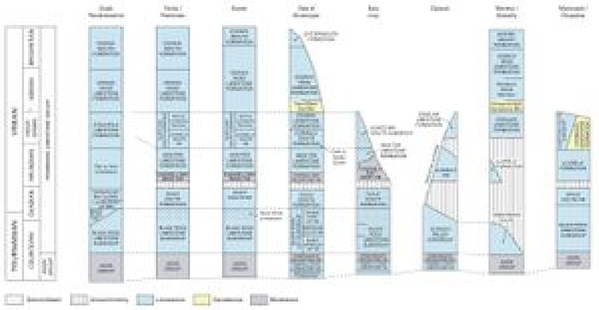
Visean, Dinantian, Carboniferous, Wales

From Earthwise

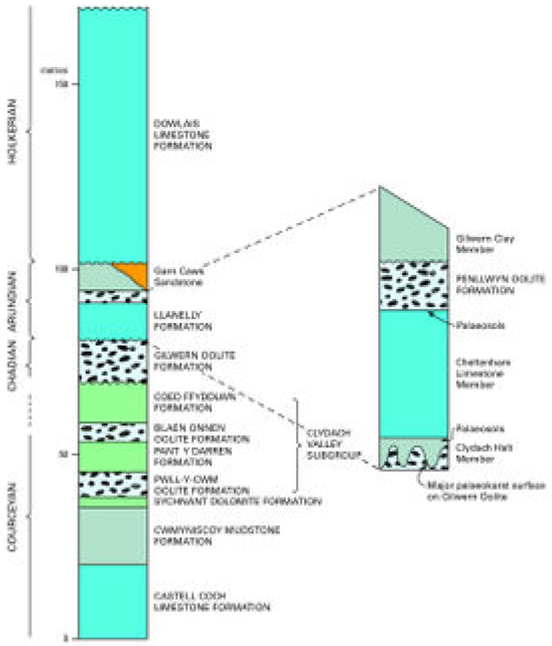
[Jump to navigation](#) [Jump to search](#)

From: Howells, M F. 2007. [British regional geology: Wales](#). Keyworth, Nottingham: British Geological Survey.

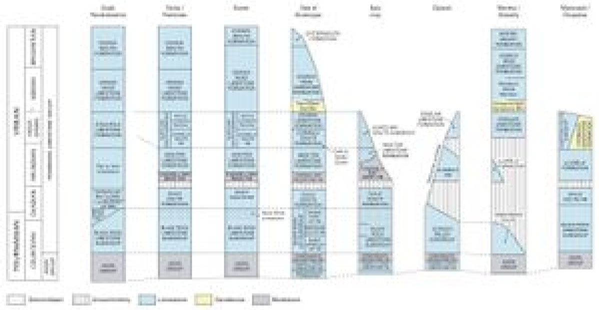


Vertical sections illustrating the Dinantian of south Wales (adapted from Waters et al., 2007). P916181.

High Tor Limestone Formation dipping south, Three Cliffs Bay, Gower (MFH P662425).

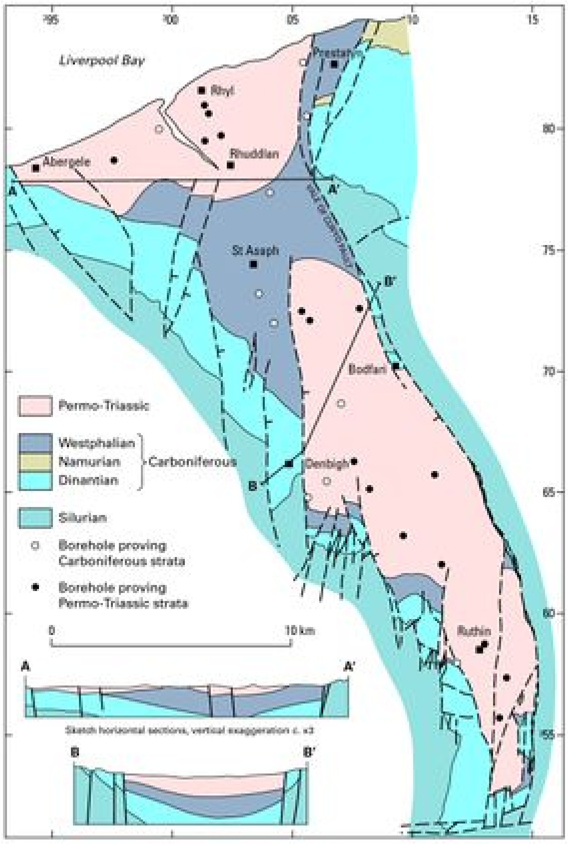


Vertical sections illustrating the Dinantian of the east crop, south Wales (adapted from Barclay, 1989 and Wright 1996). P916184.

