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NATURAL ENVIRONMENT RESEARCH COUNCIL

An annotated geological bibliography for the Quaternary of the Lower Lea Valley

IGS (South) Programme

Commissioned Report CR/04/024N

BRITISH GEOLOGICAL SURVEY

COMMISSIONED REPORT CR/04/024N

An annotated geological bibliography for the Quaternary of the Lower Lea Valley

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Summary

This bibliography lists 59 publications and published articles which include information about the Quaternary geology of the Lower Lea Valley area of north-east London and western Essex, between the line of the M25 at Waltham Abbey and the confluence with the River Thames. A further 14 publications are listed which might also yield relevant information, but which were not consulted.

It was prepared in support of a project led by the Museum of London Archaeology Service (MoLAS) to study the Quaternary deposits of that area, under a grant from the Aggregates Levy Sustainability Fund, through English Heritage.

1 Introduction

This bibliography lists publications and published articles which include information about the geology, particularly the Quaternary geology, of the Lower Lea Valley area of north-east London and western Essex, between the line of the M25 at Waltham Abbey and the confluence with the River Thames.

It was prepared in support of a project led by the Museum of London Archaeology Service (MoLAS) to study the Quaternary deposits of that area. The project area forms part of 1:10 000 scale geological sheets TQ38NW, TQ38NE, TQ38SE, TQ39NW, TQ39NE, TQ39SW, TQ39SE and TQ48SW.

Where these publications provide apparently useful information on the Quaternary sequences at specific localities within the Lower Lea Valley Project areas, these localities were marked on copies of the corresponding 1:10 000 scale geological map sheets, with a reference to the publication concerned. The relevant sheet numbers are given at the start of each entry in this bibliography. These annotated copies were delivered to MoLAS and are not available at BGS.

This list of 59 published works is a product, initially, of searches in the relevant BGS Memoirs (Whitaker, 1889; Bromehead, 1925a; and Ellison et al., 2003), and in on-line bibliographic databases using keywords 'Lea Valley' or 'Lee Valley'. Secondary searches were carried out for relevant material cited in within the works found. Finally, further on-line searches were carried out for additional works by the principal authors of works listed. The databases consulted were Geolib (Index to the BGS Library Collection), ISI Web of Science, Geoarchive, GEOREF, the ASLIB Index to Theses and ZETOC.

Only literature available in the BGS Library was consulted. This excludes archaeological or life science journals. A list of 14 publications which were not consulted but which are possibly relevant is given at the end of the bibliography. It seems unlikely, however, that these will yield much significant additional geological information.

A general account of the geology of the area is given by Ellison et al. (2004), which is Bibliography number 11.

2 Citations in date order

Prestwich, 1855;

Smith, 1867;

Tylor, 1868, 1869;

Woodward, 1869;

Smith, 1879, 1882a, b, 1882-83;

Smith, 1883a, b;

Woodward, 1882-1883;

Greenhill, 1884;

Smith, 1884;

Smith, 1887;

Whitaker, 1889;
Woodward, 1889-90;
Smith, 1894;
Kennard and Woodward, 1897;
Wilson, 1897-1898
Holmes, 1901-02a, b;
Monckton, 1901-02;
Kennard and Woodward, 1903-1905;
Hinton and Kennard, 1905-1906;
Kennard, 1909;
Woodward, 1909;
Warren, 1911, 1912-1913, 1914;
Reid, 1915-1917;
Warren, 1915-1917, 1923;
Bromehead, 1925a, b;
Warren et al., 1934;
Sherlock, 1937;
Reid, 1949;
Allison et al., 1952;
Holmes, 1952;
Holmes and Hayward, 1955;
Hayward, 1955-56, 1956-57, 1957-58;
Godwin and Willis, 1960;
Wymer, 1968;
Shotton and Williams, 1971;
Gibbard, 1974;
Godwin, 1975;
Gibbard, 1977;
Cheshire, 1981;
Roe, 1981;
Barton, 1982;
Coope and Tallon, 1983;
Harding and Gibbard, 1984;
Gibbard, 1985;
Wymer, 1985;
Cheshire, 1986;
Marsland, 1986;

