

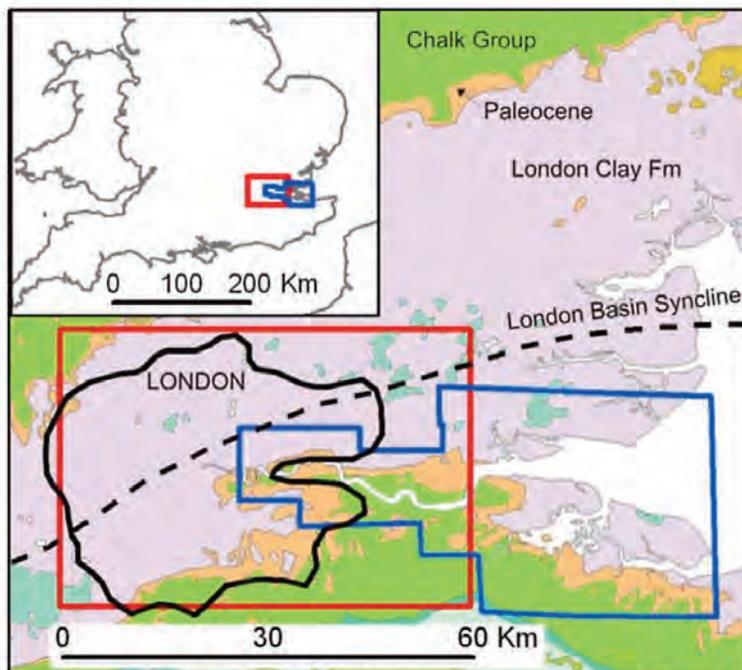


Excursion à Londres 20-22 mai 2014

Leader: Horst Gödicke

THE GEOLOGY AND HISTORY OF BEDFORD SQUARE AND HOLBORN

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Map summarising bedrock geology of the London Basin and the extent of 3D modelling; London LithoFrame (red) and Thames Gateway (blue). OS Topography ©Crown Copyright. All rights reserved 100017897/2008.

Lithostratigraphic unit	Potential Ground Constraint
Artificial Deposits	<ul style="list-style-type: none"> ▪ Variable excavation and foundation conditions ▪ Groundwater protection issues
Alluvium	<ul style="list-style-type: none"> ▪ Risk of flooding ▪ Variable excavation and foundation conditions ▪ Variable and poor load-bearing capacity
“Brickearth”	<ul style="list-style-type: none"> ▪ Metastable when wet
River Terrace Deposits	<ul style="list-style-type: none"> ▪ Variable excavation and foundation conditions ▪ Highly variable thickness ▪ Potential for “scour hollows”
London Clay Fm.	<ul style="list-style-type: none"> ▪ Ground heave and subsidence ▪ Landslips ▪ Shrink-swell effects
Lambeth Group	<ul style="list-style-type: none"> ▪ Variable excavation and foundation conditions ▪ Running sand ▪ Shrink-swell effects ▪ Local thick flint pebble beds
Thanet Sand Fm.	<ul style="list-style-type: none"> ▪ Hydrological continuity with the Chalk ▪ Running sand
Chalk	<ul style="list-style-type: none"> ▪ Groundwater protection issues ▪ History of over-abstraction ▪ Dissolution cavities and sink holes ▪ Variable excavation and foundation conditions

Table 1 Summary of potential geohazards and ground constraints (modified after Ellison et al., 2004)

