Kelsey Hill

[TA 239 266]

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Introduction

Excavations during the nineteenth and twentieth centuries around Kelsey Hill, on the northbank of the Humber, have provided extensive exposures through a sediment body known as the 'Kelsey Hill Gravels', an important Quaternary sediment–landform assemblage deposited in association with the margin of the Dimlington Stadial ice sheet in the East Riding of Yorkshire. First reported near Burstwick by Smith (1821) and Phillips (1829), the gravels contain a rich fauna (Prestwich, 1861; Penny, 1963) that has been at the centre of considerable controversy over the origin of the deposits. The stratigraphical position of the Kelsey Hill Gravels, between the Dimlington Stadial age Skipsea and Withernsea tills, suggests that sedimentation was a product of glacier marginal fluctuations, but interpretations of exact depositional environment range from marine to glaciofluvial (Lamplugh, 1925; Penny, 1963; Catt and Penny, 1966; Eyles *et al.,* 1994). Further discussion on the Kelsey Hill Gravels has been provided by Geikie (1877), Reid (1885), Sheppard (1895), Sheppard and Stather (1907), Bisat (1940), Carruthers (1948) and Baden-Powell (1956), highlighting the importance of these controversial sediments in reconstructing the Quaternary glacial history of northern England.

Description

The Kelsey Hill Gravels form a low sinuous ridge up to 15 m high around Kelsey Hill [TA 239 266] (Figure 4.29). Surface exposures and borehole evidence from the vicinity have been used more recently by Eyles *et al.* (1994) to suggest that the Kelsey Hill Gravels actually form a series of parallel ridges trending north–south and that Kelsey Hill constitutes the westernmost of these ridges.

The Kelsey Hill Gravels are described by Catt and Penny (1966) as typically yellowish-brown sands and gravels, including erratics, diamicton balls and lenses of diamicton resembling the Withernsea Till. The current bedding in the sands and gravels document a palaeocurrent from the north. More recently, Eyles *et al.* (1994) have described an outcrop at Mill Hill that displays a coarsening upwards succession from pebbly sand overlain by imbricated, openwork gravels or massive gravels capped by imbricated gravels with a north–south palaeocurrent direction. Diamicton balls occurring throughout the sequence here are ascribed to the underlying Skipsea Till. Eyles *et al.* (1994) report that the Kelsey Hill Gravels form a wedge that thins towards the east, eventually grading into a thin stratified layer between the Skipsea and Withernsea tills. On the eastern flank of Kelsey Hill, the Withernsea Till possesses a sharp erosional contact with the Kelsey Hill Gravels (Figure 4.30), the latter having been glaciotectonized and incorporated as small lenses by shearing into the base of the till.

Of particular interest is the rich and diverse fossil fauna of the Kelsey Hill Gravels, which includes more than 50 species of marine mollusc in addition to abundant examples of the freshwater bivalve *Corbicula fluminalis* and miscellaneous water-worn vertebrate remains (Penny, 1963). The marine molluscs are littoral and sub-littoral types (e.g. *Cardium, Mytilus, Macoma, Ostrea, Buccinum, Littorina* and *Nassa*) and are temperate in distribution, possessing similar characteristics to Ipswichian interglacial marine fauna. In contrast, the vertebrate remains include cold species such as mammoth, reindeer and bison in addition to interglacial species such as straight-tusked elephant and rhinoceros.

Interpretation

The sinuous nature of the north–south-trending ridge containing the Kelsey Hill Gravels has been used by Catt and Penny (1966) to suggest that it is an esker. This interpretation is supported by the north–south-trending palaeocurrents recorded in the sediments in addition to the numerous peat-filled kettleholes on the ridge surface. Catt and Penny further

suggest that the widening and lowering of the esker form to the south represents the subaerial continuation of the esker, where a marginal outwash fan emanated from the subglacial tunnel mouth. Sometime after its deposition the esker was covered by the Withernsea Till, explained by Catt and Penny (1966) as a product of the later stages of drainage of a tiered ice sheet within which the Withernsea Till was the last to melt out.