Fairclough, 1987;
 Bridgland, 1988;
 Essex County Council, 1989, 1990;
 Bedwin, 1991;
 Strange, 1992;
 Bridgland, 1994;
 Gibbard, 1994;
 Chambers et al., 1996;
 Gibbard, 1999;
 Maddy and Bridgland, 2000;
 Sidell et al., 2000;
 Wilkinson et al., 2000;
 Ellison et al., 2004

3 Annotated bibliography

3.1 PUBLICATIONS CONSULTED

1. ALLISON, J, GODWIN, H, and WARREN, S H. 1952. Late-glacial deposits at Nazeing in the Lea Valley. *Philosophical Transactions of the Royal Society, Series B*, Vol. 236, 169-240.

TL30NE: north of the project area. A relatively complex sequence is described in detail. It includes a correlative of the 'Ponders End Arctic Bed', but also later peats deposited during post-glacial times. See Godwin and Willis (1960) for a radiocarbon date.

2. BEDWIN, O. 1991. An early Flandrian peat in the Lea Valley: excavations at the former Royal Ordnance factory, Enfield Lock 1990. *Essex Archaeology and Natural History*, Vol. 22, 162-163.

TQ39NE: includes a more precise grid reference for the Enfield Lock excavation than the more detailed paper by Chambers et al 1996. TQ 3742 9835.

3. BRIDGLAND, D R. 1988. The Pleistocene fluvial stratigraphy and palaeogeography of Essex. *Proceedings of the Geologists' Association*, Vol. 99, 291-314.

Discusses regional context of Lea Valley deposits but provides no specific details for localities within the project area.

4. BRIDGLAND, D R. 1994. *The Quaternary of the Thames*. Geological Conservation Review Series. (London: Chapman & Hall.)

Discusses regional context of Lea Valley deposits but provides no specific details for localities within the project area.

5. BROMEHEAD, C E N. 1925a. The geology of North London. *Memoir of the Geological Survey of England and Wales*, Sheet 256 (England and Wales).

Gives generalised descriptions of the deposits found within the area of Sheet 256 (North London), which covers nearly all the project area, followed by summaries of the details found at individual localities. Covers parts of the Thames deposits as well as parts of the Lea Valley. Incorporates details from papers listed elsewhere in this bibliography, together with information from a selection of borehole records and field observations.

6. BROMEHEAD, C E N. 1925b. The geology of the London District. 2nd edition. *Memoir of the Geological Survey of Great Britain*.

Revision of Woodward (1909); provides no extra relevant details.

7. CHAMBERS, F M, MIGHALL, T M, and KEEN, D H. 1996. Early Holocene pollen and molluscan records from Enfield Lock, Middlesex, UK. *Proceedings of the Geologists' Association*, Vol. 107, 1-14.

TQ39NE: provide a detailed description and analysis of a Holocene section near Enfield Lock. An organic mud at the base of the sequence gave a radiocarbon date of about 9.5 ka. See Bedwin (1991) for a more precise location. See Essex County Council (1989, 1990) for more information.

8. CHESHIRE, D A. 1981. A contribution towards a glacial stratigraphy of the Lower Lea Valley, and implications for the Anglian times. *Quaternary Studies*, Vol. 1, 27-69.

Deals only with glacial and near-glacial deposits of Anglian age. A map of the bedrock surface extends as far south as Waltham Cross (the northern edge of the project area).

TL30SW, TQ39NW, TQ39NE: Fig. 3, Fig. 4 SI boreholes for the M25 revealed a deep channel (the 'Waltham Cross Channel') cut into the bedrock (down to the Chalk) near the line of the A10, but no similar channel cut into the London Clay near the River Lea. Although this channel presumably extends southwards, no evidence is found, except for Hayward's (1957) borehole 274. This channel was attributed to Anglian sub-glacial meltwater erosion.

