FILEY BRIGG

J.K. Wright

OS Grid Reference: TA126817–TA139814

Introduction

The rocky, E–W-trending coastal promontory of Filey Brigg extends for nearly 1.5 km along the north side of Filey Bay and lies some 1 km north-east of the town of Filey (Figure4.8). It provides a continuous section from the top of the Lower Calcareous Grit Formation through 14 m of the Coralline Oolite Formation. Much of the latter is present in a sandy facies transitional from Hambleton Oolite into Birdsall Calcareous Grit. It is easily accessible, and this enables a continuous bed-by-bed examination of the whole sequence to be made (see Figure4.10).

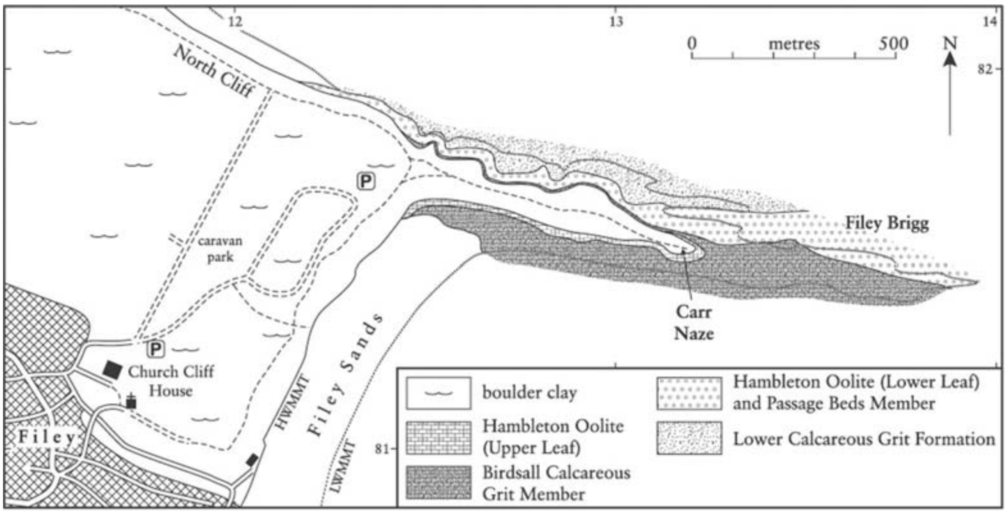

Figure 4.8: Sketch map of the geology of Filey Brigg (after Rawson and Wright, 2000, fig. 33).

