ST LUKE'S SQUARE, CANNING TOWN, LONDON BOROUGH OF NEWHAM (SITE CODE: LUC07): PALYNOLOGICAL ASSESSMENT

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INTRODUCTION

This report provides the results of a palynological assessment of a radiocarbon dated peat sequence from St Luke's Square, Canning Town, London Borough of Newham (Site code: LUC07; National Grid Reference: TQ 398 812) (Fig. 1). The assessment was undertaken to evaluate the potential of the sedimentary sequence for reconstructing the vegetation history of the site and its environs, and to identify any evidence for human activity and land use. The work was commissioned by Thames Valley Archaeological Services (TVAS) on behalf of Mizen Design Build Ltd., and constitutes one aspect of an archaeological evaluation of the St. Luke's Square site, in accordance with the Department of the Environment's Planning Policy Guidance (PPG16 1990) and local council policies on land redevelopment.

GEOLOGICAL CONTEXT

The site is situated on river alluvium *ca.* 300 m to the east of the lowest reaches of the River Lea and *ca.* 600 m NNE of the confluence of the Lea with the River Thames. Several published and unpublished reports describe the lithostratigraphy of the floodplain alluvium for the central eastern reaches of the River Thames in London, along with some information relating to palaeoenvironmental evidence. For this report, the following records are relevant:

1. Canning Town (NGR TQ 393 815) *ca.* 0.63 km NNW of the current site, at a ground-level of +3.0 m OD, Sidell *et al.* (2000) record from their Borehole 1 (BH1): 1.30 m of made-ground overlying 0.80 m of organic mud; 0.40 m of silt/clay; 2.40 m of organic mud lying unconformably above the surface of the gravels (*ca.* -3.0 m OD) of the Shepperton Gravel (*sensu* Gibbard, 1994), a Late Devensian stratum deposited either by the Lea or the Thames.

2. At St. Margaret's Convent, Canning Town (NGR TQ 399 826) *ca.* 1.25 km due north of the current site, Green *et al.* (2006a) record *ca.* 1.20 m of made-ground overlying an organic silt deposit (with a thin layer of peat *ca.* 0.14 m thickness) that is sandwiched between less organic sediments. Here, the alluvial sequence is underlain by Lea Valley Gravels (equivalent to the Shepperton Gravels stratum).
3. At West Silvertown Urban Village (NGR TQ 401 804) *ca.* 0.70 km SSE of the current site, Wilkinson *et al.* (2000) record in their Borehole 8 (BH8) *ca.* 1.50 m of made-ground (the surface of which lies at +8.0 m OD) overlying 1.21 m of silt/clay and 0.86 m of organic silt/clay. Below this lies a complex sequence of inter-bedded sand, silt/clay and peat (0.53 m), silt/clay (2.43 m), organic silt clay (0.36 m), peat (2.34 m) and organic silt clay (0.82 m) overlying gravel.
4. Green *et al.* (2006b) present a generally similar sedimentary sequence at the nearby Barrier Park East site (NGR: TQ 415 799) although they record only the later phase of peat accumulation reported at Silvertown by Wilkinson *et al.* (2000).

The sedimentary sequences outlined above demonstrate the presence of Holocene alluvial sequences that incorporate peat and organic mud that possibly formed at the floodplain margins, which in some cases lie unconformably over gravels deposited under cold climatic conditions during the Devensian glacial period (Gibbard, 1994). However, many of the sites lack a radiocarbon chronology for peat formation inception making inter-site correlation problematic.

METHODS

Field investigations

A 1.30 m column sample (LUC07 Sample 1) was recovered from the peat unit recorded in the south facing section of Trench 3 by TVAS. This was submitted to the Archaeological, Forensic & Environmental Scientific Services (AFESS), University of Reading for observation, recording, and sub-sampling for radiocarbon age determinations and palynological assessment of the peat unit.

Lithostratigraphic descriptions

The lithostratigraphy of the column sample LUC07 Sample 1 was described in the laboratory using standard procedures for recording unconsolidated sediments following

Troels-Smith's (1955) classification of physical properties, notably colour, composition, unit boundaries and inclusions. The results of the lithostratigraphic descriptions are provided in Table 1.

