Dolyhir Quarries

[SO 241 581]

Introduction

The Dolyhir area has a series of quarries in Wenlock and Precambrian rocks belonging to the Old Radnor Inlier. The Wenlock strata comprise the Dolyhir and Nash Scar Limestone Formation and the younger Coalbrookdale Formation. Murchison (1839, 1854), when discussing mainly the adjacent and geologically similar Nash area near Presteigne, commented on the nature and age of this limestone, which he first concluded to be identical in stratigraphical position and organic content to the (Much) Wenlock Limestone (Formation) and subsequently considered to be equivalent to the Woolhope Limestone (Formation). Calloway (1900) briefly commented on the so-called Woolhope (= Dolyhir) Limestone in his study of the Old Radnor Precambrian. However it was Garwood and Goodyear (1919) who first described the limestone and the other Silurian geology of this district in detail, producing a geological map of the whole inlier and a larger-scale map of some of the quarries. Bassett (1974a) and Hurst *et al.* (1978) considered aspects of dating and palaeogeography of the Old Radnor Silurian, whilst Bassett (1977) formally introduced the name 'Dolyhir and Nash Scar Limestone Formation'. Woodcock (1988) addressed the effects of tectonics on the Silurian and Precambrian rocks of the inlier.

The early Wenlock (Sheinwoodian) Dolyhir and Nash Scar Limestone Formation represents a uniquely rich facies of algal limestone within the British Silurian. This lithostratigraphical unit is superbly exposed and has its type development in the Dolyhir quarries. These workings also show evidence of the Welsh Borderland Fault System — a very important early Palaeozoic tectonic boundary for southern Britain (Woodcock, 1988; Woodcock and Gibbons, 1988).

Description

Extraction of limestone in this area appears to go back almost 400 years (Garwood and Goodyear, 1919). The present-day complex of workings at Dolyhir is generally referred to two main quarries: Dolyhir and Strinds (Figure 4.40). The current GCR site boundary encompasses almost all of these, plus (the subsidiary) quarries C and D of Garwood and Goodyear (1919). The northern end of Dolyhir Quarry has been extended beyond the existing site boundary in recent years. The overall succession consists of Precambrian basement followed by the Dolyhir Limestone and then Coalbrookdale Formation.

The Precambrian strata are sediments belonging to the Yat Wood and younger Strinds formations, the former comprising fine sandstones, siltstones and laminated mudstones, and the latter medium sandstones and pebbly sandstones. Such lithologies have analogues in the Longmyndian rocks of the Church Stretton area (Calloway, 1900; Woodcock, 1988; Woodcock and Pauley, 1989).

The Dolyhir Limestone is a pure carbonate (99% $CaCO_3$; Garwood and Goodyear, 1919), bluish-grey to white, highly crystalline and poorly to massively bedded; it is at least 24 m thick and lies with angular unconformity on the Precambrian. The bottom of the limestone often comprises a basal rudite up to some 2 m thick containing angular sandstone and mudstone clasts plus rounded quartz pebbles, all derived from the Precambrian; *Favosites* colonies occur amongst these Precambrian fragments.

The dominant faunal elements of the limestone are calcareous algae (Johnson, 1966) in the form of oncolites up to 20 cm in diameter: for example *Solenopora gracilis, Rothpletzella gotlandica, Girvanella pusilla* and *Girvanella problematica.* These algal nodules have a typically porcellanous appearance, contrasting with the surrounding coarsely crystalline limestone. Bryozoans are also abundant in the limestone, and corals, crinoids, gastropods, bivalves, cephalopods, brachiopods and trilobites are also recorded in a faunal list of some 70 species (Garwood and Goodyear, 1919). Brachiopods from the limestone (Bassett, 1974a, 1974b, 1977) include *Streptis grayii, Antirhynchonella linguifera, Leptaena oligistis, Megastrophia* (*Protomegastrophia*)*quetra* and species of *Plectatrypa* and *Whitfieldella;* trilobites

