Hamstead Marshall Gravel Pit

[SU 414 662]

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Highlights

The Hamstead Marshall site provides a rare combination of sedimentological, archaeological and pedological evidence that can be used to interpret the Silchester Gravel of the River Kennet, one of the best-preserved terrace deposits in southern Britain.

Introduction

Hamstead Marshall Gravel Pit is of considerable importance for Pleistocene stratigraphy in the western London Basin, as it is the type locality of the Hamstead Marshall Terrace of the River Kennet (Chartres *et al.,* 1976; Chartres, 1981, 1984). This, the most extensive and best-preserved of all the Kennet terraces, was former ly referred to as the 'Silchester Stage' (White, 1907), a name revived by Gibbard (1982) for his Silchester Gravel. This aggradation was generally correlated with the Winter Hill Terrace of the main river (Ross, 1932; Wooldridge, 1938; Thomas, 1961; Wymer, 1968) until reappraisal of the terrace stratigraphy in the main Thames valley led Gibbard (1979, 1983, 1985) to equate it with the slightly later Black Park Gravel Formation. Either way, an Anglian age is implied, indicating aggradation during probably the most severe climatic interval during the Pleistocene.

The discovery of Palaeolithic artefacts in the gravel at Hamstead Marshall (Wymer, 1968; Roe, 1981) supports the view that humans occupied southern Britain before the Anglian Stage glaciation of the London Basin.

Description

Sections in the Hamstead Marshall pit reveal *c.* 3.0–3.5 m of gravels with occasional sandy and clayey lenses, overlying buff-coloured sands of the (Palaeogene) Reading Beds. The contact with the top of the latter is undulating, suggesting incision by a network of braided river channels prior to deposition of the basal gravels. The sequence can be divided as follows (Chartres *et al.,* 1976; Chartres, 1981, 1984; (Figure 3.13)):

	Thickness
4. Topsoil	0.4 m
3. Silty gravel, unbedded	0.8 m
2. Clayey gravel, reddened matrix, especially in lower half; manganese stained near top; poorly bedded	1.0 m
1. Sandy gravel, well-bedded up	to 1.0 m
Reading Beds	

Chartres interpreted these divisions as of pedogenic rather than sedimentary origin. Micro-morphological studies have shown that all but the basal part of the gravel has been affected by complex pedogenesis under various climatic conditions (Chartres, 1984).

The gravel, predominantly of coarse grade, is composed of flints with occasional sarsens. Few sedimentary structures are evident and clear stratification is confined to the lowest division (unit 1). The most noticeable structures result from post-depositional disturbance by peri-glacial processes, particularly prevalent in the uppermost metre, where involutions and vertically orientated stones are in evidence (Figure 3.13). Chartres (1975) interpreted several scoop- or bowl-shaped hollows as ice-wedge casts, but these are not laterally extensive and seem more likely to have resulted from solution of Chalk clasts within the gravels (D.T. Holyoak, pers. comm.).

Interpretation

Hamstead Marshall Gravel Pit is important as a representative section in the deposits that form the terrace for which it is the type locality, the Hamstead Marshall Terrace of Chartres *et al.* (1976). This aggradation was previously attributed to the 'Silchester Stage', the lowest of three early Kennet gravels identified by White (1907). The sequence described by White was as follows:

1. Cold Ash Stage (80 m above the floodplain)
2. Bucklebury Stage (70 m above the floodplain)
3. Silchester Stage (47 m above the floodplain)

Gibbard (1982) used the term Silchester Gravel to classify the lowest of White's 'stages'. This is one of the best-preserved terrace aggradations in southern Britain, forming a wide and nearly continuous plateau on the southern flank of the Kennet valley from Wash Common [SU 455 648], near Newbury, to Burghfield Common, near Reading (Wymer, 1977b). The surface of this gravel falls from 120 m O.D. to 95 m O.D. between these points, while the width of the gravel sheet reaches a maximum 5 km at its eastern (downstream) end. The longitudinal gradient shows a flattening downstream, from 1.9 m to 1.3 m per km. This remarkable spread of gravel attracted the attention of numerous early geologists; notably, in addition to White, Buckland (1823), Monckton (1892), Blake (1900, 1903) and Hawkins (1928).

