

## From Eros to Eternity: Piccadilly's Stone Heritage

*Great Geowalk, 12<sup>th</sup> October 2013, for the Geological Society of London in association with London Walks*

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City centres are not normally thought of as likely environments for geological field trips, however the wealth of building and decorative stones, conveniently available in accessible surfaces, allows geologists to see exotic stones up close. London has never had a good, local building stone resource and so the materials used here have been imported from all over the British Isles and indeed the World. Piccadilly and its surrounding streets is an ideal place to study global geology in just a few hundred meters. Buildings on the street feature London's classic building material, Portland Stone, as well as granites, gneisses and marbles from Scotland, Scandinavia, China, India and many other localities. We will also travel through time, seeing stones that range in age from billions of years old to a few hundred thousand years old. This walk will introduce the stones used on Piccadilly and will explain how they may be described and characterised.

This walk builds very much on the tour Eric Robinson published in his (now out of print) *Illustrated Geological Walks, Volume 2*. (1985). Piccadilly is one of the few London Streets which has not changed much over the last 30 years and many of the buildings Eric described are still standing, with few new editions. A very useful architectural companion to this walk is the most recent edition of Pevsner (Bradley & Pevsner, 2005). Details of architects and architecture given below have largely been taken for this text, or for more recent buildings, from architecture firm websites.

*Burlington House, like many of the buildings on Piccadilly is built from Portland Stone. However we will observe the varieties of this stone on new buildings on the street where weathering and cleaning has not obscured the surface of the stone. From the Piccadilly entrance of the Geological Society, Burlington House (opposite Fortnum & Mason's), turn left and walk along the north side of Piccadilly towards Piccadilly Circus. Our first stop will be to examine kerbstones and paving at Sackville Street.*

### Sackville Street

The corner of Sackville Street is a good place to look at the materials traditionally used on London's pavements. Special properties are required in rocks used for these purposes. Kerb stones need to be tough, hard-wearing rocks and paving slabs need to be rocks that are again relatively resistant to erosion, but also easily split into flags. Kerbstones in London are almost universally igneous rocks. The examples here are porphyritic, 300 million year old, Cornish granite. These are probably from the St Austell Pluton (**Penryn Granite**), but similar types of stone were also quarried on Bodmin Moor. In addition to granites, other

stones commonly used for kerbs are red Mountsorrel Granodiorite, dark grey Channel Islands diorites and whinstone, a black dolerite from various sources.

The paving slabs are York Stone, which is ubiquitous on London Streets. They are not from York, but from the Pennines of southwest Yorkshire and Lancashire. These flagstones come from the Pennine Lower Coal Measures Formation, where sandstones are interbedded with shales and coals.

### Cordings, Denman House, 19-20 Piccadilly

Gentleman's outfitters, Cordings (left), was built in 1903 by H. A. Woodington. The upper storeys are Portland Stone and the intricate carving of grape vines demonstrates Portland's excellent quality as a freestone. At pavement level, the windows are framed by larvikite



from the Oslo area of Norway. These monzonites are around the same age as the Cornish Granites at around 300 million years old. These have been a very popular building stone since the late 19<sup>th</sup> Century, particularly because of the striking 'schillerescent' play of colours shown by the oligoclase feldspars. Larvikite is the National Stone of Norway and this variety is known as **Emerald Pearl** from quarries at Tjølling.

