A Guide to County Hall Building Stone

Welcome to County Hall

Welcome to County Hall, which is the headquarters of Devon County Council in Exeter. Designed by architect Donald McMorran and completed in 1964, the building was listed Grade II* in 1998. In the listing notice it is highlighted that the building is constructed with quality materials. We hope you enjoy this guide which leads you to some of the best examples of the interesting building stones used, with an explanation of their geology.

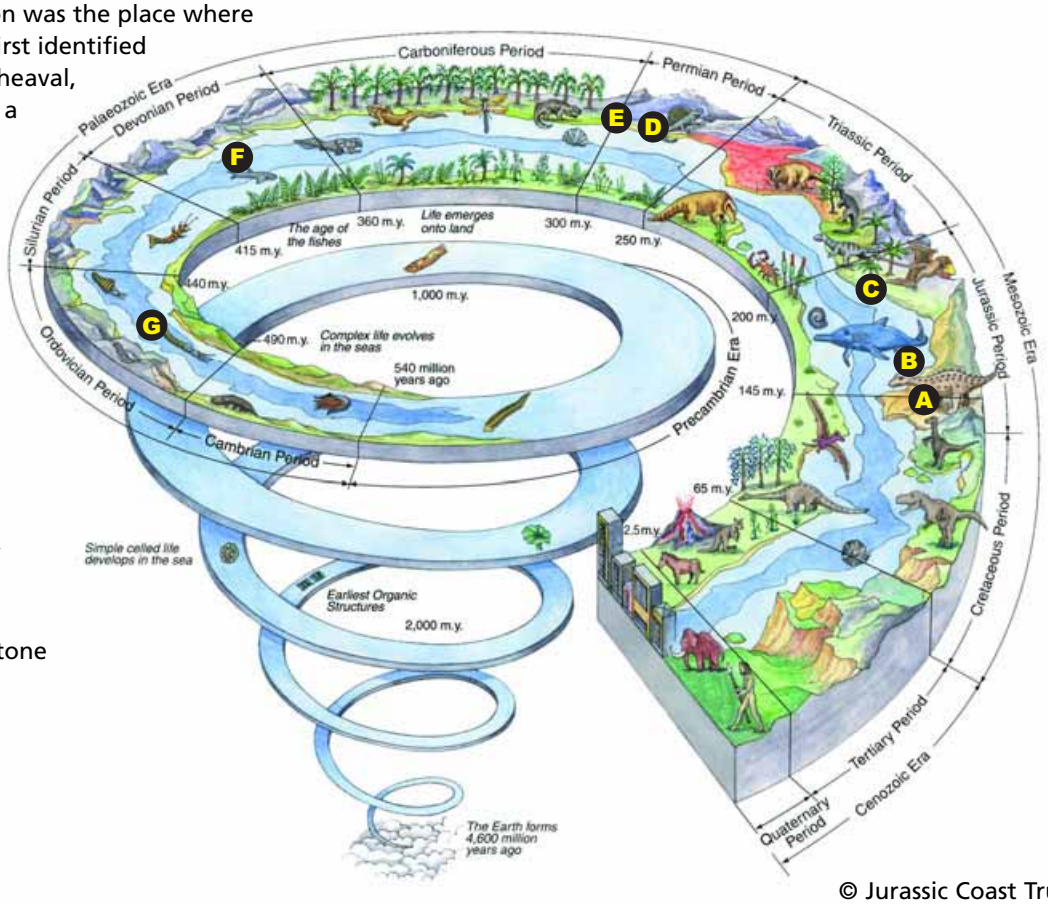
The varied building stone found at County Hall reflects elements of the geological history of Devon, the south-west and even the whole of Britain. Devon's story spans millions of years, during which time the county travelled northwards across the equator, experiencing arid deserts, warm tropical seas, deeper muddy continental shelves, mountain-building events, and even volcanic eruptions. Follow this guide and take a closer look at the building stones to witness remnants of these past environments.

