Blea Wyke, North Yorkshire

[NZ 990 013]

B.M. Cox

Introduction

The GCR site known as 'Blea Wyke' comprises the headland Blea Wyke Point (with its surrounding wave-cut platform Blea Wyke Steel) (Figure 5.31) and the adjacent coastal section to the south-east. The cliffs here expose the topmost beds of the Lias Group (Blea Wyke Sandstone Formation — which also forms Blea Wyke Steel) overlain successively by the Dogger, Saltwick, Eller Beck, Cloughton and Scarborough formations (Figure 5.32). The Blea Wyke Sandstone is of Early Jurassic (Toarcian) age and will not therefore be considered in detail herein. The main interest of the section rests with the overlying Dogger Formation of which the site is the most important coastal exposure, with a formational thickness of *c.* 12 m (Figure 5.33).

Description

The Dogger Formation is seen dipping gently south-eastwards in the lower part of the cliff face to the south-east of Blea Wyke Point and soon reaches beach level (Hemingway and Wright in Rawson and Wright, 1992; (Figure 5.32)). It consists of strongly ferruginous, brown-weathering sandstone; when fresh, it is greyish-green owing to the presence of berthierine both in the matrix and as ooids. Its basal boundary is marked by slender vertical tubular burrows (*Skolithos*) that penetrate the top of the underlying Yellow Sandstone Member of the Blea Wyke Sandstone Formation. The basal bed (0.45 m thick) contains abundant phosphate pebbles and casts of terebratulid brachiopods (the Terebratula Bed). The pebbles may be fine-grained, or silty/sandy and ooidal. As well as the brachiopod *Lobothyris* (formerly *Terebratula*) *trilineata* (Young and Bird), there are less common bivalves (including *Gresslya donaciformis* (Phillips) and *Myophorella ramsayi* (Wright)), pentacrinoids, belemnites and fossil wood. Just above the Terebratula Bed, there is a similar thickness of micaceous shaly ironstone that is, however, lenticular. In the overlying sandstone, there are two other pebble or nodule horizons (0.08 m thick), but the most notable and distinctive horizon is the highly fossiliferous lenticular shell-bed known as the 'Nerinea Bed', which occurs about 3 m below the top of the formation. As well as the high-spired gastropod *Nerinea cingenda* (Phillips), which gives its name to the bed, it includes the gastropods *Natica* and *Ceritbium,* and a rich fauna of bivalves including, in particular, *Neocrassina elegans* (J. Sowerby), *Gervillella* sp. and *Trigonia costata* J. Sowerby. Brachiopods (*Rhactorhynchia subobsoleta* (Davidson)) and corals are also recorded. The original calcareous shells are replaced by siderite and weather in sharp relief from a matrix of sandy berthierine oolite. The extensive faunal lists for the Dogger Formation given by Wright (1860), Hudleston (1874) and Fox-Strangways (1892) are largely based on this bed; within the main body of sandstone, the Dogger Formation is generally poorly fossiliferous.

Sedimentary structures are generally lacking in the Dogger Formation, but above the Nerinea Bed, large-scale, low-angle stratification is seen. The top metre or so contains abundant spherulitic siderite. The junction with the overlying Saltwick Formation is usually sharp but locally the top of the Dogger Formation appears to have been reworked (Knox *et al.,* 1991).

Within the GCR site, the other formations of the Ravenscar Group are not easily accessible but the Eller Beck Formation makes a feature about 50 m above the Dogger Formation. The Scarborough Formation caps the cliff.

Interpretation

Many of the early investigators of the section at Blea Wyke Point (e.g. Wright, 1860; Hudleston, 1874; Tate and Blake, 1876; Fox-Strangways, 1892; Richardson, 1911c; Fox-Strangways and Barrow, 1915) were concerned with how it related to the Lias Group and Inferior Oolite Group successions in southern England, and where the boundary between these

two units should be placed at Blea Wyke. All were agreed that the Dogger Formation was the basal bed of the 'Inferior Oolite' but there was disagreement about where the base of the Dogger Formation should be drawn. The present position (at the base of the Terebratula Bed) follows Rastall and Hemingway (1939). Wright (1860) had taken the boundary at the top of that bed but other workers chose positions ranging from as low as within the Peak Mudstone Member of the Whitby Mudstone Formation (Lias Group) up to as high as the base of the Nerinea Bed in the upper part of the Dogger Formation, a range of some 40 m. A comparison of some of the different interpretations is shown by Dean (1954, fig. 1).