A possible reason for the exceptional preservation of this deposit is that subsequent phases of Kennet development were constrained by the river having cut through the Tertiary strata, which underlie the older gravels, to become entrenched in the Chalk. As noticed by Thomas (1961), the Silchester Gravel marked the end of a progressive southward migration, by the Kennet, attributed by him to uniclinal shifting. Bridgland (1985b) has observed that neither migration nor the development of extensive terrace remnants are usual in valleys cut through Chalk.

Wooldridge (1938) correlated the Silchester Gravel with the then newly defined Winter Hill Terrace of the Thames (Saner and Wooldridge, 1929), an interpretation that was confirmed by Thomas (1961), who equated it with the Lower Winter Hill Terrace of Sealy and Sealy (1956). The spreads of gravel in the Thames valley with which correlations were made include the 'Ancient Channel gravel' between Mapledurham and Henley, originally included in the (Lower) Winter Hill aggradation but recently redefined by Gibbard (1983, 1985; Gibbard and Wymer, 1983) as Black Park Gravel (see above, Highlands Farm Pit). Thus the term Silchester Gravel is a synonym, applied in the Kennet valley, for the Black Park Gravel Formation.

Thomas (1961) summarized earlier observations on the gravels beneath the Hamstead Marshall (his 'Lower Winter Hill') Terrace surface, noting that their composition and appearance are remarkably consistent over a wide area. Significant variations were, however, observed in the depth of the gravels. On Wash Common, they attain a thickness of 6.1 m, but become progressively thinner downstream; they decline to 4.6 m on Greenham Common [SU 495 648], 3.0 m on Brimpton Common [SU 570 630] and further east to as little as 1.8–2.4 m, although they thicken towards their north-eastern margin, near Sulhamstead Abbots [SU 645 677], to 3.0 m. Thicker remnants are also found on the north side of the valley, attaining a thickness of 3.7 m on May Ridge [SU 610 707] and over 4.3 m at Dark Lane [SU 615 745]. Thomas (1961) argued that these variations, together with the character of the gravels and the great extent of the terrace, indicate a considerable period of planation followed by a short, rapid period of aggradation, during which the gravels were deposited by a fast-flowing braided river. He also suggested that the planation occurred under interglacial conditions, whereas the gravels were seen as possible products of solifluction from surrounding hillslopes under periglacial conditions.

In comparison with the deposits forming the later Thatcham and Beenham Grange Terraces of the Kennet (Chartres et al, 1976), which are much less well developed, the Silchester Gravel is intensively cryoturbated and generally more weathered in appearance. It is possible that this extensive, relatively thin and uniform gravel-spread results from the frequent lateral shifting of a network of braided river channels. Alternatively, it could represent a long period of deposition in an essentially stable fluvial environment.

The occurrence of palaeoliths on and in the Silchester Gravel (Shrubsole, 1906; Smith, 1915; Wymer, 1968) has attracted considerable interest, on account of the correlation of the former with (originally) the Winter Hill Terrace and (since the early 1980s) the Black Park Gravel of the Thames. Both of these correlations imply contemporaneity with the (Anglian Stage) glaciation of the Vale of St Albans (Hare, 1947; see above, Highlands Farm Pit). There is no direct local evidence for the age of the Silchester Gravel, so correlation with the Thames sequence forms the basis for most attempts at relative dating (Thomas, 1961; Chartres *et al.,* 1976; Chartres, 1980).

The widely held view, prevalent until quite recently, that the earliest human occupation of Britain was during the Hoxnian Stage (see above, Highlands Farm Pit; Wymer, 1961), led Wymer (1968, 1977b) to suggest that most, if not all, of the finds from the Silchester Gravel were probably artefacts dropped on to the terrace surface and incorporated into the top of the deposits by cryoturbation. He noted, however, that the abraded condition of hand-axes from sites on this gravel at Sulhamstead [SU 645 680] and, in particular, the pits at Hamstead Marshall indicate that they have been transported with the gravel and so are presumably contemporaneous with it or older. Palaeolithic artefacts have continued to be found in the gravel at the Hamstead Marshall GCR site by local collectors; Wymer (1968) listed five hand-axes (plus a broken fragment) but, by 1992, the number had increased to at least 23 hand-axes Q.J. Wymer, pers. comm.). The occurrence of hand-axes in the Black Park Formation is now well established (see above, Highlands Farm Pit), so the finds at this site need no longer be regarded as anomalous.