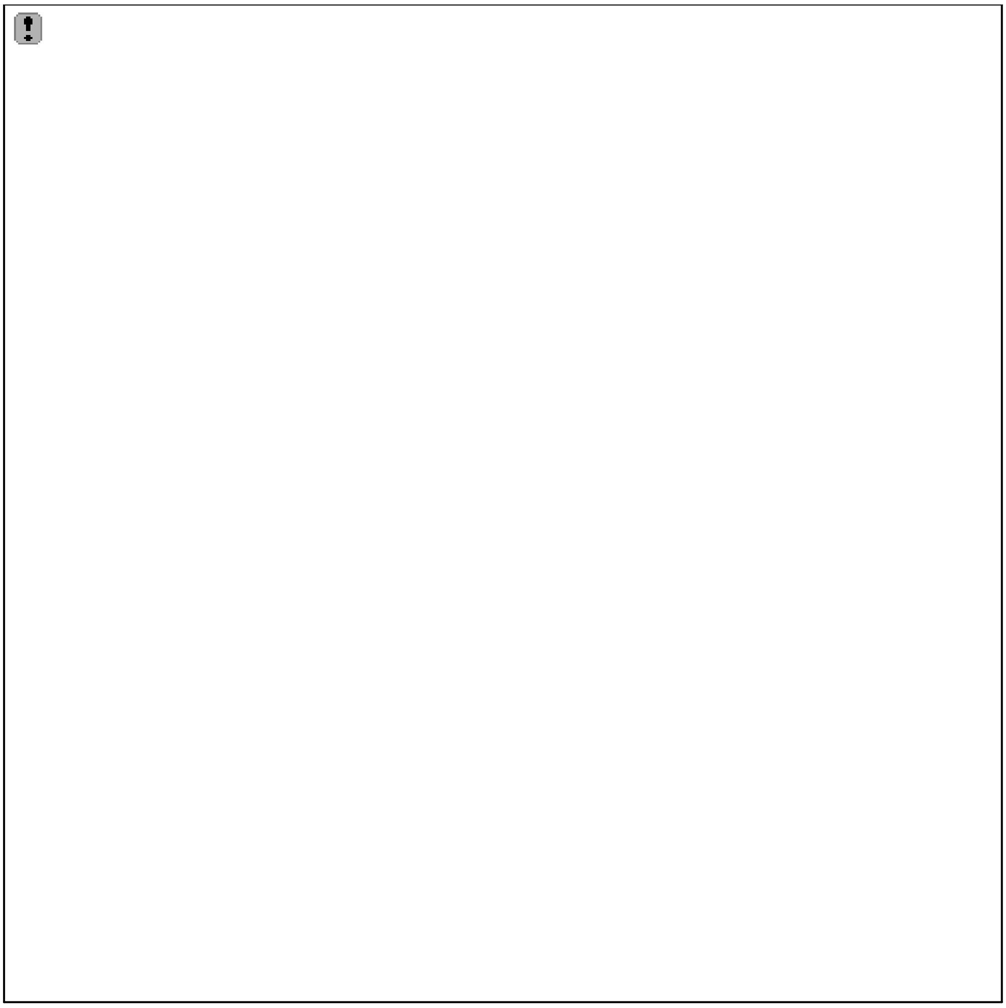

Figure 4.10: View of the southern side of Filey Brigg showing fossiliferous Hambleton Oolite (Upper Leaf) overlying Birdsall Calcareous Grit in the rock platform. The junction is where the figure is pointing with the hammer. (Photo: J.K. Wright.)

The presence of Oxfordian strata at Filey Brigg was first recorded by Phillips (1829). Pioneer studies were carried out by Hudleston (1876), Blake and Hudleston (1877) and Fox-Strangways (1892), each providing a sound framework for the later researches of the 20th century. Arkell (1933, 1945) made significant contributions to the stratigraphy of the succession. However, it was Wilson's comprehensive investigation of the section over a period of more than 30 years, fully detailed in Wilson (1949), which provides the basis for most later studies.

Wilson's subdivision of the Corallian beds at Filey Brigg was used by Sylvester-Bradley (1953), but subsequent authors (i.e. Lee, 1971; Hemingway, 1974; Kent, 1980b) have not adopted Wilson's scheme, preferring to use the stratigraphical subdivisions of Wright (1972). However, Wright's scheme was subsequently shown to be in need of amendment (Wright, 1983), and this later version is used by current workers (Coe, 1995; Rawson and Wright, 1995, 2000).

Description

Filey Brigg exposes a fine section through almost 24 m of Lower and Middle Oxfordian strata, which range in age from the early Cordatum Zone to the early Densiplicatum Zone. The following section is taken from Wright (1983):

