Part 2 Pre-Diversion deposits in the Middle Thames Basin and the Vale of St Albans

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Introduction

In this part of Chapter 3 the most extensive gravel formations to have been produced by the Thames are described. These were laid down after the river gained headwaters that drained a large part of the West Midlands, probably also extending into Wales (the 'Severn-Thames' of early writers), and before the diversion of the river by the Anglian Stage glaciation of the Vale of St Albans. Evidence for this diversion, which took the river into its modern valley through London, is derived from sites in the Vale of St Albans (see below, Moor Mill). The 'Severn-Thames', as envisaged by many Victorian authors and recently promoted by Hey (1986; see Chapter 2), was a huge river, probably the largest to have existed in Britain during the Quaternary. It appears to have come into existence in the Early Pleistocene, although its initiation probably post-dated the interglacial represented at Nettlebed (see above). The decline of the Thames appears to have begun before its diversion into the modern valley, in the Anglian. According to Whiteman (1990), the river had already lost its headwaters beyond the Cotswolds by the Anglian Stage, by which time it was more or less confined to the present catchment (see Chapter 1). Evidence from Essex suggests that the river's size was much diminished by 'Cromerian Complex' times, during which it formed a series of terrace deposits in the north-east of that county for which few equivalents have thus far been recognized upstream in the Middle Thames (see Chapters 1 and 5).

The deposits of the pre-diversion Thames are so extensive, and their far-travelled component so dominant, that they have often been interpreted as glacial outwash material and were mapped by the Geological Survey largely as 'Glacial Gravel'. The earliest 'Severn-Thames' gravels are, however, found within the high-level deposits of the Pebble Gravel Group, already described in Part 1 of this chapter. The oldest major fluvial formation to be recognized in the London Basin is the Nettlebed Gravel (Gibbard, 1985; see above), but the first appearance of a significant component of material from beyond the present Thames catchment is in lower-level formations within the Pebble Gravel, the Stoke Row and Westland Green Gravels (Table 3.1).

Salter (1896) had recognized that the lowest deposits of Pebble Gravel type could be separately defined on the basis of their distinctive clast composition, which included abundant quartz and quartzites. He classified such gravels as his 'Bell Bar type'. Hey's (1965) reinvestigation of these gravels confirmed that they represent a compositionally distinctive gravel type that can be traced across the London Basin from the Goring Gap to eastern Hertfordshire. He demonstrated that the quartz and quartzite content of these deposits, which he named the 'Westland Green Gravels', was consistently at least twice that of other deposits that had been classified as Pebble Gravel. He also noted that pebbles of orthoquartzite from the Triassic ('Bunter') pebble beds of the Midlands were present in the Westland Green Gravels, but not in other varieties of Pebble Gravel. He noticed that remnants of Westland Green Gravels occurred at progressively lower altitudes eastwards from the Goring Gap, falling from 174 m O.D. to 107 m O.D. near Bishops Stortford. He concluded that these deposits, which he later traced into Essex, Suffolk and Norfolk (Hey, 1980; Chapter 5) were of Thames origin and that they represented the first influx of material from the Midlands through the Goring Gap.

A large proportion of the high-level gravels in the Thames valley has been classified at various times as 'Glacial Gravel'. This terminology dates back to Wood (1867, 1870; Wood and Harmer, 1868, 1872), who assigned the till and associated gravel of East Anglia to his 'Glacial Series'. Wood's classification was adopted by the Geological Survey throughout the London Basin (for example, Whitaker, 1875, 1889; Sherlock and Noble, 1922; Bristow, 1985). Generally the gravels were classified as 'Middle Glacial' and the overlying till (later the Lowestoft Till) as 'Upper Glacial' (Wood and Harmer, 1868, 1872). The lowest tier of Wood's tripartite classification, the 'Lower Glacial', referred to a till of more localized distribution, later identified as part of the Scandinavian-derived North Sea Drift. Although Wood's original classification seems to have had predominantly stratigraphical (rather than genetic) implications, the term led inevitably to the misinterpretation of the gravel deposits as glaciofluvial outwash.

