MELTON BOTTOM CHALK PIT

OS Grid Reference: SE970277–SE970272

Introduction

The Melton Bottom Chalk Pit GCR site consists of two quarries. The southern quarry (SE 970 272–SE 973 273), to which the name Melton Bottom Chalk Pit should strictly be applied, is a narrow quarry, aligned NW–SE. The quarry is now abandoned and the sides have been graded, obscuring the section. It formerly provided an excellent*c*. 30 m Cretaceous section, from the unconformable contact between the Lower Albian Carstone with the Upper Jurassic (basal Upper Oxfordian) mudstones of the Ancholme Clay Group, up to the basal 6 m of the Welton Chalk Formation of the Chalk Group.

To the north of the Melton Bottom Chalk Pit is an enormous working quarry cut into the hillside, extending back to Welton Wold, which is the name by which this upper quarry is known. This quarry is the stratotype section for the Welton Chalk Formation and additionally exposes the basal few metres of the Burnham Chalk Formation. The Melton Bottom Chalk Pit GCR site is currently, with the exception of the Black Band at the base, the only inland section exposing the entire formation. It is also the best inland exposure of the higher part of the formation, from the Melton Ross Marl upwards.

Description

The two Melton Bottom Chalk Pit site quarries (Figures 5.10 and 5.11) are described separately. Previous published records of this site are limited to general descriptions and a photograph (Sheppard, 1903, fig. 39). The first and only measured sections are those of Whitham (1991, fig. 4).

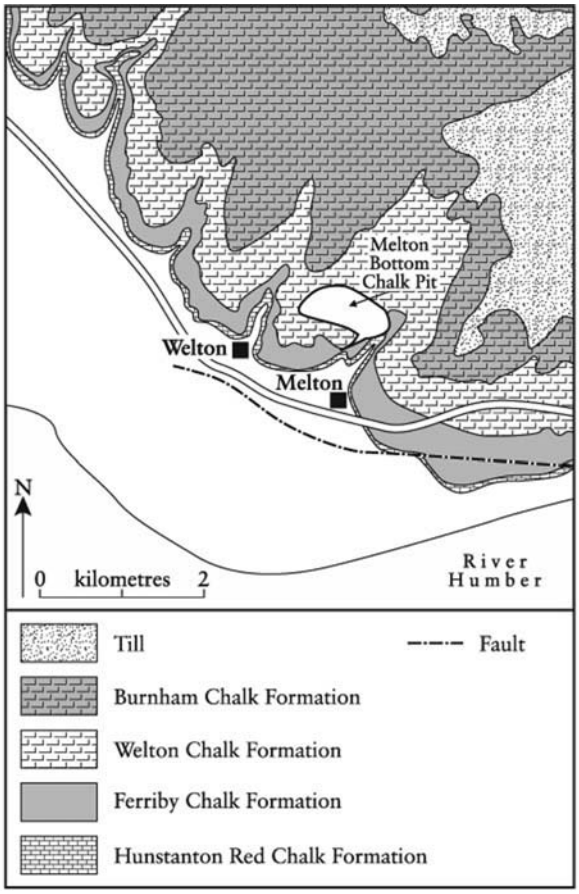

Figure 5.10: The Melton Bottom Chalk Pit GCR site, East Yorkshire; type locality of the Welton Chalk Formation. (Based on British Geological Survey Sheet 80, Kingston upon Hull.)

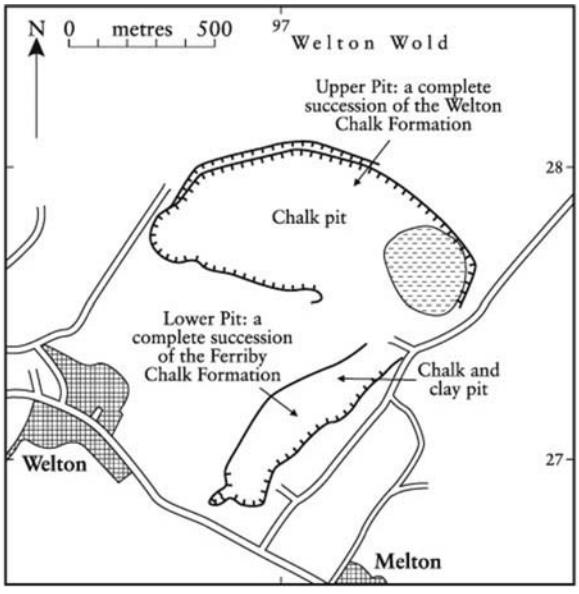

Figure 5.11: The Melton Bottom Chalk Pit GCR site, represented by the 'Lower Pit' (Melton Bottom Chalk Pit, and the 'Upper Pit' (Welton Wold Quarry).