		Thickness (m)
Coralline Oolite Formation		
Hambleton Oolite Member, Upper Leaf, Vertebrale Subzone		
14	Loose limestone rubble	
13	Flaggy, argillaceous, shelly, sandy limestone containing *Cardioceras (Scoticardioceras) excavatum* (J. Sowerby), *Goliathiceras* sp. and *Perisphinctes* sp.	seen to 0.75
12	Argillaceous, shelly, sandy limestone containing *Cardioceras (Subvertebriceras) densiplicatum* Boden and *Perisphinctes* sp.	0.75
Birdsall Calcareous Grit Member, Cordatum Subzone		
11	Soft-weathering, fine-grained laminated sandstone	0.6
10	Sandy limestone, sporadically shelly, and frequently with a sand parting in the middle. *Rhaxella* spicules are abundant. The ammonite fauna comprises *Cardioceras (Cardioceras)* aff. *persecans* (S. Buckman), *C. (Plasmatoceras)* aff *plasticum* Arkell and *Peltoceras* sp.	0.9
9	Soft-weathering, fine-grained sandstone	0.45
8	Shelly, sandy, spicular limestone, somewhat lenticular	0.25
7	Brown-weathering, shelly, fine-grained sandstone, well-bedded to massive, cross-bedded in part, with a bed of tough, calcareous sandstone towards the base. Ammonites collected loose comprise *Cardioceras (Cardioceras) cordatum* (J. Sowerby), *C. (C.) angusticordatum* Arkell, *C. (C.) persecans* and *C. (C.) ashtonense* Arkell	4.6
Hambleton Oolite Member, Lower Leaf		
6	Two sequences of well-bedded to massive, shelly oolitic limestone containing profuse *Thalassinoides* burrow networks and numerous bivalves and brachiopods, separated by sporadically oolitic, calcareous sandstone	3.7
Passage Beds Member, Costicardia Subzone		
5	Variably sandy, non- or sporadically oolitic, white, shelly limestone with numerous bivalves and brachiopods	1.9
4	Softer-weathering, fine- to medium-grained, well-sorted sandstone with large *Nanogyra nana* (J. Sowerby) and *Chlamys fibrosus* (J. Sowerby)	0.6
Lower Calcareous Grit Formation		
Saintoft Member, Bukowskii Subzone		
3	Massive, fine- or fine to medium-grained sandstone forming three roughly equal beds, each with two rows of large calcareous concretions or ‘cannon balls'	2.75
2	Massive, very tough fine-grained calcareous sandstone forming a long promontory	0.6
Tenants' Cliff Member		
1	Yellow, spicular sandstone with occasional beds of grey, sandy limestone	seen to 6

A log of the Corallian succession at Filey is given in Figure4.9. The Tenants' Cliff Member of the Lower Calcareous Grit is present here as a tough, thick-bedded, calcareous sandstone. Though well exposed, it is only seen at low tide at the base of the precipitous cliffs. Further description and discussion is given in the Tenants' Cliff site report (this volume), where the section is more accessible.

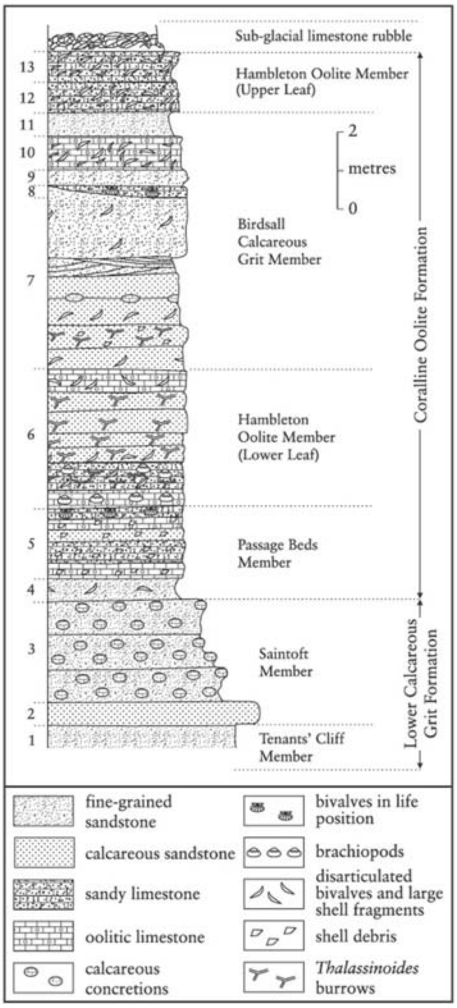

Figure 4.9: Log of the Corallian succession at Filey Brigg (after Rawson and Wright, 2000, fig. 34).

The Saintoft Member displays the regular rows of large calcareous concretions resembling cannon balls from which the original name ‘Ball Beds' came. The concretions are not particularly fossiliferous on the coast, but inland at Saintoft Quarry (SE 797 887) they have yielded an excellent ammonite fauna, together with abundant bivalves (Wright, 1983).

