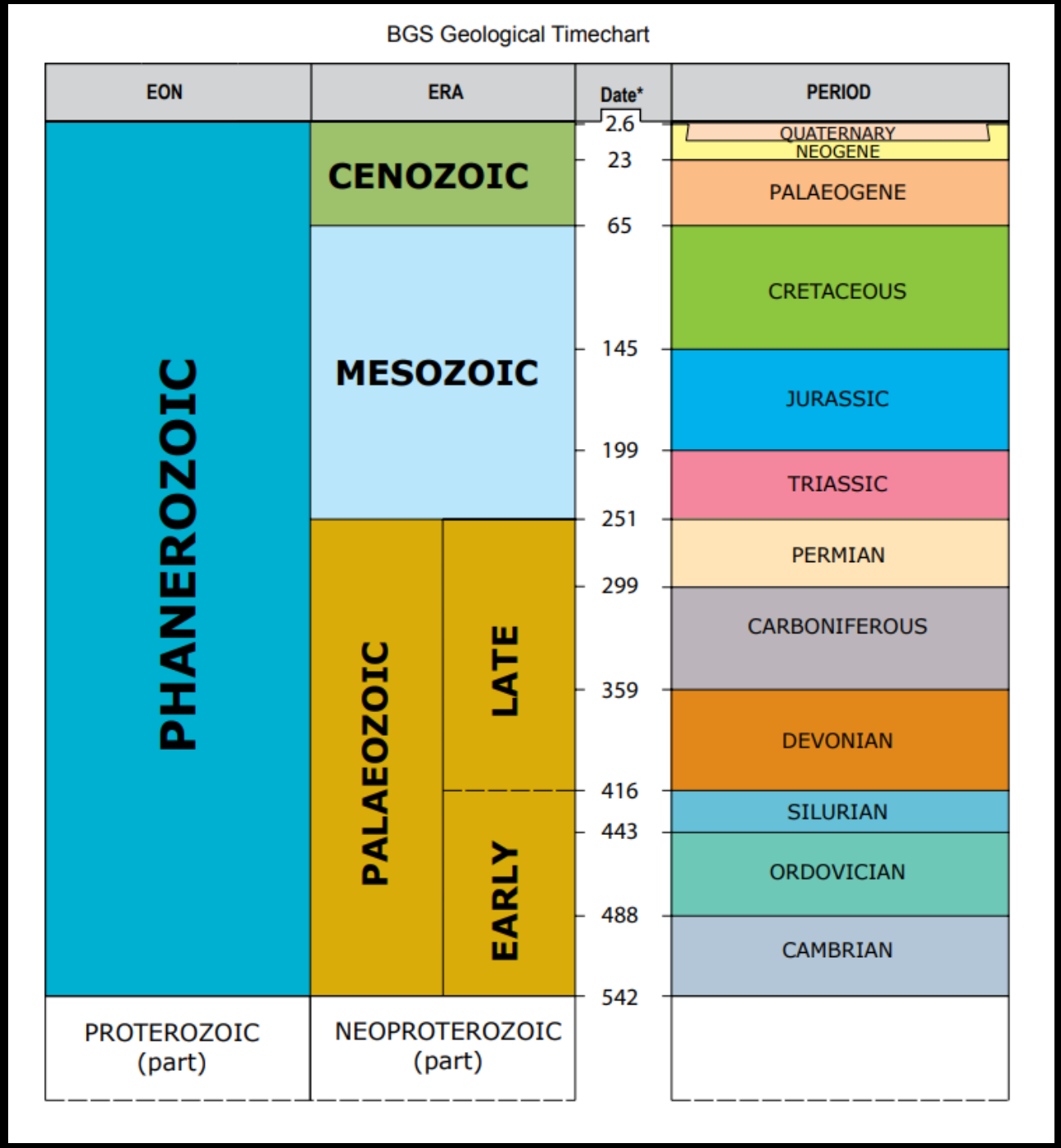
A Virtual Building Stones Walk in Uxbridge

Before we start, some introductory slides…



This virtual walk visits the station, the High Street, the Chimes and Pavilions shopping centres, the Parish Church and Windsor Street.

The building stones we will see are igneous and sedimentary.

They date from several periods in the chart, and a few, such as several kerbstones and setts, are Precambrian in age.

*Dates are in millions of years (Ma).

The timechart was produced by the British Geological Survey.

Rock types that we will see along the way – 1

There are three major groups of rocks:

1. Igneous rocks are those that have formed by the cooling and crystallisation of magma, either at the Earth's surface or within the crust.

2. Sedimentary rocks are those that have formed when eroded particles of other rocks have been deposited (on the ocean floor, river/lake beds, etc.) and compacted, or by the precipitation or evaporation of minerals from water.

3. Metamorphic rocks are those that have formed when existing rocks have undergone pressure and / or temperature changes so that their original mineralogy has been changed.

Rock types that we will see along the way – 2

Igneous rocks are formed by the solidification of magma, a silicate liquid generated by partial melting of the upper mantle or the lower crust. Different environments of formation, and the cooling rates associated with these, create very different textures and define the two major groupings within igneous rocks:

Volcanic rocks
Volcanic rocks form when magma rises to the surface and erupts, either as lava or pyroclastic material. The rate of cooling of the magma is rapid, and crystal growth is inhibited. Volcanic rocks are characteristically fine-grained. Volcanic rocks often exhibit structures caused by their eruption, e.g., flow banding (formed by shearing of the lava as it flows), and vesicles (open cavities that represent escaped gases). Examples: basalt (on this walk), but also andesite, rhyolite.