Lithostratigraphy

A skeletal log of the Ferriby Chalk Formation in Melton Bottom Chalk Pit (the 'Lower Pit' on Figure 5.11) showing the main beds and marker horizons is given in Figure5.12, which is largely based on Whitham's log (1991, fig. 4). The extra descriptions and interpretations of this log are those of the present authors, based on correlative sections at Middlegate Quarry, South

Ferriby. As this quarry is now backfilled, no further details can be obtained and the present authors are indebted to Dr Whitham for his information.

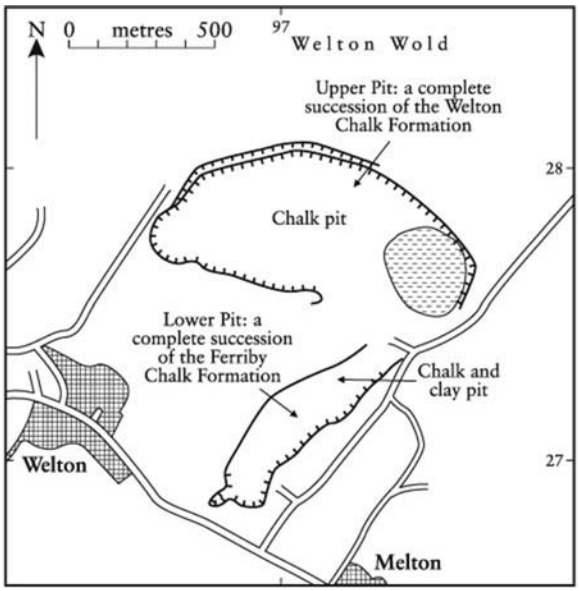

Figure 5.11: The Melton Bottom Chalk Pit GCR site, represented by the 'Lower Pit' (Melton Bottom Chalk Pit, and the 'Upper Pit' (Welton Wold Quarry).

