Part 2: Eastern Essex

D.R. Bridgland

Introduction

The second part of this chapter deals with sites associated with the sequence of terrace deposits classified as 'East Essex Gravel' by Wood (1866b). These deposits primarily occupy the coastal district of Essex between the estuaries of the Thames and Blackwater, although they are also represented on Mersea Island and in the south-eastern corner of the Tendring Plateau (Figure 5.1). Bisected by the Crouch estuary, this region is characterized by a series of gravel terraces descending south-eastwards, towards the North Sea (see (Figure 5.15) and (Figure 5.16)). These give way inland to higher, isolated hills capped by Bagshot Beds, Claygate Beds and, frequently, high-level gravel remnants (still part of the East Essex Gravel), the highest of which are found on the Rayleigh Hills, up to a maximum height of 76 m O.D. at Hadleigh. The northward extension of part of this sequence to the Clacton area provides a direct link with the stratigraphical sequence on the Tendring Plateau, described in Part 1 of this chapter.

Wood (1866b) believed the East Essex Gravel to be a dissected spread of marine shingle formed in an embayment of the North Sea. Whitaker (1889) interpreted the deposits as a continuation of the gravels of the Lower Thames valley, laid down by a united Thames-Medway river. Holmes (1896), Gregory (1922) and Coles (1934) all attempted the reconstruction of former fluvial courses across this area, the first proposing a route trending east-north-eastwards to the north of the Langdon and Rayleigh Hills, his 'Romford River'. Of these three early workers, Gregory paid most attention to the deposits, noting abundant material from Kent in the composition of the East Essex Gravel. He envisaged these deposits as accumulations, of considerable antiquity, on the northern slope of an extended Weald, pre-dating the excavation of the modern Thames valley.

Work in the late 1960s by Gruhn *et al.* (1974) demonstrated that the gravels of this area represent the left-bank terrace deposits of a fluvial valley system whose eastern side has been lost to the North Sea. In an early application of clast-lithological analysis, they recognized an abundance of Lower Greensand material in the gravels, combined with a paucity of quartz and other 'exotic' lithologies from the north and west. They therefore attributed the bulk of the gravel to the Medway, although noting (after Whitaker, 1889) that the Thames was probably confluent with the Medway at that time. They suggested that the Medway, with a steeper gradient and a more proximal supply of gravel-forming source materials, provided the major part of the gravel load of the Thames-Medway system.

The work of Gruhn *et al.* pre-dated the publication of New Series geological maps of the area (Sheets 241 and 258/9; Bristow, 1985; Lake *et al.,* 1986; also maps in Hollyer and Simmons, 1978, and Simmons, 1978). The East Essex Gravel is divided on these maps into 'Sand and Gravel of Unknown Age' (high-level deposits south of the Crouch) and four terraces, designated 'Crouch Terraces 1–4', the nomenclature reflecting their distribution either side of the modern Crouch estuary rather than implying deposition by that river. A number of buried channels were recognized beneath these terrace gravels and were attributed to subglacial or partly subglacial streams associated with a hitherto unrecognized ice lobe occupying the southern North Sea (Lake *et al.,* 1977). These authors also suggested that the fourth terrace was formed at approximately the same time, as a kame terrace system at the margin of this ice lobe.

More recent appraisal of these deposits has augmented the Geological Survey mapping, using a lithostratigraphical approach based on detailed analysis of clast types and frequencies (Bridgland, 1980, 1983a, 1983b, 1986a, 1986b, 1988a). Two broad types of gravel have been recognized within Wood's East Essex Gravel, differentiated on both clast lithology (Table 5.5) and altitudinal distribution. They comprise an earlier 'High-level East Essex Gravel', composed almost exclusively of local and southern rocks, and a later type, the 'Low-level East Essex Gravel', containing similar materials but with the important addition of a significant suite of exotic rocks derived from the north and west. Within each of these two types of gravel, a number of separate terrace formations can be distinguished on the basis of geological mapping (Table 5.6); the High- and Low-level East Essex Gravels are therefore classified as subgroups.

The local gravel component is made up of flint from the Chalk and (in rounded pebble form) from the Palaeogene. Flint accounts for 35–68% of the High-level East Essex Gravel and 74–94% of the Low-level East Essex Gravel. The southern component consists largely of chert from the Folkestone and Hythe Beds (Lower Greensand), supplemented by sandstones, siltstones and ironstones from the Hastings Beds of the central Weald and rare arenaceous lithologies from the Lower Greensand (Bridgland, 1986b). This southern component falls from 13–65% in the High-level East Essex Gravel to 5–25% in the Low-level East Essex Gravel. The most marked difference between these two subgroups, however, is the presence in the Low-level East Essex Gravel of a small but consistent exotic component (0.5–3%), comprising vein quartz, various quartzites, Carboniferous chert, *Rhaxella* chert and igneous rocks (Bridgland, 1986b; see (Table 5.5)).

The High-level East Essex Gravel is believed to be the product of an extended River Medway, laid down by that river when the Thames flowed further north, prior to its diversion by Anglian ice. Gravels of this type can, in fact, be traced upstream to the Hoo Peninsula, north Kent, where they form part of a terrace system of the Medway (Bridgland, 1980, 1983a; Bridgland and Harding, 1985). The exotic rocks recognized in the Low-level East Essex Gravel are identical to those found in the terrace deposits of the Lower Thames (see Chapter 4). The Low-level East Essex Gravel is therefore attributed to the combined Thames-Medway, confirming the interpretation of Whitaker (1889). This type of gravel clearly post-dates the diversion of the Thames. The diversion was the direct result of the Anglian glaciation of the Vale of St Albans, which produced a proglacial lake, the overspill from which is thought to have effected the rerouting of the river (Gibbard, 1977, 1979; see Chapter 3, Part 2), probably by way of a preexisting left-bank tributary of the 'pre-glacial' Medway (Bridgland, 1988a). The diverted Thames appears to have joined the pre-existing Medway valley in the area of the present Thames estuary and then flowed northwards across eastern Essex, eventually rejoining its pre-diversion course in the Clacton area (Bridgland, 1980, 1983a, 1983b, 1988a; (Figure 5.5)).