Radiocarbon dating

Two sub-samples were taken from 1) base of peat (-2.01 m to -2.02 m OD) and 2) top of peat (-0.75m to -0.76 m OD) in LUC07 (Column) Sample 1. The sub-samples were submitted for radiocarbon dating to Leibniz Laboratory, Kiel, Germany. The results were calibrated using CALIB rev 5.01 (Stuiver & Reimer, 1993) using data from Reimer *et al.* (2004). The results of radiocarbon dating of the peat unit are provided in Table 2.

Pollen assessment

Eleven sub-samples of peat were extracted from LUC07 (Column) Sample 1 for assessment of the pollen count. The sub-samples were prepared as follows:

- A standard volume of peat (1 cm^3) per sub-sample was chemically prepared using standard laboratory preparation techniques as outlined in Moore *et al.* (1991)
- Tablets containing *Lycopodium* spores were added to permit calculation of pollen concentrations
- Treatment of the sub-sample with HCl (7%) to remove carbonates
- Treatment of the sub-sample with NaOH (10%) to remove humic colloids
- Sieving to remove particles >180 µm
- Treatment of the sub-sample with HF (60%) to remove silicious material
- Treatment of the sub-sample with acetolysis to remove cellulose
- Samples were stained with 0.2% safranin and mounted in Kaiser's glycerol jelly.
- Each treatment stage was preceded and followed by thorough sample cleaning in filtered, distilled water.
- Quality control was maintained by periodic checking of pellets and the assembly of sample batches from random depths to check for systematic laboratory effects

Samples were analysed under a Leica DME biological microscope at x400 magnification, with critical determinations observed under an oil-immersion lens at x1000 magnification and phase contrast. Wherever possible, a minimum of 100 pollen grains were identified per

sample, excluding aquatics and spores. Pollen and spores were identified using the key and photographic plates in Moore *et al.* (1991), and by comparison with a pollen reference collection in the School of Human & Environmental Sciences, University of Reading. All taxa follow current nomenclature established in Moore *et al.* (*ibid.*) and the revisions of Bennett *et al.* (1994), with plant taxonomy following Stace (1991). Indeterminable grains were recorded according to Cushing (1967). All pollen frequencies are expressed as a percentage of the total sum of terrestrial pollen, excluding aquatics and spores. Aquatics and spore frequencies are expressed as percentages of the total sum of terrestrial pollen plus aquatics, and percentages of the total sum of terrestrial pollen plus spores, respectively. Pollen concentrations are expressed as number of pollen grains per cm^3 of sediment. The results of the pollen count assessment are provided in Table 3.

RESULTS AND INTERPRETATION OF THE LITHOSTRATIGRAPHY

The lithostratigraphic sequence of the south facing section in Trench 3, St. Luke's Square (Table 1) comprised *ca.* 0.02 m of dark grey coarse sand and flint gravel at the base (surface altitude -2.03 m OD), which is likely to represent the Late Devensian Shepperton Gravel (*sensu* Gibbard, 1994). Bridgland (1994) reported the upper surface of the Shepperton Gravel passing below OD in central London with a local relief on this surface of at least 2.0 m (Gibbard, *ibid.*). The upper surface of the gravel is therefore clearly within the expected height range for the Shepperton Gravel. Unconformably overlying the Shepperton Gravel at St. Luke's Square is a 1.42 m sequence of compacted peat/organic mud that could be associated with the thin peat layer recorded at St. Margaret's Convent and a sequence of wood peat/organic mud recorded in Canning Town (Sidell *et al.*, 2000) both to the north of the current site. The peat unit at St. Luke's Square is thicker than those at the aforementioned sites although Sidell *et al.* (*ibid.)* report the peat unit as thinning northwards, which is in accordance with the findings in this report. However, the complexity of the Holocene strata in this area of London makes correlation of the timing of peat accumulation difficult. Studies of sequences in the Canning Town region demonstrate that peat deposits may have been subjected to strong turbidity currents due to their proximity to the Lea/Thames confluence resulting in their erosion (Sidell *et al.*, 2000: p. 101). As such, the peat unit at St. Luke's Square may be an example of a localised marginal pocket of marshland development, at a location intermittently protected from the active turbidity currents of the confluence. Weale (2008) records the top of the peat

sequence at St. Luke's Square at *ca.* -0.61 m OD overlain by blue and brown alluvial clay to *ca.* +0.72 m OD, presumably deposited as a result of rising sea-level, which in turn is overlain by 1.10 m of made-ground.