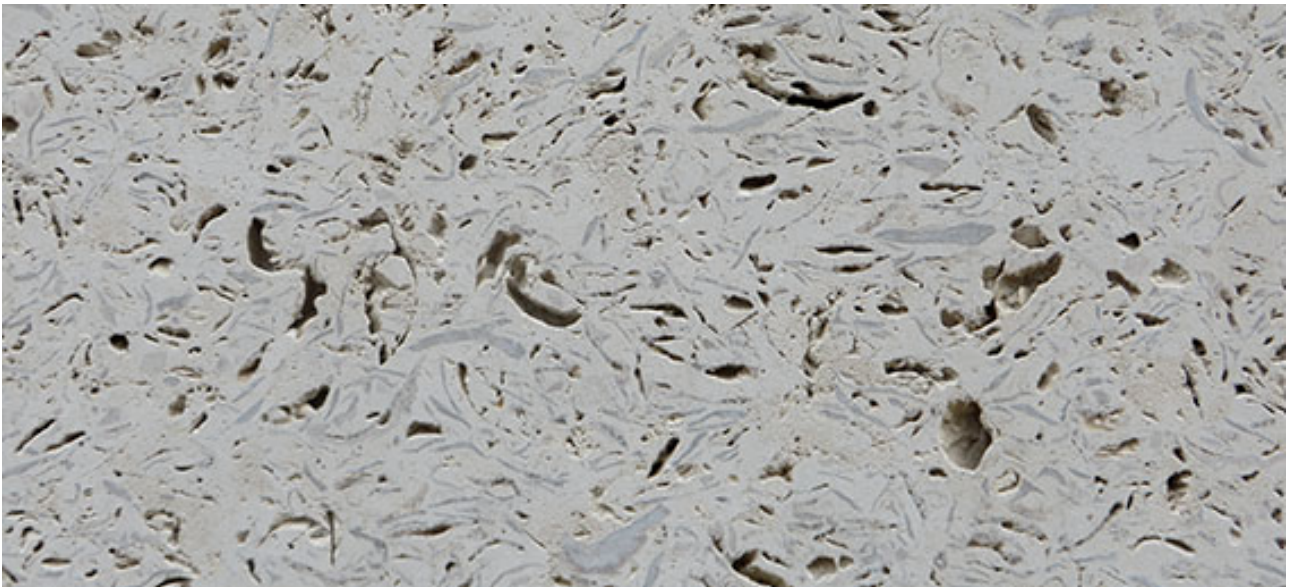
*Cross over to the south side of Piccadilly.*

### **210, Piccadilly**

210 Piccadilly is clad in **Portland Basebed** and is a good example of the appearance of this stone whilst fresh, uniform ivory-white and relatively free of fossils. The building is by Eric Parry Architects 2013. This rock is an oolitic limestone formed in shallow, tropical Jurassic seas around 150 million years ago (Cope, 2012). 'Oolites' are composed of carbonate sand grains, which are concentric spheres, less than a millimetre in diameter. These can be seen in the stone with the aid of a hand lens. In modern day environments, oolitic sediments form in places like the Bahamas. Portland Stone is quarried from the Isle of Portland in Dorset. As the name suggests, the Basebed forms the lowest member of the Portland Freestone.

### **Eagle Place**

Next door on Eagle Place and also by Eric Parry Architects 2013, is clad with **Portland Grove Whitbed** supplied by Albion Stone. Grove Whitbed is packed with grey fossil oyster shells and cavities where aragonitic shells have weathered out. The Whitbed overlies the Basebed and is still an oolitic limestone, but it also contains variable amounts of shell fragments (below).



### **National Westminster Bank, 207-209 Piccadilly**

The building housing the bank is by the great Victorian architect, Alfred Waterhouse, and built in 1894. The upper storeys of this bank are of Portland Stone. The pillars and panels surrounding the doorway are of Scottish **Kemnay Granite**. Aged about 460 million years old, it is composed of quartz, biotite and feldspar. Many granites were quarried in Aberdeenshire in the 19<sup>th</sup> Century, Kemnay is one of the very few quarries still operating on a large scale.

The interior (accessible when the bank is open) is by Michael Waterhouse (1925). Rectangular pillars support the high ceiling of the hall and they are clad in Devonshire 'marbles'. The upper parts of the columns are clad in clouded **Petitor Marble** (below left), from Torquay, and the plinths are **Ashburton Marble** (below right), rich in fossil stromatoporoids.