This new route is exemplified by the distribution of the Southchurch Gravel of the Southend area and its downstream equivalents, the Asheldham Gravel of the Dengie Peninsula, the Mersea Island Gravel and the Wigborough Gravel of the Clacton area (see (Figure 5.2), (Figure 5.5) and (Figure 5.15)). The northern part of the old Medway course across eastern Essex was abandoned following the deposition of the Southchurch/ Asheldham Gravel, the river subsequently turning eastwards towards the North Sea Basin in the region of the modern Crouch estuary (Figure 5.5). Later gravels in this northern part of the area are products of tributary rivers such as the Chelmer and Blackwater (see Part 3 of this chapter). The Thames-Medway course across the coastal fringe of Essex is reflected by evidence offshore of the submerged (pre-Holocene transgression) valley, which turns northwards off Southend to run parallel to the coastline as far north as the Crouch estuary ((Figure 5.5)F), from which a substantial submerged tributary valley emerges (D'Olier, 1975; Bridgland and D'Olier, 1989). The East Essex Gravels essentially form left-bank terraces of this continuation of the Thames-Medway valley, the axis of which is now submerged.

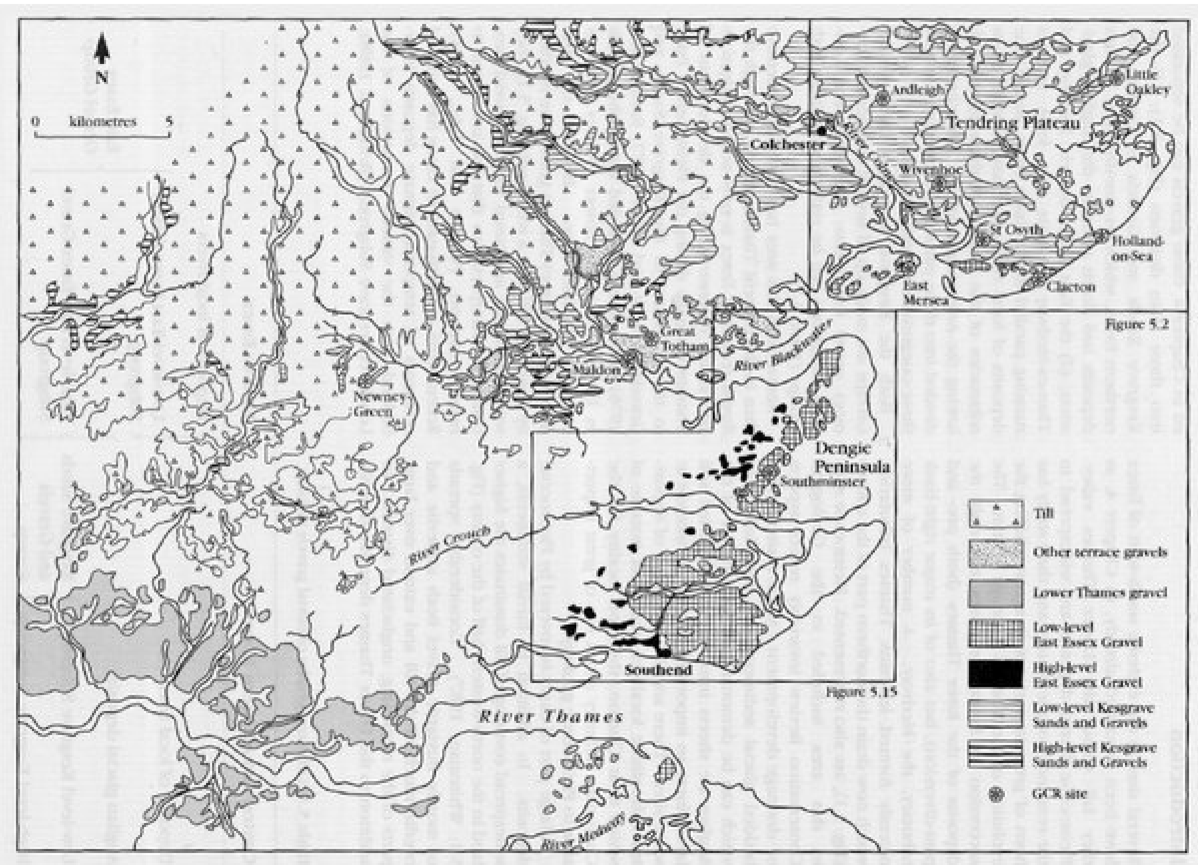
The abrupt compositional change between the High-level and Low-level East Essex Gravels provides an important stratigraphical marker, of great assistance to correlation both within eastern Essex and, thanks to its causal link with the Anglian glaciation and the associated diversion of the Thames, with other areas. Furthermore, the highest of the Low-level East Essex Gravel formations, the Southchurch/Asheldham Gravel, can be traced as far north as Clacton ((Figure 5.5)B), thus linking with the Kesgrave Group sequence in southern East Anglia (Bridgland, 1980, 1983a, 1988a). This stratigraphical marker is the basis for correlation of the lowest three High-level East Essex Gravel Medway formations with the lowest three Kes-grave Group formations on the Tendring Plateau, where the pre-diversion confluence between the two rivers has been recognized ((Figure 5.4); see Part 1 of this chapter).

