Upper Old Red Sandstone, Devonian, Wales

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The Sugar Loaf viewed across the Usk valley from Govilon. The Sugar Loaf hill is capped by an outlier of Quartz Conglomerate (Upper Old Red Sandstone) with the Senni Beds below. P662423.

Late Devonian Upper Old Red Sandstone strata, referred to the local Farlovian stage, overlie the unconformity that truncates the underlying Breconian and older successions. They are predominantly fluvial, deposited on a southerly facing palaeoslope, but lacustrine, aeolian and marginal marine facies occur sporadically. The succession is thin in comparison with the Lower Old Red Sandstone, with up to a maximum of about 350 m in south-west Pembrokeshire. Stratigraphical correlation, mainly by vertebrate remains and palynology, is imprecise, but an age range from late Frasnian to early Carboniferous has been demonstrated, with much of the succession being Famennian.

In the Pembroke peninsula, the Skrinkle Sandstones Group is well exposed to the south of the Ritec Fault. The group accumulated as a synrift succession of alluvial fan, alluvial plain and lacustrine deposits in the hanging wall of the Ritec Fault. Its distribution is confined to the Tenby-Angle fault block, thickening southwards from 100 m near the Ritec Fault to 330 m at Freshwater West. The beds lie unconformably on the Ridgeway Conglomerate, overstepping it eastwards to rest on the Milford Haven Group. There is a transition into grey Carboniferous beds at the top of the group. The group is subdivided into the Gupton Formation and overlying West Angle Formation. Locally, as at Freshwater West, the Gupton Formation is interpreted as comprising two, axial basin-fill, fluvial, coarsening-upwards sequences of mature clean sandstone. The lower sequence (Lower Sandstone Member) is exposed only at Freshwater West. It is 55 m thick and comprises, in upward succession: small, multistorey sandstone units in a background of mudstone and siltstone; thicker, single-storey sandstone beds; and stacked, pebbly sandstone-based, fining-upwards units. The member is interpreted as the product of a south-eastward prograding terminal fan. The higher sequence (Stackpole Sandstone Member) comprises a lower, mudstone-rich, heterolithic facies and an upper, trough cross-bedded and parallel-laminated sandstone facies association. This member is 6 m thick near the Ritec Fault, thickening to 68 m at Freshwater West. It is interpreted as the product of lacustrine and high-energy braidplain environments.
The overlying West Angle Formation comprises channel-fill conglomerates and sandstone sheets, typical of meandering channel systems, fining up into fluvial sandstones with mudstone and calcrete interbeds. It is characterised by red sandstones, conglomerates rich in igneous, sandstone and phyllite clasts and calcretes. The lower part of the formation (Conglomerate Member), in which conglomerate channel-fills and sheets are typical, is interpreted as the product of meandering channel systems that prograded southwards. The pebbles were probably derived from the Precambrian Pebidian volcanic complex and associated Ordovician volcanic rocks of the north Pembrokeshire coast, either directly or by recycling of the clasts of the Cosheston Group. The upper part of the formation (the Red-Grey Member) comprises fining-upwards fluvial sequences with mudstone and calcrete tops, similar to the meandering channel deposits below, but showing an upward increase in grey beds and grey-green sandstones with plant remains. The grey beds contain nonmarine fossils initially, but there is an upwards increasing marine influence, a precursor to the main transgression at the start of the Carboniferous. The finer sandstones and mudstones contain phosphatised plants, fish teeth and bivalves. Beds with a thin coal, root traces, Planolites, calcretes and a shelly limestone have been interpreted as a lagoonal accumulation, and spores indicate a Late Devonian age. The highest bed of the formation, a yellow-weathered, calcareous sandstone with internal parallel- and cross-lamination, reflects a transgressive barrier beach sequence, and the overlying slumped grey mudstones and calcareous sandstones have yielded spores (VI Biozone flora) of Early Carboniferous age.