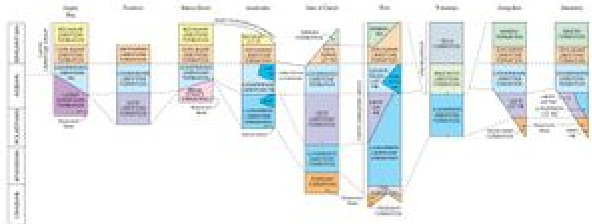


Vertical sections illustrating the Dinantian of south Wales (adapted from Waters et al., 2007). P916181.

Palaeokarstic surface at the top of the Dinantian Dowlais Limestone overlain unconformably by pebbly grit at the base of the Namurian; the grit also infills large solution cavities in the limestones, Trefil Quarry (MFH P662436).



Vale of Clwyd, sketch map of the geology (adapted from Warren et al., 1984). P916185.



Vertical sections illustrating the Visean of north Wales (after Waters et al., 2007). P916186.

Great Ormes Head, Llandudno. The Loggerheads Limestone Formation is exposed in the main cliff face with a capping of the Cefn Mawr Limestone and Red Wharf Limestone formations (MFH P662387).

Carboniferous limestone (Leete, Loggerheads and Cefn Mawr limestones) overstep on to the lower Silurian strata in the foreground, Mynydd Eglwyseg (MFH P662426).

Visean strata occur throughout south Wales, and they are the sole representatives of the Lower Carboniferous in north Wales. In south Wales, the precise position of the Tournaisian–Visean boundary in relation to the lithological subdivisions (P916181) remains problematical, but there is enough conodont evidence to place it close to the top of the Friars Point Limestone and Tears Point Limestone in the Vale of Glamorgan and the Gower, respectively. The sequence is dominated by highly fossiliferous limestone that is typically medium- to thick-bedded, dark bituminous, argillaceous wackestone to grainstone. On cursory examination, the limestone appears uniform, although detailed examination and comparison with modern carbonate systems indicate a shallowing from deeper water settings during a major marine transgression into a more proximal setting above storm-wave base.

On the south side of the Cowbridge Anticline, dolomitisation at the top of the Friars Point Limestone was probably initiated by an influx of meteoric water and then enhanced both during later emergence and again during post-Dinantian burial. The dolomitisation is particularly prominent (Langland Dolomite) at the top of the Tears Point Limestone Formation in eastern Gower, and here, as elsewhere through the eastern outcrops in early to mid-Chadian times, regression initiated the lowering of the wave base and the extensive development of ooidal shoals (Gully Oolite Formation and Caswell Bay Oolite), which prograded southwards. The oolites comprise two shallowing up sequences, each capped by an irregular surface with persistent stromatolite growth and evidence of subaerial exposure. Farther east, four similar cycles have been determined in the formation. To the west, into western Gower, the formation thickens and becomes more bioclastic and bioturbated. In south Pembrokeshire, about Bosherton and Linney Head, the sequence (Linney Head Limestone Member and Hobbyhouse Bay Limestone Member) is mainly of thinly bedded crinoidal limestones interbedded with richly fossiliferous, dark grey, calcareous mudstone. Carbonate mud mound build-up continued with massive to poorly bedded, dolomitised calcite mudstone interdigitating with bedded limestone at the margins; polyzoan fronds and patches of crinoid debris are the only determinable fossils.

Along the north-east crop, the Gilwern Oolite Formation comprises a thin basal, coarse-grained, shelly ooidal grainstone, which grades up into a massive, pale grey, ooidal bioclastic grainstone at the top of the Clydach Valley Subgroup. Calcrete development at the top of the formation marks a widespread non-sequence (the mid-Avonian unconformity of early surveyors) at the base of the Arundian. The surface is infilled with mottled grey-green clays, representing a fossil soil, with detached blocks of oolite.