Devon travelling through Geological Time

Imagine a tropical sea with crystal clear waters on shallow banks fringed by coral reefs, and deeper basins through which mud from the distant lands to the north was channelled. This was Devon in the Devonian period, so named because Devon was the place where rocks of this age were first identified and described. Later upheaval, caused by collision with a continental mass approaching from the south riding piggy-back style on another tectonic plate, pushed the sea floor and its load of sediments northwards, at the same time folding and compressing them. The mud was converted to shale and slate, with the coral reefs and the surrounding slopes of coral fragments converted to limestone, of which the ***Ashburton Marble*** is an example. These dramatic events, called the Hercynian Orogeny or mountain building event, were accompanied by the melting of the rocks in the roots of the mountains. The molten material or magma moved upwards through the earth's crust, cooled and solidified

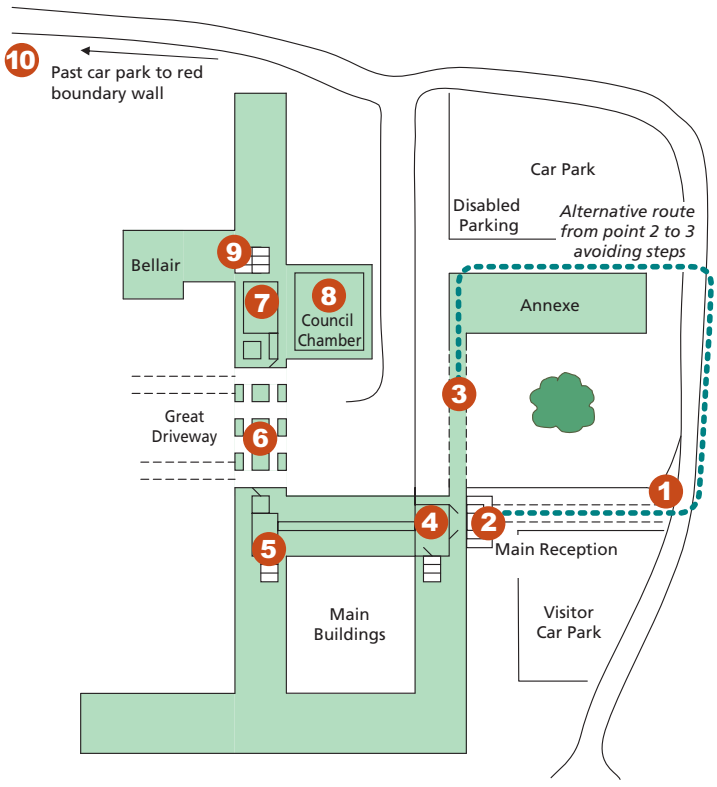
Age of County Hall Building Stones

- **A** Purbeck Stone
- **B** Portland Stone
- **C** Doulting Stone
- **D** Heavitree Breccias & Exeter Volcanics
- **E** Dartmoor Granites, Greenstone & Yorkstone
- **F** Ashburton Marble
- **G** Cumbrian Slates



within it, forming the ***Dartmoor and Cornish Granites*** about 290 million years ago. At almost the same time, volcanoes located at deep fractures in the crust erupted, forming the lavas we now know as the ***Exeter Volcanic Series***.

As soon as the mountains were formed, wind, rain and the action of streams and rivers started wearing them down. Because Devon now lay at the latitude of the present Sahara Desert and in the interior of a huge new continent called Pangaea, the climate was arid; rainfall was sporadic but intense and, falling on a desert landscape without vegetation, led to flash floods that carried the red iron-stained surface waste rock to the foot of the mountains and deposited it there as gravel. We see these deposits as the Permian ***breccias*** widely used for building in Exeter and Torbay. The seas slowly returned in subsequent times, flooding in from the east. ***Doulting Stone***, a limestone made of fossil fragments in the shallow sea surrounding the Mendip Hills which were islands at that time was formed in the Jurassic period. ***Portland Stone***, much favoured by Christopher Wren and widely used for government buildings in London is also Jurassic but younger in age. ***Purbeck Limestone*** is younger still, formed not in the open sea but in brackish water, perhaps in lagoons or other coastal locations.



The Trail

The numbered points on the map above represent particular sites where you can see good examples of the different building stones used at County Hall.