The lowest 0.6 m of the Passage Beds consists of heavily bioturbated sandstone resting on an erosion surface cut in the Saintoft Member. Above is the main Passage Bed limestone: almost 2 m of grey-weathering limestone in six beds. *Nanogyra* colonies weather out, and there are many *Gervillella* valves in the top two beds, both dissociated and in life position. Small-scale cross-bedding fills small scours, and dips to the south.

A major bedding plane marks the base of the Hambleton Oolite Member, whose Lower Leaf contains several massive beds of oolite, with extensive networks of *Thalassinoides* burrows that weather out in spectacular fashion in the large transported blocks in the centre of the Brigg. The Brigg itself is formed of the tough calcareous sandstone of the Birdsall Calcareous Grit. Towards the base there are calcareous concretions with shelly bands containing occasional ammonites (Figure 4.5H). Massive cross-bedded sandstone forms the bulk of the unit, with two tough calcareous beds towards the top (Bed 8 and Bed 10).

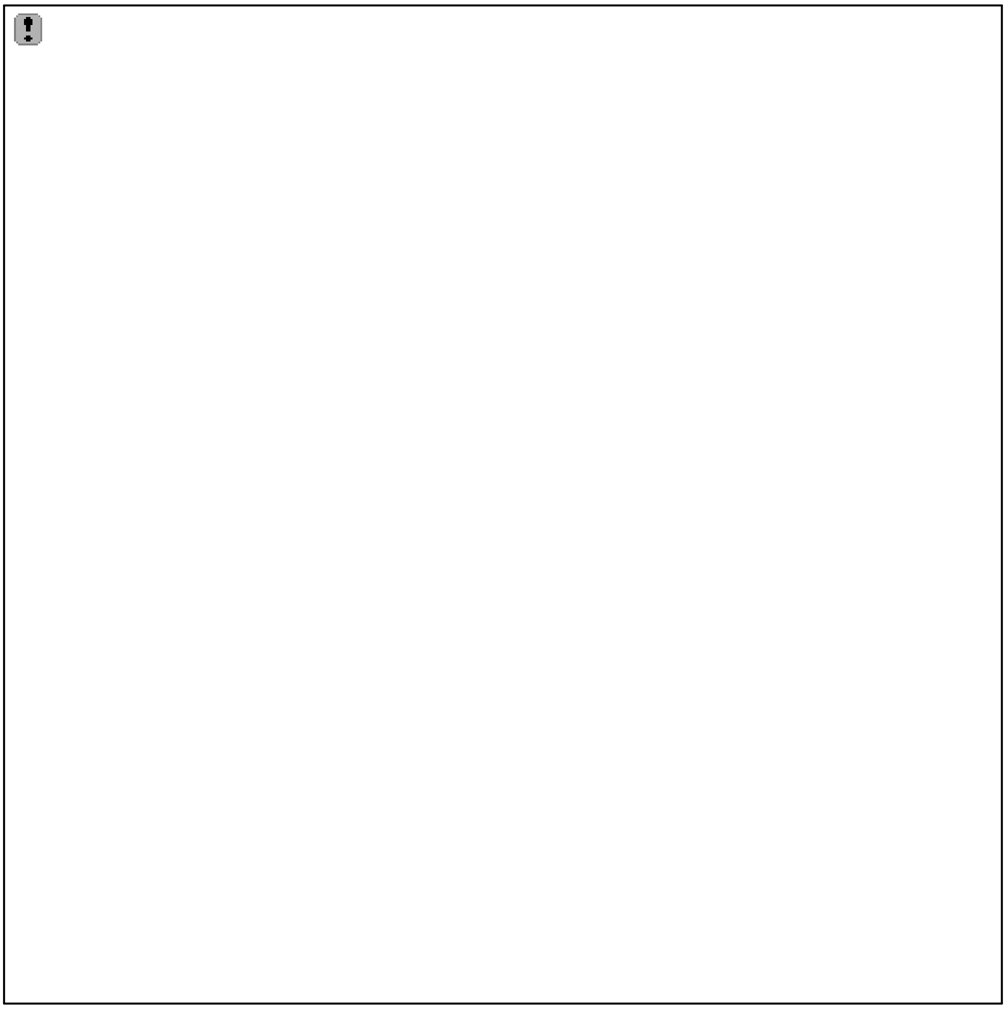

Figure 4.5: Selection of ammonites from the Corallian Group of the Cleveland Basin. (A) Amoeboceras nunningtonense Wright (holotype), Spaunton Sandstone, Leysthorpe Quarry, m27, ×1. (B) A. glosense (Bigot and Brasil), Newbridge Member, Leysthorpe Quarry, U/1/14, ×1. (C) A. transitorium Spath, Newbridge Member, Leysthorpe Quarry, U/1/5, ×1. (D) A. ilovaiskii (M. Sokolov), Spaunton Sandstone, Newbridge Quarry, U/2/38, ×1. (E) A. newbridgense Sykes and Callomon, Spaunton Sandstone, Newbridge Quarry, U/2/20, ×1.(F) Perisphinctes (Pseudarisphinctes) pachachii Arkell, Spaunton Sandstone, Spaunton Moor Quarry, U/3/63, ×0.33. (G) P. (Dichotomosphinctes) sp. Newbridge Beds, Leysthorpe Quarry, U/1/103, ×0.7. (H) Cardioceras (Cardioceras) persecans S. Buckman, Birdsall Calcareous Grit, Filey Brigg, YM1983/45F, ×1. (I) C. (C.) cordatum (J. Sowerby), Birdsall Calcareous Grit, Flassen Gill, YM1983/36F, ×1. (J) C. (Vertebriceras) aff. dorsale S. Buckman, Hambleton Oolite, Spikers Hill Quarry, C/2/17, ×1. (K) C. (Plasmatoceras) popilaniense Boden, Hambleton Oolite, Spikers Hill