Laura Ashley 15 , next door, has a grand classical 1920's frontage with four fluted Portland Stone columns which belong in Cathays Park. The upper façade of **Bradford & Bingley** 16 , next in line, is of Triassic red sandstones from the Midlands, visible only where the paint coating has flaked away.

On the opposite (south) side of Queen Street 17 , the shop frontages such as McDonald exhibit 20th century substitutes for those earlier artificial stones, although some have upper façades of Portland Stone.

The frontages display a bland paste peppered with chips of mineral calcite or marble, or quartz, floating in the matrix without the sorting and settling we would see in a normal sedimentary rock. This is terrazzo which is equally 'plastic' and mouldable. It also can be coloured in tints which shout "not natural!"

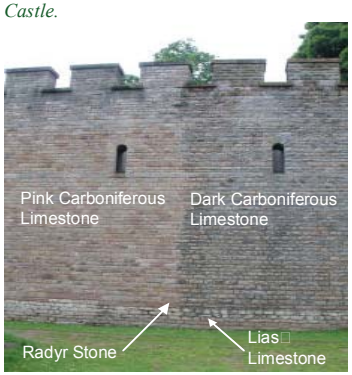
An exception to all this is the frontage to **Thomas Cook** 18 , 16 Queen Street, where we see slabs of rusty-stained green stone which is really a mix of fragments cemented together. This is a breccia of green serpentinite, the kind of rock often found in mountain chains such as the Alps.

This stone probably came from the Italian province of Savoy, source of the lustrous green stone we see in many shop fronts in modern malls and arcades nearby. It needs to be polished and rubbed down with oils to impress.

Although is frontage at street level is artificial, **Abbey** 19 , is of Portland Stone, freely carved with elephant heads high up on the front, but it is the style of the building which deserves note. The simple carving fits the Art Deco style of buildings we see in most towns and cities in the branches of Montague Burton, the 'fifty shilling tailors' who dressed the people in the thirties.

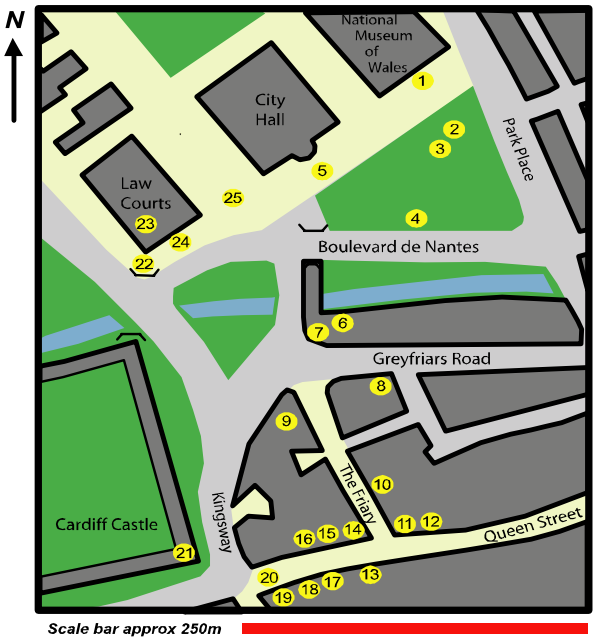
The statue of **Aneurin Bevan** 20 by Robert Thomas of Barry (1987) stands on a plinth of dark red granite which is Balmoral Red from Finland. Years ago, this might have been Scottish Peterhead Granite from Aberdeenshire, but nowadays most granites come from overseas. Notice that there are two contrasting stones here, the difference being in the size of the feldspar crystals. Crystal size depends upon rate of cooling in the melt, and that in turn, closeness

Cross the road at the pedestrian crossing to the southeast corner of Cardiff Castle.



Cardiff Castle

The **castle** 21 we see today was restored by the Butes between 1869 and 1921, but their walls are built in part upon the remains of the walls of a Roman fort. The old Roman walls are built of Jurassic Blue Lias limestone probably from Aberthaw in the Vale of Glamorgan. A Victorian course of red Radyr Stone caps the Roman walls and distinguishes them from the reconstructed walls which are built of two types of Carboniferous Limestone.



Scale bar approx 250m

The walls east of the main gate are pink limestone from Culverhouse Cross, but on the east wall this gives way to darker limestone from the Pentyrch-Creigiau area.

The sloping floral display here is supported by part of Cardiff's old town wall built mainly of Blue Lias limestone probably robbed from the walls of the Roman fort or from Greyfriars Monastery nearby. Another part of the wall can be visited in the alleyway behind the Sony Centre on the other side of Kingsway.