Use this guide either as a trail through the site or to find specific locations on the map which interest you.

1 Walkway in front of the Visitor Car Park

Go to the visitor car park…

Notice the granite setts across the road near Lucombe House (top left in photo). ***Granite*** is an igneous rock formed by partial melting deep within the Earth's crust. The magma was less dense than the surrounding rocks so intruded upwards into the surrounding country rocks above. The magma then cooled slowly, allowing the minerals to form large crystals. Note the large white ***alkaline feldspar*** crystals, black ***biotite mica*** flecks, and glassy grey ***quartz***. Notice also that there are finely crystalline red-pink blocks. These are composed of rhyolite – a similarly quartz and feldspar rich rock to the granite, but one which cooled very rapidly. The black blocks are ***dolerite*** (similar to those described below).

Greenstone kerbs (pictured diagonally through centre of photo): Look out for the dark kerbstones lining the pavements here and around much of the County Hall grounds. These are altered ***dolerite*** - igneous rocks formed from basic magma, which didn't reach the surface to form a ***basalt lava***. The word 'greenstone' is a local name for this rock, which mose likely came from the Teign Valley. If you can get up close to this you should be able to spot needles of white ***plagioclase feldspar*** crystals and dark-coloured ***pyroxene***.

Paving slabs (bottom right in photo): These are composite paving slabs, not a true 'building stone', usually formed from a mixture of crushed-up rocks and concrete.

2 Main Entrance Steps

Find the ***granite*** steps. As well as the previously mentioned granite setts used as paving, here we see light-coloured granite slabs used for most of the steps. You should be able to see the same sorts of minerals as previously listed in

these rocks, however their colour and texture is much more uniform. The typical light colour of granite is due to its ***acid*** composition. It contains large amounts of ***feldspar*** and ***quartz***. Look really closely and find small black needle-like crystals throughout the granite – these are ***tourmaline***, a mineral characteristic of southwest granites. Although we don't know the exact quarry location, it is likely that these slabs came from Cornwall or Dartmoor.

Look for ***Yorkstone*** paving and steps. These are the dusty grey or light brown coloured stones making up one of the steps towards the main entrance. These are a type of sandstone (a sedimentary rock) known for its hard-wearing qualities. It has tightly packed grains of quartz, feldspars, and micas, with a natural cement of reddy brown iron oxide and silica that binds the sediment together making it strong. If you look closely, erosion from people walking over the stone has brought out small-scale structures on the surface (cross-bedding). This is not to be confused with the groove markings that have been made on the surface of the rock when it was cut, to give extra grip. It is likely that this was quarried in Yorkshire, although the exact quarry location is unknown

Look up! The roof of the building is covered in ***Cumbrian Slates***. This fine-grained metamorphic rock is a baked and squeezed mudstone. Deformation and recrystalisation led to the parallel orientation of mica minerals in the rock, which allowed it to be split into thin sheets – perfect for roofing.

3 Walkway

Here there is more ***Yorkstone*** paving, ***granite*** gutters and window ledges around the red brick structures. Most of the walkways and pavements around the main County Hall buildings consist of some combination of these stones, so look out for them as you walk around.

This is a good opportunity to take a closer look at the bricks, which are the most extensively used building material at County Hall. These bricks are particularly interesting for their special shape, with a thin (two inch) thickness. Historic documents record the handmade bricks as being sourced from Leceistershire and are described as a 'golden brown Ibstock brick'.

As you walk inside, notice the unpolished doorframe to main reception. This buff-coloured shelly limestone is ***Doulting Stone***, used also in the Council Chamber, and is explained later.

4 Main Reception

Go into main reception and look down at the floor. Notice the red-orange floor tiles lined at the edges of the room by a black stone.

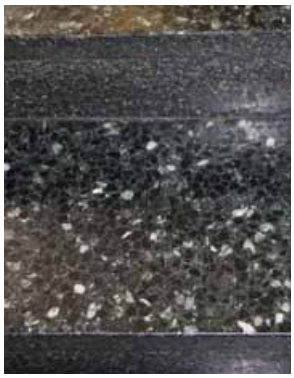
The red tiles are Welsh Quarry tiles from Wrexham, Clwyd, made from natural clay (***Etruria Marl***) which has been quarried at Ruabon since 1878 and fired in kilns.