Roe (1981) suggested that the abraded hand-axes from sites on the Silchester Gravel, which can be confidently interpreted (because they are water-worn) as derived from the body of the Black Park Formation, are 'archaic-looking', thick and narrow in form. More 'advanced' ovate hand-axes from the same terrace are generally unabraded; Roe agreed with Wymer (1968) that the latter were probably surface finds or artefacts intruded into the top of the gravel by cryoturbation. Roe likened the small assemblage of 'crude' implements from the Silchester Gravel to collections of similar artefacts, from other high-level (pre-Boyn Hill) gravels, that he had previously interpreted as 'Early Acheulian' (Roe, 1964, 1968a). The view that a distinctive and stratigraphically significant 'Early Acheulian' culture existed in Britain during the Middle Pleistocene, promoted by Roe (1964, 1968a, 1981), is less convincing now that well-made hand-axes have been discovered in an apparently pre-Hoxnian context at Boxgrove (see Chapter 1).

The role of pedogenesis in the modification of the Silchester Gravel at Hamstead Marshall has been confirmed by studies of micromorphology and mineralogy (Chartres *et al.,* 1976; Chartres, 1981, 1984). Micromorphological studies showed that the clayey matrix in the middle division of the gravel sequence (unit 2) is of illuvial origin, indicating soil formation under temperate conditions. This clay is strongly orientated, but has been disrupted following illuviation, probably under permafrost conditions. Chartres considered the silt in the matrix of the upper division (unit 3) to be of aeolian (loessic) origin, an interpretation that was supported by the analysis of its mineralogy (Chartres, 1981). This revealed significant quantities of minerals such as epidote, which are rare in pre-Quaternary deposits in the Kennet valley but are common constituents of loess. Chartres concluded that a covering of loess had been deposited on the surface of the gravel and then mixed into the upper disturbed division (unit 3) by cryoturbation. He suggested that this intrusive silt had been prevented from penetrating to depths below 1.2 m from the surface by the clayey layer (unit 2), which had already been formed by pedogenesis prior to the accumulation of the loess.

Micromorphological studies have revealed significant differences, below the levels affected by recent pedogenic activity, between soils formed on the different terraces in the Kennet valley (Chartres, 1975, 1980, 1984; Chartres *et al.,* 1976). As might be expected, the older, higher-level gravels show more evidence for pre-Holocene pedogenesis than those of lower terrace levels; soils on the higher gravels also have a more complex history of modification. Chartres found that the high-level gravels, including those at Hamstead Marshall, were the only ones to contain concentrations of significantly rubified illuvial clay (ferriargillans and papules). These were considered by Chartres to be relict features, since they are generally embedded in yellow illuvial clay, thought to be the product of a later phase of illuviation. The soil has been thoroughly disturbed on at least two occasions; once between the two phases of illuviation, breaking up the reddened illuvial clay, and again after the second illuvial phase. Chartres (1980, p. 140) attributed these disturbance events to cryoturbation, considering that wetting and drying, the principal alternative mechanism, would not have been able to produce the 'general disturbed nature of the profiles'.

The pedogenic evidence from Hamstead Marshall implies that the Silchester Gravel has been subjected to soil-forming processes during at least two temperate intervals and two cold intervals. This may be taken as an indication of relative antiquity. The occurrence of reddened illuvial clay may provide further evidence for the relative antiquity of the gravel. Chartres (1980) cited work in the Paris Basin by Federoff (1971) that suggests that rubification to the degree observed in the earliest papules at Hamstead Marshall is only found there in pre-Saalian soils. The Kennet sequence, in which such reddened material is found in soils formed on the Silchester Gravel and higher formations, but not on the younger Taplow (Thatcham Terrace) Gravel, appears to follow a similar pattern, since the latter deposit is probably of Saalian or post-Saalian age (see below, Brimpton). It has been shown, however, that rubification has occurred under favourable soil conditions in Germany during the Holocene (Schwertmann *et al.,* 1982), raising doubts about the stratigraphical significance of rubified horizons in palaeosols (R.A. Kemp, pers. comm.).