On p. 35, p. 42 he notes an occurrence of till overlying gravel in Theobald's park, Waltham Cross [TL340 006], immediately north of the project area. Details of a section resting on London Clay are given.

Correlation of this section is shown in Fig. 11, wherein the till is correlated with the Eastend Green Till of Gibbard (1974).

He argues that a north-south valley existed along the line of the present Lower Lea before southwards diversion of the Thames from its pre-Anglian course into Essex.

See also the description of Borehole 274 in Hayward (1957-58).

9. CHESHIRE, D A. 1986. The lithology and stratigraphy of the Anglian deposits of the Lea Basin. PhD thesis, Hatfield Polytechnic.

Abstract only seen. Seems to cover the same material as Cheshire (1981).

10. COOPE, G R, and TALLON, P. 1983. A full glacial insect fauna from the Lea Valley, Enfield, North London. *Quaternary Newsletter*, Vol. 40, 7-10.

TQ39SE: Organic silts found in sands and gravels near Pickett's Lock yielded a radiocarbon date of about 21.6 ka, and a cold climate insect fauna. The authors point out that this seems to be significantly younger than the 'Arctic Bed' (c. 28 ka) previously found in the Lea Valley and consider that correlation should not be assumed.

However, work by Hayward (1956-57) implies that this organic silt is part of the Arctic Bed. Note also that the determination of 28 ka was on material probably from Broxbourne or Nazeing (Shotton and Williams, 1971).

11. ELLISON, R A, WOODS, M A, ALLEN, D J, FORSTER, A, and PHARAOH, T C. 2004. Geology of London. *Special Memoir of the British Geological Survey*.

Not yet published. Gives a general account of the geological framework of the area, with few local details.

12. FAIRCLOUGH, K R. 1987. The River Lea, 1571-1767: a river navigation prior to canalisation. PhD thesis, Queen Mary and Westfield College, University of London.

Abstract only seen. Appears to deal with history/sociology, rather than archaeology/geology.

13. GIBBARD, P L. 1977. Pleistocene history of the Vale of St Albans. *Philosophical Transactions of the Royal Society, Series B*, Vol. B280, 445-483.

Discusses a region to the north of the project area.

14. GIBBARD, P L. 1985. *The Pleistocene history of the Middle Thames Valley*. (Cambridge: Cambridge University Press.)

Discusses a region west of the project area.

15. GIBBARD, P L. 1994. *Pleistocene history of the Lower Thames valley*. (Cambridge University Press.)

TQ38, TQ39: Discusses the detailed correlation of Pleistocene deposits of the Lower Thames. Many of his detailed sections cover the area immediately west of the southern project area, with a few crossing the project area. Mentions some localities in the Lea Valley but does not discuss the area in detail (p.110). Nevertheless, this information will assist in correlating the Lea Valley terraces with the Thames terraces.

Uses separate nomenclatures for the river terraces in the Middle Thames, the Lower Thames and the Lea Valley (Gibbard, 1999).

Suggests (p. 49) that terrace remnants in the north-west of the project area correlated by BGS with the Boyn Hill Gravel are instead correlatives of the Lynch Hill Gravel. This is, however, open to question – see notes on annotated photocopy.

Suggests (p. 85) that some river terrace deposits in the Hackney Downs area (and outside the project area) were laid down by the Lea, rather than by the Thames.

Includes observations on the artefact stratigraphy (pp. 166 onwards).

16. GIBBARD, P L. 1999. The Thames Valley, its tributaries, valleys and their former courses. 45-58 in A revised correlation of Quaternary deposits in the British Isles. BOWEN, D Q (editor). *Geological Society of London Special Report*, No. 23.

