, which, weathering brown and resembling Barren Mudstones, are visible at the side of the footpath and dip S.S.E. It is probable that a fault intervenes between these mudstones and the greywackes and silky shales to the north.

The Barren Mudstones are followed on the south side by a fine exposure of black shales, vertical or nearly so, in the stream and at the side of the footpath. These shales yield graptolites of Hartfell age, as given in the following list:

Diplograptus foliaceus (Murch.)

Diplograptus quadrimucronatus (Hall.)

Diplograptus sp.

Dicranograptus sp.

Retiolites (Neurograptus) fibratus (Lapw.)

Climacograptus tubuliferus (Lapw.)

Climacograptus bicornis (Hall.)

Dicellograptus Forchhammeri (Gein.)

Dicellograptus like *Morrisi* (Hopk.)

Dicellograptus sp.

Leptograptus flaccidus (Hall.)

Siphonotreta micula (M'Coy.)

A fault truncates the southern margin of the black shales, and brings them in contact with Barren Mudstones, which dip south-east on the bank of the burn. Further up stream, the brown mudstones are succeeded by greywackes and shales, which are pierced by a trachyte dyke. At the waterfall, crushed black shales appear on the cliff on the east bank of the stream, which are so shattery that fossils are difficult to obtain in them. They are followed on the north side by grey greywackes and shales, and on the south side by greywackes, that form the waterfall and dip to the north at 75°. The latter are succeeded on the south side by greywackes and shales with silky seams, which have yielded to Professor Lapworth graptolites of Upper Birkhill age.

Further up stream, a fine trachyte dyke, which shows fluxion structure, runs along the west bank, and at the footbridge crosses the burn, where it is in contact with greywackes and shales.

Coldshiels Loch. — [NT 51484 32118] About three-quarters of a mile to the west of the section just described, the representatives of the Moffat series reappear at the S.E. margin of Coldshiels Loch, the intervening ground being covered with drift. When the loch is low and a flat selvage of its floor is exposed, grey shaly mudstones, red shales, and greywacke bands with dark seams are visible. These dark seams yield fossils in considerable abundance, belonging to the horizon of the Birkhill division and the lower portion of the Tarannon beds; as in the subjoined list:

Monograptus spinigerus (Nich.)

Monograptus spiralis (Geinitz.)

Monograptus leptotheca (Lapw.)

Monograptus cyphus (Lapw.)

Monograptus Sedgwicki (Yortl.)

Monograptus Hisingeri (Carr.)

Monograptus communis (Lapw.)

Monograptus attenuatus (Hopk.)

Monograptus triangulatus (Hark.)

Monograptus lobiferus (M'Coy.)

Monograptus priodon (Bron.)

Monograptus turriculatus (Barr.)

Diplograptus tamariscus (Nich.)

Diplograptus sinuatus (Nich.)

Diplograptus sp.

Petalograptus palmaeus (Barr.)

Petalograptus sp.

Climacograptus

On a knoll about 100 yards south-east of the loch, in cultivated ground, debris of black shales occurs, in conjunction with *greywackes*. The horizon of these shales has not been proved.

Lindean Glen — [NT 48831 31526] Westwards, about a mile from Coldshiels Loch, the Moffat Shales are again met with in a small burn about a third of a mile to the north of Lindean Farmhouse. At the head of the rocky gorge, greywackes and shales with white clays and dark seams are seen, followed further down, at the old "coal-pit", by black shales of the *D. vesiculosus* zone. These are succeeded by mudstones and crushed black shales, while at two localities contorted, much jointed grey radiolarian cherts appear. Above the outcrop of the cherts, the black shales are truncated by a fault for a short distance along the north-east bank of the stream. The shales at this point are much crushed and veined with quartz, and graptolites are not easily obtained from them.

Further down, on the north bank, greywackes, clays, and dark seams, followed by grey and red mudstones, are succeeded, on the right bank, by black shales associated with grey shales and clays, which have afforded the following Birkhill fossils:

Rastrites maximus (Carr.)

