Ditchley Road Quarry, Oxfordshire

[SP 368 198]

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Introduction

Ditchley Road Quarry, also known as 'Town Quarry', at Charlbury, Oxfordshire, exhibits a fine section ranging from the Chipping Norton Limestone Formation up to the Taynton Limestone Formation ((Figure 3.66) and (Figure 3.67)). Formerly, the section included the upper half of the Clypeus Grit Formation at the base; this is currently (1999) not visible, but future development of the quarry may re-expose it. The quarry offers one of the few complete sections of the Chipping Norton and Sharp's Hill formations in Oxfordshire, and is also the type section of the Charlbury Formation. The succession comprises a range of lithologies, some very fossiliferous, which represent a variety of depositional environments. The section was described in outline by McKerrow and Kennedy (1973) and also by Sellwood and McKerrow (1974). More detailed descriptions were published by Horton *et al.* (1987) and Boneham and Wyatt (1993), the latter including details of the newly defined Charlbury Formation.

Description

The greater part of the section given below is based on Horton *et al.* (1987) and Boneham and Wyatt (1993). Details of the Taynton Limestone Formation were recorded by the present author in April 1997.

	Thickness (m)
Taynton Limestone Formation	
Soil and subsoil	0.35
9: Limestone, grey, fine grained, finely ooidal, flaggy-weathering; locally only sparsely ooidal	0.40
8: Marl, brown, finely shell-detrital, thinly bedded, forming prominent bed; small lenses and lenti-cles of fine-grained limestone in upper half	0.40
7: Limestone, creamy-grey, fine grained, compact, rubbly weathering; passing down into increasingly ooidal and shell-fragmental rubbly weathering limestone	0.40
6: Limestone, fawn, coarse grained, ooidal, shell-fragmental, locally gently cross-bedded; sporadic mudstone clasts	0.25–0.30
5: Limestone, buff, weathering to cream, fine-to medium-grained, sparsely ooidal; thinly bedded, locally gently cross-bedded, fissile calcarenite; sporadic, thin, impersistent, laminated, darker-buff marl seams	0.08–0.15
4: Oolite, pale-cream, medium- to coarse-grained, shell-fragmental, sparry, with prominent planar cross-bedding; impersistent thin seams of thinly bedded, fissile calcarenite; scattered larger shell-fragments including *Praeexogyra hebridica* (Forbes); also unbroken shells of small immature bivalves; planar top, undulating base	0.05–1.00
3: Limestone, cream, fine-grained, very thinly bedded, fissile calcarenite; locally absent	0–0.08
2: Oolite, similar to above but creamy-white and with less prominent cross-bedding but with individual beds showing internal cross-bedding structure	1.40

1: Oolite, pale-cream, medium- to coarse-grained, shell-fragmental, sparry, thick-bedded, with large-scale trough cross-bedding; fawn, very hard, 'raggy' in basal 0.15 m, with large shell-fragments including *Isognomon;* sharp planar base	1.45
Charlbury Formation	
11: Marl, buff, laminated; clay partings with carbonaceous plant-debris; lenticular beds of shell-detrital, sparry limestone	0.20–0.32
10: Limestone, buff, very marly, shell-fragmental, bivalve fauna including *Camptonectes, Ceratomya* cf. *concentrica* (J. de C. Sowerby), *Eocallista antiopa* (*Thevenin*), *Mactromya, Modiolus imbricatus* J. Sowerby, *Pachymya* (*Arcomya*), *Pinna, Pleuromya?* and *Protocardia* cf. *stricklandi* (Morris and Lycett); also the gastropod *Ampullospira stricklandi* (Morris and Lycett) and the echinoid *Nucleolites woodwardi* (Wright)	0.45
9: Marl, brown, finely shell-detrital	0.25
8: Limestone, brown, ooidal, shell-fragmental, hard, sparry; partings at top and base with many *Isognomon* shells	0.30
7: Limestone, buff, very marly, thinly bedded, fine calcarenite	0.30
6: Limestone, fawn, ooidal, shell-detrital, hard, sparry	0.15–0.30
5: Marl, brown, with lenses of hard, ooidal, shell-fragmental sparry limestone	0.23–0.30
4: Limestone, brown, shell-detrital, slightly marly, banded, hard, with scattered oyster shells; *Camptonectes* and *Antiquicyprina loweana* (*Morris and Lycett*)	0.18–0.30
3: Limestone, buff, very marly, Shelly, shell-fragmental, ooidal with abundant *Praeexogyra hebridica* (Forbes) and other bivalves including *Camptonectes* (*C.*) *auritus* (Schlotheim), *Isognomon, Modiolus, Plagiostoma* and *Pleuromya?;* also *Kallirhynchia* cf. *bella S.S.Buckman;* an *hebridica* lumachelle up to 0.15 m-thick locally in middle	0.55–0.80
2: Limestone, brown, shell-fragmental, slightly ooidal, hard, sparry; coarsely shell-fragmental at base	0.16–0.20
1: Limestone, buff, very marly, shell-fragmental, very shelly, soft, with many bivalves including *Camptonectes* and *Isognomon,* and rhynchonellids including *Epithyris* '*maxillata*'of authors, *Kallirhynchia bella* and *K.* cf. *decora* S.S. Buckman; sharp base	0.15–0.40
Sharp's Hill Formation	
8: Clay, mainly dark bluish-grey with sporadic *Placunopsis;* crudely layered oyster-shell debris at base	0.25–0.32
7: Clay, black, peaty, with abundant white, decalcified, oyster-shell fragments	0.02–0.03
6: Marl, brown, shelly, unevenly bedded; abundant *Praeexogyra hebridica* and *Epithyris oxonica* Arkell; sporadic *Modiolus*	0.55
5: Limestone, bluish-grey, weathering greenish-buff; shell-fragmental, with crudely bedded oyster-shell debris; oyster-encrusted planar upper surface; thin layer of fibrous gypsum at base	0.30–0.35