Early interpretations of the Kelsey Hill Gravels were considerably influenced by the dominance of temperate fossils, resulting in proposals for an interglacial status for the deposits. More recently, Catt and Penny (1966) used the diversity of the fossil assemblage, in addition to the waterworn nature of the vertebrate remains, in the Kelsey Hill Gravels to suggest that they were derived from pre-existing deposits. This is verified to some extent by the fact that the deposit lies between two tills. However, the Devensian age tills on Holderness are rarely shelly (see the site reports for Sewerby, this chapter, and Dimlington, Chapter 5), as would be the case if glaciers had reworked pre-existing shell-rich sediments. The only possible source for shells is the Bridlington Crag, which contains an arctic assemblage rather than a temperate one. Furthermore, the well-preserved nature of the fossils is difficult to reconcile with the normally long distances of travel that are associated with esker production. A further alternative origin is the glacial transport of rafts of Ipswichian sediments from the Humberside embayment (Berridge and Pattison, 1994), an interpretation that explains the lobate arrangement of the Kelsey Hill Gravel outliers and similar glaciofluvial gravel mounds to the south of the Humber. Similarly, Valentin (1957) interpreted the elongate ridge containing the Kelsey Hill Gravels to the north of the Humber as an ice margin, possibly documenting a readvance of the North Sea lobe during its recession from the Dimlington Stadial maximum.

Exposures through the Kelsey Hill Gravels at Mill Hill (Figure 4.31), where the sediments form several distinct ridges, have been used recently by Eyles *et al.* (1994) to propose a marine origin for the sediments. In the southernmost exposures through the proposed outwash fan, they highlight the lack of cross-stratified facies and associated channel fills typical of outwash deposits and propose a correlation of the subaqueously deposited lenses of sediment in the Basement, Skipsea and Withernsea tills at the coast with the inland exposures of the Kelsey Hill Gravels (Figure 4.31). The imbrication and openwork nature of the gravels together with their flat-lying nature are used to support a near-shore, shallow beach-face environment. Further support for this interpretation is: a) the north-south orientation of the 30-km-long ridges containing the Kelsey Hill Gravels, parallel to the trend of the buried interglacial chalk cliffline at Sewerby and the modern coast; and b) the prolific mixed marine and freshwater fossil assemblage. Eyles *et al.* (1994) go on to suggest that the North Sea Lobe surged into a shallow marine embayment, deforming and incorporating parts of the Kelsey Hill Gravels in the base of the Withernsea Till. However, the high sea level required in Eyles *et al.'s* model for the marine flooding of Holderness during the last glaciation is difficult to reconcile with known glacio-eustatic and glacio-isostatic trends, which indicate that the North Sea was dry land until approximately 6500 years BP, well after ice had disappeared from the British landscape (Funnell and Pearson, 1989; Brew *et al.,* 1992; Funnel, 1995; Lambeck, 1995). In addition, the Ipswichian affinities of the marine molluscs and freshwater gastropods indicate that they could not have been living on the Holderness coast during the Devensian glaciation and therefore were probably derived. Nevertheless, the ice-damming of pro-glacial lake water on Holderness, into which the North Sea Lobe could have surged, is a palaeogeographical scenario that requires further testing. The Kelsey Hill Gravels remain central to such palaeogeographical reconstructions; the proliferation of fossil fauna over such a small area remains enigmatic.

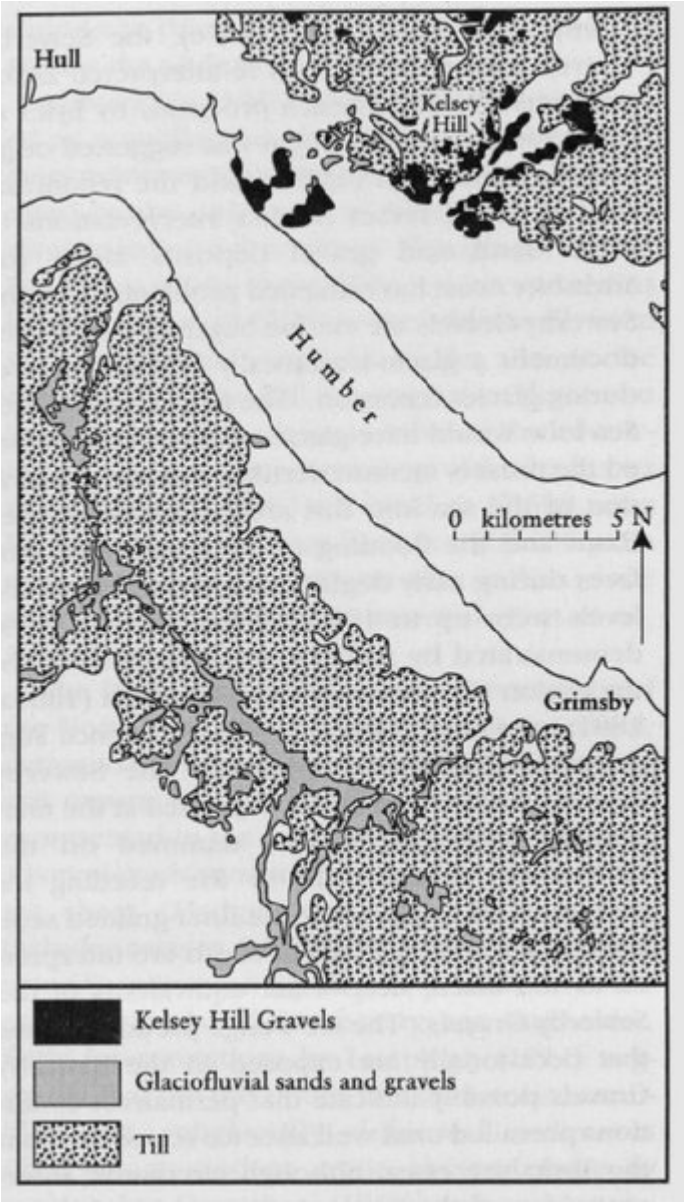
Following the proposals of the revised correlation of Quaternary deposits in the British Isles (Bowen, 1999), the Kelsey Hill Gravels should in future be referred to as the 'Mill Hill Member'. The Skipsea Till and Withernsea Till, with which the gravels are juxtaposed, are now labelled the 'Skipsea Member' and 'Withernsea Member' under the same scheme.