Depth (m OD)	**Sediment Description**
-2.03	5Y 4/1 dark grey coarse sands and gravels with black, amorphous peat (Gg 2 Ga1 Th1); sharp contact with
-2.03 to -0.61	10YR 2/1 black, compacted wood and herbaceous peat (Tl2 Th2)
-0.61 to +0.72	Alluvial clay
+0.72 to +1.82	Made-ground

Table 1. Lithostratigraphic sequence of Trench 3 south facing section, St. Luke's Square, Canning Town, London Borough of Newham (Site Code: LUC07)

RESULTS AND INTERPRETATION OF THE RADIOCARBON DATING

The results of the radiocarbon dating indicate that the base of the peat sequence in Trench 3 (LUC07 [Column] Sample 1) is 3712 to 3632 cal yr BC (-2.01 m to -2.02 m OD) (Table 2). Peat from the top of LUC07 (Column) Sample 1, Trench 3 is 1616 to 1494 cal yr BC (-0.75m to -0.76 m OD). The $\delta^{13}C$(‰) values are consistent with that expected for peat, and there is no evidence for carbon contamination, either mineral or biogenic. The results indicate that the earliest record for peat accumulation at St Luke's Square occurred during the Early-Mid Neolithic cultural period, which continued into the Mid Bronze Age.

Laboratory code	**Material and location**	**Depth (m OD)**	**Uncalibrated Conventional Radiocarbon Years BP**	**Calendar Age (years BC)**	**2 Sigma Probability**	**$\delta^{13}C$ (‰)**
KIA37389 (AMS method)	Base of peat	-2.01 to -2.02	4870 ± 35 BP	3712 to 3632 cal BC	91.6 %	-28.66 ± 0.10
KIA37390 (AMS method)	Top of peat	-0.75 to -0.76	3270 ± 25 BP	1616 to 1494 cal BC	93.5 %	-25.32 ± 0.11

Table 2. Results of the radiocarbon dating of LUC07 (Column) Sample 1, St Luke's Square, Canning Town, London Borough of Newham (Site Code: LUC07)

RESULTS OF THE POLLEN ASSESSMENT

Pollen assemblage zonation was not undertaken for this assessment due to the following reasons:

- In general, preservation of pollen was poor with *ca.* 50% of the spectra showing visible signs of corrosion. As such, a distortion of the spectra due to the total disappearance of part of the pollen flora must be suspected. Counting pollen grains with any notable degree of corrosion will inevitably result in an over-representation of pollen more resistant to the processes of decay and corroded grains of easily recognizable taxa. This is apparent in the St Luke's Square peat sequence where pollen spectra are dominated by alder (*Alnus*), ferns (*Pteropsida*), hazel (*Corylus*-type), and to a lesser extent lime (*Tilia*).
- It was not possible to obtain a reliable pollen count greater than 100 grains from the peat between -0.75 to -0.76 m OD and -1.35 m OD to -1.60 m OD due to poor preservation. The remainder of the samples produced moderately abundant pollen to enable pollen counts and a preliminary interpretation to be offered.
- The limited pollen count presented in this assessment does not constitute a full palynological analysis of the St Luke's Square peat sequence. The total land pollen count in an assessment of this kind is small and a greater range of plant taxa will always be encountered during full analysis. As such, the pollen profile must be taken for what it is worth and considered with due caution, with only very general patterns of vegetation inferred from the limited dataset.