4: Clay, dark bluish-grey to black, with many carbonaceous plant-fragments, partings of quartz sand and a few streaks of yellowish marly 'race'; abundant *Placunopsis* in lower part	0.18–0.40
3: Limestone, greenish-buff, marly, sandy, shell-fragmental; many bivalves including *Placunopsis*	0.20–0.42
2: Clay, dark-grey, weathering rusty-brown, with lenticles of quartz sand; locally a shell sand or clay with *Placunopsis;* micritic limestone conglomerate at uneven base	0.15–0.33
1: Limestone, pale-fawn, sparsely ooidal, micritic; hard and porcellanous at top; passing down into pale-grey marly, more ooidal limestone with scattered quartz grains and small gastropods (*Bathonella?*)*;* carbonaceous plant-debris near uneven base	0.10–0.40
Chipping Norton Limestone Formation	
3: Limestone, cream to white, fine- to medium-grained, shell-fragmental, ooidal; small-scale cross-stratification and rippled surfaces; hard, brownish and recrystallized at top	3.00
2: Limestone, pale-cream, fine grained, sandy, finely ooidal; thickly bedded and compact	3.10
1: Sand, orange-brown, marly, with impersistent limestone ribs; shell debris and shells	0.10–0.15
Clypeus Grit Formation	
7: Clay with *Stiphrothyris globata* (of authors)	0.05–0.15
6: Limestone, cream, marly, ooidal, sparsely pisolitic	1.80
5: Limestone, pale-orange to cream, soft, marly, shell-fragmental	0–0.10
4: Limestone, yellowish-cream, marly, ooidal, shell-fragmental; many brachiopods and bivalves	0.50–0.75
3: Limestone, creamy-fawn, marly, fine grained, sparsely ooidal; many brachiopods, bivalves, some gastropods; two thin beds of sand	2.13
2: Limestone, pale-brown and buff, soft, very marly, shell-fragmental, sparsely ooidal	0.90
1: Limestone, brown, hard, marly, sparsely ooidal, shell-fragmental	seen to 0.25

Boreholes drilled in the floor of the quarry proved a further 5.8 m of the Clypeus Grit Formation, indicating a total thickness of 11.7 m for the formation.

Interpretation

The succession in Ditchley Road Quarry records a period in which depositional environments varied between shallow-water, unrestricted, carbonate shelf-sea; marine, quiet-water, protected, carbonate lagoon; and brackish-water, near-shore, sub-littoral mudflat.

At the base of the succession, the micritic matrix of the Clypeus Grit Formation suggests a generally low-energy environment in which the deposition of carbonate mud was dominant. It is inferred that the matrix-supported ooids and pisoids were washed into the depositional area from nearby sources during higher-energy events. A stable substrate encouraged the development of a large and varied, sessile and motile bivalve–brachiopod fauna, as well as species of shallow-burrowing echinoids.

The ooidal limestones of the overlying Chipping Norton Limestone Formation, which are in part current-rippled or cross-bedded, were deposited in the medium- to high-energy, shallow waters of an offshore, carbonate shelf-sea. The sandy nature of the lower beds indicates some input of terriginous sediment. The paucity and low diversity of the fauna and the rarity of burrowing organisms indicate an unstable substrate, conditions that have been compared to the mobile, carbonate sand-belts of Florida and the Bahamas (Sellwood and McKerrow, 1974). The hard, recrystallized top surface of the formation suggests a pause in sedimentation before deposition of the overlying unit commenced.