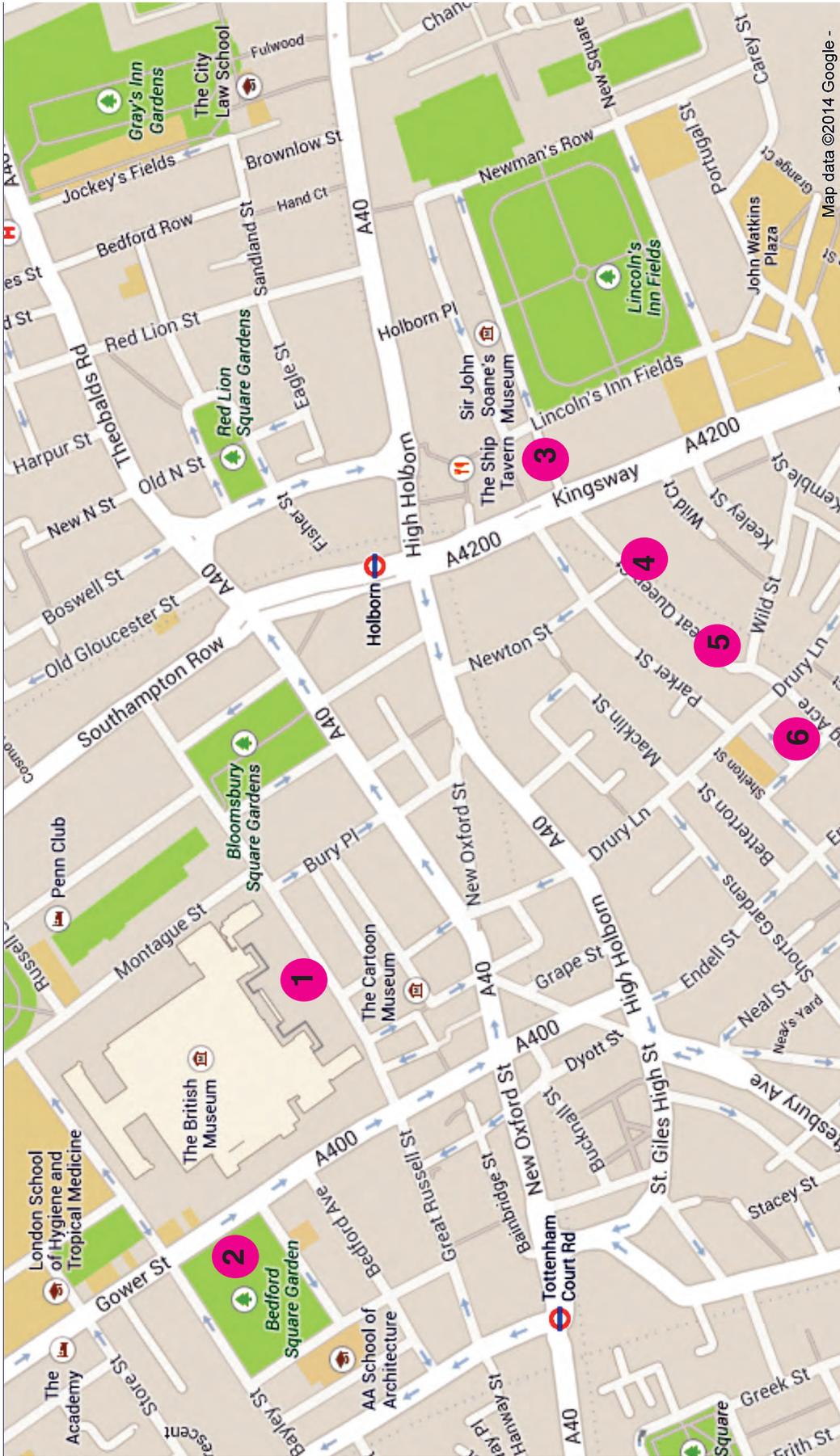


Figure 1. Google street map of Bloomsbury, Holborn and Covent Garden areas of London.

The Wrong Stone (British Museum) Locality 1. Figure 1.

“Prior to the public opening of the new Great Court there was a vicious carping surrounding the use of the wrong stone in the construction of the British Museum’s magnificent new courtyard.