Conclusions

Kelsey Hill and surrounding sites contain one of the most enigmatic Quaternary sediment bodies in northern England. Early interpretations invoked marine interglacial conditions to explain the temperate fauna enclosed within the gravels. A more traditional interpretation of the landforms containing the gravels has invoked the deposition of esker ridges grading southwards into a pro-glacial outwash fan, but the sedimentary structures and preservation of the prolific faunal assemblage are difficult to reconcile with such a reconstruction. More recently, the Kelsey Hill Gravels (Mill Hill Member) have been interpreted as marine beach gravels and correlated with deeper water sediments occurring as lenses within the Basement, Skipsea and Withernsea tills (Bridlington, Skipsea, Withernsea members) on the coast. This implies that

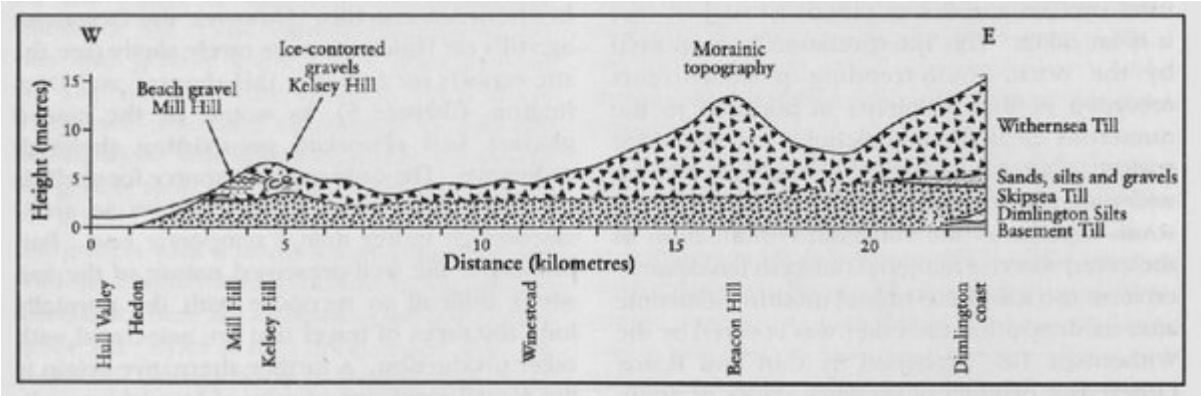
the gravels were deformed and partially reworked by the North Sea Lobe of the British Ice Sheet as it surged into a shallow marine embayment; the temperate nature of the shells within the gravels, if they are *in situ,* is difficult to reconcile with this interpretation. A further interpretation invokes ice-marginal thrusting of rafts of Ipswichian sediments from the Humberside embayment during advance of the Dimlington Stadial North Sea Lobe, thereby explaining the short distances travelled and localized proliferation of the faunal remains.

References



(Figure 4.29) Map of the distribution of the Kelsey Hill Gravels and associated landforms and sediments (after Berridge and Pattison, 1994).

(Figure 4.30) Horizontally bedded Kelsey Hill Gravels truncated by Withernsea Till. (Photo: N. Eyles).



(Figure 4.31) Simplified stratigraphical sequence along an east–west transect from Dimlington to Mill Hill, after Eyles et al. (1994).