West Whipcott Quarry, Devon

[ST 069 186]

Introduction

The West Virhipcott Quarry GCR site is a large, disused quarry [ST 069 186], located to the west of the Grand Union Canal, 1.5 km north of Westleigh, east Devon. It provides one of the best exposures of a thick sequence of Viséan limestones and interbedded shales known as the 'Upper Westleigh Limestone'. Lithological and palaeontological evidence suggests a turbiditic origin for these limestones, which are only developed locally in the typically thin, chert-dominated sequences of east Devon. There is no recent detailed account of the Westleigh Limestone and what follows is based on the field observations of Thomas (1963a, 1971) and the palaeontological analysis of Matthews and Thomas (1974).

Description

The relationship between the largely coeval Westleigh Limestone and Bampton Limestone successions is shown in (Figure 10.2) but the boundary between them appears to be abrupt and is probably complicated by faulting or slumping (Thomas, 1963b). In the numerous quarries around Westleigh it is possible to distinguish a lower unit and an upper unit within the Westleigh Limestone succession. Thinly bedded detrital limestones with few interbedded shales characterize the lower unit, whereas the overlying limestones are thicker, coarser and occasionally conglomeratic.

The Upper Westleigh Limestone at West Whipcott consists of calcarenites and calcirudites, typically < 0.5 m thick, which include chert horizons and nodules, along with some evidence of graded bedding and sole marks. Although the succession is complicated by folding and faulting, at least 25 m of well-bedded limestone is preserved in successive benches of the quarry. Some beds are coarsely conglomeratic and contain angular blocks of micritic and/or skeletal limestone set in a matrix of oolitic and crinoidal debris. Comminuted fossils such as bryozoans, crinoids, corals and brachiopods are recognizable in some of the larger (up to 5 cm) lasts. The thicker limestones are massive, sharp-based and poorly sorted but may possess a thin (*c.* 5 cm thick), laminated upper horizon that grades into the overlying shale.

The interbedded buff and purple micaceous shales are slightly calcareous, finely colour-banded and often bioturbated. Nodular developments of chert and limestone occur commonly and spectacular examples of concentric weathering are evident on many joint and bedding surfaces. There is no evidence of a benthic fauna here, although in adjacent quarries some brachiopods, trilobites and crinoids have been recorded, as have flattened pelagic fossils such as *Goniatites crenistria* and *Posidonia* (Thomas, 1963a; Matthews and Thomas, 1974).

Several large angular folds are well exposed in the lower levels of the quarry and abrupt changes in dip suggest localized faulting (Figure 10.11). At the top of the quarry, a thin veneer of New Red Sandstone is preserved above a pronounced angular unconformity. The ferruginous sandstones impart a red surface coloration to many of the underlying limestones and shales.

Interpretation

Lithological evidence from Whipcott and neighbouring quarries indicates that the limestones contain reworked 'shelf' material such as ooliths, pellets, fossil fragments and some coarsely conglomeratic horizons with angular clasts of medium-grained limestone. These features, occurring in beds that are commonly sharp-based and graded, are attributed to limestone turbidites (Thomas, 1963a). In contrast, the intervening shales with their fine lamination and sparse benthic fauna show little sign of transportation. Indeed, there is evidence that certain fine-grained intervals such as the Crenistria Limestone were deposited during periodic oxic conditions in an otherwise anoxic deep-water basin that extended throughout the Rhenohercynian Zone (Jackson, 1990; Warnke, 1997).

Ammonoids originally provided the basis for dating the Westleigh Limestone succession. Poorly preserved prolecanitids described by Prentice and Thomas (1965) indicate a late Viséan (Asbian–Brigantian) age for the upper unit. Towards the top, shales interbedded with thick limestones yield both *Neoglyphioceras spirale* and *Lusitanoceras granosus.* These species characterize the P_{1d}–P_{2a} a ammonoid zones of the Brigantian Stage (Figure 10.3), indicating that these beds represent the youngest phase of limestone sedimentation in the Culm Trough.

