Spara Bridge, Devon

[SX 843 841]–[SX 841 849]

Introduction

The Spara Bridge GCR site is a road cutting developed along the minor road (B3193) that runs through the Teign Valley near Chudleigh, south Devon. It extends for nearly one kilometre northwards from Spara Bridge [SX 843 841] and provides intermittent exposure through the thickest and most complete Lower Carboniferous succession in the Culm Trough. The succession is entirely marine and represents some 30 million years of depositional history from the latest Devonian to early Namurian times. It has benefited from a long history of research, beginning in the mid-18th century with the pioneer work of Godwin Austen (1842). A more detailed account emerged following the regional mapping by the [British] Geological Survey (Ussher, 1913) and this spawned several research papers during the course of the following 50 years. These are summarized in the most recent [British] Geological Survey memoir (Selwood *et al.,* 1984) that accompanies the current map of the Newton Abbot district (Institute of Geological Sciences, 1976c).

Description

The structure of the Teign Valley is dominated by an anticlinorium that plunges eastwards away from the Dartmoor granite and preserves conformable Lower Carboniferous sequences in several folds. This site provides a section through the southern limb of the Ashton Anticline from the road cutting at [SX 841 849] to Spara Bridge. The beds dip steeply (40°–60°) south and the succession youngs in that direction. Beyond the southern end of the site, part of the same succession is re-introduced by a SW–NE-trending fault 500 m south of Lower Ashton village (Figure 10.14).

The oldest rocks are exposed in the road cutting north of Ashton Mill Weir and are ascribed to the Hyner Shale. They consist of grey-green and blue-green silty shales with tough calcareous siltstone bands. *Sanguinolites ellipticus* is abundant and a horizon bearing *Phacops granulatus* indicates a Late Devonian age. Miospores from the same locality (Whiteley, 1983; Dean, 1992) suggest an age that approximates to the Devonian–Carboniferous boundary whereas the lowermost Carboniferous index ostracode *Richterina latior* has been identified at a slightly higher stratigraphical level (Gooday, 1983). Thus the Devonian–Carboniferous boundary occurs in the upper part of the Hyner Shale.

A conformable passage into the overlying Trusham Shale is marked by increasingly micaceous and calcareous shales. This unit is about 60 m thick and is characterized by olive-green and pale-grey shales with a well-developed conchoidal fracture. They are Interbedded with more micaceous shales that are finely banded and locally calcareous. The Trusham Shale is not richly fossiliferous, but Gooday (1983) records lowermost Carboniferous (*latior*-Zone) ostracodes from nearby localities, whilst the bivalve *Sanguinolites? ellipticus,* athyrid brachiopods and bryozoans are evident in the higher part of the succession. On this basis, the Trusham Shale is considered to be of Tournaisian age.

Roadside exposures and small quarries provide the type section for the succeeding Combe Shale, which comprises highly fissile blue-black or black shales with white silty laminations. The shales are about 150 m thick and they are intruded by two dolerite sills that are well exposed in quarries near Ashton Mill Weir (Figure 10.14). Localized induration and bleaching of the shales is evident at the contact with the dolerites. No fossils have been found In the Combe Shale but siliceous nodules become increasingly common in the younger horizons and suggest a conformable transition into the overlying Teign Chert.

This site also serves as the stratotype for the Teign Chert, and Selwood *et al.* (1984) described the following measured succession from north to south, in ascending stratigraphical order:

cherts and siliceous shales containing a 6 m coarse crystal-tuff horizon	45 m

cherts and shales with thin bands of jasper and mineralized (manganese) veins	27 m
radiolarian cherts and siliceous shale with thin tuff bands towards the top	109 m
gap in exposure	40 m
interbedded tuffs, shales and cherts, locally folded and sheared	42 m
well-bedded cherts and siliceous mudstones	55 m
pale-grey calcareous cherts and mudstones with radiolarians	13 m
black shale and grey limestone (Posidonia Beds)	4 m