The Sharp's Hill Formation comprises lithologies ranging from dark, organic clay to oyster-rich shell-fragmental limestone, and contains a variety of fossils from fully marine (*Modiolus, Epithyris*) to brackish water (*Placunopsis*). These characteristics indicate rapid variations in depositional conditions from offshore, open marine to nearshore, brackish-water mudflat, the latter incorporating drifted plant-debris. The micritic limestone at the base of the formation reflects a shallow-water, low-energy, carbonate lagoonal environment. The presence of the freshwater gastropod *Bathonella* in the lower part suggests greater proximity to the shoreline, the gastropods having been washed into the lagoon from the hinterland. A depositional break is marked by the hardground that caps this bed and the conglomerate that overlies it. It should be noted that this limestone and the conglomerate are restricted to a part of the quarry [SP 3687 1985] that is not now visible.

The strata of the Charlbury Formation have formerly been included with the Taynton Limestone Formation but Boneham and Wyatt (1993) argued that they were of sufficiently different facies to warrant separation as a distinct formation. Its hard, sparry, shell-fragmental limestones, which are ooidal in part, point to clear, shallow, turbulent waters associated with a mobile substrate. By contrast, the soft, very marly limestones reflect a much less turbulent environment and a more stable substrate that supported a large and diverse bivalve fauna, accompanied by numerous brachiopods. The subordinate marl beds indicate quiet waters in which carbonate mud deposition dominated; the fine carbonate sand content was, perhaps, reworked from adjacent areas.

The succeeding Taynton Limestone Formation witnesses the establishment of a uniformly shallow water, high-energy, current-dominated shelf-sea in which deposition of shell-fragmental, cross-bedded carbonate shoal-sands dominated. Like the Chipping Norton Limestone Formation, a meagre, low-diversity fauna implies an unstable, mobile substrate.

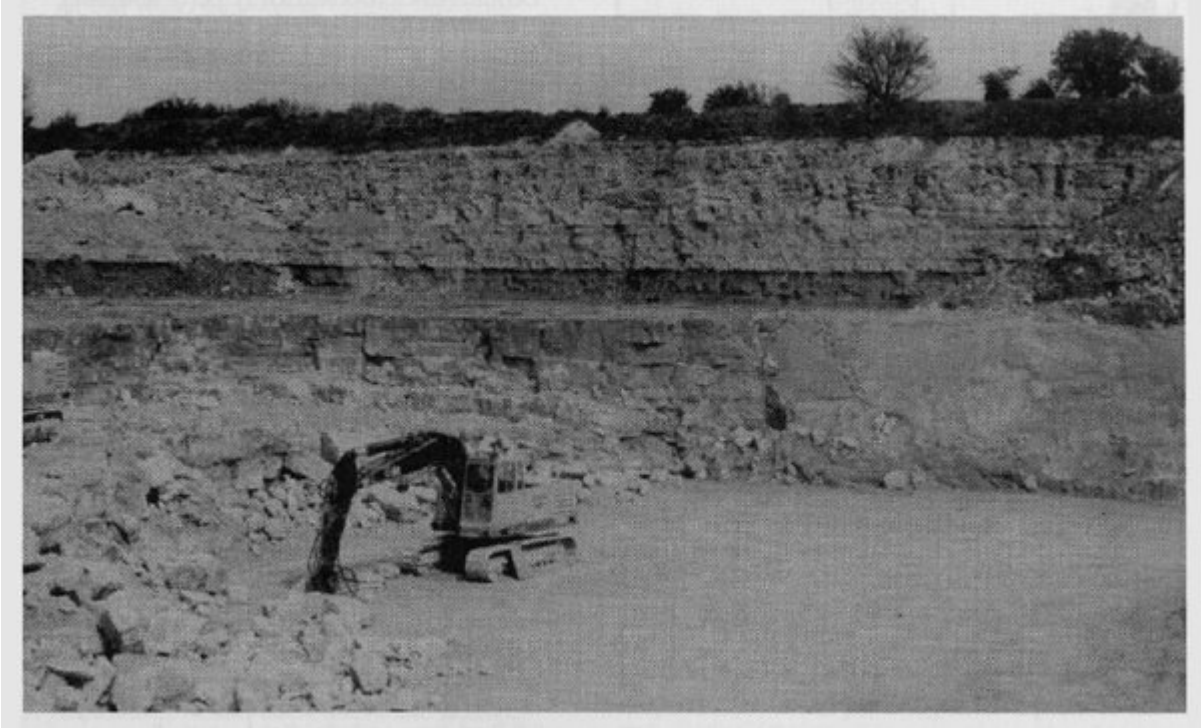
The section at Ditchley Road Quarry has yielded no fossils of special biostratigraphical significance. However, the stratigraphy of a comparable nearby succession at Stonesfield (Boneham and Wyatt, 1993; see GCR site report, this volume) allows it to be dated satisfactorily. The Taynton Limestone Formation is assigned to the Middle Bathonian Progracilis Zone on the basis of a diagnostic ammonite fauna, including the zonal index taxon *Procerites progracilis* Cox and Arkell, in coeval beds at Stonesfield (see GCR site report, this volume). The underlying Charlbury Formation may be referred to the same zone on the evidence of a similar diagnostic fauna found in corresponding beds farther west in Gloucestershire. The Chipping Norton Limestone Formation is known to belong to the Lower Bathonian Zigzag Zone, Yeovilensis Subzone in the type area (Torrens, 1969e). The stratigraphical position of the Sharp's Hill Formation suggests that it belongs to the overlying Tenuiplicatus Zone. The exposed portion of the Clypeus Grit Formation at Ditchley Road Quarry is inferred to be equivalent to the bulk of the Hook Norton Member of the Chipping Norton Limestone Formation in the type area, which belongs to the Lower Bathonian Zigzag Zone, Macrescens and Convergens subzones (Torrens, 1969e). Much of the remainder, proved in boreholes, is probably coeval with the 'Hook Norton Conglomerate Beds' at Hook Norton (see GCR site report, this volume), which belong to the Upper Bajocian Parkinsoni Zone, Bomfordi Subzone.