Since it was the glacial diversion of the Thames that brought the river into its modern lower valley and effected the change to Thames-Medway drainage in eastern Essex, the terrace gravels of the Lower Thames (see Chapter 4) and the Low-level East Essex Gravel must be lateral equivalents. Correlation between the two areas has proved difficult, largely because of a lengthy downstream gap in the terrace record between Stanford-le-Hope and Southend, where the Pleistocene gravels are cut out by the extensive Holocene alluvium of Fobbing Marshes and Canvey Island. Previous correlations have relied primarily on the downstream projection of gravel bodies, although with some palaeontological and archaeological support (Bridgland, 1983a, 1988a). Recently it has become apparent, partly from offshore evidence, that a revision of the correlation scheme suggested by Bridgland (1988a) is necessary (Bridgland *et al.,* 1993; (Table 1.1) and (Figure 1.3); (Table 5.6)). Further discussion of this correlation will appear in the three site reports below.

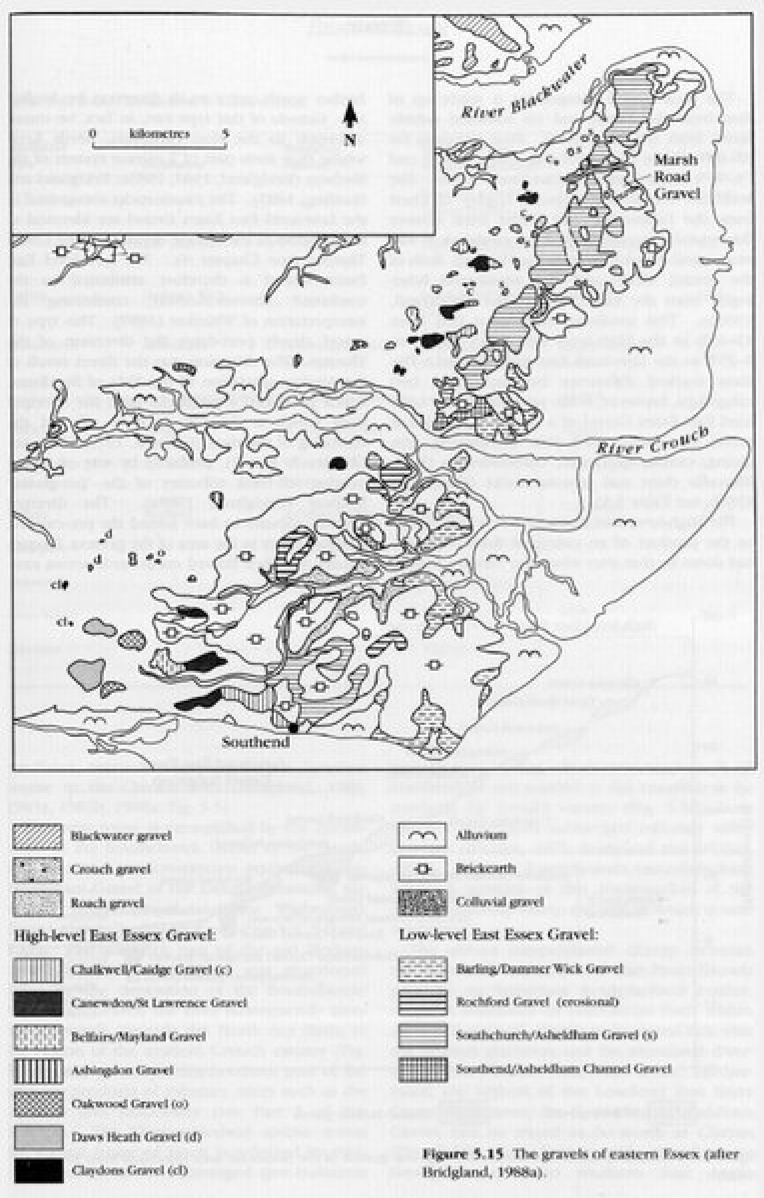
The buried channels first recognized by Lake *et al.* (1977), and attributed by them to glaciofluvial processes, have been reinterpreted as integral parts of the fluvial stratigraphy of the Low-level East Essex Gravel sequence (Bridgland, 1980, 1983a, 1988a; Bridgland *et al.,* 1993). These channels cover a range of altitudes, a possible reason for the original glaciofluvial interpretation. Bridgland (1983a, 1988a) believed that three separate downcutting events were represented, associated with three Low-level East Essex Gravel formations, his Southchurch, Rochford and Barling Gravels (Figure 5.15). Each of the channels contains basal gravels overlain by probable interglacial sediments, usually of apparent estuarine character, but these have only been recorded from c and have yet to be described in detail (new work on these channel-fills has been carried out recently by H.M. Roe). They are generally capped by the deposits mapped as terrace gravels, thus showing tripartite sequences that correspond to phases 2, 3 and 4 of the climatic model for terrace formation (see Chapter 1). The oldest of these channels is believed to represent an upstream continuation of the Clacton Channel, traditionally assigned to the Hoxnian (Warren, 1955; (Figure 5.5)A; see below, Clacton). It is also thought to be preserved at Cudmore Grove, East Mersea (see Cudmore Grove).

Eastern Essex is an important area for research on the British Pleistocene, because it lies directly between the Lower Thames valley and East Anglia, both of which have well-documented and detailed stratigraphical records. The area is also of considerable significance for studies of the southern North Sea, since many of the deposits in eastern Essex can be traced offshore (Bridgland and D'Olier, 1989). Because it lies at the edge of the North Sea Basin, the gravel sequence in eastern Essex is interbedded with estuarine channel-fills related to high sea-level events. The sequence in this area, although poorly documented through lack of exposure, promises to be more complete than elsewhere in the Thames system and will probably be the source of valuable future contributions to the Pleistocene record. As much of the evidence from this area lies deep below ground level, the coverage of GCR sites is limited. The Low-level East Essex Gravel is represented, however, in GCR sites at Clacton, Cudmore Grove (East Mersea) and Southminster. The Clacton and Cudmore Grove sites include important interglacial sequences; the former is also the internationally recognized type locality for the Clactonian Palaeolithic Industry. It is possible that future research in this area will result in other important sites being recognized and added to this coverage.

