Coplow Quarry, Lancashire

[SD 751 432]

Introduction

The Coplow Quarry GCR site is a disused quarry lying 1.5 km NNE of Clitheroe town centre at [SD 751 432]. Exposures at Coplow include part of the earliest phase of 'knoll reef' development in the Clitheroe area, but much of the 'knoll' structure has been quarried away and the centre of the quarry has been filled. Nevertheless, parts of the original Waulsortian bank that made up the knoll (Figure 6.7), and the associated facies, are well exposed in the quarry walls. The quarry is historically important for its rich and well-preserved echinoderm faunas (Figure 6.10). Aspects of the site geology have been described by many workers, including Parkinson (1950b), Earp *et al.* (1961), Miller and Grayson (1972) and Arthurton *et al.* (1982).

Description

The rocks exposed in the quarry walls belong to the lower part of the Clitheroe Limestone Formation. The section includes the type section of the Coplow Limestone Member of Riley (1990a), the base of which is defined at the site (Figure 6.2). The oldest exposed rocks consist of alternating dark calcareous shales and impure limestones, Informally assigned to the Lower Coplow Shales by Miller and Grayson (1972). The regional dip in the quarry is to the southeast. On the northern face, the proportion of limestone increases upwards and there is a transition first to cross-stratified crinoidal beds and then into the pale carbonate mudstones of the Waulsortian facies (= Coplow Bank Beds of Miller and Grayson, 1972). This rapid transition was described in detail by Miller (1986). On the west wall of the quarry there are complex inter-tonguings of Waulsortian bank and crinoidal flank facies, while the same horizon on the east wall is dominated by bank facies.

Coplow Quarry is particularly well known for its extensive faunas which include examples of bryozoans, sponges, tabulate and rugose corals, brachiopods, bivalves, gastropods, echinoderms, nautiloids, goniatites, trilobites and ostracodes (Parkinson, 1926). Of special importance are the abundant, superbly preserved echinoderms, described in a long series of papers by Wright (1928, 1935, 1942, 1943, 1947, 1948, 19501960; see (Figure 6.10)). Useful summaries of the Coplow echinoderm faunas are also provided by Westhead (1967) and Donovan (1992).

Of the 20 genera and 60 crinoid species described by Wright (1950–1960), many have type specimens from Coplow (Figure 6.10)A and some have distinctive local names such as *Taxocrinus coplowensis, Pleurocrinus coplowensis, Actinocrinites coplowensis, Gilbertsocrinus coplowensis* and *Pimlicocrinus clitheroensis.* Whilst *Actinocrinites* is the most common and characteristic genus represented (Wright, 1928; Earp *et al.,* 1961), the flexible crinoid *Euryocrinus rofei* is worthy of note on account of its rarity. Other uncommon elements of the fauna include the blastoids *Orophocrinus pentangularis* and *O. versus* (Wright, 1947, 1948) and the echinoids *Archaeocidaris* spp., *Lovenechinus anglicus, Melonechinus etheridgii, M. keepingi, Palaechinus* spp., *Perischodomus biserialis* and *Pholidocidaris tenuis* (Jackson, 1912; Hawkins in Parkinson, 1926).

Within the mud-bank there is a distinctive fauna characterized by the absence of corals, apart from *Amplexus coralloides* which is locally abundant, and by the occurrence of brachiopods not usually found outside this facies, such as plicated varieties of *Pugnax acuminatus* and *P. sulcatus, Brachythyris pinguis* and *Spinier coplowensis.* The last named is the most common brachiopod in the bank facies, the holotype being originally described from Coplow by Parkinson (1926).

The limestone-shale bedding plane surfaces on the northern face of the quarry offer excellent opportunities for detailed palaeoecological studies of the bedded facies, although much less is visible today than formerly. Complete in-situ cup-shaped fenestellid bryozoans, outstretched or coiled crinoid stems, often with complete or partly dissociated calices are abundant, and mats of well-preserved hyalosteliid sponges with rod bundles over 15 cm long also occur. Articulated athyrid and spiriferoid brachiopods also occur, with an abundance of delicate 'stick' bryozoans. Many limestones contain

a rich microbiota including *Girvanella,* foraminifera and palaeoberesellids. *Chondrites* and thalassinoid burrows are also common.