Plutonic rocks
Plutonic rocks form when magma cools within the Earth's crust. The rate of cooling of the magma is slow, allowing large crystals to grow. Plutonic rocks are characteristically coarse-grained.
Examples: granite, gabbro, diorite, syenite.

Rock types that we will see along the way – 3

Sedimentary rocks are the product of the erosion of existing rocks. Eroded material accumulates as sediment, either in the sea or on land, and is then buried, compacted and cemented to produce sedimentary rock.

There are two major groupings of sedimentary rocks:

Clastic sedimentary rocks
The fragments of pre-existing rocks or minerals that make up a sedimentary rock are called clasts. Sedimentary rocks made up of clasts are called clastic (clastic indicates that particles have been broken and transported). Clastic sedimentary rocks are primarily classified on the size of their clasts (e.g., cemented from pebbles/boulders, sand and mud; *bioclastic* from organic remains e.g., shell, skeletal, such as limestone).

Non-clastic sedimentary rocks
These sedimentary rocks occur when minerals are precipitated or evaporated directly from water or are concentrated by organic matter / life. Components have not been transported prior to deposition. No clasts are present (e.g., flint , rock salt, gypsum, coal).

Rock types that we will see along the way – 4

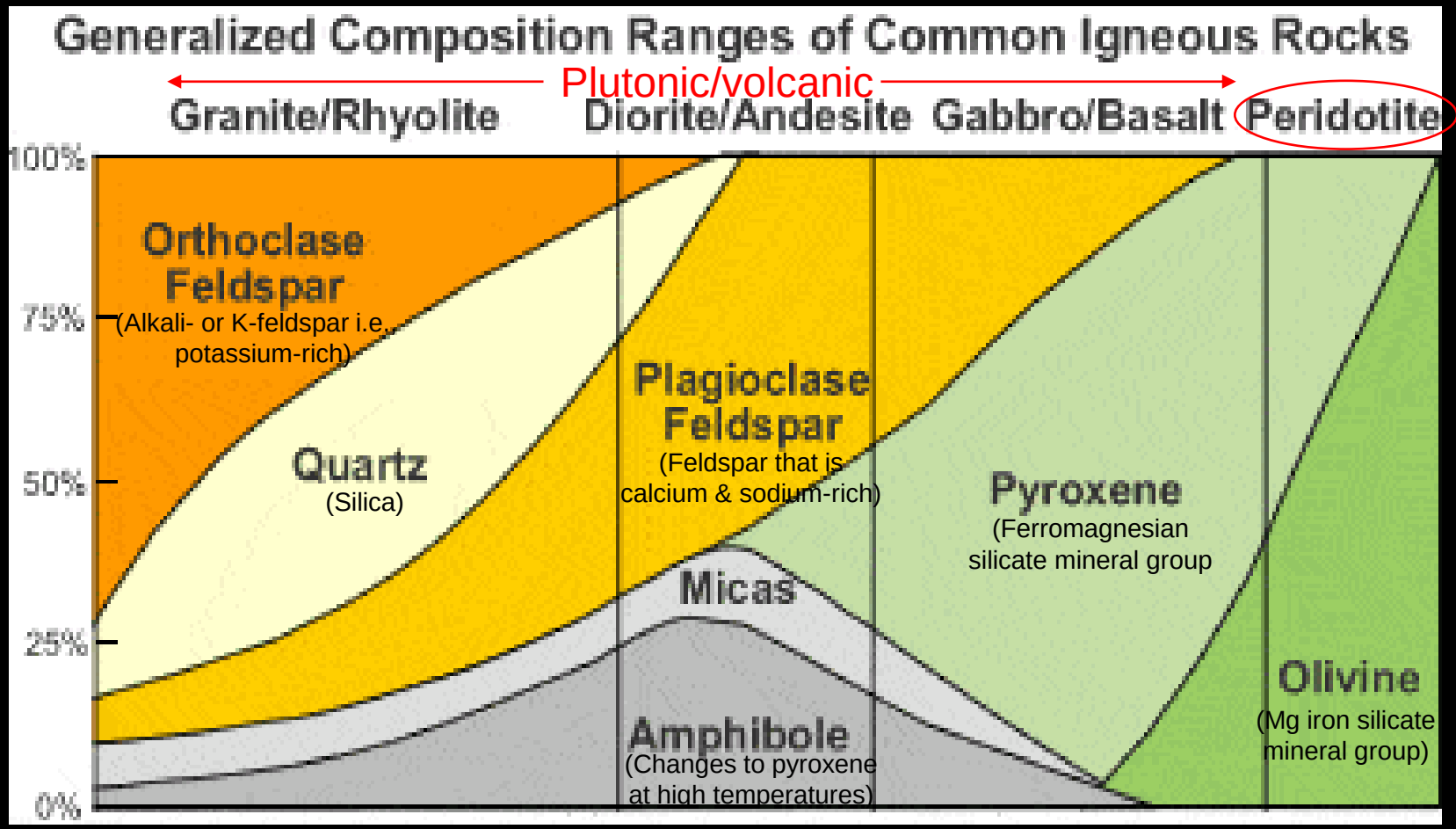
Metamorphic rocks

Metamorphism is the alteration of pre-existing rocks in the solid state due to changes in temperature and pressure. Under increasing temperature and / or pressure existing minerals become unstable and break down to form new minerals. In the case of regional metamorphism, the rocks are subjected to tectonic forces which provide the necessary mechanisms for metamorphism. Products include schist and slate. Contact metamorphism involves alteration through heating by an intruding plutonic body such as granite. Rocks can also be altered by superheated fluids.