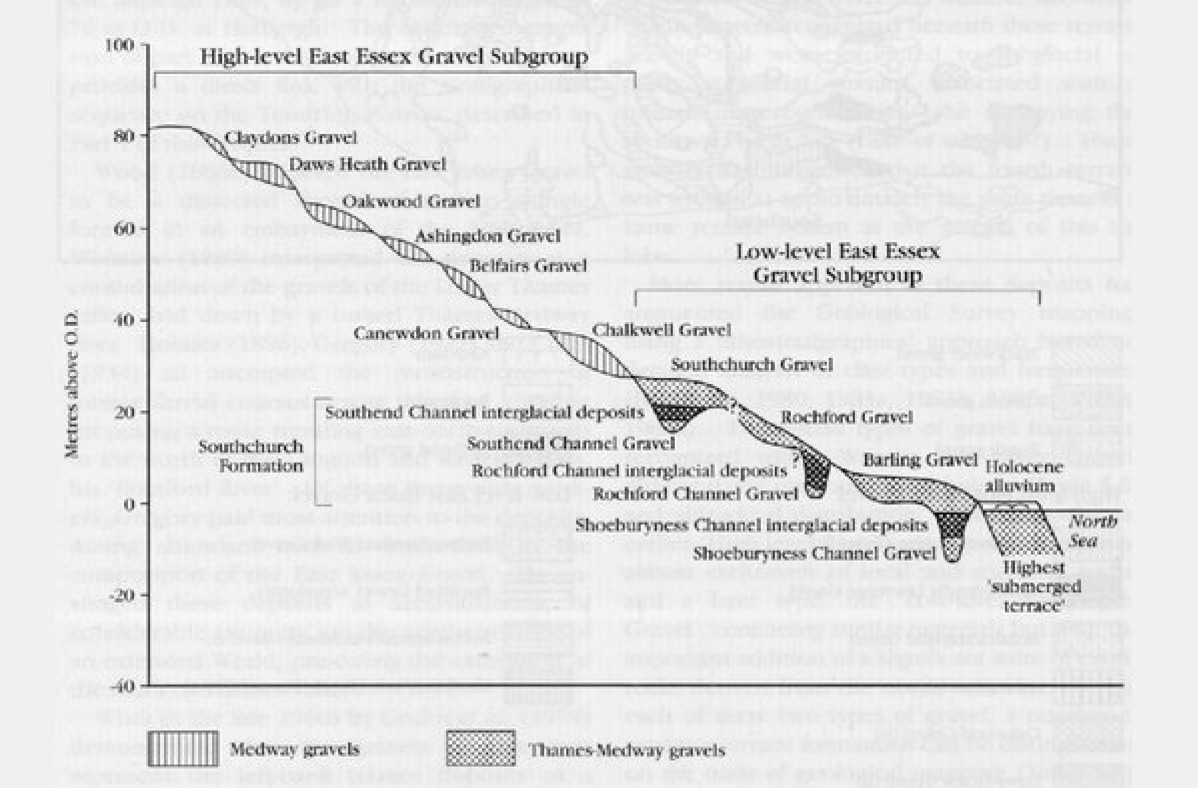
References



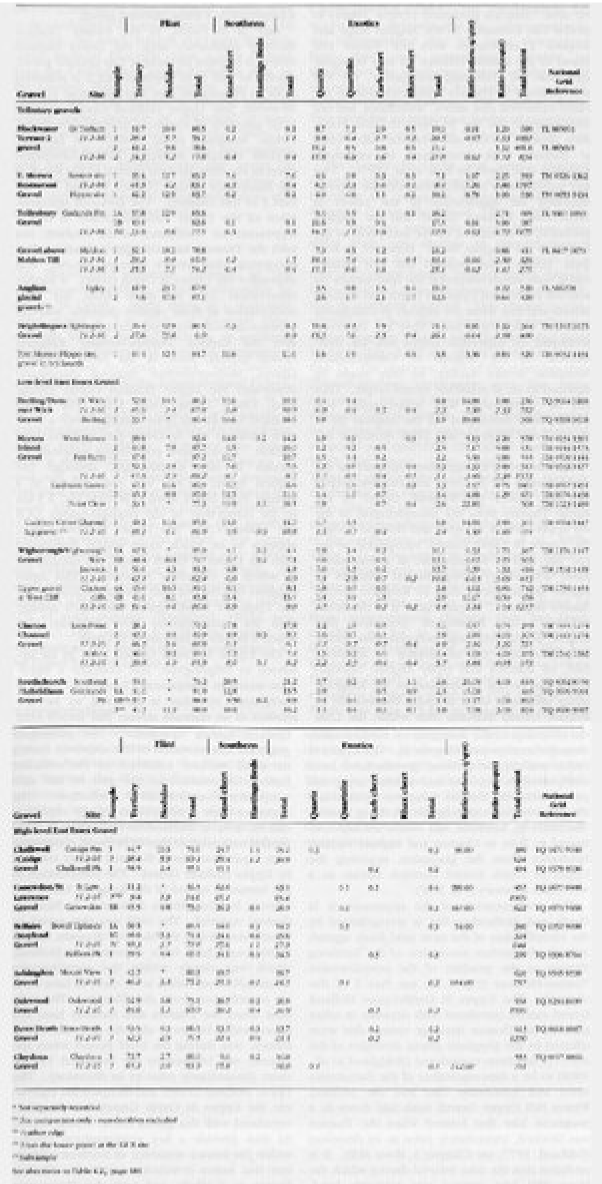
(Figure 5.1) Pleistocene geology of Essex, showing the various types of gravel described in this chapter, the extent of the Anglian till sheet and the relation of these to the existing drainage systems (modified from Bridgland, 1988a).



