Fern House Gravel Pit

[SU 883 885]

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Highlights

This site provides an exposure in gravels of the Taplow Gravel Formation. The sediments here, and their contained fossils, may hold the key to elucidating a poorly understood part of the history of the Thames, that between the (glacial) Anglian Stage, when the river was diverted into its modern course, and the last (Ipswichian) interglacial.

Introduction

Fern House Gravel Pit, Buckinghamshire, also known as 'Ferns Pit' and 'Well End Pit', exposes sediments of the Taplow Gravel Formation overlain by several metres of colluvial gravels. This pit, which lies *c.* 10 km upstream from the Taplow type locality, was much visited earlier in this century, when it yielded a number of elephant remains, mostly teeth of mammoth.

The Taplow Terrace, the geomorphological feature formed by the Taplow Gravel, was one of the three Thames terraces originally defined by the Geological Survey (Bromehead, 1912). It had previously been referred to as the 'Middle' or '50 ft Terrace' (Hinton and Kennard, 1900, 1905, 1907; Pocock, 1903). The status of this formation as an important element of the Thames sequence was consolidated in later work (Dewey and Bromehead, 1915; Sherlock and Noble, 1922; King and Oakley, 1936; Oakley, 1937; Hare, 1947). Sealy and Sealy (1956) proposed a division into Upper and Lower Taplow Terraces, but these are not considered to represent separate fluvial aggradations (Gibbard, 1985).

According to Gibbard (1985), the Taplow Gravel is characterized by a mammalian fauna indicative of severe cold. However, the occurrence of occasional remains of temperate species suggests that deposition of this formation also spanned one or more temperate intervals.

Description

Fern House Pit appears first to have been operational in the early years of this century. Many years earlier, however, sections showing a 4 m thickness of (Taplow) gravel were recorded 10 km further downstream, at what was to become the type locality of both this terrace and the gravel that forms it, Taplow Station Pit (Owen, 1855; Prestwich, 1855; Sherlock and Noble, 1922; Oakley, 1937). This site yielded bones of mammoth, woolly rhinoceros and musk ox (Sherlock and Noble, 1922), the last being the first record of this species in Britain. Musk ox was later considered by Gibbard (1985) to be particularly characteristic of the Taplow Gravel.

The earliest description of Fern House Pit appears to be that by Treacher (1916) who, in a Geologists' Association excursion report, observed that two types of gravel were exposed: a lower sandy, current-bedded deposit, which he thought likely to belong to the Taplow Terrace, and an upper, less well-bedded, clayey spread, which he suggested was hillwash from Flackwell Heath to the north. During the visit, a fragment of mammoth's tooth was discovered in the lower gravel (Treacher, 1916). A pit west of Well End, probably the GCR site, was described by Sherlock and Noble (1922), who reported up to 8 m of gravel, the lower metre of chalky composition (this thickness presumably includes the upper colluvial gravel). The presence of Chalk clasts in fluvial gravels is exceptional in the Thames terrace sequence and is restricted to deposits immediately overlying the source (bedrock Chalk or coombe rock). The calcareous nature of the lower gravel may explain the preservation in it of mammalian remains in some quantity (see below).

The Geologists' Association again visited the pit in 1933 (Treacher, 1934), when the distinction between the lower fluviatile gravel and the upper 'slopewash' material was once again noted. Treacher suggested that the latter comprised material washed down from the neighbouring hills through a series of short steep valleys that converged to form a fan in the vicinity of the pit. According to Treacher, mammalian remains were commonly found in the gravel, especially molar teeth of mammoth (*Mammuthus primigenius*), although at least one tooth of straight-tusked elephant (*Palaeoloxodon antiquus*) had also been found. Treacher also noted on this occasion that the two types of gravel were separated by a band of 'loam' (silt?) averaging 1.2 m thick.

Wymer (1968) noted that the site had been overgrown since 1960, when he had observed 3 m of 'solifluction gravel' overlying sandy bedded gravel. According to Wymer, the upper gravel contains a high proportion of quartzite pebbles, indicating that it represents the redistribution of one of the early Thames drifts to the north, as suggested by Treacher. Although Treacher (1934) maintained that no artefacts had been found in the pit, Wymer believed that a very rolled primary flake in the Ashmolean Museum, found in 1941 (after Treacher's observation) and marked 'Bourne End Pit', might have originated there. Sherlock and Noble (1922) claimed the Taplow Terrace to be associated with Mousterian (Levallois) artefacts, but Gibbard (1985) considered such material to have come from wind-blown silt (loess) overlying the fluvial deposits, his 'Langley Silt Complex'. According to Gibbard, therefore, these artefacts post-date the deposition of the Taplow Formation (see, however, Chapter 4, Lion Pit and Northfleet). Gibbard provided the results of a stone count from this pit (Table 3.2), showing a typical Taplow Gravel composition, but lacking the Chalk reported by Sherlock and Noble. Gibbard's sample presumably came from the upper (Chalk-free) part of the bedded gravel at the site.

