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## Yewdale Beck

[SD 3073 9858]–[SD 3073 9850]

### Introduction

The Llandovery rocks of the Lake District are exposed in a narrow ENE–WSW strip of outcrop extending from Broughton Mills in the west, across the heads of Coniston Water and Lake Windermere to Browgill, near Shap, in the east (Figure 3.49). The term 'Stockdale Shales' was first applied to these strata by Aveline and Hughes (1872), who referred them to the upper Silurian. Some debate followed, in which several authors (e.g. Nicholson, 1874; Hicks, 1876; Lapworth, 1876b) argued that these strata were of Llandovery, not upper Silurian, age. Marr and Nicholson (1888) used the terms Skelgill Beds and Browgill Beds for the two subdivisions of the Stockdale Shales, confirmed that they were conformable on the underlying Ashgill shales, and affirmed their Llandovery age. They also introduced a biozonation using graptolites and trilobites. This biozonation, as applied to the Lake District and the Howgill Fells, was refined by Rickards (1970a) and Hun (1974), who based their biozones entirely on graptolites. The stratigraphy and palaeogeography of the Llandovery strata in the Lake District have been summarized by Rickards (1978).

The lithostratigraphy of the Windermere Supergroup (Late Ordovician to late Silurian) of northern England has been formalized by Kneller *et al.* (1994), who defined a Stockdale Group divided into the Skelgill and Browgill formations. They also identified a Spengill Member at the base of the Skelgill Formation, equivalent to the 'Basal Beds' of previous authors (Marr and Nicholson, 1888; Hutt, 1974; Rickards, 1978). This member comprises pale mudstones mainly referable to the *persculptus* Biozone (latest Ordovician), but locally extending up to the lower *atavus* Biozone.

Four GCR sites in the Lake District together form a network that provides a coverage of the lithostratigraphical and biostratigraphical units in the area and illustrates regional variations. These localities are at Yewdale Beck, Skelghyll Beck, Brow Gill Beck, and Spengill. The Ordovician–Silurian boundary can only be recognized unequivocally, on the basis of graptolites, in the western Lake District, where a particularly well-exposed continuous section is displayed in Yewdale Beck (Rickards, 1988; (Figure 3.50)). This is, therefore, an important site for regional and national Lower Palaeozoic lithostratigraphy and biostratigraphy. It has yielded rich graptolite faunas and is the type locality for a number of taxa, including *Pristiograptus fragilis pristinus* Hutt, 1975, *Atavograptus ceryx* (Rickards and Hutt in Rickards, 1970a), *Coronograptus cirrus* Hutt, 1975, *Monograptus capis* Hutt, 1975, and *Mongraptus cerastus* Hutt, 1975.

### Description

A measured section across the boundary in Yewdale Beck was illustrated by Rickards (1988, fig. 4). At the base are 7 m of Ashgill Formation, comprising grey shales and siltstones with calcareous nodules and containing a fauna of abundant brachiopods and some trilobites; these are of Hirnantian (late Ashgill, Ordovician) age. Succeeding these are 0.3 m of blue-grey shales with a good graptolite fauna including *Glyptograptus persculptus* and other indicators of the *persculptus* Biozone; shelly fossils, including abundant specimens of the brachiopod *Kaysarella* sp. also occur (Hutt, 1974). These shales mark the base of the Skelgill Formation, and Hutt (1974) presented a detailed measured section through the exposed 31.5 m of the formation from the base of the *persculptus* Biozone (Figure 3.51). *Parakidograptus acuminatus* first occurs at 0.3 m, together with other typical members of the *acuminatus* Biozone fauna, and marks the base of the Silurian System. Graptolites are found throughout the remainder of the section, with the greatest abundance in the pyritous, blackest mudstones of the *acuminatus* and *atavus* biozones. The *triangulatus* Biozone is cut out by a strike fault, but otherwise the section is complete up to the basal *convolutus* Biozone, which is exposed on the right bank of the stream.

