Slot Burn, Ayrshire

[NS 681 321]–[NS 680 321]

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Introduction

Slot Burn lies about 4.5 km north of Muirkirk in the Lesmahagow Inlier. This is one of four inliers of Silurian age in the central part of the Midland Valley of Scotland, along with the smaller inliers of the Hagshaw Hills, Charmichael and Eastfield see (Figure 2.5) and (Figure 2.11). Structurally the Lesmahagow Silurian is folded into an asymmetrical anticline, and in terms of age it includes Llandovery and Wenlock series sediments, at least, with those of the Slot Burn site belonging to the Wenlock Series, some 426 million years old. Enveloping the inlier are Devonian and Carboniferous strata.

Murchison (1856) was an early commentator on the geology of the Lesmahagow area. He was followed in the late 19th century by Peach and Horne (1899; see (Figure 2.19)), who provided in their classic memoir on the Scottish Silurian a much more in-depth account, including a description of the rocks in Slot Burn. The mapping of Jennings (1961) provided the basis for our current understanding of the geology of the inlier. In particular it led to the establishment of stratigraphical units for the Silurian succession there, and these have been used without qualification by nearly all authors subsequently. Rolfe (1973b, 1992b), Ritchie (1968, 1985), Walton and Oliver (1991), and Dineley (1999a), for example, all employed the stratigraphical terminology of Jennings in their various geological and palaeontological works relating to the inlier. Most recently, however, investigations by Paterson *et al.* (1998) have produced a slightly modified lithostratigraphy for a few of the units. Lovelock (1998) carried out a biofacies and environmental analysis of the Lesmahagow Silurian strata.

Historically, the Silurian rocks of the Lesmahagow, Hagshaw and Carmichael inliers have been notable for yielding a variety of non-trilobite arthropods (see, for example, Currie, 1927; Rolfe, 1960, 1962a, 1962b, 1973, 1992b; Ritchie, 1968; Selden and White, 1983; Siveter, 2000a; Palmer, 2000; Tetlie and Braddy, 2004). Peach and Horne were among the earliest authors to note arthropods from Slot Burn, recording two eurypterids, a phyllocarid crustacean and a myriapod from here. Størmer (1934, 1936), Lamont (1955), Ritchie (1968) and Waterston (1979) (see (Figure 2.20)) all studied the eurypterids from Slot Burn. Plotnick (1999) then used a eurypterid species database from here in his analysis of the habitats of Siluro-Devonian members of the group. Rolfe (1980) and Almond (1985) commented on supposed myriapods from the locality.

Thus in terms of its arthropod fauna, Slot Burn came to prominence essentially because of its eurypterids. It is,. however, probably an even more famous locality for fossil fish and it has been included in the JNCC volume covering that topic (Dineley and Metcalf, 1999). The site is otherwise known in the literature as 'Segholm', 'Seggholm', or 'Seggieholm', after the house of the same name that lay about 180 m downstream from the locality; and which even at the time of Peach and Horne was in ruin. In addition to the fossil arthropod importance of this site, the area is also independently selected for the GCR for the Silurian–Devonian Chordata selection category.

Description

Jennings (1961) divided the Silurian of the Lesmahagow Inlier into Priesthill succeeded by Waterhead and then Dungavel groups, with each containing several formations. Above the Dungavel Group there are Old Red Sandstone conglomerates and sandstones of the Devonian. Paterson *et al.* (1998) recognized a Ponesk Burn Formation for those strata originally forming the lower part of the Patrick Burn Formation, Priesthill Group, of Jennings. Other modifications that Paterson and his co-workers introduced were to alter slightly the boundaries of the Castle, Kip Burn and Blaeberry formations within the Priesthill Group. Also, they did not recognize the Passage Formation of Jennings at the base of the Waterhead Group, and they reassigned the argillaceous strata in the lower part of this formation to the underlying

Dunside Formation at the top of the Priesthill Group. The incoming of red beds into the sequence was arbitrarily taken by Paterson and his colleagues to mark the base of the Waterhead Group.