Quarry, C/2/59, ×1. (L) C. (Scarburgiceras) harmonicum Arkell, Tenants' Cliff Member, Tenants' Cliff, YM1983/17F, ×1. (M) C. (S.) reesidei Maire, Tenants' Cliff Member, Tenants' Cliff, YM1983/20F, ×1. (N) C. (Vertebriceras) aff. phillipsi Arkell, Tenants' Cliff Member, Tenants' Cliff, YM1983/23F, ×1. (O) C. (S.) praecordatum (Douvillé), Weymouth Member, Cayton Bay Waterworks, YM1983/9F, ×1. (P) C. (S.) scarburgense (Young and Bird), Weymouth Member, Cornelian Bay, YM1983/3F, ×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.)

The Upper Leaf of the Hambleton Oolite is seen excellently in the low cliff on the southern side of the Brigg (Figure 4.10). Numerous limestone-infilled *Thalassinoides* burrows descend from the base of the Upper Leaf (Bed 12) into the soft sandstone of the Birdsall Calcareous Grit (Bed 11). The tough, impure limestone contains well-preserved bivalves and ammonites. The higher beds are cut out by ice action at the base of the glacial till.

Wilson (1949) published a detailed measured section of the Coralline Oolite Formation at Filey Brigg, dividing the succession into 34 beds. Extensive fossil lists were given for each bed. The correlation of Wilson's bed numbers with those of Wright (1983) is given by Coe (1995). Wilson

(1949) discussed at length the palaeoecology of the faunas, and also the conditions of sedimentation and the local palaeogeography. Further observations on the faunas were made by Wright (1972).

Interpretation

The Coralline Oolite Formation is present in an attenuated sequence, but the re-interpretation of the section by Wright (1983) shows that there is much less attenuation than formerly thought, and that this is confined to the Passage Beds. These are only 2.5 m thick at Filey, in contrast to 10–12 m in the Tabular Hills. The Hambleton Oolite, including the Birdsall Calcareous Grit, is 12.2 m thick, with the top not seen. This thickness is comparable with that measured in the Cayton Carr Borehole (Wright, 1972). Filey now fits much better into the regional pattern of sedimentation, with the Cordatum Subzone sediments thickly developed as they are elsewhere in the Cleveland Basin (Wright, 1983).