Along the south crop, bedded calcareous mudstone (Caswell Bay Mudstone Formation) represents the basal Arundian marine transgression across the Gully Oolite Formation. The mudstone forms a restricted but distinctive sequence at Three Cliffs Bay (P662425) and Caswell Bay in Gower, at Tenby and along the north crop, west of Blorenge. In Gower, coarse conglomerates at the base are wholly calcareous, but those along the north crop include much siliclastic debris derived from the Old Red Sandstone. The thickness and lithological variations are attributed mainly to deposition on the irregular, underlying palaeokarst surface. The eroded upper surface was buried beneath lower shoreface sands, and the subsequent sea-level rise established peritidal conditions with the deposition of the High Tor Limestone Formation to the north of a barrier in the vicinity of the Vale of Glamorgan axis. The High Tor Limestone Formation shows significant variations in thickness and facies. It comprises a basal, coarse bioclastic grainstone, with reworked limestone clasts, overlain by well-bedded, fine-grained to coarsely crinoidal, skeletal packstone and wackestone with intercalated thin mudstone and a rich and diverse Arundian fauna. Across the Vale of Glamorgan, it is overlain by a thick bedded to massive oolite (Cefn yr hendy Oolite), which, at its top, is marked by an irregular palaeokarstic surface with a thin palaeosol. This sequence represents a single transgressive (High Tor Limestone) to regressive (Cefn yr Hendy Oolite) cycle, comparable to those in the northern sequences except that it is considerably thicker. In western Gower, the High Tor Limestone Formation, up to 150 m thick, comprises medium- to thick-bedded bioclastic packstone and grainstone with no indication of shallowing events.

Along the north crop, to the east of Merthyr Tydfil, a karstic surface at the top of the Gilwern Oolite is infilled with terrestrial thin fluvial siliclastic beds (Clydach Halt Member) at the base of the Llanelly Formation (P916184). The sequence of massive and thickly bedded bioclastic and ooidal grainstones and dolomites contains many depositional breaks, some marked by palaeokarst surfaces, which are well developed on the top of the oolite beds.

The uppermost Penllwyn Oolite displays the same gradation, bioclastic grainstone into ooidal grainstone, as in the lower sequence, and its base marks marine erosion. The shallowing-up cycles represent a shallow marine peritidal coastal complex and are most clearly expressed, and thickest, in the Cheltenham Limestone Member. At the top of the sequence, the Gilwern Clay Member marked a regression, with flood-plain clays accumulating in an arid to semiarid climate, with a rootlet bed and coal at the top, suggesting probable back-swamp deposition and more humid conditions.

Northwards and westwards from the Clydach valley, the Llanelly Formation thins and is overstepped by the Dowlais Limestone Formation. Along the north crop, uplift restricted limestone deposition, and fluvial quartzitic sandstone and conglomerate with thin intercalations of plant-bearing mudstone (Garn Caws Sandstone Formation) occupy a similar position. These were deposited in distributary channels within a deltaic complex that prograded southwards on to the carbonate shelf. The channels are incised, up to 5 m, into the underlying Gilwern Clay. During late Arundian times, the barrier complex that had restricted the earlier peritidal environment and prevented the establishment of open marine conditions migrated progressively northwards. The hummocky cross-stratified packstones and grainstones at the top of the sequence indicate the return of a high-energy shoreface environment that culminated in an oolite shoaling event (Hunts Bay Oolite Subgroup). The subgroup is widespread and shows considerable variations in thickness and facies; it is mainly Holkerian in age. In the Vale of Glamorgan, the progradational Cefn yr hendy Oolite culminated in local emergence. However, the succeeding limestone (Argoed Limestone) marked a marine transgression (Holkerian) and a return to offshore conditions and colonisation by lithostrotionid corals. Simultaneously, an ooidal shoal complex (Cornelly Oolite Formation) prograded southwards and peritidal deposits (Stormy Limestone Formation) accumulated behind it (P916181). A karstic surface developed at the top of the subgroup during a marine regression at the end of the Holkerian. To the west, in south Pembrokeshire, the broadly equivalent Stackpole Limestone is richly fossiliferous and bioclastic.