(Thomas, 1981) include *Radnoria syrphetodes, Cornuproetus peraticus, Planiscutellum kitharos* and *Dudleyaspis portlockii.* An abundant suite of conodonts has been recovered (see Aldridge, 1976; Aldridge *et al.,* 1981) that includes *Ozarkodina sagitta rhenana, Ozarkodina excavata, Dapsilodus obliquicostatus* and *Decoriconus fragilis.* The limestones have also yielded a fairly low diversity acritarch assemblage (Aldridge *et al.,* 1981), dominated by species of *Veryhachium, Micrhystridium* and thin-walled forms of *Diexallopbasis.*

Included within the lower part of the limestone is a relatively thin shale horizon that is often tectonized and thus discontinuous and which sometimes contains greenish carbonate concretions plus abundant crinoid debris (Garwood and Goodyear, 1919; Woodcock, 1993). In detail the fauna from this horizon tends to be different from that in the main limestone. Trilobites include *Cyphoproetus depressus* and species of *Kosovopeltis* and *Scotoharpes,* together with *Tapinocalymene volsoriforma* (Thomas, 1978; Siveter, 1980).

Several of the species from the Dolyhir Limestone Formation at Dolyhir have their type horizon and locality here, for example *S. gracilis* Garwood and Goodyear, 1919, *M.* (*F*) *quetra* Bassett (1977), *R. syrphetodes* Owens and Thomas (1975), *T volsoriforma* Siveter (1980), *C. peraticus* Owens (1973) and *Bumastus? pbrix* Lane and Thomas (1978).

On palaeontological grounds, using brachiopods, trilobites, conodonts and (from the regionally overlying Coalbrookdale Formation) graptolites, the limestone is believed to span the *centrifugus, murchisoni* and at least some part of the *riccartonensis* biozones, the presence of *O. sagitta rhenana* restricting at least part of the limestone to the eponymous conodont biozone (lower Sheinwoodian); on purely stratigraphical criteria the base could be as old as early Telychian (Kirk, 1951a, 1951b; Zeigler *et al.,* 1968b; Bassett, 1974a; Aldridge and Schonlaub, 1989; Cocks *et al.,* 1992; Jeppsson *et al.,* 1995).

The Coalbrookdale Formation is exposed in Quarry D and, now also, parts of the extended Dolyhir Quarry. In Quarry D it occurs as a small, downfaulted patch that may be conformable with the underlying limestone and contains calcareous concretions yielding well-preserved specimens of *Tapinocalymene nodulosa* and *Dalmanites.* The presence of *Monograptus flemingii* indicates an age within the *rigidus* to *lundgreni* biozones (Bassett, 1974a).

Precambrian and Silurian strata within the quarries are cut by three large, continuous faults striking NNE, dipping WNW with apparent normal offsets (WNW downthrow) (Figure 4.41). However slickensides indicate that strike-slip, not dip-slip, displacement is responsible for the normal offsets and further evidence from related, minor fault sets implies a sinistral sense of movement. Imposition of this strike-slip component occurred in post-Wenlock time, probably during the early Devonian Acadian (late Caledonian) event (Woodcock, 1988).

Interpretation

The Dolyhir Limestone, with its algal nodules, represents deposition in a very shallow water, turbulent environment with minimum elastic input. It formed somewhat offshore (mid-outer shelf), on the topographical highs formed by the Precambrian basement, though it may have been part of a more continuous carbonate shelf extending to the probably coeval Woolhope Limestone Formation area of deposition of the Woolhope, May Hill and Malverns inliers to the south-east (Bassett, 1974a; Hurst *et al.,* 1978).