At the base of the Dogger Formation at Blea Wyke, there is a hiatus that elsewhere in the Cleveland Basin is even more pronounced; in most areas, the Dogger Formation rests on the Alum Shale Member of the Whitby Mudstone Formation, a much lower level of the Lias Group. According to Knox (1984), although the Dogger Formation at Blea Wyke appears superficially to be a continuation of the Late Toarcian upward-coarsening cycle developed in the underlying beds of the Blea Wyke Sandstone Formation, the sharp changes in average and modal grain-size at the base of the Dogger Formation, together with the regional evidence, argue for a significant break in sedimentation; the incoming of grains of coarse sand- and granule-grade at the base of the Dogger Formation may even indicate emergence of new source areas. The phosphatic pebbles in the basal bed of the Dogger Formation (Terebratula Bed) are derived from the underlying Lias Group; the fine-grained types from the Alum Shale and Peak Mudstone members of the Whitby Mudstone Formation, the silty/sandy and oolitic types from the Fox Cliff Siltstone Member of the Whitby Mudstone and the Blea Wyke Sandstone Formation (Knox *et al.,* 1991). The abundant spherulitic siderite in the top metre or so of the Dogger Formation is presumed to have developed through the downward percolation of meteoric water during deposition of the over lying non-marine sediments (Ravenscar Group, Saltwick Formation). Detailed petrographical descriptions of the lithologies of the Dogger Formation have been undertaken by Rastall and Hemingway (1940b), although they appear to have considered only the exposures west and north of the Peak Fault (Rastall and Hemingway, 1940a). This fault bounds the western margin of a narrow graben (the Peak Trough) in which syndepositional movements allowed greater thicknesses of sediment to accumulate (Milsom and Rawson, 1989). Consequently, the Dogger Formation at Blea Wyke Point is relatively thick.

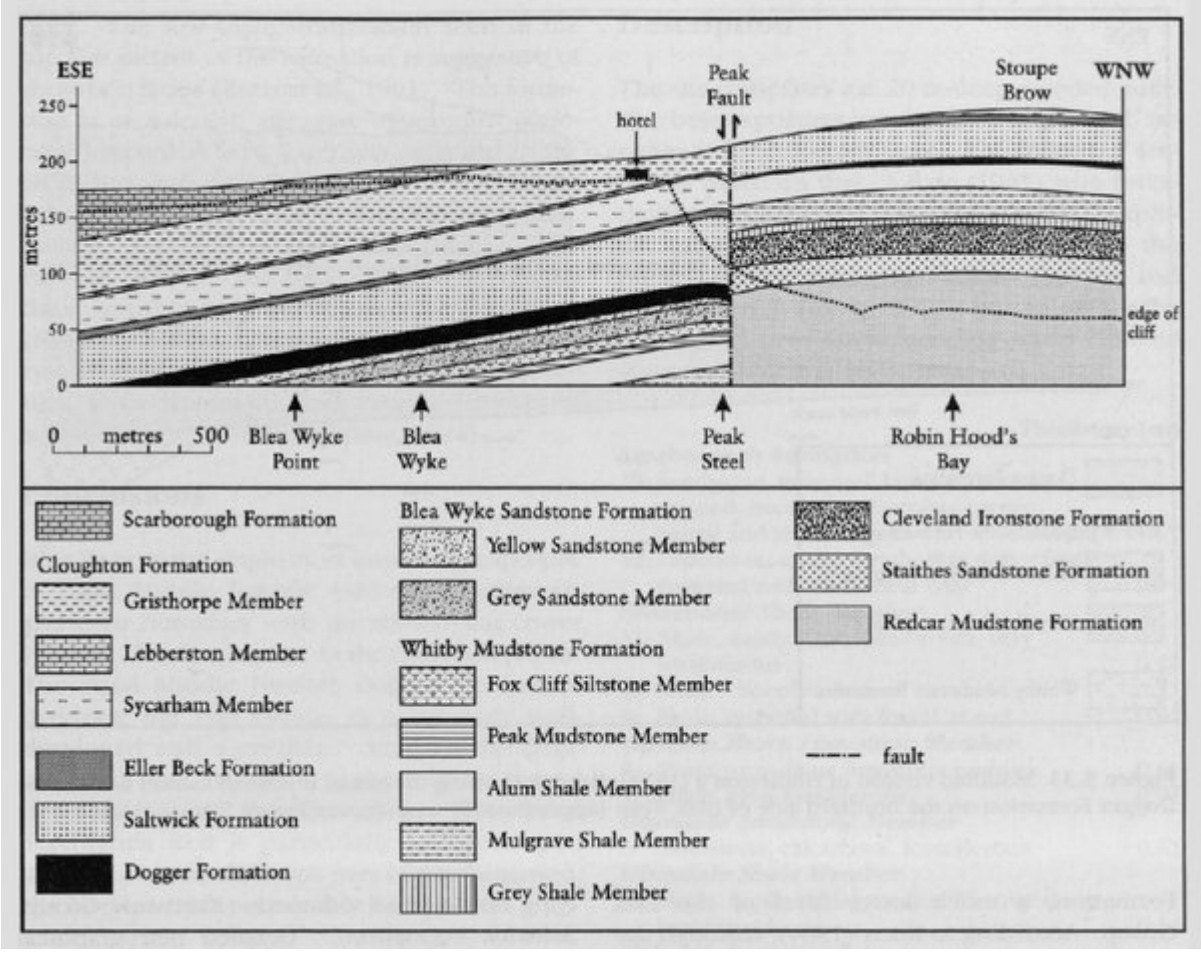
The ammonite fauna from the top beds of the underlying Lias Group (Blea Wyke Sandstone Formation, Yellow Sandstone Member) indicates that they belong to the Upper Toarcian, Levesquei Zone, Moorei Subzone (Dean, 1954; Howarth, 1980). These beds are believed to have been deposited in shallow, sublittoral marine environments, above the wave base (Knox, 1984). According to Rastall and Hemingway (1940b) and Hemingway (1974), the succeeding Dogger Formation, with its basal hiatus, was deposited in fairly open sea of not more than 20 m depth with a well-oxygenated floor. The low-angle stratification seen in the top few metres of the formation is suggestive of shoreface facies (Knox *et al.,* 1991). The formation is of Aalenian age; rare ammonites (*Leioceras*) recorded from Ravenscar, adjacent to the GCR site, indicate the Opalinum Zone, and others (*Ludwigia*), from a little farther afield, indicate the Murchisonae Zone (Black, 1934; Parsons, 1980a). The basal hiatus at Blea Wyke thus represents one ammonite subzone (Parsons, 1980a). Age-indicative dinoflagellate cyst assemblages have been recovered from the Blea Wyke Sandstone and Dogger formations adjacent to the GCR site (Riding, 1984).