The Priesthill Group is generally thought to be of late Llandovery age, though on palynological grounds beds as old as those within the Patrick Burn Formation of this group, and so all younger formations of the group, may be Wenlock in age (Wellman, 1995; Anderson and Moore, 2004). The Waterhead Group has been assigned to the Wenlock Series, and some part of the Dungavel Group may belong to the Ludlow Series (Wellman and Richardson, 1993; Cocks *et al.,* 1992; Palmer, 2000; Paterson *et al.,* 1998)

The stream in Slot Burn flows ENE into the head of Greenock Water, and on the sides of the burn are sediments of the Slot Burn Formation of the Waterhead Group. In the vicinity of Slot Burn and its tributary from Spindle Burn the formation is about 85 m thick. It is composed of similar sediments to those of the slightly older Dippal Burn Formation of the same group. They comprise thin beds of alternating greenish-grey mudstone, siltstone and silty sandstone. Planar bedding or sometimes ripple- or cross-bedding is present in the sandstones. Basal erosion surfaces and loading features are typical of some of the beds.

Grey and red variegated mudstones occur near the base of the formation, these being transitional from the red sandstones, siltstones and mudstones of the underlying Monument Formation. The variegated units are succeeded by the grey mudstones and laminated siltstones that make up the 5 m thick Slot Burn Fish Bed, which itself includes two main productive horizons, a lower one 1–1.3 m thick and an upper one 1 m thick that occurs some 15–20 m upstream (Paterson *et al.,* 1998; Dineley, 1999a). This same mudstone–siltstone lithology occurs several times within the lower part of the Slot Burn Formation, and is also reflected in the dark grey fissile mudstones that form the Dippal Burn Fish Bed which crops out about 1.5 km to the east. The Slot Burn Fish Bed contains, as well as important early vertebrates, arthropods that form the basis for listing the site in the present volume. In addition to Slot Burn, the eponymous formation is also exposed in the tributaries that lead into Dippal Burn from the north and also in the adjacent Auchingilloch Glen. Peach and Horne (1899) described the Slot Burn and Dippal Burn fish beds as part of their stratigraphical group number nine, horizon 6c (Figure 2.19).

The stylonuroids *Stylonurella spinipes* (Page, 1859), *Parastylonurus ornatus* (Laurie, 1892), and *Brachyopterella ritchiei* Waterston, 1979, together with the non-stylonuroids *Lanarkopterus dolichoschelus* (Størmer, 1936) and *Nanahughmilleria* sp. make up the eurypterid fauna recorded from Slot Burn (see Peach and Horne, 1899; Størmer, 1934, 1936; Lamont, 1955; Ritchie, 1968; Waterston, 1979; Plotnick, 1999; (Figure 2.20) and (Figure 2.21). The site stands as the type locality for the *Lanarkopterus* and *Brachyopterella* species.

The phyllocarid *Ceratiocaris laxa* (Etheridge, Jones and Woodward; see Rolfe and Burnaby, 1961) and a myriapod have also been listed from Slot Burn (Peach and Horne, 1899). However the presence of *Ceratiocaris,* at least, has been dismissed (Ritchie, 1968) and the myriapod record remains unsubstantiated. Nevertheless, the type species of the enigmatic *Dictyocaris, D. slimoni* Salter, 1860, a genus considered by some to possibly be a phyllocarid, has also been found in association with *L. dolichoschelus.* The enigmatic arthropod *Pseudarthron whittingtoni* Selden and White, 1983 has recently been listed (Paterson *et al.,* 1998) from Slot Burn, though when the species was established just a single specimen was available, from the Slot Burn Formation of South Hill quarries in the Lesmahagow Inlier, some 10 km to the NNW. Associated, non-arthropod elements in the Slot Burn site include the agnathans *Birkenia, Lasanius, Lanarkia, Sheilia* and *Ateleaspis,* together with *Pachytheca, Taitia* and *Parka* plant material (Ritchie, 1968; Dineley, 1999a)

Interpretation

The Priesthill group — is fully marine in its lower part (Ponesk Burn Formation) and in its upper part (Patrick Burn Formation) it changes to restricted marine influenced by turbidite flows (Paterson *et al.,* 1998). The Waterhead Group, which consists of red and purple siltsones and sandstones, is continental in origin. These latter sediments were fluvially derived, except for some within the Dippal Burn and Slot Burn formations, including the fish bed horizons, which are probably of lacustrine origin. The fluviatile sedimentation that existed throughout most of the Waterhead Group times was apparently interrupted twice through blockage to the drainage system, which led to the formation of lakes and the deposition, when waters were at their highest, of the sediments comprising the fish beds. The Dungavel Group sediments

indicate stable terrestrial conditions. The Silurian succession of Lesmahagow, as with almost all other Silurian successions in the Midland Valley, charts a regression from the marine turbidites of the Llandovery through into the fluviatile and lacustrine non-marine facies of Wenlock and later times. In the Girvan area, however, marine conditions continued into the early Wenlock.