The black stone edging the room is a ***welded tuff*** or ***'ignimbrite'***. To form this rock, hot material was blasted out from within a magma chamber and a caldera of a volcano. This blast resulted in powerful pyroclastic flows heated to hundreds of degrees Celsius that burnt anything in their path. Bedrocks were sometimes ripped up off the ground and included in the flow. The fast flow carried ash, lava and fragmented rocks which were deposited on the flanks of the volcano and surrounding land. The flows can result in bedding, laminations and swirled structures. After deposition, the hot ash was compacted and welded together becoming hard and resistant. It is possible that later lava flows and regional metamorphism have caused continued heating, recrystallising the tuff to what we see today. The white streaked quartz veins were formed later through cracking of the rock, with deposition of silica in the cracks.

Look out for the polished walls of ***Purbeck Limestone*** used as wall tiles here, along the corridor in front of you and in much of the interior of the main building and near the Council Chamber. This is thought to be ***'Thornback'*** – a local name for this cream shelly limestone, which is part of the formation that is used for Purbeck building stones. It was formed in warm shallow freshwater or brackish lagoons roughly 140 million years ago and in this case is crammed with fossils; bivalves such as ***Corbula*** (small tear-drop shaped shells, usually white) and ***Neomiodon***, oysters including ***Praeexogyra contorta***, along with gastropods. Crocodile and turtle bones have been recovered in some of these rocks!

Look out for these rocks as you continue along the corridor through the main building…

5 Stairways



These consist of black ***terrazzo*** – a manmade composite material made from crushed black, white, green, and red ***marble*** chips in a black epoxy binder. Composed of ***calcium carbonate***, marble is a broad term applied to a variety of recrystallised limestones. The colour variations are often caused by metallic impurities in the rock. Look out for the white ***calcite*** veining across many of the chippings.

6 The Great Gateway

Notice the huge ***granite*** pillars. These are the same granite as used for the steps to main reception and the window lintels. On closer inspection you should see the usual quartz, black biotite mica, larger white alkaline feldspar (here ***orthoclase feldspar***), and a background of poorly formed whitish ***plagioclase feldspar***. The white orthoclase feldspar crystals found here are large and rectangular shaped (termed phenocrysts). These probably crystallised first in the intruding magma and had enough space to develop a good crystal structure. Look closely at them moving from side-to-side and you should find that one half of the crystal will glint in the light, while the other side remains dull. This is due to their twinning – two sides of the same crystal, grown in different orientations. Look out also for brown halos around the black flecks of ***biotite***. The iron content of these decomposes and causes this staining to the surrounding rock.

Notice again the walkways with their ***granite*** and ***rhyolite*** bricks, ***Yorkstone*** paving, and ***Greenstone*** kerbs…

7 Into the Antechamber

Enter this building and notice how lavishly it has been decorated. A Purbeck Limestone called ***Thornback*** clads the walls and the floor is covered in the most spectacular black, white, and red rock. This is ***Ashburton Marble***.

Formed roughly 370 million years ago, the Ashburton Marble is from a time when Devon was situated close to the equator. This Devonian limestone is a fine lime-based mud with abundant fossils found throughout. It was formed in a shallow tropical sea with neighbouring coral shelves, much like the Caribbean today. Look closely, you should see oval-shaped white fossils – these are individual corals which look like cartwheels. Also you can see examples of ***tabulate*** and ***rugose*** corals here, both of which are extinct forms. ***Stromatoporoids*** can easily be found, these are a type of fossil sponge. There are also ***algal patches*** (which look like very fine nets) and ***brachiopods*** (a marine shell). After deposition, squeezing of the land caused faulting and thrusting of the rocks. Once the compressional period had ended the rock extended and lens-shaped cracks formed and were infilled with whitish calcite, which can be seen across the floor tiles (known as ***en echelon veins***). This outstanding rock was extensively quarried from sites such as the Linhay Hill Quarry near Ashburton.