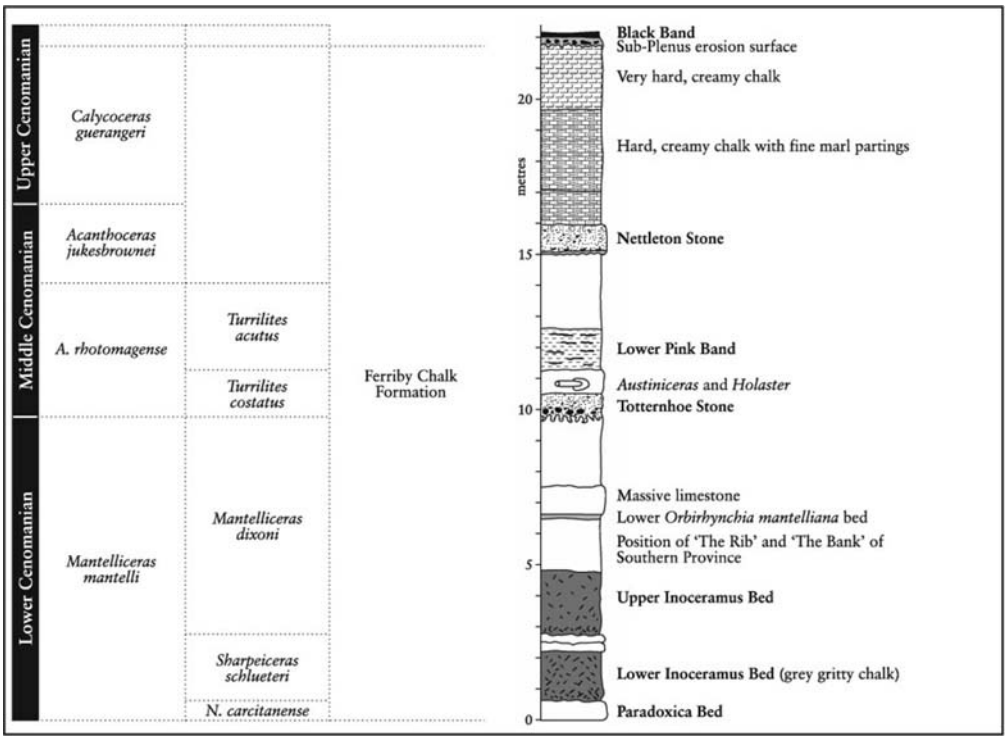

Figure 5.12: The Red Chalk and Ferriby Chalk succession at Melton Bottom Chalk Pit (the 'Lower Pit' at Melton, Figure 5.11) (N. = Neostlingoceras). (After Whitham, 1991.)

Biostratigraphy

The biostratigraphy of the Ferriby Chalk Formation, based on Lincolnshire localities, was reviewed by Wood (1992). Records relating specifically to Melton Bottom Chalk Pit were given by Whitham (1991). Of particular interest is the reported occurrence there of *Aucellina* in the Lower Inoceramus Bed, which, if correctly identified, would represent the highest record of *Aucellina* in the UK, i.e. within the *Sharpeiceras schlueteri* Subzone. The previous highest record was in the lower part of the Paradoxica Bed (basal Cenomanian *Neostlingoceras*

carcitanense Subzone).

Melton Bottom Chalk Pit yields specimens of crushed ammonites (*Schloenbachia* sp.) in shaly beds overlying the Upper Inoceramus Bed. These have not been recorded from other correlative sites. Whitham (1991) noted four specimens of the belemnite *Praeactinocamax primus* (Arkhangelsky) in the Totternhoe Stone and, surprisingly, additionally recorded the small pectinacean bivalve *Lyropecten* (*Aequipecten*) *arlesiensis* (Woods). In Southern Province basinal successions, this latter species is usually restricted to a bed (Arlesiensis Bed) in the basal Middle Cenomanian *Cunningtoniceras inerme* Zone, below the level of the Cast Bed and hence below the equivalent of the Totternhoe Stone. In the Chiltern Hills, this species is entirely absent from the Totternhoe Stone, although it is known from the channel facies of the Stone at Arlesey (see p. 340, Chapter 4), north of Hitchin, which is the type locality for the species. Current evidence (e.g. Mitchell *et al*., 1996, fig. 3) suggests that the bed in question is missing here and in all other platform successions (e.g. Middlegate Quarry, South Ferriby; **Hunstanton Cliffs**) in the sub-Totternhoe Stone hiatus. The higher part of the Totternhoe Stone yields specimens of undescribed large *Holaster* sp., *Acanthoceras rhotomagense* (Brongniart), *Parapuzosia* (*Austiniceras*) sp. and moulds of large *Turrilites*; at the nearby Rifle Butts section (SE 901 427) the diminutive aberrant belemnite *Belemnocamax boweri* Crick has been collected from the same level.

Welton Wold Quarry

Welton Wold Quarry (the 'Upper Pit' on Figure 5.11) is located to the north of the abandoned Melton Bottom Chalk Pit.

Lithostratigraphy

The section extends from the Black Band at the base of the Welton Chalk Formation to the basal part of the Burnham Chalk Formation. It was designated the stratotype of the Welton Chalk Formation (Wood and Smith, 1978) because it was then the only section exposing the entire succession, albeit that at that time the vertical quarry walls were relatively inaccessible and were not logged in detail. The composite section for the Welton Chalk in the British Geological Survey Memoir (Wood, 1992, fig. 33) was actually constructed from the section in the Melton Ross Quarry (TA 082 112) in north Linconshire for the succession from the Grasby Marl up to the Melton Ross Marl at the top of the quarry (for which this is the stratotype), with the remainder of the succession being taken from other sections in the same area. Subsequently the style of quarrying at Welton Wold Quarry has changed, and sloping roadways provide easy access to most parts of the section. The section (Figure 5.13) is modified from the skeletal log given by Whitham (1991, figs 5, 6), supplemented with information from the relevant part of the Melton Ross section. The basal Variegated Beds, including the Black Band (see Figure 5.5), and overlying shell-detrital chalks equivalent to the Holywell Nodular Chalk Formation of the Southern and Transitional provinces, are only 3.3 m thick here. The stratotype Welton Chalk Formation is 54 m thick, and an additional 2 m of basal Burnham Chalk, up to the lowest of the Triple Tabular Flints, is exposed at the top of the quarry, by the access road.

