Caban Côch

[SN 925 647]

Introduction

Llandovery strata exposed in the area around Rhayader, to the north-west of the Thwy Lineament, were deposited in slope and basinal environments on the eastern margin of the Welsh Basin. Both Murchison (1839) and Sedgwick (1847) assigned the rocks of the Rhayader district to the Cambrian System, but the Geological Survey map and sections, published in 1850 on the basis of mapping undertaken by Ramsay and Aveline, used fossil evidence to refer them to the Lower Llandovery.

The first exhaustive study of the area was completed by H. Lapworth (1900), who drew particular attention to strata referred to the Caban Group, which occupies a band of country about 3 km long extending from Caban Côch to the confluence of the rivers Elan and Wye. Lapworth divided the Caban Group into two main units, the Caban Conglomerates and the Gafallt Beds, and designated a typical section extending from Cnwch Hill, to the south of the Afon Elan, across to the north side of the river. The Caban Conglomerates were further subdivided into three: the Lower Conglomerates, the Intermediate Shales and the Upper Conglomerates. The Gafallt Beds were divided into the *Monograptus–Sedgwickii* Grits' below and the Gafallt Shales above. Lapworth (1900, pp. 11218) also noted the lenticular geometry of the Caban Group and discussed its relationship to the strata above and below, concluding that the group lay with erosional unconformity on the underlying Gwastaden Group. The overlying Rhayader Group was observed to overlap the Caban Group, but not necessarily unconformably. Lapworth thus considered the Caban Group to have been deposited during the transgression of the sea across a pre-existing, sub-aerially eroded hollow, with the conglomerates, by implication, of shallow-water origin.

The Rhayader district was remapped by Davies (1928), who noted that the unconformity identified by Lapworth at the base of the Caban Group (referred by Davies to the 'Upper Birkhill Series') was not detectable to the west and south, towards and around the village of Abergwesyn. A further map, highlighting the distribution of grits and conglomerates, was produced by Davies and Platt (1933), who also discussed the composition of the coarse elastic bands, and attributed their origin to longshore drift.

Kelling and Woollands (1969) also mapped the Rhayader area, paying particular attention to the stratigraphical and sedimentological framework of the deposits, and concluded that Lapworth's interpretation of an erosional unconformity at the base of the Caban Group could not be upheld. They instead considered the rudite and coarse arenite bodies to represent the sites of major offshore submarine channels, in which erosion and infilling were almost simultaneous. This idea was developed by Davies and Waters (1995), who reconstructed the architecture and evolutionary history of the channel and lobe system; further details are included in the British Geological Survey Memoir on the geology of the country around Llanilar and Rhayader (Davies *et al,* 1997).

The quarry and the crags above at Caban Côch (Figure 3.31), (Figure 3.32) provide excellent representative exposures of the Caban Conglomerate Formation (approximately equivalent to Lapworth's Caban Group). They expose the western part of a channel complex, and enable detailed study of the character of the entire complex and of the nature and relationships of the individual conglomerate and sandstone units.

Description

The rocks exposed in the quarry belong to Lapworth's 'Lower Conglomerate' and are dominated by clast-supported pebble and cobble conglomerates, with subordinate coarse sandstones (Figure 3.32), (Figure 3.33). The conglomerate bands have erosional bases, and in several cases can be seen to occupy channels, which can be traced for up to 20 m; they sometimes have steep sides and display undercutting. The coarser conglomerates are normally disorganized, but finer conglomerates commonly display normal and reverse grading and there is some evidence of imbrication. Sole marks are rare, and restricted to linear or elliptical gouge structures up to 15 cm deep. Angular clasts of mudstone are common within the conglomerates, and reach up to 2 m in size; some are armoured by small pebbles and granules. The rounded and subrounded clasts are dominated by quartz, quartzites and sandstones, together with acid and basic igneous rocks, pyroclastics, and occasional broken fossils. The conglomerate bands each pass up into coarse, pebbly sandstones, which commonly show grading and may be more laterally persistent than the lenticular conglomerate horizons; some display megaripple cross-lamination on a scale of 15–25 cm. Some units of thin-bedded sandstone and mudstone also occur, reaching 60 cm in thickness; one of these units, near the bottom of the quarry, has produced graptolites referred to the *acinaces* or *cyphus* Biozone (Davies *et al.,* 1997).

