Local Industry

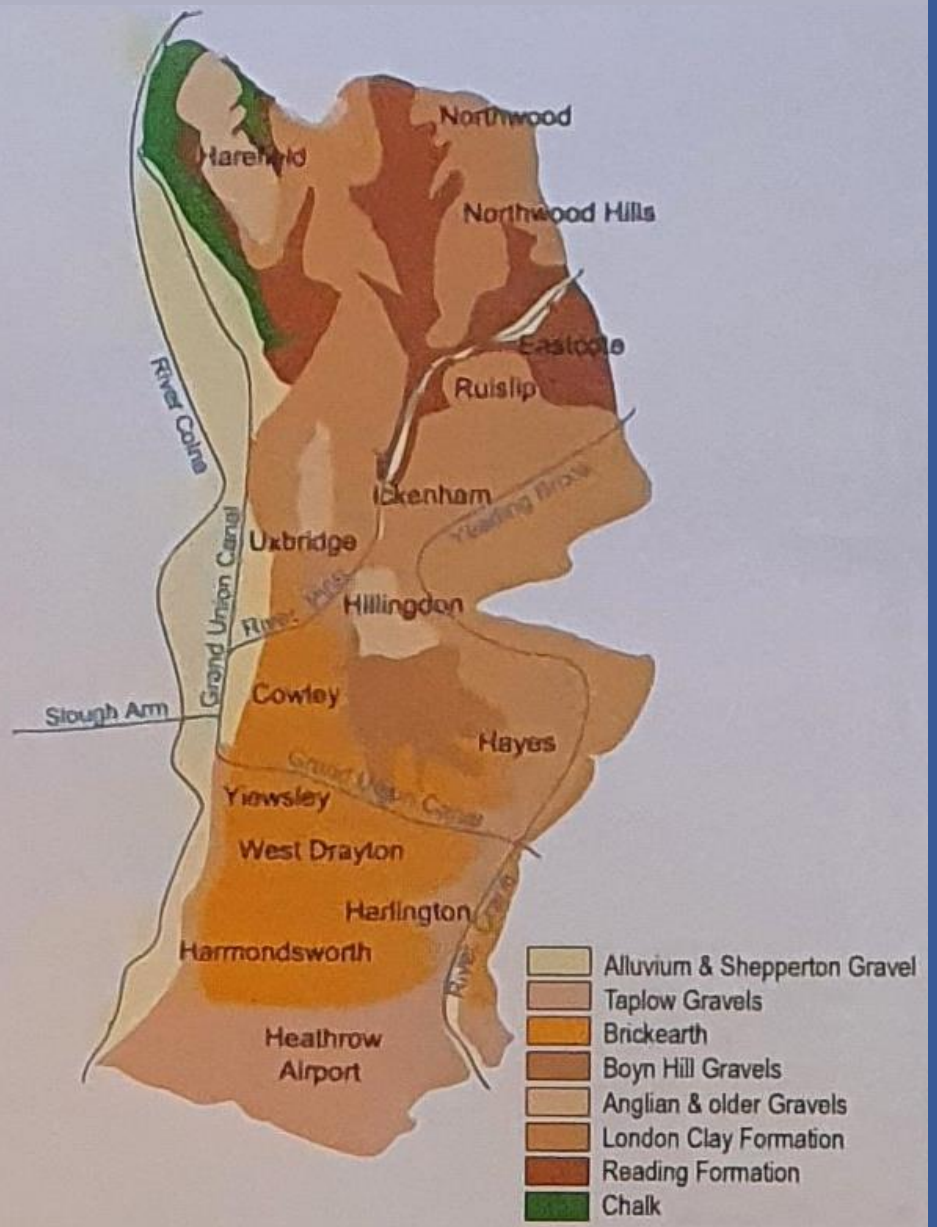
Harrow & Hillingdon Geological Society

The two London Boroughs encompass numerous historic towns and villages:

Harefield, Uxbridge, Hillingdon, Ruislip, Northwood, Ickenham,
Cowley, Hayes, Harlington, Yiewsley, West Drayton, Harmondsworth, Sipson, Botwell,
Eastcote, Pinner, Harrow, Harrow Weald, Hatch End, Headstone, Kenton, Wealdstone

Simplified Geological Map

of the London Borough of Hillingdon



On this map, the colours represent the different rock types.

Only the rock types to be found at the surface are shown, but they extend across large areas at varying depths.

The oldest rocks are generally at the bottom, having been buried subsequently by younger and younger rocks through time.

The layers of rock under London are incomplete. Over time there have been periods of deposition but also periods of erosion when the rock record has been swept away.

Hillingdon's rock layers include very long gaps in time for which we have no remaining rocks,

In the key, the different rock types are listed in order of age:

Chalk is at the bottom of the list because it is the oldest.

Alluvium is at the top of the list and is the youngest

Strata of Hillingdon (similar across London)

Oldest at the bottom occasionally found at the surface

Brickearth (110k-15k yrs)
Taplow Gravel
191,000-130,000 years

The Taplow Terrace Gravels underlie Heathrow Airport, but north of the airport they are covered in Brickearth, which was worked for brickmaking until the early 20th century.

Unconformity ~ ~ ~ ~ ~ ~ ~ ~ ~ ~ ~ ~ ~ ~ 50 Million year gap

London Clay
55-48 million years

The London Clay Formation underlies much of the London area, Essex and north Kent, extending into Belgium. It is a marine deposit comprising mainly bluish clay that weathers brown, with some sand and silt. Fossils include plant fruits and seeds which indicate a tropical rainforest, bordered by a swampy coastal plain.

Reading Formation
56-55 million years

Fringing the western London Basin, this is a mottled clay formed of sediments laid down on marshy mudflats crossed by river channels. The mottling indicates a warm climate with a dry season. Fossils are rare (sporadic plant-rich seams only).