The pollen spectra throughout the peat sequence are dominated by tree and shrub taxa (in excess of 85% of the total pollen sum for each level) (Table 3). Lime (17%), hazel (11%) and oak (*Quercus*) (7%) are the dominant dryland taxa at the base of the sequence (-2.01 to -2.00 m OD), whilst alder (51%) is the dominant local wetland component. Also present at low frequencies are pine (*Pinus sylvestris*) and ash (*Fraxinus*). Low frequencies of herbaceous pollen taxa include grasses (Poaceae), sedges (Cyperaceae) and daisies (*Aster* -type). Spore taxa are represented by ferns (6%), bracken (*Pteridium aquilinum*) (5%) and polypody fern (*Polypodium vulgare*) (5%). Taxonomic diversity is restricted, although of note is an occurrence of ribwort plantain (*Plantago lanceolata*).

At -1.83 to -1.82 m OD cm the pollen spectrum is characterised by high percentage values of wetland pollen taxa, notably alder (52%), with lesser proportions of dryland pollen taxa including lime (9%), oak (5%), pine (4%) and elm (*Ulmus*) (1%). Values for hazel rise to 19%, whilst values for herbaceous pollen taxa remain low with Poaceae at 8%. Also present are buttercups (*Ranunculus*-type) and common sorrel (*Rumex* undiff.). Spore taxa are represented by ferns (11%) and polypody fern (5%).

Values for alder rise to 69% at -1.71 to -1.72 m OD, whilst dryland taxa such as lime and pine decline to 3% and 1%, respectively. Values for oak rise slightly to 9%. This is concomitant with a decline in hazel to 7%. Common heather (*Calluna vulgaris*) is also represented (1%) as a component of the shrubland taxa. Herbaceous taxa include daisies, sedges and grasses with values at <5%. Spores are represented by ferns (3%).

Alder continues to dominate the spectra (84%) at -1.23 to -1.24 m OD after which values steadily decline to 14% at the top of the sequence. This decline is concomitant with an increase in arboreal taxa diversity dominated by lime and to a lesser extent oak with hornbeam (*Carpinus*-type), birch (*Betula*), pine and elm represented (at <4%). Shrubland taxa include hazel, which rises from 8% at -1.23 to -1.24 m OD to 18% at -1.11 to -1.12 m OD, before falling to 11% at the top of the sequence. Other shrubland taxa include willow (*Salix*) (1%) and common heather (1%). Herbaceous taxa include campion (*Silene dioica*-type), members of the rose family (Rosaceae), garlics (*Allium*-type) and sedges at ≤ 5%. Grasses rise gradually from 1% at -1.23 to -1.24 m OD to 8% at the top of the sequence, which is concomitant with a slight rise in ribwort plantain (1% rising to 3%). Spore taxa are dominated by ferns (3% to 17%) along with bracken, polypody fern, buckler fern (*Dryopteris*-type) and mosses (*Sphagnum*).

St Luke's Square (LUC07 [Column] Sample 1)											
Pollen Taxa ↓ **Depth (m OD) →**	**2-3 cm**	**14-15 cm**	**26-27 cm**	**38-39 cm**	**50-51 cm**	**62-63 cm**	**74-75 cm**	**86-87 cm**	**98-99 cm**	**110-111cm**	**122-123 cm**
Pinus sylvestris	4	1	1	2	0	(0)	(0)	(0)	1	4	5
Quercus	7	6	4	12	4	(1)	(0)	(0)	9	5	7
Carpinus-type	2	0	0	2	0	(0)	(0)	(0)	0	0	0
Alnus glutinosa	30	36	48	60	84	(13)	(3)	(2)	69	52	51
Tilia	0	21	24	5	0	(1)	(0)	(0)	3	9	17
Ulmus	2	0	0	0	0	(0)	(0)	(0)	0	1	0
Betula	2	4	0	0	2	(0)	(0)	(0)	1	0	0
Fraxinus	0	0	0	0	0	(0)	(0)	(2)	0	0	1
Corylus avellana-type	24	17	14	18	8	(8)	(1)	(0)	7	19	11
Salix	0	0	1	0	0	(0)	(0)	(0)	0	0	0
Calluna	0	1	0	0	0	(0)	(0)	(0)	1	0	0
Ranunculus-type	0	0	0	0	0	(0)	(0)	(0)	0	1	0
Silene dioica-type	0	0	1	0	0	(0)	(0)	(0)	0	0	0
Rumex undiff.	0	0	0	0	0	(0)	(0)	(0)	0	1	0
Rosaceae	0	1	0	0	0	(0)	(0)	(0)	0	0	0
Plantago lanceolata	7	1	0	0	1	(0)	(0)	(0)	0	0	1
Aster-type	0	0	0	0	0	(0)	(0)	(0)	1	0	1
Cyperaceae	4	5	0	0	0	(0)	(0)	(0)	3	0	2
Poaceae	17	6	5	2	1	(2)	(0)	(0)	4	8	2
Allium-type	0	0	3	0	0	(0)	(0)	(0)	0	0	0
Sphagnum moss	0	1	0	0	0	(0)	(0)	(0)	0	0	0
Pteropsida (monolete) undiff.	19	13	17	17	3	(1)	(0)	(0)	3	11	6
Pteridium aquilinum	3	6	4	1	1	(0)	(0)	(0)	0	0	5
Polypodium vulgare	0	6	2	0	2	(0)	(0)	(0)	0	5	5
Dryopteris filix-mas	0	0	0	1	0	(0)	(0)	(0)	0	0	0
Total indeterminables	69	45	32	27	8				35	10	12
Pollen concentration (No. of pollen grains per cm^3 of sediment)	7663	15834	6658	15918	15220	5342	3767	1773	124300	16860	17398