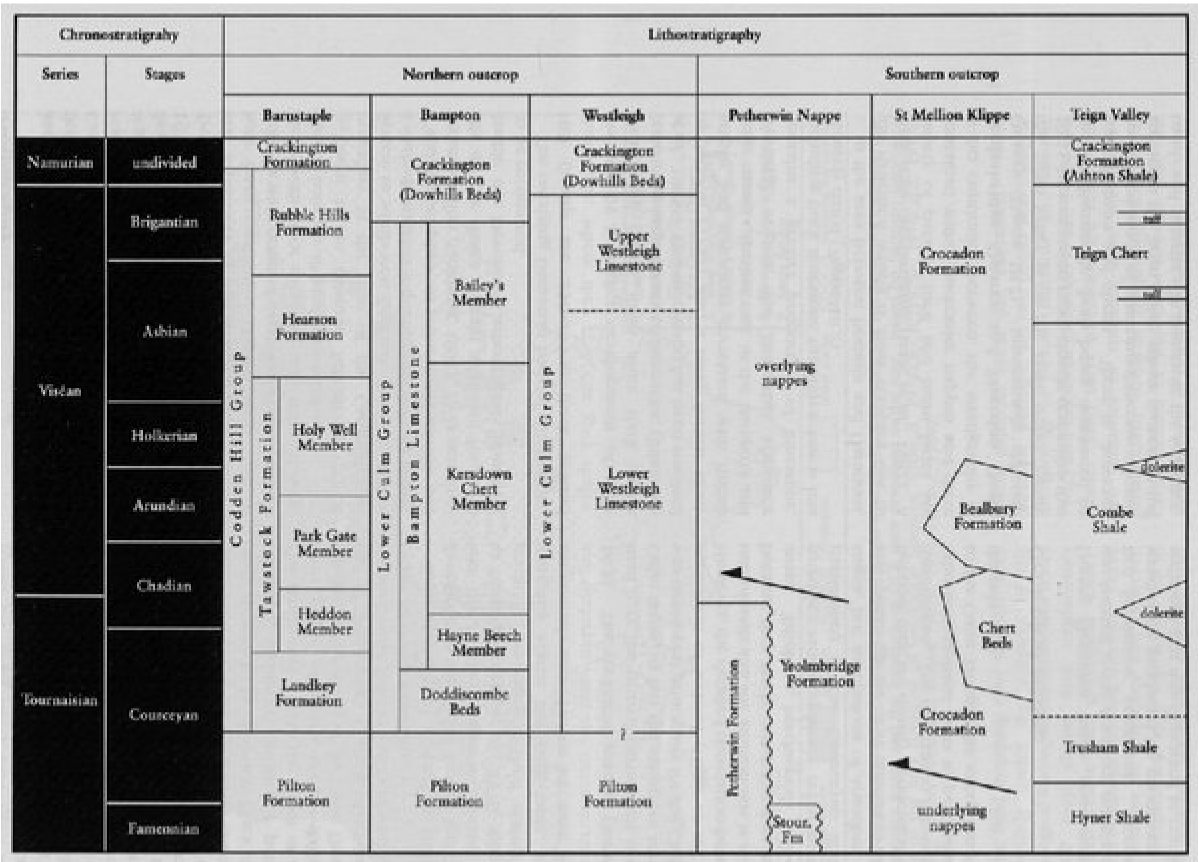
Matthews and Thomas (1974) subsequently undertook a more detailed biostratigraphical study, using conodonts in an attempt to isolate the indigenous and reworked components of the succession. Abundant gnathodids (particularly *Gnathodus bilineatus*)were recovered from various localities in the area and they confirmed the age determination provided by the ammonoids. In addition, a number of significantly older species, such as *Scaliognathus anchoralis* and *Polygnathus communis,* occurred in the conglomeratic horizons, implying that an admixture of Tournaisian sediment had been acquired, either at source or during deposition. These species are common components of the 'Avonian' limestones in the Mendip area (Butler, 1973).

By combining the evidence above, Thomas (1982) concluded that the laterally continuous limestone beds in the Westleigh succession resulted from turbidity currents sweeping into the area from nearby shelf sequences. This interpretation requires that the provenance lay to the north-east of Westleigh and was perhaps a southward extension of the Mendip Shelf facies (Figure 10.4). Whilst there are obvious differences in detail, this pattern of deposition is a common feature of the Dinantian sequence throughout much of the Rhenohercynian Zone (e.g. Franke *et al.,* 1975; Bellca, 1987).

