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## Ordovician rocks

Ordovician rocks formed during the episode of earth history known as the Ordovician Period. This is currently regarded as having extended from around 495 to 443 million years ago.

### Ordovician rocks in Great Britain

The succession of Ordovician rocks in Great Britain includes substantial thicknesses of both sedimentary and volcanic rocks. The most complete Ordovician sedimentary succession in Great Britain occurs in central and North Wales. Volcanic rocks comprise a substantial volume of the succession in the latter area. Thick sequences of Ordovician rocks, including both sedimentary and volcanic rocks, are present within the central Lake District and associated inliers. Other extensive outcrops of Ordovician sedimentary rocks occur in the Southern Uplands of Scotland. Smaller outcrops are also present in North West Scotland.

Great Britain's Ordovician rocks were deposited mainly within a deep ocean, known by geologists as the Iapetus Ocean. Thick layers of mud accumulated on the ocean floor, together with substantial amounts of muddy sandstones (commonly known as greywackes), which were deposited by vigorous turbidity currents carrying sediment from the adjoining continental shelves. The Iapetus Ocean lay between two huge continents which, during Ordovician, and succeeding Silurian, times were rapidly converging. Enormous crustal stresses resulting from these continental movements caused widespread subsidence of the ocean basin, substantial volcanic and other magmatic activity, and severe deformation of the rocks being deposited. The continents eventually collided, destroying the Iapetus Ocean, late in Silurian times.

Great Britain's Ordovician rocks are important on a regional, national and international level. Their fossil content has contributed a wealth of data which has advanced understanding of evolutionary processes and palaeoecological studies: the rocks have importance worldwide as standards of reference for this episode of geological history.

### Geological SSSIs

The only exposures of Ordovician rocks in the county lie within the Moorhouse — Upper Teesdale National Nature Reserve and SSSI, but they are not specifically designated within the Geological Conservation Review.

### Durham County geological sites

#### Skiddaw Group:

Cronkley Pencil Mill, Upper Teesdale [NY 848 296]

### Ordovician rocks in County Durham

Outcrops of Ordovician rocks comprise approximately 221 hectares, or 0.1%, of the surface area of County Durham.

Ordovician rocks crop out only in a very restricted area, known as the Teesdale Inlier, beneath Cronkley Fell in Upper Teesdale. Evidence from mapping, and a borehole at Widdybank Farm, suggests that the outcrop may extend to several square kilometres. However, much of this is concealed beneath substantial thicknesses of superficial deposits and exposures are limited to a few small sites alongside the River Tees.

Two main divisions of Ordovician rocks, which can be correlated with rocks in the Lake District, are recognised in the Teesdale Inlier.

#### Skiddaw Group rocks

The exposures at Pencil Mill, near Cronkley Fell comprise pale grey to greenish grey mudstones, locally with thin gritty laminae. These rocks locally exhibit low grade metamorphism and up to two phases of cleavage: the most intensely cleaved rocks here may be described as phyllites. Despite this alteration some beds have yielded scarce graptolite fossils indicative of the Ordovician *Didymograptus bifidus* Zone. They may therefore be correlated with the Skiddaw Group rocks of the Lake District.

Although no fossils were found in the poorly cleaved fine-grained greywacke sandstones proved in the borehole at Widdybank Farm, these rocks have also been correlated with the Skiddaw Group rocks of the Lake District.

Metamorphosed slates, proved beneath the Carboniferous rocks in a deep borehole at Emma Pit, Roddymoor Colliery, near Crook, are also correlated with the Skiddaw Group. The metamorphism exhibited by these rocks may be an effect of the Weardale Granite (see Metamorphic Rocks).

### **Borrowdale Volcanic Group rocks**

A very small exposure in the banks of the River Tees, a short distance upstream from Pencil Mill, reveals much altered and silicified tuff, believed to correlate with part of the Ordovician Borrowdale Volcanic Group of the Lake District. Several erratic boulders of volcanic rocks, found within the till of Teesdale suggest that the outcrop of Borrowdale Volcanic rocks beneath superficial cover may be more extensive than previously thought and may contain rock types not presently exposed at the surface.