Interpretation

The Taplow Terrace and underlying Taplow Gravel have an important place in the later part of the Thames terrace succession. The middle of the three terraces originally mapped in the Maidenhead area (see above and Introduction to Part 3), this aggradation has been widely recognized throughout the Middle and Lower Thames basins (see Chapter 1). Correlation of Taplow remnants throughout this area is not without its problems, however. For example, recent work in the Lower Thames suggests that it has previously been misidentified downstream from London (see Chapters 4 and 5).

Following the introduction of the terms Taplow Terrace and Taplow Gravel by the Geological Survey (Bromehead, 1912; Dewey and Bromehead, 1915), King and Oakley (1936) proposed the name 'Taplow Stage' for the period represented by this aggradation. This was linked to the 18 m 'Main Monastirian Sea-Level' by Zeuner (1945), who believed the gradient of the terrace downstream from Ealing to be negligible (after Pocock, 1903). This now appears to be a mistaken impression that arose from miscorrelation across the London area; recent re-evaluation of the sequences in the Lower Thames and eastern Essex indicates that the Taplow Gravel declines continuously towards a low sea level (see (Figure 1.3); Chapters 4 and 5). This is consistent with aggradation of the Taplow Formation during a cold episode, as is indicated by the mammalian fauna. However, east of London the gravel is overlain by or interbedded with fine-grained sediments of probable estuarine origin that are ascribed to a high (interglacial) sea level, thought to be equivalent in age to Oxygen Isotope Stage 7 of the oceanic record (see Chapter 4).

Hare (1947), in his detailed geomorphological mapping of the Slough–Beaconsfield area, noticed a minor, lower sub-facet of the Taplow Terrace. Later authors used this as a basis for a division into Upper and Lower Taplow Terraces (Sealy and Sealy, 1956; Thomas, 1961; Evans, 1971). The importance of 'Ferns Pit', and the descriptions of it by Treacher, were acknowledged by Sealy and Sealy (1956). These authors attributed the upper gravels at this site to rapid deposition during a cold episode following the aggradation of the lower bedded gravel, which they assigned to their Upper Taplow Terrace. As this implies, they correlated the fluvial deposits at Taplow level in the Marlow district, including the lower gravel at Fern House Pit, with the Upper Taplow Terrace of the type area, around Slough, which they believed to be the major of the two divisions. Gibbard (1985), however, considered Sealy and Sealy's division of the Taplow Terrace to be of geomorphological significance only. He observed that the Upper Taplow Terrace of the type area is formed by the Taplow Gravel aggradation with an overlying layer of wind-blown silt (loess). The localized removal of this later silt has given rise to the minor, lower facet originally described by Hare. The upper surface of the Taplow Gravel, which is Sealy and Sealy's Lower Taplow Terrace, is therefore the true expression of the fluvial aggradation; the higher feature has no significance to the history of Thames drainage evolution. The layer of 'loam' at Fern House Pit, between the lower bedded gravel (presumed to represent the Taplow Formation) and the upper colluvial gravel, may well represent this windblown accumulation, the 'Langley Silt Complex' of Gibbard (1985).

Gibbard's reinterpretation of the Upper and Lower Taplow Terrace features applies only to the area downstream from Fern House Pit, however. The Taplow Formation has been entirely removed by erosion in the district immediately upstream from Marlow, but further west, in the Reading area, separate geomorphological terraces have again been recognized at both the Upper and Lower Taplow levels (Sealy and Sealy, 1956), despite the absence in this district of loessic overburden. Wymer (1968) recognized these as his Henley Road and Taplow Terraces, respectively. Gibbard (1985) considered the higher of these (Wymer's Henley Road Terrace) to represent the Taplow Gravel *sensu stricto* and interpreted the lower as a unit peculiar to this area, his 'Reading Town Gravel'. He attributed this deposit to aggradation during the Early Devensian, although noting that possible temperate-climate deposits had been described from a site at this level known as Redlands Pit [SU 732 727] (Poulton, 1880; Wymer, 1968). Gibbard considered that these were probably residual Ipswichian Stage deposits and that the Reading Town Gravel had been banked against them. The Redlands Pit site, some 25–30 km upstream from Fern House Pit, yielded reworked Jurassic, Cretaceous and Palaeogene Mollusca, together with (Pleistocene) bones of ox, horse, mammoth and rhinoceros (Poulton, 1880). Poulton also described tree trunks, which Wymer believed to have been reworked from the Palaeogene (leaf-beds occur in the immediate vicinity within the Reading Beds). Gibbard (1985) thought that these tree remains, tentatively identified as *Pinus* by Poulton, might equally well have been of Pleistocene age, although the original description indicates that they were partly mineralized, which would seem to support Wymer's interpretation. If they were of Palaeogene origin, the only evidence for a Pleistocene temperate episode from this pit would be the mammalian fossils, none of which can be regarded as indicating fully interglacial conditions.