Unconformity ~ ~ ~ ~ ~ ~ ~ ~ ~ ~ ~ ~ ~ ~ 29 Million year gap

Chalk (and flint)
100-85 million years

Seen in old quarries in the Colne valley near Harefield, the chalk belongs to that forming the Chiltern Hills. Chalk is a very fine-grained pure limestone, formed on the sea floor mainly from the disintegration of skeletons of minute coccolith algae. Flint occurs as bands of nodules; it is silica which dissolved in the chalk mud.

Pinner Chalk Mine*

Harrow & Hillingdon Geological Society site visit, 13 October 2001

TOP OF SHAFT NO 3.
1850 MINE

PINNER CHALK MINE
13 OCT 2001

PINNER CHALK MINE
13 OCT 2001

LOOKING UP
NO 3 SHAFT.

BRICK LINED EXCEPT FOR RING OF VERY HARD PUDDINGSTONE 10 FT. FROM BOTTOM

1850-60

"PILLAR AND STALL" GALLERIES

GRAFFITI BY MINERS

← NODULAR FLINT

← TABULAR FLINT

*Historically known as the Dingles Mine

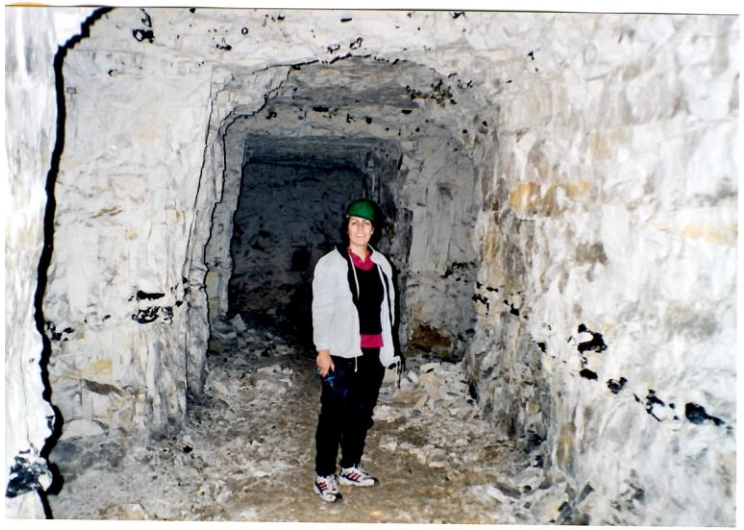
Huge volumes of chalk have been removed from beneath Pinner, leaving an extensive network of tunnels.

Most of the quarrying was done in the 19th Century, and the chalk was used for brick making and for soil improvement on local fields.

PINNER CHALK MINE
13 OCT 2001

A FALL IN THE 1840 MINE

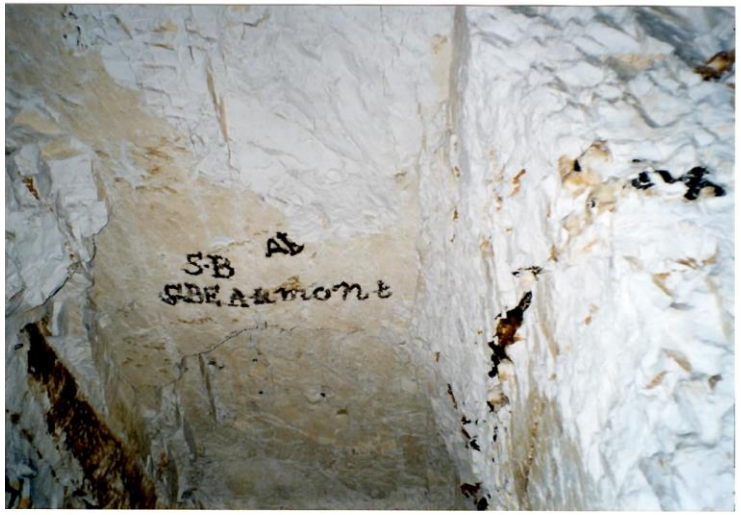
? READING BEDS NOT SUPPORTED HERE BY PUDDING STONE (WHICH WAS NOT SEEN)



A GALLERY IN THE 1840 MINE.

NOTE NODULAR FLINTS

PINNER CHALK MINE 13 OCT 2001



GRAFFITO OF S. BEAUMONT (MINER) 1850 MINE.

PASSAGE FROM 1850 MINE INTO 1840 MINE

Seven mines have been found in and around North Pinner. The earliest record in 1388 described 'marlpits', suggesting that the chalk was used on farms for agricultural purposes.

Bricks were used for construction from the 16th Century onwards and lime was required for the mortar. Chalk had to be burned in kilns to create the lime. From 1830 the Dingles mine was owned by a local brick maker, and chalk was taken and added to clays and sands of the local Reading Beds and London Clay in order to stop the finished products cracking.
The Chalk Mines of Pinner – YouTube

In March 2017 Pinner Wood School was forced to close when a sink hole opened up in the car park. Laser technology was used to map the extensive network of tunnels and the school was closed for 9 months while a major grouting operation was undertaken.

Report - - Pinner Chalk Mine, London - Nov 2022 | Mines and Quarries | 28DaysLater.co.uk
Recent photos from illegal entry by explorers

Hertfordshire Puddingstone
Above the chalk in Pinner is a layer of concrete-like puddingstone which has prevented the tunnels from collapsing.

Above the Dingles Mine is a block of flats and houses on Albury Drive also have mine tunnels beneath them. Some of Britain's deepest chalk mine shafts are in Pinner, with Pinner Hill Farm built near the top of one of them.