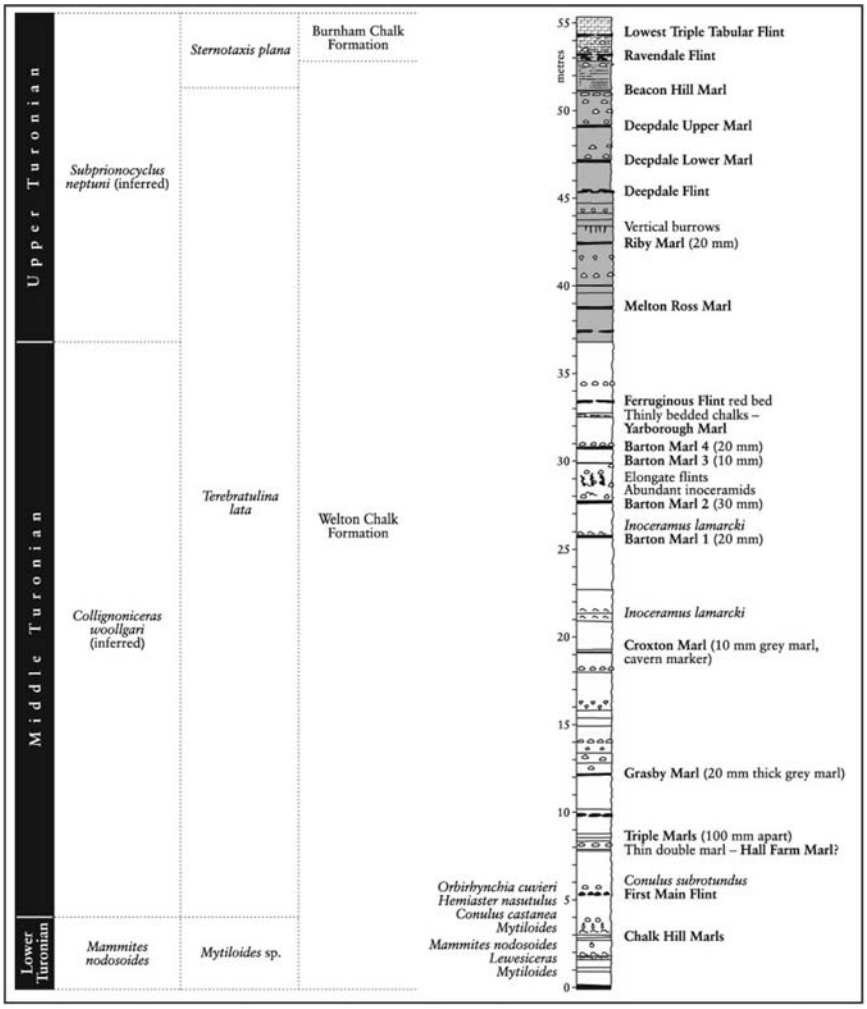

Figure 5.13: The stratotype section for the Welton Chalk Formation at Welton Wold Quarry (the 'Upper Pit' at Melton, Figure 5.11). (After Whitham, 1991, fig. 5.)

Figure 5.5: The Black Band of the Northern Province at the base of the White Chalk Subgroup and the Welton Chalk Formation. (a) The top of the Black Band to the twin marls (Inoceramus Pebble Bed) in Bigby Quarry, Lincolnshire. Note the mould of a very large ammonite (Lewesiceras, labelled 'L'). (b) The Black Band succession of Variegated Beds in Melton Ross Quarry, Lincolnshire. (Photos: R.N. Mortimore.)

Biostratigraphy

The succession in Welton Wold Quarry spans the interval from highest Cenomanian (*Metoicoceras geslinianum* Zone) to the basal part of the *Sternotaxis plana* Zone (Upper Turonian). Details of the biostratigraphy of the Welton Chalk Formation taken from localities in north Lincolnshire, notably the Melton Ross Quarry section and other nearby sections, were given by Wood (1992). Important additional information, largely based on the Welton Wold Quarry site, was given by Whitham (1991).