Another pit in Reading on the Taplow Terrace of Wymer (1968), the 'Reading Town Gravel' of Gibbard (1985), provided stronger evidence for interglacial conditions in the form of teeth of hippopotamus (Shrubsole and Whitaker, 1902; Wymer, 1968). This site, on a separate remnant to Redlands Pit, was at Kensington Road [SU 698 734]. The records provide no information about the context of these remains, but there is no indication that they were associated with fine-grained or organic sediments. Gibbard (1985) cited the occurrence of these remains in his 'Reading Town Gravel' as important evidence for the Early Devensian age of the latter, since hippopotamus is believed to have been present in Britain, after the Anglian Stage, only during the last interglacial, the Ipswichian Stage (*sensu* Trafalgar Square) (see Chapter 1 and Chapter 2, Stanton Harcourt and Magdalen Grove). Attribution of the mammalian assemblage from Redlands Pit to the Ipswichian may be problematic, however, since horse is widely believed to be absent from that stage (Shotton, 1983), although Stuart (1982a) considered that it disappeared at the beginning of the Ipswichian, to reappear in pollen biozone

Reassessment of the altitudinal distribution of gravel remnants in the Reading area attributed to the post-Lynch Hill aggradations of the Thames (Chapter 1) suggests a different interpretation to that of Gibbard (1985). If the Taplow Gravel of the type area is projected upstream, passing through the fluvial gravels at Fern House Pit (Figure 3.3), the deposits in the Reading area that fall at the predicted elevation for this formation are those identified by Gibbard as his 'Reading Town Gravel'. It is thus concluded that this is the true upstream equivalent of the Taplow Formation at Reading (see Chapter 1), confirming the view of Wymer (1968). An alternative interpretation is therefore required for the higher gravel remnants, attributed by Gibbard to the Taplow, that lie between the true Taplow (Reading Town) Gravel and the Lynch Hill Gravel. Wymer tentatively associated these gravels, his 'Henley Road Terrace', with the deposits at Iver (see above, Cannoncourt Farm Pit), some 18 km downstream from Fern House Pit. Moreover, he regarded deposits in the Sonning area, which were also included by Gibbard in the Taplow Gravel, as part of the Lynch Hill Formation. It seems likely that all these problematic remnants represent degraded thicker parts of the Lynch Hill Gravel, separated from the downslope feather-edge of that formation by later erosion; the Henley Road Terrace may thus be an erosional terrace similar to the Stoke Park Cut, cut in Lynch Hill Gravel (see above, Introduction to Part 3 of this Chapter).

This re-evaluation of the terrace stratigraphy in the Reading area has major repercussions for correlation with deposits in the Upper Thames basin and for the relative dating of the Taplow Formation. Gibbard (1985) argued for correlation of his Reading Town Gravel with the Summertown-Radley Terrace of the Upper Thames, which he also attributed to the Early Devensian. Reappraisal of terrace correlations between the Upper and Middle Thames (see Chapter 1) supports Gibbard's view, thus implying that the downstream continuation of the Summertown-Radley Formation in the Middle Thames is the Taplow Gravel. The Summertown-Radley aggradation is seen by many workers to be a highly complex succession of both temperate- and cold-climate deposits, most if not all of which is pre-Devensian (see Chapter 2, Stanton Harcourt and Magdalen Grove). This formation is, according to the interpretation favoured in Chapter 2, dominated by cold-climate gravels that accumulated in Oxygen Isotope Stages 8 and 6, although it also incorporates interglacial sediments from Stage 7 and Substage 5e (= Ipswichian *sensu* Trafalgar Square) and may culminate in Lower Devensian gravels (Figure 2.18).