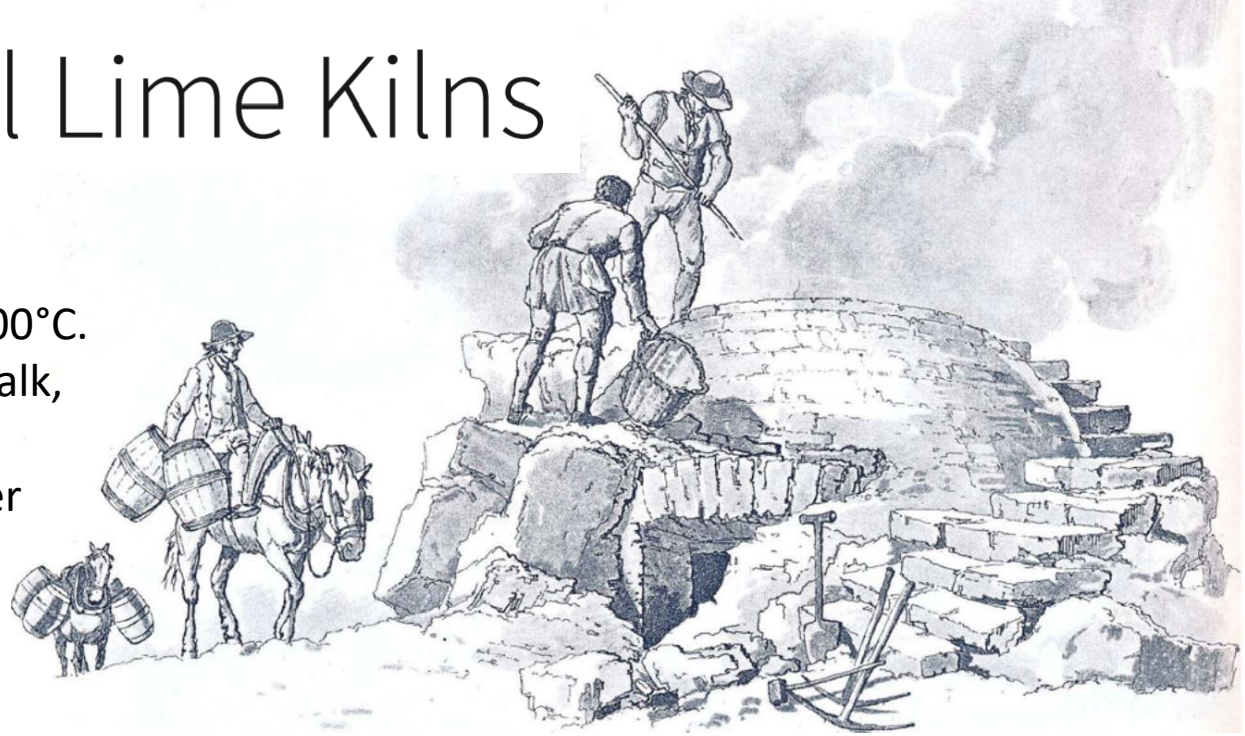
Hertfordshire Puddingstone from a roof collapse in the Pinner Chalk Mines Length of clast is c. 10 cm
Source: Diana Clements (collection J. Pester)

Guide to London's Geological Sites (londongeopartnership.org.uk)

Flint from the chalk has been used in the construction of local walls for centuries, including the walls of some local churches.

Historic England

Pre-industrial Lime Kilns



A lime kiln was a structure used to manufacture lime (calcium oxide) by burning calcium carbonate at temperatures above 900°C. The calcium carbonate burned was commonly limestone or chalk, but occasionally other materials such as oyster or egg shells. Most lime, also referred to as ‘quicklime’, was mixed with water water, a process known as ‘slaking’, to produce hydrated lime (calcium hydroxide). This product formed the basis of plasters, mortar and concrete.

The simplest method of producing lime was by using a ‘clamp kiln’. This was not really a kiln at all, but layers of fuel and limestone stacked together in a mound, covered with clay or turf and slowly burned in a method similar to that used in charcoal burning. The remains of such ‘kilns’ comprise merely a hearth on the floor of a pit, measuring up to 2.5 m in diameter and up to 2 m in depth.

[Historic England – Pre-industrial Lime Kilns – Introductions to Heritage Assets]

More sophisticated stone- or brick-built lime kilns were of two basic types: ‘Flare kilns’, also known as ‘intermittent’ or ‘periodic’ kilns; and ‘perpetual’, ‘running’ or ‘draw’ kilns. As their name suggests, ‘flare kilns’ were loaded with a single charge of limestone and burning had to stop for this to be removed before it could be re-loaded for the next firing. ‘Draw’ kilns were loaded with alternate layers of fuel and stone which was kept burning continuously while further supplies of raw material and fuel were fed in at the top and the lime was drawn off at the bottom. Both types had the same basic structure, consisting of a thick-walled stone chamber with a hearth at the base.

Harefield Cement Kilns

https://www.cementkilns.co.uk/cement.html

Established as Coles Shadbolt Works, the site was originally developed for brickworks. Coles Shadbolt made Roman Cement on the Regent's Canal in Islington, and a dock on the Grand Union Canal was constructed at Harefield to ship bricks to Islington. In charge of this, Percy Shadbolt, recognised the suitability of the site for Portland cement.