Pollen proportions are expressed as a percentage of total land pollen, except spores, which are expressed as a percentage of total land pollen plus spores for each level. Total indeterminable pollen is expressed as a percentage of the total number of pollen and spores counted for each level. Numbers in brackets refer to actual number of pollen grains counted where a full count was not achieved.

Table 3. Results of palynological assessment of St Luke's Square peat sequence LUC07 (Column) Sample 1.

INTREPRETATION OF THE POLLEN ASSESSMENT

The base of the pollen profile indicates that alder was locally dominant, possibly forming a Carr community on the floodplain, with an understorey comprising grasses, sedges and polypody ferns. Surrounding dry-land communities were dominated by oak, lime and to a lesser extent ash, with an understorey consisting of hazel shrub and a range of herbs including grasses, buttercups, docks and sorrels and members of the daisy family. Hazel may also have been colonizing drier areas within the floodplain. The occurrence of lime is of particular palynological interest as lime is an insect-pollinated tree that is often under-represented in pollen profiles. Its importance as a dominant component of woodlands in southern and eastern England during the mid- to later Holocene period is now widely recognised (Greig, 1992; Sidell *et al.,* 1995). There is tentative pollen-stratigraphic evidence for human activity with the occurrence of ribwort plantain at the base of the peat, which may suggest soil disturbance through cultivation. Sidell *et al.* (2000) identify early agricultural phases in the form of localised woodland clearance in Southwark to the west of Canning Town, dated to 4630 ± 110 BP (3641–3083 cal BC). The Early to Middle Neolithic date of the early agricultural phases in Southwark post-dates the occurrence of ribwort plantain at St. Luke's Square. However, the occurrence of plantain spp. could equally represent disturbance caused by natural tree-throw or animal burrowing activity.

Alder Carr woodland continues to dominate the wetland vegetation possibly reaching maturity forming a closed structure that is likely to have largely eliminated many light-demanding taxa at *ca.* -1.23 to -1.24 m OD. There is no pollen-stratigraphic evidence for human activity e.g. the occurrence of cereal pollen although this may be due to the pollen filtering effects of the dense alder Carr woodland or simply be a symptom of poor pollen preservation. However, the drop in lime pollen values and low frequencies of dryland arboreal taxa at this level may provide indirect evidence of human activity impacting the natural environment due to woodland clearance for farming beginning in the Neolithic (see Scaife, 1987) and continuing through to the Bronze Age (e.g. Sidell *et al.* [2000] present convincing archaeological evidence for human activity in the Lower Thames Valley on both the wetland and dryland during the Bronze Age in the form of settlements, trackways and platforms).