White (1895) was the first to advocate the idea that such gravels were the remains of early terrace deposits of the Thames, but this view did not gain widespread acceptance until Sherlock and Noble (1912) traced gravels rich in Midlands lithologies from the Goring Gap towards Watford and suggested that the Thames formerly flowed along this more northerly route. Shrubsole (1898) subdivided the various high-level gravels of Berkshire and Oxfordshire according to their clast content, which he listed in percentages. He defined four categories (in addition to 'local gravel'), as follows: 'Pebble Gravel', 'Goring Gap Gravel', 'Quartzose Gravel' and 'Quartzite Gravel'. The last two incorporated the lower pre-diversion Thames formations, classified as 'Glacial' by most of Shrubsole's contemporaries. The change from 'Quartzose' to 'Quartzite' type is reflected in the progressive decline in the quartz : quartzite + sandstone ratios subsequently recognized within the pre-diversion Thames sequence (Hey, 1980, 1986; Green and McGregor, 1986; (Table 3.2)). Shrub-sole's work was therefore much ahead of its time, but he did not positively associate these gravels with the Thames.

The first attempt to define early terraces of the Thames within the so-called 'Glacial Gravels' of the lower Chiltern dip slope was by Saner and Wooldridge (1929). They recognized a 'Winter Hill Terrace' in addition to, and higher than, the previously identified terrace gravels. This and two older, much-dissected Thames aggradations, the 'Higher' and 'Lower Gravel Trains', were fully described by Wooldridge (1938). Hare (1947), on the basis of detailed geomorphological mapping of the area between Slough and Beaconsfield, redefined the Lower Gravel Train as the 'Harefield Terrace'. Later studies by Sealy and Sealy (1956), Thomas (1961) and Allen (1978) extended Hare's terrace mapping both westwards and eastwards. These workers added a number of new terraces to the Thames sequence, in some cases upgrading minor features that Hare had previously recognized. The separate existence of most of these 'has not been upheld in recent work by Gibbard (1985), although the Rassler Terrace of Sealy and Sealy (1956) has been interpreted in Chapter 1 as the product of a genuine and additional Thames aggradation, between the Harefield and Winter Hill Terraces as defined by Hare (1947).

Hey's (1965) work on the Westland Green Gravels pioneered an approach based on clast-lithological analysis (see Chapter 1). Using this technique, he distinguished the Westland Green Formation from the rest of the Pebble Gravel and recognized it as an early aggradation of the Thames, despite the fact that erosion has reduced this deposit to small patches of gravel capping hills. The Westland Green Gravels were the oldest Thames deposits to be recognized until Gibbard (1983, 1985) identified the earlier Nettlebed and Stoke Row Gravels (above, and (Table 3.1) and (Table 3.2)). Gibbard recognized another additional Thames formation, his Satwell Gravel, which is intermediate, within the terrace sequence, between the Higher Gravel Train and the Westland Green Gravels (Table 3.1). Gibbard (1977, 1978a, 1983, 1985) redefined the Thames terrace deposits on a lithostratigraphical basis, generally using the geographical names that had previously been applied to the terrace surfaces. He replaced the terms 'Higher Gravel Train' and 'Lower Gravel Train' (Harefield Terrace) with Beaconsfield Gravel and Gerrards Cross Gravel respectively, thus establishing the system of nomenclature presently in use.

It is interesting to note that the elevation of the deposit at Chorleywood [TQ 023 953], claimed by Moffat and Catt (1986a) as a further representative of the Westland Green Gravels, appears from its altitudinal position (Figure 3.6) more likely to result from a separate aggradation, hitherto unrecognized, between that formation and the later Satwell Gravel. According to analyses by Moffat (1986; Moffat and Catt, 1986a), this deposit, which is situated approximately 10 m below the expected level of the Westland Green Formation, contains higher levels of quartz and quartzites and less flint than other outliers of the Westland Green Gravels (Table 3.2). A further low-level Westland Green Gravels outlier with a high quartz and quartzite content appears to have been recorded by Green and McGregor (1978a), on the opposite side of the River Chess from Chorleywood, to the north-west of Croxley Green. Caution must be exercised in the interpretation of altitudinal evidence on the Chilterns dip slope, given the prevalence of Chalk solution phenomena. However, the apparent clast-lithological distinction is potentially significant, particularly as it is in keeping with the progressive trend, in successively lower pre-Gerrards Cross Gravel formations, of increasing quartzose rocks at the expense of flint (see (Table 3.2)). Further investigation of this area is called for, to assess whether an additional terrace formation is preserved there.