Rastrites peregrinus (Barr.)

Monograptus spinigerus (Nich.)

Monograptus lobiferus (M'Coy.)

Monograptus Hisingeri (Carr.)

Monograptus attenuatis (Hoek.)

The following species, ranging from the *Climacograptus Wilsoni* zone to the *Monograptus gregarius* zone, were collected many years ago from the beds in Lindean Glen by the Geological Survey:

Monograptus gregarius (Lapw.)

Monograptus tenuis (Portl.)

Climacograptus normalis (Lapw.)

Diplograptus acuminatus (Nich.)

Diplograptus foliaceus (Murch.)

Lasiograptus sp.

Dicellograptus Forchhammeri (Gein.)

Buthograptus laxis (Hall.)

Siculae of graptolites.

This locality is important from the occurrence of the rare form *Buthograptus*, the horizon of which has recently been proved in the Hartfell Scar section (Moffat), viz.: at the base of the *Climacograptus Wilsoni* zone. (See Page 137.)

From the evidence obtained along the line extending from the Rhymer's Glen to Lindean Glen, it is clear that the relations of the Moffat series have been much disturbed by faulting. Originally they must have been arranged as anticlinal arches. In the Rhymer's Glen, the lowest beds exposed are probably the Hartfell black shales, succeeded by the Barren Mudstones. The *D. vesiculosus* bands of the lower Birkhill horizon are not recognisable, but the representatives of part of the Upper Birkhill division occur.

River Tweed, Leaderfoot. — [NT 57531 34695] On the banks of the Tweed at Leaderfoot Bridge much shattered and crushed black shales appear, which have yielded *Diplograptus foliaceus*, *Climacograptus tubuliferus*, *Pleurograptus linearis*.

Pirn Quarry, Innerleithen. — [NT 34090 37307] In the exposures just referred to, some of the sub-divisions of the Moffat series still preserve the characteristics met with in the Central Moffat area; but in the valley of the Tweed, upwards to near Innerleithen, evidence of the intercalation of members of the Birkhill group in coarser sediments has been obtained by Professor Lapworth, the late Mr. R. Mathieson, Innerleithen, and Mr. Wilson, Galashiels. For example, in the Pirn Quarry, by the roadside, about three-quarters of a mile east of Innerleithen, hard blue grits with bands of grey and dark shales, to all appearance regularly interbedded in them, include a band or lenticle of dark sandy shales lying on the face of the quarry, whence the following collection of graptolites was obtained by the late Mr. R. Mathieson, and named by Professor Lanworth:

Monograptus cyphus (Lapw.)

Monograptus argutus (Lapw.)

Monograptus leptotheca (Lapw.)

Monograptus crenularis (Lapw.)

Monograptus tenuis (Portl.)

Climacograptus normalis (Lapw.)

Dawsonia campanulata (Mich.)

Discinocaris browniana (Woodw.)

Orthoceras.

The following assemblage was collected by Mr. Wilson, Galashiels, from the same quarry:

Monograptus cyphus (Lapw.)

Monograptus gregarius (Lapw.)

Monograptus argutus (Lapw.)

Monograptus attenuatus (Hopk.)

Monograptus crenularis (Lapw.)

Climacograptus normalis (Lapw.)

Woolandalee Burn (Leithen Water Basin). — [NT 32031 45181] Northwards from Innerleithen, the gradual disappearance of the representatives of the Birkhill Shales is still more apparent, for only fragments of undoubted *Monograptidae* and other forms are obtainable in thin films intercalated in coarse sediments. About five miles up the Leithen Water, this stream receives the Woolandslee Burn, in which, about a mile up from the foot, brown, cleaved, micaceous shales appear, resembling the Lowther Shales, and having a general dip to N.N.W. At a point on the west bank of the stream opposite Woolandslee Tower, a form resembling *Diplograptus tamariscus* was found in a dark blue seam. Rather more than half a mile further up, and about 70 yards above the junction of a small burn on the east side of the valley, several graptolites were found in thin fissile shales with dark seams. The shales, which occur on the west bank, are shattery, iron-stained, and break into thin splintery fragments. From these beds two species of *Climacograptus*, *Monograptus tenuis*, *Dimorphograptus*, and *Diplograptus* were obtained. All these forms are here small. The peculiar