Interpretation

The Coplow Limestone Member is the lowest limestone-dominant member of the Clitheroe Limestone Formation in the Clitheroe area. Its development records the earliest development of the Chadian Waulsortian mud-bank facies in the Craven Basin (Figure 6.2). The section at Coplow begins approximately 60 m above the base of the formation (Earp *et al.,* 1961), with the Waulsortian facies itself originally being more than 100 m thick (Parkinson, 1950b; Earp *et al.,* 1961). Parkinson (1950b) maintained that the depositional slope on the south-east side of his alleged mound was 29.5°. He assumed that all changes In dip and strike of the exposed beds were caused by lateral changes in the facies associated with 'mound' development. However, using the attitudes of geopetal sediments, Miller and Grayson (1972) showed that original slopes were nowhere greater than 10°. The Coplow Waulsortian facies is now generally regarded as an aggregate of gently lensing carbonate mud-banks (cf. Lees and Miller, 1995)

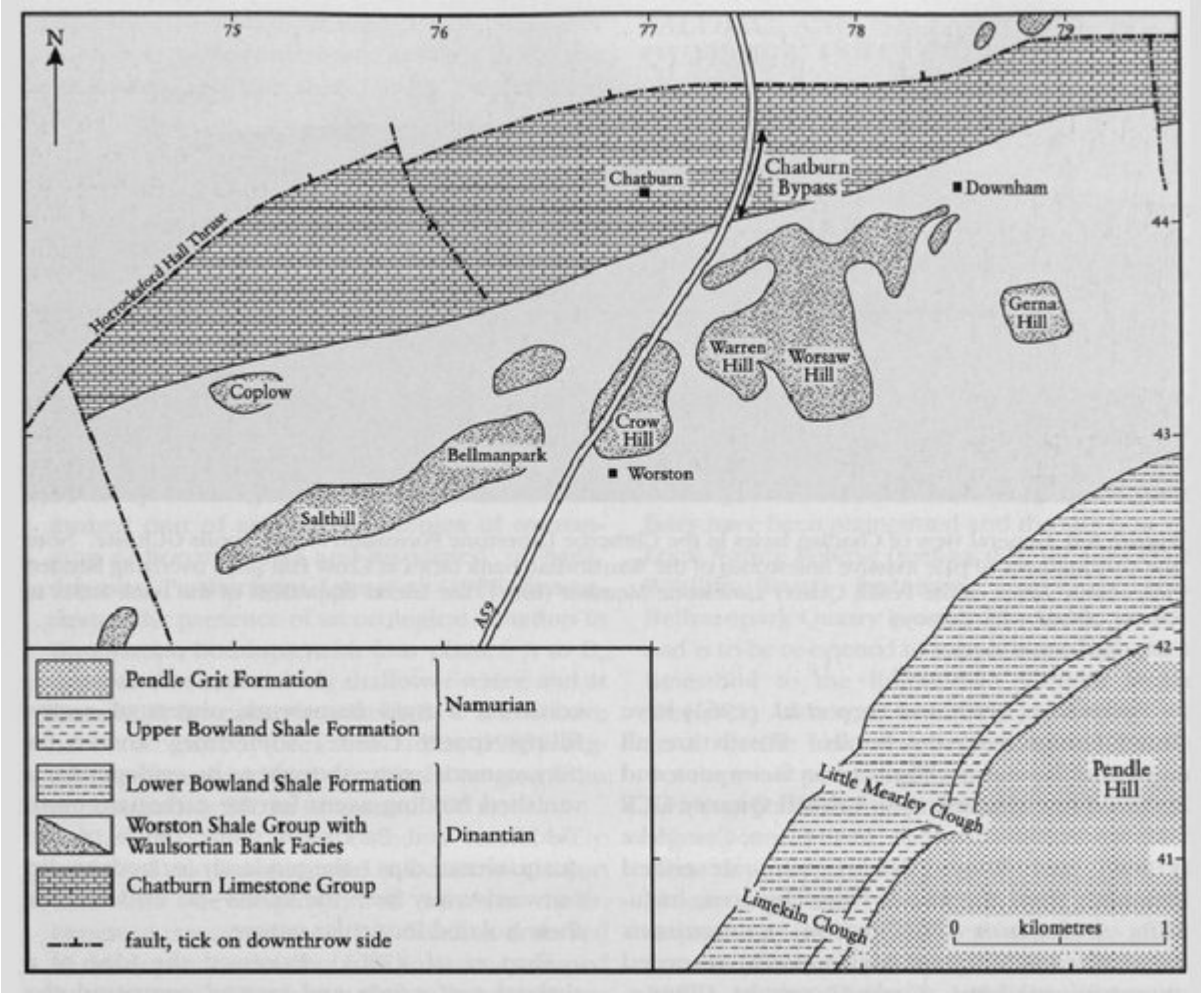
Earlier ideas for the development of the Waulsortian bank facies are discussed in The Knolls GCR site report (this chapter). The Coplow accumulation includes the Waulsortian phases B, C and D in common with other buildups of the Clitheroe area, suggesting deposition in water depths ranging from approximately 280 m to around 150 m (Lees and Miller, 1985).