Gives brief notes on each named Quaternary deposit, and its correlation. See Gibbard (1994).

17. GODWIN, H. 1975. *The history of the British flora* (2nd edition). (Cambridge: Cambridge University Press.)

Several local sites are listed in Chapter IV (Recorded Sites). In each case the original source has been consulted for geological details, except for works by Reid (1949) and Warren et al. (1934).

The sources consulted appear elsewhere in this bibliography.

18. GODWIN, H, and WILLIS, E H. 1960. Cambridge University Natural Radiocarbon Measurements II. *Radiocarbon*, Vol. 2, 62-72.

TL30NE: Gives a radiocarbon age of about 28 ka, from a locality "probably near Nazeing or Broxbourne". By inference, this is from 'Warren's 1947 section', described by Hayward (1956-57), pp58-61. Warren states that 'a sample of the base of this peat [from a channel at this site] was sent to Dr Godwin.' This section is on the west side of the River Lea at TL382 072.

19. GREENHILL, J E. 1884. The implementiferous gravels of north-east London. *Proceedings of the Geologists' Association*, Vol. 8, 336-343.

TQ38NW: discusses localities just outside the project area and their relationship to the Hackney Brook.

20. HARDING, P, and GIBBARD, P L. 1984. Excavations at Northwold Road, Stoke Newington, north east London. *Transactions of the London and Middlesex Archaeological Society*, Vol. 34, 1-18.

TQ38NW: This site is just outside the project area. Gives a detailed description of the geology exposed in an excavation at this site, including pebble lithology, particle size distribution, micromorphology of clayey silt, and silt mineralogy. Also describes the archaeological remains found, which include Palaeolithic and Mesolithic implements.

21. HAYWARD, J F. 1955-56. Borehole records from the Lea Valley between Cheshunt and Edmonton. *Proceedings of the Geologists' Association*, Vol. 66, 68-73.

TQ39NE, TQ39SE: Records of these boreholes appear to be held in the NGRC archives, probably based on driller's records. Hayward appears to give greater detail, probably based on his own observations. He deduces the presence of an anticline in the bedrock, bringing the base of the London Clay up to meet the base of the superficial deposits at Brimsdown.

Only a generalised description of the Quaternary deposits is given, although Hayward notes that no clear correlatives of the Arctic Bed were found in these boreholes (although it is known to occur only a few hundred metres to the east).

His section gives a guide to the depth of the top London Clay surface. Accurate locations for the boreholes are given.

22. HAYWARD, J F. 1956-57. Certain abandoned channels of Pleistocene and Holocene age in the Lea Valley, and their deposits. *Proceedings of the Geologists' Association*, Vol. 67, 32-63.

TQ39SE: Describes the sequences through the superficial deposits (including several organic beds) into the top of London Clay, at Deephams Sewage Works. An occurrence of organic clays (presumably the same as dated by Coope and Tallon, 1983) was identified as the 'Arctic Bed'.

TQ39NE: details of a poorly located section through an infilled channel in the gravel proved by augering.

TQ39SE: sections in the alluvium at the Gothic Works, Angel Road, are described.

TL30NE: Describes a site near Carthage Lock, Broxbourne, visited by Warren in 1947. A sample of peat dated by Godwin and Willis (1960) is probably from this site.

23. HAYWARD, J F. 1957-58. Borehole records from the Lea Valley in the neighbourhood of Edmonton, Middlesex. *Proceedings of the Geologists' Association*, Vol. 68, 39-44.

TQ39SW, TQ39SE, TQ38NW: Hayward deduces the presence of an anticline in the London Clay at Angel Road Station, Edmonton, trending NE-SW.

He also describes an occurrence of till in a borehole near the Hedge Lane Pit. (cf. Cheshire, 1981). Otherwise few details of the Quaternary are given, but the borehole records provide a good guide to the shape of the top bedrock surface.