In the north crop, the major regression marked by the siliclastic deposition of the Gilwern Clay and Garn Caws Sandstone was followed by a marine transgression in the Holkerian and the re-establishment of carbonate deposition (Dowlais Limestone Formation). The limestones, up to 80 m thick near Trefil (P662436) are progressively overstepped by Namurian strata, and, east of Gilwern Hill, they are totally absent. In the vicinity of Monmouth, the undivided Drybrook Limestone abuts sandstone (Cromhall Sandstone) deposited from a south-flowing fluviodeltaic system that was initiated in early Holkerian times. West of Merthyr Tydfil, the limestone rests directly on the Avon Group, and shows a particularly distinctive alternation of nodular algal limestone in which brachiopods acted as nuclei for algal growth, and fine-grained calcite mudstone (Concretionary Beds). The limestone hosts the widespread cave systems at Dan yr Ogof and Ogof Ffynnon Ddu in the Tawe valley, which developed from phreatic incursions of water utilising joint, fault and bedding plane surfaces.

In the Vale of Glamorgan, a major regression in late Holkerian to early Asbian times initiated reworking of terrigenous quartz sand (Pant Mawr Sandstone Member) and its transport on to the carbonate shelf; on the north crop, the Honeycombed Sandstone occurs in a similar position. These sandstones are characterised by low-angle cross-bedding and bioturbation. The overlying Oxwich Head Limestone Formation of Asbian age comprises thickly bedded, fine- to coarse-grained, recrystallised, grey mottled, skeletal packstones. In Gower, the limestones are the main site of extensive cave systems that probably owe their development to the influence on the subsurface drainage of a thin coal, in the middle of the sequence, and to the overlying mudstone. Ooidal grainstones have been determined near the base, and in the north crop (Penderyn Oolite) they thin markedly. Mottled red and green clay seams (possibly palaeosols) above hummocky and pitted surfaces are common in the lower part of the Asbian sequence in the northern crop and some, as at Locks Common, Porthcawl, are well developed in the south crop.

To the west of Bridgend, the final phase of Dinantian sedimentation (Late Brigantian) is represented by interbedded thin limestone and mudstone with silicified limestones and banded cherts (Oystermouth Formation). An increase in the supply of terrigenous mud marked the transition into the siliclastic deltaic environment of the Late Carboniferous. In the west, this transition was essentially conformable, but, to the east, increasing non-sequence culminated in unconformity. The thinning of the Asbian and Brigantian strata towards the north crop and the vertical and lateral facies variations have been related to three basin-wide fluctuations in the regional subsidence rate. Along the north crop, ooidal grainstone deposition was interspersed with a number of quartz sandstone beds derived from the landmass to the north. In the south crop, the absence of sandstones and the dearth of ooidal limestones indicate more open marine conditions, although, at times, prograding barrier islands probably intervened.

In north Wales, the Dinantian sequence was initiated in Chadian times and records periodic transgression on to the northern edge of the Wales–Brabant Massif. The distribution of facies and the thickness of the mainly shallow-water limestone sequence was influenced by movement along the Welsh Borderland, Bala and Menai Straits fracture zones, and intervening fractures, which formed downfaulted embayments such as the Vale of Clwyd (P916185). The sequence (P916186) can be correlated more directly with the Craven Basin to the north-east than with south Wales. It has mainly been ascribed to the Clwyd Limestone Group, but a restricted development of the overlying Craven Group has been recognised in the vicinity of Prestatyn.

At the base of the sequence, unfossiliferous red sandstone and mudstone with a few calcretes and laterally impersistent conglomerates, informally named the Basement Beds, could possibly range down into the Tournaisian. The beds represent fluvial and alluvial deposits with few marine incursions, and have been placed in a number of formations, based on their geographical location (P916186). Thin, conglomerate-based, fining-upwards sequences record deposition in meandering streams, and striped silty mudstones are interpreted as overbank deposits laid down on a gently inclined coastal plain. On either side of the Alyn Valley Fault that runs subparallel to the east of the Clwydian Range, the Basement Beds are overlain by the Foel Formation (late Chadian), which consists of variably dolomitised and argillaceous limestone with beds rich in oncolites, calcareous sandstone and plant-bearing siltstone. The lithologies are interpreted as a peritidal, aggradational sequence. The sequence thins markedly on to the horst between the Alyn Valley and Vale of Clwyd faults, indicating their contemporary movement. Subsequent marine transgression, in early Arundian times, culminated in the widespread accumulation of open marine, platform carbonates across much of north Wales; these include the Llanarmon Limestone Formation in Flintshire, which now replaces the Llysfaen Limestone Formation of Colwyn Bay and Ochr-y-foel Limestone Formation of Prestatyn. The cross-bedded, peloidal and skeletal grainstones developed through the south-westward migration of high-energy, inner ramp facies. Subsequent north-eastward progradation created a broad, gently inclined carbonate platform.

