

# Coniston Group succession, Windermere Supergroup, late Ordovician to Silurian, Northern England

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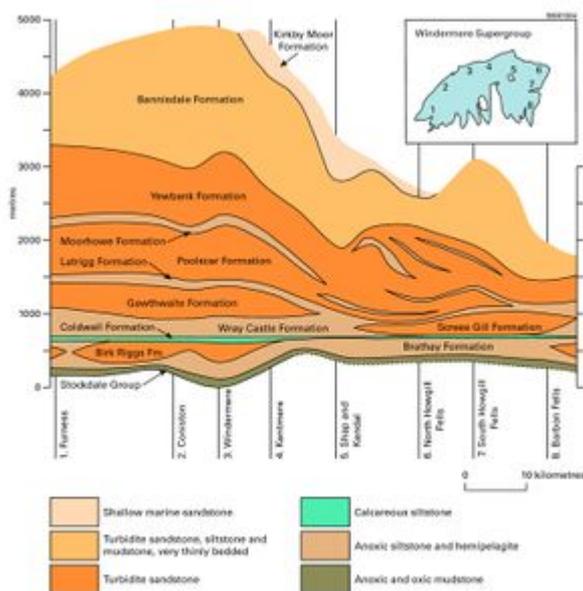
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## Introduction



Lateral stratigraphical variation through the Silurian sector of the Windermere Supergroup (after Rickards and Woodcock, 2005).:). P916056.



'Donkey Rock': an extensive development of flute casts on the base of a vertical bed of Gawthwaite Formation (Coniston Group) sandstone at Eccles Riggs Quarry [SD 2105 8682]. The flow direction of the eroding turbidity current was from the top to the bottom of the quarry face. The hammer is 37 cm long. (P005161).

The base of the Coniston Group is marked by the first substantial appearance of thick, turbidite sandstone sequences in the Windermere Supergroup succession. The group's thickness is variable within the 1.5 to 2.5 km range, and since deposition was mostly within a single Gorstian graptolite biozone (*scanicus*, Early Ludlow), it represents a dramatic increase in sedimentation rate over that responsible for the lower parts of the Windermere Supergroup. Within the southern Lake District, there are three major sandstone-dominated sequences separated by two intervals in which the main lithology is hemipelagic siltstone. These five units have been afforded formation status but further east, in the southern Shap Fells and the Howgill Fells, the lower formations thin, pinch out and merge with the underlying siltstones of the Wray Castle Formation ([P916056](#)). As an additional complication, the turbidite sandstones marking the base of the Coniston Group in the Howgill Fells, probably extend to a lower stratigraphical level than do their counterparts further west. Hence the base of the Coniston Group is probably diachronous.

The five-part Coniston Group stratigraphy is most fully developed in the south-west of the southern Lake District outcrop. There the basal sandstone unit, the Gawthwaite Formation, ranges up to about 500 m thick but contains a fairly high proportion of silty, laminated hemipelagite. The individual, graded sandstone beds are rarely more than 50 cm thick and tend to occur as repetitive series of beds cumulatively up to about 15 m thick, alternating with rather thinner runs of hemipelagite in which there are only sporadic sandstone interbeds. Apart from the grading, other

sedimentary features indicative of turbidite deposition include flute and groove casts on the bed bases ([P005161](#)), and an upward progression within the beds to parallel, cross and convolute lamination. The base of the formation (and hence of the Coniston Group) lies within the earliest Gorstian, *nilssoni* graptolite Biozone, but the top of the formation is probably within the succeeding *scanicus* Biozone.

The Gawthwaite Formation is succeeded by 100–250 m of silty hemipelagite with only sporadic interbeds of turbidite sandstone. This is the Lattrigg Formation, which is in turn succeeded by another major development of turbidite sandstone, the Poolscar Formation, with a 450–700 m thickness range. The Poolscar Formation has the highest proportion of turbidite sandstone beds (relative to hemipelagite) of any part of the Coniston Group. Some individual beds are very thick, up to several metres, and amalgamation of the sandstone beds is widespread. Another unit of mainly hemipelagite lies above the Poolscar Formation; this is the approximately 100 m thick Moorhowe Formation. Finally, the top of the Coniston Group is formed by the third thick development of turbidite sandstones, the Yewbank Formation. This is 700–750 m thick and appears to be intermediate relative to the two lower sandstone formations in terms of bed thickness and hemipelagite proportion. Like them, the Yewbank Formation shows the characteristic range of sedimentary features produced by turbidity current deposition. All of the higher part of the Coniston Group lies within the *scanicus* graptolite Biozone.

There are significant lateral changes in the Coniston Group lithostratigraphy such that eastwards, in the Shap Fells area, it is hard to apply the formational terminology established further west ([P916056](#)). At the base of the group, the Gawthwaite Formation thins eastwards and finally fails, thus eliminating the means of distinguishing between the lithologically similar, hemipelagite formations above and below, respectively the Lattrigg and Wray Castle formations. Higher in the succession, a similar problem is caused by the eastwards thinning and disappearance of the hemipelagic Moorhowe Formation, which accordingly allows the sandstone formations above and below to merge. Hence, in the Shap Fells, the Coniston Group is represented by an upper interval largely of turbiditic sandstone, equivalent to the combined Yewbank and Poolscar formations, and a lower interval of largely hemipelagite equivalent to the Lattrigg Formation but extending downwards into the, now indistinguishable, Wray Castle Formation. In effect, the boundary between the Tranearth and Coniston groups has become arbitrary. Some of this lateral variation in lithofacies and stratigraphy may have been influenced by syndimentary faulting.

Further changes are apparent eastwards into the Howgill Fells. There, a thick unit of turbidite sandstone, the Screes Gill Formation, again defines the base of the Coniston Group. It is typically about 250 m thick but thins southwards. It consists mostly of fine-grained sandstone in beds of variable thickness (but most commonly about 30 cm) that grade upwards to a silty mudstone top. Laminated hemipelagic mudstone is interbedded irregularly throughout the formation and contains a fauna indicative of the *nilssoni* graptolite Biozone. However, since the underlying Wray Castle Formation is here only about 10 m thick, it seems possible that the base of the Coniston Group is older than is the case further west, where a much thicker Wray Castle succession is seen. It is not clear whether or not the Screes Gill Formation can be correlated in any way with the Gawthwaite Formation, or whether they represent discrete, though possibly overlapping, turbidite fans.

The upper part of the Coniston Group in the Howgill Fells comprises an alternation of sandstone and hemipelagite intervals. The lithologies present are very similar to those seen elsewhere in the group and together make up a thickness of about 1000 m, rather less in the south of the area. A succession has been recognised in which four mainly sandstone units are separated by three much thinner units of laminated silty mudstone. Other divisions can be defined locally but prove to be lenticular on a regional scale. Stratigraphically, this succession is equivalent to the highest four formations further west (from Lattrigg up to Yewbank) but precise correlations are not possible.

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