(Figure 5.15) The gravels of eastern Essex (after Bridgland, 1988a).



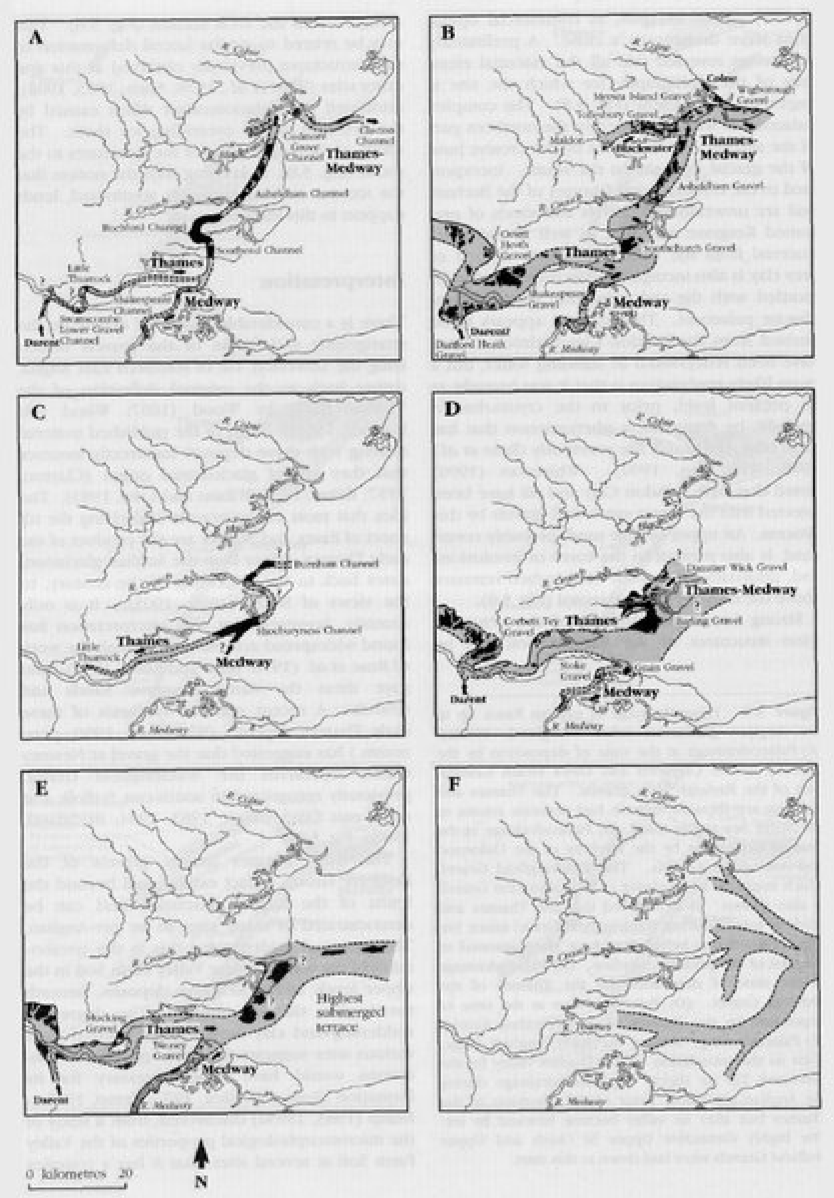
(Figure 5.16) Idealized transverse section through the gravels of the Southend area (modified from Bridgland, 1988a).