East of the Milford estuary, in the Carmarthenshire Fans, Black Mountain and Brecon Beacons, the Upper Old Red Sandstone consists of the Plateau Beds Formation, which is named from its typical topography along this outcrop. The formation rests unconformably on the Brownstones Formation and is best known for its sporadic vertebrate and marine brachiopod faunas. The Afon y Waen Fish Bed is one of several fish-bearing, lenticular conglomerates. The formation consists mainly of red-brown and purple, quartzitic sandstone with subordinate mudstone. Thickness ranges up to a maximum of 58 m in Breconshire. Three divisions have been recognised on the basis of facies, and together they comprise a broadly transgressive sequence from fluvial and possible aeolian deposition to marginal marine environments. A widespread, granule-rich mudstone, up to 8 m thick at the base of the formation, may have been a mudflow. It is succeeded in the Swansea valley area by up to 7.5 m of conglomerate, pebbly sandstone and red mudstone (Division A), perhaps formed in a southerly directed, braided stream environment. At a similar level east of Afon Llia, planar cross-bedded red sandstone displaying north-westerly directed palaeocurrents and intercalated with water-laid sandstones overlie the basal granule bed. These beds (Division B) are about 18 m thick and have been interpreted as aeolian and possible wadi sediments, although a shallow, tidal origin may be more likely. The overlying division (C) is up to 18 m thick. Its lower half comprises fining-upwards, red-brown sheet sandstones, lenticular, channelised, red-brown and purple quartzose sandstones, pebbly sandstones, some fish-bearing conglomerates (including the Afon y Waen Fish Bed) and interbedded red mudstones. This is overlain by a heterolithic sequence of interbedded fine-grained, red-brown sandstones, fish-bearing conglomerate lenses and mudstones. The succession has yielded sporadic brachiopods (including Cyrtospirifer verneuili, Lingula spp., Ptychomalotoechia omaliusi), bivalves (Leptodesma cf. lichas, Pterinopecten sp., Sanguinolites sp.), fish fragments (Bothriolepis, Coccosteus, Holoptchius, Pseudosauripterus anglicus, cf. Rhinodipteryx and Sauripterus), the resting trace Rusophycus, an abundance of burrows (including cf. Planolites) and trails, and plant fragments. This upper division is interpreted as being marginal marine, showing a general upward transition from supratidal to intertidal and subtidal environments. It indicates a transgressive event, the dating of which remains imprecise, but P. omaliusi is confined to the early Famennian in the marine deposits of mainland Europe.

The Plateau Beds Formation is overstepped by the Grey Grit Formation, about 13 m thick, which consists mainly of greenish grey or greenish white, very fine- to fine-grained, cross-bedded,
quartzitic sandstones. Thin green mudstone interbeds and quartz pebble layers occur sporadically. Fauna is restricted to fish fragments and the bivalve *Sanguinolites*, along with some burrows, including forms resembling *Skolithos* and * Arenicolites*. Cross-bedding indicates a predominantly southerly or south-easterly flow, but north-east current indicators have also been recorded, as well as some herring-bone cross-bedding. A braided stream environment is suggested, but a shallow marine setting for at least part of the formation cannot be discounted. Between the Cennen valley and the Tawe Valley Disturbance, a thin (4 to 7 m) unit of pale grey to yellow and greenish, tabular-bedded quartz conglomerate and pebbly, quartzitic sandstone (Pont Clydach Formation) oversteps the Plateau Beds and grades up into the Avon Group (Lower Limestone Shales, Carboniferous). *Ctenocanthus* spines, *Planolites* and *Palaeophycus*-type burrows have been recorded, and lingulids occur in mudstone in the uppermost transitional beds. The formation is probably entirely of Carboniferous age.

In the vicinity of Cardiff, the basal Upper Old Red Sandstone (Cwrt yr ala Formation) oversteps the Lower Old Red Sandstone sequence between Creigiau and the Taff valley. comprises thinly bedded, quartzitic sandstone, siltstone and mudstone in fining upwards alluvial cycles, with some thick, commonly pebbly sandstone beds. Nodular calcrite profiles are well developed in the mudstones. The sequence is interpreted as the product of a high-sinuosity fluvial channel system, the mudstones being more distal flood plain deposits. *Bothriolepis* and *Sauripterus* have been recorded, as well as *Beaconites* burrows.

Around the eastern crop of the South Wales Coalfield, the Upper Old Red Sandstone is represented by the Quartz Conglomerate Group, which forms a narrow outcrop on the coalfield escarpment and, most distinctively, a small outlier capping the Sugar Loaf at Abergavenny (P662423). The group thickens from about 25 m at Llangattock in the north, to over 70 m at Risca in the south. In the Cardiff area, it rests unconformably on the Cwrt yr ala Formation. At its base, 14 to 20 m of grey-green quartzitic sandstones (Wern Watkin Formation) correlate with the Grey Grit Formation of the Merthyr district. A mature calcrite at the top of the Wern Watkin Formation is overlain by quartz pebble conglomerates (Craig-y-cwm Formation), which contain sporadic fish fragments, including Bothriolepis. At the top of the group, micaceous, feldspathic and garnet-rich sandstones with interbedded red mudstones constitute the Garn gofen Formation. Fish remains from these beds include a fragment of *Osteolepis macrolepidotus*. In addition, the bivalve *Archanodon jukesi* was collected from the Quartz Conglomerate Group in Gwent, and *Holoptychius nobilissimus* has been recorded at Tongwynlais. The group is interpreted as being fluvial in origin, formed in generally southerly prograding alluvial fan systems. The Wern Watkin Formation is of sandy, braided stream origin; the Craig-y-cwm Formation is the product of gravely, braided stream deposition; and the Garn gofen Formation is very immature and was deposited in high-sinuosity streams, the influx of mica, garnet and feldspar indicating the erosion of a newly exposed metamorphic rock source. Locally the uppermost beds of the Quartz Conglomerate Group in south-east Wales are sharply overlain by the early Tournaisian Tongwynlais Formation (Avon Group) of the Carboniferous Limestone. Spores from 18 m below the top of the group at Tongwynlais north of Cardiff are regarded as earliest Famennian. To the north, there is a depositional break between the uppermost beds of the group and the Carboniferous Limestone.

**Bibliography**


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