The reason for the row was focussed on who was to blame for the £100m lottery-fuelled project falling into disfavour with English Heritage because the wrong sort of stone was used on the south facade of the Great Court. A new Ionic portico, the principal gateway to the two-acre Great Court, has been erected here to replace an original demolished 125 years ago. The contractor supplied a couple of thousand tons of **Anstrude Roche Claire (Figure 2)** limestone for the task, instead of good old **Portland Stone (Figure 3)**. The former is a French Oolitic limestone (Middle Jurassic, Bathonian stratum) quarried in Bierry-les-Belles-Fontaines, Yonne, Burgundy. and, therefore, in the eyes of the Heritage proponents, a bad choice. *‘There have been tantrums and calls for resignations in the exquisite halls of one of the most popular museums in the world’.*

No doubt something a little dodgy has been going on somewhere along the line between the French quarries and Bloomsbury but, for visitors to the Great Court, this storm in a wine goblet will mean little if anything. In 10 years, few will know or care what all the fuss was for. What they will know, instead, is one of the most extraordinary covered squares to be found in any city, ancient or modern”.

(Text modified from Jonathan Clancey, 2000. Guardian, Monday 27 November. A feast for the eyes)



Figure 2.

Anstrude Roche
Claire
Pinkish and mottled



Figure 3.

Portland Perryfield
Basebed
White and tight

Bedford Square (Locality 2)

(Text from Urban Geology in London No. 2 Ruth Siddall; UCL Earth Sciences 2012)

Bedford Square (**Figure 4**) was laid out and built between 1775-1780 to an overall design by Thomas Leverton. The square was envisioned by the 4th Duke of Bedford, who died before work started in 1771. Nevertheless, all property was subsequently leased by the 4th Duke's factotum, Robert Palmer and the Duchesses of Bedford and Marlborough. All was meant to be refined, respectable and orderly and the square was built of the highest quality materials; including sills and balustrades of Portland Stone, roofs of Welsh Slate, pavements of York Stone and kerbs stones of Mountsorrel Granodiorite (dull red) and Channel Islands Diorite (grey). Uniformly the doorways were decorated with the architectural ceramic, Coade Stone. It was certainly intended to be the residence of the aristocracy and many well known people have lived here as the rash of blue plaques testify. Of particular interest geologically is number 39 in the south west corner with its ornamental pilasters of red Peterhead Granite from Aberdeen.



Figure 4. The north side of Bedford Square. (*Russ London, Wikipedia CC-BY-SA-2.5*).

Coade Stone

Coade Stone is in fact an artificial stone which was extremely weather-proof and imitated natural stonework well, with the advantage that it could be cast into the required shape, be that architectural ornaments (**door surrounds**) or statues. The material is a ceramic which was developed and patented by Richard Holt of Lambeth in the 1720s. However the material did not take off and the patent lapsed. In the 1760s, Holt's

yard was bought out by Mrs Eleanor Coade who improved the recipe and set up the Coade Artificial Stone Manufactory. Coade Stone was not a concrete but a ceramic, in fact a high-fired (c. 1100-1150°C) stoneware made from ball-clay tempered with grog (crushed pre-fired ceramic), crushed flint, quartz sand and crushed soda -lime-silica glass; this latter helped the vitrification of the clay resulting in a hard, weather-resistant material. The temper represented c. 40% of the body which meant that the material would not have been very plastic; better for moulding rather than sculpting. Mrs Coade referred to her material as *lithodipyra*, suggesting that it may have been twice fired or alternatively this may have also referred to the use of grog as a temper.

Guernsey Diorite

Guernsey Diorite comes from Les Vardes Quarry in the north of the island. This quarry is still active, operated primarily for aggregate by Ronez, but resources are currently fast running out. The diorite is composed of plagioclase, hornblende and biotite is part of the 560 Ma Cadomian North Guernsey Igneous Complex (**Ornamental and kerb stones**).