24. HINTON, M A C, and KENNARD, A S. 1905-1906. The relative ages of the stone implements of the Lower Thames valley. *Proceedings of the Geologists' Association*, Vol. 19, 76-100.

Rather general discussion with no locality details.

25. HOLMES, T V. 1901-02a. Additional notes on the sections shown at the new reservoirs in the Valley of the Lea, near Walthamstow. *Essex Naturalist*, Vol. 12, 224-231.

TQ39SE: Gives the depth at which the London Clay was found, at various points. He notes the presence of a channel in the bedrock surface, to a depth of 17 m, and speculates as to its origin.

26. HOLMES, T V. 1901-02b. Geological notes on the new reservoirs in the valley of the Lea, near Walthamstow. *Essex Naturalist*, Vol. 12, 1-16.

TQ39SE: Describes extensive sections in the alluvium in rather generalised terms. Describes the situation of two old boats found in the alluvium in this area. The boats are illustrated.

27. KENNARD, A S. 1909. Excursion to Ponders End. *Proceedings of the Geologists' Association*, Vol. 21, 172-173.

TQ39NE: Gives generalised descriptions of poorly located sections in the alluvium near Chingford, near the King George's Reservoir.

28. KENNARD, A S, and WOODWARD, B B. 1903-1905. The non-marine mollusca of the River Lea alluvium at Walthamstow. *Essex Naturalist*, Vol. 13, 13-21.

TQ39SE: Describes the sections through the alluvium briefly. Most of the paper is given to listing the molluscan fauna.

29. KENNARD, A S, and WOODWARD, H B. 1897. The post-Pliocene non-marine Mollusca of Essex. *Essex Naturalist*, Vol. 10, 87-103.

Provides no section details. Most of the paper is given to listing the molluscan fauna.

30. MADDY, D, and BRIDGLAND, D R. 2000. Accelerated uplift resulting from Anglian glacioisostatic rebound in the Middle Thames valley, UK?: evidence from the river terrace record. *Quaternary Science Reviews*, Vol. 19, 1581-1588.

Discusses regional development of river terraces in the Thames basin.

31. MARSLAND, A. 1986. The flood plain deposits of the Lower Thames. *Quarterly Journal of Engineering Geology*, Vol. 19, 223-247.

Describes the alluvium of the River Thames, including the portion at the mouth of the Lea Valley.

32. MONCKTON, H W. 1901-02. Excursion to the East London waterworks, Tottenham. *Proceedings of the Geologists' Association*, Vol. 17, 135-136.

TQ39SE: Mentions unlocated fossils and artefacts from near Tottenham Hale; gives a general description of the alluvium and contained fossils at a site between Girling Reservoir and the North Circular Road (Chingford Mills).

33. PRESTWICH, J. 1855. On a fossiliferous deposit in the gravel at West Hackney. *Quarterly Journal of the Geological Society*, Vol. 11, 107-110.

TQ38NW: Describes a section in a 'gravel-pit in Shacklewell Lane', but possibly actually in brickpits marked on the east side of Rectory Lane. A bed of organic sandy clay some 0.76 m thick, with temperate flora, occurs within the gravels.

Just outside the southern project area.

34. REID, C. 1915-1917. The plants of the late-glacial deposits of the Lea Valley. *Quarterly Journal of the Geological Society*, Vol. 71, 155-163.

TQ39SE, TQ39SW, TQ38NE: Discusses the fossil flora in 4 pits: Ponders End (Pickett's Lock); Angel Road, Hedge Lane and Temple Mills. No details of the geological sequence are given.

35. REID, E M. 1949. The late glacial flora of the Lea Valley. *New Phytologist*, Vol. 48, 245-252.

Gives detailed floras for the 'Arctic Bed' at 7 localities in the Lea Valley (Broxbourne, Waltham Cross, Ponder's End, Angel Road, Temple Mills, Hedge Lane, Barrowell Green). Suggests that three associations can be distinguished, indicating 'subarctic', 'cold or cool', or 'cool temperate' climatic conditions. No details of sections given.