Metamorphic rocks are of different grades depending on the amount of heat and pressure they have been subjected to e.g., low grade – slate; medium grade – schist; high grade – gneiss.

Rock types that we will see along the way – 5

There is a variety of igneous rocks on this walk, and they can be classified thus:



A rock of the Earth's mantle; becomes gabbro/basalt when it melts

High in silica ← → Low in silica

Felsic (Rich in feldspar & silica) — Intermediate — Mafic — Ultramafic (Rich in magnesium & ferrous minerals)

Source: geology.com

Rock types that we will see along the way – 6

Further details of the igneous rocks you will see

Granite: This felsic igneous rock is the most abundant basement rock beneath the relatively thin sedimentary rock cover of the continents. Produced in volcanic island arcs (which formed the earliest continental masses) and more commonly in mountain building resulting from continental collision. Island arcs form where tectonic plates collide, when one plate is forced beneath the other (subduction). This leads to melting of the subducted slab, and forms magma which rises absorbing impurities. Granite is an intrusive rock. The volcanic equivalent is rhyolite, which is a gas-charged highly viscous lava associated with explosive eruptions.

Diorite: An intrusive igneous rock intermediate in composition between felsic granite and mafic gabbro. Produced in volcanic island arcs and in mountain building. The volcanic equivalent is andesite, which also produces explosive eruptions.

Gabbro: Gabbro is a dense mafic intrusive rock. It occurs in along mid-ocean ridges and oceanic crust, or in ancient mountains composed of compressed and uplifted oceanic crust. The volcanic equivalent is basalt, which produces effusive eruptions with low-viscosity lava producing fountains and flows. The eruptions can be explosive if the lava comes into contact with water.

Granodiorite: This intrusive rock is intermediate in composition between granite and diorite. Although often similar in appearance to diorite or granite, it has a higher quartz content than diorite, and a higher mafic mineral content than granite. It is commonly produced in volcanic arcs, and in mountain building where it emplaces as large masses in mountain roots. The volcanic equivalent is dacite which produces explosive eruptions.

‘Larvikite’: This is a local name given to a rock occurring at Larvik, near Oslo in Norway. It was intruded into much older rocks during the Permian at ~290 Ma. Known to geologists as monzonite, feldspar is its most important mineral, with less quartz than granite, and contains mafic minerals such as hornblende, biotite and augite. In larvikite, light reflects off internal planes within the feldspar crystals at different angles giving rise to an iridescent play of colour especially when polished.

Uxbridge, in the London Borough of Hillingdon, is a former Middlesex market town on the old London to Oxford Road. Geologically, Uxbridge lies in the London Basin and is situated mainly on the Paleogene London Clay Formation, and the slightly older Reading Formation in the north-west. The London Clay was laid down in the sea about 50 million years ago and the Reading Formation of clays and sands (~55 Ma) was deposited in coastal swamps, estuaries and deltas. These formations are largely covered by much younger Quaternary river gravels (<0.5 Ma) and the old town was built on these, avoiding the alluvial flood plain of the River Colne. Brickearth underlies the southern part of the town and was exploited until the 19th century for brickmaking. It is a mixture of wind-blown and water-lain silt deposited in tundra conditions in the last Ice Age.

St Margaret's Church

On the High Street

We begin at Uxbridge station.

- The station replaced one of 1904 that was built with the branch line from Harrow. It was similar in design to Ruislip station and stood where the nearby Sainsbury's car park is now.
- The present station was completed in 1938 to the designs of Charles Holden, whose architectural practice designed quite a few other stations for the London Underground in the 1920s and 1930s as the system expanded into the suburbs.
- Granite cladding and brick form most of the frontage which is topped by limestone sculptures.

Entrance & lower façade

- The entrance is in Art-Deco style, popular in the 1920s and 1930s.
- The lower façade including the shop fronts, and the pillars further inside the entrance, are cladded with a fine-grained pale grey granite.
- The black rock at ground level and in the striped columns is another igneous rock, gabbro.
- The cream-coloured stripes in the columns are of polished limestone.

Station

Details of stones in and around the entrance

This granite consists of crystals of white feldspar, glassy quartz and black and brassy specks of biotite and muscovite mica.

It is uncertain as to where the granite is from, but it is similar to that from Bodmin Moor and Carnmenellis (near Falmouth) in Cornwall.

SW England granites were emplaced into deformed Devonian and Carboniferous rocks between 300 and 270 Ma in the Permian. A mountain range had been formed as continents collided forming the supercontinent of Pangaea, and melting was taking place deep in the crust.

Gabbro consists of the ferromagnesian mineral pyroxene and white crystals of plagioclase feldspar.

Gabbro is a coarse-grained equivalent of basalt and occurs in oceanic crust. This gabbro (usually called ‘black granite’ in the stone trade) is similar in appearance to ‘Bon Accord’ from Sweden. This example is Precambrian in age.

Upper façade

The bricks are made from the Jurassic Oxford Clay Formation, and the sculptures are of Portland Limestone.