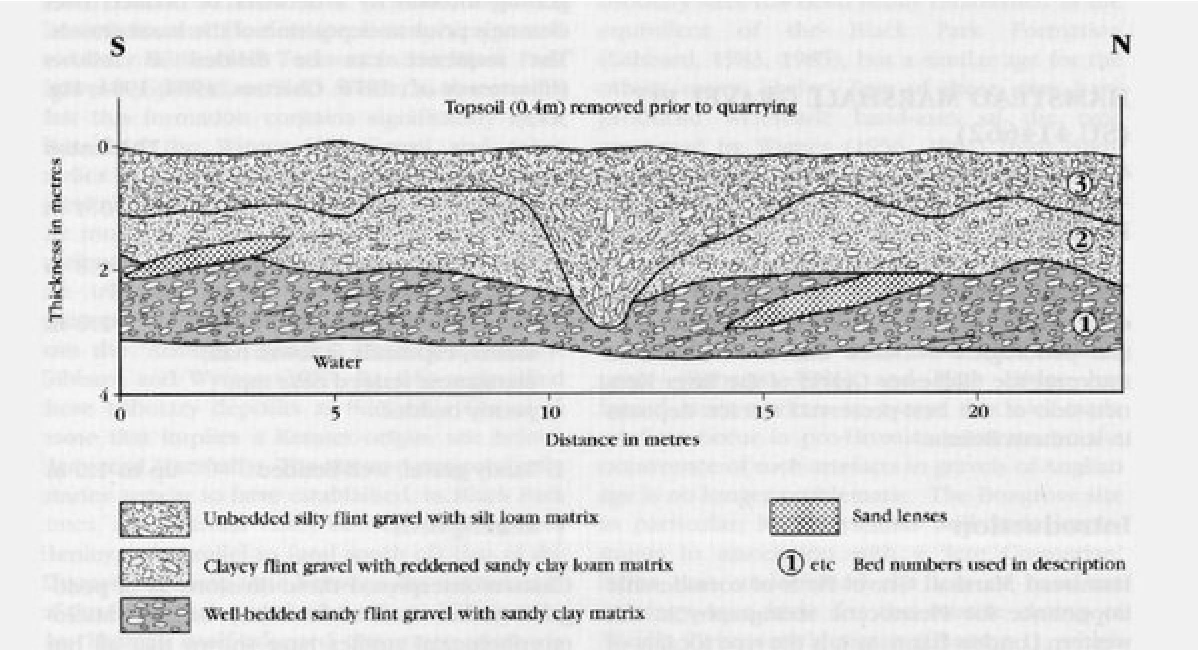
Chartres's research was carried out before the greater complexity of climatic fluctuation during the Middle Pleistocene, as indicated by the oceanic oxygen isotope record (Chapter 1), was widely acknowledged in land-based studies. It is possible that detailed micromorphological analyses in the future will determine that more phases of illuviation and disruption have affected the gravel at Hamstead Marshall than were recognized by Chartres, although the resolution of complex sequences of pedogenic activity in relict soils is fraught with difficulty (Whiteman and Kemp, 1990).

Although the Silchester Gravel is now recognized as an upstream continuation of the Black Park Formation of the Middle Thames (see (Figure 3.1)), it is possible that deposits equivalent to the (higher) Winter Hill Gravel, as redefined in this volume (see Chapter 1), are also represented within this aggradation in the upper reaches of the Kennet. This is because of the unique association between the Winter Hill and Black Park Gravels, both of which are at least partly coeval with the glaciation of the Vale of St Albans (see Part 2 of this chapter). The rejuvenation from the Winter Hill to the Black Park floodplain level is believed to have resulted directly from the diversion of the Thames. This rejuvenation is not thought to have extended upstream in the Upper Thames basin beyond the Abingdon area (see Chapter 2, Sugworth). The shallow and steep downstream gradients of the Winter Hill and Black Park Formations (respectively) provide important evidence in support of this interpretation (Figure 1.3); these formations appear to converge upstream from the Goring Gap. In the Kennet valley, possible remnants of the Winter Hill Formation were recorded in the Beenham area by Thomas (1961), who classified them as Upper Winter Hill Terrace. He correlated these gravels with remnants in the Henley area that Sealy and Sealy (1956) also ascribed to the Upper Winter Hill Terrace. The Lower Winter Hill Terrace of both the Henley area and the Kennet valley is now assigned to the Black Park Formation and the remnants of Upper Winter Hill Terrace recognized by the Sealys have been reinterpreted in this volume as part of the Winter Hill Formation (Chapter 1). Thus the deposits at Beenham probably represent the continuation of the Winter Hill Formation upstream into the Kennet valley (Figure 3.1) and (Figure 3.3). As downstream gradients in the Kennet are generally steeper than in the main Thames, foreshortening the various terraces in comparison to their equivalents in the Upper Thames (Figure 1.3), it might be expect ed that the convergence of the Winter Hill and Black Park terrace surfaces occurs a shorter distance upstream in the Kennet than in the Thames. This would mean that it occurs between Hamstead Marshall and the Beenham area (Figure 1.3), so that the deposits at the Hamstead Marshall site include equivalents of both formations. This may explain why remnants of the Silchester Gravel are thicker in the higher reaches of the Kennet than those further down the valley; in the former area aggradation would have continued at the same floodplain level throughout the period of Winter Hill and Black Park Gravel deposition, whereas downstream these two formations are separately represented.

