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# The Helm

[SD 5307 8871]

Potential GCR Site

N. H. Woodcock

## Introduction

The elongate hill of The Helm has its summit 1 km south of Oxenholme and 4 km SSE of Kendal, Cumbria. Natural exposures and small disused quarries provide an incomplete but informative section through the upper part of the Kirkby Moor Formation. The origin of this lithostratigraphical term is discussed in the introduction to the Benson Knott (Ludlow Series) GCR site. The Helm is particularly important in displaying a distinctive lithofacies within the Kirkby Moor Formation, designated the Helm Member by King (1992; see (Figure 6.28)a, b). The Helm Member is the youngest stratigraphical unit present in the three sites chosen to illustrate the progressive late Silurian shallowing of the Lake District Basin.

The Helm Member is both underlain and overlain at The Helm by typical Kirkby Moor Flags, and the part of the succession it occupies was dated as P<sup>midol</sup> by correlation of ostracod faunas (Shaw, 1971a, b). The whole succession is patchily reddened, in contrast to the general green-grey colour of the main body of the Kirkby Moor Flags. The reddened units were designated the Scout Hill Flags by Shaw (1971a). However, the probable secondary nature of the reddening questions the lithostratigraphical validity of the Scout Hill Flags. Kneller *et al.* (1994) recommend that the term be abandoned.

## Description

The Helm displays a gently north-dipping section, bounded to the east and west by NNE–striking faults (Shaw, 1971a). Much of the hill is underlain by typical Kirkby Moor Formation, similar to that at the Benson Knott site. The description of this lithofacies will not be repeated here. However the south end of the hill, between [SD 5298 8854] and [SD 5320 8900], is formed of the distinctive Helm Member, reaching a thickness of about 140 m. This member contains beds of four lithofacies (King, 1992, 1994), numbered to match those shared with Benson Knott. A typical logged section through the Helm Member is shown in (Figure 6.29).

3. *Thin to medium-bedded graded sandstones* occur as sharp-based beds 0.05–0.3 m thick and comprise micaceous fine sand grading up into silt and clay. The sandstone intervals preserve planar lamination, low-angle cross-lamination, ripple cross-lamination and occasional convolute lamination. The mudstone tops are often bioturbated.

4. *Thick-bedded stratified sandstones* occur as beds 0.2–2.0 m thick, often amalgamated, comprising fine-grained micaceous sandstone, which may grade up into mud. They show similar internal structures to lithofacies 3, although some beds may be massive. Low-angle hummocky cross-stratification and symmetrical ripple cross-lamination are widespread. The mud tops to beds may be bioturbated, often by vertical *Skolithos* burrows. The bed bases may be planar, but are usually erosive or loaded. This lithofacies predominates in the Kirkby Moor Formation but becomes a subordinate component in its Helm Member.

5. *Thick-bedded massive sandstones* are similar to lithofacies 4, but lack internal structure. They occur in tabular beds 0.5–1.0 m thick at [SD 5298 8854], one showing large-scale planar cross-stratification through the whole bed. The beds may be topped by symmetrical ripples. These sandstones occur in a packet near the base of the Helm Member

6. *Heterolithic siltstones* comprise alternating irregular laminae of siltstone and silty mudstone. The mudstone laminae are generally thinner (0.5–2 mm) than the siltstone laminae (2–10 mm), and tend to occur as mud drapes defining flaser

bedding. Bi-directional cross-lamination foresets can occur in the siltstones. Bedding surfaces can display symmetrical or asymmetrical ripples, irregular undulations and prod marks. Bioturbation is rare. The heterolithic siltstones are the predominant and characteristic lithofacies of the Helm Member.