The above correlation indicates that deposits of this wide range of ages might also be expected in the Taplow Formation downstream from the Goring Gap, certainly in the Reading area and perhaps at sites such as Fern House Pit. In the lower reaches of the river, however, the Taplow Formation is restricted in age to Oxygen Isotope Stages 8–6 (Chapters 1 and 4), incision to a new terrace level having occurred within Stage 6 (see Chapter 1). This incision (rejuvenation) was followed by the aggradation of the Kempton Park Formation, which has only been recognized in the Thames valley below Reading (see Chapters 1 and 2, Stanton Harcourt and Magdalen Grove). Within the Kempton Park Formation, each element of the aggradational sequence predicted by the climatic model for terrace formation promoted in Chapter 1 has been recognized (Figure 2.18). After the erosional phase (phase 1), the first phase of cold-climate gravel deposition (phase 2) is represented by the Spring Gardens Gravel of Gibbard (1985), which underlies the Trafalgar Square (Ipswichian) sediments and can be attributed to Oxygen Isotope Stage 6. The sediments at Trafalgar Square (and equivalent deposits at Brentford) represent the interglacial phase of the model (phase 3), attributable in this case to the Ipswichian Stage (Oxygen Isotope Substage 5e). The major part of the Kempton Park Formation represents phase 4 of the model, the post-interglacial cold-climate aggradation, and is of well-established Devensian age (Gibbard, 1985).

The occurrence of hippopotamus in the Taplow Gravel at the Kensington Road pit suggests that Ipswichian deposits occur within that formation in the Reading area. This implies that no Stage 6 rejuvenation occurred in this area, so the terrace sequence there is equivalent to that in the Upper Thames and not to that in the London area (Figure 2.18). It is interesting that Sandford (1932), reviewing the previously published evidence, observed that the Taplow Terrace had yielded fauna of both warm and cold affinities, pre-empting the above conclusions.

The above paragraphs provide a context for discussing the information from Fern House Pit. Evidence for the relative dating of the deposits of the Middle Thames sequence is extremely rare, there being no pre-Devensian sites within the lower terraces that have yielded molluscan remains or pollen. The only evidence. to support hypotheses based on the reconstruction of terrace aggradations derives from mammals. The mammalian record from the Taplow Formation is relatively sparse and is restricted to large animals, but it appears to incorporate a cold-climate fauna, typified by musk ox (Gibbard, 1985), and temperate-climate species characteristic of both Oxygen Isotope Stage 7 and the Ipswichian Stage (*sensu* Trafalgar Square). The assemblage from the Redlands Pit at Reading includes horse and mammoth, two of the three important species of the 'Stage 7 fauna' described by Shotton (1983). The third species, straight-tusked elephant, was recorded at Fern House Pit by Treacher (1934), presumably from the main body of the Taplow Gravel. This is the most important of the three, since horse and mammoth are known from interstadial deposits and cannot alone be used as evidence for a major temperate-climatic event. Straight-tusked elephant occurs in Ipswichian deposits, however, so it could be attributed to the same origin as the hippopotamus from Kensington Road, Reading. It should be noted that most, if not all, of these large-mammal remains probably come from cold-climate gravels, into which they have been reworked; no *in situ* temperate-climate sediments have yet been recognized within the Taplow Formation in the Middle Thames area (except perhaps at Redlands Pit).