The thin interval from the Black Band itself to the onset of the shell-detrital chalks is difficult to interpret in terms of the Southern Province succession. From the shell-beds above the Black

Band, however, Whitham (1991) reported specimens of *Peroniaster nasutulus* Sorignet (i.e. *Hemiaster minimus* (Agassiz)), as well as the ammonites *Lewesiceras peramplum* (Mantell), *Mammites nodosoides* (Schlotheim) and *Parapuzosia* (*Austiniceras*) *austeni* (Sharpe). In other Northern Province quarries similar ammonites were found (e.g. *Lewesiceras peramplum*, *Mammites nodosoides* and *Morrowites wingi* (Morrow) in Elsham Quarry, Lincolnshire (TA 038 131); Mortimore and Pomerol, 1991b, fig. 3). These records place the shell-rich beds in the Lower Turonian *Mammites nodosoides* Zone. This is supported by the occurrence of abundant *Mytiloides* spp., including *M. labiatus* (Schlotheim) and *M. mytiloides* (Mantell), which are indicative of the provisional *Mytiloides* spp. inoceramid bivalve Zone, (the *Inoceramus labiatus* Zone of earlier zonal schemes).

Towards the top of the shell-rich beds there is a thin (c. 0.4 m), orange-brown bed of pebbly, shelly chalk full of flattened valves of large *Mytiloides* spp., which rests on an erosion surface and is overlain by a silty marl passing up into silty chalks with abundant *Mytiloides* sp., the Inoceramus Pebble Bed of Hart *et al*. (1991). This bed is inferred to correlate with the acme-level of shell detritus in the Holywell Nodular Chalk Formation, and with the associated *Filograna avita* marker horizon. However, no trace of the diagnostic sepulid-encrusted shells has been found at any locality in the Northern Province, which follows the trend seen in the Chiltern Hills, where this event is virtually undetectable north of the Pitstone Quarry 2 RIGS site. The Inoceramus Pebble Bed is also inferred to equate with the so-called 'Violet Marl' marker horizon in the Rotpläner red limestones in northern Germany (Ernst *et al*., 1983, 1998; Hilbrecht and Dahmer, 1994).

The change from *Mytilodes* shell-rich chalks to smooth chalks with brachiopods and few *Mytiloides* in southern England (the change from Holywell Nodular Chalk to New Pit Chalk formations) is similarly well developed here, and *Terebratulina lata* R. Etheridge is first recorded a short distance below the Grasby Marl. However, the records of *Mytiloides labiatus* (Schlotheim) from just above the Chalk Hill Marls at Welton Wold (Whitham, 1991) could possibly represent *M.* ex gr. *subhercynicus* (Seitz). Whitham also noted that *Conulus subrotundus* Mantell occurred above the First Main Flint, a short distance above the base of the flinty part of the Welton Chalk (i.e. the equivalent of the basal New Pit Chalk Formation), and that crushing teeth of the ray *Ptychodus mammillaris* Agassiz had been found in beds below the Ferruginous Flint.

Interpretation

A feature of the Melton Bottom Chalk Pit GCR site is the presence of the 'Black Band' at the base of the Welton Chalk Formation. The so-called 'Black Band' is in fact an extremely condensed succession of thin limestones and silts at the base of the Welton Chalk Formation with one or more Black Bands (Wood and Mortimore, 1995). The Melton Bottom Chalk Pit GCR site section of the 'Black Band' has not been studied in the same detail as pits south of the Humber where the relationship of these beds to the Plenus Marls–Meads Marls interval of the Southern Province has been worked out (see references in Wood *et al*., 1997; and Southerham Grey Pit GCR site report, this volume). Beds immediately below the Black Band, down to the sub-Plenus erosion surface can be correlated, on the basis of the occurrence of the belemnite *Praeactinocamax plenus* (Blainville) and the rhynchonellid brachiopod *Orbirhynchia multicostata* Pettitt, with the Plenus Marls Member of the Southern Province, at least up to and including Jefferies' Bed 4. The stratigraphical correlation of the Black Band itself is highly controversial, and remains unresolved; stable isotope and other evidence suggests that it may equate with the basal part of the Melbourn Rock–Meads Marls of the Southern Province and that the Cenomanian–Turonian boundary falls between the Black Band and the terminal green clay of the Variegated Beds (see Wood and Mortimore, 1995). The Black Band succession of variegated beds is more complete in the Melton Ross Quarry (Figures 5.5 and 5.14).