shales that contain them closely resemble those at the roadside near Bower, on the Gala Water, to be described presently. They are here associated with blue flags and greywackes, either vertical or dipping down stream at angles from 70° to 80° In this stream also, at the bend above Thorter Cleuch, and about a mile from the watershed, a section shows alternations of white clayey bands and grey mudstones or shales with black or dark seams, the latter yielding fragments of very minute graptolites (*Climacograptus* and *Diplograptus*). This locality is not far south of the boundary line of the Llandoverly Rocks.

Ladyside Burn (Basin of the Heriot Water). — [NT 36570 49346] Still further to the north-east, graptolites belonging to the Lower Birkhill division have been obtained from thin seams in massive grits and greywackes in the Ladyside Burn, a tributary of the Heriot Water, eight miles north of Innerleithen. The Llandoverly boundary line crosses this burn about 1100 yards south from its point of junction with the Heriot Water. North of this line a fine development may be seen of brown shales and mudstones, with limestone nodules; while to the south massive grits supervene with blue leaf-like seams, in which occur fragments of Birkhill graptolites. The best fossiliferous locality in this neighbourhood lies about a mile up stream from the junction with the Heriot Water. Here specimens of *Climacograptus normalis*, *Monograptus attenuatus*, *M. tenuis* (?) were obtained; also the proximal portions of graptolites, either *Monograptus* or *Dimorphograptus*.

Wolf Cleuch, Dewar Water. — [NT 34430 47895] Again in the small tributary of the Dewar Water named Wolf Cleuch, about seven miles north of Innerleithen, dark seams in the greywackes enclose fragments of *Climacograptus* like those intercalated in the Llandoverly grits in Ladyside Burn. The Gala Water at Fountainhall, and the Lugate Water, with its tributaries, supply additional evidence of the intercalation of various sub-zones of the Birkhill Shales in grits, conglomerates, greywackes, and shales, as shown by Professor Lapworth. It would thus appear that various sediments of considerable thickness are interbedded with the Birkhill sub-divisions, ranging from the *D. acuminatus* zone to that of *Monograptus spinigerus*. Sections illustrating this feature occur near Fountainhall Station, and in tributaries of the Gala Water that drain the western side of the valley.

Quarry at Bower, near Fountainhall. — [NT 42928 50083] In this quarry, at the roadside, on the east bank of the Gala Water, about half a mile north of Fountainhall Station, a thin band of blue-black flaky shales is interleaved in greywackes and shales, yielding graptolites sparingly, and of no great variety, viz.: *Climacograptus normalis*, *Diplograptus*, and *sicalae* of graptolites. Not improbably this band may be on the horizon of the *D. acuminatus* zone. The strata exposed by the roadside south of the quarry consist of grits, greywackes, flags, and shales, dipping mainly to the north-west.

Still Burn. — [NT 42605 49187] In this tributary, which unites with the Gala Water about a quarter of a mile to the south of Fountainhall Station, some of the bands exposed have been correlated by Professor Lapworth with those of the *D. acuminatus* zone. Near the foot of the burn, at a point about 400 yards westwards from the Still Burn bridge, in a small tributary rivulet, grey, flaky, iron-stained shales occur like those in the Bower Quarry. In the Still Burn, west from the wood, the strata resemble lithologically the Hawick Rocks. Further up the stream, and not far to the west of Howliston Farmhouse, blue-grey shales appear which might, on further examination, prove to be fossiliferous. They are exposed only at intervals, and consist for the most part of grey-blue sandy shales with occasional flags, and as a rule are much crushed and shattered.