The Vale of St Albans Thames and its demise

Salter (1905) was apparently the first to recognize that fluvial drainage through the Goring Gap formerly continued north-eastwards into Hertfordshire by way of the Vale of St Albans. He observed that varieties of rock introduced into the area in glacial deposits are absent in the gravels associated with this former drainage route, but that they occur in all the gravels associated with the modern drainage system. He thus concluded that the initiation of this system must have coincided with the glaciation. Perhaps because these far-reaching conclusions were lost in a weighty description of deposits over the whole of south-eastern England, they received no immediate support. Thus Sherlock and Noble (1912), who claimed that the Thames formerly flowed from the Beaconsfield area towards Watford, through the Vale of St Albans, and that the glaciation of this district brought Thames drainage by this route to an end, are often given credit for the initiation of the theory. Later, Sherlock (1924), Sherlock and Pocock (1924) and Clayton and Brown (1958) described lacustrine deposits in the Vale of St Albans that, they suggested, were related to the ponding of the Thames by ice. Overspill from the proglacial lake so formed was considered to have effected the diversion of the river into its modern valley.

Wooldridge (1938, 1960) believed that the Thames had formerly occupied two different northerly courses, one running through the Vale of St Albans and a later route through Finchley (Figure 3.4). He suggested that both of these routes were abandoned as a result of ice advances, the Vale of St Albans route because of an early 'Chiltern Drift' advance (Barrow, 1919a) and the Finchley route as a result of the main 'Chalky Boulder Clay' advance (now attributed to the Anglian Stage). Wooldridge considered that the Higher and Lower Gravel Trains and the Winter Hill Terrace all continued eastwards via the intermediate Finchley route.

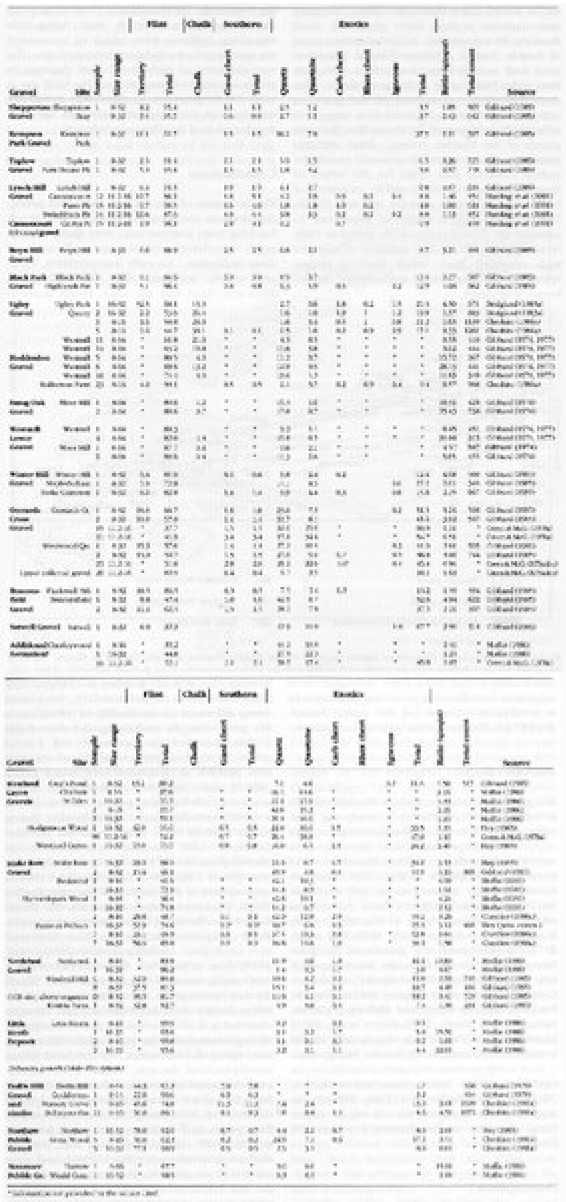
Hey (1965) traced his Westland Green Gravels from the Goring Gap along the Chiltern dip slope to Hertfordshire, thus confirming that the river at this time flowed through the Vale of St Albans. Later work showed that the Beaconsfield, Gerrards Cross and Winter Hill Gravels also extended along this route (Gibbard, 1974, 1977, 1983, 1985; Green and McGregor, 1978a, 1978b; McGregor and Green, 1978), rather than through Finchley, as suggested by Wooldridge. Hare (1947) had recognized that the Winter Hill Terrace, in the area immediately west of the Colne confluence, flattens downstream until it has a very small eastward gradient. He attributed this marked decrease in downstream gradient to the ponding of the Thames at this time by ice. Gibbard (1977, 1985) confirmed this interpretation, although he attributed the flattened terrace surface in this area to an upper, deltaic division of the Winter Hill Formation (Chapter 1), his 'Winter Hill Upper Gravel'.

