Nunnington

[SE 646 785], [SE 648 787] and [SE 649 787]

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Introduction

An abandoned railway cutting, Nunnington Railway Cutting, an adjacent overgrown quarry, Nunnington Railway Cutting Quarry, and Leysthorpe Quarry, a large quarry formerly worked by E.W. Creaser (Quarries) Limited of Pocklington, York, constitute a composite site west of Nunnington village and north-west of Stonegrave village (Figure 4.34). Leysthorpe Quarry lies beside the B1257 between Stonegrave and Leysthorpe. The Ordnance Survey spelling of the latter changed from 'Laysthorpe' to 'Leysthorpe' in the 1970s.

These exposures occur on the southern side of the Vale of Pickering adjacent to the E–W-trending Asenby–Coxwold Graben. The low ground occupied by this structure (Hovingham Carrs, (Figure 4.34)) separates the Corallian rocks of Caulldeys Bank, upon which the Nunnington site occurs, from the Howardian Hills to the south.

The railway cutting and adjacent quarry have been known to geologists for some time. The cutting was first described by Blake and Hudleston (1877), and by Fox-Strangways (1892). It was mentioned briefly by Arkell (1933, 1935–1948), and was visited by the Geologists' Association in 1933 and 1950 (Wilson, 1934, 1954). Wright (*in litt,* 1960) mapped the area and prepared detailed descriptions of the exposures. Wright (1972) described the Coral Rag in the cutting and adjacent quarry, and figured several ammonites collected from the Upper Calcareous Grit of Leysthorpe Quarry. The latter acquired importance as the stratotype locality of the Nunningtonense Subzone of the Upper Oxfordian Pumilus Zone (Sub-Boreal zonal scheme). Leysthorpe Quarry was referred to by Kent (1980b) as 'a quarry at Nunnington'. Wright (1996a, b) figured numerous ammonites from the two quarries, and gave a detailed measured section of the Upper Calcareous Grit at Leysthorpe Quarry.

Description

Measured sections at the three exposures: Nunnington Railway Cutting, Nunnington Railway Cutting Quarry and Leysthorpe Quarry are given below. These are updated versions of measured sections originally prepared by the present author in 1960.

Nunnington Railway Cutting section

	Thickness (m)
Upper Calcareous Grit Formation	
Spaunton Sandstone Member, Glosense Subzone	
10. Tough, massive, fine-grained sandstone seen to	2.35
9. Poorly cemented sandstone	0.3
8. Extremely tough, calcareous sandstone, a *Rhaxella* spiculite with large calcareous concretions	0.50
7. Tough, massive sandstone with *Perisphinctes* sp.	2.1
6. Poorly cemented sandstone	0.45
5. Irregularly cemented, fine-grained sandstone, heavily bioturbated towards the top	1.25
4. Very fine-grained sandstone with bivalve fragments	0.35
Newbridge Member ?absent due to erosion	
Coralline Oolite Formation	
Coral Rag Member, ?Tenuiserratum Subzone	

3. Massive, micritic limestone with abundant *Thecosmilia annularis* (Fleming) in living position, *Thamnasteria concinna* (Goldfuss), *Paracidaris florigemma* (Phillips) and numerous bivalves seen in cross-section	1.9
2. Shelly, micritic, well-bedded limestone with abundant bivalve and gastropod fragments, plus occasional rolled *Thecosmilia* and *Cidaris* spines	1.5
Malton Oolite Member, ?Maltonense Subzone	
1. Fine-grained oolite	seen to 0.55

Blake and Hudleston (1877) record *Gervillella aviculoides* (J. Sowerby), *Cerithium muricatum* (J. Sowerby) and '*Trigonia*' sp. from Bed 4.

Nunnington Railway Cutting Quarry section

	Thickness (m)
Upper Calcareous Grit Formation	
Newbridge Member, Ilovaiskii Subzone	
7. Fine-grained, flaggy sandstone containing *Amoeboceras transitorium* Spath, *A. newtonense* Wright, *A.* sp., *Perisphinctes* (*Pseudarisphinctes*) sp. and *P.* sp.	seen to 2.1
Coralline Oolite Formation	
Coral Rag Member, ?Tenuiserratum Subzone	
6. Impure, rubbly limestone, heavily recrystallized, containing *Isastraea explanata* (Goldfuss), *Thecosmilia annularis, Paracidaris florigemma* spines and bivalve fragments	1.35
5. Massive, micritic limestone containing *Thecosmilia annularis, Rhabdophyllia philipsi* Edwards and Haime, *Thamnasteria concinna, Montlivaltia dispar* (Phillips), *Paracidaris florigemma, Cidaris smithi* (Wright), *Ctenostreon proboscideum* (J. Sowerby), *Lithophaga inclusa* (Phillips), *Chlamys* sp., *Ditremaria tornatilis* (Phillips), *?Solenopora* sp. and crinoid ossicles	0.9
4. Pisoidal oolite containing frequent *Thecosmilia annularis, Paracidaris florigemma* (spines), *Pseudomelania heddingtonensis* (J. Sowerby) etc.	0.7
Malton Oolite Member, ?Maltonense Subzone	
3. Shelly oolite containing large, poorly preserved bivalves	1.15
2. Massive, extremely poorly sorted oolite	4.20
1. Tough, shelly oomicrite	seen to 1.80

Blake and Hudleston (1877) record *Hemicidaris* sp., *Natica clio*, *Nerinea* sp., *Chemnitzia* sp. and *Nanogyra nana* (J. Sowerby) from Bed 2.