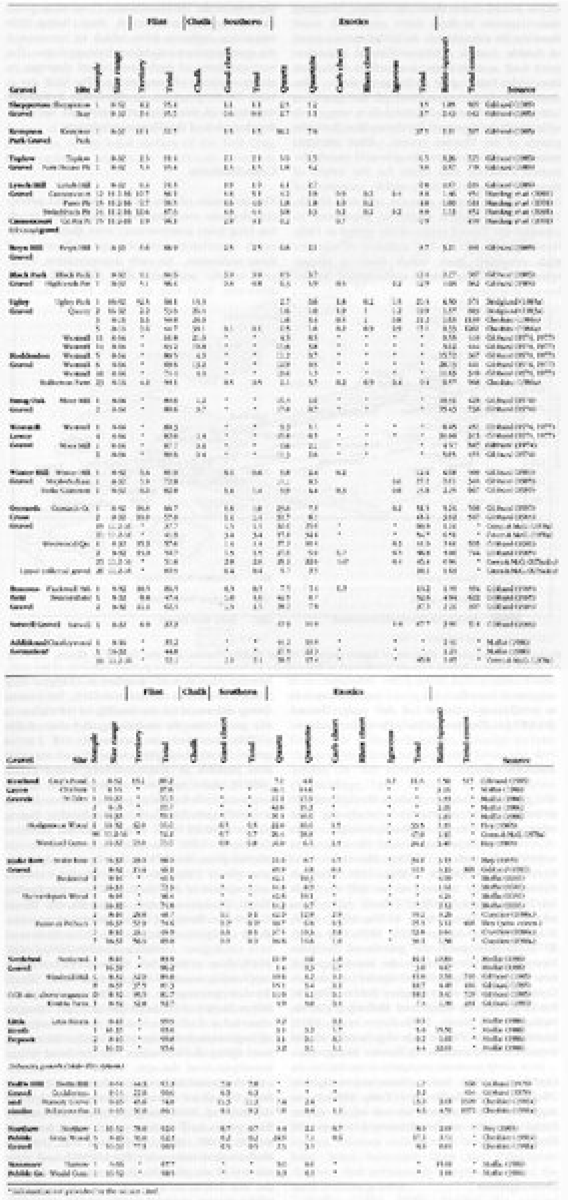
Fern House Pit is located at the extreme upstream limit of the area in which the Kempton Park Formation has been recognized. Gibbard (1985) regarded a low-level gravel at Marlow [SU 865 874] as a potential outlier of the Kempton Park Gravel, the furthest upstream that he recognized. A beetle assemblage from organic sediments within this gravel is suggestive of the Upton Warren Interstadial (Coope, in Gibbard, 1985), supporting an early or mid-Devensian age. This deposit extends to *c.* 3 km upstream of Fern House Pit (Figure 3.1). It thus seems likely that incision from the level of the Taplow Formation to that of the Kempton Park Gravel did occur in the Marlow area during Oxygen Isotope Stage 6, following the aggradation, during the early part of this cold episode, of the main (phase 4) part of the Taplow Formation as recognized in the type area (see (Figure 2.18)). This is an important concept to establish, because it implies that the straight-tusked elephant from Fern House Pit is pre-Ipswichian and that it was reworked from temperate-climate deposits laid down prior to Stage 6 (probably in Stage 7). It is possible, in the light of the recent discovery at Cannoncourt Farm Pit (see above), that the 'loam' separating the Taplow Gravel from the overlying colluvial gravel at Fern House Pit may show evidence of pedogenesis. This might provide a means for demonstrating the pre-Ipswichian age of the Taplow Formation at Little Marlow.

Fern House Pit therefore exposes an important and fossiliferous remnant of the Taplow Gravel Formation of the Middle Thames. Further work is clearly required on these sediments in order to test the revised stratigraphical interpretation of this formation outlined above. The reports of a basal chalky gravel suggest that the deposits at Little Marlow are more likely to have fossils preserved in them than the more typical non-calcareous gravel of the Middle Thames, a view supported by the early records of mammalian remains. It is hoped that re-excavation of sections in the fluviatile deposits will provide future opportunities for modern studies of the sediments and their faunal content.