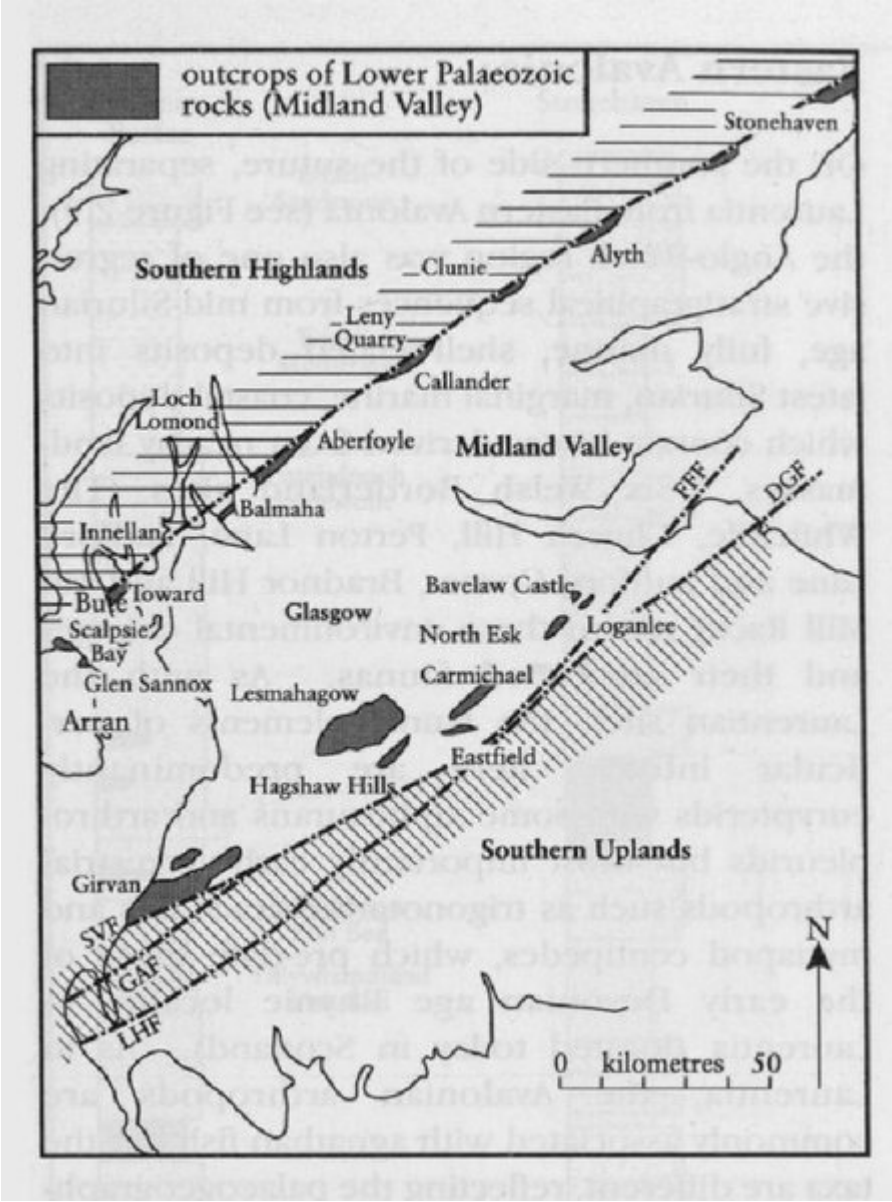
Størmer (1936) and Lamont (1955) both described material of *Lanarkopterus dolichoschelus,* originally a manuscript species of Laurie (see Peach and Horne, 1899), before Ritchie assembled much more material, both from his own field collections and also from that identified by him from museums. This enabled the morphology of the species to be known almost completely and a new genus to be established for it. *Lanarkopterus* is known only from the Lesmahagow area. Similarly, prior to the establishment of *B. ritchiei, Brachyopterella* was known from just one species based on three specimens. The description of the Scottish material showed for the first time the nature of the opisthosoma and abdominal appendages in a species of this genus. The material of *Stylonurella spinipes* from Slot Burn, a single specimen, was only the second specimen of this species to have been found and added to our knowledge the morphology of the species. The affinities of *Pseudarthron whittingtoni* are unknown.