Location:

- Grid reference: TQ04868985
- x=504860
- y=189850
- 51°35'52"N; 0°29'10"W
- Civil Parish: Harefield, Middlesex

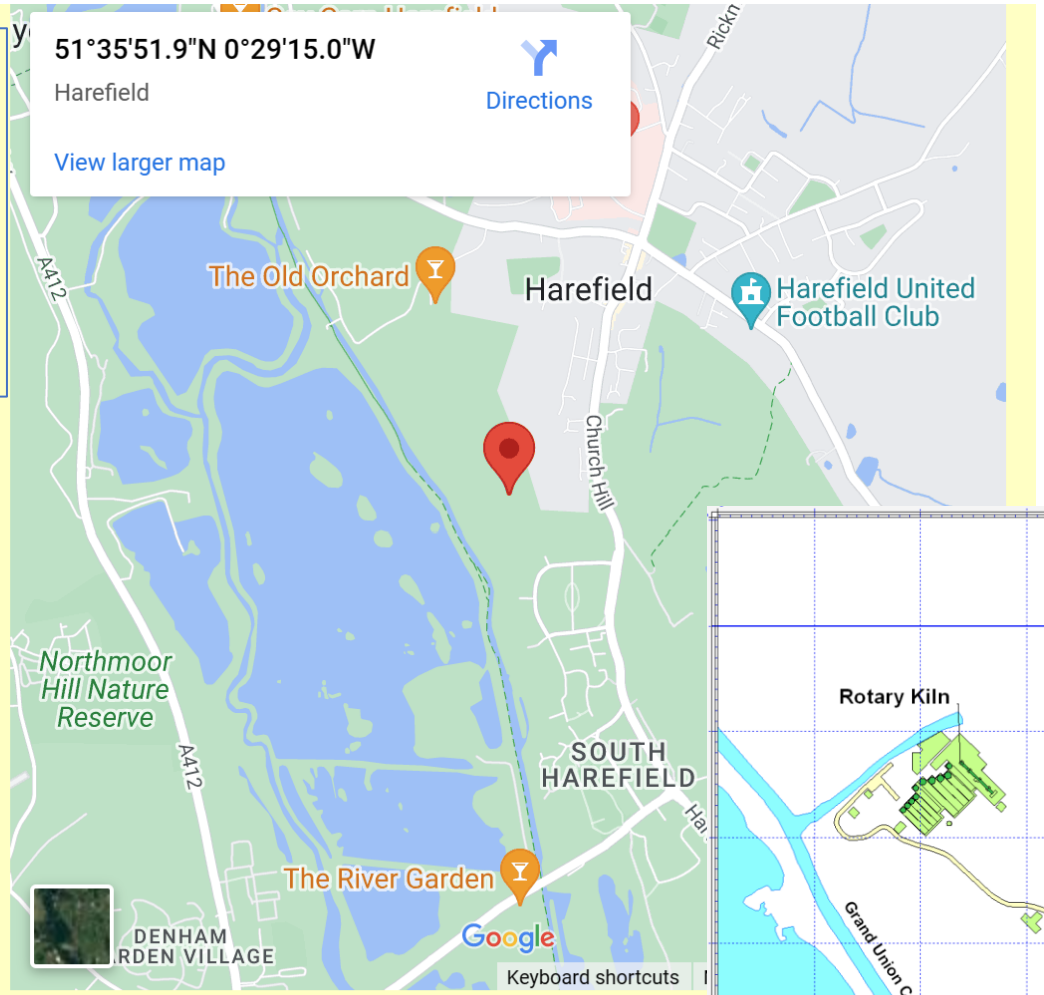
Cement clinker is a solid material produced in the manufacture of Portland cement as an intermediate product, Clinker occurs as lumps or nodules usually 3-25mm across. It is produced by heating limestone and clay/shale in the cement kiln stage. Difference between Roman and Portland cement

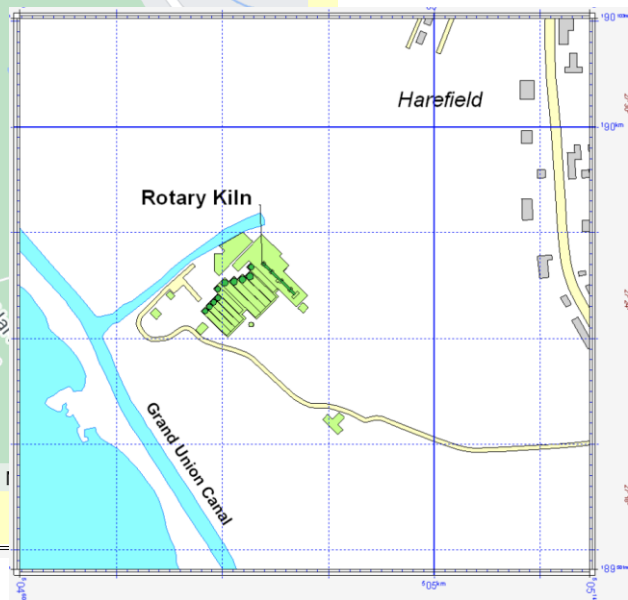
Clinker manufacture operational: 1880-7/1929

Approximate total clinker production: 790,000 tonnes

Raw materials:

- Upper Chalk (Seaford Chalk Formation: 85-88 Ma) from pits at
  - 505050,189750
  - 504950,189950
  - 504850,190000
  - 504650,190150
- Overlying London Clay (London Clay Formation: 48-55 Ma) and Colne Valley Alluvium