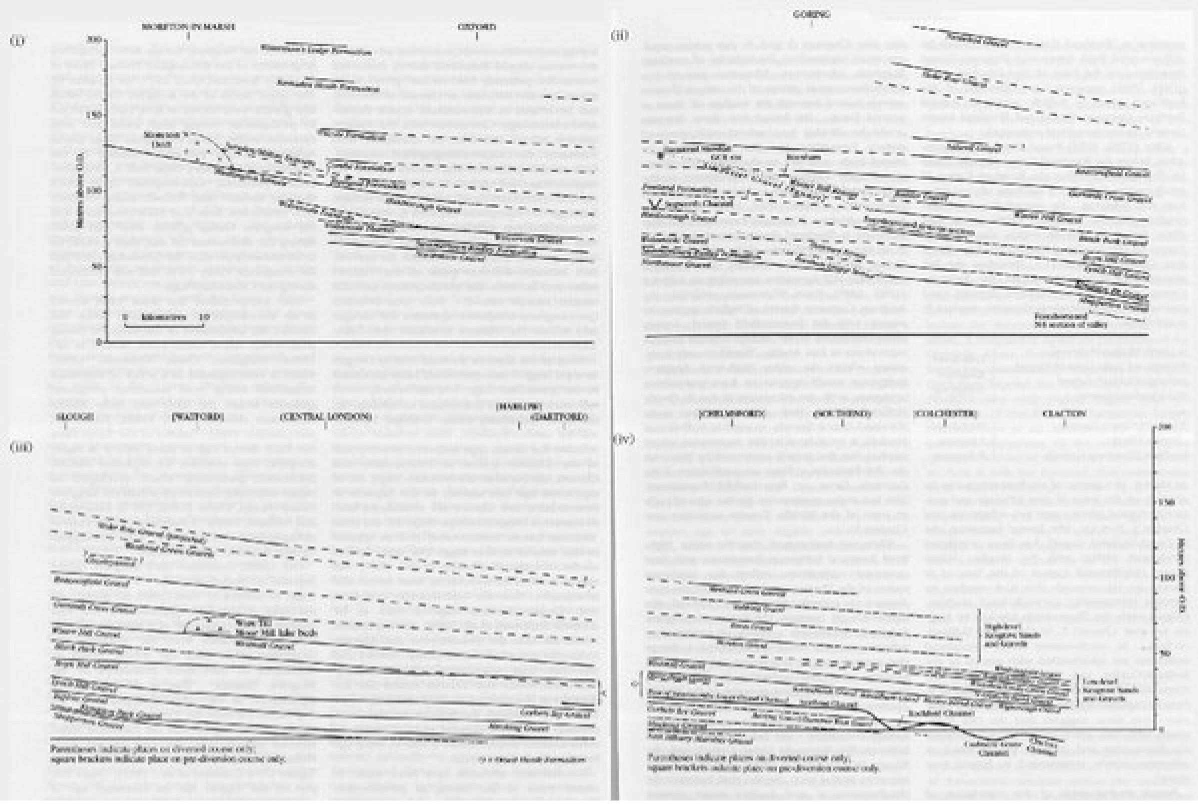
Conclusions

Fern House Pit provides exposures of the Taplow Gravel, which forms the Taplow Terrace, one of the best-known and longest recognized of the Thames terraces. Well-bedded river gravel is here overlain by a thick accumulation of unbedded gravelly deposits that have moved down the valley side from the north, probably under intensely cold conditions. Teeth of woolly mammoth and the temperate-climate-dwelling straight-tusked elephant (an even larger extinct species) have been found in the bedded gravel. The dating of the deposits is controversial. It is generally agreed that they fall in an interval of geological time known as the Saalian Stage, which began around 400,000 years BP and. finished 128,000 years BP. It used to be thought that this interval was a single cold (glacial) phase, intermediate between the Anglian, when the Thames was diverted by ice, and the 'last glacial', which ended only 10,000 years ago. However, it is now believed that a succession of climatic fluctuations occurred during the Saalian Stage, with three cold and two warm episodes. This view is far from being universally accepted, but the record of Thames terraces formed during the Saalian may prove critical in providing evidence for this complex series of climatic changes. To this end, the evidence from the Fern House Pit may hold the key to resolving some of the outstanding problems.