The superb preservation of the faunas in the facies surrounding the Waulsortian mud-bank, with virtually undisturbed bryozoans and crinoids, testifies to the tranquil environments during deposition and perhaps to rapid postmortem burial. However, the presence of cross-stratified crinoidal limestones elsewhere in the associated beds points to the existence of traction currents at other times.

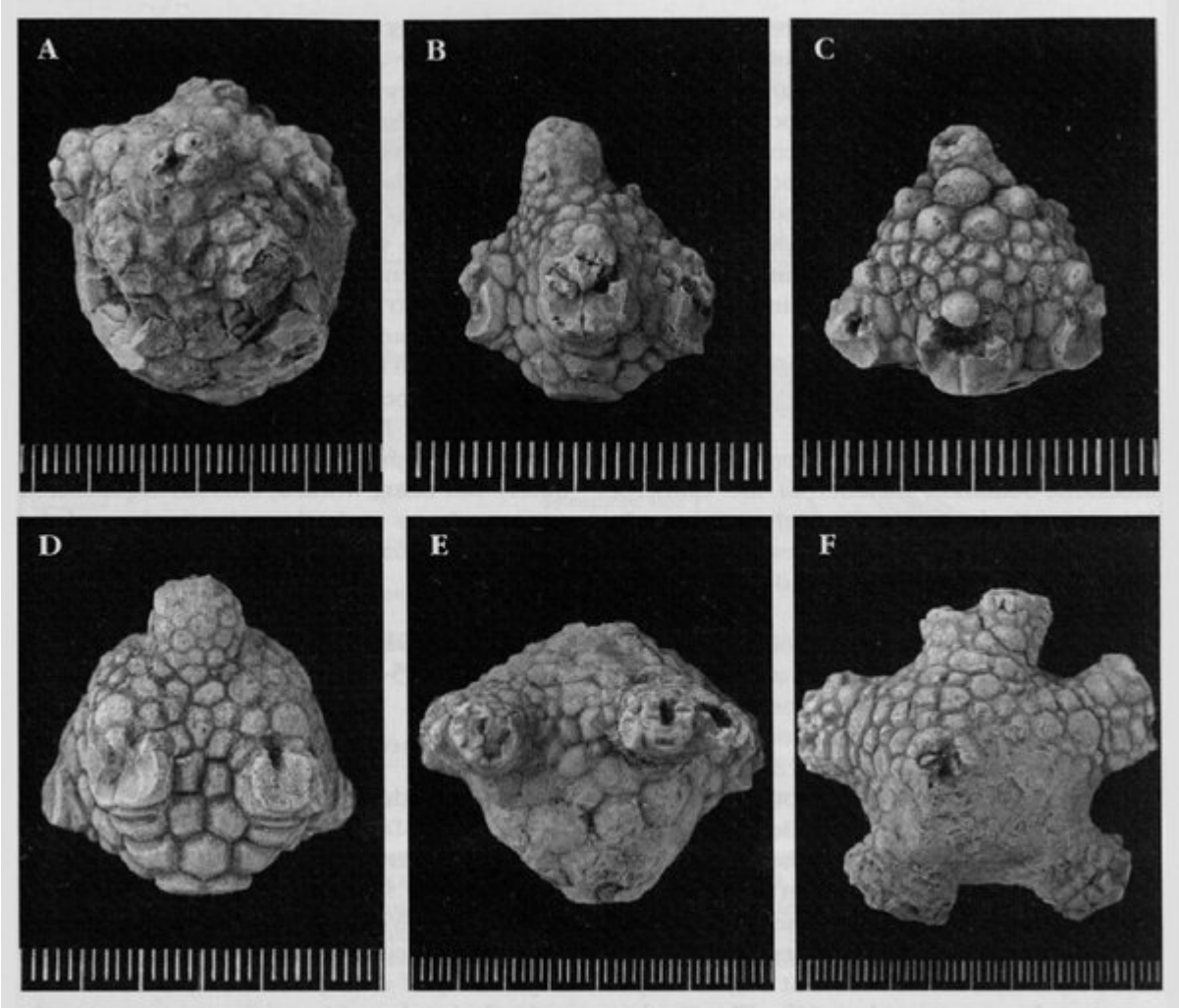
Conclusions

Coplow Quarry is one of the most important multiple-interest sites of Lower Carboniferous age in the Craven Basin, with a range of stratigraphical, palaeontological and sedimentological features of interest within its boundary. It provides the type section of the Coplow Limestone Member and, in addition, a rare opportunity to examine the transition from Waulsortian bank facies laterally into bedded strata. It is also the type locality for many fossils. Furthermore, bedding planes with exceptionally well-preserved faunas on the north face of the quarry, although not as clearly seen as when the quarry was being worked, offer an unparalleled opportunity to study the palaeoecology of the Chadian mud-bank and associated facies.