The numerous volcanic tuff bands contribute to this unusually thick succession, but apart from poorly preserved radiolarians (Hinde and Fox, 1895; Ussher, 1913), no fossils have been found below the level of the Posidonia Beds. Other localities in the immediate vicinity show that the Posidonia Beds are typically 30–45 m thick and contain both large and small forms of *P. becheri* and the anunonoids *Neoglyphyioceras spirale* and *Sudeticeras* aff. *ordinatum.*

South of Spara Bridge (Figure 10.14), the beds are assigned to the Crackington Formation, the lower part of which is predominantly fine-grained and known locally as the Ashton Shale'. It consists of micaceous shales with some siltstone and sandstone horizons that rarely exceed 25 mm in thickness. The shales are pale grey-blue when fresh, weakly cleaved and contain thin carbonaceous bands yielding *Cravenoceratoides* of Arnsbergian (E_{2b} Zone) age. Some 150 m thick, they pass upward into laterally continuous sandstone beds that possess all the characteristics of distal turbidites.

Interpretation

The Spara Bridge succession in the Teign Valley is probably the thickest (*c.* 450 m) and certainly the most complete Lower Carboniferous succession in the Culm Trough. Although the exposure is not continuous, it does appear that the succession is conformable and wholly marine in origin. It is characterized by shales and cherts and In this respect resembles the stratigraphy in the northern outcrops around Barnstaple (Figure 10.2). There is, however, a major difference in that the Teign Valley succession has an abundance of penecontemporaneous igneous rocks, mainly tuffs, agglomerates and dolerites, which are virtually absent farther north. These provide evidence for submarine volcanic eruptions that formed vesicular lavas and produced sufficient airborne pyroclastic material to create thick, graded tuffs. At the same time, alkali dolerite sills were probably intruded into the sediments at no great depth because vesicles are widespread in both the sills and host rock. The similarity in chemistry, age and provenance of the igneous rocks suggests that the Teign Valley succession formed in an area of crustal instability, perhaps dictated by pre-existing fractures or by propagating Hercynian thrusts (Figure 10.4).

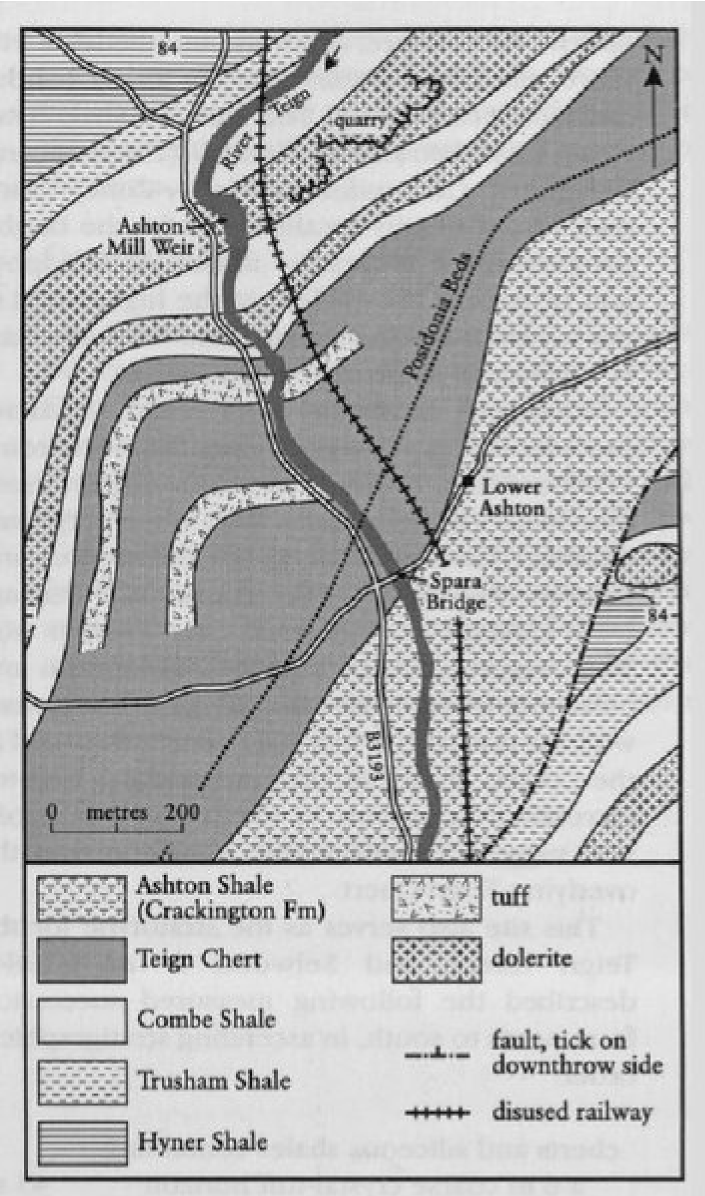
The palaeontology of the Teign Valley strata is also interesting. Faunas in the Upper Devonian (lower part of the Hyner Shale) strata are dominated by a variety of benthos, notably trilobites and brachiopods, but some pelagic elements are evident. A comparatively shallow-water setting, free from strong current activity, is envisaged, with uninterrupted access to deeper water allowing pelagic forms to drift into the area. The overlying Dinantian rocks become increasingly fine-grained and siliceous, with a rapidly diminishing bcnthos suggesting euxinic conditions. Increased levels of ventilation in the water column during late Asbian and Brigantian times are indicated by the sudden appearance of abundant pelagic forms in the Posidonia Beds and the associated development of calcareous lithologies (Thomas, 1982). The succession as a whole is interpreted as the product of an extended transgressive phase of Dinantian sedimentation, with the cherts representing a condensed sequence in a very widespread, starved sedimentary basin.

