Roscobie Quarry, Fife

[NT 091 932]

Introduction

The Roscobie Quarry GCR site, a disused quarry in the Charlestown Main Limestone (Lower Limestone Formation, upper Brigantian), lies 5 km north of Dunfermline in West Fife [NT 091 932]. Gelkie (1900) described the quarry briefly and gave a faunal list, but the best descriptions of the quarry, at the time when it was being worked, are those of Wright (1914b, 1920). The site is of great palaeontological importance and in particular Wright (1914b, 1920, 1939, 1950, 1960) worked extensively on its significant crinoid fauna. Roscobie Quarry also has the best exemplars of the unusual carbonate bioherms that occur in the Charlestown Main Limestone of West and Central Fife. Detailed sedimentological studies of these carbonates have recently been carried out by Pickard (1992, 1994).

Description

The most important and best known section at Roscobie is its north-eastern quarry face; now the only part of the original quarry remaining and protected after a period of landfill. In this face a 30 m-thick sequence of the Charlestown Main Limestone (13 m) and overlying shale (13 m) and sandstone (4 m) can be seen (Figure 2.18). The basal beds of the Charlestown Main Limestone comprise biomicrites (2 m), containing gigantoproductids, and crinoid debris. These are overlain by bedded biomicrites and biomicrosparites, which can be seen at the north end of the section and which pass laterally into a thicker and more massive lenticular unit (the 'hump' or knoll of Wright, 1920) of crinoidal biomicrites (wackestones and packstones), which becomes coarser and more crinoidal towards the top. The sedimentology and palaeoecology of these beds have been described in detail by Pickard (1990, 1992, 1994). Within them, brachiopods, sponge spicules and bryozoan and crinoidal debris are abundant, and foraminifera, worm tubes, ostracodes and calcispheres are common. Microfabrics and '*stromatactis*-like' cavities within the limestones suggest a significant microbial contribution to the carbonates (Pickard, 1992, 1993, 1994; Friedman, 1993). Thickness variations in the limestones have caused compactional shears and slickensiding both in the limestone and in the overlying shales. These dark shales contain a prolific and diverse marine fauna, especially at their base.

Interpretation

The limestone at Roscobie Quarry is the Charlestown Main Limestone of West Fife, which is the equivalent of the Blackhall Limestone (middle Lower Limestone Formation) and is of late Brigantian (P_2) age. The site provides a unique opportunity to study the transition from level-bedded limestones into a biohermal carbonate buildup, which had developed a small relief above the surrounding sea floor (Pickard, 1992). A reconstruction has determined that the buildup must have been at least 230 m long, 46 m wide and 15 m thick, and that following its initial development as small lenticular banks its subsequent growth was predominately vertical (Pickard, 1992). This led to steep palaeoslopes of up to 30° against which flanking debris beds were deposited during erosional phases. The Roscobie complex appears to have developed in deeper water than similar buildups nearby at Charlestown and Kinnesswood (Bishop Hill) (Pickard, 1992). In the Midland Valley, carbonate buildups of this type are rarely exposed and are restricted in their occurrence (Pickard, 1994). Those of the Charlestown Main Limestone in West Fife have been linked to an area of reduced subsidence on the structural feature known as the 'Burntisland High' (Pickard, 1992, 1994). The buildup facies may once have been more widespread in association with structural highs and largely lost as the limestones were eroded off the highs in later geological periods. The carbonate of Roscobie Quarry contrasts in character with the more argillaceous banks, which occur in the calcareous shales above the Charlestown Main Limestone at Invertiel Quarry (see GCR site report, this chapter) and also in East Lothian (Whyte, 1973). Growth of the bioherm and deposition of limestone was terminated by the influx of the overlying mud.

Most of the previous work on Roscobie Quarry has been taxonomic in nature and in particular has concentrated on the crinoid fauna for which the site has become internationally famous (Wright, 1914b, 1920, 1939, 1950–1960). This material largely came not from the limestone itself but from the calcareous basal parts of the overlying dark shale. Although the crinoid fauna is not quite as abundant or as diverse as that at Invertiel Quarry, it is better preserved, and fine crowns including good specimens of *Woodocrinus* and *Poteriocrinites* have been obtained. The locality has provided type or figured material for 21 of the 27 crinoid species that have been recorded from it. In composition, the fauna shows rheophobic tendencies and is very different both taxonomically and ecologically from 'knoll reef' faunas of the English Carboniferous System. Wright (1926, 1927) used specimens from Roscobie in his ground-breaking studies of the variation of the anal (CD) plate inter-ray in several inadunate crinoid species.

The fossil list for other groups is also long (Geikie, 1900) and includes a number of species for which this is the type locality. These include sponges, trilobites, bivalves, gastropods and brachiopods (Hinde, 1887–1912; Hind, 18961905; Reed, 1943, 1954). In addition to the new species *Bucaniopsis roscobiensis,* Weir (1931) recorded *B. decussatus, B. striatus* and *B. tenuis* from Roscobie Quarry. This diversity of bellerophontid gastropod species is a typical feature of the Neilson Shell Bed Fauna (Weir, 1931; Wilson, 1966) and this fauna is represented in the shales above the Charlestown Main Limestone at Roscobie Quarry. This supports the correlation of the Charlestown Main Limestone with the Blackhall Limestone of the Central Coalfield Basin. Currie (1954) recorded varieties of the goniatite *Beyrichoceratoides truncatum* from Roscobie and more importantly *Sudeticeras* aff. *newtonense* which confirms the P_2 age of the Charlestown Main Limestone (see Riley, 1993; and Kinghorn Coast GCR site report, this chapter).

Conclusions

The Roscobie Quarry GCR site reveals an outstanding section of the biohermal Charlestown Main Limestone (Lower Limestone Formation, upper Brigantian) and of the fossiliferous shale and sandstone sequence immediately above it. This is a classic locality, famous for its crinoid fauna, but yielding an abundance of other taxa of great taxonomic, palaeoecological and stratigraphical interest. In addition to its fauna, the site exhibits sedimentological features of major significance, including the transition from bedded limestone into the massive limestones of a carbonate buildup within the Charlestown Main Limestone.

References

(Figure 2.18) General view of the upper Brigantian Lower Limestone Formation (Clackmannan Group) at the Roscobie Quarry GCR site illustrating massive lenticular limestone units of a carbonate buildup within the Charlestown Main

Limestone (base of cliff face) overlain by shales and sandstones (middle and top of cliff face). (Photo: C. MacFadyen.)