Sit Burn. — Crossing the watershed to the Sit Burn, which joins the Lugate Water about half a mile to the west of Overshiels, we find massive pebbly grits or conglomerates at a point about a mile up from the junction, not far below the spot where the Heathery Burn is crossed by a stone dyke [NT 39621 48202]. Above the junction of the two small streams, the Heathery and Fernie Burns, which unite to form the Sit Burn, an exposure of grey thick mudstone bands is succeeded southwards by grits, the whole dipping up stream. Below the junction of the streams [NT 39414 47595] shales and sandy mudstones dip north-north-west at high angles, and are followed by grits. At a point half a mile up from the foot of the Sit Burn similar shales and mudstones appear [NT 39440 47458]. A little further down this stream, blue-grey sandy shales yield *Climacograptus normalis*. These strata are followed southwards by alternations of grits and shales, till, at and near the foot of the burn, greenish thick-bedded flaggy worm-piped shales are met with.

Lugate Water. — [NT 39847 46795] The geologist who ascends this stream above the foot of the Sit Burn comes upon the same worm-piped blue flaggy shales, together with grey shales and blue, almost black, mudstones. At one point about 300 yards west from the foot of the Sit Burn, blue, almost black, mudstones and shales, which yield

Climacograptus, can be followed to the foot of the Ewes Water. About half a mile up the Lugate Water from that confluence an important section is to be seen in which certain bands furnish a suite of fossils characteristic of the *M. gregarius* zone [NT 39130 46374]. Here the stream divides near the west margin of Sheet 25 of the Survey Map. About 32 yards below the forkings, grey sandy platy shales occur dipping up stream (N.N.W.) about 70°. These contain dark or black seams alternating with grey shales, which have supplied the following forms:

Monograptus gregarius (Lapw.)

Monograptus attenuatus (Hopk.)

Monograptus triangulatus (Hark.)

Monograptus Sandersoni (Lapw.)

Monograptus cocinnis (Lapw.)

Monograptus lobiferus (M'Coy.)

Diplograptus tamariscus (Nish.)

Petalograptus palmaeus (Barr.)

Climacograptus normalis (Lapw.)

Rastrites peregrinus (Barr.)

Discinocaris browniana (Woodw)

Peltocaris aptychoides (Salt.)

These strata are followed northwards by pebbly grits and greywackes, visible a few yards above and below the fork. On the south side, the *M. gregarius* beds are likewise succeeded by grits, followed by sandy dark shales with calcareous ribs, and sandy mudstones with dark streaks yielding graptolites. Grits come next for a short distance, till at a point at the head of an alluvial plain, about 250 yards below the fork, grey-blue shales with dark streaks yielding *Rastrites peregrinus*, *Climacograptus normalis*, and *Diplograptus*, are met with. For a distance of 400 yards down stream no rocks are exposed, for the stream flows along an alluvial flat. At a point, however, 100 yards up from the junction with the Ewes Water on the west bank, grey, sandy, shaly greywackes and shales with dark strains, may be seen, from which the following forms were obtained, viz.: *Monograptus spinigerus*, *M. attenuatus*, *M. tenuis*, &c.

Ewes Water (Trously), tributary of the Lugate (Lugatehead). — [NT 38407 45915] This stream, above its junction with the Lugate, lays bare a good section of blue flaggy shales with grey sandy mudstones, and exposes also a band of fine conglomerate (Haggis Rock) a short distance below the shepherd's house of Trously. Further up the stream the strata consist of grits, flags, and shales, dipping to the N.N.W. and much shattered by faults. Below the point where several streams from the Deaf Heights unite, fault breccia is visible. Where the Ewes Water takes a bend to the south-west about half a mile to the south of Trously [NT 38348 45204], blue sandy shales and flags with dark seams yielded the following forms:

Monograptus spinigerus (Nich.)

Monograptus attenuatus (Hopk.)

Monograptus lobiferus (M'Coy.)

Monograptus tenuis (Portl.)

Monograptus (not determ.)

Rastrites sp.

Climacograptus normalis (Lapw.)