Leysthorpe Quarry section

	Thickness (m)
Upper Calcareous Grit Formation	
Spaunton Sandstone Member, Glosense Subzone	

13. Fine-grained, spicular sandy limestone containing septarian cracks. The fauna includes *Amoeboceras nunningtonense* Wright, *A. glosense* (Bigot and Brasil), *A. ilovaiskii* (M. Sokolov), *A. transitorium* and *Perisphinctes* sp.	seen to 0.05
12. Flaggy, spicular sandstone with occasional *Amoeboceras newtonense* and *Perisphinctes* (*Pseudarisphinctes*) *pachathii* Arkell approx.	2.0
11. Massive, pale-coloured, spicular sandstone full of infilled *Thalassinoides* burrows, and weathering brown. Contains *Amoeboceras glosense, A. ilovaiskii, A. newtonense, Perisphinctes* (*Dichotomosphinctes*) sp. and numerous bivalve fragments including *Chlamys* sp.	1.0
Newbridge Member, Ilovaiskii Subzone	
10. Massive, white, blocky, homogeneous spiculite containing *Amoeboceras nunningtonense, A. glosense, A. transitorium, A. ilovaiskii, A. newtonense, Perisphinctes* (*Perisphinctes*) aff. *parandieri* de Loriol, *P.* (*P.*) *uptonensis* Arkell, *P.* (*Arisphinctes*) *kirkdalensis* Arkell, *P.* (*A.*) sp., *P.* (*Dichotomosphinctes*) aff. *elizabethae* de Riaz, *P.* (*D.*) spp. and *Nanogyra nana*	0.6
?. White, laminated, sandstone with frequent flattened, distorted ammonites: *Amoeboceras* aff. *transitorium, A. ilovaiskii, A. newtonense, Perisphinctes* (*P.*) aff. *parandieri, P.* (*A.*) *kirkdalensis, P.* (*D.*) sp., and *Decipia ravenswykensis* Wright	0.3
3. Soft, flaggy, decalcified, laminated sandstone approx.	0.6
Coralline Oolite Formation	
Coral Rag Member, ?Tenuiserratum Subzone	
7. Shelly, coralliferous micrite with *Thamnasteria concinna* and *Rhabdophyllia phillipsi*	1.1
5. Shelly oobiosparite with *Thecosmilia annularis,* numerous fragments of *Fungiastraea* and *Thamnasteria,* and *Chlamys* sp., *Lima aciculata* Miinster, *Nerinaea* sp. and *Perisphinctes* sp.	1.3
Walton Oolite Member, ?Maltonense Subzone	
5. Monotonous series of poorly bedded, ill-sorted, fine-grained oosparites containing *Dentalium* sp. and *Macromesodon* cf. *bucklandi* (Agassiz)	8.3
4. Shelly pelmicrite with only very sporadic ooids. Contains *Nanogyra nana, Pseudomelania heddingtonensis,* and thin-shelled bivalves and gastropods	2.6
3. Shelly, very poorly sorted oosparite, numerous shell fragments having micrite envelopes. Contains *Chlamys fibrosus* (J. Sowerby) and '*Cerithium*' sp.	1.6
2. Well-bedded to massive, shelly oomicrite with *N. nana* and thin-shelled bivalves and gastropods. Some quartz silt present	2.2
1. Well-bedded, sandy oomicrite passing up into oosparite. The quartz sand content is appreciable below, with pyrite skins to the ooids so that these weather an orange colour	seen to 1.9

A log of the Coralline Oolite Formation in Leysthorpe Quarry is given in (Figure 4.35).

The shelly oomicrites and oosparites of Beds 1–4 in the quarry mark a distinctive series of limestone beds that can be traced along Caulkleys Bank and pass into a coral bed and a shell bed at Ness (Wright, 1972). The upper Malton Oolite in the quarry is a very poorly sorted, pasty oolite (bed 5), with very few fossils preserved. The sequence of limestone beds at Leysthorpe Quarry is illustrated in (Figure 4.36).

The Coral Rag has an extremely prolific fauna. In all three exposures it divides into a coralliferous shell bed below, overlain by a fossilized coral reef with corals in growth position. The shell bed has yielded bivalves, gastropods and echinoids, spines of *Paracidaris florigemma* being abundant. The upper massive, micritic limestone is well exposed both at the Railway Cutting Quarry and in the railway cutting. It is noteworthy for the variety of corals present. *Isastraea explanata* occurs sparingly, and only one specimen of *Montlivaltia dispar* has been recorded. The tiny branching coral *Rhabdophyllia phillipsi* is more common, but the most abundant phaceloid coral is *Thecosmilia annularis,* with several arborescent colonies weathering out in Nunnington Railway Cutting and the Railway Cutting Quarry. *Thamnasteria concinna* is ubiquitous, layer upon layer of this massive coral encrusting bivalves and gastropods into one solid mass. Of the bivalves, *Chlamys* is notably rare, its place being taken by abundant *Ctenostreon proboscideum.* The massive corals are riddled with *Gastrochaenolites* borings containing *Lithophaga inclusa,* and many specimens can be found with the bivalve nestling in its hole. Gastropods and echinoid spines abound in the micritic matrix in between the corals, spines of *Paracidaris florigemma* being much more numerous than those of *Cidaris smithi.* The thickness of the Coral Rag varies considerably, increasing from 2.5 to 3.5 m when traced southwards in a 50 m length of the railway cutting.