Above the quarry, at the foot of the crags on Caban Côch, shales of the 'Dyffryn Flags facies' (Waters *et al.,* 1993; 'Intermediate Shales' of Lapworth, 1900) crop out., These comprise cleaved mudstones interbedded with thin (1–30 cm thick) grits and sandstones, which are graded and parallel laminated or may show ripple drift lamination. The proportion of coarser clastic horizons increases upwards, and small lenses of conglomerate with scoured bases occur in the upper 5 m of the unit. At [SN 9253 6470], in the uppermost mudstones, graptolites have been recovered from a thin laminated hemipelagite (Siveter *et al.,* 1989). These include *Rhaphidograptus toernquisti, Orthograptus cyperoides, Climacograptus rectangularis sensu lato* and *Pseudoclimacograptus? retroversus,* an assemblage indicative of the *triangulatus* or *magnus* Biozone.

The upper conglomerate member is exposed in the crags above the quarry and descends to the road 200 m east of the quarry [SN 9267 6469]. The unit displays a channelized base, and is similar in character to the lower conglomerate member. Large contorted and angular clasts of the underlying mudstone are present in the basal conglomerates.

The overlying *'M. sedgwickii* Grits' are exposed in a buttress at [SN 9260 6477]. The transition from the conglomerates is gradational, and the unit comprises turbiditic sandstones and mudstones with rare burrowed hemipelagites. The sandstone beds are normally up to 40 cm thick and commonly display flute casts and basal shelly lags; a few thicker, coarser, sometimes pebbly sandstones occur. A little higher in the hillside, at Craig Gigfran [SN 9260 6488], the crags display strata of the overlying Gafallt Shales (Davies *et al.,* 1997). These comprise thin turbiditic mudstone and siltstone couplets, with occasional fine to coarse sandstones up to 4 cm thick. The turbidite units are interspersed with burrowed hemipelagites.

Interpretation

The Caban conglomerates and sandstones accumulated in a north-westerly trending channel complex, which probably developed at the base of a fault-controlled slope (Kelling and Wool-lands, 1969). The complex is situated on the north-west side of the Towy Lineament, which during the Rhuddanian to early Telychian defined the south-eastern margin of the deep-water region of the Welsh Basin. Along this margin, a westwardly thinning wedge of mud-dominated slope–apron sediments built out into the basin, locally punctuated by a complex system of nested channel fills and associated sandy lobes (Davies and Waters, 1995). The Caban Conglomerate Formation comprises the proximal lobe and channelled facies of this system, with the median and distal lobe facies represented by the Ystrad Meurig Grits Formation to the west.

Davies and Waters (1995) showed that the Caban conglomerates were confined to broad tracts up to 4 km wide. The high level of amalgamation between successive units, the complex grading and the steep-sided erosive channels were interpreted by these authors to indicate deposition in a braided submarine channel system from surging and switching high-concentration, gravel-laden turbidity flows. The pebbly sandstone units between the conglomerates were regarded as deposits from expanding, gravel-depleted flows. The 'Dyffryn Flags facies', between the two main conglomerate units, comprises turbidite sandstones and mudstones representing Bouma Tc-e or Tb-e sequences (see (Figure 3.40)). These were interpreted as having occupied a more marginal setting in the system, where the turbidity currents were depleted in coarser sediment and carried a greater proportion of mud. A similar setting was suggested for the 'Gafallt Shales facies', with Tb-e units very subordinate in this case; the burrowed hemipelagites suggest more oxic bottom conditions. The *'M. sedgwickii* Grits facies' exhibits a similar lateral restriction to the conglomerates, but shows Bouma Tb, The and Tb-e sequences, suggesting that lower-concentration turbidity currents also deposited sediment within the confines of the feeder channels.