In late Arundian to early Holkerian times, as the Dinantian transgression resumed, localised uplift and erosion caused major changes in the distribution of facies across the platform. Sea level rose throughout Holkerian times and drowned the platform; the shoal facies was restricted to the margin where coarsely crinoidal and cross-stratified sequences were formed in the upper part of the Llanarmon Limestone Formation, previously the Gop Hill Limestone, at Prestatyn. To the west, there was extensive epigenetic dolomitisation and mineralisation (previously Llandudno Pier Dolomite) and also the bryozoan ‘reef’ of Nant y Gamar. The coeval Leete Limestone Formation of Flintshire and south Denbighshire, now replacing the Dulas Limestone Formation of Colwyn Bay and the Tandinas Limestone Formation, at Penmon, on Anglesey, are peritidal deposits, which accumulated within protected landward embayments. The limestones are commonly oncolitic, subtidal packstones and grainstones. They are interbedded with intertidal fenestral wackestone with root traces and gypsum pseudomorphs, and calcite mudstone (‘birds eye micrites’) in a series of progradational rhythms that range from less than 0.5 m to several metres thick.

Oscillations in sea level in late Asbian times, caused by the onset of the Gondwanan glaciation, resulted in deposition of thick-bedded, massive, mottled or pseudobrecciated skeletal packstones (Loggerheads Limestone Formation including the Llandulas, Great Orme and Penmon limestones; (P662387); (P662426). The lithologies show that during intervals of high sea level, open-marine subtidal conditions prevailed over much of the platform, and the abundant karst surfaces, mudstone palaeosols and calcretes indicate intermittent regressions with emergence. Late Asbian limestones are the oldest preserved in the Corwen outlier and, at the same time, knoll reefs, at Little Orme, Dyserth and Axton, defined the northern edge of the platform. The reefs comprise fossiliferous wackestone and floatstone, with characteristic stromatactis structures and numerous brachiopods and ammonoids (goniatites). On the basin side of the reef at Dyserth, thin graded packestones and wackestones (Prestatyn Limestone Formation) and the succeeding fine-grained, well-sorted packestones (Gwaenysgor Limestone Formation), with blocks of the reef limestones, represent carbonate detritus derived from the adjacent reef and platform.

During late Asbian times, in south Flintshire, a profound rifting episode is reflected in the thick, late Asbian and Brigantian sequence on the north side of the Bala Fault Zone. In contrast, the sequence is condensed to the south at Minera. Similar thickness variations between Anglesey and the Great Orme, may be due to coeval movement along the Menai Straits Fault Zone. In early Brigantian times, regional subsidence modified the eustatic oscillations, causing widespread changes in the cyclicity. The Cefn Mawr Limestone Formation, including the Bishops Quarry and Traeth Bychan limestone formations, comprise shoaling upward cycles characterised by thin-bedded wackestones and mudstones, rich in corals, brachiopods and, locally, in the foraminifera *Saccaminiopsis*. At the top of the cycles, skeletal packstones and peloidal and ooidal grainstones are commonly capped by karstic surfaces and calcretes. The cycles are thicker and more varied than those within the Asbian, and record more extensive and rapid rises in sea level. The carbonate platform facies, between Berwyn, Arfon and Anglesey, records the highest inundation. Along the platform margin, near Prestatyn, the older reefs were overwhelmed by turbiditic and hemipelagic mud (Teila Formation) with distinctive ammonoid and bivalve faunas. Farther east, on Halkyn Mountain, seismic activity along the Nercwys–Nant figillt Fault Zone caused the collapse of the adjacent platform.

Throughout Asbian and early Brigantian times, small volumes of siliclastic debris were supplied from the south on to the encroaching carbonate platform. Intermittently, during subaerial exposure, the streams cut deep channels into the carbonate sediments causing shoe-string sandbodies, which are particularly well exposed on Anglesey where they have been named at various localities, such as Helaeth, Benllech, Fedw Fawr and Parc. In the late Brigantian (Minera Formation of Flintshire and Denbighshire, and the Red Wharf Cherty Limestone of Anglesey), beds of shallow marine sandstones within the limestones record an increase in the supply of siliclastic detritus. This has been ascribed to both tectonic rejuvenation of the source areas, as a result of plate collision in southern Europe, and climatic changes associated with the Gondwanan glaciation; the same events contributed to the northward advance of the fluviodeltaic sandstones in early Namurian times.