The structural setting of the Teign Valley succession is considered to be largely in *situ* or autochthonous (Selwood *et al.,* 1984). It thus provides evidence that the Culm Trough extended at least this far south, although overlying thrust sheets contain rocks of equivalent age that probably formed closer to the currently unidentified southern margin of the basin.

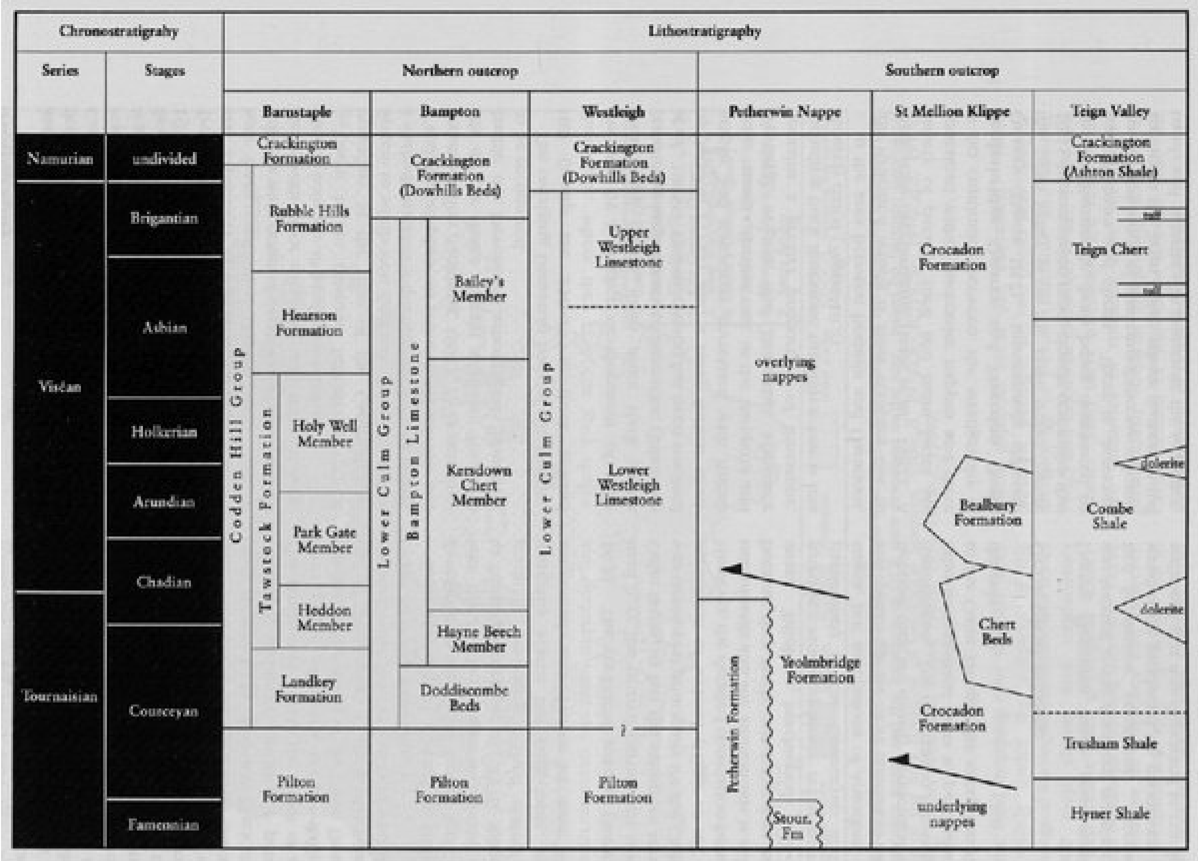
Conclusions

The Spara Bridge GCR site provides the most informative section through the Lower Carboniferous successions in the Culm Trough. Palaeontological data are sufficient to define the Devonian–Carboniferous boundary with some accuracy, and the presence of the *Cravenoceratoides* indicates an Arnsbergian age for the top of the succession. The