The Passage Beds can be divided into a sandstone unit (Bed 4) followed by limestone (Bed 5) as is typical over the Scarborough–Hackness area. Near-shore marine sandstone is thus followed by fine bioclastic limestone. The latter, with its gentle cross-bedding combined with the preservation of delicate fossils, seems to have formed in a series of storm surges that washed shell debris from shallower water existing in the area of the Hackness Coral–Sponge Bed to the north-west (Figure 4.19). Small clasts of the corals *Thamnasteria* and *Fungiastraea,* 2–3 mm in diameter, derived from the reef margin south-west of Hackness, occur sporadically in the Passage Beds limestones. Sedimentation was thus intermittent in this area. Throughout most of the time interval occupied by the Passage Beds, little or no sedimentation seems to have been taking place, and substantial networks of *Thalassinoides* burrows were constructed within the stable sediment. Much of the fauna is allochthonous, though in the highest bed *Gervillella* occurs in life position.

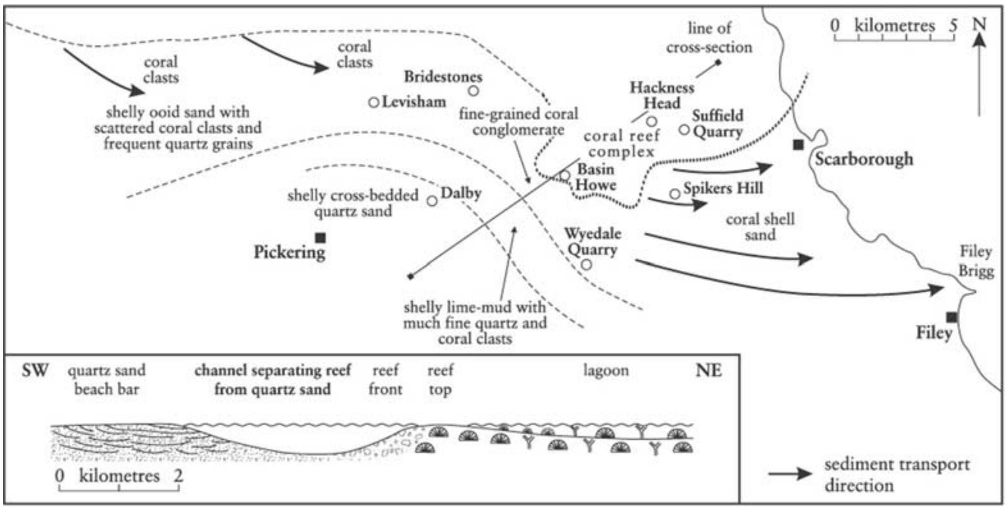

Figure 4.19: Facies distribution across the central and eastern parts of the Cleveland Basin during deposition of the Hackness Coral–Sponge Bed (after Wright, 1992, fig. 10).

The erosion surface that separates the Passage Beds from the Hambleton Oolite can be traced throughout the whole Cleveland Basin (Wright, 1983). Particularly in the Hambleton Hills (Wright, 1983, fig. 3), erosion was accompanied by considerable uplift. The implication is that subsequent to the deposition of the Passage Beds the whole Cleveland Basin was uplifted and became land or an intertidal rock platform for a period of time. Erosion of the Hackness Coral–Sponge Bed may have given rise to the presence of the sponges *Enaulofungia* and *Corynella* found by Wilson (1949) in the overlying Hambleton Oolite at Filey. Debris from the Hackness reef was spread over a wide area between Pickering and the coast in late Passage Beds and early Hambleton Oolite times (Figure 4.19).

Renewed regional subsidence in the Cordatum Subzone, accompanied by erosion of a series of islands of lithified Passage Beds and Lower Calcareous Grit, led to the accumulation of a comparatively thick series of sediments – Hambleton Oolite in the north and Birdsall Calcareous Grit in the south. Filey Brigg lay in the transition zone between these two facies. The Hambleton Oolite does not show cross-bedding at Filey, and contains many well-preserved delicate echinoids and brachiopods in addition to the substantial bivalve fauna. It thus accumulated in a stable, quiet environment, also encouraging the development of networks of *Thalassinoides* burrows. Sedimentation was clearly intermittent, and long periods with little or no sedimentation allowed extensive burrow networks to become established and occupied. Occasional *Cardioceras* spp. indicative of the Cordatum Subzone have been found.