Peterhead Granite

The Peterhead Granite (**Figure 4**) comes from Stirlinghill, near Boddam, Aberdeenshire. Commercial-scale quarrying began in the 18th to 19th Centuries and the quarries continued in use until 16 June 1956, closing because they were unable to compete with granite sources from abroad. Nevertheless, Peterhead Granite was used throughout the 19th Century for monuments, architectural elements and facing stone throughout the world. The ‘red’ variety of Peterhead Granite is a dark red coloured by blotchy phenocrysts of orthoclase feldspar, together with grey quartz and black hornblende. It is one of the Caledonian ‘Newer Granities’ intruded ~ 400Myrs ago. *See 39 Bedford Square*

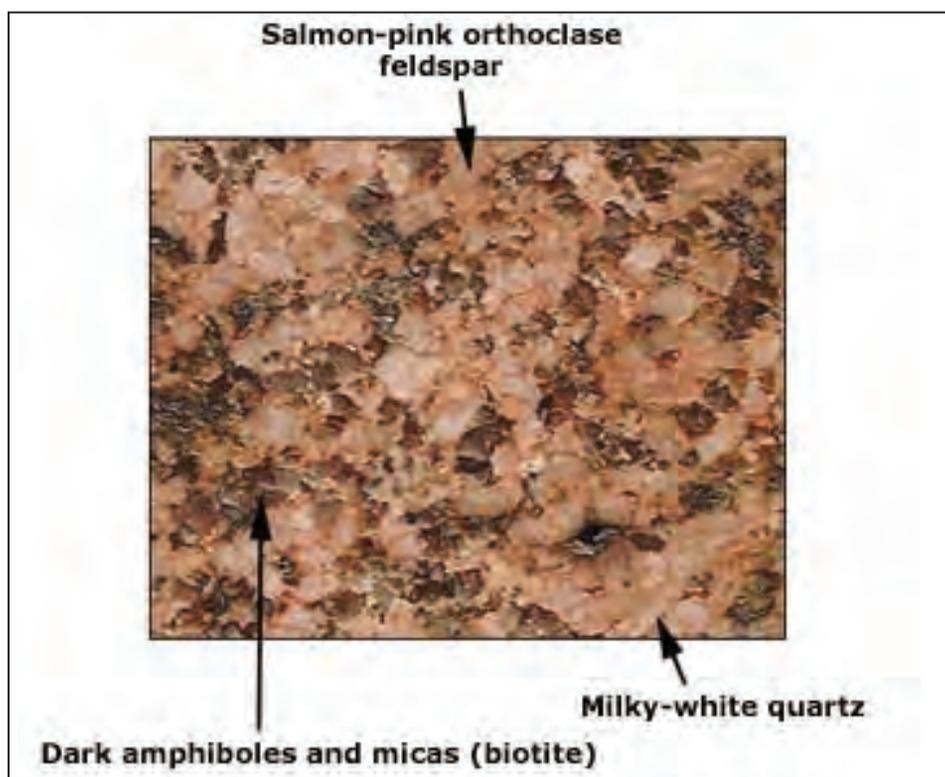


Figure 4. Peterhead Granite as used in Jane Grundy Memorial

London Stock Bricks

London stock brick (**Figures 3&5**) is the type of handmade brick which was used for the majority of building work in London and South East England until the growth in the use of Flettons and other machine-made bricks in the early 20th century. Its distinctive yellow colour and soft appearance come from the yellow local clay from which the bricks were made. London Stocks are still made in comparatively small quantities in traditional brickworks, mainly in Kent and Sussex, for heritage work,



Figure 5. Reclaimed, handmade London Stock Bricks. (source Wikipedia)

London's Lost Rivers (Locality 3-near Holborn Underground Station)

London has a number of rivers flowing into the Thames both north and south of the river, though this presentation dealt only with those north of the Thames and focussed on the Walbrook, the Fleet and the Tyburn (**Figure 6**). While the headwaters are often still above ground, in the suburbs, the City and Westminster, they are culverted and hidden. As early as 1598, John Stow described the Walbrook as already covered and hidden. (A good book on the subject is N.J. Barton – *Lost rivers of London*).