Slot Burn has close network links with the other Scottish Siluro-Devonian arthropod sites at Gutterford Burn, Dunside and Turin Hill. These other sites are also rich in eurypterids, and in both Slot Burn and especially Gutterford Burn stylonuroid species are well represented. Slot Burn also has links with the younger, Ludlow through to P■ídolí Series Anglo-Welsh arthropod sites of Church Hill, The Whiteliffe, Ludford Lane and Ludford Corner, Tin Mill Race, Perton Lane, and Bradnor Hill, all of which have eurypterid faunas, though of a different composition. The fish–eurypterid biofacies of the Slot Burn site has been compared, at least in broad compositional terms, with that of penecontem-poraneous sites in the nearby Hagshaw Hills and ones from Wenlock and Ludlow age rocks of the Ringerike area of Norway (Rolfe, 1961; Ritchie, 1968).

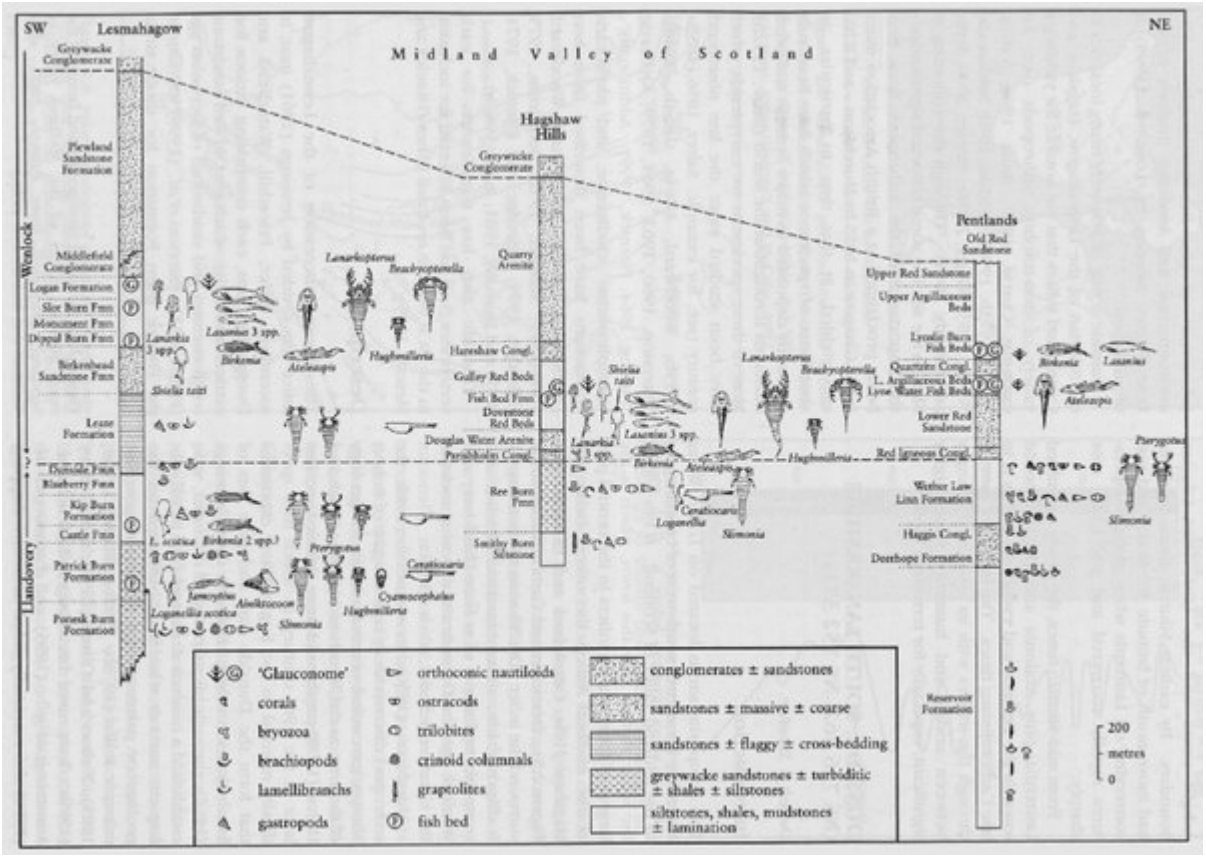
Conclusion

This Lesmahagow site is best known for its eurypterid fauna, totalling five species, two of which have it as their type locality. The eurypterid specimens from here have added significantly to our ¯knowledge of rare species. The fauna is of Wenlock Series (Silurian) age, unlike those of other eurypterid-based sites described in this volume from Scotland, which occur in Llandovery Series or Devonian strata, or those from the Anglo-Welsh area, which are from Ludlow and P■ídolí series rocks. Analogues of the Slot Burn biofacies are present in Silurian strata of the adjacent Hagshaw Hills and the Ringerike area, Norway.