The Oxford Clay outcrop extends from Dorset to Yorkshire. These machine-made bricks were made by the London Brick Company, so named because much of the output was sent to London by rail.

Most of London's inter-war suburban housing was built of this brick and its use for housing continued into the 2000s.

The clay is rich in organic matter which is combustible, making the firing process more efficient by needing less fuel.

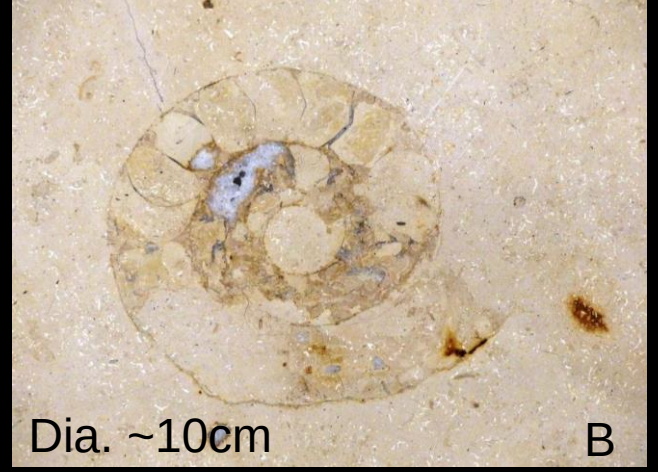
Today, the only active Oxford Clay brickworks is at Whittlesey, near Peterborough, now operated by Forterra plc (formerly Hanson Building Products). Other Oxford Clay pits in the Home Counties operated in Buckinghamshire and Bedfordshire but their sulphur dioxide emissions led to their closure by 2010.

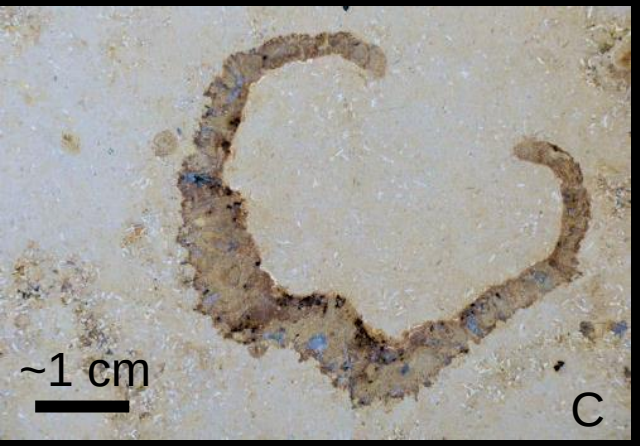
The sculptures are by Joseph Armitage and are based on stylised train wheels and leaf springs.

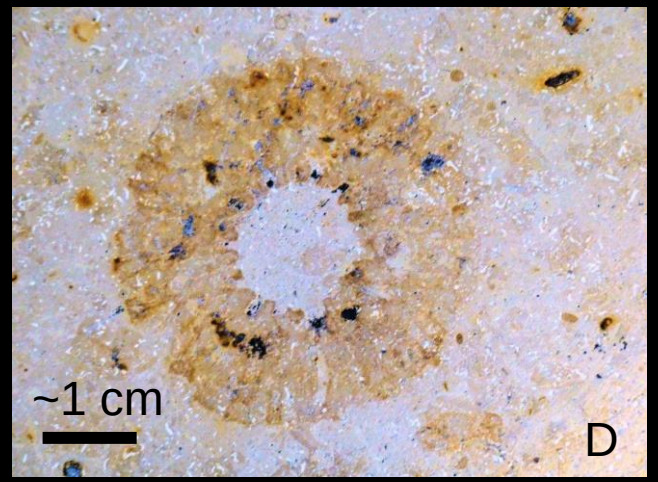
The Portland Limestone is from Dorset, laid down in a warm shallow sea at ~150 Ma in the late Jurassic. The best quality stone is relatively unfossiliferous and thus very suitable for carving.

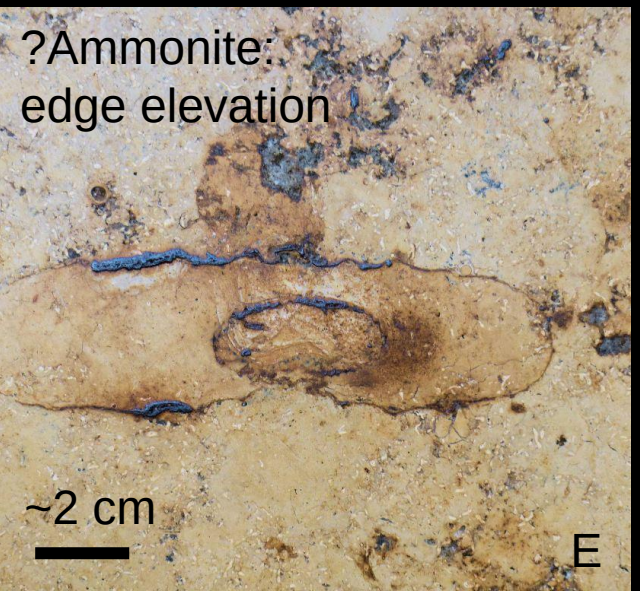
High Street

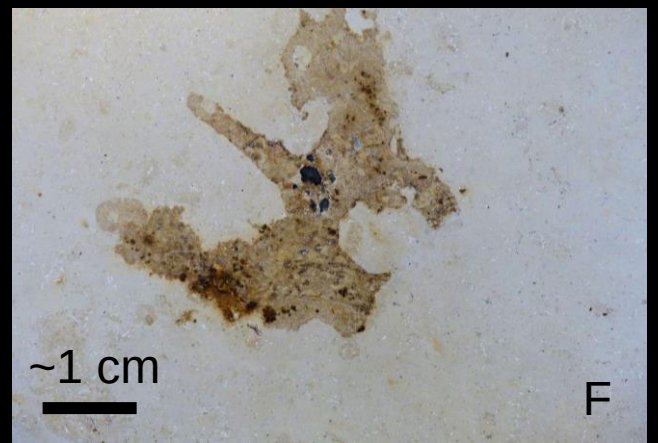
The Chimes Centre – the floor (1)