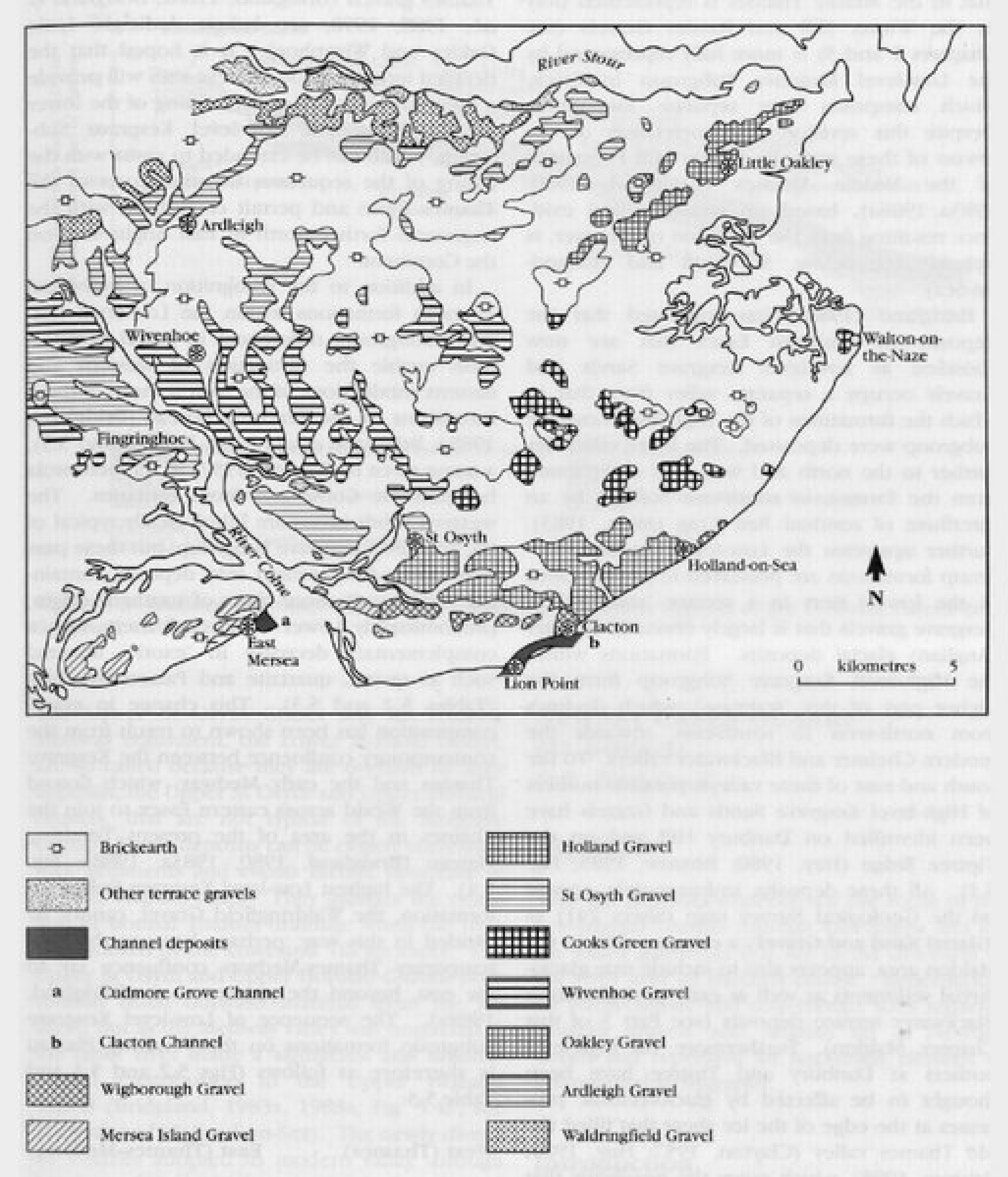
(Table 5.5) Clast-lithological composition of gravels described in Chapter 5, Parts 2 and 3.

Southend area	Dengie Peninsula	Tendring Plateau	Middle/Lower Thames equivalent	Stage	¹⁸O
– – – – – – – – – – – Offshore – – – – – – – – – – – –			Kempton Park/East Tilbury Marshes	late Saalian - Devensian	6-4 or 2
– – – – – – – – – – Below alluvium – – – – – – – – – – –			Taplow/Mucking	late Saalian	8-6
Barling	Dammer Wick		Lynch Hill/Corbets Tey	mid-Saalian	10-8
Southchurch	Asheldham	Mersea Island/Wigborough	Boyn Hill (and Black Park)	Anglian - early Saalian	12-10
– – – – – – – – – – – – – – Thames diversion (stratigraphic marker) – – – – – – – – – – – –				Anglian	12
Chalkwell	Caidge	St Osyth/Holland	Winter Hill	Anglian	12
Canewdon	St Lawrence	Wivenhoe/Cooks Green		early Anglian	12
Belfairs	Mayland	Ardleigh/Oakleigh	?Rassler	'Cromerian Complex'	21-13
Ashingdon		Waldringfield			
Oakwood			?Gerrards Cross		
Daws Heath			?Beaconsfield	Early Pleistocene	Pre-21
Claydons			?Satwell		

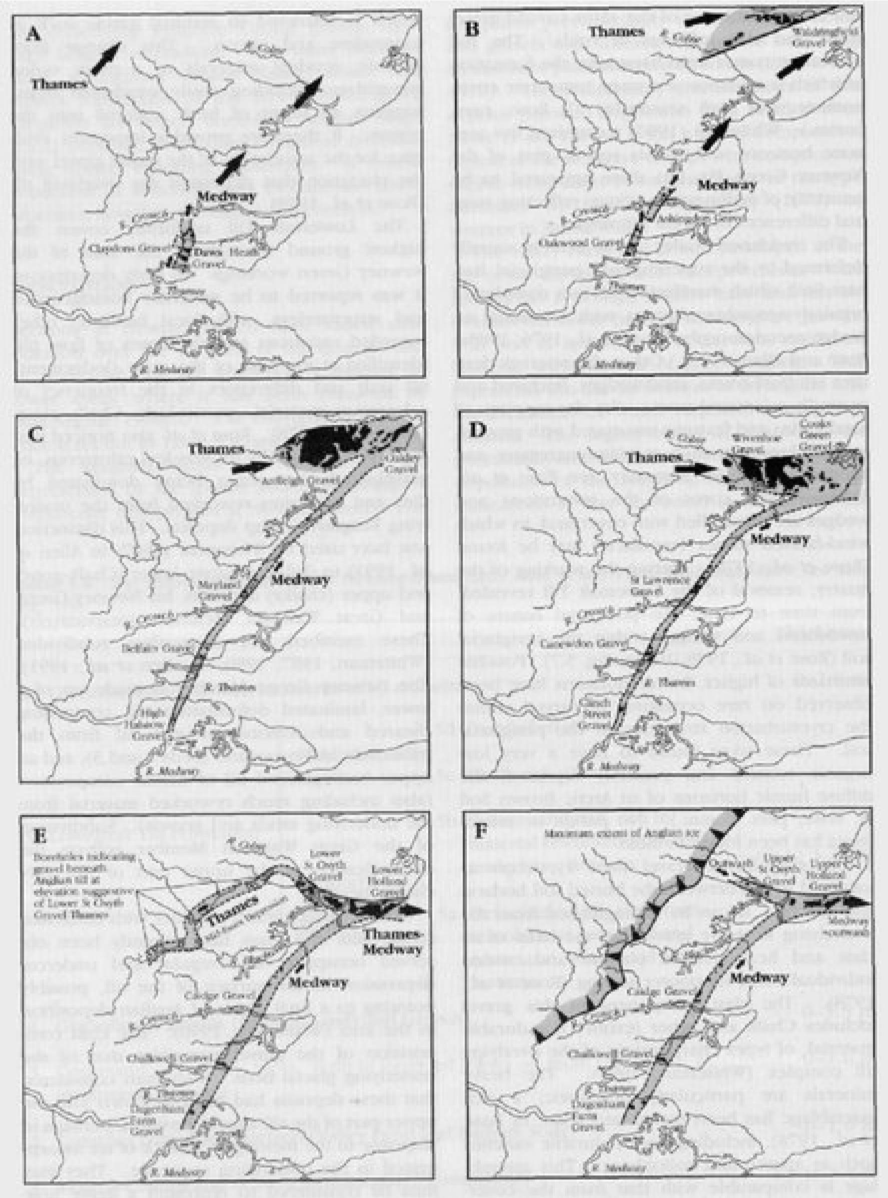
(Table 5.6) Gravel formations in eastern Essex.