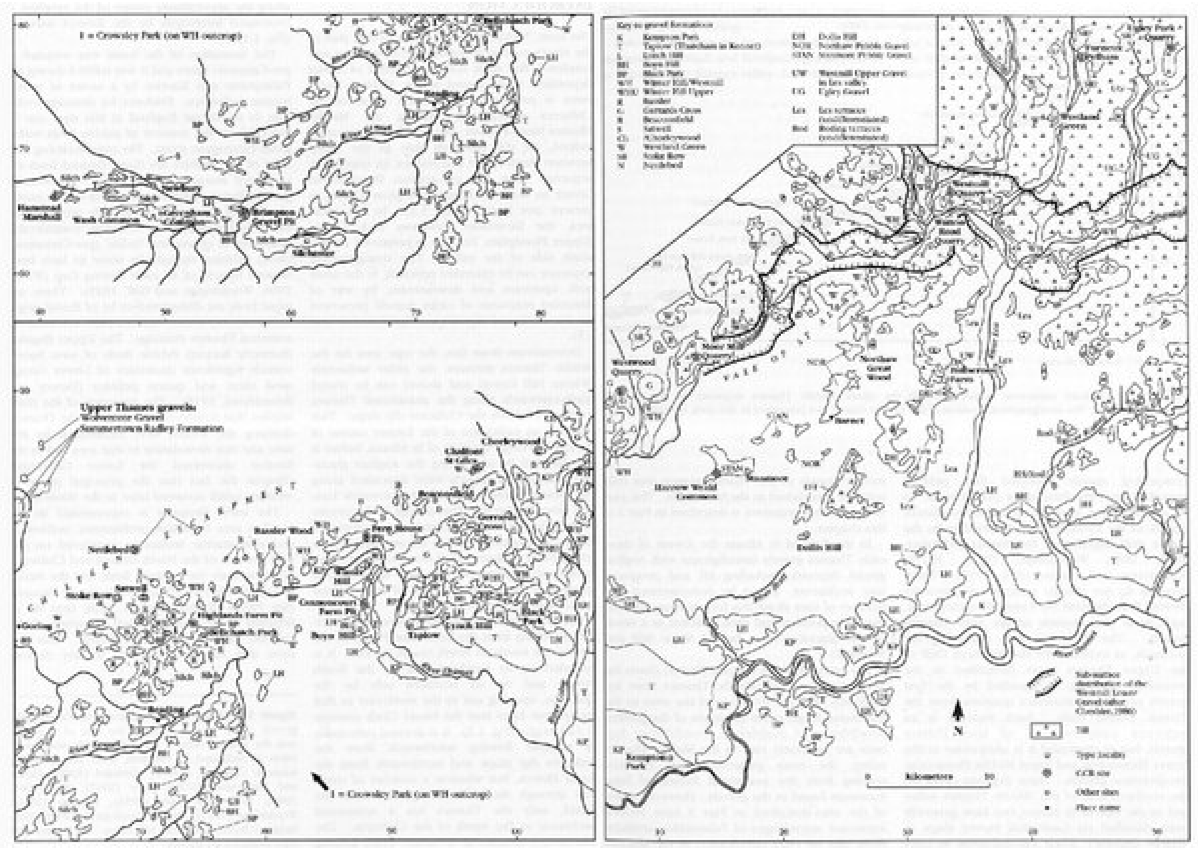
Conclusions

The Silchester Gravel at Hamstead Marshall was deposited during what was probably the most severe climatic phase of the Quaternary Ice Age — during the Anglian Stage. The Hamstead Marshall site shows deposits that form part of a huge spread, or terrace, formed by these ancient Kennet gravels. This terrace is one of the finest and most extensive examples in southern Britain, extending laterally some 5 km at its widest point. It probably accumulated at a time when the river flowed in many individual channels, separated