

Hydrogeology of Wales: Carboniferous aquifers

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This page is part of a category of pages that provides an updated review of the occurrence of groundwater throughout Wales.

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Geological setting

The Carboniferous strata traditionally divide between the lowermost Carboniferous Limestone facies, the Millstone Grit facies and the uppermost Coal Measures facies. These names have now been superseded ([Waters et al., 2009](#)). In north Wales the sequence divides between the lowermost Clwyd Limestone Group, which is separated from the Millstone Grit Group by the Craven Group, the Pennine Coal Measures Group and the uppermost barren Warwickshire Group. In south Wales this translates into the lowermost Avon Group, the Pembroke Limestone Group, the Marros Group (of Millstone Grit facies), followed by the South Wales Coal Measures Group and the Warwickshire Group (formerly the Pennant Measures). The Warwickshire Group is absent in Pembrokeshire.

Lower Carboniferous rocks of Tournaisian to Viséan age were deposited as warm water carbonates in marine shelf environments to form the Clwyd Limestone facies on the northern (north Wales) and the Pembroke Limestone Group on the southern (south Wales and Forest of Dean) flanks of the Wales-Brabant Massif.

The Clwyd Limestone Group occurs in Anglesey, north Wales and along the Menai Strait, on the west side of the Vale of Clwyd and adjacent coastal tract and along the eastern flank of the Clwydian range. Some local dolomitisation has occurred. The Pembroke Limestone Group in south Wales forms narrow outcrops peripheral to the South Wales, Pembrokeshire and Forest of Dean coalfields. The limestone is partly dolomitised on the east and south-east crop of the South Wales Coalfield.



Waterfall on shales in the Afon Mellte Gorge north of Glyn Neath. P802427.

The Namurian age Marros Group crops out around and underlies the South Wales Coalfield whereas in north Wales it forms a narrow belt of strata between Ruabon and Oswestry. These outcrops result from deposition on the flanks of the Wales-Brabant Massif. In the Gower Peninsula the Marros

Group attains 55 m thickness, whereas there is less than 20 m of it in the east crop of the South Wales Coalfield. It is also thin in north Wales. The deposits are characterised by cyclic deposition with marine mudstones (**Plate P802427**) and deltaic and fluvial sandstones.

The Coal Measures groups crop out most extensively in the coalfields of south and west Wales, in the Flintshire and Denbighshire coalfields of north Wales and in the Forest of Dean. There are small outliers in Anglesey and in the Welsh Borderland. The sequence which equates to the Westphalian is divided between the South Wales Lower, Middle and Upper Coal Measures formations (the latter part of the Warwickshire Group) and mostly comprises cyclic sequences of fluviodeltaic origin. These consist of a coarsening upwards sequence of mudstones, siltstones and fine-grained sandstones which grade into seatearths which are succeeded by coals that derive from basin-wide peat mires. Periodic intrusion of the sea resulted in deposition of numerous mudstones characterised by marine bands with distinctive bivalve fauna.

Thicker sandstones also occur as valley infill deposits; thinner sandstones were deposited as levées, bars and deltas. Barren measures and the Warwickshire Group succeed the grey-coloured productive Coal Measures, the predominantly red beds being deposited in a more arid environment.

The Westphalian succession in the South Wales Coalfield (the Coal Measures formations and the Pennant Sandstone Formation) attains a thickness of over 2500 m towards the south-west ([Thomas, 1974](#)). It is dominated by mudstones and siltstones in the South Wales Lower and Middle Coal Measures formations, in which there are 20 to 25 principal economic coal seams. The South Wales Upper Coal Measures Formation and the Pennant Sandstone Formation are predominantly sandstones with persistent but thin mudstone and coal horizons. These rocks tend to form the plateau area of the central coalfield.

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