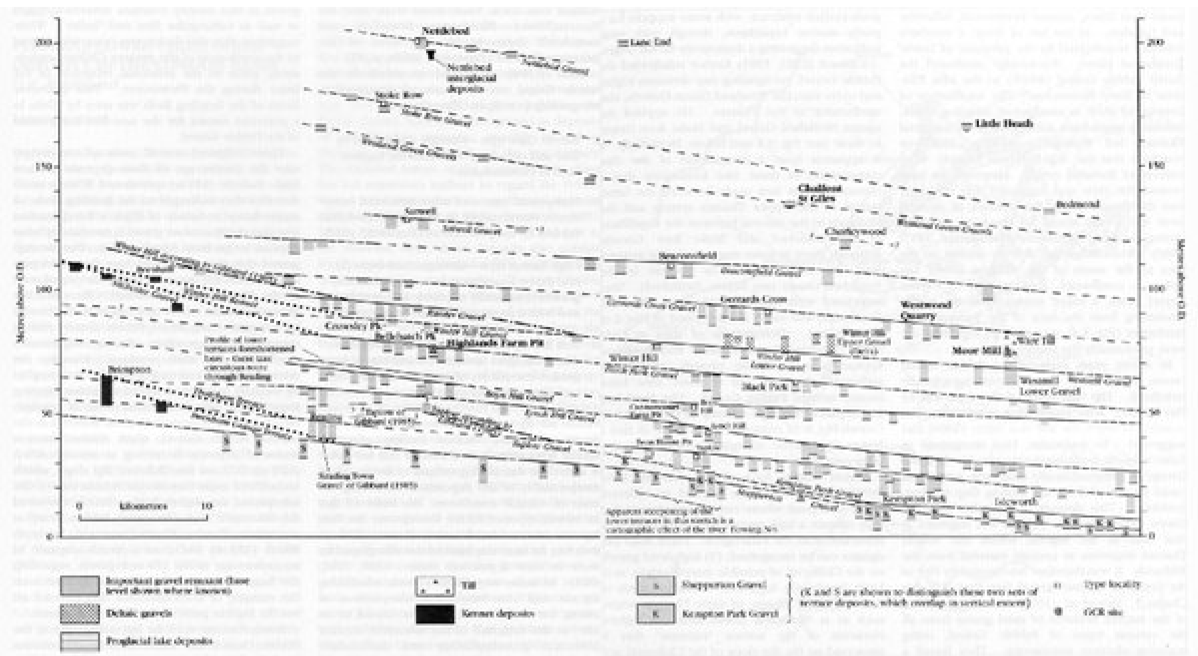
References



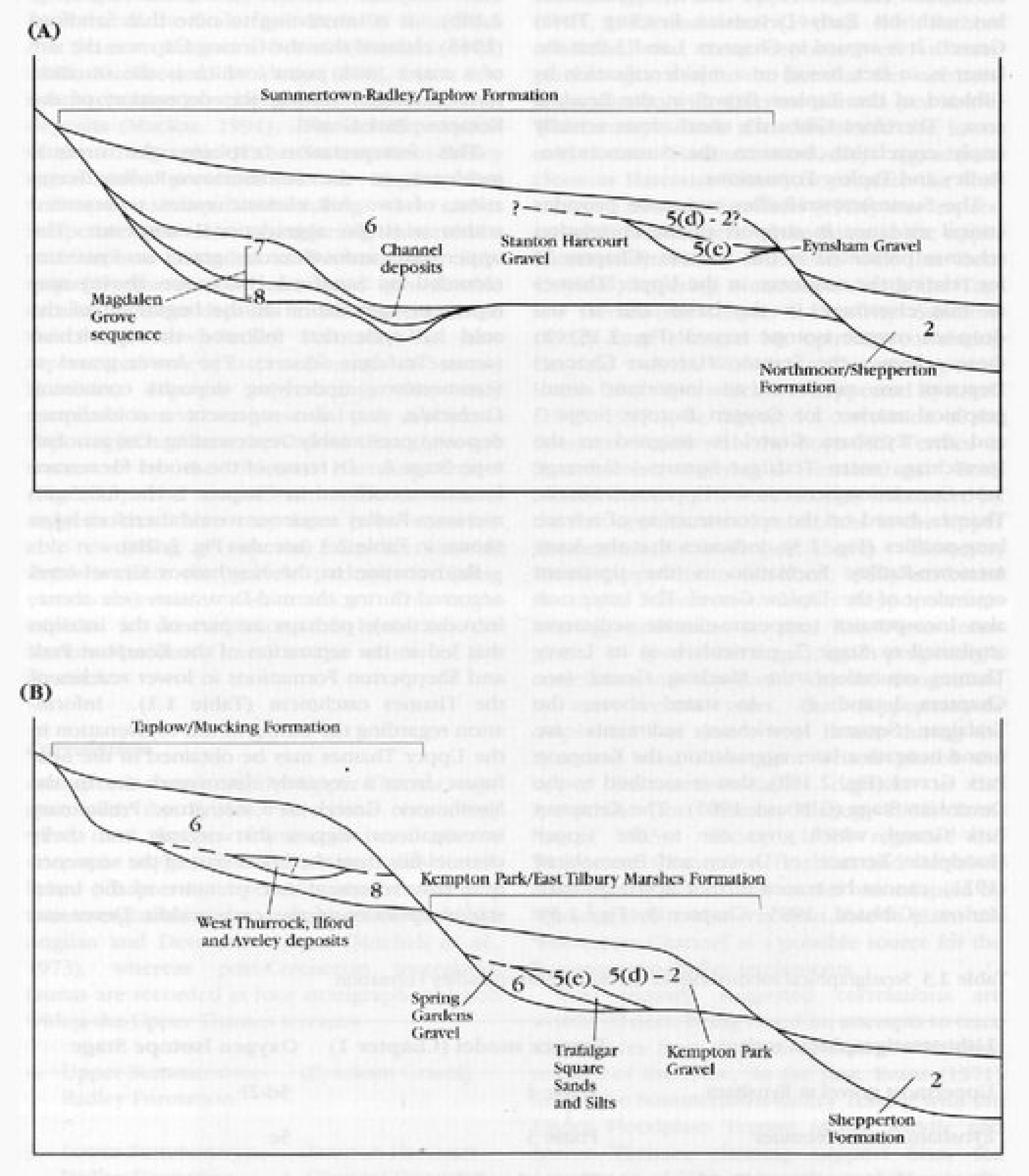
(Table 3.2) Clast-lithological data (in percentage of total count) from the Middle Thames and Vale of St Albans (compiled from various sources). The data concentrates on key sites, GCR sites and localities mentioned in the text. Note that many different size ranges are included and that these yield strikingly different data (this can be observed where results from different fractions from the same deposits have been analysed). As in (Table 4.2), (Table 5.1) and (Table 5.3), the igneous category includes metamorphic rocks (very rarely encountered) and the quartzite category includes durable sandstones. The Tertiary flint category comprises rounded pebbles (sometimes subsequently broken) reworked from the Palaeogene (see glossary with (Table 4.2)).



