

The Cambrian of SW Wales: Towards a United
Avalonian Stratigraphy

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The Cambrian of SW Wales: Towards a United Avalonian Stratigraphy

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Preface

The classic Cambrian succession of SW Wales comprises some 1250 m of clastic rocks that make up a part of the Dyfed Supergroup, and which range from Terreneuvian to Furongian in age. The existing lithostratigraphical framework owes much to the Nineteenth Century researchers, with relatively little detailed work having been published since. We here present a detailed, rationalized and revised lithostratigraphy for the Cambrian part of the Dyfed Supergroup of the area: where possible and appropriate, we have retained original and well-known names for formations and other units in harmony with current usage. The practice of recognizing four lithostratigraphical groups is overly complex and sometimes unworkable however, and a two-fold subdivision is proposed instead. The Caerfai and much of the Lower and Middle Solva groups of earlier usage are combined into a revised Caerfai Group, while the Upper Solva Group, Menevian Group and Lingula Flags comprise the newly erected Porth-y-rhaw Group. Six formations, including one divided into three members, are recognized within the revised Caerfai Group, and a further six formations make up the Porth-y-rhaw Group.

Deposition of the Dyfed Supergroup took place on the microcontinent of East Avalonia, one of a number of circum-North-Atlantic terranes and superterranes that were once part of an accretionary orogen developed on an active Gondwanan margin of the Neoproterozoic supercontinent Rodinia and its successor Pannotia or Greater Gondwana. These peri-Gondwanan terranes are defined by their Neoproterozoic evolution on an active continental margin and by the Acadian or Baltoscandian aspect of their Cambrian-Ordovician overstep successions. The oldest part of the Caerfai Group records a transition from westerly-derived alluvial fan sediments, through braided stream environments, into transgressive nearshore marine sandstones. Above lie sedimentary rocks deposited under a wide range of conditions ranging from nearshore tidally-influenced to shelfal sediment gravity flows. Deposition of the Porth-y-rhaw Group began with fine-grained turbidites deposited in a mid-outer shelf setting. These pass up first into hemipelagites, then sedimentary deposits formed on a storm-dominated shelf, and finally on an extensive, largely shallow subaqueous delta platform.

Cambrian chronostratigraphy is in a state of flux. Instead of the traditional tripartite subdivision, four series are now recognized, which are further divided into ten stages. Not all these divisions have been named and ratified, and the bases of some of them have yet to be internationally agreed. In the account below, the Unnamed Second and Third

Cambrian series are respectively referred to as C2 and C3. Unnamed stages are denoted by CS2, CS3 and so on.

Trace fossils low in the Caerfai Group date that part of the succession to the *Rusophycus avalonensis* Ichnozone or the *Teichichnus* Interval of the oldest Cambrian series, the Terreneuvian. A little higher up, a high resolution U–Pb date indicates a CS3 (C2) age. Shelly fossils, especially trilobites, become much more common at some levels in the higher parts of the Caerfai Group and parts of the Porth-y-rhaw Group, and these faunas facilitate correlation particularly with the C3 (CS5) to Furongian (Paibian Stage) parts of the Scandinavian succession. The *Baltoparadoxides oelandicus* Biosuperzone and probably the *Ptychagnostus gibbus* Biozone occur in the Caerfai Group. The Porth-y-rhaw Group yields trilobites diagnostic of the *Tomagnostus fissus*, *Hypagnostus parvifrons*, *Ptychagnostus punctuosus*, *Agnostus pisiformis* and *Olenus* biozones.

High resolution sequence-stratigraphical techniques, constrained by the biostratigraphical data wherever possible, are applied to the Dyfed Supergroup across southern Britain to integrate the revised lithostratigraphy with the Avalonian chronostratigraphy based on the western Avalonian successions of maritime Canada. The relative ease of integration reflects the shared epeirogenic history, sediment sources and accumulation history of a microcontinent unified early in Cambrian times. An overall two-fold subdivision into megasequences respectively representing tectonically active and passive phases of sedimentation is recognized. Megasequence 1 spans the Terreneuvian, C2 and much of C3. It records transform termination of Avalonian subduction following oblique convergence, and the accretion of island arcs to the northern periphery of Gondwana. Under transpressional regimes, late Precambrian arc-related basins were inverted and recycled into pull-apart successor basins which were initially dominated at their margins by alluvial fans and coarse-grained fan-deltas built by flood-generated sediment dispersal processes. In the later transform stage of Cadomian–Avalonian orogenesis, there was a switch to sediment supplied from highlands to the east. The Ogof Velvet Formation lies at the base of Megasequence 2, which extends from late C3 into the early Ordovician, and reflects passive margin sedimentation. The Formation was deposited as part of a subaqueous delta platform at the mouth of a huge fine-grained river system that drained part of West Gondwana; its depositional setting and characteristics are best understood in terms of nearshore sediment bypass that facilitated rapid progradation under high sediment input regimes.

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