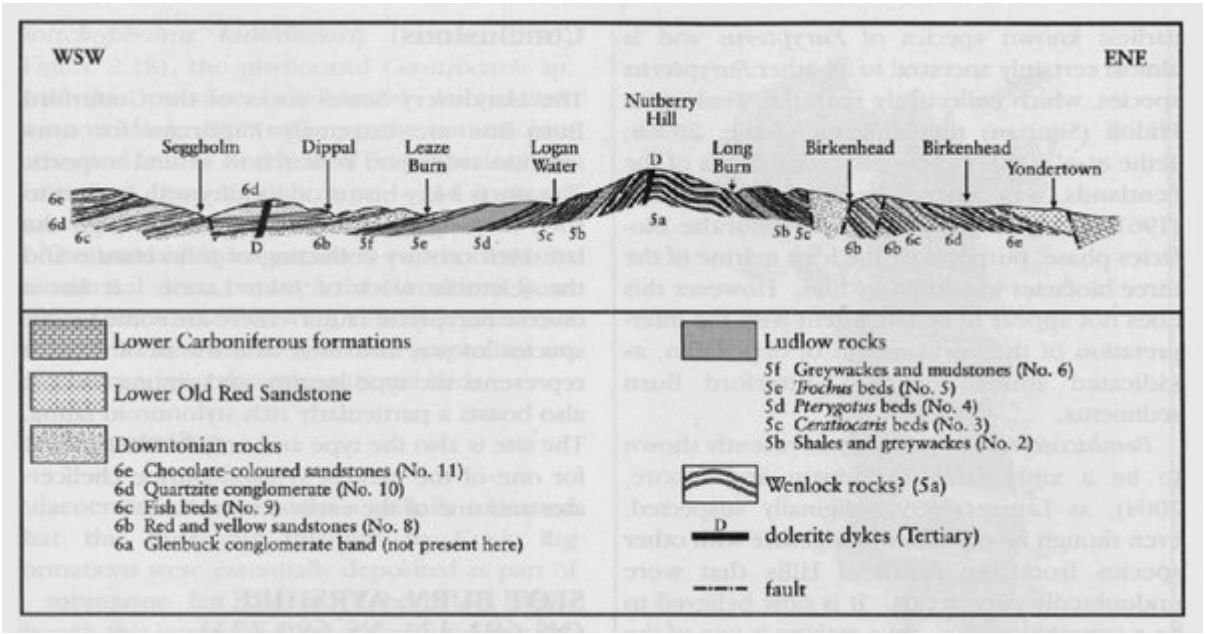
References



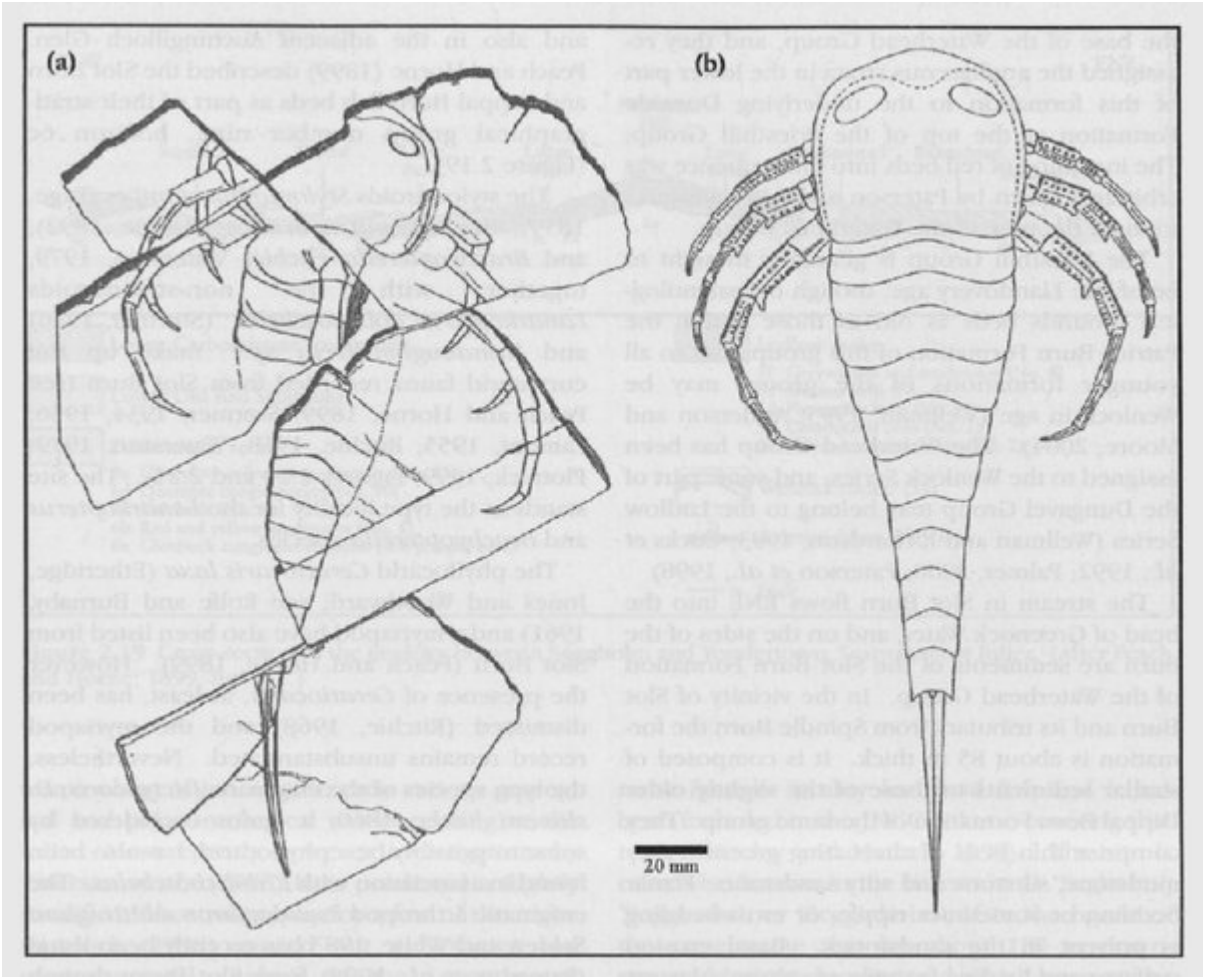
(Figure 2.5) Location of the main Silurian inliers of the Midland Valley of Scotland, and faults. SVF Stinchar Valley Fault; GAF Glen App Fault; LHF Leadhills Fault; FFF Firth of Forth Fault; DGF Dunbar–Gifford Fault; HBF Highland Boundary Fault. (After Palmer, 2000 and Bluck, 2002.)