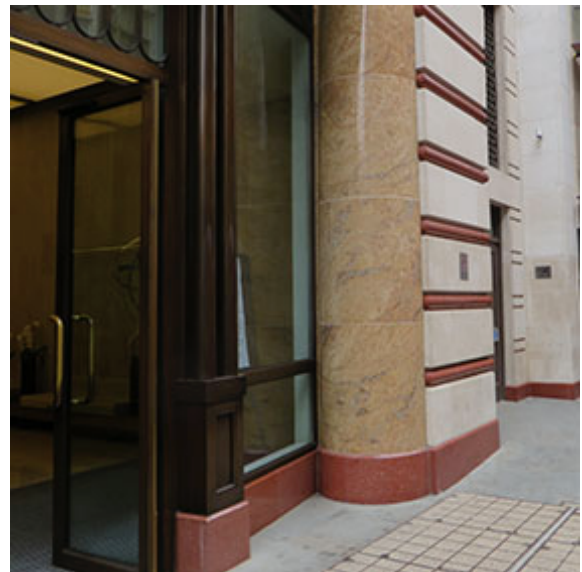


Devon Marbles in the NatWest Bank

### 198-202, Piccadilly

Completed in 2008, this building was designed by Robert Adam Architects. It is clad in **Portland Whitbed**, and being new, the white colour of this stone when fresh is a marked contrast to the greyer stone on the early 20<sup>th</sup> Century buildings on Piccadilly. The brief was “to construct a traditional classical-style office development in the centre of London within a very tight budget” (World Buildings Directory). The Portland stone is derived from the strata known as the Basebed and it contains a few fossil oyster shells which are greyer than the surrounding oolitic limestone. Striking on this building is the contrasting red, highly polished rock. This is a variety of granite called **Sanhe Red** which is from the mountains west of the city of Chengdu in Sichuan Province.

Walking around the building into Church Place (right) takes us to Jermyn Street where the entrance to the same building is at 33 Jermyn Street. Here the theme of White Portland Stone and red Sanhe granite continues, but in addition the doorway is framed with pillars of **Kashmir Gold**. The name is deceptive, this rock is not from Kashmir in the Himalayas, but from Tamil Nadu in Southern India. Around a billion years old, these are metamorphic rocks transformed by heat and pressure deep in the Earth’s crust. They were heated almost to the point of melting and this is responsible for their streak appearance. Once they would have been granites, composed of quartz and feldspar. The red metamorphic mineral garnet is also present here. The yellow colour is imparted by iron oxides and is probably the result of chemical weathering in tropical India.



### Fortnum & Mason’s Department Store

In 2014, a new pavement was laid outside Fortnum & Masons. This is atypical York Stone in that it is a coarse grained sandstone with a brown-yellow colour. It is worth a quick look because it shows spectacular cross-bedding, picked out by iron staining. This stone was supplied by Marshalls and I am grateful to both this firm and Stancliffe Stone for confirming to me that this is **Scout Moor Yorkstone** from the Scout Moor Quarry near Ramsbottom, Bury in the Lancashire Pennines. Yorkstone comes from the Upper Carboniferous Pennine Lower Coal Measures and these sandstones are interbedded with shales and coal seams.

*Return to Piccadilly, cross over and walk up to the Burlington Arcade on the west side of Burlington House.*

### Burlington Arcade

Burlington Arcade was built by Samuel Ware in 1818-1819, but has undergone several additions and modifications subsequently. The Arcade was commissioned by Lord George Cavendish, the 1<sup>st</sup> Earl of Burlington and owner of Burlington House next door. George's grandson, William Cavendish, the 2<sup>nd</sup> Earl of Burlington (and later, the 7<sup>th</sup> Duke of Devonshire) became the owner in 1843 of the Burlington Slate Quarries, near Ambleside in Cumbria. Therefore it is not surprising that Burlington Slate was used in the 20<sup>th</sup> Century for the steps at the entrance of the Burlington Arcade. The Arcade itself was originally paved in York Stone, but it was replaced in the 1960s, perhaps with Burlington Slate, but this too was partially replaced in the 1990s with terrazzo and carpeted. Now you cannot miss the stonework laid during 2015. Designed by Jamie Fobert Architects, the stones used for the floor were supplied by Britannicus Stone and laid by contractors Tudor Stonework. The stones used are **Moorcroft Marble** and **Ashburton Marble** from Devon, **Mendip Marble** and of course, **Burlington Slate**. The floor is a complex *opus sectile* pattern and has around 64,000 pieces of stone, which were cut in Italy. It was installed in sections overnight so that the arcade could remain open during the day.