site contains stratotypes for the Combe Shale and Teign Chert successions and abundant igneous rocks that contribute to an understanding of basin evolution.

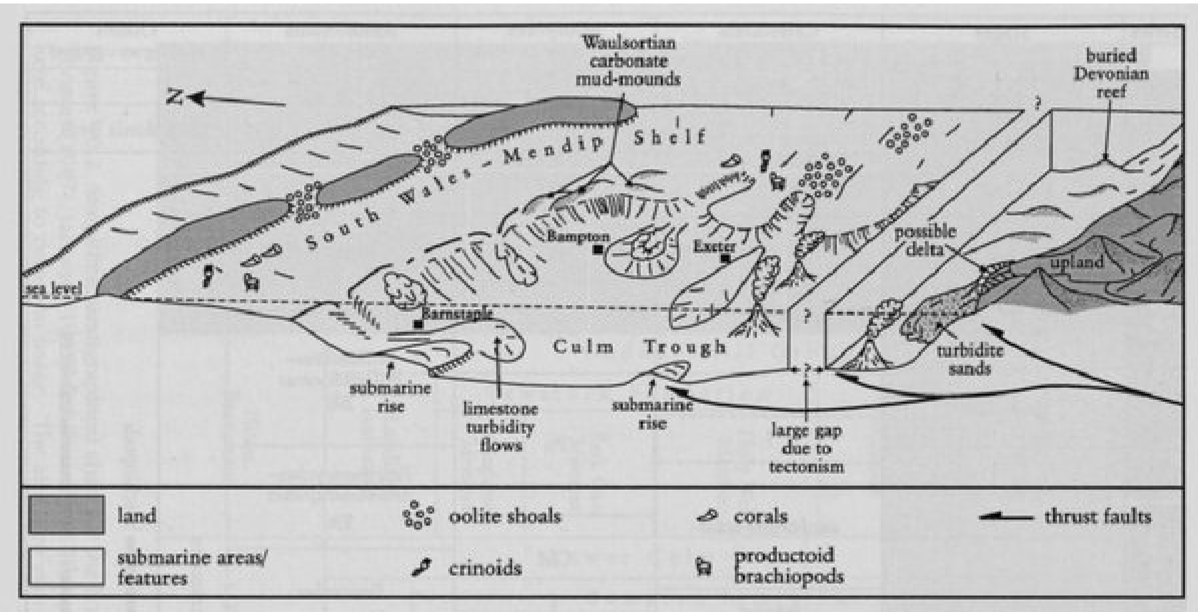
[References](#)



(Figure 10.14) Geological map of part of the Teign Valley showing the location of the Spara Bridge GCR site, south Devon. The site runs along the roadside close to the River Teign, west of Lower Ashton. Note that minor roads and alluvium have been omitted for clarity. After the geological map of the Newton Abbot district (Institute of Geological Sciences, 1976c).



(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 CuIm 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 10.4) 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.