

Ludlow Series, Silurian, Wales

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[Jump to navigation](#) [Jump to search](#)

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The marine transgression in early Ludlow times had little effect on the broad palaeogeographical framework of the Welsh Basin. However, subsequent prolonged marine regression with a few transgressive pulses finally obliterated the broad sedimentation patterns that had dominated the Welsh Basin since early Cambrian times. The basin silted up and, before the close of the epoch, terrestrial red-bed sedimentation had become firmly established in south-west Wales, although in different places at different times ([P916174](#)).

Throughout Wales, Ludlow strata conformably overlie Wenlock strata; the type area for the series lies near Ludlow in the Welsh Borderland, and its base is regarded as coinciding with the base of the *nilssoni* Biozone. In north Wales, Ludlow strata crop out in the hinge areas of the Llangollen and Denbighshire synclines, and in the Clwydian Hills. They also crop out at Long Mountain east of Welshpool, and form a wide outcrop southwards from Newtown across Black Mountain and Clun Forest to Builth Wells. To the south-west, the outcrop is overstepped by the Old Red Sandstone, south-west of Llandeilo. Ludlow strata also form small outcrops in south Pembrokeshire and in the inliers at Cardiff and Usk.

The Gorstian marine transgression resulted in the widespread deposition of mud, increasingly calcareous towards the east, across the shelf in the Welsh Borderland, and this environment was inhabited by a diverse shelly fauna. At the same time, graptolitic mud accumulated in the Welsh Basin, and at the height of the transgression it encroached onto the shelf margin. The source of most sediment was probably the landmass of Pretannia to the south. Thin bentonites within the shelf sequence indicate contemporaneous and distant volcanism.

In the Welsh borders, there is a marked increase in thickness of Ludlow strata westwards across the shelf ([P916175](#)). Graptolitic mudstone (Oakeley Mynd Formation) at the base of the succession east of Clun Forest is overlain by a thick sequence of interbedded calcareous siltstone and hemipelagite with carbonaceous laminae (Bailey Hill Formation) deposited by turbidity currents and mass sliding on the outer shelf. Upwards, the sequence becomes progressively more typical of a shallow marine environment, with an abundant shelly fauna. Large slump folds lie along the axis of a trough, which persisted between Clun Forest in the north and New Radnor in the south into late Ludlow times, with silt being transported into an area of hemipelagic mud. Graptolites, orthocones and a poor benthic fauna suggest poorly oxygenated bottom waters, below wave base.

Ribbon-banded mudstone of the slope apron can be traced into Denbighshire in the upper part of the Nantglyn Flags Formation, and the *Neodiversograptus nilssoni* Zone has been identified. The disturbed beds, which are a dominant element in the lowest part of the sequence, decrease upwards ([P662419](#)), and here consist entirely of mudstone and are generally restricted to the area between Llangerniew and Llansannan. The top of the formation is defined by a facies change to turbiditic sandstone, striped siltstone, mudstone and disturbed beds with rare ribbon-banded mudstone (Elwy Group) ([P916173](#)). The easterly directed sediment transport along the axis of the Denbigh trough persisted from Wenlock times.

In the well-defined outcrop between Builth Wells and Llandeilo, there is marked thinning of the

sequence and an increase in the proportion of impure shelly limestone and decalcified rottenstone. Most distinctively, near Llandeilo, there is a restricted sequence of conglomerate and coarse-grained, cross-bedded, ripple-marked deltaic sandstone (Trichrug Formation) with red beds reflecting temporary emergence. These sandstones indicate an increasing clastic input and the proximity of a landmass to the south. To the south of Builth Wells, in the Wye valley, the river traverses the Ludlow sequence between Llanellwedd and Twmpath. The section is one of those examined by R Murchison, where he recognised the transition from fossiliferous offshore mudstone and siltstone, with slump bedding, into the Old Red Sandstone.

In the Cardiff inlier, sheet sandstones and limestones in a dominantly mudstone sequence (Cardiff Group) are interpreted as sublittoral deposits, laid down above storm wave base in a mid-shelf environment, with a rich and varied fauna. Towards the top of the sequence, amalgamated sandstones and limestones suggests a more proximal shoreline association, deposited around normal wave base. In the Usk inlier, nodular silty limestone is common in the lower part of the sequence in the eastern outcrops, but to the west the carbonate content decreases.

Towards the top of the sequence, shelly conglomeratic limestone shows evidence of hardground development. The sequence reflects the progressive shallowing on a distal shelf environment passing into a nearshore, high-energy, proximal shelf setting with evidence of traction and storm processes. In Pembrokeshire, fluviatile conditions were established during early Ludlow times. At both sides of Marloes Bay, reddened marine, grey and green mudstone and quartzite (Gray Sandstone Group) are conformably overlain by red siltstone with mud-cracked surfaces and calcretes with subordinate sandstones and air-fall tuffs (Red Cliff Formation). By late Ludlow times, the Irish Sea landmass had probably merged with Pretannia. With continuing emergence, the area of marine deposition across Wales was becoming more restricted and, progressively, the basin was silting up.

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Contents

Introduction

[History of geological research](#)

[Geotectonic setting](#)

Precambrian and ?Cambrian

[Monian Composite Terrane](#)

[Coedana Complex](#)

[Blueschist Terrane](#)

[Monian Supergroup](#)

[Avalon Terrane](#)

[South-west Wales and the borders](#)

Cambrian

[Comley Series](#)

[St David's Series](#)

[Merioneth Series](#)

Ordovician

[Tremadoc](#)

[Arenig](#)

[Llanvirn](#)

[Caradoc](#)

[Ashgill](#)

[Ordovician volcanism](#)

Silurian

[Llandovery](#)

[Wenlock](#)

Ludlow

[Přídolí](#)

[Caledonian orogeny](#)

Devonian

[Lower Old Red Sandstone](#)

[Lochkovian](#)

[Pragian—Emsian](#)

[Upper Old Red Sandstone](#)

[Carboniferous](#)

[Dinantian](#)

[Tournaisian](#)

[Visean](#)

[Silesian](#)

[Namurian](#)

[Westphalian](#)

[Coal](#)

[Variscan orogeny](#)

[Mineralisation](#)

[Mesozoic](#)

[Permian—Triassic](#)

[Jurassic](#)

[Lower Jurassic](#)

[Middle Jurassic](#)

Upper Jurassic

Cretaceous

Lower Cretaceous

Upper Cretaceous

Oil and gas

Cainozoic

Palaeogene—Neogene

Quaternary

Pleistocene

Holocene

Geology and man

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Category:

- [Regional Geology of Wales](#)

Navigation menu

Personal tools

- Not logged in
- [Talk](#)
- [Contributions](#)
- [Log in](#)
- [Request account](#)

Namespaces

- [Page](#)
- [Discussion](#)

Variants

Views

- [Read](#)
- [Edit](#)
- [View history](#)
- [PDF Export](#)

More

Search

Navigation

- [Main page](#)
- [Recent changes](#)
- [Random page](#)
- [Help about MediaWiki](#)

Tools

- [What links here](#)
- [Related changes](#)
- [Special pages](#)
- [Permanent link](#)
- [Page information](#)
- [Cite this page](#)
- [Browse properties](#)

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