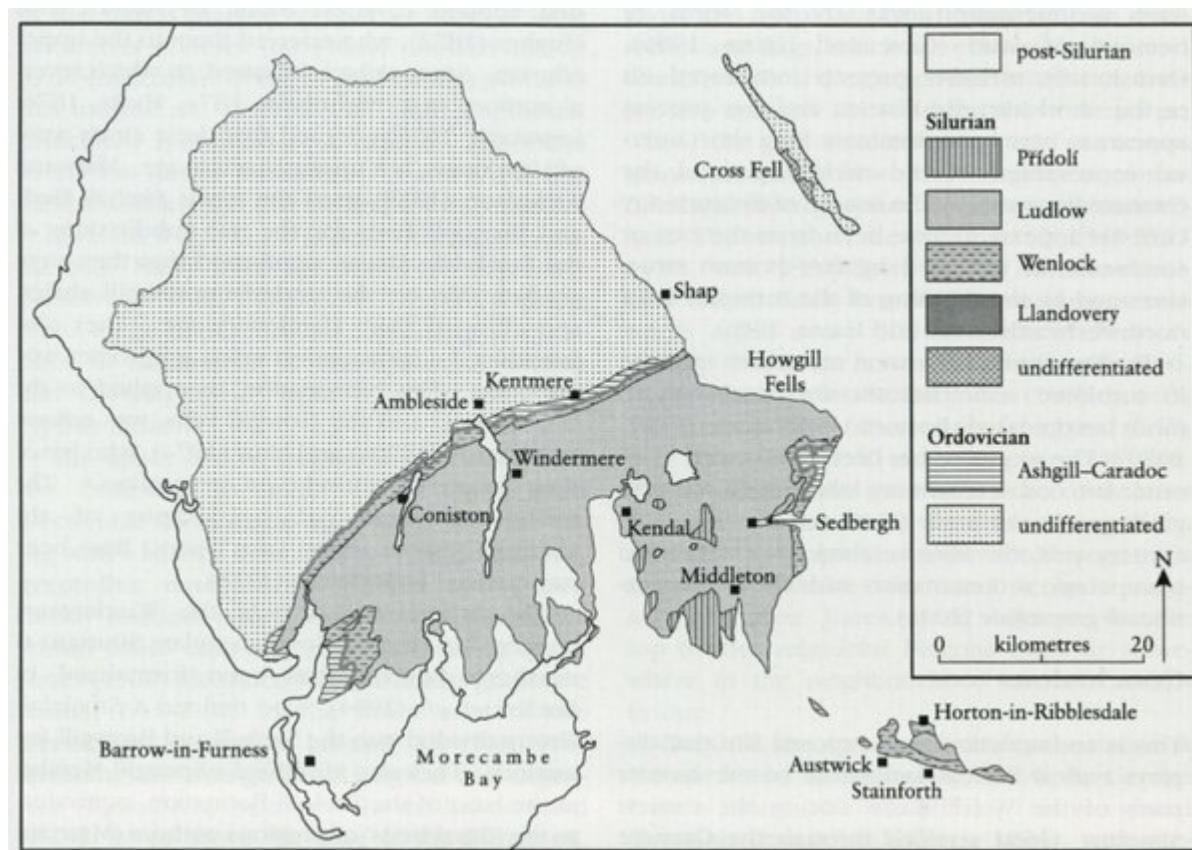
### Interpretation

The Lake District Basin was developed in the late Ordovician and Silurian on the subsiding remnants of an Ordovician volcanic arc terrane (see Chapter 1). The Rhuddanian and Aeronian black shales of the basin reflect a deepening environment following the glaciogenic sea-level lowering of the late Ordovician. Rickards (1978), following Hutt (1974), presented a general interpretation of the depositional setting of the basal Silurian strata in the Lake District, envisaging a westward or north-westward facing fault scarp against which the black offshore shales of the Yewdale Beck area were deposited (Figure 3.52). Regional evidence suggests that the scarp feature was buried by the accumulating black shale deposits by upper *atavus* Biozone times. The blackness of the shales and the richness of their graptolite faunas suggests an anaerobic environment pertained on the sea bed in this western area throughout the Rhuddanian and for much of the Aeronian. This deep-water anoxia may reflect the stagnant oceanic conditions interpreted for the Spirodden Secundo Episode by Aldridge *et al.* (1993a).