(Figure 5.5) Palaeodrainage of Essex following the Anglian glaciation (modified from Bridgland, 1988a). (A) Palaeodrainage during the filling of the Southend/Asheldham/Clacton Channel. The Swanscombe Lower Gravel Channel and the Cudmore Grove Channel are both thought to be lateral equivalents. The Rochford Channel is now thought to represent an overdeepened section of the same feature (see text). This channel was excavated in the late Anglian by the newly diverted Thames and filled during the Hoxnian Stage (sensu Swanscombe). (B) Palaeodrainage during the deposition of the Southchurch/Asheldham Gravel.. This aggradational phase is believed to have culminated during the earliest part of the Saalian Stage, early in Oxygen Isotope Stage 10. (C) Palaeodrainage during the filling of the Shoeburyness Channel. The channel beneath the Corbets Tey Gravel of the Lower Thames is believed to be an upstream equivalent of this feature. It is thought that both the excavation and filling of the channel were intra-Saalian events, dating from Oxygen Isotope Stages 10 and 9 respectively. (D) Palaeodrainage during the deposition of the Barling Gravel. This is regarded as an intra-Saalian deposit, aggraded during Oxygen Isotope Stage 8. (E) Palaeodrainage during the deposition of the Mucking Gravel of the Lower Thames. The Thames-Medway equivalent of this formation is buried beneath the coastal alluvium east of Southend and can be traced offshore (Bridgland et ed., 1993). This aggradational phase occurred towards the end of the complex Saalian Stage, culminating early in Oxygen Isotope Stage 6. (F) Palaeodrainage during the last glacial. The submerged valley of the Thames-Medway has been recognized beneath Flandrian marine sediments in the area offshore from eastern Essex (after D'Olier, 1975).



(Figure 5.2) Pleistocene gravels of the Tendring Plateau (after Bridgland, 1988a).