Flint: Stone Age Technology

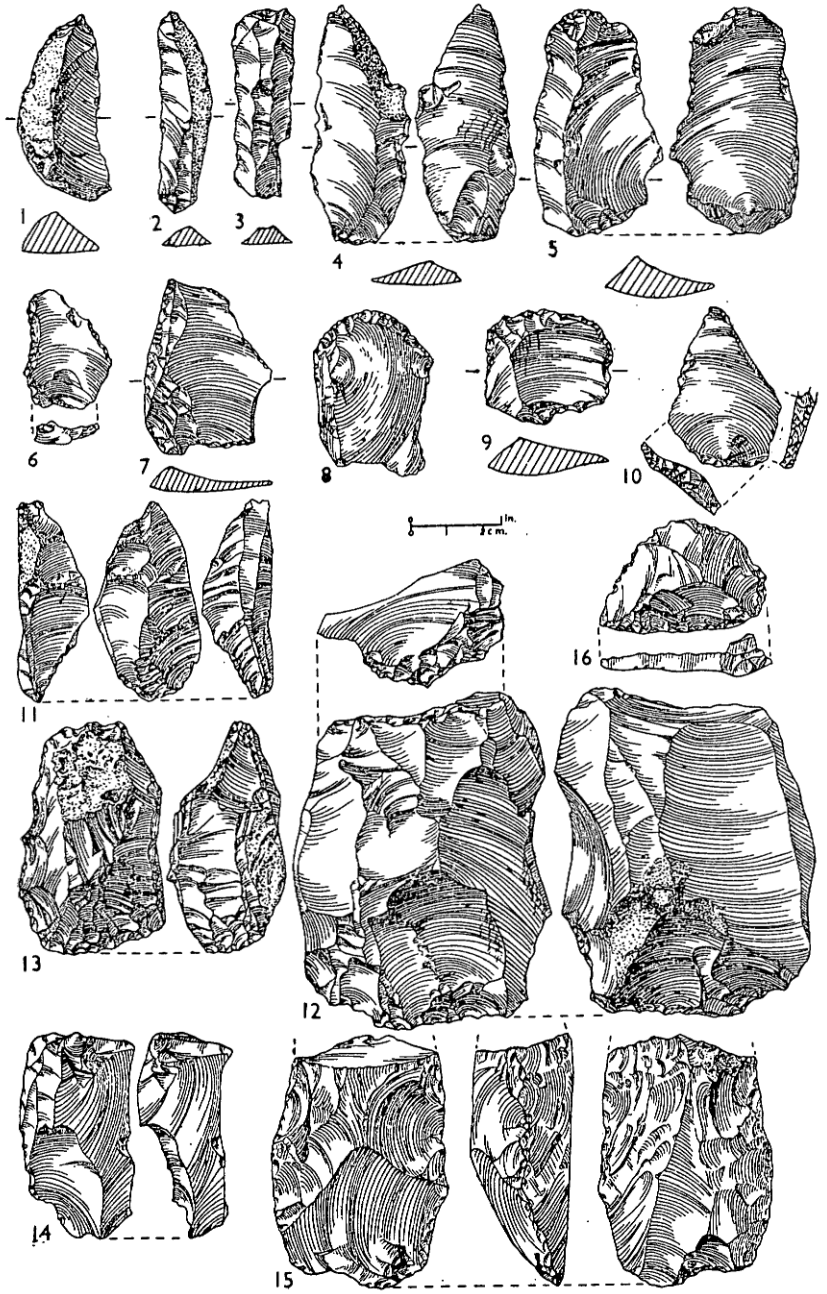
Flint only forms in Chalk

Hillingdon Council has around 170 prehistoric items in their museum collection - mostly flint tools from the Mesolithic and Neolithic periods, around 8,000-2,500 BC
from axes and arrowheads to scrapers for removing skin from meat and bone, which tell us much about our local ancestors

[Stone age flints - Hillingdon Council]

At Croxley Green, near Rickmansworth, hundreds of hand-axes, flakes, and cores were found by gravel diggers in the early 20th century. Excavations were conducted by R.A. Smith of the British Museum and H. Dewey of the Geological Survey in 1914. Simple and refined tools were mixed together and the jumbled and distorted gravel was thought to be glacial outwash affected by periglacial agencies.

Archaeological digs in local gravel pits have revealed Stone Age and Iron Age pottery in West Drayton and Palaeolithic stone tools in Yiewsley.



Products of Flint Industry from Dewe's Farm, South Harefield
1-5, flakes and blades; 6-10, scrapers; 11, graver; 12, core; 13-14, trimmed cores; 15, lower part of *tranchet*.

Summerleaze
a carbon negative group

[Aggregates - Summerleaze]

The quarry at Denham in Buckinghamshire contains 2.4 million tonnes of high quality sand and gravel aggregate. A strategic partnership between Summerleaze and London Concrete has meant that much of the high quality aggregate at Denham is supplied directly to the on-site concrete plant, thereby removing unnecessary vehicle movements.

New Denham Quarry is an active sand and gravel quarry located in south Buckinghamshire to the southwest of New Denham and due south of Junction 1 of the M40 motorway. The proposed extension area lies to the east of the existing quarry and immediately west of Knighton-Way Lane. It will enable viable mineral to be worked out and allow a continuation of supply following the working of the permitted northern extension area.

New Denham Quarry is a circa 90 hectare sand and gravel quarry with planning permission for mineral extraction and restoration to lakes, woodland, tussocky grassland, wildflower meadow and hedgerows. The original quarry, apart from the processing plant area, is worked out and mostly restored. An extension area to the north, permitted on 31st March 2017 under permission CM/23/16, is currently being worked, infilled and restored progressively.

As found within the main quarry and northern extension, the eastern extension contains sands and gravels of the Taplow Gravel Formation, which is between 2.3m and 5.6m thick. It is underlain by silty and sandy clays of the Lambeth Group, with occasional sand horizons, which in turn rest on the Chalk.

The mineral will be worked ‘wet’, i.e. no artificial lowering of the groundwater during mineral extraction is proposed. The as dug mineral will be transported via conveyor to the existing processing plant located to the west of the extension area. Here the sands and gravels will be washed and screened ready for sale off site.