The London Topographic Society has published the Agas map and the Copperplate map showing Elizabethan rivers. Street names such as Cow Cross, Town Mill, Fleet Street, Water Street and Knightsbridge tell of hidden rivers, as do early Ordnance Survey maps before the major development of London and its suburbs. One of the best sources is the North London Geological Survey map, where old river courses are picked out in alluvium.

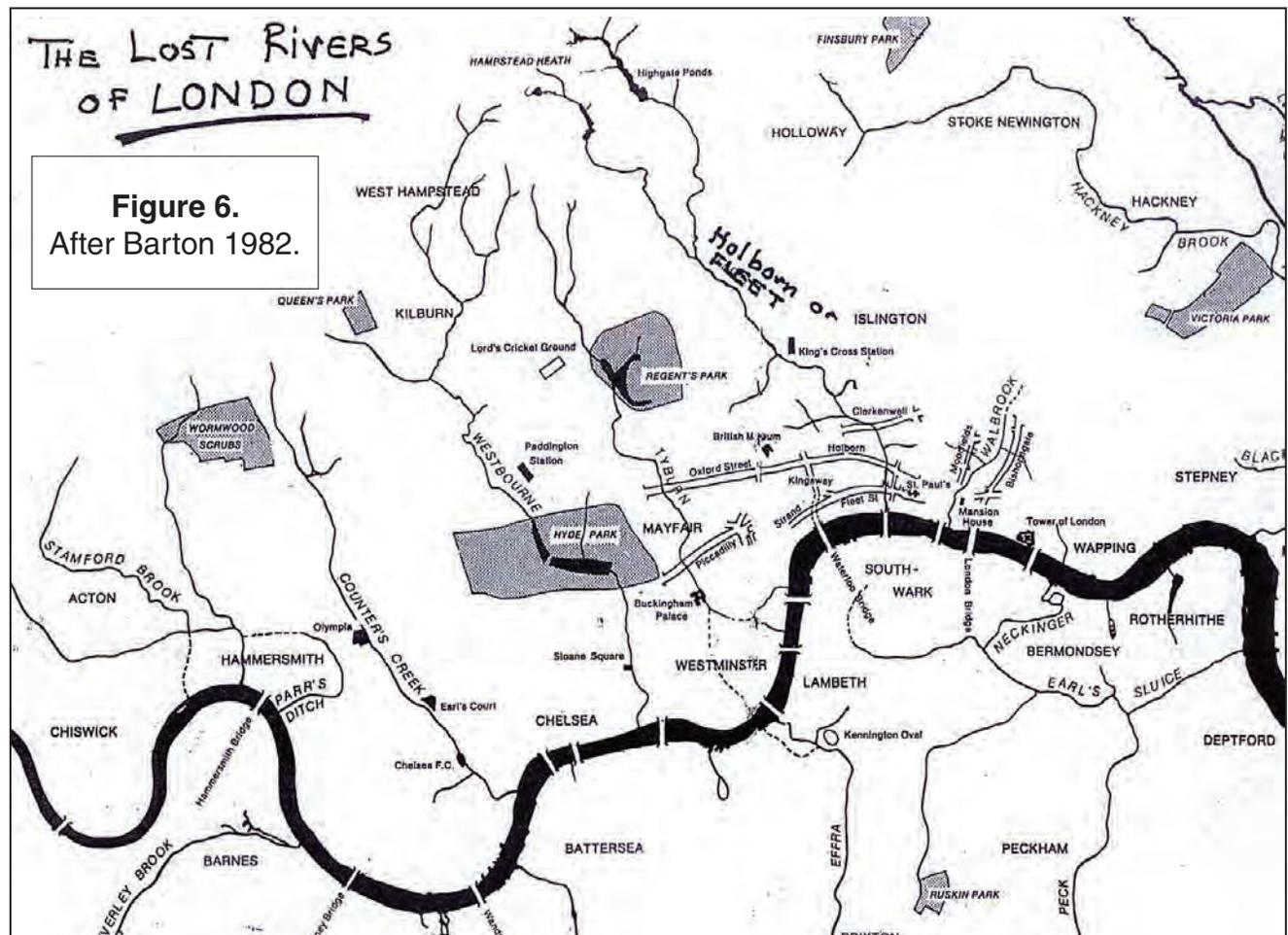
River Holborn (or Fleet)