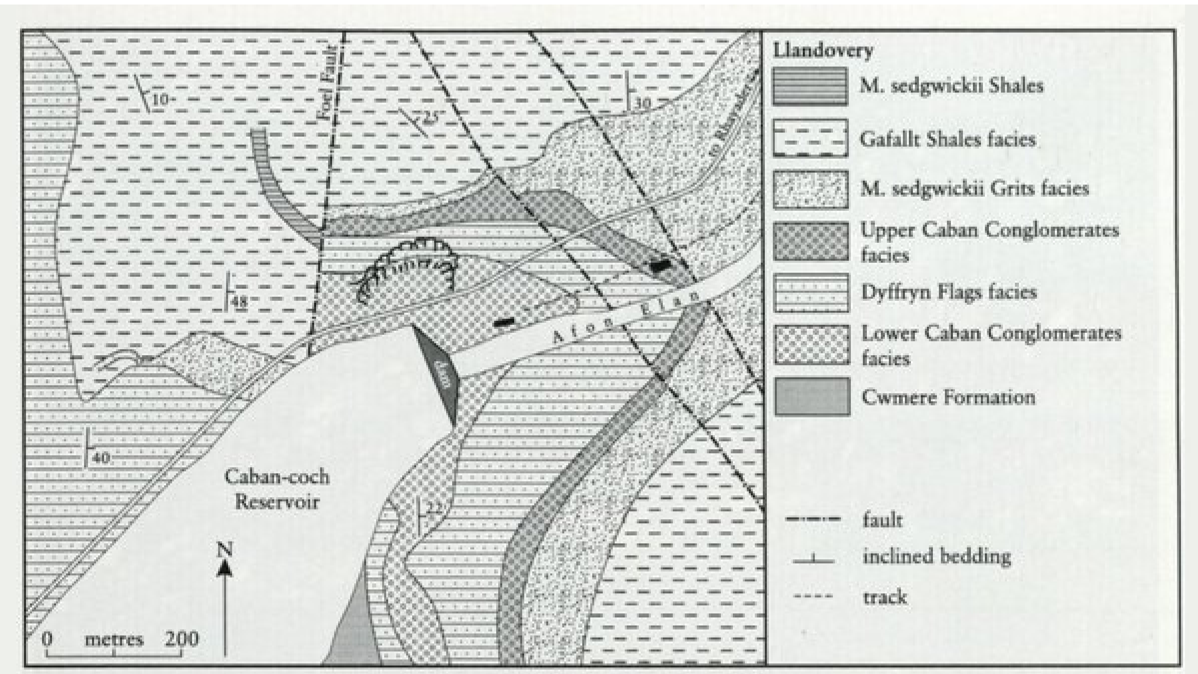
A reconstructed model of the depositional system at different times in its history was presented by Davies and Waters (1995; (Figure 3.34)), who also discussed the evolutionary history of the complex. The system was initiated in latest Ordovician (*persculptus* Biozone) times, when the feeder channel advanced over the underlying turbidites, followed by expansion during the Rhuddanian. A brief cessation of coarse elastic deposition occurred in the main Caban channel during the early Aeronian (*triangulatus* Biozone), with gravel supply being re-established during *magnus* to *argenteus* Biozone times. This may reflect tectonic rejuvenation of the sediment source areas. The onset of deposition of the 'sedgwickii Grits facies' in the *convolutus* Biozone marked an abrupt decrease in the sediment-carrying efficiency of the system. The transition to the 'Gafallt Shales facies' during the earliest Telychian (lower *turriculatus* Biozone) records a gradual decline of the supply of coarse elastics and the abandonment of the Caban channel complex. During this final phase, low-concentration turbidity currents were routed across the slope–apron area via the relict channel system.

The cessation of turbidite supply into the Welsh Basin from the eastern margin coincides with the inception of northerly turbidite flows into the Aberystwyth area from a southerly source. This change may relate to tectonic events creating uplift to the south, evidence for which is also provided by the Telychian unconformity at Marloes.