As in the rest of the Kirkby Moor Formation, fossils occur as shelly lenses within or at the base of beds of lithofacies 3 and 4. Shaw (1971a) did not distinguish faunas from the Helm Member from those of the rest of the reddened 'Scout Hill Flags'. Comparing the fauna of the whole 'Scout Hill Flags' of the southern 'Kendal area', with that of the underlying Kirkby Moor Flags he noted a 26% decrease in the number of species. Significant disappearances include the trilobites *Alcymeres neointermedia*, *Acastella prima*, *Homalonotus knighti* and *Acastella? spinosa*, and the ostracod *Aechmina* sp.. Importantly, the ostracod *Frostiella groenvalliana* is introduced into the sequence, together with an increase in the abundance of gastropods and fish remains. The latter fauna correlates with that at the base of the Downton Castle Sandstone Formation in the Welsh Borderland (see GCR site report Ludford Lane and Ludford Corner), and with the internationally defined base of the Pridoli Series (Martinsson, 1967; Shaw, 1969; Siveter, 1978, 1989).

## Interpretation

The sediments at The Helm accumulated at a late stage in the history of the Lake District marine basin. The heterolithic siltstones of lithofacies 6 that characterize the Helm Member are interpreted as the product of fair weather waves in a very shallow water marine environment (King, 1994). This interpretation is based on the bi-directional cross-lamination and the short wavelength of the ripple sets. This marine environment was sheltered from the pervasive effect of storms, suggesting deposition in a bay or lagoon behind a barrier bar or island (see (Figure 5.81)). Sporadic storm deposition, probably breaching or overtopping this barrier, is recorded by the graded and stratified sandstones of lithofacies 3 and 4. These sandstones are fully diagnosed in the site description for Benson Knott, the diagnostic sedimentary structure being hummocky cross-stratification. The thick-bedded massive sandstones of lithofacies 4 are insufficiently exposed to diagnose accurately. Their position near the base of the Helm Member suggests deposition in an intermediate environment between the storm-dominated shelf and the lagoon, perhaps as part of a sandbar complex (Figure 5.81).

The Helm Member therefore represents the most inshore component of the late Silurian basin-shallowing sequence in the Lake District. This marginal marine assignment is supported by the decrease in faunal diversity and the increase in the abundance of vertebrate debris (Shaw, 1971a, b). The Helm offers a tantalizing last glimpse of an environment that probably continued to accumulate marginal marine then non-marine sediment well into Devonian time.

The Helm, Benson Knott and Hills Quarry sites form the network that demonstrates the gradual, late Silurian shallowing of the Lake District Basin. Benson Knott illustrates the typical Kirkby Moor Formation, there dated as upper Ludfordian Stage, Ludlow Series. Hills Quarry exposes the somewhat deeper environments recorded in the Underbarrow Formation, there dated as lower Ludfordian Stage. In its chronostratigraphical position and palaeoenvironmental signature in the history of its sedimentary basin The Helm is comparable to GCR site Ludford Lane and Ludford Corner of the Welsh Basin.