Moorcroft Marble from Plymouth and Ashburton Marble, from Ashburton, are both Devon marbles of Devonian age. The brown, coral-rich Moorcroft is from the Plymouth Limestone Formation of the Tamar Group and black and grey Ashburton is from the Chercombe Bridge Limestone Formation. Both also contain stromatoporoid fossils and are veined with calcite. These stones make up the main part of the design with mottled brown Mendip Marble from the Carboniferous of Somerset and dark green Burlington Slate from the Ordovician Seathwaite Fell Formation of Cumbria.



Burlington Arcade

### Collette House; Bentley & Skinner

Blending in perfectly with the pre-WWI buildings that dominate Piccadilly is Collette House, the home of jewellers Bentley & Skinner, built in 1975 by architects Ronald Ward & Partners. At pavement level, the building is faced with a coarse grained, bright red granite with 'crushed' feldspar grains and blue-ish, strained quartz and biotite. The exact provenance of this stone is unknown, however it is undoubtedly one of the '**Coastal Red**' pyterlite-type rapakivi granites from Kalmar Province on the Baltic coast of Sweden. The Gotemar, Figeholm and Blau Jungfrun (or Virgo) red granites intruded the Småland Massif around 1.4



billion years (Ga) ago. They are intruded into 1.8 - 1.65 Ga Småland Granites (Åberg, 1986), which were also popular building stones. Quarries in the red granites were active throughout the 19<sup>th</sup> Century but trade declined in the 20<sup>th</sup> Century, with only quarries in the Gotemar granite still in operation. This is therefore the likely origin of this stone.

### Mappin & Webb, 1A Old Bond Street

Next door to Collette House is the Mappin & Webb store, also by Alfred Waterhouse and built in 1880-1881. This stone is clad with one of England's most spectacular decorative stones, **Shap Granite**, from Shap Fell, Cumbria. This stone is a porphyry, meaning that texturally it has a population of crystals significantly bigger than the surrounding groundmass. Pink K-feldspar phenocrysts (the large crystals) are set in a dark brown groundmass of orange K-feldspar, grey translucent quartz, plagioclase and biotite. The Shap Granite was intruded at the end of the Caledonian Orogeny 397 million years ago (Cox et al., 1996; Loughlin, 2007). Shap Granite was very popular in Victorian architecture in London, especially after the coming of the railways in the mid 19<sup>th</sup> Century. It was primarily used for columns and pilasters. This is a relatively unusual instance of it being used as cladding.