Most of the floor is of a beige-coloured polished limestone of late Jurassic age (~155 Ma) from the Upper Bavarian Jura Region of southern Germany. Marketed as 'Jura Beige', it was deposited in a shallow sea which covered parts of what is now central Europe.

The quarries lie about 130 km north of Munich and 10 km north of Eichstätt which is on the River Danube.

The stone features brown shapes – the cross-section of fossils. Many of the slabs display the spiral shapes of ammonites (B, E?) and a number show suture lines which separate the chambers inside the shells (B). There are also fossil algae (C, D, F), sponges and corals, and the very characteristic shapes of belemnites (A), a squid-like creature. The dark brown colour of the fossils and small fragments of them are due to replacement by iron oxide mineralisation.

The Chimes Centre – the floor (2)

Juramarble.com

Parts of the shopping centre are floored with a dark green stone. It is a calcareous sandstone comprising lime-cemented quartz grains stained dark green by glauconite (potassium iron silicate). Slabs show cross-sections of fossils. Glauconite forms only in marine settings and is commonly associated with low oxygen conditions on the seabed.

A trade name of the stone is 'German Greenstone' and is from the state of Nordrhein-Westfalen in NW Germany. It is quarried at Anröchte near Soest, 60 km east of Dortmund.

Upper Cretaceous in age (~90 Ma), the stone is coeval to part of the Chalk. It occurs as a several metre thick bed within grey-white limestone. It records a fall in sea level meaning that land was closer allowing an increased supply of sandy and muddy sediment.

The Chimes Centre – Goldsmith's

This shop nearly opposite Superdry has larvikite cladding below the windows. It is a variety of monzonite from Larvik near Oslo in Norway and is its national stone.

Monzonite is an igneous rock containing mainly feldspar, but less than 5% quartz.

The feldspar crystals produce a 'Schiller effect' in the way they reflect light i.e., giving rise to iridescence. The crystals are of three forms of feldspar – sodium, calcium and potassium aluminium silicates – which each reflect and bend light at different angles to each other. The rock has a similar age to the SW England granites (~290 Ma, Permian). Its intrusion was associated with the formation of the Oslo Rift Valley which is responsible for the large indentation in the coastline south of Oslo.

High Street

The Market House colonnade, 1789

Bronze statue *Anticipation* by Anita Lafford, 2002

The colonnade paving and (to be confirmed) the statue's plinth are of 'York Stone' from the >300 Ma Carboniferous Coal Measures. This sandstone consists mainly of quartz grains, with some of feldspar, mica and other rock types. As it wears, the non-slip quality of the stone is maintained, unlike limestone which can become polished and slippery when wet. The sandstone occurs interbedded with shales and coal seams, laid down when the 'British Isles' lay near the equator. Deposition was by braided river systems on large waterlogged plains that drained to the sea. Some paving slabs show ripple marks. The plains were covered in dense tropical vegetation and peat mires formed as dead plant material decayed. In time the peat was compressed into coal under the weight of younger sediments.

London Stock Brick – 1 25-27 High Street

The main façade of this mid-19thC building is in London Stock Brick – a type of handmade brick widely used in London and the SE until the growth in the use of machine-made bricks from the Oxford Clay etc. in the early 20thC. Stucco dressings and pediments.

Stock bricks were made from local clay and brickearth and in this area before World War I they came from brickfields in Yiewsley and West Drayton. In the main these were alongside the Grand Junction (now Grand Union) Canal. The clay was mixed with combustible refuse for more efficient firing.

The pillars and below window level of the shop fronts are of a shelly limestone from Lincolnshire. This was laid down in a warm shallow sea during the mid-Jurassic period at ~175 Ma. Close-up, this rock shows many layers of different colours such as pink, brown, yellow and grey, due to staining mainly by iron oxide minerals.

London Stock Brick – 2 Windsor St.

Both buildings are good examples of stock brick use with decorations in red brick from the clays of the London Clay or Reading Formation.

Dressings and keystones are in the Dorset Portland Limestone.

The ‘Metropolitain’

Former Police Station (1871)

Former Post Office, Windsor Street

(1909 with 1930 extensions)

Now converted into flats as Westcombe House, this is the best example of Portland Limestone use on the walk. The best quality stone has been used which has few fossils, can be cut in any direction (freestone) and is good for carving.

The bricks are like those once made in Bracknell from the London Clay – it was an important industry there before it became a New Town. A notable example of the use of Bracknell brick is the original Royal Holloway College building at Egham.

Examples of alternative sources: Chesham-Bovingdon, Reading and Maidenhead areas (Reading Fm.)