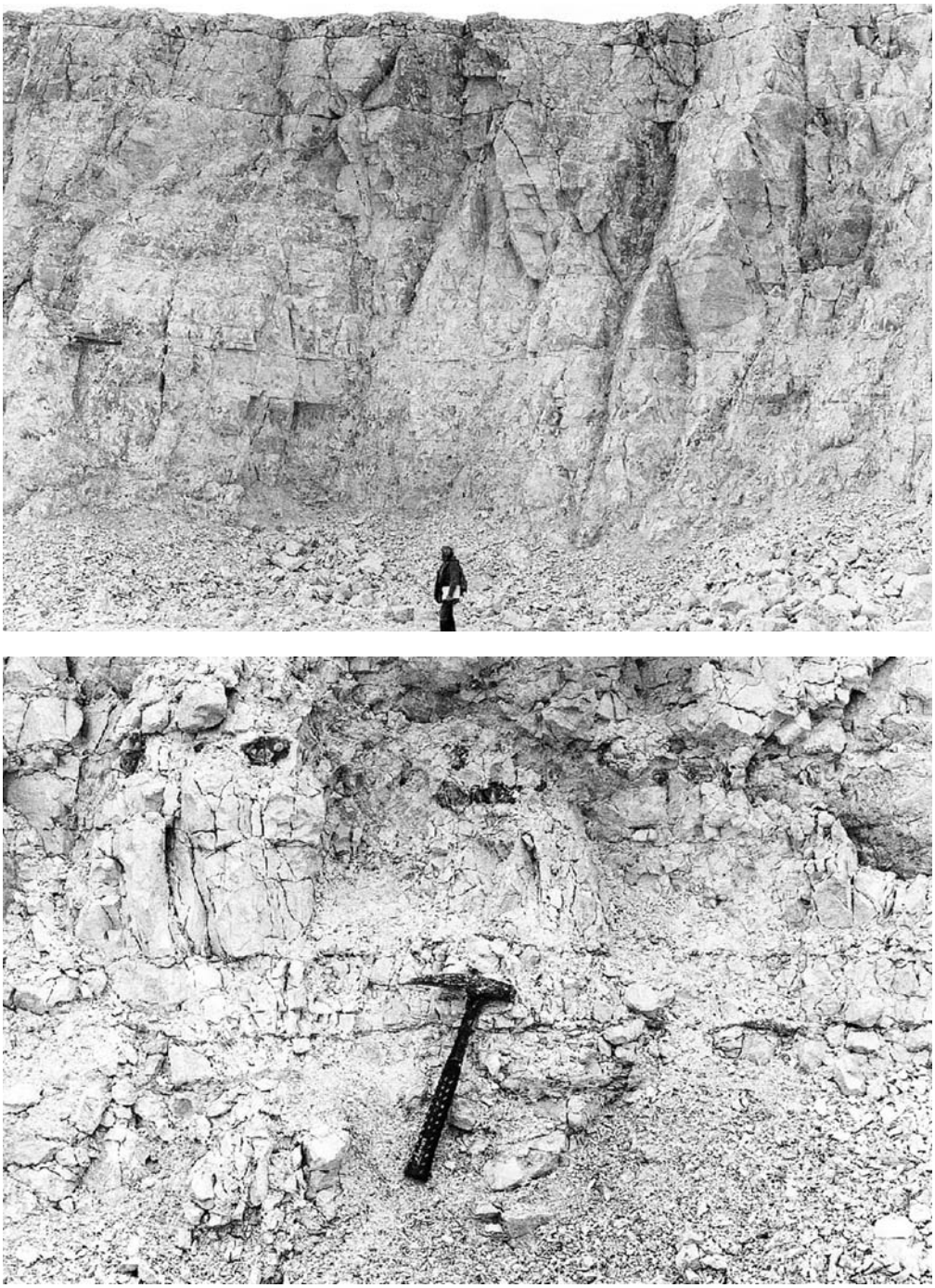

Figure 5.14: The Welton Chalk Formation in the Northern Province, Melton Ross Quarry, Lincolnshire. (a) The lower part of the Welton Chalk Formation marker marl seams. Note the typical conjugate fractures characteristic of this Chalk. (b) The Chalk Hill Marls and the First Main Flint at the boundary between the Mytiloides spp. and Terebratulina lata zones. This is effectively correlated to the boundary between the Holywell Nodular Chalk and New Pit Chalk formations of the Southern Province. (Photos: R.N. Mortimore.)