Conclusions

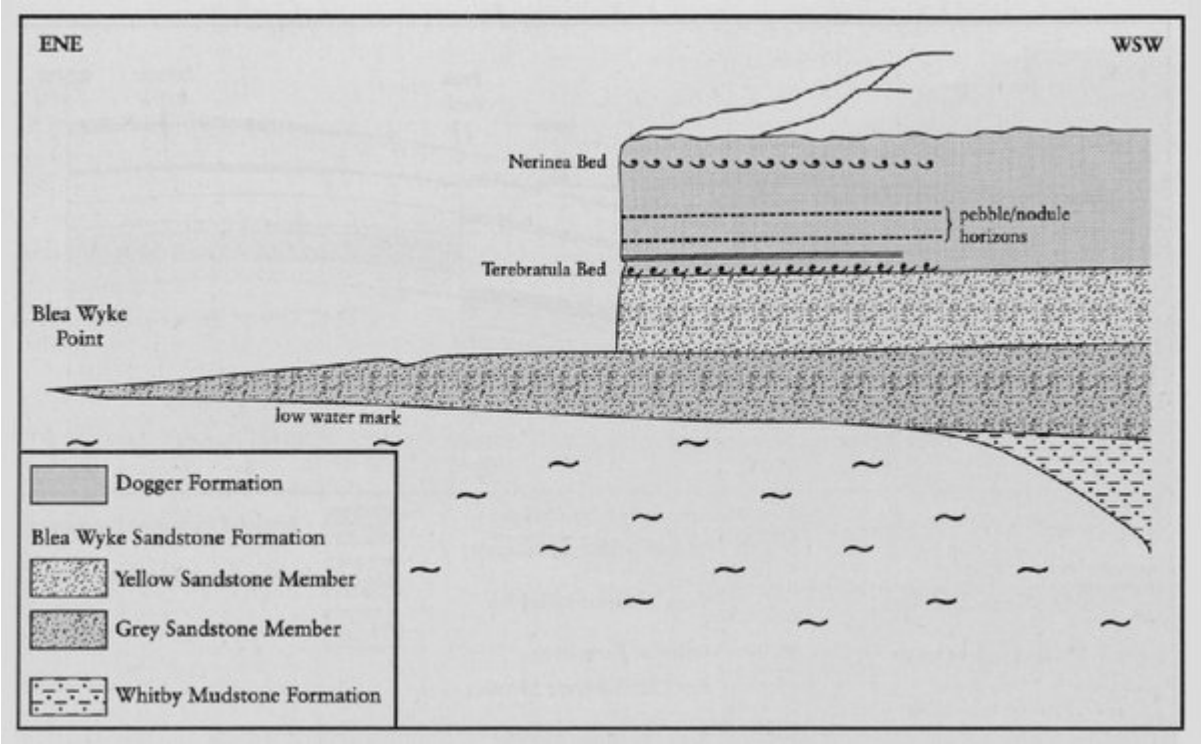
Blea Wyke is the single most important exposure of basal Middle Jurassic (Aalenian) sediments and their boundary with the underlying Lower Jurassic (Toarcian) strata, in the Cleveland Basin. The basal Middle Jurassic Dogger Formation, overlying the Lias Group, is particularly well-developed and accessible. Sited in the fault-bounded Peak Trough, it is the thickest coastal development of the formation. The basal Terebratula Bed is particularly well-developed and the most fossiliferous part of the formation, the Nerinea Bed, occurs only here.

References

(Figure 5.31) Blea Wyke Sandstone Formation (Lias Group) overlain by the Dogger Formation. (Photo: British Geological Survey, No. A5504, 1931.))



(Figure 5.32) Diagrammatic cross-section through the Peak Fault at Ravenscar and adjoining cliffs. (After Rawson and Wright, 1992, fig. 13.))



(Figure 5.33) Modified version of Hudleston's (1874) diagram showing the stratal units and marker beds in the Dogger Formation on the northern side of Blea Wyke (approximately to scale; see (Figure 5.31)).)