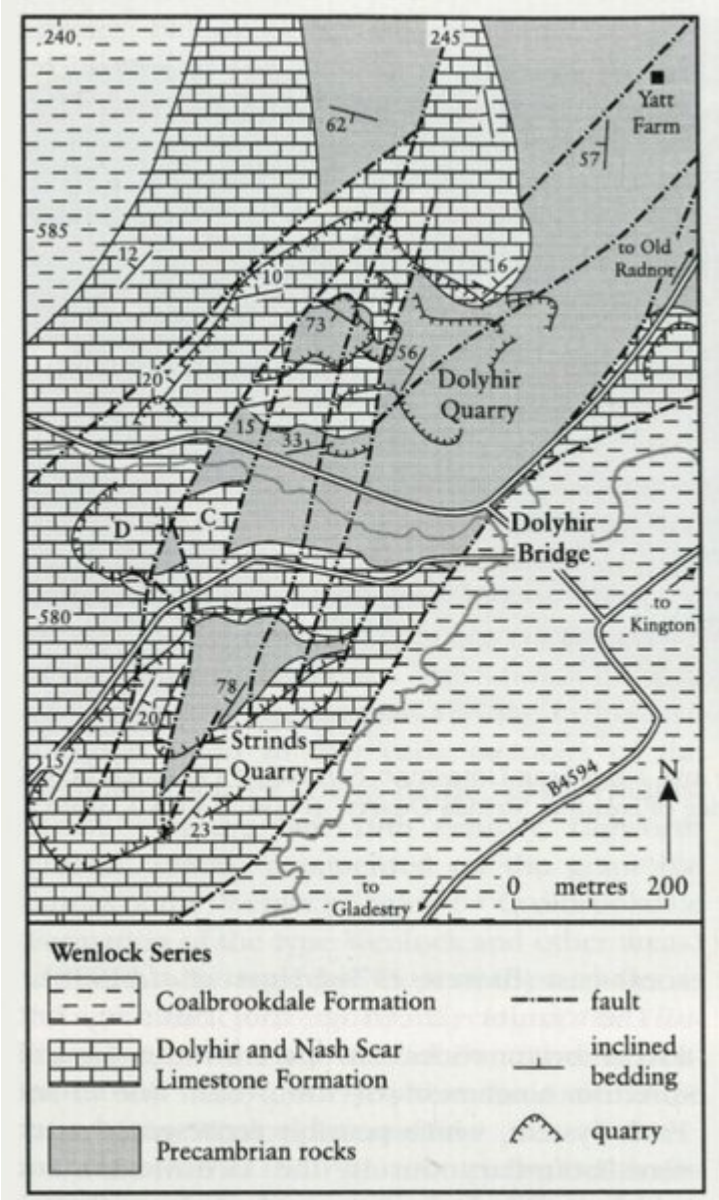
The faults affecting the Silurian and Precambrian rocks are part of the Church Stretton Lineament of the Welsh Borderland Fault System, which possibly represented a terrane boundary during the Ordovician, and which in Silurian times marked a transitional divide between the contrasting sedimentary regimes of the Midland Platform to the east and the Welsh Basin to the west (Woodcock, 1988; Woodcock and Gibbons, 1988). The Acadian event affecting these faults involved sinistral transpression and has been interpreted as representing a final collision between Avalonia and Laurentia (Soper and Hutton, 1984; Pickering *et al.,* 1988; Woodcock *et al.,* 1988).

Conclusions

The early Wenlock limestone at Dolyhir, together with the nearby development at Nash Scar, is the richest development of algal limestones in the British Silurian. These are fingerprint environmental indicators for shallow water. The

limestones were deposited offshore between the inner shelf and the basin on Precambrian highs, in an area caught up within movements along the Welsh Borderland Fault System. These quarries also represent the type locality for several species belonging to different invertebrate groups. The site is of great palaeontological, palaeoenvironmental, palaeogeographical and tectonic interest, and is used frequently for research and teaching purposes.

References



(Figure 4.40) Geology of the Dolyhir area, Radnorshire (after Garwood and Goodyear, 1919, Woodcock, 1988, and Siveter et al., 1989).

(Figure 4.41) Dolyhir Quarries, Radnorshire. Dolyhir and Nash Scar Limestone Formation (Wenlock Series) overlying Strinds Formation (Precambrian), with evidence of faulting, Strinds Quarry. (Photo: Derek J. Siveter.)