Portland Freestone makes up the steps and small square tiles between the Ashburton Marble. A light coloured limestone, this looks quite different from the ***Purbeck Limestone*** wall cladding above it, and is older. As sea levels shallowed roughly 145 million years ago in the Upper Jurassic, marine limestones began to be deposited in this tropical warm water. Shelly fossils were preserved including ***gastropods*** and ***bivalves*** such as oysters. These shells are much less numerous in comparison to the Purbeck Limestone. ***Portland Stone*** is

characteristically ***oolitic***. ***Ooids*** are small (<2mm) spherical grains built up from layers of precipitated calcium carbonate. The layers formed around a sand grain or shell fragment nucleus which was rolled around on the seafloor due to currents and waves, coating in needles of calcite – great quantities of these are currently forming off the Bahamas. This white stone became fashionable throughout the country when Sir Christopher Wren used it to rebuild St Paul's Cathedral after the Great Fire of London.

8 The Council Chamber

For such a grand room, this has surprisingly only one visible building stone on show – ***Doulting Stone***. This ***inferior oolite*** was sourced from just east of Shepton Mallet in the Doulting Quarry, having been used historically since the Middle Ages and in famous buildings such as Wells Cathedral and Glastonbury Abbey. Older than both Portland and Purbeck stones, this was formed in the Early Jurassic when sea levels were rising. The flooding of the land in the region of today's Mendips effectively made them into islands and it was near these ancient shores that this shell-rich limestone was formed. It's difficult to closely view this as it's so high up on the walls, but if you could you would see fossils including ***brachiopods***, ***bivalves***, ***ammonoids***, and sea urchins (***echinoids***).

9 The Grand Stairs

Follow the corridor towards the Grand Stairway. Notice on your way the large ***granite*** commemorative stone inscribed and laid at the base of the back wall. This is a similar granite used for the pillars in the Great Gateway.

As always, the walls are clad with ***Thornback*** (a Purbeck Limestone) and the steps are of the noticeably different ***Portland Freestone***. Following the stairs upwards, notice that there is a third limestone used around the windows, doorframes, and lining the walls above the Purbeck Limestone. This is ***Spangle*** – a local name for this coarse grained fossiliferous grey limestone quarried from St Aldhelm's Quarry in Dorset. This rock type occurs in conjunction with both the Portland and Purbeck beds. Notice the fossils it contains – there are some excellent cross-sections through ***oysters*** and ***stromatoporoids***.

At the top of the stairs, there are two beautiful columns of polished ***Ashburton Marble***. This is another opportunity to look closely for the fossils mentioned previously, and for a three dimensional view of the rock. The columns are capped at the top and base by turned ***Portland Freestone***. Ashburton Marble was also used for the fireplace in the Roborough and Chairman's Rooms.

10 County Hall Boundary Wall

Exit the buildings and follow pavements which are mostly made from ***Yorkstone*** and lined with ***Greenstone***. Find the wall behind the road north of County Hall, which pre-dates the construction of the buildings. This bright red construction is unmistakable through the garden shrubs and can also be found lining the pavements and roads down Matford Lane. Similar walls are easily sighted around Exeter Cathedral.

The wall seems to have been built out of reclaimed blocks from the local area along with locally quarried material. The characteristically red-brown rock is a ***Permian breccia*** quarried from Heavitree Quarry in Exeter itself. When these rocks were formed, Devon was experiencing hot arid conditions stricken with flash flooding across this desert. These would rip up clasts from sediments and bedrock they flowed over and it was these large angular pebbles that make up the rock between coarse sandy grains. The matrix and cement that glues the rock together is red because of its high iron oxide content (particularly ***haematite***). Purple-grey ***Exeter Volcanics*** are also present in the wall and mostly consist of *basalts*. Some of these lavas are *vesicular* (where small bubbles of volcanic gases were trapped in the fast-cooling rocks). Others contain white veins of calcite (locally known as ***Pocombe Lavas***).

Looking closer, you'll see that the wall also contains rounded blocks of ***quartz*** along with broken bricks. This really was just built out of what came to hand!

Acknowledgements

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For more information about geology in Devon visit www.devon.gov.uk/geology
Here you can also find a leaflet version of this guide.