Aggregates - Summerleaze

London Bricks

The London stock is a type of brick the manufacture of which is confined to London and south-east England (particularly Kent and Essex). It is made from superficial deposits of brickearth overlying the London Clay, which are easily worked and produce a durable, generally well-burnt brick. This durability actually increases, since the London stock brick has the fortuitous advantage of hardening with age and in reaction to the polluted London atmosphere. Other characteristics of the London stock result from its method of manufacture, two stages being especially important. The first of these is the practice of mixing the clay with what bas been variously known as Spanish, soil, town ash, or rough stuff - that is, London's domestic rubbish, which contained a large amount of ash and cinders. The addition of this sifted ash provided a built-in fuel when the bricks were fired, thereby considerably reducing the cost of production. During firing, the particles of ash were consumed leaving characteristic pock-marks on the surfaces of the bricks. These create a porous brick that allows moisture to pass freely in and out of the brick, so that even when it becomes saturated, the water quickly drains out; and as a result, the London stock is normally resistant to frost damage.

London stocks were generally clamp-fired, the unfired bricks being stacked up in the open air and then fired, baked or burned, without the use of a permanent kiln. The overall tendency of this combination of clamp-firing and the use of ashes in the brick-clay, and as fuel, was to bricks which were fairly irregular in shape, rough in texture, and with a great variation in quality and colour. Aesthetically, therefore, the London stock often lacks refinement: its rough, pitted faces are one obvious drawback, and other blemishes, caused by impurities in the mixture of clay and ash, may also disfigure the brick. In addition, its colour can vary very widely, from red, through purple, brown, various shades of yellow (sometimes even being described, rather over romantically, as golden), to off-white. Individual bricks can display a mottled effect which may run through the whole gamut of this range of colours.

chs-vol.13-pp.57-to-66.pdf (cam.ac.uk)

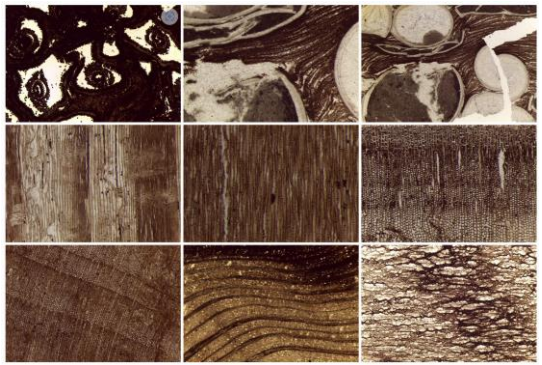
Thames Discovery Programme - Clay Pipes from London

Clay tobacco pipes were an important part of everyday London life from the end of the 16th century onwards, surviving in considerable quantities from archaeological excavations, and commonly found on the foreshore. Many pipe makers marked their products with their personal initials or symbols, some of which can be identified with documented individuals working in London. Pipes were typically made using ball clay from Dorset and Devon.

Pipemakers Arms
58 St Johns Road
Uxbridge UB8 2UR

The London Clay is rich in smectite which makes it very plastic/sticky and not the best for ceramic production. It also has a high shrink-swell capacity, meaning that pots can shrink and crack upon drying. Nevertheless, it might have been mixed with a plastic 'temper' to counteract the plasticity. The shrink swell capacity can also be modified in this way or by mixing with another clay source.

London Clay Project — Maja Quille



Winsor and Newton, traditional British artist paint manufacturer in Harrow

[A colourful history of pigments | Winsor & Newton (winsornewton.com)]

Earth Colours

Considered staples of any artist's palette, the range of Ochre, Sienna, Umber, and Green Earth pigments, known collectively as earth colours, were much easier and cheaper to produce. Prior to the Industrial Revolution the raw materials would have been obtained locally, as they are discovered easily when an ochre-coloured soft rock is jutting up from the ground. They would then be ground using a horse-powered mill, and sold to local decorators or to artists from apothecary (pharmacy) shops.

It takes little effort to grind down the raw materials, and they can be prepared as a paint using a kitchen mortar and pestle, by wetting them with water and then adding gum arabic for the grinding. Proper mulling reduced the particle size and ensured there would be no large particles that could give a grainy effect when painted.

Winsor Red, a Pyrrole pigment, is extremely stable and lightfast, and was first detected by chemist F. F. Runge in 1834 as a constituent of coal tar.

Producing purple dye was a laborious and expensive process, though the method of extracting it was less glamorous. The dye stemmed from the foul-smelling mucous gland of a marine mollusc. A time-consuming process saw these sea snails dried and boiled to make Tyrian dye. The intensity of the colour was long-lasting and not prone to fade.

A synthetic purple dye was created by way of a serendipitous accident. In 1856 an 18-year-old English chemist, William Henry Perkins, mistakenly invented Perkin's Purple, or the shade we recognise today as mauve. At the time he was trying to find a cure for malaria by synthesizing quinine. When cleaning up the solution with alcohol he noticed he had produced a dark purple liquid. This shade went on to make him a fortune and revolutionise the world of fashion.

History of Whitefriars | Whitefriars: Behind the Glass

Whitefriars

In 1923 James Powell and Sons, later to become Whitefriars Glass Limited, opened a factory on Tudor Road, Wealdstone in Harrow. Relocating there from the crowded and smoggy corner of the City of London, where it had been based since 1680.

The City of London Glassworks

The original Whitefriars site was located close to the River Thames. This meant that sand, clay, coal and other materials used in the glass making process could easily be transported to the Factory. This useful location had previously been a monastery of the Carmelite Fathers (founded in 1241), whose white habits earned the monks the nickname ‘White Friars’.

New Horizons

But with limited room to grow the firm began construction of “the largest and most extensive glass works in the world” in Harrow, on the North West edge of London.