by gravel bars, across a hostile, sparsely vegetated landscape. Detailed analyses of the gravels show that soils subsequently formed on the terrace surface on at least two separate occasions during the warmer 'interglacial' episodes of the Ice Age, with disruption of these soils by frost action during colder phases. The man-made flint implements recovered from the gravels at this site add a further controversial element to its interest, having a major bearing on the time when humans first appeared in Britain.

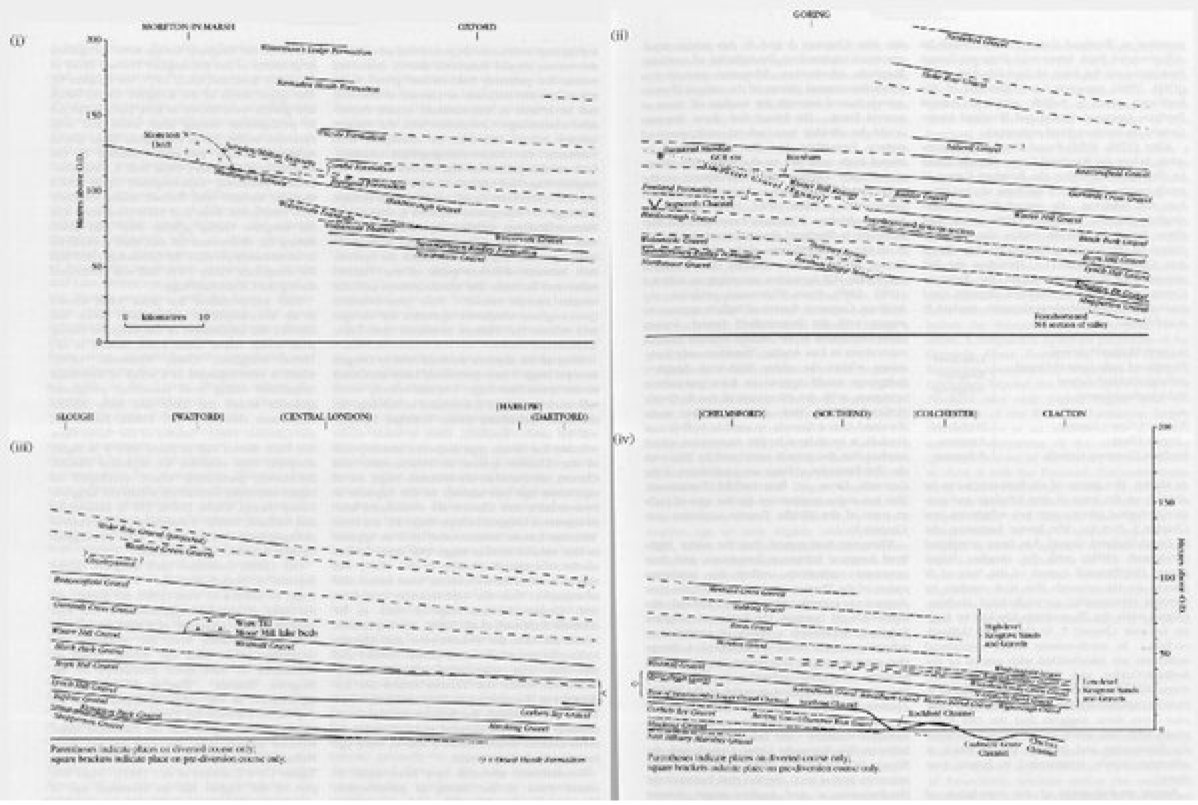
[References](#)