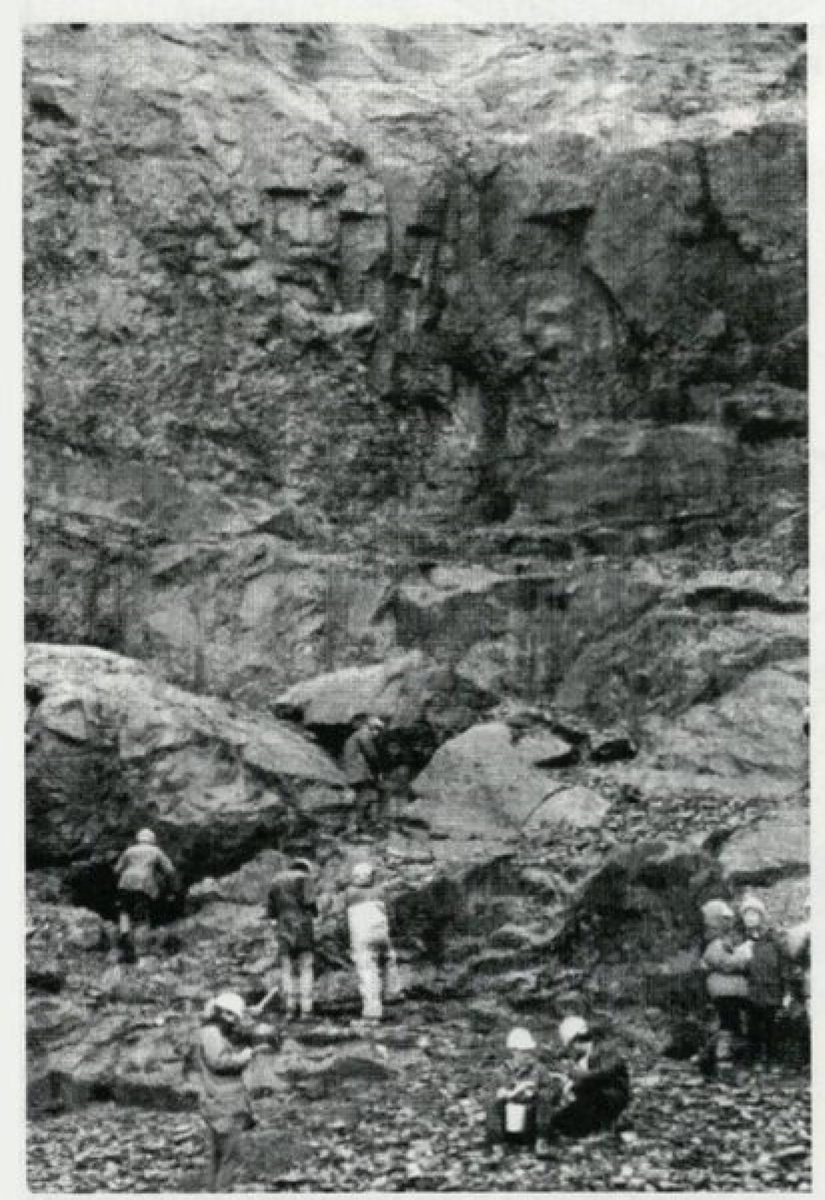
Conclusions

The rocks in the quarry and surrounding crags at Caban Côch provide excellent exposures through sediments deposited in submarine channels on the eastern margin of the Welsh Basin. These channels acted as pathways for transport of sediment eroded from the land to the south-east into the deep water of the basin. The channels themselves were the sites of deposition of coarse conglomerates and sandstones, while finer sand, silt and mud was carried further to the west. The system was in operation from the latest Ordovician until the early Telychian, when the sediment supply waned. The architecture of the channels and the sedimentary characteristics of the conglomerates are beautifully displayed in the quarry, while the alternation of coarse-grained and fine-grained units in the crags above record the changing conditions in the channel system. The exposures are of major importance, as they provide the best evidence available of the nature of the sedimentary feeder channels into the Welsh Basin during the early Silurian, and they also give important clues to the tectonic events that caused variations in the sediment supply. The site is frequently visited by students and by national and international researchers and has a high conservation value.