(see http://harrownaturalhistory.org.uk/talks%20winter%202011_12.html)

This river has at least 4 names, the Holborn, the Fleet, the Turnmill Brook and the River of Wells. While the name Fleet has tended to stick, it should properly only refer to the tidal inlet (as far upstream as Holborn Viaduct). It is not on Fleet Street, which is the road leading to the River Fleet, just as Holborn is the road leading to the River Holborn.

Its source is on Hampstead Heath and Highgate, which is the source of a number of rivers, such as the Westbrooke, Tyburn and Fleet draining south, tributaries of the River Brent draining north and Hackney Brook and Mosul Brook draining east. Hampstead Heath is capped by Bagshot Sands and water dissolves iron to produce Chalybeate Wells. Springs occur at the junction with the Claygate Beds and drain into Hampstead and Highgate Ponds. The latter was built as part of the late medieval water supply of the City of London. The official source is the Vale of Health, one of the few places in London where bubonic plague did not occur but now a damp frost hollow. The other arm of the Fleet arises near Kenwood House and the two arms join just north of Camden Town Station. The Claygate Beds (London Clay) acts as the seal to the Chalk aquifer (**Figure 7 and frontispiece**).

In 1800 it flowed down to St Pancras Station and there are paintings of bathers in the Fleet in 1815. It passed by Smithfield Market, where the traders were allowed to draw off water to wash their meat but not to discharge into it (though they often did). It became hemmed in by houses and rapidly became an open sewer. It flowed past the Fleet Prison, Fleet Bridge and Bridewell in 1670 and there was a major



attempt to revitalise the river (by Sir Christopher Wren) after the Great Fire of London. The aim was to have the lower part of the Fleet as a Venetian style canal. The area north of Fleet Bridge was covered over and became a market and there are remnants in street names such as Turnagain Street, Newcastle Street (the coal trade) and Stone Cuttes' Street (Portland Stone trading). The Romans also used the Fleet for unloading stone and Kentish Rag has been found in a ship at the mouth of the Fleet (one of 1500 loads recorded as being used for building the Roman wall of Londinium).

The river Fleet does not enter the Thames any longer. In the mid-19th century, Bazalgette designed a series of interceptor sewers with a 10 feet per mile gradient (self-flushing). The Northern low-level sewer goes to a pumping station in Stratford where it is pumped to the Northern high-level sewer, which has a natural fall to the Beckton treatment works. The sewers take water from the Highgate arm and the middle and lower levels of the Fleet to assist flow. However, the former outlet of the Fleet is still visible near Blackfriars Bridge.



Figure 6. Early geological section drawn across the London Basin in 1849, Diagram highlights where London gets its water from. Published by James Reynolds on the Strand.

The History of Holborn (Figure 7) (text modified from the History of Camden)

The earliest known settlement was on the high lands of Hampstead Heath and dates back to the Mesolithic age around 7000BC. For many centuries the area remained heavily forested, with fertile land drained by the Fleet, Tyburn and Westbourne rivers, and other streams. From the Roman city of Londinium legions used a great highway leading to the west that is now High Holborn and Oxford Street. Watling Street, another Roman road leading to St Albans,

The Saxons later built their city Ludenwic to the west of Londinium, on a site which excavations have recently confirmed as stretching from the Thames through Covent Garden to around the Kingsway and Holborn areas. Early charters from that period include boundaries that, over a thousand years later, still form part of the boundaries of the present borough.