Evidence from the Roddymoor Borehole, a borehole at Allenheads in Northumberland, and exposures on the Pennine escarpment near Cross Fell, suggests that Ordovician rocks are extensively present beneath the Carboniferous rocks across the county.

### **Influence on the landscape**

The comparatively restricted outcrop of Ordovician rocks in Upper Teesdale forms an area of lower ground adjacent to Cronkley and Widdybank fells. However, as these are everywhere concealed by a substantial thickness of glacial deposits except in the very small exposures adjacent to the River Tees near Pencil Mill, these rocks have comparatively little direct influence upon the landscape of the county.

### **Influence on biodiversity**

Because of their extremely limited exposure these rocks have little or no impact upon the biodiversity of County Durham.

### **Economic use**

The soft slates, exposed adjacent to the River Tees, were formerly worked at Pencil Mill for the making of slate pencils. No details are known of the date of working or the amount of material worked, though the quantities produced are likely to have been very small.

### **Future commercial interest**

Future commercial interest is extremely unlikely.

### **Threats**

The few exposures are generally robust and appear to be subject to no particular threats.

### **Wider significance**

The known occurrences of Ordovician rocks within the Teesdale Inlier, and in two boreholes, give the only evidence of the nature of Ordovician rocks in this part of northern England. They therefore contribute much to our understanding of the nature and pattern of Ordovician geology of Great Britain.

## Selected references

Burgess and Holliday, 1979; Dunham, 1990; Johnson, 1961, 1970, 1995.

## Figures and photographs

(Figure 7) Distribution of Ordovician rocks in Great Britain.

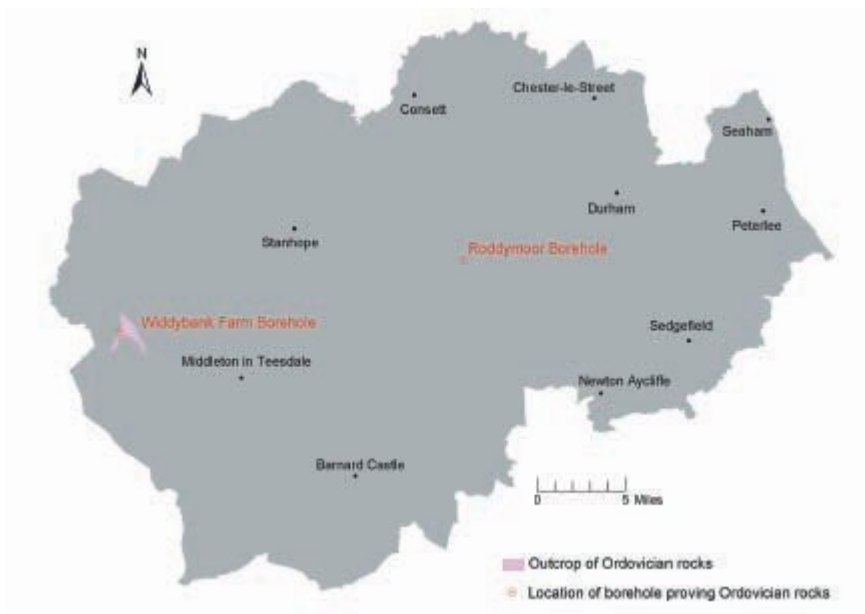
(Figure 8) Distribution of Ordovician rocks in County Durham.

(Photo 1) Cronkley Pencil Mill, Teesdale. Old quarry in Ordovician Skiddaw Group slates, formerly worked for making slate pencils. BGS, ©NERC, 2004.

## [Full references](#)



(Figure 7) Distribution of Ordovician rocks in Great Britain.



*(Figure 8) Distribution of Ordovician rocks in County Durham.*



*(Photo 1) Cronkley Pencil Mill, Teesdale. Old quarry in Ordovician Skiddaw Group slates, formerly worked for making slate pencils. BGS, ©NERC, 2004.*