[References](#)

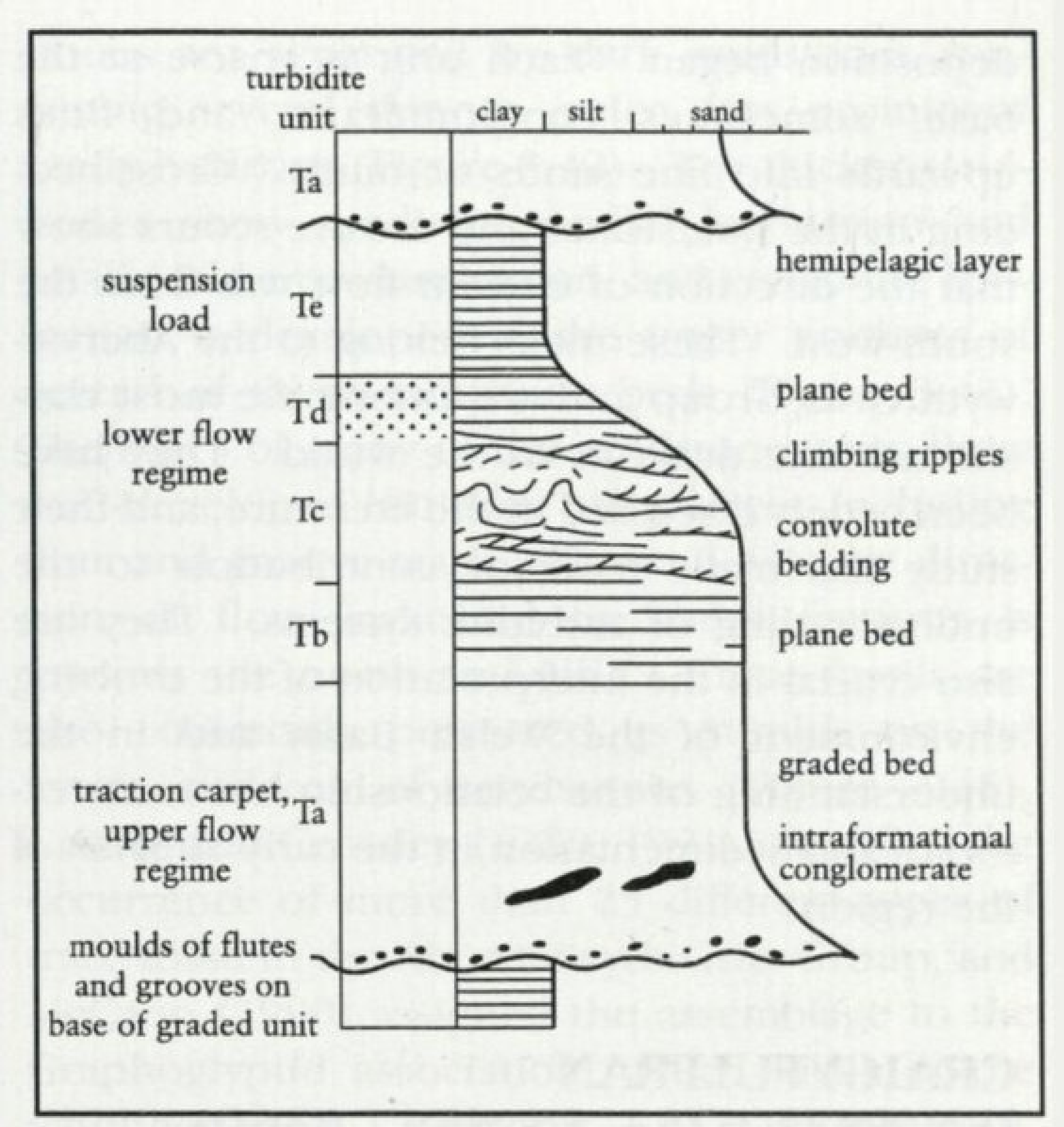


(Figure 3.31) Geological sketch-map of the area around Caban Côch quarry (after Waters et al, 1993).