Stone setts outside the Market House

(See ‘kerbstones’ later for more details on the rocks)

A variety of igneous rocks have been used, mainly granites, granodiorites and diorites, with a few of basalt and dolerite. The granites may have come from SW England or overseas; the diorites from Leicestershire (pink or green-black/reddish) and maybe Guernsey (grey), the granodiorites from Leicestershire (pinkish grey to reddish) and the Carboniferous-age basalt/dolerite from the Black Country (West Midlands), the Whin Sill (Northumberland) or central Scotland. The stones were laid in one of the Town Centre refurbishments and are possibly reused. Red concrete paving blocks are to each side.

St Margaret's Church

The exterior of the church is faced with flint, most likely from the Chiltern Chalk outcrop. The upper walls are of knapped flint – individual nodules have been split to give a flat face and then carefully fitted together in lime mortar. They appear in the photo as a darker grey.

Probable Cotswold or Lincolnshire limestone of Jurassic age

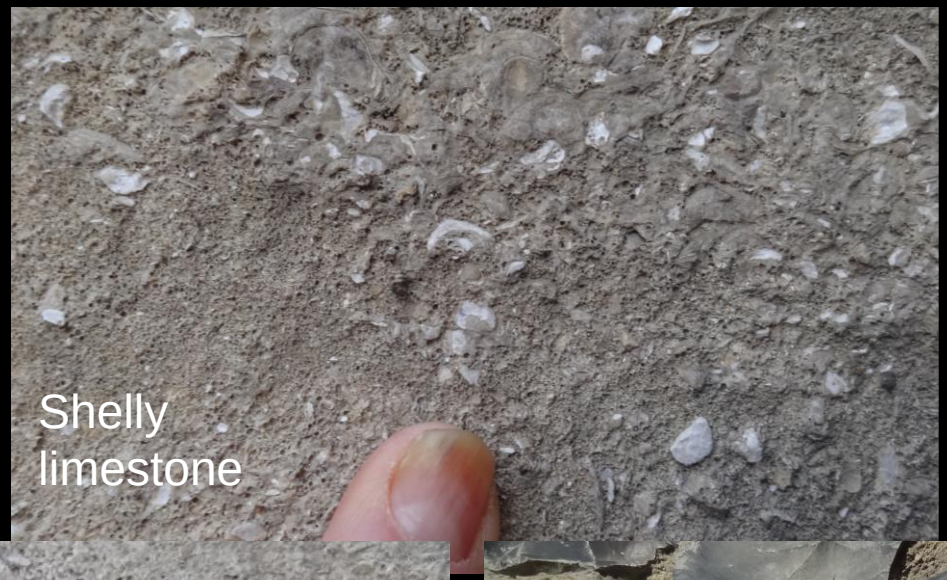
Tower orig. 14thC; largely rebuilt c.1820

Mid-15thC south aisle

Original early 15thC nave & north aisle

Building restored 1872 when most of the windows were replaced using Bath Stone, a mid-Jurassic limestone.

Stone dressings



These limestones are middle Jurassic in age. The grey stone could be from the Cotswold Hills or Lincolnshire and the Bath Stone has been, and is, quarried mainly underground around Bath and in north Wiltshire.

Oolitic limestone is formed from ooids (ooliths), spherical grains composed of concentric layers. The name is from the Ancient Greek for egg. The ooids seen in this rock are ~1-2 mm diameter.

The ooids are cemented by lime mud. They form when calcium carbonate is deposited on the surface of sand grains rolled around by wave action on a shallow sea floor.

The church floor – south aisle

St Margaret's Church


Crinoid stems


Cross-section of bivalve shell


Sediment disturbed by burrowing bottom-dwelling animals


Goniatite (forerunner of ammonites)


Coral


Coral

Carboniferous Limestone from Derbyshire, known as Hopton Wood Stone (age ~330 Ma) from the SE Peak District

The Font

The late 15thC font is of limestone but the black bowl, panels and plinth together with the metal lid were added in the 1980s. The provenance of the cream limestone is uncertain, but the black stone closely matches 'Nero (or Negro) Marquina Marble' with its distinctive white veins. Lower Cretaceous in age (~125 Ma), it is not a true marble* and comes from the Basque region of northern Spain. It is a bituminous limestone, hence the black colour. The veins are tension gashes infilled with calcite and is evidence that the rock has been weakly deformed.

