Green Lane Pit and Golden Hill Pit

[SE 732 837] AND [SE 724 827]

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Introduction

The Jurassic clays that mainly floor the Vale of Pickering beneath a blanket of Quaternary deposits crop out only sporadically around the edge of the Vale and as scattered 'islands' within the Vale, for example at Kirby Misperton, Great Barugh, Salton, South Holme, Normanby, Great Edstone, near Sinnington and near Helmsley (Hudleston, 1876, 1878; Fox-Strangways, 1881; Arkell, 1933, 1945). In the 19th century, the clays were excavated in a number of small brick-pits such as at Kirbymoorside, Newton Grange, Wass Grange, Hildenley, Scagglethorpe and Knapton (Blake and Hudleston, 1877; Fox-Strangways, 1881, 1892; Lamplugh, 1896) (Figure 4.26). No measured sections are avail able for these old brickpits, and records of fossils, some of which may be substantiated by material in museum collections, provide the only evidence of the strata that they exposed. From just before World War I, Jurassic clays were again worked at Kirbymoorside where they were used for making drainpipes and tiles. When production changed to the manufacture of bricks in the 1950s, it was found that the clays from further south in the Vale were more suitable and, from 1964, clay was brought instead from two pits near Marton. A section through the clays at Kirbymoorside was recorded by Pyrah (1977) but, in recent years, the two brickpits at Marton (Green Lane and Golden Hill) have provided the only significant inland exposures of Upper Jurassic clays in the Cleveland Basin (Hemingway and Twombley, 1964; Callomon in Callomon and Cope, 1971; Cope, 1974, 1980; Wignall, 1993).

Description

Green Lane Pit

According to Cope (1974), the then already disused Green Lane Pit exposed *c.* 12 m of fissile, organic-rich ('bituminous') shales, generally too weathered (with bedding planes covered with selenite crystals) to yield identifiable fossils. A discontinuous bed of ferruginous, calcareous siltstone (ankeritic concretions), at *c.* 4 m above the base of the pit, yielded various species of the ammonites *Amoeboceras* (*Amoebites*) *, Amoeboceras* (*Hoplocardioceras*) and *Aulacostephanus,* including A. (*Aulacostephanoceras*) *eudoxus* (d'Orbigny), *A.* (*Aulacostephanoceras*) *pusillus* Ziegler and A. (A.) cf. *pseudomutabilis anglicus* (Steuer) (Callomon in Callomon and Cope, 1971). Blocks of this bed, breaking with a conchoidal fracture, littered the pit floor. A hard, silty shale, up to 0.03 m thick, *c.* 6 m higher in the pit face, yielded the diminutive ammonite *Amoeboceras* (*Nannocardioceras*) *.* The only other fauna that has been noted is Hemingway and Twombley's (1964) record of 'other molluscs and fish remains', and Wignall's (1990a) record of a few scattered specimens of *Protocardia* and *Liostrea.*

Golden Hill Pit

Cope (1974) provided a measured section through *c.* 15 m of interbedded, grey, calcareous mudstones and organic-rich shales at a time when the pit was still being worked intermittently. Since then, the pit has seen some activity and Wignall (1993) provided additional data based on newly cleaned sections. His composite section for the pit, based on three separate but nearly overlapping faces (A, B, C), is shown in (Figure 4.27) together with both Wignall's (1993) and Cope's (1974) bed numbers. The strata, totalling *c.* 25 m, dip gently north so that Face A, in the southern half of the pit, exposes the oldest beds; Wignall's bed numbers begin at the base of that face, which is dominated by silty mudstones with four horizons of indurated, yellow-weathering siltstones capping poorly developed coarsening-upwards cycles. The top part of Face A includes two thin shales that weather to a brown colour and 'leathery' texture, indicating their high organic content. A slight stratigraphical gap (probably little more than a metre) exists between the top of Face A and the base of the 100 m long Face B. The lowest two-thirds of Face B consist of weakly developed alternations of organic-rich shale and mudstone capped by a distinct, blocky marl (Bed 29 of Wignall) overlain by an organic-rich shale (Bed 30 of Wignall), which weathers to form a prominent overhang.