Succeeding pollen spectra indicate that the composition and structure of the wetland and dryland vegetation cover changed in the upper levels of the peat sequence. On the wetland, the declining pollen values of alder in the top 50 cm of the peat sequence suggest the formation of open Carr woodland with an increased understorey of sedges, grasses and ferns. A

corresponding increase in the frequency of lime suggests that this became the dominant taxon in dryland communities, along with oak and to a lesser extent hornbeam, elm, ash with birch on the periphery. Hazel shrub appears to remain dominant in the dryland understorey and possibly the drier areas of the floodplain. Preservation of pollen in the uppermost radiocarbon dated level of peat from St. Luke's Square (-0.75 to -0.76 m OD) is extremely poor and any interpretation of pollen proportion fluctuation must be viewed with suspicion. However, the apparent drop in lime pollen at this level (radiocarbon dated to 1616–1494 cal BC), along with reductions in oak and hazel and rises in ribwort plantain and grasses, could correspond with a second lime decline, as reported at several sites during the Bronze Age by Sidell *et al.* (2000).

DISCUSSION

The base of the stratigraphic sequence in the south facing section of Trench 3, St. Luke's Square, Canning Town comprises the gravels of the Late Devensian Shepperton Gravel of the Thames sequence. Deposits unconformably overlying the gravels represent Holocene alluvium and resemble sequences recorded nearby. The different lithologies reflect variations in the depositional energy of the fluvial system; from that of high-energy channel flow as represented by the Shepperton Gravels; to a significant change in the local environment as reflected by peat formation that continued to accumulate for 1600 years. The shift from erosional channel processes to peat formation possibly occurred as a consequence of the lateral migration of the main river channel, and the subsequent formation and infilling of a back-swamp area, or in response to a reduction in the rate of relative sea-level rise (*sensu* Devoy, 1979). A radiocarbon date from the base of the peat sequence at St. Luke's Square (3712–3632 cal BC) (-2.01 to -2.02 m OD) demonstrates that peat formation occurred *ca.*1800 years earlier than that forming at St. Margaret's Convent, Canning Town (1978–1767 cal BC) (-0.62 to -0.48 m OD). It should be noted that the St. Margaret's Convent alluvium is underlain by the Lea Valley member (Shepperton Gravels equivalent) at a surface elevation of -1.40 m OD. The peat deposit is considerably thinner than that at St. Luke's Square and is underlain by inorganic silty sands thus demonstrating the variability of Holocene alluvial sequences within the catchment of the Lea/Thames confluence. However, the earliest peat formation at St. Luke's Square does appear to be broadly synchronous with the Middle Holocene peat forming at Silvertown as recorded by Sidell *et al.* (1996, 2000) and Wilkinson *et al.* (2000). The inorganic silts overlying the peat at St. Luke's Square represent further changes to the fluvial depositional/erosional environment indicating a virtually stationary water body resulting in the deposition of floodplain deposits after 1616 to 1492 cal BC.

At 3712 to 3632 cal BC, alder Carr dominated the wetland vegetation cover. On dryland, oak and lime with elm would have been dominant with an understorey comprising hazel shrub and a range of herbaceous taxa. The lack of direct pollen stratigraphic evidence for human activity during the period of peat formation at St. Luke's Square is perhaps surprising given the rapidly expanding body of archaeological and environmental evidence for later Neolithic/ Bronze Age activity in the lower Thames Valley although this report presents only a limited dataset. This notwithstanding, the occurrence of plantain spp. and the decline in lime pollen values and low overall pollen proportions of dryland arboreal taxa at the top of the peat could be indicative of human-induced disturbance of the natural environment. The inferred timing of a possible lime decline at St. Luke's Square occurs prior to 1616 to 1494 cal BC, which is consistent with other sites in the Lower Thames Valley where it has been dated from the late Neolithic onwards (Thomas & Rackham, 1996; Sidell & Wilkinson, 2000).

CONCLUSION AND RECOMMENDATIONS

Additional pollen work is not recommended for this sequence as little is to be gained by increasing the pollen counts due to the poor preservation of pollen throughout. The indications provided by the palynological assessment appear to fall broadly within a pattern established by other well-dated pollen stratigraphies within close proximity to St Luke's Square, e.g. Silvertown (Wilkinson *et al.*, 2000), St. Margaret's Convent (Green *et al.,* 2006), Preston Road (Branch *et al.*, 2007) and Station Limmo, Canning Town (Sidell *et al.,* 2000). It is likely that full pollen analysis of the St. Luke's Square peat sequence would produce broadly similar environmental data to that produced at the aforementioned sites.