Bibliography

BARCLAY, W J. 1989. Geology of the South Wales Coalfield, Part II, the country around Abergavenny. Third edition. *Memoir of the British Geological Survey*. Sheet 232 (England and Wales).

DINELEY, D L. 1992. Devonian. 179–205 in *Geology of England and Wales*. DUFF, P MCL D, and SMITH, A J (editors). (London: The Geological Society of London.)

FRESHNEY, E C, and TAYLOR, E A. 1980. The Variscides of south-west Britain. 49–57 in *United Kingdom introduction to general geology and guides to excursions*. OWEN, T R (editor). Proceedings of the 26th International Congress, Paris, 1980.

GAYER, R, FOWLER, R, and DAVIES, G. 1997. Coal rank variations with depth related to major thrust detachments in the south Wales coalfield: implications for fluid flow and mineralization. 161–178 *in* European coal geology and technology. GAYER, R, and PES EK, J (editors). *Geological Society Special Publication*, No. 125.

GEORGE, T N. 1970. *British regional geology: south Wales*. Third edition. (London: HMSO.)

HAMPSON, G J, ELLIOTT, T, and DAVIES, S. 1997. The application of sequence stratigraphy to Upper Carboniferous fluvio-deltaic strata of the onshore UK and Ireland: implications for the southern North Sea. *Journal of the Geological Society of London*, Vol. 154, 719–733.

JONES, D G. 1074. The Namurian series in south Wales. 117–132 in *The Upper Palaeozoic and post-Palaeozoic rocks of Wales*. OWEN, T R (editor). (Cardiff : University of Wales Press.)

KELLING, G. 1974. Upper Carboniferous sedimentation in South Wales. 185–224 in *The Upper Palaeozoic and post-Palaeozoic rocks of Wales*. OWEN, T R (editor). (Cardiff: University of Wales Press.)

POWELL, C M. 1989. Structural controls on Palaeozoic basin evolution and inversion in south-west

Wales. *Journal of the Geological Society of London*, Vol. 140, 439–446.

RAMSBOTTOM, W H C. 1973. Transgressions and regressions in the Dinantian: a new synthesis of British Dinantian stratigraphy. *Proceedings of Yorkshire Geological Society*, Vol. 39, 567–607.

THOMAS, L P. 1974. The Westphalian (Coal Measures) in south Wales. 133–160 in *The Upper Palaeozoic and post-Palaeozoic rocks of Wales*. OWEN, T R (editor). (Cardiff: University of Wales Press.)

WARREN, P T, PRICE, D, NUTT, M J C, and SMITH, E G. 1984. Geology of the country around Rhyl and Denbigh. *Memoir of the British Geological Survey*, Sheet 107 and parts of sheets 94 and 106 (England and Wales).

WATERS, C N, BROWNE, M A E, DEAN, M T, and POWELL, J H. 2007. Lithostratigraphical framework for Carboniferous successions of Great Britain (onshore). *British Geological Survey Research Report*, RR/07/01.

WHITE, S. 1991. Palaeogeothermal profiling across the South Wales Coalfield. *Proceedings of the Ussher Society*, Vol. 7, 368–374.

WILSON, D, DAVIES, J R, FLETCHER, C N J, and SMITH, M. 1990. Geology of the south Wales Coalfield, Part VI, the country around Bridgend. Second edition. *Memoir of the British Geological Survey,* Sheets 261 and 262 (England and Wales).

WOODLAND, A W, and EVANS, W B. 1964. The geology of the south Wales Coalfield. Part IV. The country around Pontypridd and Maesteg. *Memoir of the Geological Survey of Great Britain,* Sheet 248 (England and Wales).

WRIGHT, V P. 1996. Use of palaeosols in sequence stratigraphy of peritidal carbonates. 63–74 *in* Sequence stratigraphy in British geology. HESSELBO, S P, and PARKINSON, D N (editors). *Geological Society of London Special Publication*, No. 103.

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

Retrieved from
'http://earthwise.bgs.ac.uk/index.php?title=Visean,_Dinantian,_Carboniferous,_Wales&oldid=27861'
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

Search Go

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

- This page was last modified on 5 May 2016, at 09:53.