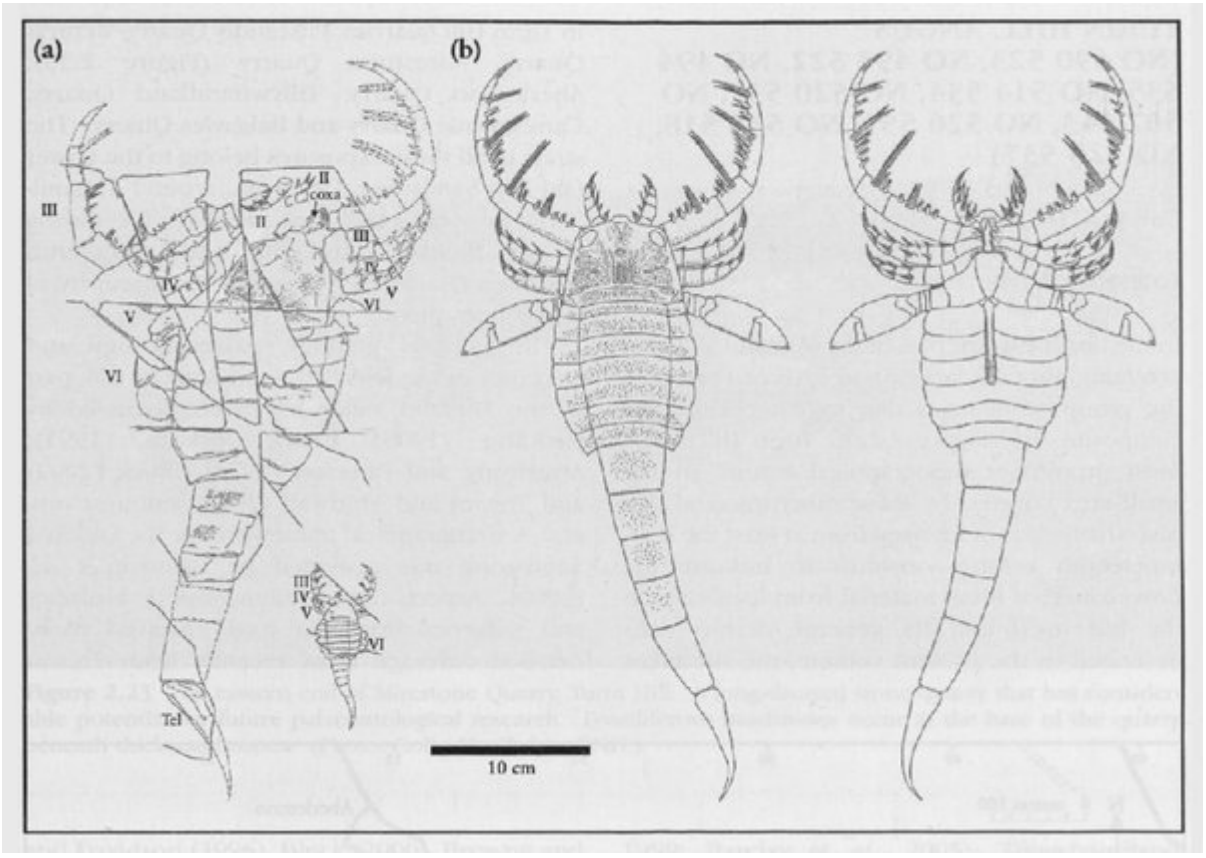
(Figure 2.11) (overleaf) Stratigraphy and faunas of the main Silurian inliers of the Midland Valley of Scotland. (Modified from Palmer, 2000, after Wellman and Richardson, 1993.)



(Figure 2.19) Cross-section of the geology between Seggholm and Yondertown, Lesmahagow Inlier. (After Peach and Horne, 1899, fig. 117.)



(Figure 2.20) Brachyopterella ritchiei Waterston, 1979; holotype, National Museums of Scotland, NMS 6.1968.14; Slot Burn Formation, Waterhead Group, Wenlock Series, Silurian, Slot Burn, Lesmahagow Inlier. (a) Line drawing of the holotype specimen; (b) reconstruction, dorsal view. (From Waterston, 1979, text-fig. 11.)



(Figure 2.21) Lanarkopterus dolichoschelus (Størmer, 1936); Slot Burn Formation, Waterhead Group, Wenlock Series, Silurian, Slot Burn, Lesmahagow Inlier. (a) Drawing of largest and smallest individuals, National Museums of Scotland, NMS G.1967.65.1 and 2 respectively. II–IV, first to fourth 'walking' legs; VI, swimming leg; Tel, telson. (b) Reconstruction, dorsal and ventral views. (From Ritchie, 1968, figs 3–5.)