



BRENTWOOD ROCK

A Geological Trail in Brentwood High Street

The trail is designed for adults but children will also find it of interest. There are at least 18 different types of rocks visible in the High Street, and probably many more. Each one formed under different conditions at different times in the Earth's history. Children may enjoy ticking off the different rock types as they come across them.

Sedimentary rocks

Clipsham Limestone
Kentish ragstone
Oolitic limestone
Travertine
York stone
Flint
Chert
Portland Stone
Sarsen stone
Ferricrete
Puddingstone

Igneous rocks

Granite
Larvikite
Gabbro

Metamorphic rocks

Marble
Serpentine
Slate
Quartzite

Produced for the Essex Rock and Mineral Society
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1 WAR MEMORIAL

The memorial itself and all the walls surrounding it are of **Clipsham Limestone**, a 170 million year old limestone of Jurassic age from near Oakham in Leicestershire. It is an attractive buff to cream colour when fresh, weathering to grey on exposure to the air. It is full of shell fragments, the remains of shellfish that lived in the Jurassic sea. There are also belemnites, an animal related to the cuttlefish, which can be seen in cross section on some of the surfaces. Also note the layering of the shell fragments, this is mostly horizontal but in some cases cross bedding is visible (e.g. high up on the memorial). All this indicates a shallow coastal environment where waves have broken up the shells and deposited them in undersea dunes. At this time the climate in Britain was thought to be tropical as the country was much nearer the equator. This limestone was chosen for the memorial as it is a 'free stone', i.e. it can be freely worked in any direction irrespective of the bedding. Limestone is classed as a *sedimentary* rock because it is made from fragments or grains.

The paving surrounding the memorial is of **York stone**, a fine grained flaggy sandstone with numerous flakes of mica. It is from Yorkshire and of Carboniferous age (about 300 million years old).

2 SHEN PLACE ALMSHOUSES

The wall in front of the almshouses is composed of fine knapped **flints** (i.e. flints broken to produce a flat surface), probably from Brandon in Suffolk. Flints are hard nodules of silica from the Chalk (Upper Cretaceous period and about 80 million years old). Several traces of fossils can be seen, made by animals, such as sponges, that lived on the Chalk sea floor. At this time almost all of Britain was under the sea.

The white limestone blocks capping the wall are of **Portland stone**; we shall see more of this later on in the trail.

Note the **granite** kerbstones along this entire stretch of road, but don't risk examining it here, there will be another opportunity later.

3 HUNTER MONUMENT

The upper part of the monument is of fine polished **granite**. This is Peterhead granite from Aberdeen. Note that granite consists of three minerals - feldspar (milky pink), quartz (glassy) and mica (flecks of brown, black or silver). Granite is classed as an *igneous* rock which means that it was once molten and on cooling the constituent chemicals crystallised as distinct minerals. These three minerals enable us to identify the rock as a granite although the colours

and proportions of these minerals varies depending on where the granite comes from. If the surface is viewed obliquely, the effects of weathering can be seen. The quartz is resistant to weathering and still retains its polish but the feldspar is dull, while the mica is softer and easily weathered leaving shallow pits. Occasionally there are fragments of fine grained rock within the granite. These are known as xenoliths, pieces of 'foreign' rock broken off from the walls of the intrusion and partly consumed by the granite. The conspicuous cracks in the monument are apparently due to the heat of a severe fire in the nearby building in 1910.

The lower part of the monument is an unpolished light coloured **granite**, typical of the granite from South West England which was formed in the Permian period some 250 million years ago. This piece is probably from Dartmoor.

The monument sits on **York stone**. Note the difference between these sawn blocks and the broken slabs used for paving at the war memorial.

4 LARKIN'S DRINKING FOUNTAIN

The trough is made of Cornish **granite**, reputedly from Bodmin Moor. In this case the feldspar crystals are large compared with the Dartmoor granite of the Hunter monument. The fountain bowl itself is of a beautiful red granite known as 'Balmoral' from either Sweden or Finland. It acquired its Scottish-sounding name when it was imported through Aberdeen in the last century. Note the colour of the feldspar crystals.