Conclusions

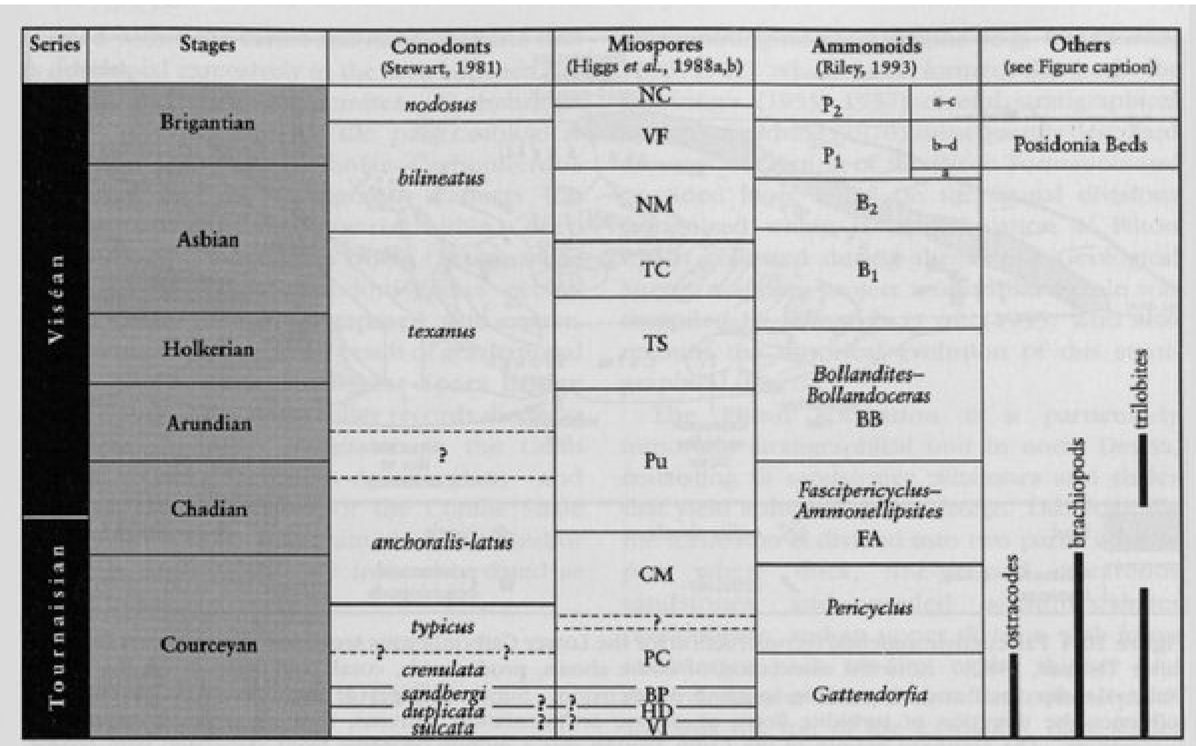
West Whipcott Quarry is one of the most informative and extensive exposures of the Upper Westleigh Limestone and it is particularly important because other sites in the area are either actively quarried or largely overgrown. The limestones were deposited in a deep marine trough that received sediment from a shallow marine shelf located many kilometres to the north-east. Turbidity currents transported the limestones and fragments of fossils down the sloping seabed into the trough.