The striking lithological and colour change at this Bed 29/30 boundary is the most obvious marker in the pit. Unfortunately, Cope (1974) appears to have mislabelled this boundary between his Bed 12 and Bed 13 instead of 8 and 9 (Wgnall, 1993). There is an estimated stratigraphical gap of *c.* 1.5 m between the top of Face B and Face C. The latter exposes 8 m of mostly mudstone passing up into organic-rich shales; in the middle part of the section, there are three thin coccolith limestones.

Fossils in the pit are dominated by ammonites of the genus *Pectinatites.* Beneath Wignall's Bed 29, the majority of these are immature and commonly encrusted with abundant specimens of *Liostrea multiformis* (Koch). This oyster also occurs in the overlying shales and mudstones together with moderate numbers of *Buchia mosquensis* (von Buch), *Lingula ovalis* J. Sowerby, and rare specimens of *Camptonectes auritus* (Schlotheim) and the limpet-like gastropod *Pseudorhytidopilus latissimus* (J. Sowerby). The ammonite fauna in these higher beds is rarely oyster-encrusted.

Interpretation

The ammonite fauna of *Amoeboceras* and *Aulacostephanus* reported by Cope (1974) from Green Lane Pit indicates the Lower Kimmeridgian Eudoxus Zone. That from Golden Hill Pit indicates the Upper Kimmeridgian Hudlestoni and Pectinatus zones, although interpretation of the species of *Pectinatites* and the zonal sequence present there has not been straightforward (Cope, 1974, 1980; Wignall, 1993). According to Wignall (1993), the abundant occurrence of *Pectinatites* (*Arkellites*) *hudlestoni* Cope in Wignall's beds 5 to 30 is unequivocal evidence of the Hudlestoni Zone, and the presence of *P.* (*Virgatosphinctoides*) *encombensis* Cope from beds 8 to 29 suggests that most of the exposed strata belong to the Encombensis Subzone. Wignall (1993) reported some overlap of ranges of supposedly zonally diagnostic ammonites at this locality and chose not to pinpoint the position of the Hudlestoni–Pectinatus zonal boundary there; *P.* (*A.*) *hudlestoni* is last seen in the basal few centimetres of Bed 30 whilst *P.* (*P.*) *eastlecottensis* (Salfeld), which is supposedly characteristic of the lower part of the Pectinatus Zone, first appears in the basal part of Bed 29. No such overlap in the ranges of these two ammonite taxa has been noted in the Dorset coastal sections (see site report for Tyneham Gap–Hounstout, this volume) where the Upper Kimmeridgian ammonite zonation was established; in fact, in Dorset no ammonites have been documented from the 10 m of strata across this zonal boundary, which is there defined at the base of the White Stone Band (Cope, 1967; Wignall, 1993). However, in terms of the lithological succession, the section at Golden Hill Pit is generally closely comparable with that on the Dorset coast. Indeed, Gallois (in Cope, 1980) already drew attention to this when he refuted Cope's (1974) earlier assertions that the Hudlestoni Zone was absent at Golden Hill Pit and that the Pectinatus Zone there directly overlaid the Wheatleyensis Zone. Both Gallois and Medd (1979) and Wignall (1993) reckoned that the coccolith-rich Bed 16 of Cope (1974)/Bed 37 of Wignall (1993) was probably the correlative of the White Stone Band of the Dorset coast. According to Bailey *et al.* (1997), ranges of key dinoflagellate cysts at Golden Hill can be clearly related to those elsewhere in north-west Europe and particularly in Dorset. They placed the Hudlestoni–Pectinatus zonal boundary somewhere between Bed 8 and Bed 15 of Cope (1974) and probably at his 'abrupt lithological change' (= base Bed 30 of Wignall, 1993). Unfortunately, they appear to have been unaware of this latter author's work.