The Birdsall Calcareous Grit consists of a wedge of sand poured into the southern side of the Cleveland Basin during uplift of the Market Weighton High in the Cordatum Subzone. Oolite (Hambleton Oolite) continued to be deposited throughout the northern half of the basin. In the south, where the Birdsall Calcareous Grit is present (Figure 4.3), the Hambleton Oolite is divided by this sandstone unit into Upper Leaf and Lower Leaf. Massive, cross-bedded sandstone forms the bulk of the Birdsall Calcareous Grit at Filey, with, at bottom and top, beds of tough calcareous sandstone that have yielded most of the fossils. Conditions favoured the deeper-burrowing bivalves, such as *Pholadomya* and *Goniomya*, as well as *Pinna* – forms that do not occur in the Hambleton Oolite. Numerous Cordatum Subzone *Cardioceras* have been collected from this unit (Figure 4.5H).

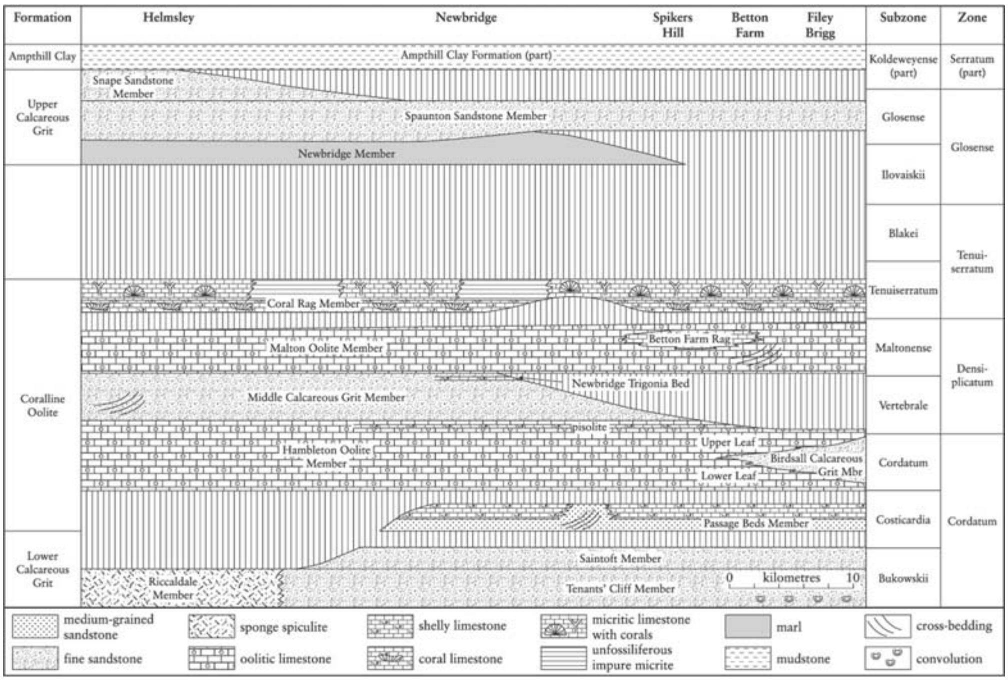

Figure 4.3: Stratigraphical cross-section of the Yorkshire Corallian Group on the north side of the Vale of Pickering from Helmsley to Filey (after Rawson and Wright, 1995, fig. 15).

Arkell (1935–1948) recorded *Perisphinctes plicatilis* (J. Sowerby) and *Cardioceras excavatum* from the Upper Leaf of the Hambleton Oolite, and this unit thus belongs to the overlying Densiplicatum Zone. The impure limestone contains excellently preserved fossils, though many shells are broken or have the valves dissociated. Again, these appear to have been swept from a shelf area into deeper water.