References

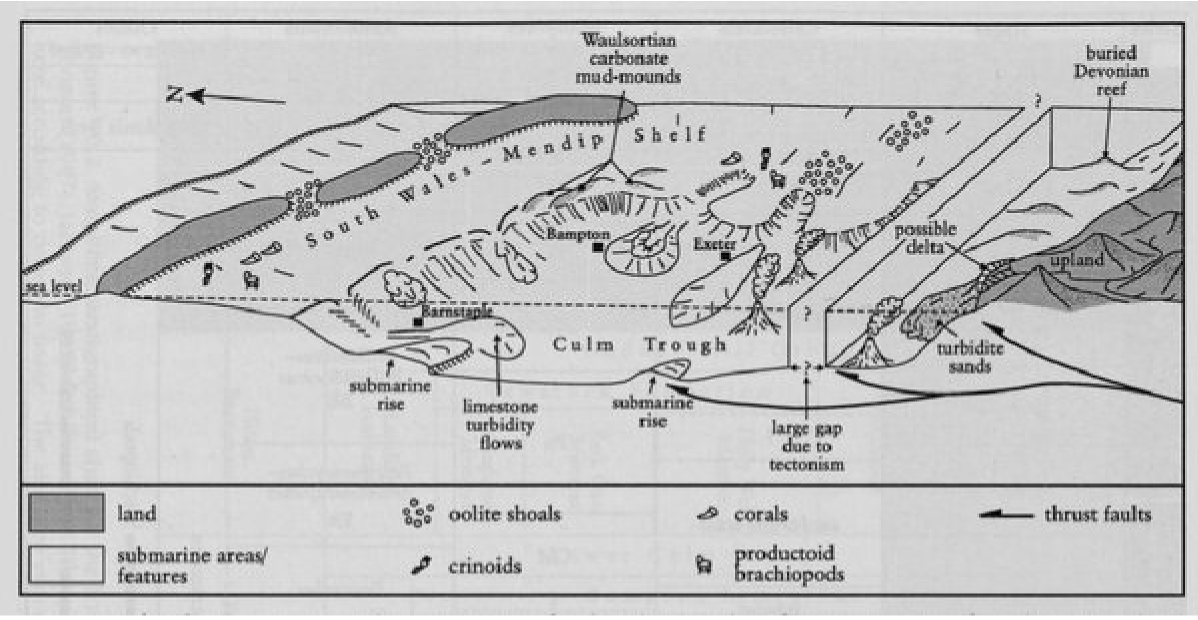


(Figure 10.2) Simplified stratigraphical chart for the Lower Carboniferous strata of the Culm Trough. Compilation based on information from Seiwood and Thomas (1987), Jackson (1991) and Owens and Tilsley (1995). Much of the stratigraphical nomenclature in the Culm Trough is informal and is reproduced here according to common usage. The aim is to summarize a range of differing successions rather than imply that the rock units are well dated and have isochronous boundaries. Note that the Chert Beds and the Bealbury Formation in the Crocadon Formation of the St Mellion Klippe may be olistoliths or isolated thrust-bound units; see Viverdon Down Quarry GCR site report (this chapter) for further details. Half-arrows represent thrust faults. Stour. Fm — Stourscombe Formation. Not to scale.

(Figure 10.11) Sequence of stacked, massive calcarenites and thin shales of the Upper Westleigh Limestone succession, West Whipcott Quarry, east Devon. (Photo: J. Jones.)



(Figure 10.3) Biostratigraphical schemes for the Lower Carboniferous strata in the Culm Trough based on conodonts, miospores and ammonoids. The distribution of other useful fossil groups is also shown; entomozoid ostracodes are *locally abundant in the Courceyan Stage (Selwood et al., 1982; Gooday, 1983), as are diverse trilobite and brachiopod faunas (Goldring, 1955, 1970). Trilobites are more sporadic in the Chadian (Owens and Tilsley, 1995) and younger stages (Prentice, 1967) but the concurrence of Posidonia becheri and Neoglyphioceras spirale is a common feature within the early Brigantian Posidonia Beds (Thomas, 1982; Riley, 1993).*



(Figure 10.4) Palaeoenvironmental reconstruction for the Lower Carboniferous sequence of south-west England (after Thomas, 1982). Note the association of oolite shoals, productoids, corals and crinoids on the South Wales–Mendip Shelf and its possible southward extension. Subtle changes of basin-floor topography may influence the direction of turbidite flows or dictate sedimentation patterns, forming isolated rise-related successions. The southern margin of the Culm Trough was a mobile orogenic front associated with coarse clastic and volcanic rocks. Half-arrows represent northward-propagating Variscan thrust faults.