The chief interest of the Upper Calcareous Grit is its remarkable ammonite fauna ((Figure 4.5)A–C, G), the most diverse, abundant and best-preserved in this formation in Yorkshire.

Though often compressed, particularly in the Newbridge Member, the ammonites, both macroconchs and microconchs, are usually fully preserved complete with body chamber. Wright (1996a, b) has figured 35 specimens collected in the two quarries.

Interpretation

During deposition of the Malton Oolite, Leysthorpe Quarry seems to have been situated in a slightly sheltered or depressed area, possibly lagoonal, accumulating sediments deposited in lower energy conditions. The sandy oolites of Bed 1, with their appreciable pyrite content, thus seem to have been laid down in a poorly circulated, stagnant area separating clastic sedimentation to the west from pure carbonate sedimentation to the east. They mark the lateral transition from the Middle Calcareous Grit into Malton Oolite (Figure 4.4). These sandy carbonates are overlain by micrites laid down under quiet, fully marine conditions, and yielding a thin-shelled bivalve and gastropod fauna (Bed 2 and Bed 4), separated by a higher-energy incursion containing much broken shell debris (Bed 3). The higher ooidal beds (Bed 5) are remarkably ill-sorted at Leysthorpe Quarry, without cross-bedding, and thus show no sign of winnowing by currents. They were presumably dumped into deeper water immediately after being formed in tidal channels. These channels, with their cross-bedded oolite, can be seen only 1.5 km away to the east in Nunnington Quarry [SE 661 787] (Figure 4.34).

The Coral Rag has a profusion of *Paracidaris florigemma* and a large variety of corals preserved in shelly micrite. This is clearly the true Coral Rag, and not simply a coralliferous facies of the Malton Oolite as was the case at Betton Farm Quarry (this volume). Many of the corals, particularly the 1 m high arboresques of *Thecosmilia,* indicate slightly more sheltered conditions away from the reef-front, which was probably situated to the south (see site report for Wath Quarry, this volume). The development of the Coral Rag at this site is much thinner than is usual and it is absent altogether east of Leysthorpe, at Nunnington village and Ness (Wright, 1972). In contrast, in the West Newton Grange Borehole 1.5 km to the north-west [SE 628 802] (Wright, 1996a), it is 8.7 m thick, and this thickness seems typical throughout the western end of the Vale of Pickering, with the exception of the present area. In the borehole core, the junction of Upper Calcareous Grit on Coral Rag was clearly bored and erosive, and it would appear that the thinning in the area of the Nunnington site, and absence at Nunnington village and Ness, is due to erosion beneath the Upper Calcareous Grit. A substantial gap between the two is indicated in (Figure 4.4), which also shows the limited area where the Newbridge Member is preserved due to erosion beneath the Spaunton Sandstone.

The Upper Calcareous Grit is present in a markedly atypical facies towards the base, and the laminated spiculites (Bed 7 in the Railway Cutting Quarry and Bed 9 and Bed 10 in Leysthorpe Quarry) are only tentatively correlated with the Newbridge Member. In the West Newton Grange Borehole, the normal, argillaceous facies of the Newbridge Member is present (Wright, 1996a). These laminated, clayey silts appear to pass into the laminated spiculites. Shallow, quiet, slow conditions of sedimentation are implied, without the influx of mud that characterizes the Newbridge Member at other localities. In the east, around Nunnington village and Ness, where flaggy sandstone (?Spaunton Sandstone) overlies Malton Oolite (Wright, 1996b), the Newbridge Member appear to have been overstepped (Figure 4.4). This is probably the case also in the railway cutting section. The upper members of the Upper Calcareous Grit, the Spaunton and Snape sandstones, were instantly recognizable in the borehole core, and comparison of these thicknesses with those measured in the Nunnington Railway Cutting suggests that the Snape Sandstone comes above the highest beds seen in the cutting.

The Upper Calcareous Grit at Leysthorpe Quarry, and to a lesser extent at Nunnington Railway Cutting Quarry, has yielded an *Amoeboceras* fauna that fills a significant gap in British Oxfordian stratigraphy (Wright, 1972). With its coarsely ribbed *A. transitorium* and *A. glosense* ((Figure 4.5)B, C), and its finer-ribbed *A. ilovaiskii, A. newtonense* and *A. nunningtonense* ((Figure 4.5)A) this fauna is older than the Glosense Subzone *Amoeboceras* fauna of the Clavellata Formation of Dorset (Figure 2.11)B, E. It is therefore also older than the equivalent Bed 4 *Amoeboceras* fauna of Newbridge Quarry (Figure 4.5)D, E. It rests on the Coral Rag, whose ammonite fauna both in Yorkshire and around Oxford is that of the Sub-Boreal Parandieri Subzone of Callomon (1960) (Figure 1.4). The *Amoeboceras* and associated peri-sphinctid fauna of Bed 9 and Bed 10 thus became the type fauna of the Sub-Boreal Nunningtonense Subzone of the full Pumilus Zone (Wright, 1972), and it also typifies the Boreal Ilovaiskii Subzone of the Glosense Zone (Sykes and Callomon, 1979).