*True marble is metamorphosed limestone

The Town Pump

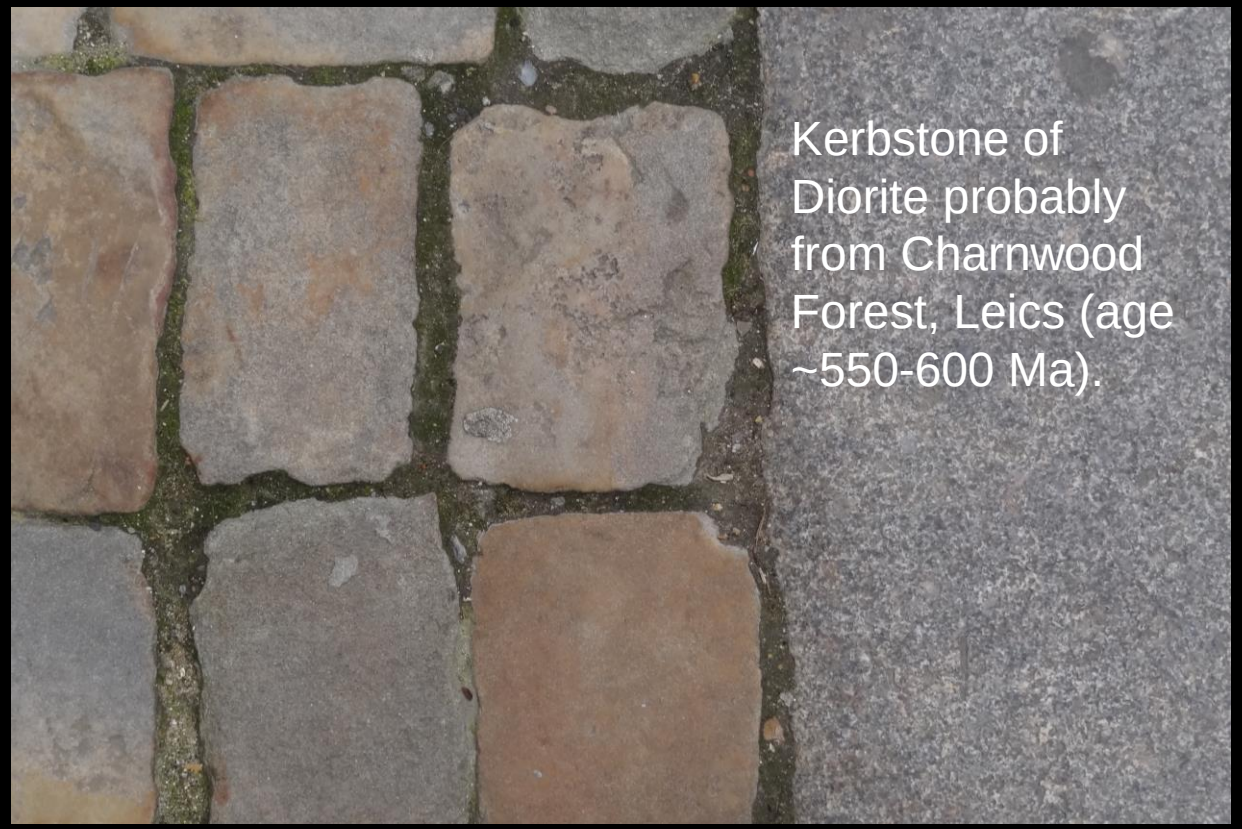
The pump, on Windsor Street by the church, supplied water from a well and was built sometime after 1800. It features a sandstone trough on a Portland limestone base.

The sandstone may be Pennine Millstone Grit, deposited by river systems during the Carboniferous ~330-320 Ma.

The rivers flowed across what is now Northern England from the Scandinavian region.

Paving and kerbing alongside St Margaret's church

The footway along the S. side is paved with setts of sarsen stone (formal term silcrete), which occurs as blocks of cemented remnants of the Reading Formation (Lambeth Group) of age 56-55 Ma (Paleogene). Under a warmer climate than today, silica dissolved in groundwater cemented sands and pebbles into very hard loose blocks that occur sporadically across southern England having survived erosion. Locally, they occur in the Chiltern Hills where the Reading Formation has degenerated into Clay-with-Flints which covers much of the higher ground between the valleys. Some blocks lie at lower levels to where they have crept downhill via mass movement of debris due to freeze-thaw action during the Pleistocene ice ages of the last 2.6 million years.



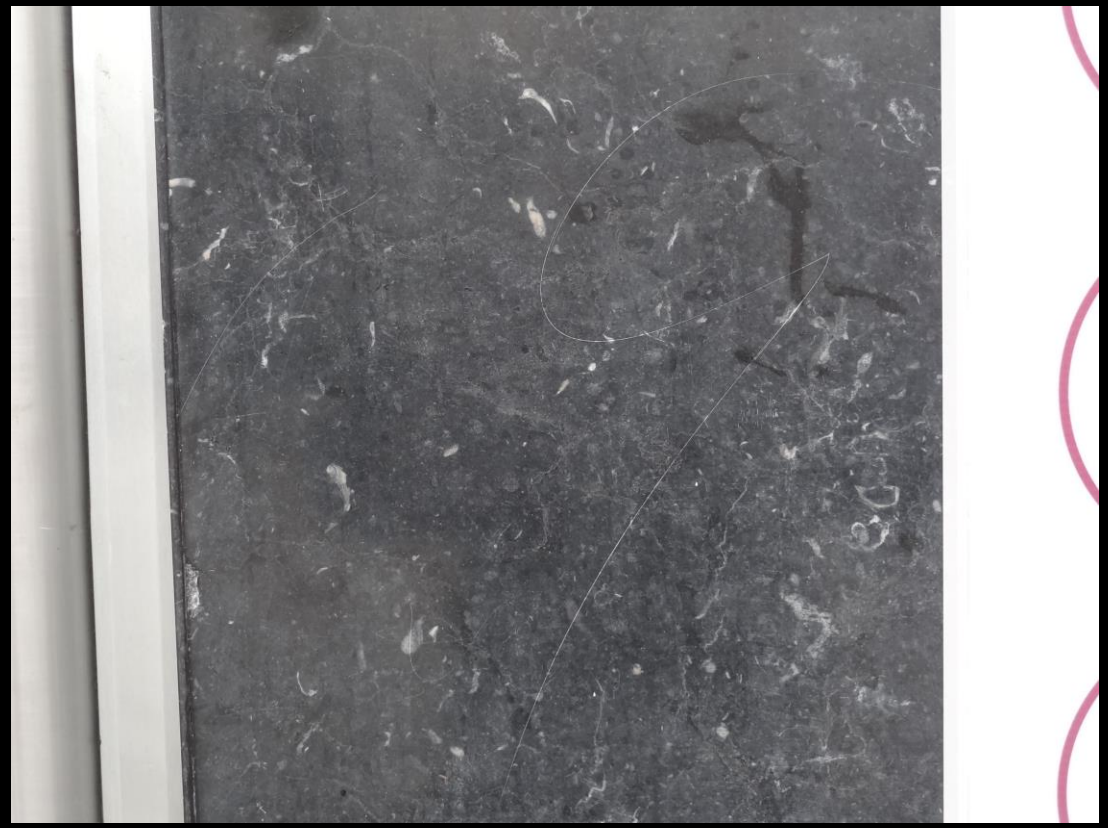
Kerbstone of Diorite probably from Charnwood Forest, Leics (age ~550-600 Ma).