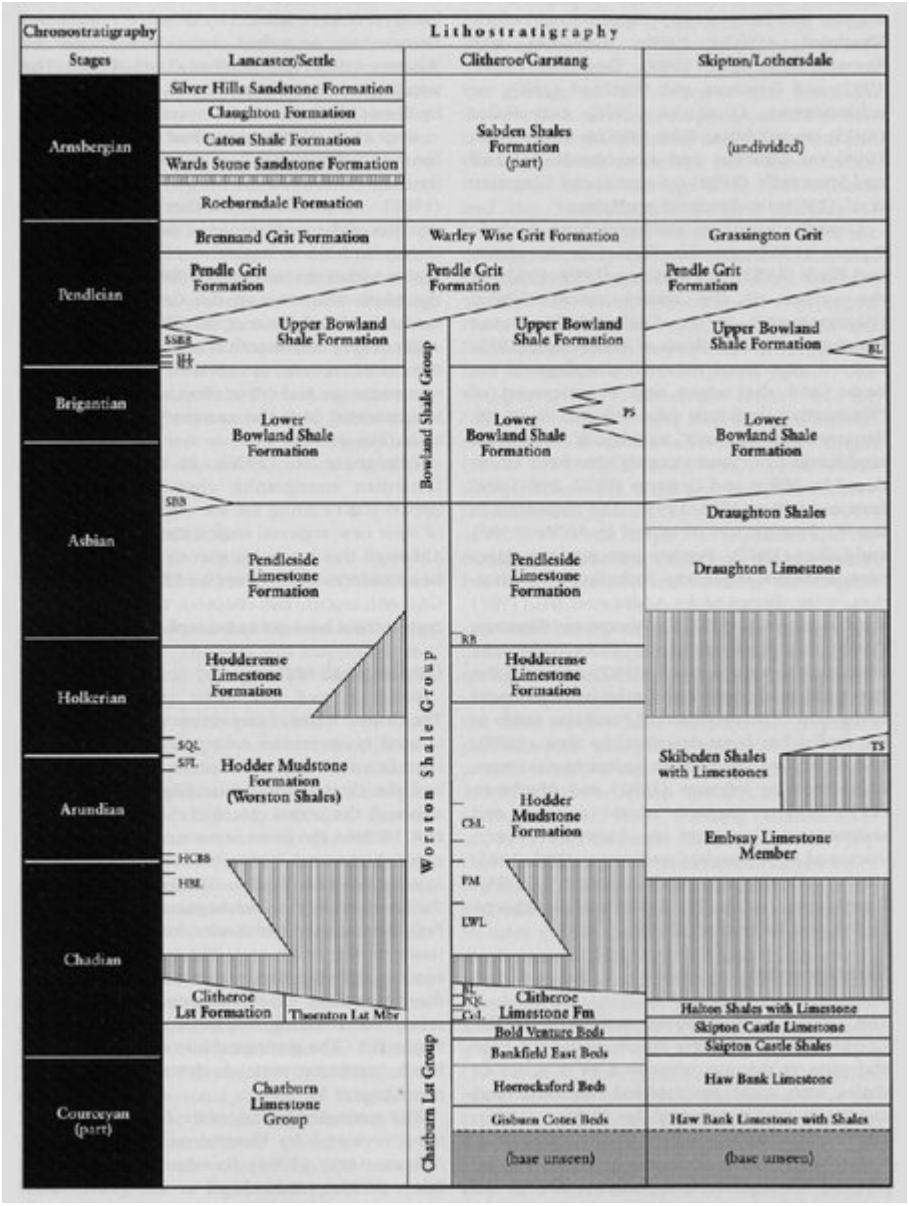
References



(Figure 6.7) Geological map of the area to the east of Clitheroe showing the location of the exposed eroded remnants of the Waulsortian bank facies at The Knolls GCR site (Crow Hill to Gerna Hill) based on a [British] Geological Survey map of the area (Institute of Geological Sciences, 1970). The locations of several other GCR sites in the region (Chatburn Bypass, Salthill and Bellmanpark Quarries, Coplow Quarry, Pendle Hill) are also shown.



(Figure 6.10) Crinoid calices from the Coplow Quarry GCR site. A — Sampsonocrinus westheadi (Wright), holotype, lateral view (calyx width is 2.8 cm); B —Amphoracrinus gilbertsoni (Phillips), lateral view (calyx width is 1.8 cm); C — Amphoracrinus gilbertsoni (Phillips), lateral/oblique view (calyx width is 2.0 cm); D — Amphoracrinus rotundus Wright, lateral view (calyx width is 2.6 cm); E —Actinocrinites parkinsoni Wright, lateral view (calyx width is 3.7 cm); F — Actinocrinites parkinsoni Wright, lateral view (calyx width is 3.9 cm). Scalebars show millimetre graduations. (Photos: courtesy of D. Lewis, S. Donovan and staff in the Photographic Unit of the Natural History Museum (British Museum).) All specimens are from the Stanley Westhead collection (BMNH).



(Figure 6.2) Simplified stratigraphical chart for the Lower Carboniferous succession of the Craven Basin. (HBL — Hetton Beck Limestone Member; HCBB Haw Crag Boulder Bed; SFL — Scaleber Force Limestone Member; SQL — Scaleber Quarry Limestone Member; SBB — Scaleber Boulder Bed; SLS — Sugar Loaf Shales; SLL — Sugar Loaf Limestone; SSBB School Share Boulder Bed; CoL — Coplow Limestone Member; PQL — Peach Quarry Limestone Member; BL — Bellman Limestone Member; LWL — Limekiln Wood Limestone Member; PM — Phynis Mudstone Member; ChL — Chaigley Limestone Member; FIB — Rad Brook Mudstone Member; PS — Pendleside Sandstones Member; TS — Twiston Sandstone Member; BL — Berwick Limestone.) Areas of vertical ruling indicate non-sequences. Not to scale. Compilation based on Hudson and Mitchell (1937), Metcalfe (1981), Arthurton et al. (1988), British Geological Survey (1989), Riley (1990a, 1995), Aitkenhead et al. (1992), Brandon et al. (1995, 1998).