### 39, St James's Street

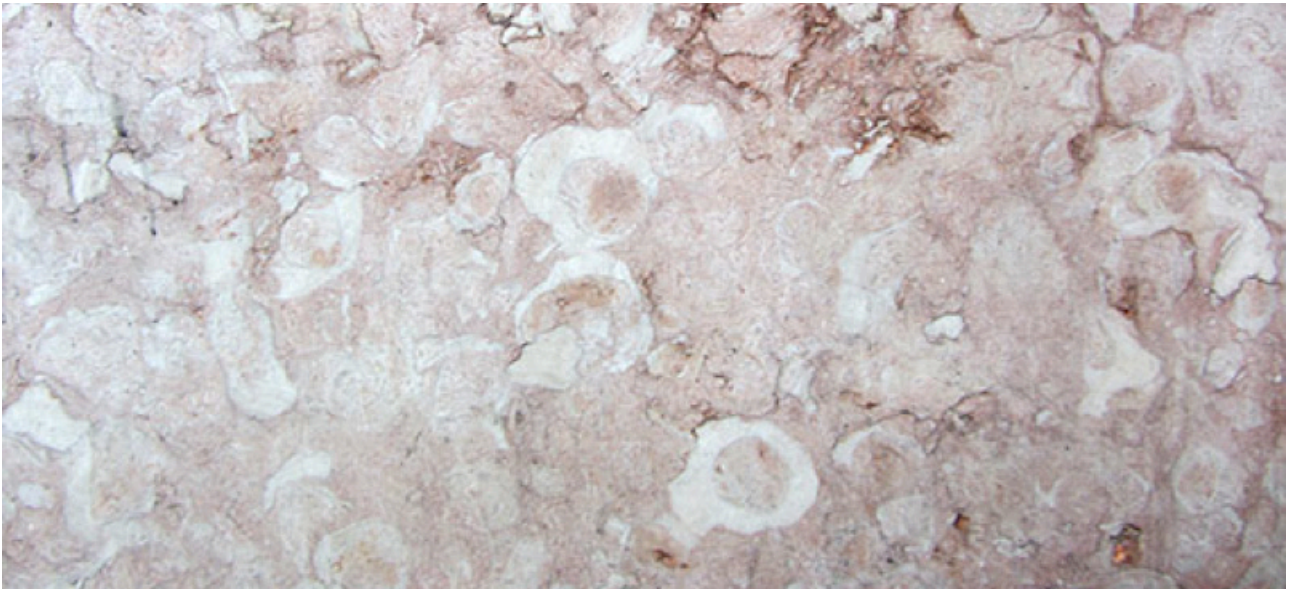
39, St James Street is a geological gem and deserves to be recognized historically on the use of its stone alone. The building was erected early in the 20<sup>th</sup> Century by architects Runtz & Ford (1906-1908). It is clad in a rarely used stone called **Welsh Jasper** which is from Mynydd Carreg, near Aberdaron on the Llyn Peninsula of North Wales. The quarry is tiny and it is possible that it only ever furnished stone for this building. This is derived from 800 million year old rocks which outcrop on the Llyn (Gibbons & McCarroll, 1993) and also on Anglesey where they can be easily inspected at Newborough Warren. They are composed of silica rich dolomites, stained pink by the mineral rhodochrosite with patches of red jasper. Elsdon & Howe (1923) note that when new, the 'marble' here was "*bright pink and red, but exposure has caused it to assume a more sombre and mellow hue*". They go on to suggest that this might be a marble more widely used, but sadly it seems that it was not.



39, St James's Street

Panels at pavement level on St James's Street are also of an interesting rock, with a red matrix, packed with large white fossils of reef-building bivalves called rudists. These are characteristic of the Cretaceous period and in Europe are typical of the Mediterranean region, forming in the precursor to the Mediterranean Sea,

the Tethys Ocean. During the Renaissance, these rocks were called 'Occhio di Pavone' or peacock eye, because the sections through the thick-shelled rudists resemble the eyes on peacock feathers. This stone is probably **Rojo Bilbao** from northern Spain (Robinson, 1985; Perrier, 1992).



*Red rudist limestone at 39, St James's Street*

This geological wonder does not end here. The upper stories are clad with Greek **Pentelic Marble** from Athens. This is the stone that was used to build the Parthenon and it is also used opposite on 49, St James's Street. It is more readily observed in this building and is described below.

#### **49, St James's Street**

Across the road from 39 St James's Street, number 49, by J. J. Joass was also built in 1906-1908. It is clad in **Pentelic Marble** from pavement level and the stone is easily observed here. Mount Penteli has been worked for marble since the late 6th Century BC. Pike (2000) has identified 172 quarries, ancient and modern. At least 30 of these were worked in antiquity. Modern quarrying began in 1836 under Royal Decree from King Otto for building his Palace. The stone was subsequently used for the great neoclassical buildings of Athens, including the Academia and the Vouli (parliament building). The Anglo-Greek Marmor Company bought the quarries in 1897 and began exporting Pentelic Marble to Europe and the UK and the USA. This stone started life as Tethyan limestones, deposited during the Triassic to Cretaceous which were subsequently metamorphosed during the Alpine mountain building phase. The stone shows variable schistosity and textures from the ancient type white marbles to marbles figured with pale grey streaky, sometimes contorted veins. Pyrite is often present and visible in these rocks.

#### **The Ritz**

Built in the French style in 1903-6 by Charles Mewés & Arthur J. Davies the Ritz is an iconic building on Piccadilly. Their structural engineer was Sven Bylander, who may have influenced their choice of building stone, Iddefjord Granite from SE Norway. It was also used for the RAC Club on Pall Mall and Inveresk House on the Strand, also by Mewes & Davies (Robinson 1985). The medium grained, grey, Iddefjord Granite has been quarried since the mid 19th Century. According to Elsdon & Howe (1923), the stone for the Ritz Hotel came from Orevigan Quarry in the Østfold of SE Norway, close to the Swedish Border. Another ancient rock, the Iddefjord granite was intruded 920 million years ago at the end of a Proterozoic Mountain Building event known as the Sveconorwegian-Grenvillian Orogeny (Andersson *et al.*, 1996).