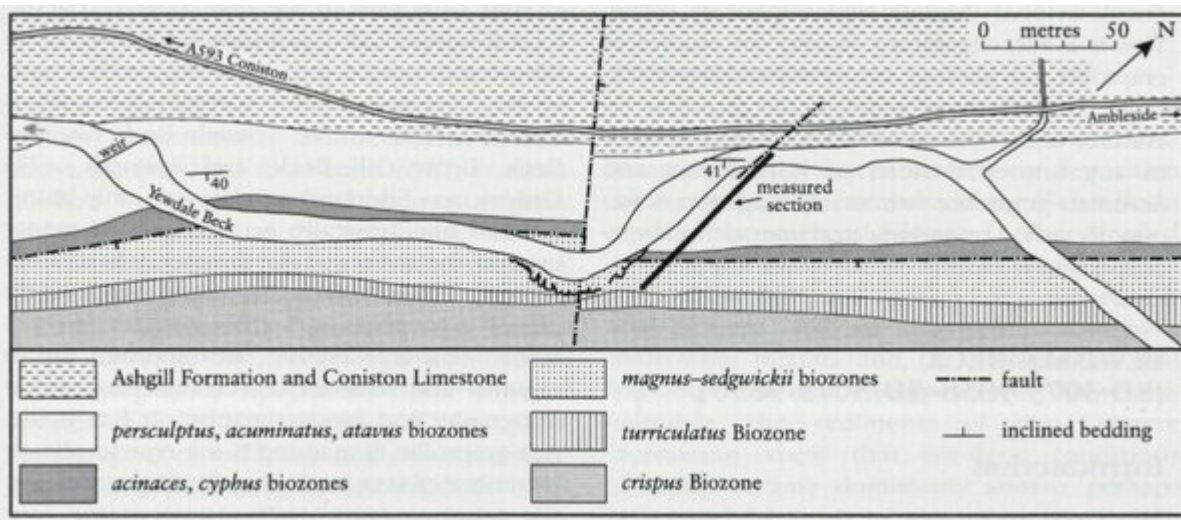
## Conclusions

This is an important section in the western Lake District, straddling the Ordovician–Silurian boundary. Biozonal graptolite faunas of the latest Ordovician *persculptus* Biozone and the earliest Silurian *acuminatus* Biozone allow precise recognition of the position of the boundary. A nearly complete sequence through much of the Skelgill Formation, rich in graptolites throughout, is well exposed and provides a representative sequence through the local Rhuddanian–Aeronian black shales. The sections in this area can be contrasted with those farther east in the Lake District to develop a model of the fault-controlled topography of the sea bed during the early Silurian eustatic deepening.