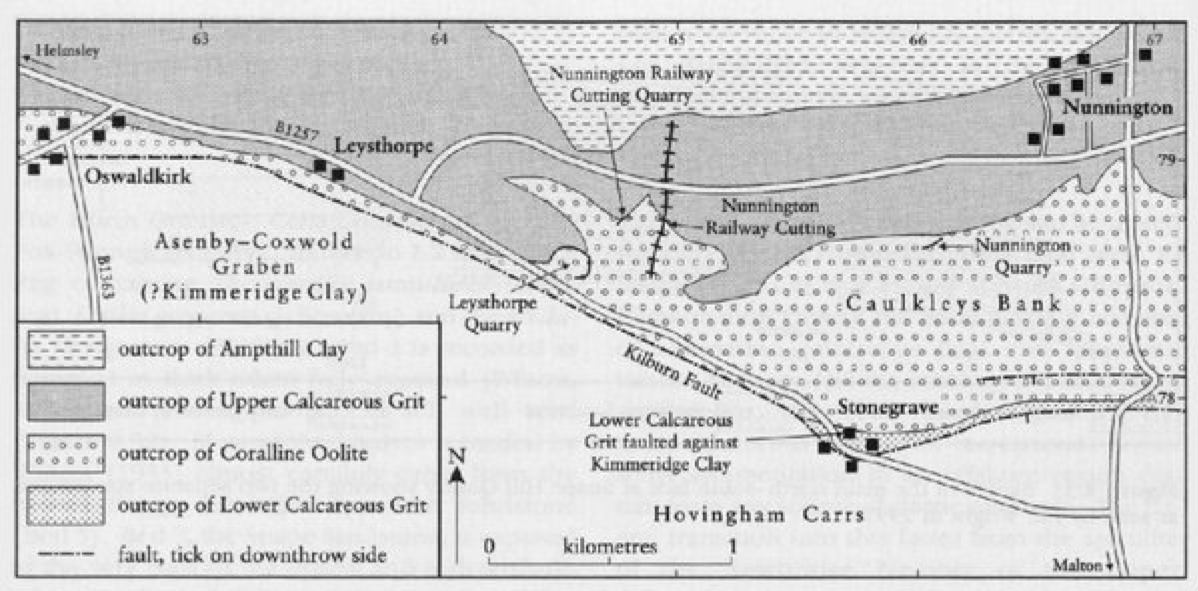
Perisphinctes is remarkably common in Bed 9 and Bed 10 at Leysthorpe Quarry ((Figure 4.5)G, H). This section is therefore the only exposure in England where the *Amoeboceras* of the Ilovaiskii Subzone (Sykes and Callomon, 1979) and the *Amoeboceras, Perisphinctes* and *Deci pia* of the equivalent Nunningtonense Subzone (Wright, 1972) can be collected from a permanent exposure. All other Yorkshire exposures of Upper Calcareous Grit, with the possible exception of Ravenswyke Quarry, Kirkby Moorside (Wright, 1996a), yield faunas predominantly of Glosense Subzone age. The highest beds at Leysthorpe Quarry (beds 11–13) may belong to this subzone.