Conclusions

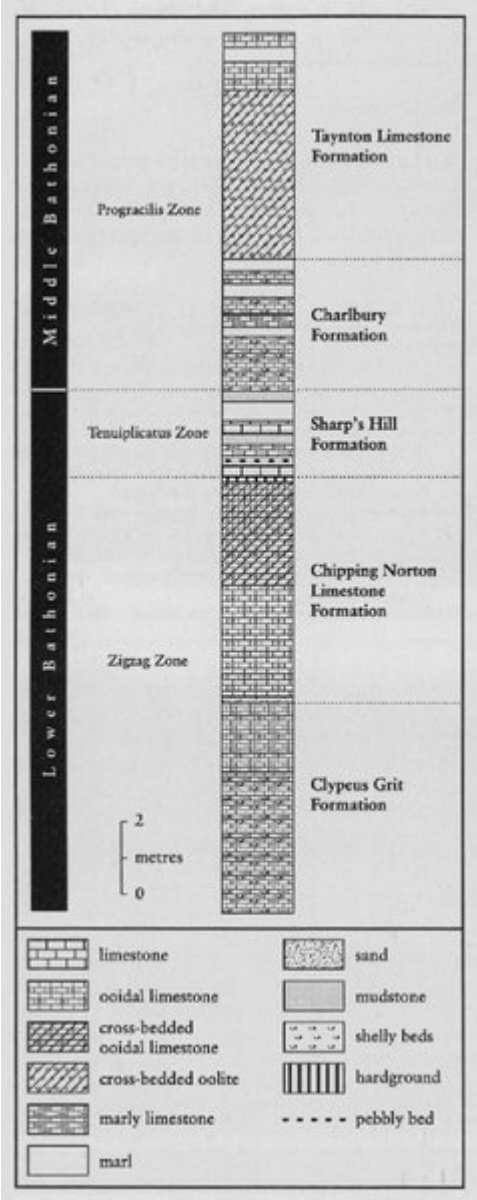
Ditchley Road Quarry currently reveals a varied lithological succession ranging from the Lower Bathonian Chipping Norton Limestone Formation (Zigzag Zone), to the Middle Bathonian Taynton Limestone Formation (Progracilis Zone). The section is of considerable importance in establishing the depositional history of the lower part of the Bathonian succession in this part of Oxfordshire, and in interpreting the lateral lithological changes that characterize the Sharp's Hill Formation. The latter formation is characterized at Ditchley Road Quarry by the local development of a basal micritic limestone bed, which is capped by a hardground and which contains freshwater gastropods. The quarry is the type

section of the Charlbury Formation, which, though regionally widespread, is nowhere else satisfactorily exposed; this perhaps explains why it has hitherto been overlooked. The section exhibits well-developed cross-bedding structures.

References



(Figure 3.66) Ditchley Road Quarry. The lower part of the quarry is excavated in Chipping Norton Limestone Formation, which is locally the basal unit of the Great Oolite Group. This is overlain by dark-grey clays of the Sharp's Hill Formation, which are, in turn, succeeded by the buff marls and marly limestone of the Charlbury Formation with the paler Taynton Limestone Formation above. (Photo: British Geological Survey, No. A15217; reproduced with the permission of the Director, British Geological Survey, © NERC, 1991.))



(Figure 3.67) Graphic section of the Bathonian succession at Ditchley Road Quarry.)