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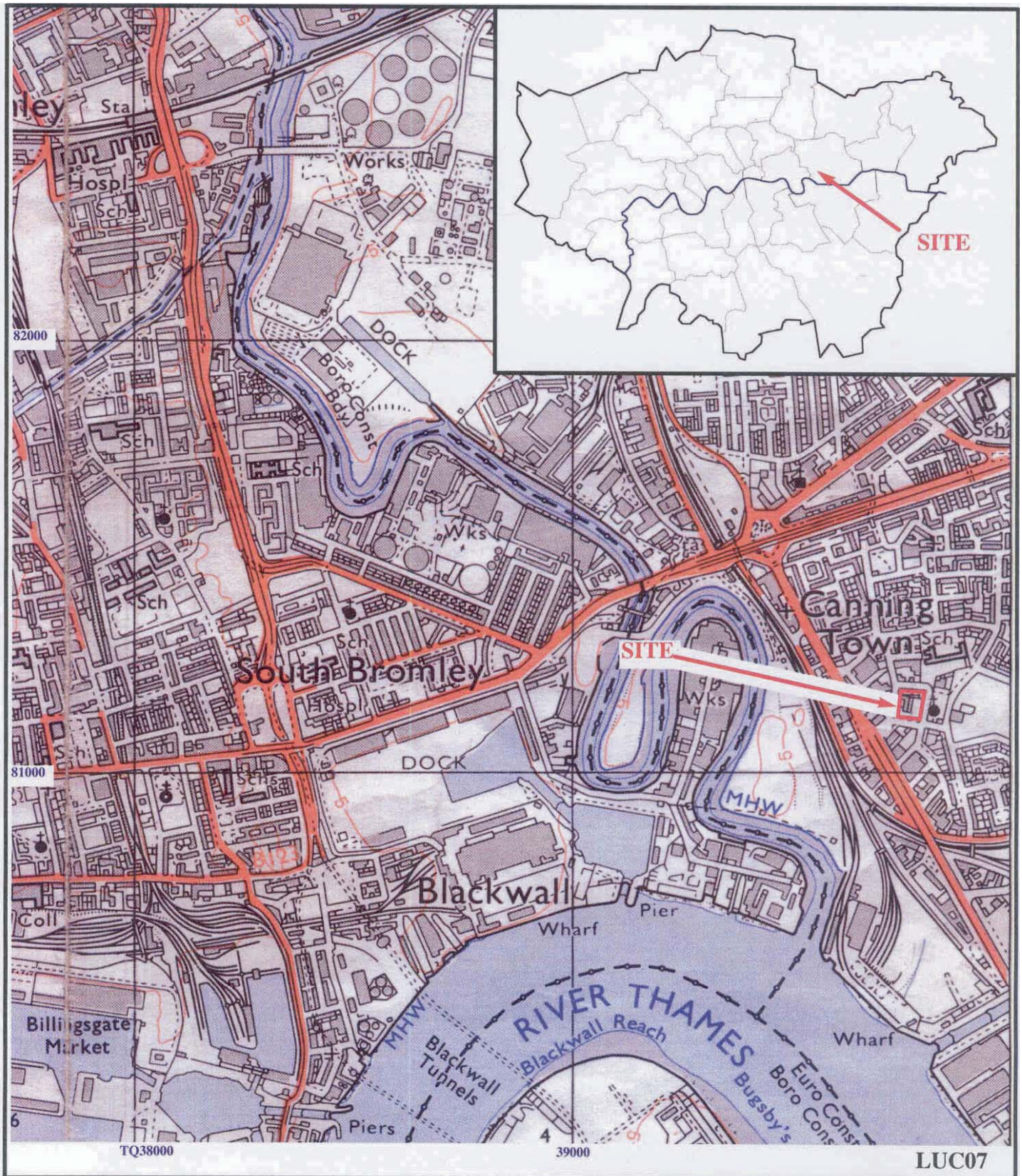

St Luke's Square, Canning Town, London Borough of Newham

Figure 1. Location of site within Canning Town and Greater London.