Conclusions

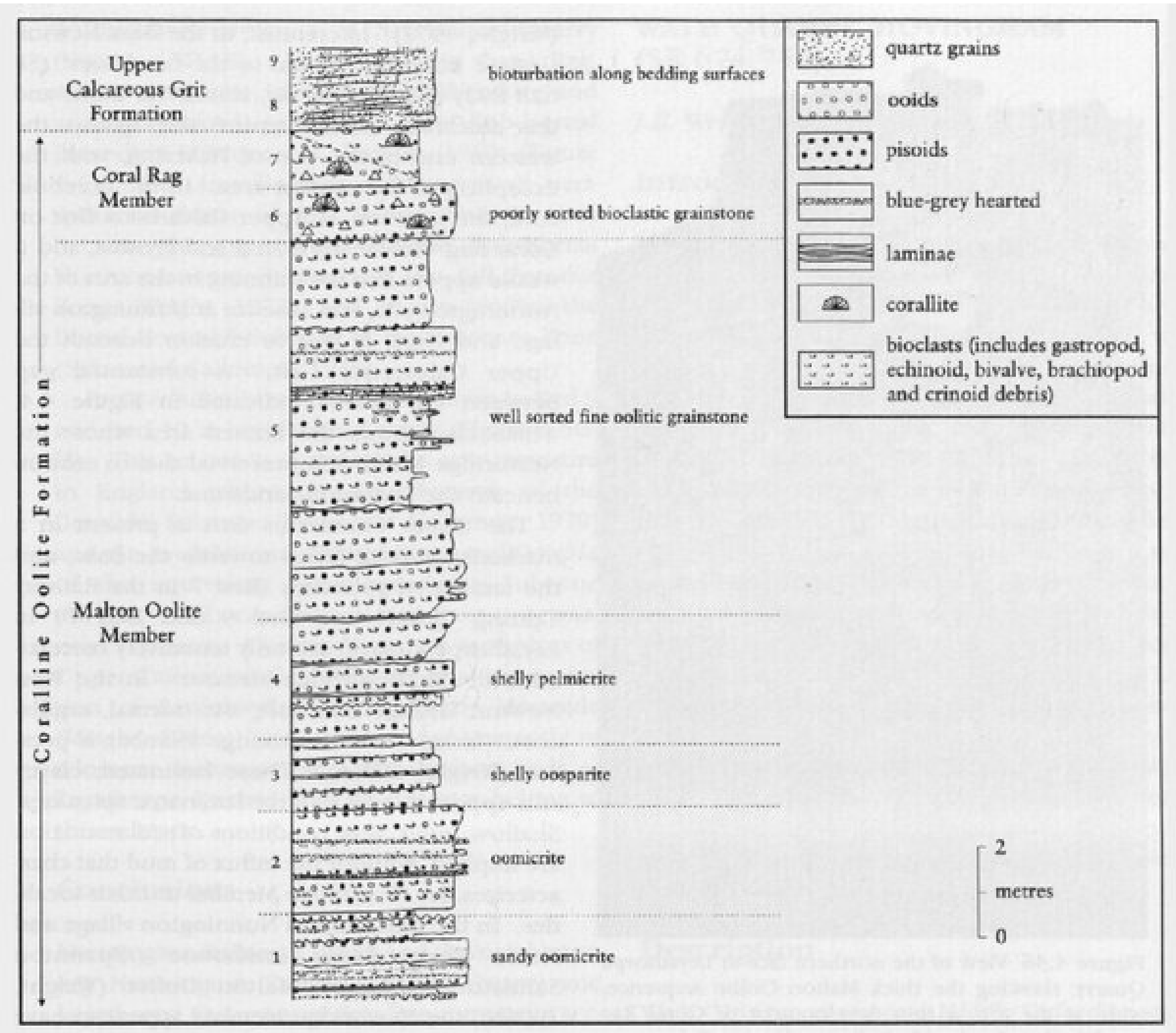
Nunnington Railway Cutting and the neighbouring Nunnington Railway Cutting Quarry and Leysthorpe Quarry provide a fine composite section through the Malton Oolite and Coral Rag Members of the Coralline Oolite Formation. The shelly facies of the Malton Oolite forms a significant marker band that can be traced throughout the Caulkleys Bank area. The Coral Rag shows lateral thickness and facies changes together with a rich and diverse reef-forming and reef-dwelling invertebrate assemblage.

The Upper Calcareous Grit has yielded important holotype ammonites defining a new Sub-Boreal subzone (Nunningtonense Subzone). This allows correlation with areas containing similar ammonites in the Sub-Mediterranean Province in southern Europe and Poland. The presence in addition of ammonites typifying the Boreal Ilovaiskii Subzone allows correlation with areas in the Boreal Realm such as Skye and Greenland. Nunnington is thus a key stratigraphical locality for both the wide variety of lithologies and fossil groups present here, and its bearing on intercontinental correlations.