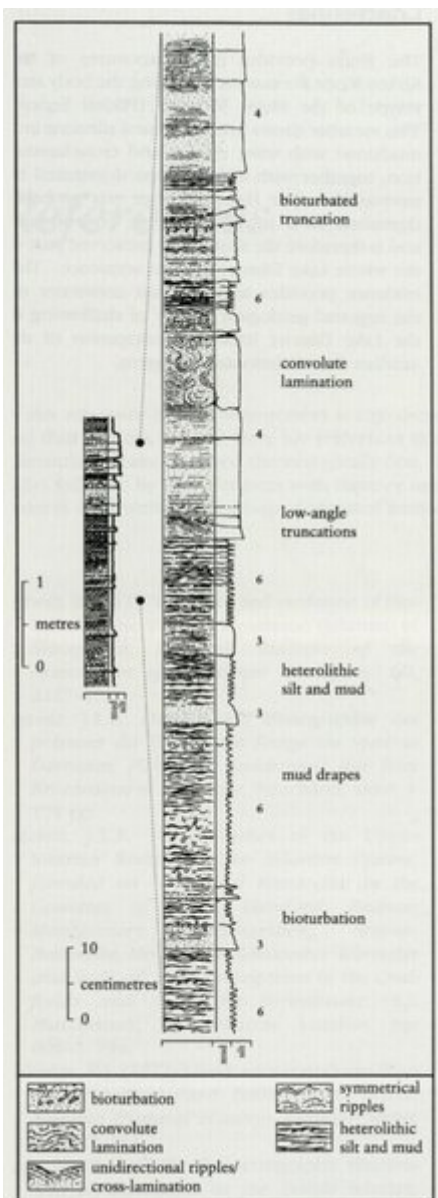
## Conclusions

The Helm provides good exposures of the Kirkby Moor Formation, including the body stratotype of the Helm Member (Pridoli Series). This member shows interlaminated siltstone and mudstone with wave ripples and cross-lamination, together with a fossil fauna dominated by gastropods. The Helm Member was probably deposited in a marginal marine environment and is therefore the shallowest preserved part of the whole Lake District Silurian sequence. This evidence provides an important constraint on the regional geological history of shallowing of the Lake District Basin in anticipation of the Acadian (late Caledonian) Orogeny.

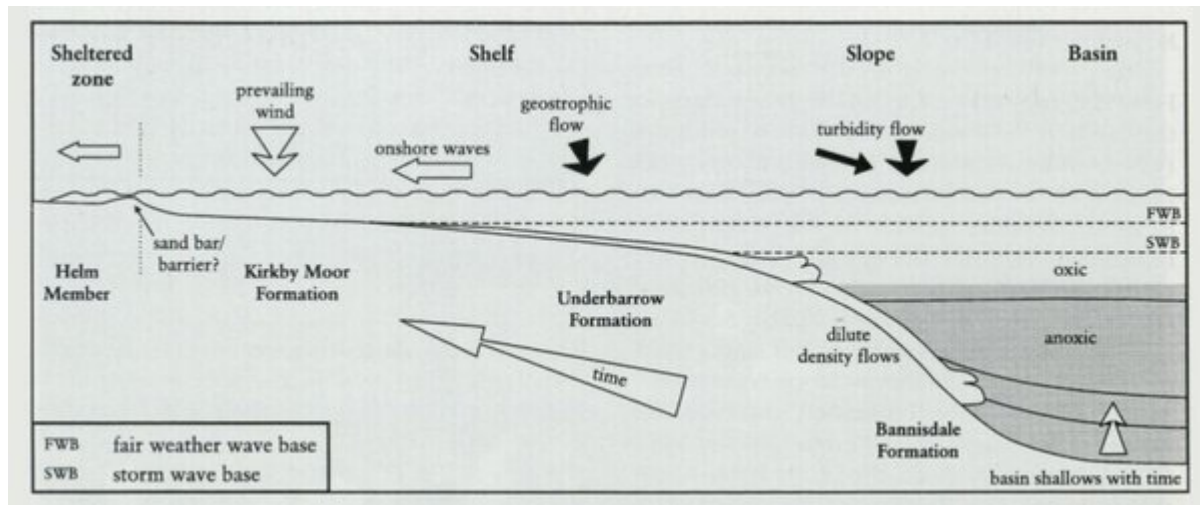
## [References](#)



(Figure 6.28) The Helm, Cumbria (a) outcrop displaying the Helm Member (P<sup>er</sup>idol<sup>i</sup> Series) of the Kirkby Moor Formation, (b) close-up of the strata. (Photos: David J. Siveter.)



(Figure 6.29) Representative log of the Helm Member of the Kirkby Moor Formation at The Helm (SD 5307 881; modified from King, 1992). Beds are assigned to one of several lithofacies (see text), numbered to match similar facies in the main Kirkby Moor Formation (see GCR site report for Benson Knott); in this particular section at The Helm, Cumbria, only lithofacies 3, 4 and 6 occur.



(Figure 5.81) Hypothetical reconstruction of the northern margin of the Lake District Basin and its associated depositional environments, for formations spanning the Ludfordian-early Pridoli time interval (after King, 1992). No absolute depths or scale are implied.