In 959AD King Edgar granted to Westminster Abbey land that lay south of the 'wide army street' of High Holborn, including the old wooden church St Andrew on 'Holebourne'. The Anglo-Saxon name of burna, a stream, and hol, a hollow, provided the original name of Holborn, while the lower part was a tidal creek

known in Anglo-Saxon as a fleet which later became the Fleet River.

The Domesday Survey of 1086 was the first systematic attempt to describe the communities; who owned them, their value and how many people worked the land. The manors of Tothele [Tottenham Court], Rugmere, St Pancras, Hampstead, and Holborn are recorded as small hamlets where the inhabitants ploughed the land and kept pigs in the forests.

The spread of London continued outside the city walls, along High Holborn and to the south towards the river Thames. John de Kirkby built a house and chapel in the 13th century, which later became the London palace of the Bishops of Ely. John of Gaunt, Elizabeth I, Richard III and Henry IV were among the many famous visitors and guests.

Around Holborn, London's legal quarter developed from the 14th century, lawyers often gathering together in 'Inns' for training and support, Gray's Inn and Lincoln's Inn are examples which still exist (**Figures 1&7**). To the west, the leper hospital of St Giles was established in 1117AD by Queen Matilda and remained as a hospital until the 16th century on a site that is bounded by today's St Giles High Street, Charing Cross Road and Shaftesbury Avenue. The present St Giles in the Fields Church, built in 1734, is probably the third on the site and its parish was once one of the most overcrowded and insanitary in London. The first outbreak of the Great Plague of 1665 occurred nearby and the parish was one of the worst affected.



Figure 7. Detail of the area around Covent Garden. Courtesy: Edwin C. Bowles Collection at Tufts University.

Great Queen Street (Localities 5-6)

Great Queen Street has been described as London's first real street; having changed from a bridleway to a royal thoroughfare in the 1620's. At that time residents had an 'enviable view of the pastoral charm of North London'. From 1717 the taverns around and in Great Queen Street (**Figure 8**), became meeting

places for The Freemasons who established their first permanent lodge at number 61 in 1776. By the time Rowe had published his map of London in 1804 the area around Covent Garden looked very similar to today with Drury Lane and Long Acre the major thoroughfares. In 1807 thirteen men attended a meeting at the Freemasons Tavern and founded the Geological Society. (**Figure 9**).



Figure 8. Watercolour of the Freemason's Tavern 61-63 Great Queen Street London (Nixon, 1803) "Copyright and reproduced with the permission of The Library and Museum of Freemasonry."

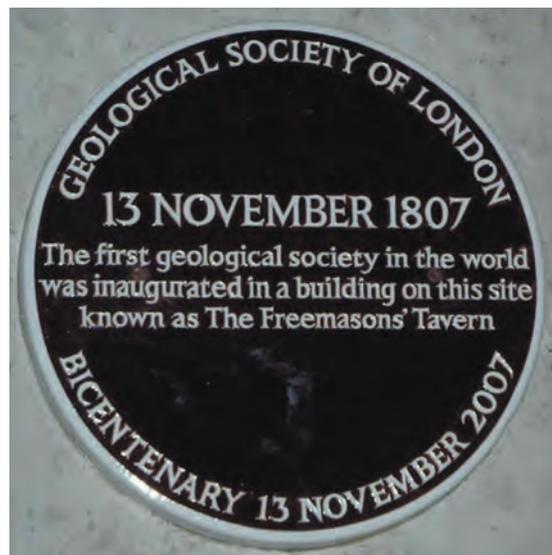


Figure 9. Bicentennial plaque erected to celebrate the inauguration of the Geological Society of London, outside the New Connaught Rooms, London, Great Queen Street.