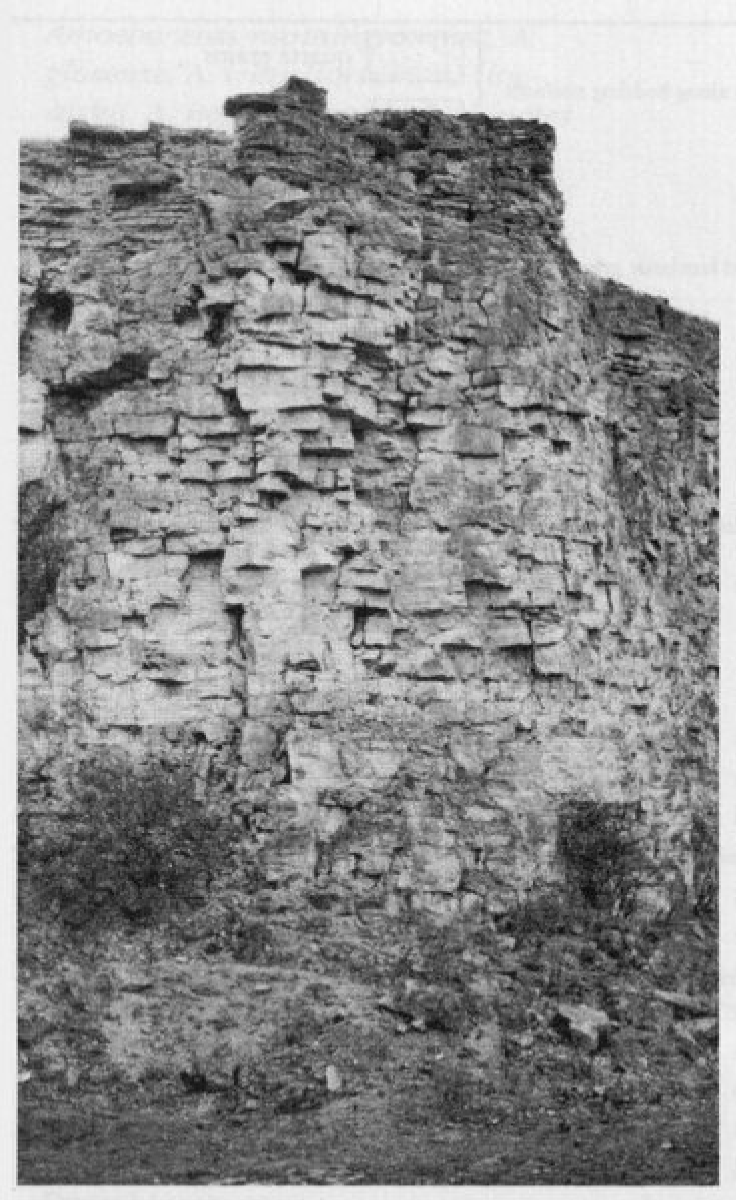
References



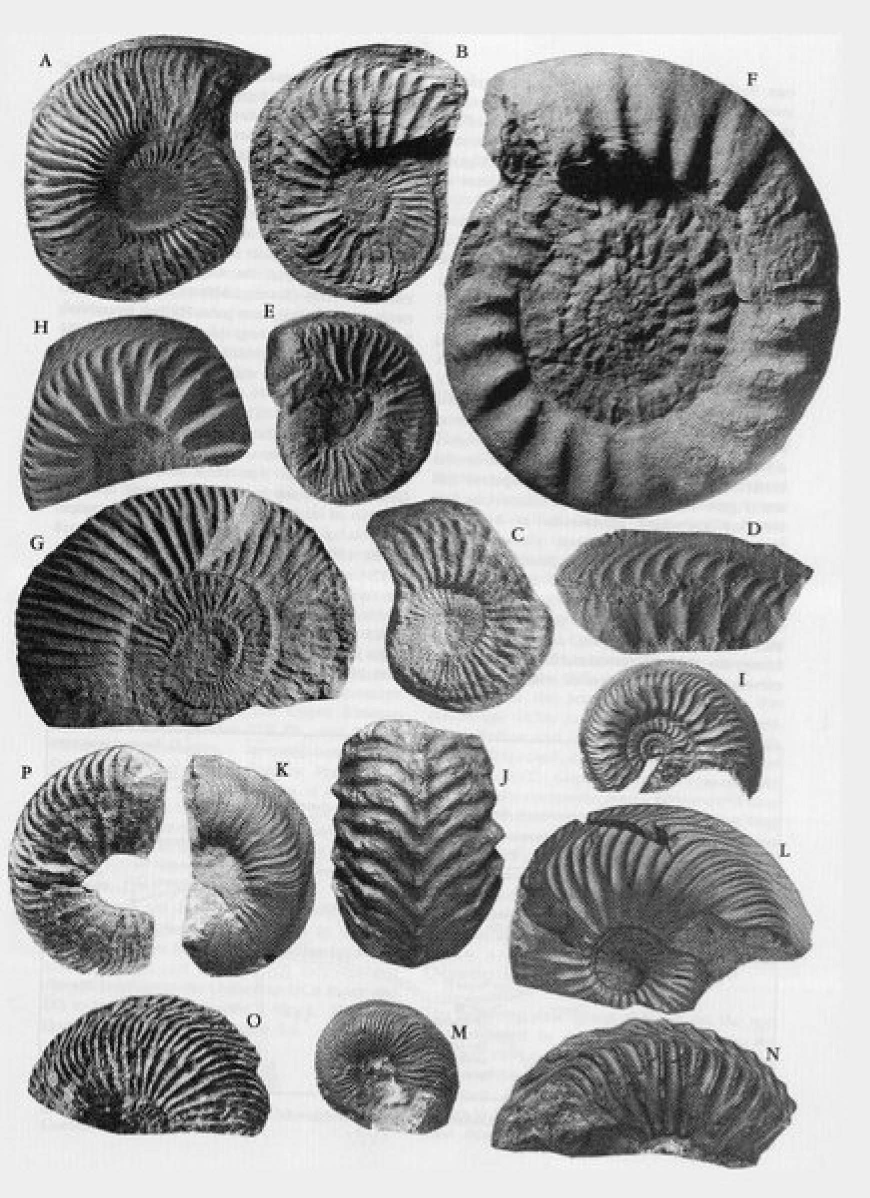
(Figure 4.34) Map showing the locations of the principal exposures WSW of Nunnington. Geological information from BGS Sheet 53 (Pickering) (1973).