The ramp on the eastern exit of the underpass 22 is faced with slabs of Pennant Sandstone and emerges in front of the **Law Courts** 23 , built in 1904 of Portland Stone. In front of this building, the statue of **Gwilym Williams of Miskin** 24 has an unpolished plinth of a distinctive granite with large pink feldspar crystals from Shap in Cumbria. On the traffic island between here and the City Hall, the **South Africa War Memorial** 25 stands on a plinth of Portland Stone on a base of pink granite from Peterhead.

Shap Granite

Continue past the City Hall to return to the Museum.

Eric Robinson. Produced by the Geologists' Association South Wales Group for Cardiff Science Festival July 2005. Registered Charity 1054303. If you want to know more about rocks, fossils and the geology of south Wales, contact the Geologists' Association South Wales Group, Cymdeithas y Daearegwyr Grwp De Cymru, Dept of Geology, National Museum of Wales, Cardiff CF10 3NP. You can also find us at www.swga.org.uk

CardiffScienceFestival
GŵylWyddoniaethCaerdydd

Geological Walks in Wales 14

Building stones of Cardiff
2. Cathays Park to Queen Street

Nowhere is Portland Stone, our best British building stone, better displayed than in the gleaming white buildings of the civic centre of Cathays Park. Most date from the early 1900s so they stand as monuments to the lasting qualities of the limestone which becomes whiter with time and weathering. These, along with stones used in the statues and monuments of Cathays Park and in the streets of central Cardiff, provide a wonderful introduction to the science of geology. This walk from the National Museum of Wales to Queen Street, Cardiff Castle and back should take about 1-1½ hours.

Take care: some of the walk involves walking along or crossing main roads. Cross at pedestrian crossings and beware of traffic.

The walk begins on the front steps of the National Museum of Wales in Cathays Park.

Portland Stone, a white limestone from Dorset is used for all of the buildings in the Civic Centre, and can be examined at the front of the **National Museum** 1 . Built between 1913 and 1927, the portico allows us to see the effects on the stone of nearly a hundred years' exposure to wind, rain, and frost.

The National Museum of Wales

Compare the smooth back wall of the portico which is almost 'as new' with the two faces of the giant columns. The side facing the prevailing westerly weather is rough to the touch while the less exposed opposite side is comparatively smooth. The roughness comes from the lime shells of Jurassic oysters in the stone being more resistant to acid rain etching than the background limestone. In the back wall you will see the same oyster shells as dark marks within the creamy white stone. Sometimes, the two valves of the oyster can be seen together in cross section. Usually, the shells were separated by tides and currents and broken into small fragments, difficult to identify as original shells. Portland Stone is also used for the plinth of the statue of **David Lloyd George** by Michael Rizzello (1960) facing the Museum.

Portland stone is a sedimentary rock, laid down in the sea 145 million years ago. The steps of the Museum, though, are different. Speckled grey and white, these large slabs are a typical 300 million year old granite from Cornwall.

Granites are a mosaic of rock-forming minerals which cooled from a hot melt deep within the earth's crust. The white rectangular crystals were the first to form, leaving the other minerals to occupy the remaining space in the mosaic. The white crystals are feldspar; the grey background mineral quartz; and the black minerals are hornblende or black mica. On rough surfaces, it is possible to pick out a gleaming silver flake which is muscovite mica.

Cross Gorsedd Gardens Road and enter the gardens opposite the front of the museum. Stop at the stone circle.

The **Gorsedd Circle** 2 was first erected for the 1899 Cardiff Eisteddfod. The upright slabs are Radyr Stone, a red breccia crowded with angular chips of grey limestone derived from the southern edge of the Coalfield. It was deposited as an alluvial fan at the mouth of a valley in north Cardiff some 200 million years ago during the Triassic Period when South Wales was a hot desert, a place seasonally torn by torrential rains.

Radyr Stone

From the stone circle, head west around the flower beds to the statue of the soldier with his back to you.

This statue of **Lord Ninian Edward Crichton Stuart** 3, a local MP who died in battle during World War I stands on a plinth of pale grey Scottish granite from Kemnay Quarry in mid-Aberdeenshire.

Go west onto the lawn until you are in front of the City Hall and turn south towards the equestrian statue close to Boulevard de Nantes.

Lord Tredegar

The plinth to this imposing statue of **Lord Tredegar** 4 astride his charger is another sedimentary rock, this time a river-deposited sand. By the Welsh sculptor W. Goscombe John, this is one of the finest equestrian statues in Britain, if not Europe. The yellow-brown stone is Millstone Grit from Derbyshire, slightly fretted by rising dampness and frost damage.