#### **Green Park Underground Station**

We end this walk at another geological marvel, this one completed in 2011, by Capita Architecture and Acanthus LW with art by Royal Academician John Maine. The building is clad in Portland Limestone, supplied by Albion Stone. The stones used come from the Portland Freestone Member and these were quarried from Jordans and Bowers Quarries on the Isle of Portland. On this building we can see the whole



range of building stones extracted from the Portland Freestone Member, in stratigraphic order, these are Basebed, three varieties of Whitbed (Jordans, Grove and Fancy Beach) and Roach. Basebed has already been encountered on this walk on 198-202 Piccadilly and on Cordings Outfitters. Similarly we have seen Grove Whitbed, packed with oyster shells at Eagle Place. However, looking back down Piccadilly towards Eros, the street appears like a canyon of Portland Stone, and this stone is the most important and distinctive building stone of London. The fashion started when architect Inigo Jones used Portland Freestone to build the Royal Banqueting House on Whitehall (completed 1622). Christopher Wren rebuilt the city of London after the Great Fire in Portland Stone, including St Paul's Cathedral and architects today require special permission to use other stones in the area surrounding St Paul's. Given the number of buildings in London built of Portland Stone, it is amazing that there is anything left of the Isle of Portland, but Albion Stone calculate that around 50% of the stone, in outcrop and subcrop has been quarried out, so there are several centuries worth of reserves available.

The Portland Freestone Member, which comprises the Basebed, Whitbed and Roach is of Tithonian age, latest Jurassic. They were deposited in shallow tropical seas and as previously discussed, are oolitic limestones (Cope, 2012). The difference between the three varieties is dependent upon the amount of fossils present. Basebed, also known as the Best Bed, is largely fossil free (and Jordans Basebed is particularly so), Whitbed has variable amounts of fossils, predominantly oysters, and the Roach is the most distinctive with few actual fossils, but riddled with holes representing casts of shells now gone. Roach features prominently in the Green Park building. Shells and limestones are made out of calcium carbonate. Two common varieties of this exist called calcite and aragonite. Most seashells are made of aragonite. Oysters are an exception, composed of calcite. Aragonite is unstable over geological time and in the Roach, it has dissolved away leaving external casts and internal moulds of the shells that were once there. The oysters, being calcite, are preserved intact. The bivalve *Laevitrigonia gibbosa* or *Trigonia* ('horses' heads') and gastropod *Aptyxiella portlandica* (the 'Portland Screw') are the most recognizable fossils in the Roach. Along with several species of oyster (as fossils), cockle shells are also present as casts. Another locally common fossil which formed patch reefs colonizing the Whitbed seafloor is *Solenopora portlandica*, a red algae and not a coral. This can be seen as debris in the Fancy Beach Whitbed used in the stairwell.



Green Park Tube Station on the south side of Piccadilly

John Maine's art installation, called 'Sea Strata' forms a frieze around the buildings and features large images etched in Basebed of the typical Portland fossils. Kemnay Granite (as seen on the National Westminster Bank at 209, Piccadilly) is used as foundations and a variety of granites, incised with spirals are

used as paving. These include a red granite of unknown provenance and a variety of grey-blue larvikite from Norway.

*This walk ends at Green Park Tube Station.*

### Acknowledgements

*I am deeply indebted to Eric Robinson who was, of course, the original author of a geological walk along Piccadilly. I would also like to thank Sarah Day, Ted Nield and Caroline Lam of the Geological Society for initiating this walk, suggesting a title and formatting the text. Many thanks also to Sarah and Di Clements for providing moral support on the day. I am also grateful to Stancliffe Stone and Marshalls for providing me with the identification and provenance of the new paving on Piccadilly, outside Fortnum & Masons.*

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*Paving in Scout Moor Yorkstone outside Fortnum & Mason's.*