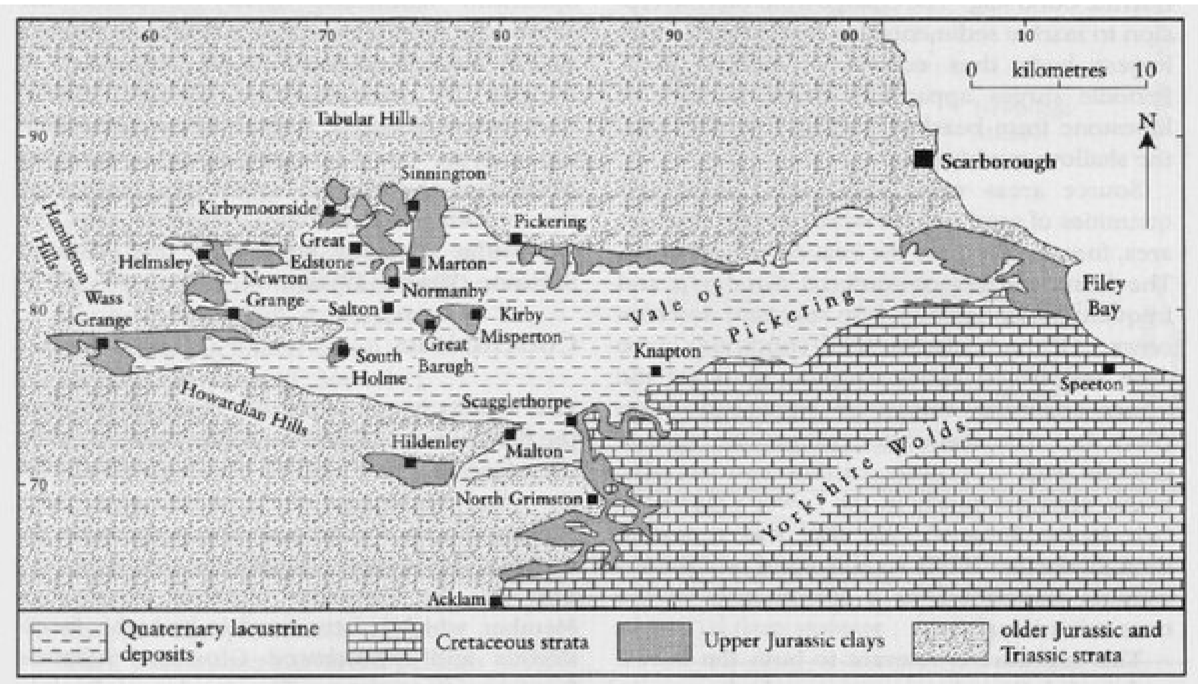
Wignall (1990a) suggested that the dearth of benthic fauna in the organic-rich shales and mudstones at Green Lane Pit indicated that anoxic bottom waters had prevailed for considerable periods of time and that the sediments had accumulated in fairly deep waters. Similar depositional conditions were suggested by Wignall (1993) for the beds below his Bed 29 at Golden Hill Pit where he interpreted the oysters that encrust the ammonites as probably pseudo-planktonic 'parasites' attached to living ammonites in the water column. The oysters appear to have outlived the ammonites in only a few cases because there are relatively few examples of oysters that have grown beyond the ammonite shell on to the sediment surface. According to Wignall (1993), the rarity of ammonites encrusted with oysters at higher levels at Golden Hill Pit indicated, perhaps, that *Pectinatites* (*Pectinatites*) was able to defend itself from the unwanted ballast of an oyster epifauna. The non-ammonite faunal assemblage recorded from these higher beds is unequivocally benthic and testifies to slightly improved oxygen levels in the bottom waters (Wgnall, 1993). Described by Wignall (1990a) as the 'E13 *Buchia mosquensis: Liostrea multiformis* Association', it differs greatly from that of equivalent organic-rich shale associations in southern England; the normally ubiquitous *Protocardia morinica* (J. de C. Sowerby) and *Corbulomima suprajurensis* (d'Orbigny) are replaced by a number of forms typical of more northern waters, such as *Buchia mosquensis.* Wignall (1990a) deduced that, in the Late Kimmeridgian, a divide existed between Boreal and Sub-Boreal faunal provinces along the line of the Market Weighton High; this prohibited the northward migration of Sub-Boreal forms, whilst Boreal forms were able to spread progressively southwards. A typically Boreal taxon is also amongst those recorded from Green Lane Pit; the main areas of occurrence of *Amoeboceras* (*Hoplocardioceras*) are central and northern East Greenland, Franz Josef Land and the Ust-Yenisei region of Siberia (Birkelund and Callomon, 1985).