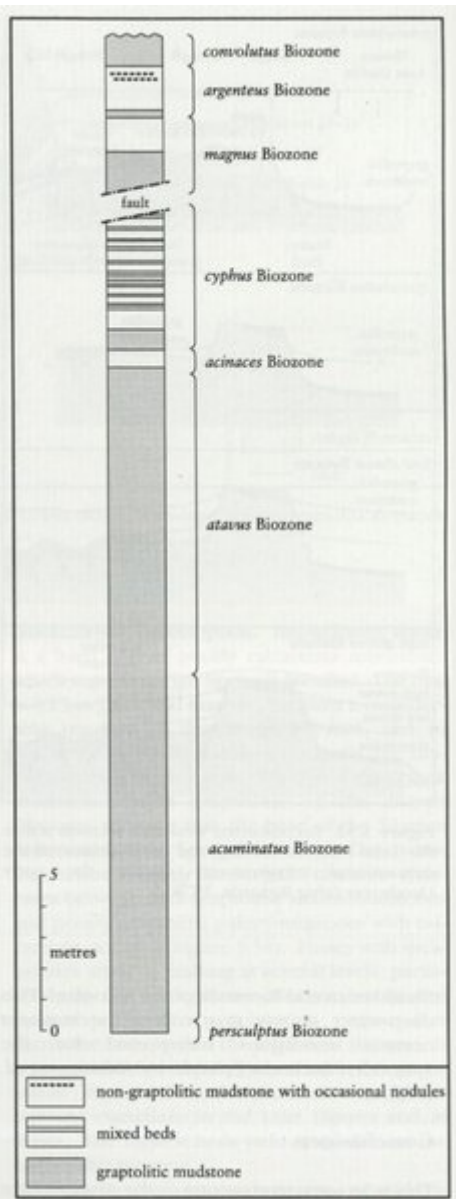
## References



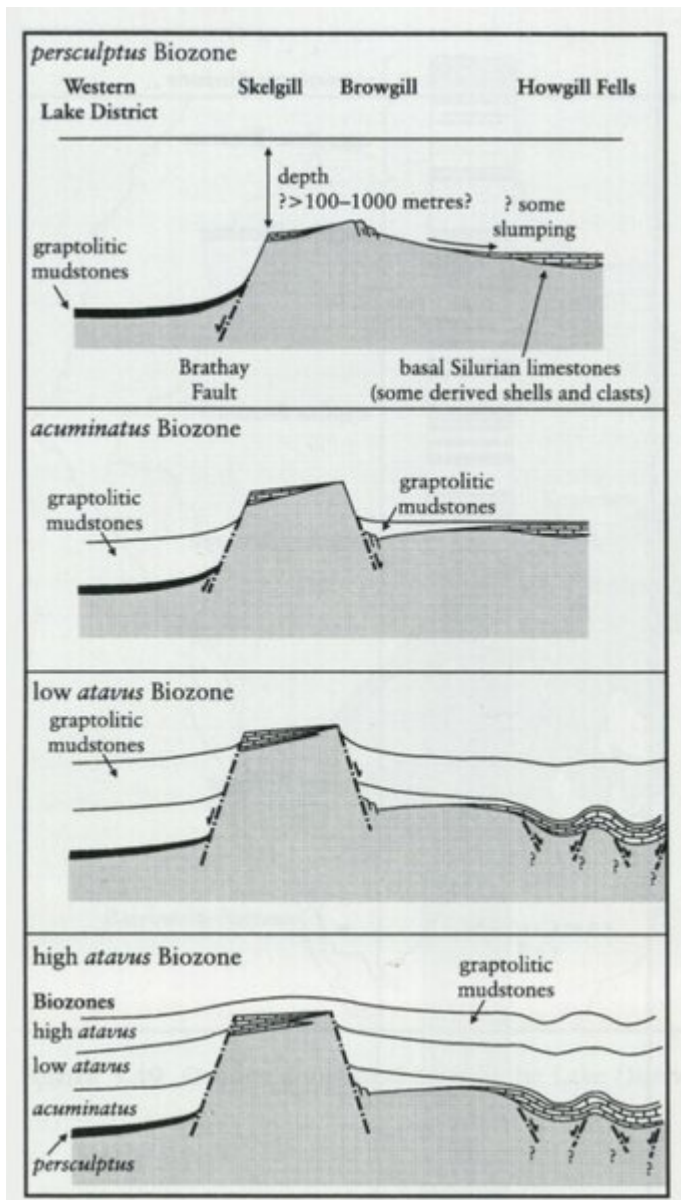
(Figure 3.49) Outline geological map of the Lake District and Howgill Fells (modified after Rickards, 1989a).



(Figure 3.50) Geological sketch-map of Yewdale Beck showing the distribution of graptolite biozones (after Hutt, 1974).



(Figure 3.51) Measured sedimentary succession through the Skelgill Formation in Yewdale Beck, showing the graptolite biozonation (modified after Hutt, 1974).



(Figure 3.52) Reconstructed west-east sections across the Lake District, showing the development of the depositional environment during the early Llandovery (after Rickards, 1978).