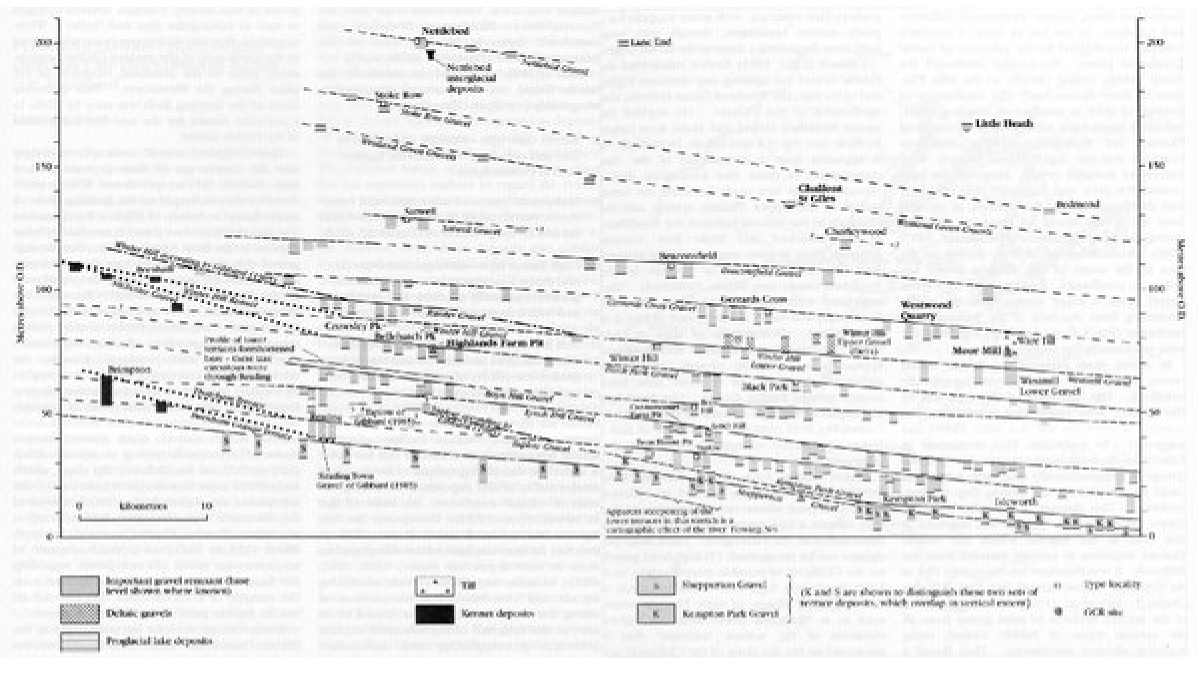
(Figure 3.13) Section at Hamstead Marshall Gravel Pit, showing the three divisions of the Silchester Gravel at this site, as described in the text (numbers apply to description). Note that the boundary between divisions 1 and 2 cuts across the sedimentary bedding. Also note central ground-ice/solution structure (after Chartres et al., 1976).



(Figure 3.1) (Following two pages) Map showing the gravels of the Middle Thames, the Vale of St Albans and the Kennet valley. Compiled, with reinterpretation as indicated in the text, from the following sources: Cheshire (1986a), Gibbard (1985), Green and McGregor (1978a), Hare (1947), Hey (1965, 1980), Sealy and Sealy (1956), Thomas (1961), Wooldridge (1927a) and the Geological Survey's New Series 1:50,000 and 1:63,360 maps. GCR sites and type localities are shown.



(Figure 1.3) Longitudinal profiles of Thames terrace surfaces throughout the area covered by the present volume. The main sources of information used in the compilation of this diagram are as follows: Arkell (1947a, 1947b), Briggs and Gilbertson (1973), Briggs et al. (1985), Evans (1971) and Sandford (1924, 1926) for the Upper Thames; Gibbard (1985) and Sealy and Sealy (1956) for the Middle Thames; Bridgland (1983a, 1988a) and Bridgland et al. (1993) for the Lower Thames and eastern Essex; Whiteman (1990) for central Essex.



(Figure 3.3) Long-profiles of terrace formations in the Middle Thames. Compiled predominantly from data provided by Gibbard (1985), with subordinate information from Sealy and Sealy (1956) and Thomas (1961). Modifications to the source information are described in the text.