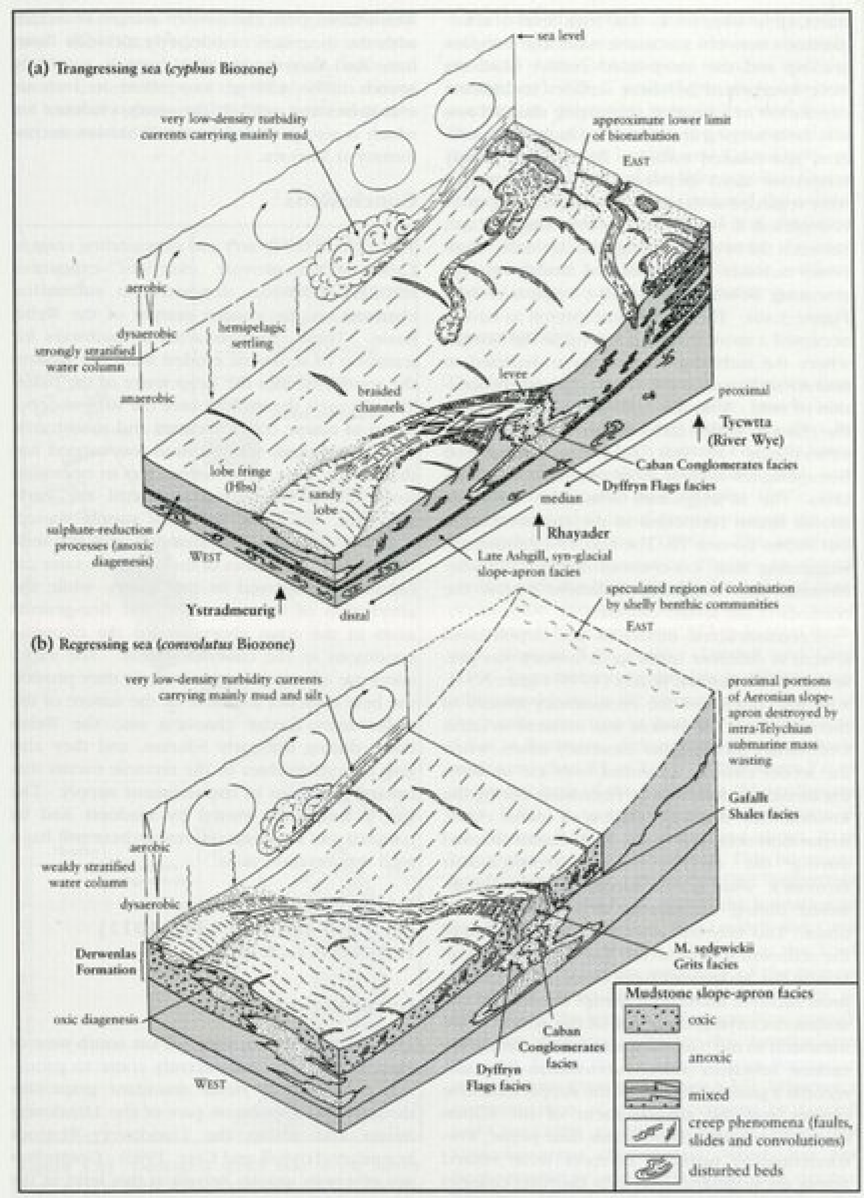


(Figure 3.32) Turbiditic sandstones and conglomeratic submarine channel fills, Caban Côch quarry. (Photo: R.J. Aldridge.)

(Figure 3.33) Detail of the conglomeratic infill of a submarine channel, Caban Côch quarry; the lower part of the conglomerate unit shows reverse grading. (Photo: R.J. Aldridge.)



(Figure 3.40) Idealized graphic log of the full Tabcde Bouma turbidite cycle (modified from Selley, 1978, after Bouma, 1962).



(Figure 3.34) Depositional model for the development of nested channels and lobes in the Caban Côch area during the Llandovery Epoch (after Davies and Waters, 1995; Davies et al., 1997).