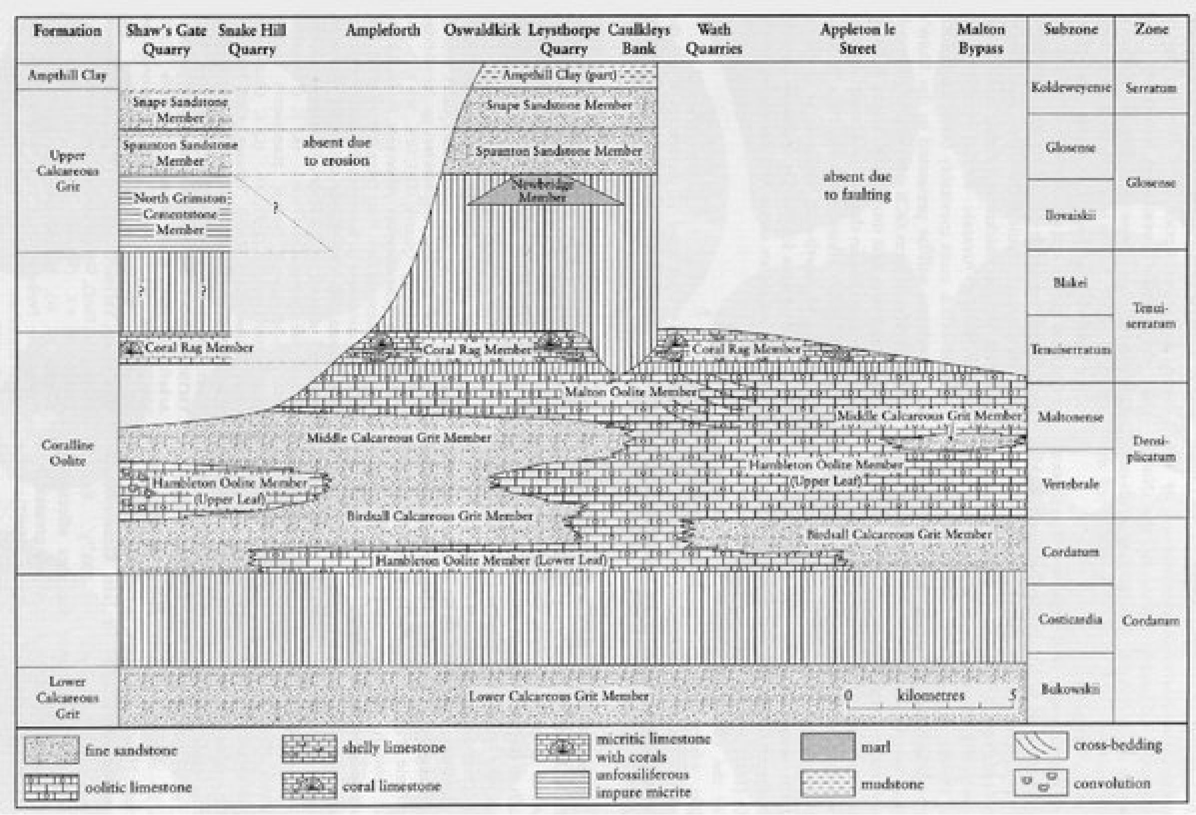
(Figure 4.35) Log of the CoraRine Oolite Formation in Leysthorpe Quarry, as measured by Mr D. Sharp and J.K. Wright, 1991–1992.



(Figure 4.36) View of the northern face at Leysthorpe Quarry, showing the thick Malton Oolite sequence, with, at the top, a thin development of Coral Rag overlain by thin-bedded, flaggy Upper Calcareous Grit. (Photo: J.K. Wright.)



(Figure 4.5) P Selection of ammonites from the Corallian Group of the Cleveland Basin. (A) Amoeboceras nunningtonense Wright (holotype), Spaunton Sandstone, Leysthorpe Quarry, m27, x 1. (B) A. glosense (Bigot and Brasil), Newbridge Member, Leysthorpe Quarry, U/1/14, x 1. (C) A. transitorium Spath, Newbridge Member, Leysthorpe Quarry, U/1/5, x 1. (D) A. ilovaiskii (M. Sokolov), Spaunton Sandstone, Newbridge Quarry, U/2/38, x1. (E) A. newbridgense Sykes and Callomon, Spaunton Sandstone, Newbridge Quarry, U/2/20, x 1. (F) Perisphinctes (Pseudarisphinctes) pachachii Arkell, Spaunton Sandstone, Spaunton Moor Quarry, U/3/63, x0.33. (G) P. (Dichotomosphinctes) sp. Newbridge Beds, Leysthorpe Quarry, U/1/103, x0.7. (H) Cardioceras (Cardioceras)persecans S. Buckman, Birdsall Calcareous Grit, Filey Brigg, YM1983/45F, x 1. (I) C. (C.) cordatum (J. Sowerby), Birdsall Calcareous Grit, Flassen Gill, YM1983/36F, x 1. (1) C. (Vertebriceras) aff. dorsale S. Buckman, Hambleton Oolite, Spikers Hill Quarry, C/2/17, x 1. (K) C. (Plasmatoceras)popilaniense Boden, Hambleton Oolite, Spikers Hill Quarry, C/2/59, x 1. (L) C. (Scarburgiceras) harmonicum Arkell, Tenants' Cliff Member, Tenants' Cliff, YM1983/17F, x 1. (M) C. (S.)reesidei Maire, Tenants' Cliff Member, Tenants' Cliff, YM1983/20F, x 1. (N) C. (Vertebriceras) aff. phillipsi Arkell, Tenants' Cliff Member, Tenants' Cliff, YM1983/23F, x 1. (O) C. (S.)praecordatum (Douvillé), Weymouth Member, Cayton Bay Waterworks, YM1983/9F, x 1. (P) C. (S.)scarburgense (Young and Bird), Weymouth Member, Cornelian Bay, YM1983/3F, x 1. (Photos: (A-E), (H, I), (L–P), J.K Wright; (F, G), K. D'Souza; (J, K) K. Denyer. Collections: Prefixes 'U', 'C', J.K. Wright Collection; 'YM', Yorkshire Museum Collection, York; 'm', Woodend Museum, Scarborough.)