5 ARGOS 16-18, High Street

Here we have Italian **serpentinite** (commonly called serpentine), a rock familiar to us from its occurrence on the Lizard peninsular in Cornwall. This is a *metamorphic* rock which is rock changed and recrystallised by being subjected to great heat and pressure deep inside the Earth. Serpentinite is thought to represent part of the Earth's mantle thrust up through the crust during continental collision. Here it is apparent that there has been intense shattering of the rock and invasion of minerals along cracks.

At floor level there are slabs of **gabbro**, another igneous rock formed at great depth in the Earth's crust but differing from granite by having different constituent minerals. It can't be a granite because although it contains feldspar it lacks the essential granite-forming mineral, quartz. Gabbro also contains other minerals such as pyroxene. The most well known outcrop of gabbro in Britain is the Cuillin Hills on the Isle of Skye but the gabbro in our high streets comes from abroad, most of it from South Africa.

6 CHAPMAN AND BLAKELEY 24, High Street

Here are superb panels of what appears to be **marble**, a metamorphic rock created by the recrystallisation of limestone. However this is reputed to be a limestone from Ashburton in Devon (Devonian period, about 360 million years old) and therefore it is a sedimentary rock. Decorative limestones often resemble true marbles when polished.

7 ST. THOMAS' CHURCH St. Thomas' Road

The walls of the church consist of a great variety of rocks (notably **flint**, **chert**, **sarsen stones**, **vein quartz** and **quartzite**) all presumably gathered locally from geologically recent ice age gravels. It is rather a lucky dip of rock types and some can be recognised as originating as far away as Scotland having been brought south by the Anglian ice sheet some 500,000 years ago. There is even a piece of **chalk** in one of the walls but this couldn't have survived in the gravels. The quoins and door surrounds are of quarried Jurassic **limestone** which has suffered badly from weathering.

If the church is open, take the opportunity to go in and see how many rock types have been used internally.

The Victorian gravestones are made of a wealth of different rocks, probably all of them from Britain. Imported rocks for gravestones were not commonly used until fairly recently. Note also the fine **York stone** flagstones at the side of the church.

8 POST OFFICE

Large amounts of **Portland stone** can be seen here. This is a late Jurassic limestone (and therefore a sedimentary rock) from the Isle of Portland in Dorset with prominent fossil shells. We can check that this is a limestone by using a small amount of dilute hydrochloric acid. It is about 150 million years old and probably the most common of all British building stones. Note the difference between this and the older Clipsham Limestone of the war memorial. What does this tell us about the undersea conditions at the time this limestone was deposited? Also, with the use of a hand lens, you will notice how the differential weathering (due to acid rain) has resulted in the shells standing proud, giving it a rough surface.

At the base of the building is a polished dark **granite**.

9 SNOOKER CLUB 40, High Street

Either side of the doorway and on the jewellers nearby are superb slabs of **larvikite**, a syenite from Larvik in Norway. This is an igneous rock, dominated by feldspar crystals which exhibit a striking sheen or iridescence when seen from certain directions. Syenites are intermediate in composition between granites and gabbros. Larvikite is so common on high streets, particularly on pubs, that it has been given the nickname 'publichouseite'.

10 ST. THOMAS A BECKET CHAPEL

This ruin has a lot of **kentish ragstone** which is a sandy limestone of Lower Cretaceous age (about 100 million years old) from a horizon known as the Lower Greensand in Kent. In South East England it has been much used in churches but it weathers badly. Some of the most weathered blocks here have been replaced with a freshly quarried Jurassic limestone. This is a pity as the same stone should always be used for repairs. Using a hand lens kentish ragstone is recognisable by the characteristic tiny dark green grains of glauconite, an iron silicate mineral, giving the rock a greenish tinge.