36. ROE, D A. 1981. *The Lower and Middle Palaeolithic periods in Britain*. The Archaeology of Britain. (London: Routledge and Kegan Paul.)

Discusses the Palaeolithic archaeology of the Stoke Newington area. Provides details of Palaeolithic artifacts found at various sites in the London Boroughs of Waltham Forest and Hackney. Little geological information.

37. SHERLOCK, R L. 1937. Field meeting in the Lea Valley. *Proceedings of the Geologists' Association*, Vol. 48, 378.

Brief details of a few localities in the Hertford area.

38. SHOTTON, F W, and WILLIAMS, R E G. 1971. Birmingham University Radiocarbon Dates V. *Radiocarbon*, Vol. 13, 141-156.

TQ39SE: Gives a radiocarbon age of about 21 ka, Deephams Sewage Works, the locality described by Coope and Tallon (1983).

39. SMITH, W G. 1882a. Palaeolithic gravels of north-east London. *Nature*, Vol. 26, 579-582.

TQ38NW: Explains that the unabraded tools found on the Stoke Newington Floor, and associated deposits are related to the Lea, not the Hackney Brook. Describes certain sections above the Hackney Gravel in detail. Attributes probable cryoturbation to ice-contact deformation. See also Smith (1882-1883).

40. SMITH, W G. 1882b. Palaeolithic floors. *Nature*, Vol. 25, 460.

TQ38NW: Gives a precise location for one site of the 'Stoke Newington floor'; includes remarks on its stratigraphic position on the surface of a terrace gravel [Hackney Gravel], and buried by sand or brickearth [Langley Silt].

41. SMITH, W G. 1883a. Palaeolithic implements of north-east London. *Nature*, Vol. 27, 270-274.

TQ38NW: mainly concerned with describing the implements (which are beautifully illustrated) rather than their geological context.

42. SMITH, W G. 1883b. Excursion to Homerton. *Proceedings of the Geologists' Association*, Vol. 8, 124-131.

TQ38NE, TQ38SE; Reproduces sections illustrated in his 1882 paper in *Nature*, pp. 579-582, and implements in 1883, *Nature*, pp. 270-274. Little, if any, additional useful information.

43. SMITH, W G. 1882-83. Primaeval man in the valley of the Lea. *Transactions of the Essex Field Club*, Vol. 3, 102-147.

TQ38NW: Rather rambling essay, but gives details of a section at Stoke Newington (as in 1882a).

44. SMITH, W G. 1887. Primaeval man in the valley of the Lea. *Essex Naturalist*, Vol. 1, 83-91 and 125-137.

TQ38NW: Supplements papers by Smith in 1883 and 1884 with descriptions and illustrations of implements, and discussion of their manufacture. The second part includes a sketch section across the Lea Valley, showing the position of the 'Palaeolithic floor'. Details are given for only one locality near Bayston Road [TQ 3374 8623]. He also expands his list of molluscan remains.

45. STRANGE, P J. 1992. A new nomenclature for the river terrace deposits of North London. *British Geological Survey Technical Report*, WA/92/52.

Explains the basis for the terrace nomenclature used on BGS geological map sheet 256 (1:50 000), and the corresponding 1:10 000 scale maps. Takes account of Gibbard's work on the Middle Thames (1985), but not the Lower Thames (1994).

46. TYLOR, A. 1868. Discovery of a Pleistocene freshwater deposit, with shells, at Highbury New Park, near Stoke Newington. *Geological Magazine*, Vol. 5, 391-392.

TQ38NW: This letter includes locality details for the 'Stoke Newington pit' of later literature. This pit lies outside the project area but may be of relevance. Tylor describes a bed of shelly clay, with much wood, 6 m thick and 6.7 below the surface. This was overlain by brickearth. The freshwater and terrestrial mollusc fauna indicates a temperate climate.