According to Cope (1974), a strike fault, running approximately through Marton village and with a minimum downthrow to the south of 30 m, has to be envisaged in order to explain the relative stratigraphy of the two pits. Green Lane Pit is sited on high ground (presumed by Cope to be due to the resistance of the organic-rich shales to erosion) but the beds exposed further south at Golden Hill Pit are younger, although there is no strong dip in that direction.

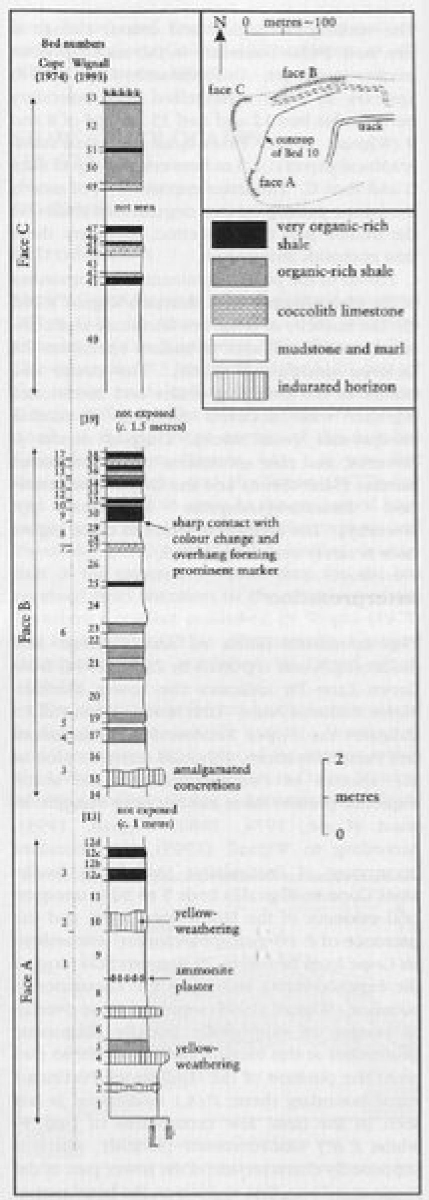
Conclusions

Cored boreholes in the Vale of Pickering indicate that there is a thick sequence (over 300 m) of Upper Jurassic clays flooring the Vale (Cox *et al.,* 1987). However, these remain largely unseen because of an extensive cover of Quaternary deposits. Green Lane Pit and Golden Hill Pit expose, respectively, clays of Early and Late Kimmeridgian age, and together with the transitory exposures on the coast at Filey Bay (see site report for Speeton Sands, this volume), offer the only exposures of these youngest Jurassic rocks in the Cleveland Basin. The sites are therefore important not only for basic stratigraphy but also for regional geology, palaeogeography and palaeobiogeography. Their proximity to the North Sea, where the Kimmeridge Clay, at depth, is an important source rock for oil and gas, gives the sites some additional significance; cored boreholes have been drilled at Golden Hill Pit by both British and French teams in connection with this aspect (Gallois, 1979a; Herbin *et al.,* 1991; Oschmann, 1994).

References



*(Figure 4.26) Simplified geological drift sketch map of the Vale of Pickering showing localities cited in the text (based on Geological Survey 1:50 000 sheets 53 and 54). The Green Lane Pit and Golden Hill Pit GCR sites are located at Marton. *Other drift deposits are omitted for clarity.*



(Figure 4.27) Composite graphic log of the section at which weathers to form a prominent overhang. Golden Hill Pit (after Wignall, 1993, fig. 3).