The Welton Wold Quarry section of the Melton Bottom Chalk Pit GCR site was originally designated the stratotype for the entire Welton Chalk Formation. However, the basal shell-detrital beds (the Buckton Member of Mitchell (2000), and the equivalent of the Holywell Nodular Chalk Formation of the Southern Province), up to the Chalk Hill Marls (Figure5.14), are better exposed in sections on the opposite side of the Humber, in north Lincolnshire, notably (from north to south) at the Middlegate Quarry, South Ferriby; Melton Ross Quarry; Bigby Quarry (TA 059 078) and Mansgate Quarry (TA 123 002), near Caistor (Figure5.1).

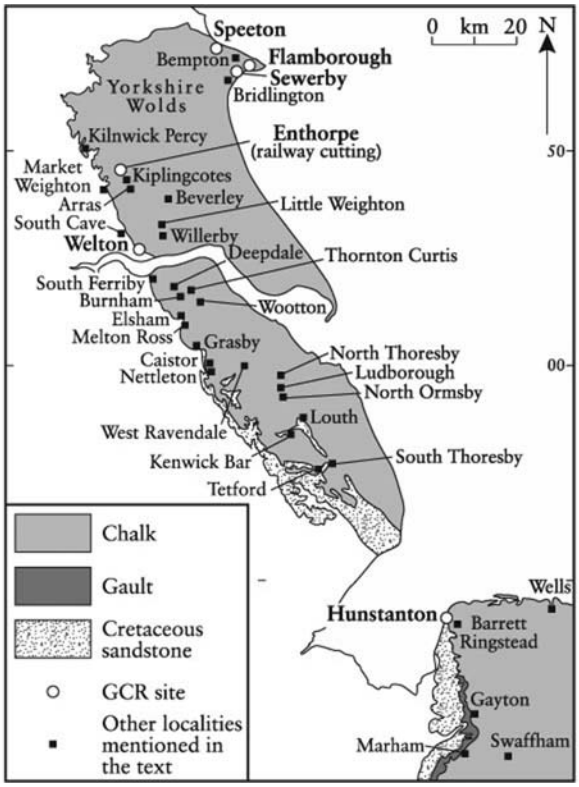

Figure 5.1: Location of GCR sites and other sites mentioned in the text in the Northern Chalk Province of England.

The Melton Bottom Chalk Pit GCR site exposes essentially the same succession as other Welton Chalk Formation localities. Whitham (1991, fig. 6) showed that, in contrast to the Melton Bottom Chalk Pit GCR site, there is considerable condensation in the top Welton Chalk–basal Burnham Chalk formations at the Newbald Wold Pit (SE 934 377), some 10 km to the north-west. However, it is unclear whether or not this is connected with proximity to the Market Weighton Axis, rather than with the general thinning observed by Wood and Smith (1978) on the west side of the Wolds. The Welton Chalk–basal Burnham Chalk succession at Welton Wold is significantly thinner than the equivalent interval at Thornwick Bay and North Landing (Whitham, 1991, fig. 7; Mitchell, 2000, fig. 3) in the **Flamborough Head** GCR site. On the other hand, the 54.8 m thickness of the Welton Chalk Formation at Speeton Cliff (Mitchell, 2000) is virtually identical to that of the stratotype.

The only feature of particular interest in the basal Burnham Chalk at the Melton Bottom Chalk Pit GCR site is that there is more evidence of preserved brecciated chalk at and around the Ravendale Flint than elsewhere.

Conclusions

The Melton Bottom Chalk Pit GCR site formerly exposed a complete Ferriby Chalk Formation and is the type locality for the Welton Chalk Formation. It is only recently (Whitham, 1991), however, that a detailed stratigraphy has been established and linked to previously more accessible sections in north Lincolnshire. A feature of the stratigraphy is the Black Band at the Cenomanian–Turonian boundary. Black Band successions across the Humber in north Lincolnshire provide additional evidence for the correlation of this succession with the Plenus Marls Member and the Cenomanian–Turonian boundary in the Southern Province. The Melton Bottom Chalk Pit GCR site is a key locality for assessing the causes of thickness variations in the Welton Chalk and Burnham Chalk formations, possibly related to structural control of sedimentation on the Market Weighton or a Humber axis.

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