Gibbard traced the fluviatile Winter Hill Gravel downstream beneath the glacial deposits of the Vale of St Albans, where it is synonymous with the Westmill Lower Gravel (*sensu* Cheshire, 1986a; see below, Westmill). He showed that this gravel is overlain in the Watford area by proglacial lake deposits, which are themselves overlain by till. Gibbard concluded that this lake arose from the same glacial ponding event that produced the Winter Hill Upper Gravel, and that the overspill from the lake eventually brought about the diversion of the Thames from its early course into its modern valley, without there having been an intermediate route as envisaged by Wooldridge. The evidence for a 'Chiltern Drift' glaciation, which Wooldridge believed to have diverted the Thames from the Vale of St Albans into his intermediate route, has been challenged by recent workers (Avery and Catt, 1983; Green and McGregor, 1983; McGregor and Green, 1983a). Cheshire (1981, 1983a, 1983b, 1986a; in Allen *et al.,* 1991) has further refined the stratigraphical succession in the Vale of St Albans and has recognized greater complexity in the sequence of Anglian glacial events in the area (this chapter, Moor Mill, Westmill and Ugley). Cheshire's work was based on a detailed examination of particle size, carbonate content and small-class lithology of till samples from sites throughout eastern Hertfordshire and western Essex. Cheshire has recognized four separate ice advances within the Anglian glaciation of the Vale of St Albans, the first of which diverted the Thames into its modern valley.

References

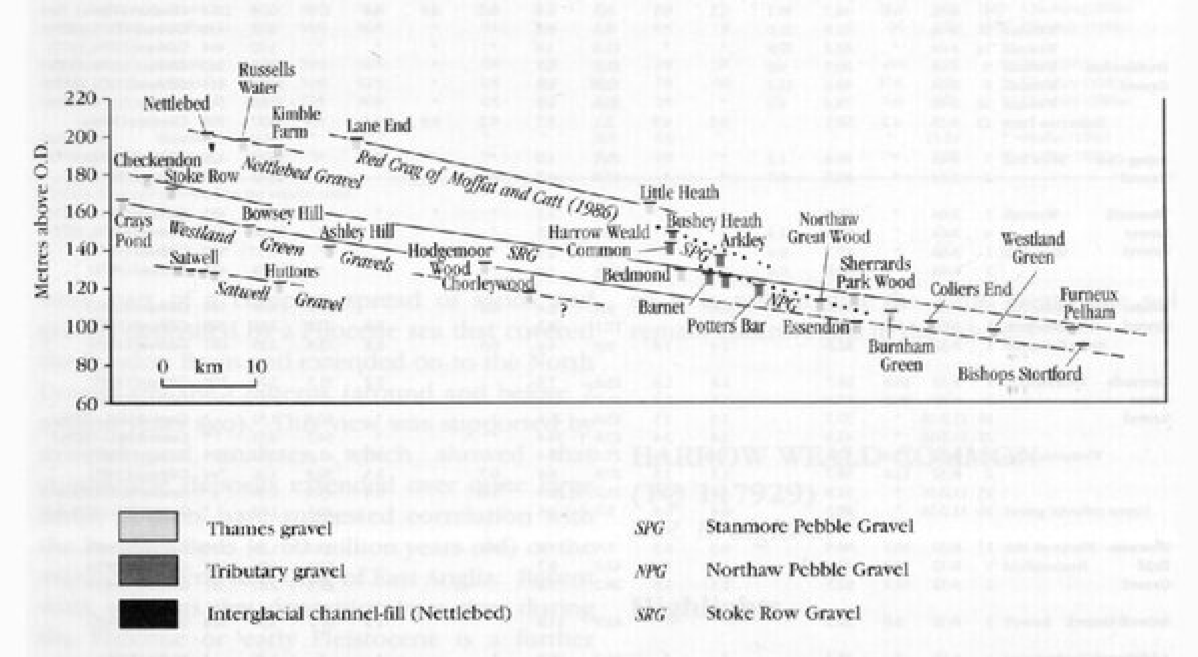
Thames formations	Tributary formations (Mole-Wey catchment?)	Group
Winter Hill Gravel	Dollis Hill Gravel	
Gerrards Cross Gravel	Equivalents may be represented within undifferentiated gravels west of Lower Lea valley	
Rassler Gravel		
Beaconsfield Gravel		
Satwell Gravel		
Chorleywood Gravel		
Westland Green Gravel	Northaw Pebble Gravel (400 ft)	Pebble Gravel
Stoke Row Gravel	Stanmore Pebble Gravel (500 ft)	
Nettlebed Gravel		

(Table 3.1) Correlation of tributary and main Thames formations within the Pebble Gravel Group and other pre-diversion gravels in the Middle Thames and Vale of St Albans regions.