47. TYLOR, A. 1869. On Quaternary gravels. *Quarterly Journal of the Geological Society*, Vol. 25, 57-100.

TQ38NW: discusses Quaternary sections at widespread localities, including his 'Stoke Newington Pit'.

48. WARREN, S H. 1911. Excursion to Ponders End and Chingford. *Proceedings of the Geologists' Association*, Vol. 22, 166-171.

TQ39SE, TQ39NE Describes the sequence in the Kempton Park Terrace near Pickett's Lock, including the Ponders End 'Arctic Bed'; also in the alluvium at this site.

Also describes relationships between gravel, brickearth and alluvium on the east side of the valley, at the south end of King George's Reservoir.

49. WARREN, S H. 1912-1913. On a late glacial stage in the Valley of the River Lea, subsequent to the epoch of River-drift Man. *Quarterly Journal of the Geological Society*, Vol. 68, 213-251.

TQ39SE, TQ39NE: Gives detailed descriptions of the 'Arctic Bed' in the Kempton Park Gravel near Pickett's Lock; also mentions exposures near Upper Edmonton (near Angel Road Station) and in Tottenham Marshes.

Also describes the alluvium at Pickett's Lock Pit and at the King George's Reservoir.

Detailed descriptions of the fauna and flora follow Warren's paper.

50. WARREN, S H. 1914. Report of an excursion to Edmonton. *Proceedings of the Geologists' Association*, Vol. 25, 285-287.

TQ39SE, TQ39SW: Brief notes on the Angel Road Pit and on sections found in Pymmes Park.

More detailed descriptions of the Kempton Park Gravel in the Hedge Lane Pit, including levels of stratigraphic horizons, including the Ponders End 'Arctic Bed'.

51. WARREN, S H. 1915-1917. Further observations on the late glacial, or Ponders End, stage of the Lea Valley. *Quarterly Journal of the Geological Society*, Vol. 71, 164-182.

TQ39SW: Provides fairly descriptions of three gravel pits at Hedge Lane, including a measured section in the Southgate District Council Pit (including the 'Arctic Bed'). Ascribes the upper gravels in the latter pit to the Middle Terrace, probably mistakenly.

TQ38NE: Also describes a section near Temple Mills, although this cannot now be precisely located. The section shows the 'Arctic Bed' in the Kempton Park Gravel.

TQ38SE: Describes a section in the Hackney Wick Pit, not now precisely located, which includes organic remains from the base of the gravel, indicating a temperate climate albeit somewhat colder than at present.

52. WARREN, S H. 1923. The late-glacial stage of the Lea Valley (Third report). *Quarterly Journal of the Geological Society*, Vol. 79, 603-605.

TQ39SW: brief discussion of plant remains from a clay bed in the Taplow Terrace at Barrowell Green, which apparently indicate a cold climate. Includes a brief report on the flora by Reid and Chandler, as an Appendix.

53. WHITAKER, W. 1889. The Geology of London and part of the Thames Valley (explanation of Sheets 1, 2 & 7). *Memoir of the Geological Survey of England and Wales*, Vol. i.

TQ38NW: pp 338-352: discusses occurrence of flint artefacts found in the Thames and Lea river deposits, with illustrations. Reproduces several of Worthington Smith's sections.

TQ38NW: pp 402-405: illustrates sections in brickearth and the Hackney Gravel at Stoke Newington and Hackney Downs (outside the project area)

TQ38NE: pp. 472-474: provides details of sections in the alluvium, mentioning fossil remains and artefacts.

54. WILKINSON, K N, SCAIFE, R G, and SIDELL, E J. 2000. Environmental and sea level changes in London from 10500 BP to the present: a case study from Silvertown. *Proceedings of the Geologists' Association*, Vol. 111, 41-54.

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