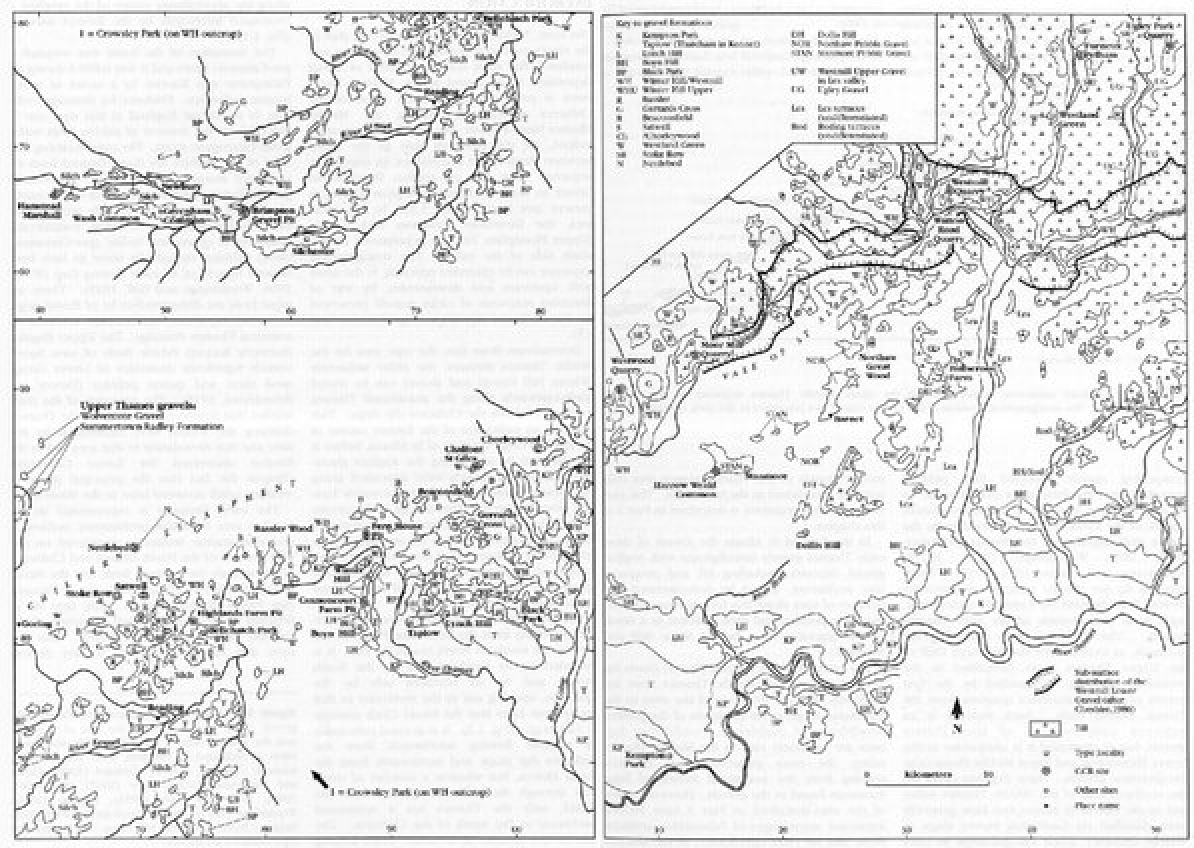
(Figure 1.3) Longitudinal profiles of Thames terrace surfaces throughout the area covered by the present volume. The main sources of information used in the compilation of this diagram are as follows: Arkell (1947a, 1947b), Briggs and Gilbertson (1973), Briggs et al. (1985), Evans (1971) and Sandford (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.



(Figure 2.18) Comparison of terrace stratigraphy upstream (A) and downstream (B) from the limit of the Kempton Park Formation. Numbers 2-8 indicate oxygen isotope stages.



(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.