Also here are occasional blocks of **oolitic limestone** of Jurassic age, probably from near Bath. Under a hand lens it can be seen to consist of tiny spherical grains or 'ooliths', giving the rock the appearance of fish roe. Ooliths are of calcium carbonate with a concentric structure formed when a nucleus, such as a shell fragment, is rolled around on the sea floor by currents. Ooliths are forming today in the shallow tropical seas around the Bahamas which gives us an idea of what England was like at the time this rock was formed. The walls of the chapel contain many other rocks including **Portland stone**, **flint**, **quartzite** and a fine piece of **puddingstone**. There are also blocks of **ferricrete**, an iron-cemented flint gravel formed as an 'iron pan' at the level of the water table. This is typically found in many of the most ancient buildings in the London basin and here it is probably re-used from an earlier structure on this site.

Near to the chapel, adjacent to the sign board is a new large rough slab of **granite**. Compare this new block of granite with the rough granite at the base of the Hunter Monument which has endured decades of Brentwood's weather.

11 NATIONAL WESTMINSTER BANK 46, High Street

Banks usually have the best rocks. Here again is a **granite** but in this case the feldspar crystals are very large which is due to very slow cooling of the 'melt'. In places the crystals are aligned or are in layers. This is due to movement in the still semi-molten rock after the feldspar crystals had been formed. In some granites there are large feldspar crystals in a matrix of very much smaller crystals (Shap granite from the Lake District is a famous example). Why do you think this is?

12 HANOVER HOUSE 78 High Street

A superb selection of **granite, marble and gabbro**. Do these differ from the granite, marble and gabbro we have seen so far? If so, what can we deduce about their origin?

There is the opportunity here to examine the fine **granite** kerbstones with less chance of being run over. Note the fine grained 'dyke' on one block which is another intrusion of granite after the main mass had cooled and solidified.

CROSS NOW TO THE NORTH SIDE OF THE STREET

13 McDONALD'S 99, High Street

McDonald's is well known for its geology as well as its beefburgers. The buff stone is Italian **travertine**, a calcareous sedimentary rock formed as a spring deposit and laid down in sheets by flowing water. This is the same rock used by the Romans to build the Coliseum. Land plants and animals (such as fresh water snails) sometimes turn up as fossils but these are very rare. Are there any visible here?

The black rock is **gabbro**. We know that this one comes from South Africa, from quarries close to Pretoria and Johannesburg.

This branch is also worth a look inside. Here can be found tables made of an unusual colourful **granite** with two varieties of feldspar, the origin of which is unknown. This is different from any granite we have seen so far on the trail.

The florist next door has a wall of rough blocks of fine-grained **sandstone**. This is no doubt British, probably from the north of England, but no more is known about it.

On the way to the next stop there is another granite dyke in a granite kerbstone outside the White Hart only this time it is very coarse grained with the large crystals indicating a slow rate of cooling.

14 MIDLAND BANK 91, High Street

The frontage here is almost entirely of **Portland stone**.

15 BARCLAYS BANK 75, High Street

Large amounts of Italian **travertine** here, only this time the cavities have been infilled with an artificial filler to produce a smooth surface.

16 SAINSBURY'S 51, High Street

Fine panels of **larvikite** on the columns either side of the store.

17 LLOYD'S BANK 47, High Street

A fine pale **granite** frontage.

18 MARKS AND SPENCERS 43, High Street

The upper portions of the columns are of fine Cornish **granite**. Occasionally there are patches of very fine grained granite completely surrounded by the coarse grained rock. Again, these are xenoliths similar to those that we saw at the Hunter monument.

19 SKETCHLEY'S BLOCK 33, High Street

Here we have **Slate** which is a marine sediment subjected to such pressure deep in the Earth that it has recrystallised in layers. Slate is perhaps the most well known metamorphic rock but we are usually familiar with it as a roofing material where it has been split along the cleavage planes. Here it is used as a cladding. This is green slate from the English Lake District, initially formed some 450 million years ago (in the Ordovician period) when volcanic ash fell into the ancient Iapetus Ocean that then separated Scotland and England. It clearly shows the graded bedding of the different sized particles of ash as it was laid down under water.

There was formerly a fine fault visible, caused by Earth movements, but this is now hidden by a new chemist's sign. However there is another good example here. It is high up on the wall in the right hand doorway.

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