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St Luke's Square, Canning Town, London Borough of Newham, 2008

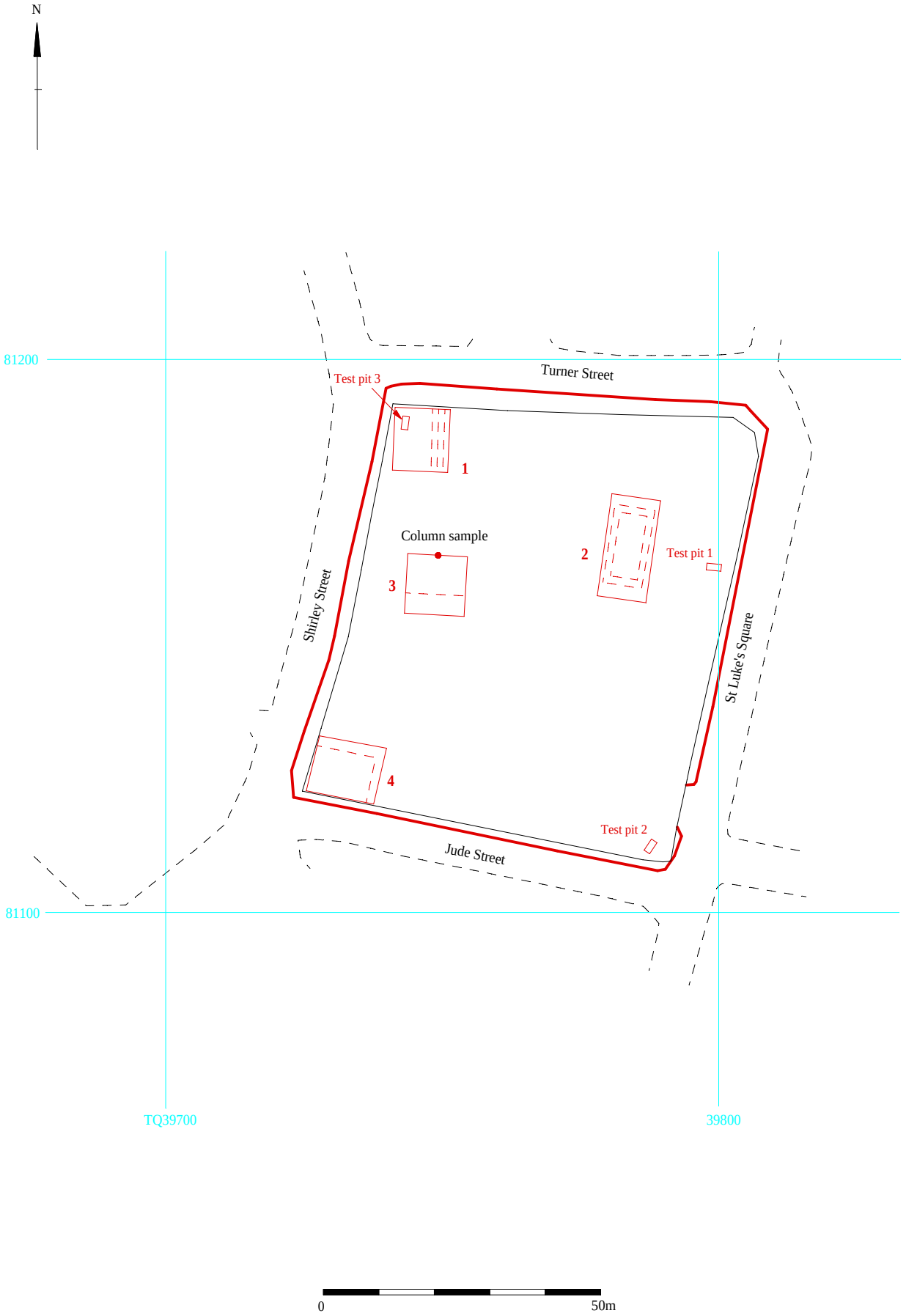

Figure 2. Location of trenches and column sample.