The silcrete was quarried for building stone especially in the 19thC and early 20thC and has been widely used for paving and kerbing in Chiltern towns and villages. Much of it came from the Walters Ash-Prestwood area north of High Wycombe and is known as Denner Hill Stone.

The Pavilions Shopping Centre

The Pavilions was completed in 1973 as open malls connected by covered walkways as part of the original Town Centre Development which began in the late 1960s. It was redeveloped in the late 1980s involving a complete revamp and enlargement of the shops and the roofing over of the malls with steel glazed canopies. A new tower (left) with lift and smoke extract shafts was built in the Market Square to provide access to the car park.

The stair bannisters are of ~160 Ma Jurassic oolitic limestone from Ketton near Stamford, Lincs.



Polished limestone at the main entrance (provenance unknown) with fossil fragments.

Halifax Bank

Part of the frontage is clad in a Sardinian granite which is a close match to Grigio Perla and Rosa Beta. The age of the granite is similar to SW England granite and was emplaced at ~290 Ma during the Permian period.

The granite was formed (as with the SW England granite) during the Variscan orogeny, the result of the collision between the N. and S. hemisphere continents of Laurasia and Gondwana. This formed the supercontinent of Pangaea which lasted for about 100 million years before it began to break-up into the present-day continents.

The granite contains pink and white feldspars, grey quartz and black biotite mica. It is quarried mainly in the NE of Sardinia.

Kerbstones – Windsor Street (1)

On each corner of the alley entrance between Natural Healthcare and Le Petit Beauty Salon is a curved kerbstone of granite with large white feldspar crystals. This is a porphyritic*, megacrystic granite, characteristic of much of the granite of the Lands End Peninsula in Cornwall (age ~275 Ma). One of the main quarries on the Peninsula was at Lamorna Cove, which operated until 1911.

* Porphyritic texture is large crystals in a finer grained matrix.

Kerbstones – Windsor Street (2)

Diorite probably from Guernsey, age ~570 Ma. This rock was formed during magmatism associated with the subduction of oceanic crust under the margin of the S. hemisphere continent of Gondwana. This formed an island arc system (cf. Indonesia today). The islands coalesced to form the landmass of Armorica, then at latitude ~60°S, now forming western France and the Channel Islands.

Granite from Cornwall, age ~290-270 Ma. This variety is dominated by large white feldspar crystals. This was emplaced during a late stage of the Variscan orogeny, when the N. and S. hemisphere continents of Laurasia and Gondwana collided to form the supercontinent of Pangaea during the Permian. Pangaea lasted about 100 million years before it started to break up in the early Jurassic into our present-day continents.

Width of kerbstones ~25cm

Kerbstones – Windsor Street (3)

These two kerbstones are of diorite from the South Charnwood Diorite of Charnwood Forest in Leicestershire. The LH one is near the *Fig Tree* and the RH one is near the junction with the High Street. The diorite is dated at ~620-600 Ma, so are latest Neoproterozoic in age. The diorite was emplaced during island arc formation above a subduction zone of oceanic crust under the Gondwana margin (then at ~60°S). The island arc coalesced to become the microcontinent of Avalonia, the eastern part* of which forms the basement rocks of England and Wales. Avalonia had rifted from Gondwana in the early Ordovician (~470 Ma).

*Western Avalonian continental crust underlies parts of Newfoundland (Avalon), Nova Scotia and New England

Kerbstone, High Street

At arched entrance to private parking next to Darren House

This is Shap Granite from a quarry near Shap, north of Kendal in Cumbria. This distinctive granite has large pink K-feldspars set in a finer grained matrix of orange K-feldspar, grey quartz, plagioclase feldspar and biotite mica. It is another example of porphyritic texture.

The granite is Devonian in age and was intruded at 397 Ma during a late phase of the Caledonian orogeny after ‘England’ and ‘Scotland’ had joined together*.

Shap Granite has been quarried since the early 19thC and has been used all over the UK for polished decorative stone as well as kerbstones. Nowadays the stone is worked to order for decorative use.

*Before 400 Ma ‘England’ and ‘Scotland’ were on different continents – Avalonia & Laurentia respectively. Laurentia was the forerunner of North America.

The End

A guide designed to be taken with you on a geological walk around Uxbridge will also be on the HHGS website, and it will be regularly updated.

Further walks in the Harrow and Hillingdon boroughs will be added as they are completed.