However, the final factory at Wealdstone ended up being much smaller than originally intended, at less than half the size, and with only two furnaces rather than three. In 1923 a lit brazier was carried from the old glasshouse to the new factory. It was used to light the first furnace, continuing the burning of the flame from the city glasshouse furnaces which had burnt continuously since 1680.

In 1962 the firm was renamed Whitefriars Glass Limited. And the following year the modern, recognisable logo of a stylised friar was introduced. Harking back to the original site of the glassworks in the City of London.

The Closure of the works

In October 1980, after 300 years of glassmaking and only 57 years in Wealdstone, the Whitefriars Glass Factory finally closed its doors. Following this closure, the site was cleared and the buildings demolished.

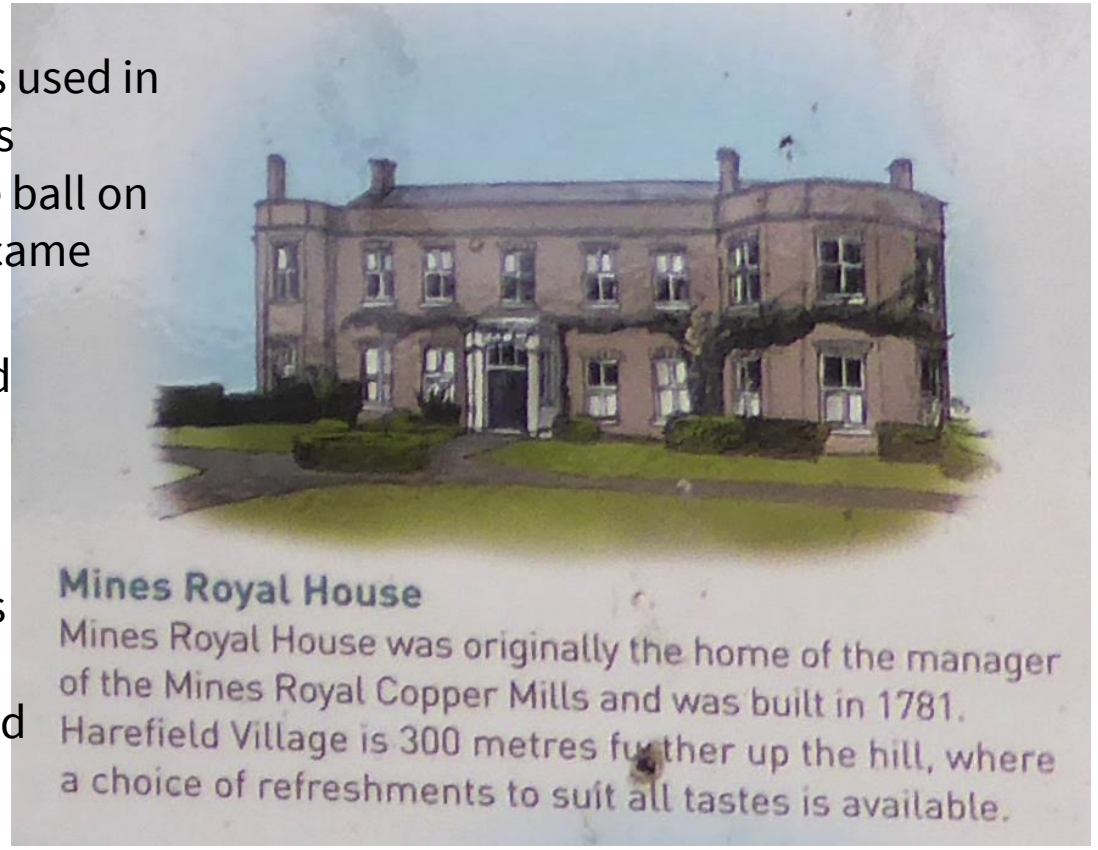
Despite its closure, Whitefriars continues to be recognised was a world leader of the glassmaking industry; famous for its iconic designs and colours. Whitefriars produced beautiful objects combining the effective use of modern machinery and ancient methods and continues to be valued for its quality and beauty.

Harefield Copper Mill

In 1674 there were 2 mills in Harefield, a paper mill and a corn mill. In 1752 both were sold to become part of the estate of Sir George Cooke. In 1781 the paper and corn mills were let to the Mines Royal Company, who converted them both to copper mills in 1803. In their new capacity they benefited enormously from the coming to the area of the Grand Union Canal, which made transport of the copper from Glamorgan, where it was smelted, to the Harefield mills where it was rolled, a much easier process.

The majority of the copper was used in sheathing the bottoms of boats although it is reported that the ball on the top of St Paul's Cathedral came from Harefield.

Gradually iron boats, which did not need copper sheathing, replaced wooden ones and business was consequently affected, and in 1863 the Mines Royal Company, which owned the Welsh copper mines, ceased working, and then also the Harefield mills.



The mills were briefly turned to paper mills around 1870 and sometime later were leased by the United Asbestos company, an amalgamation of two Italian, one Scottish and one English firm, with the object of bringing asbestos into commercial use. Motive power came from nine waterwheels, and the mill also produced millboard and textiles. In 1959 they were occupied by three rubber firms.

[Watermills and Windmills of Middlesex (Second Edition) – Page 7 – The Mills Archive]

Today the mill building still stands within the industrial estate at Copper Mill Lock and has been redeveloped as desirable canal-side housing.

Grand Union Canal (formerly Grand Junction)

A freight contract between British Waterways and two aggregates companies, Hanson and Harleyford, saved about 46,000 road journeys on the highly congested western sections of the M40, M25 and M4. Barges transported sand and gravel from a gravel pit at Denham, through Uxbridge to a canal-side concrete mixing plant near West Drayton.

The canal brought industrial opportunity. Raw materials were easily brought in and finished products could quickly reach London.