(Figure 4.4) Stratigraphical cross-section of the Yorkshire Corallian Group on the south-west side of the Vale of Pickering from the I Iambleton Hills to Malton.

(Figure 2.11) Selection of Oxfordian ammonites from the Dorset coast Oxfordian exposures. (A) Ringsteadia evoluta Salfeld, Osmington Mills Ironstone, Black Head, J44969, x0.95. (B) Amoeboceras glosense (Bigot and Brasil), Clavellata Member, Black Head, D/C/25, x0.95. (C) Perisphinctes (Perisphinctes) uptonensis Arkell, Clavellata Member, Black Head, DC42, x0.80. (D) P. (Pseudarisphinctes) pachachii Arkell, Clavellata Member, Black Head, D/C/46, x0.48. (E) Amoeboceras ilovaiskii (M. Sokolov), Clavellata Member, Black Head, D/C/29, x1. (F) Cardioceras (Subvertebriceras) zenaidae Ilovaiski, Preston Grit, Redclig D/C/90, x 1. (G, H) Cardioceras (Vertebriceras) quadrarium S. Buckman. Red Nodule Bed, Furzy Cliff, D/O/35, x 1. (I) Cardioceras (Cardioceras) costicardia S. Buckman, Red Nodule Bed, Furzy Cliff, D/O/20, x 1. (J) Perisphinctes (Dichotomosphinctes) sp. Weymouth Member, Bowleaze Clay, Furzy Cliff, D/O/41, x0.58. (K) Cardioceras (Scarburgiceras) praecordatum Douvillé, East Fleet section, just north-west of the Lynch Cove GCR site, D/O/1, x 1. (Photos: (A, C, D) K. D'Souza; (F), K. Denyer; (B, E, G–K), J.K. Wright. Collections: Prefix 'D', J.K. Wright collection; prefix , Sedgwick Museum Collection, Cambridge.)

Substage	Zone	Subzone	Standard 'bed' numbers in Eastern England	Ammonite biohorizon
Upper Kimmeridgian	Fittoni			
Upper Kimmeridgian	Rotunda			
Upper Kimmeridgian	Pallasioides			
Upper Kimmeridgian	Pectinatus	Paravirgatus		
Upper Kimmeridgian	Pectinatus	Eastlecottensis	KC 46–49	
Upper Kimmeridgian	Hudlestoni	Encombensis	KC 42 (part) –45	
Upper Kimmeridgian	Hudlestoni	Reisiformis		
Upper Kimmeridgian	Wheatleyensis	Wheatleyensis	KC 40–42 (part)	
Upper Kimmeridgian	Wheatleyensis	Smedmorensis		
Upper Kimmeridgian	Scitulus		KC 37–39	
Upper Kimmeridgian	Elegans		KC 36	
Lower Kimmeridgian	Autissiodorensis		KC 33–35	
Lower Kimmeridgian	Eudoxus		KC 24–32	
Lower Kimmeridgian	Mutabilis		KC 15–23	
Lower Kimmeridgian	Cymodoce		KC 5–14	
Lower Kimmeridgian	Baylei		KC 1–4	
				Amoeboceras bauhini
Upper Oxfordian	Rosenkrantzi		AmC 37–42	
Upper Oxfordian	Regulare		AmC 26–36	
Upper Oxfordian	Serratum	Serratum	AmC 17–25	
Upper Oxfordian	Serratum	Koldeweyense		
Upper Oxfordian	Glosense	Glosense	AmC 12–16	
Upper Oxfordian	Glosense	Ilovaiskii		
Middle Oxfordian	Tenuiserratum	Blakei	WWF 11–16 + AmC 1–11	
Middle Oxfordian	Tenuiserratum	Tenuiserratum		
Middle Oxfordian	Densiplicatum	Maltonense	WWF 5–10	
Middle Oxfordian	Densiplicatum	Vertebrale		
Lower Oxfordian	Cordatum	Cordatum	WWF 1–4	
Lower Oxfordian	Cordatum	Costicardia		
Lower Oxfordian	Cordatum	Bukowskii		
Lower Oxfordian	Mariae	Praecordatum		
Lower Oxfordian	Mariae	Scarburgense		
				Quenstedtoceras paucicostatum

Alternative zonation for the Middle–Upper Oxfordian based on perisphinctid ammonites

Subzone	Zone
Evoluta	Pseudocordata
Pseudocordata	Pseudocordata
Pseudoyo	Pseudocordata
Caledonica	Pseudocordata
Variocostatus	Cautisnigrae
Cautisnigrae	Cautisnigrae
Nunningtonense	Pumilus
Parandieri	Pumilus
Antecedens	Plicatilis
Vertebrale	Plicatilis

(Figure 1.4) Chronostratigraphical subdivisions and ammonite biohorizons recognized in the Oxfordian and Kimmeridgian stages in Britain (for sources, see text). AmC = Ampthill Clay Formation; KC = Kimmeridge Clay Formation; WWF = West Walton Formation. In Dorset, where the Kimmeridgian succession is more complete, additional 'beds' (KC50–63) up to the base of the overlying Portland Group (Portlandian) have been detailed by Gallois (2000). (See the Tyneham Gap–Hounstout GCR site report, this volume.)