The scar that runs north and south from the Deaf Heights exposes grey sandy shales and mudstones and greywackes much weathered.

From the evidence now adduced, it seems clear that the *Monograptus gregarius* zone and the *Monograptus spinigerus* zone in the basins of the Lugate, and of the Gala near Fountain-hall, are intercalated in grits, conglomerates, and shales. These appear to be the normal outcrops of the respective zones along the northern margin of the Llandoverly area. It is apparent, therefore, that a great change has here taken place in the lithological character of the Birkhill division, compared with the normal type of the Moffat region.

Earnsclough Burn, 2½ miles N.N.E. of Lauder. — The representatives of the Moffat series reappear in an isoclinal fold in the Earnsclough Burn, one of the tributaries of the Leader to the north-east of Lauder. In the lower two miles of its course this stream flows through Upper Old Red Conglomerate, excellent sections of which are visible on its north bank, west of Earnsclough Farmhouse [NT 54483 51833]. About 200 yards north of that house, in an old channel of the burn, in two small exposures, the Lower Black Shales (Glenkiln–Hartfell) appear, much jointed, decomposed, breaking in small angular fragments, and including thin black flinty bands and decomposing yellow clays.

About 200 yards still further to the north-east a big scar rises on the north-west bank of the burn. At its western end greywackes and shales are truncated by a fault that brings them in contact with the grey cherts, black flints and shales; from which black shales the following fossils have been obtained:

Climacograptus caudatus (Lapw.)

Climacograptus bicornis (Hall.)

Climacograptus sp.

Dicellograptus moffatensis (Carr.)

Dicellograptus sp.

Diplograptus foliaceus (Murch.)

Leptograptus flaccidus (Hall.)

Corynoides curtus (Lapw.)

Cryptograptus tricornis (Carr.)

Some 200 yards still higher up, on the north bank, an exposure of dark grey sandy worm-piped shales has yielded *Monograptus lobiferus*, *M. exiguus*, *M. spinigerus*, *Monograptus* sp. From this point for a distance of half a mile, to within 200 yards from the mouth of Drakestruther Burn, there is a constant repetition of flaggy shales with calcareous ribs and grey flinty bands weathering with a cream colour. The last of these members has a certain resemblance to some of the flinty bands in the zone of radiolarian cherts, but there can be no doubt that they here occupy a position at or near the base of the Tarannon series. About 300 yards down stream from the mouth of the Drakestruther Burn [NT 55205 52860], the shaly series now referred to yields *Myrianites*. At the northern edge of this series below Drakestruther Burn, massive grits alternate with shales followed by a mass of grits that are pebbly in places.

For a distance of 200 yards above Drakestruther the Earnsclough Burn flows along the strike of the beds of grit. Thereafter it bends at a right angle to the north, and traverses a peculiar series of dark shales with calcareous ribs and flinty bands. Still ascending the stream, we meet with a coarse pebbly grit, succeeded by shales. Next come alternations of grits and worm-tracked shales; some of the grits, as at Bermuda shepherd's house [NT 55725 53915], being massive.

About half a mile above that house, at a prominent bend of the burn, in a scar on the south bank, grey sandy worm-tracked shales and dark shales have furnished at the base of the cliff *Monograptus spinigerus*, and at the top *M. lobiferus* and *M. leptotheca*. Near this scar the stream takes a marked bend to the north, and from this point upwards the beds are chiefly composed of shales. About 150 yards up stream from the bend, shales on the south side of a massive grit yielded *Monograptus spinigerus*, while on the north side they furnished excellent examples of *M. lobiferus*. Northwards pebbly grits and brown sandy shales, at a spot 100 yards below the mouth of the Green Burn, supplied in great abundance from certain thin seams, *Monograptus spinigerus*, *M. leptotheca*, *M. lobiferus*, *M. attenuatus*.

For a short distance a band of grit is exposed, but owing to a slight bend in the strike the same shales with *M. spinigerus* appear in the stream, where they contain, in addition to the forms already mentioned, *Petalograptus palaeus*.