The following is an accurate statement of the quantities [tons] *of the different articles conveyed from the Thames at Brentford to Uxbridge, and from Uxbridge to the Thames, in the year 1799 (obligingly communicated by Benjamin Way, Esq).*

An historical account of those parishes in the county of Middlesex, Rev. Daniel Lysons M.A. (1800)

Flour	*4,612*	*Lime*	*14*
Grain	*4,968*	*Manure*	*164*
Coals	*6,650*	*Coke*	*68*
Ashes	*1,318*	*Loam*	*49*
Stone	*108*	*Timber*	*18*
Tiles & brick	*131*	*Sundries*	*1,821*

https://tringhistory.tringlocalhistorymuseum.org.uk/Canal/c_chapter_10.htm

Heathrow Terminal 5 archaeological excavation from 1998-2006

In all, 80,000 objects were found, including 18,000 pieces of pottery, 40,000 pieces of worked flint and the only wooden bowl found dating to the Middle Bronze Age (1,500BC-1,100BC).

8,500-4,000 BC Deep Forest and a River | Archaeology at Heathrow Terminal 5 (framearch.co.uk)

Archaeological excavation was carried out by Wessex and Oxford Archaeology; they found evidence of human activity from the Mesolithic until the end of the Roman era. The earliest site was a meeting place for hunter-gatherers in the 8th to 6th millennia BC. In a forest clearing there was a cluster of shallow pits containing burnt flint along with waste bone, suggesting the site was used for boiling meat for communal feasting.

Nearby on a gravel terrace of the River Colne floodplain, at Bedfont Court, a group of stake holes were found, dated to c 6,000 BC. Later, about 3,700 BC, the forest in this area was cleared for agriculture following an outbreak of Dutch Elm disease, reminding us that felling trees with stone tools along would have been an enormous effort. Timber posts, possibly used as totem poles, were found from this time.

Earthworks were built between c. 3,600 and 3,300 BC. A small "horseshoe shaped" earthwork enclosure aligned with sunset at the mid-winter solstice was built close to the site of the earlier timber posts, and an impressive road known as the Stanwell Cursus was built on the site of the Mesolithic burnt flint pits. This remarkable monument ran in an almost straight line for 3 kilometres from the River Colne in the northwest to the edge of the Taplow gravel terrace beneath Stanwell in the southeast. It consisted of two parallel ditches, the earth from which was used to build a single central bank.

Pottery artefacts from 2,600 – 1,700 BC are of different styles through time and had different uses, including funeral rituals.

Geological links

Settlements established on gravel. Flint tools used for cutting food and timber. Human management of the landscape (e.g. earthwork construction). Local clay used for making pottery. The River Colne for sustenance, transport, rituals, etc.

Bronze Age settlement

People started to divide the landscape up into distinct ‘farmsteads’ with ditches and banks topped by hedges. Heathrow’s landscape around 1,500 BC was one of small settlements, fields and trackways.

Geological links

Construction of earthworks

Wattle and daub buildings used wet soil, clay and sand

Iron Age settlement

From at least 700 BC (and probably from as early as 1,000 BC) a single large settlement was occupied by the whole community. From about 400 BC during the Middle Iron Age there were at least 14 roundhouses with thatched roofs and wattle and daub walls. The community farmed the area as a single agricultural resource with a vast enclosure to provide a protective pasture for collective herds of cattle, sheep or horses.

Heathrow in Roman times

The settlement complex appears to have been continually modified on a somewhat *ad hoc* basis throughout the Roman period, and would have undoubtedly become an integral part of the emerging Roman economy, with trackways being cut across the ancient landscape to serve the new markets at nearby Staines and the growing city of *Londinium.*

The area's farms may have been incorporated into large managed agricultural estates, perhaps belonging to the owners of more remote villas and/or wealthy townhouses in London. Rural farmers on these estates were probably subsistence workers, tied to the land in service of the estate, though also able to produce a meagre surplus for themselves.

Geological links
Construction of Roman roads
Movement of resources
Roman mining of lead

In about AD 400, at the end of the Roman occupation, the inhabitants of the farmstead deposited the remains of a damaged lead tank into a waterhole on the floodplain to the west of the main settlement. The tank is one of a small group of Roman Christian lead tanks found only in Britain, possibly used for baptism or washing of the feet and indicates a small Christian population at the site. The placing of this object within a waterhole suggests that Christianity had absorbed aspects of earlier spiritual traditions of the local people.

Two of the most prominent features of the Heathrow landscape were constructed in the 16th and 17th centuries.

1. The Duke of Northumberland's River was diverted in 1543 to increase the water supply to Isleworth Mill.
2. In the 17th century (during the reign of Charles I) the Longford River was constructed to improve the water supply to Hampton Court.

Both these rivers were diverted as part of the Terminal 5 construction project.

In the 19th and early 20th centuries Heathrow was noted as an important market gardening area. The reason for this was that the brickearth soils of the Heathrow area were very fertile, and their productivity was enhanced by vast quantities of horse manure from transport of people and goods in and out of London, stopping over in Uxbridge, Colnbrook and Staines.

Geological links

Industrial use of water in mills

Brickearth provided fertile soil

Water management (river construction / diversion, sewage works)

Concrete made locally from sand, gravel and cement.

Perry Oaks Sludge Works (1934-2002)

WWII created a demand for dried sewage "cake" as an agricultural fertilizer.

Early circular concrete tanks were supplemented in 1952 with large rectangular tanks and later by a series of lagoons. All were made redundant by the introduction of centrifuges in the late 1990's.

The manual process of emptying the 72 acre drying beds was mechanised in 1965 and a travelling elevator was installed.

Local Industry of Harrow and Hillingdon based on geological resources: flint, sand, gravel, clay, chalk