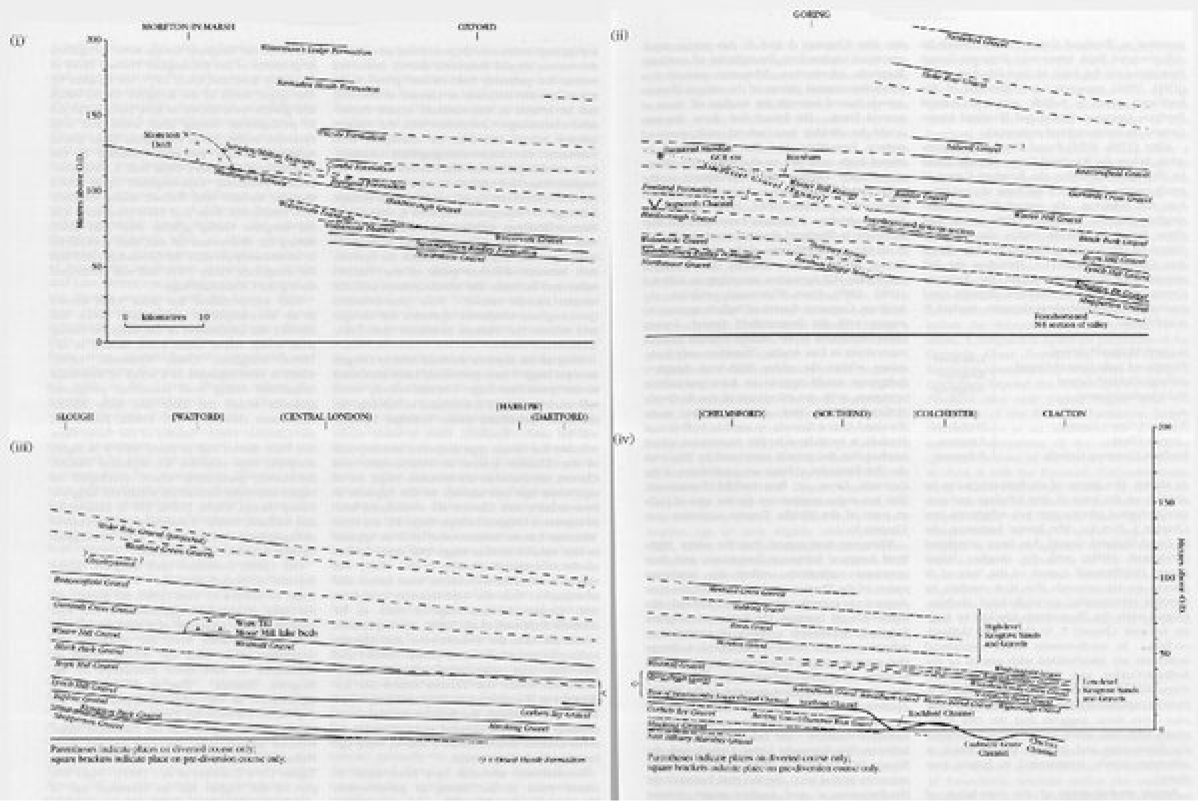


(Figure 5.4) Palaeodrainage of eastern Essex up to the Anglian glaciation (after Bridgland, 1988a): (A) Palaeodrainage at the time of deposition by the Medway of the Claydons and Daws Heath Gravels, part of the Rayleigh Hills gravels. The Thames and Medway are thought to have had separate routes to the North Sea at this time. (B) Palaeodrainage at the time of deposition by the Medway of the Oakwood and Ashingdon Gravels. The Waldringfield Gravel, which might be a correlative of the Ashingdon Gravel, is also shown. It is believed that the Thames and Medway joined during Waldringfield Gravel times, but this confluence is believed to have been situated to the east of the present coastline. (C) Palaeodrainage at the time of deposition by the Thames of the Ardleigh Gravel. (D) Palaeodrainage at the time of deposition by the Thames of the Wivenhoe Gravel. (E) Palaeodrainage during the early Anglian Stage, prior to the inundation of the Thames valley by the Lowestoft Till ice sheet. (F) Palaeodrainage during the Anglian glaciation, prior to the diversion of the Thames but after its valley became blocked by ice. The highly distinctive Upper St Osyth and Upper Holland Gravels were laid down at this time.

Age (in thousands of years)	Upper Thames	Middle Thames	Lower Thames	Essex	Stage	^{18}O
	Recent floodplain and channel deposits. Holocene alluvium of floodplain and coast				Holocene	1
10						
	Northmoor Gravel	Shepperton Gravel	Submerged	Submerged	late Devensian	2-4
	Rejuvenation event					
71						
		Temperate climate deposits at South Kensington (Isleworth centre), Isleworth and Kempton Park	Submerged	Submerged	early/mid Devensian? interstadial(s)	5a &/or 5c?
?						
	Cold climate gravels above Eynsham Gravel	**Reading area** U. levels of Taplow Gravel; **Slough area** Kempton Park Gravel	East Tilbury Marshes Gravel	Submerged	early-mid Devensian	5d-2
122						
	Eynsham Gravel	Within Taplow Formation; Trafalgar Square and Brentford deposits	Below floodplain	Submerged	Ipswichian (sensu Trafalgar Square)	5e
128						
	Stanton Harcourt Gravel	Taplow Gravel; Basal Kempton Pk Gravel - incl. Spring Gardens Gravel of Gibbard (1985)	Basal East Tilbury Marshes Gravel	Submerged	late Saalian	6
		Rejuvenation event				
		Taplow Gravel	Mucking Gravel			
186						
	Stanton Harcourt Channel Deposits, interglacial Magdalen Grove, Summertown etc.	Interglacial deposits at Redlands Pit, Reading	Interglacial deposits at Aveley, Ilford (Uphall Pit), West Thurrock, Crayford and Northfleet	Submerged	Intra-Saalian temperate episode	7
245						
	Basal Summertown-Radley Formation at some sites?	Basal Taplow Gravel?	Basal Mucking Gravel	Submerged		
	Rejuvenation event				mid-Saalian	8
	Wolvercote Gravel at some sites?	Lynch Hill Gravel	Corbets Tey Gravel	Barling Gravel		
303						
	Wolvercote Channel Deposits		Interglacial deposits at Ilford (Cauliflower Pit), Belhus Park, Purfleet and Grays	Shoeburyness Channel interglacial deposits	Intra-Saalian temperate episode	9
339						
	Basal Wolvercote Gravel	Basal Lynch Hill Gravel?	Basal Corbets Tey Gravel	Shoeburyness Channel - basal gravel		
	Rejuvenation event				early Saalian	10
	? Moreton Drift (Arkell, 1947a)					
	Hanborough Gravel	Boyn Hill Gravel	Orsett Heath Gravel	Southchurch/Asheldham/Mersea Island/Wigborough Gravel		
?						
	Reworked mammalian fauna in Hanborough Gravel		Swanscombe deposits	Southend/Asheldham/Cudmore Grove/Clacton Channel Deposits	Hoxnian (sensu Swanscombe)	11
423						
	Basal Hanborough Gravel?	Basal Boyn Hill Gravel?	Basal Orsett Heath Gravel (incl. Basal Gravel at Swanscombe)	Southend/Asheldham/Cudmore Grove/Clacton Channel - basal gravel		
	Rejuvenation event					
	Freeland Formation	Black Park gravel				
	Moreton Drift?	Anglian glacial deposits	Hornchurch Till	U. St Osyth/U. Holland Gravel	Anglian	12
	Freeland Formation	Winter Hill/Westmill Gravel	Valley did not exist as a Thames course prior to this	St Osyth/Holland Formation		
478						
	Sugworth Channel Deposits	Rassler Gravel?		Wivenhoe/Cooks Green Fm; Ardleigh/St Osyth Formation; Waldringfield Gravel	Cromerian Complex	21-13
?						
	Combe Formation	Gerrards Cross Gravel		Bures Gravel*	Early Pleistocene	pre-21
	Higher divisions of the Northern Drift Group	Beaconsfield Gravel; Satwell Gravel; gravel at Chorleywood; Westland Green Gravels; Stoke Row Gravel; Nettlebed Gravel; Nettlebed interglacial deposits		Moreton Gravel*; Stebbing Gravel*		

* Nomenclature for High-level Kesgrave Subgroup in Essex follows Whiteman (1990).

(Table 1.1) Correlation of Quaternary deposits within the Thames system. Rejuvenations that have occurred since the Anglian glaciation are indicated.



(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.