Walk north across the lawn towards City Hall.

City Hall 5 built 1901-06 of Portland Stone, is a really baroque building modelled on the grand buildings of Vienna and Paris. Look at the large figures which cap the roof line, carved from large single blocks from the Dorset quarries.

City Hall and detail of Portland Stone carving

These demonstrate that Portland Stone is a material which sculptors and masons would choose for their most three-dimensional and extravagant carvings

Walk west in front of the City Hall and take the underpass beneath Boulevard de Nantes.

The rising slope is paved with grey-green Pennant Sandstone flagstones and rows of grey granite blocks, probably from Portugal. The Coal Measure origins of the flagstones are apparent in the faint rust-staining and by pellets of ironstone in some of the slabs.

At the top of the slope, the lower part of the tower of **One Kingsway** 6 exhibits one of the many exotic stones which now crop up in Cardiff buildings

This blue-grey polished granitic rock is from Finland. If you look closely, the contrast between the pale feldspars and the darker quartz crystals is striking. The dark blue hue is caused by the crushing of the crystals and the resulting internal reflection of light. This occurred when the granite was squeezed in a mountain building event around 1100 million years ago (in short, it has been metamorphosed). The delightful statue ***Nereid*** 7 by Nathan David (1996) outside One Kingsway is ringed by the same stone and that in turn by more Pennant Sandstone flagstones.

Finnish granite. 1 Kingsway

Cross over Greyfriars Road at the pedestrian crossing and turn left to Capitol

There are three kinds of paving slabs as well as grey granite blocks in front of **Capital Tower** 8. One is pale grey Pennant Sandstone with black coaly plant fragments, which also form the building's steps. The darker grey slabs are from Caithness. They were deposited in a great lake basin about 375 million years ago. Their deeply mottled and roughly pitted and ridged surfaces are due to the sediment drying out after deposition. The other pavings are cast concrete, and much inferior to the natural stones.

Return towards the pedestrian crossing and turn left down The Friary.

Heading down The Friary, past the **Hilton Hotel** 9 which is of Portland Stone, we soon come upon more foreign rocks in the columns of **Principality House** 10 on the left. Look at the light and dark bands of the columns. The shimmering blue stone in the polished drums is from Larvik in the Oslo Fjord, Norway and is not found anywhere else in the world. It is a called larvikite, and it formed from molten rock.

The paler grey drums are the same stone but unpolished. We see the same stone, highly polished, in the staff entrance to the Principality Building Society farther down the street. The shimmer (iridescence) is a property of the large feldspar crystals which are shot through with tiny grains of metal ores which both deflect and absorb white light.

Larvikite columns. Principality House

Principality Building 11 on the corner of The Friary and Queen Street is deep yellow Bath Stone which can best be seen in the corner entrance. Here, the tiny rounded grains of lime which give the stone its character, and its geological name 'oolite' (referring to the fish egg texture) can be seen, along with irregular veins of calcite which cross the surfaces - another recognition detail. The Jurassic seas were current swept, so all shells were broken into tiny fragments. The modern window surrounds are a strange mix of different materials including a yellow artificial paste. Also here, we find grey granite, and more larvikite Some is polished; other nearby bands are unpolished (riven or hammer-dressed).

Turn left and stop outside Lloyds TSB next door to the Principality.

The tall columns at **Lloyds TSB Bank** 12, at 31 Queen Street, are also of larvikite, Its dark grey tone tells us that this came from a high level in the quarries. More modern stone comes from deeper in the quarries and is lighter in colour. The deep red stone in the bank frontage is Graverfors or Vanevik Granite from mid-Sweden which was popular in Britain before World War I. Close to the entrance you will notice that it contains a deep blue quartz, deeper than that at One Kingsway, showing that this granite has also been involved in mountain building. The façade above street level is carved Portland Stone.

Lloyds TSB Bank and detail of Swedish granite and Norwegian larvikite

Turn west along Queen Street, past the Friary towards the castle.

On the south side of Queen Street west of The Friary is one of the most elaborate buildings on Queen Street, occupied by Gap 13 **24-26 Queen Street**, and built in a Venetian Gothic style in 1878 by C.E. Bernard. Such decoration is probably the result of using the artificial stones which were popular at this time. When we look at the door surround, it is difficult to decide whether this is waxed and polished Portland Stone or really artificial.

What a contrast we see on the north side of Queen Street. Here the white slab-faced block 14 opposite Gap (occupied by Dorothy Perkins) is a bland modern complex clad in Portland Stone.

24 - 26 Queen Street