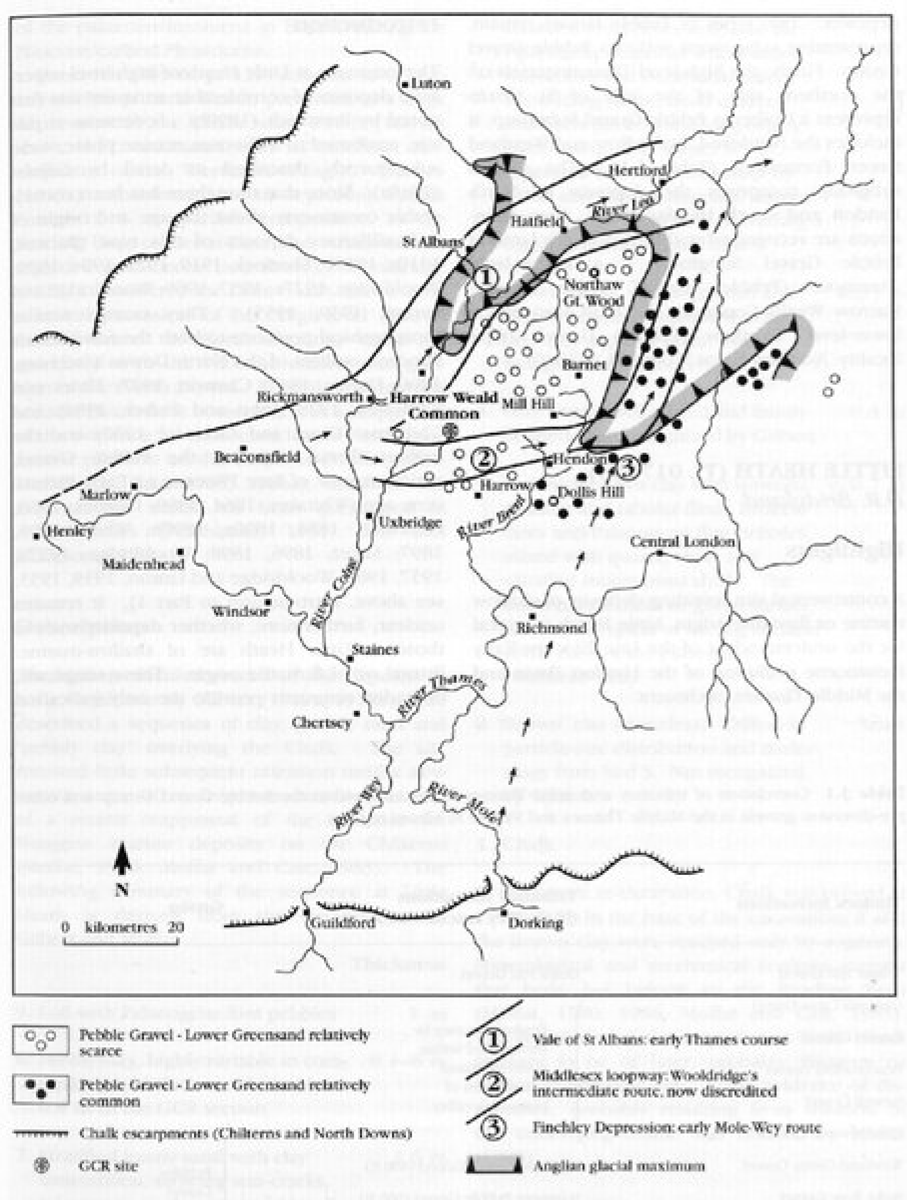


(Table 3.2) Clast-lithological data (in percentage of total count) from the Middle Thames and Vale of St Albans (compiled from various sources). The data concentrates on key sites, GCR sites and localities mentioned in the text. Note that

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 3.6) Long-profile diagram of higher deposits in the Middle Thames and the Vale of St Albans, showing the North London Pebble Gravels, attributed in this volume to deposition by a south-bank tributary of the early Thames.



(Figure 3.4) Map showing Wooldridge's reconstructed courses of the Thames and its tributary, the Mole–Wey. The distribution of Pebble Gravel remnants is also shown; those remnants in which Greensancl chert is scarce are distinguished from those in which it is relatively common.