Higher Corallian beds are not seen at Filey Brigg. Wilson (1949) suggested that this was due to the beds being cut out by a fault immediately south of the Brigg. However, the absence in the coastal section of the Malton Oolite, Coral Rag and the Upper Calcareous Grit, all of which were seen in a borehole at Filey gasworks 1.3 km to the south-west (Fox-Strangways, 1904), is better explained by the erosion of a large valley, subsequently filled with drift, through the Filey area. A complete, dipping sequence of upper Corallian beds is thus thought to lie beneath glacial drift in the Filey area. Solid rock (basal Kimmeridge Clay), overlain by drift, was met with at a depth of 25 m below sea level in the Filey gasworks borehole.

Conclusions

Filey Brigg is a key Corallian site showing the most extensive exposures in the Cleveland Basin through the Lower Calcareous Grit, the Hambleton Oolite and Birdsall Calcareous Grit. Of exceptional interest is the very fossiliferous Hambleton Oolite, which is normally present in Yorkshire in a poorly fossiliferous, ooid shoal facies. Here, it formed in a shallow, offshore shelf where shelly life proliferated. The comparatively thin development of the Passage Beds, and the facies transition into the sands of the Birdsall Calcareous Grit, are of significance in regional palaeogeographical and facies studies.

Reference list

Arkell, W.J. (1933) *The Jurassic System in Great Britain*, Clarendon Press, Oxford.

Arkell, W.J. (1935–1948) *A Monograph on the Ammonites of the English Corallian Beds*, Monograph of the Palaeontographical Society (London).

Arkell, W.J. (1945) The zones of the Upper Jurassic of Yorkshire. *Proceedings of the Yorkshire Geological Society*, **25**, 339–58.

Blake, J.F. and Hudleston, W.H. (1877) On the Corallian rocks of England. *Quarterly Journal of the Geological Society of London*, **33**, 260–405.

Coe, A.L. (1995) A comparison of the Oxfordian successions of Dorset, Oxfordshire and Yorkshire. In *Field Geology of the British Jurassic* (ed. P.D. Taylor), Geological Society, London, pp. 151–72.

Fox-Strangways, C. (1892) *The Jurassic Rocks of Britain, I. Yorkshire*, Memoir of the Geological Survey of the United Kingdom, HMSO, London.

Fox-Strangways, C. (1904) *The Geology of the Oolitic and Cretaceous Rocks South of Scarborough*, Memoir of the Geological Survey of Great Britain (England and Wales).

Hemingway, J.E. (1974) Jurassic. In *The Geology and Mineral Resources of Yorkshire* (eds D.H. Rayner and J.E. Hemingway), Yorkshire Geological Society.

Hudleston, W.H. (1876) The Yorkshire Oolites. Part 2, The Middle Oolites. Introduction and Section 1. *Proceedings of the Geologists' Association*, **4,** 353–410.

Kent, P.E. (1980b) *Eastern England from the Tees to the Wash*, British Regional Geology, Institute of Geological Sciences, HMSO, London.

Lee, A.K.C. (1971) A petrographic and palaeoenvironmental study of the Coralline Oolite Formation (Corallian) east of Newtondale, Yorkshire. Unpublished PhD thesis, Chelsea College, London.

Phillips, J. (1829) *Illustrations of the Geology of Yorkshire. Part 1, The Yorkshire Coast*, Murray, London.

Rawson, P.F. and Wright, J.K. (1995) Jurassic of the Cleveland Basin, North Yorkshire. In *Field Geology of the British Jurassic* (ed. P.D. Taylor), Geological Society, London, pp. 173–208.

Rawson, P.F. and Wright, J.K. (2000) *The Yorkshire Coast*, 3rd edn, Geologists' Association Guide No. 34, Geologists' Association, London.

Sylvester-Bradley, P.C. (1953) *A Stratigraphical Guide to the Fossil Localities of the Scarborough District. 1. Geology and Botany*, Scarborough Field Naturalists' Society.

Wilson, V. (1949) The lower Corallian rocks of the Yorkshire coast and Hackness Hills. *Proceedings of the Geologists' Association*, **60**, 235–71.

Wright, J.K. (1972) The stratigraphy of the Yorkshire Corallian. *Proceedings of the Yorkshire Geological Society*, **39**, 225–66.

Wright, J.K. (1983) The Lower Oxfordian (Upper Jurassic) of North Yorkshire. *Proceedings of the Yorkshire Geological Society*, **44**, 249–81.