Urban Geology in Chelsea: A Stroll Around Sloane Square

Ruth Siddall

Situated in the Royal Borough of Kensington and Chelsea, Sloane Square SW1, and several of the neighbouring streets are named after Sir Hans Sloane (1660-1753) who lived in the area in the mid 18th Century. The area is now owned by the Cadogan Estate Ltd. The Cadogan family inherited this from Sloane via his daughter, Elizabeth and it is still the hands of the 8th Earl Cadogan. The eldest sons of this family inherit the title Viscount Chelsea and this area is one of the top pieces of real estate in the country, earning the family over £5 billion per year. It is correspondingly a pleasant area to stroll around, the home to designer shops, the Saatchi Gallery as well as a theatre and concert venue. Development took place between the mid 19th Century and the present day and displays a range of stones fairly typical of London Building during this period – along with a few surprises.



Fountain, Sloane Square, with Peter Jones Department Store behind.

This walk starts at Sloane Square Underground Station on Holbein Place, and takes in the Square itself, the southern end of Sloane Street, Duke of York Square and the eastern end of the King's Road. It is easy to return to Sloane Square station when finished, or you could visit the Saatchi Gallery which displays a collection of contemporary art to suit all tastes (and none). For the buildings described below, architectural information below is derived from Pevsner's guide to North West London (Cherry & Pevsner, 1991), unless otherwise cited.

Holbein Place

Holbein Place has been recently redesigned as a shared space for traffic and pedestrians and consequently paved in grey, banded gneiss setts. Indeed the gneiss is almost a mylonite¹ with a fine grain size and fine banding of dark hornblende-rich layers and white feldspar-rich layers. Some bands thicken into 'augen'; a word from the German meaning eye, and these bulges in the white bands are eye-shaped. Therefore we

¹ A strongly sheared and deformed metamorphic rock.

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may call this rock an augen gneiss. The paving was laid my CED Natural Stone and I am grateful for their CEO Michael Heap for confirming the provenance of this stone to be the Southern Swiss Alps, located just to the north of Lugano. The stone is a variety of Maggia Gneiss from the Lepontine Alps, exposed in a tectonic window, The Lepontine Dome and probably quarried from the Riveo Valley.

This region exposes a series of nappes, metamorphosed at high Amphibolite Facies, representing a core complex of once deeply buried rocks. They were exposed after 18 Ma during movement on the Rhone-Simplon Detachment. The Maggia Nappe is exposed in the Maggia & Simano Klippen. It is composed of Late Carboniferous, tonalitic gneisses, which underwent a final, peak metamorphic event in the Tertiary (see Steck et al., 2013). These rocks are deformed into fold-nappes and have a strong, structural fabric. This is clear in the gneiss setts here at Holbein Place. A few examples show hairpin-shaped 'isoclinal' folds in the fine laminations.



The kerb stones are in Silver Grey Granite, a two-mica granite of Cretaceous age from Fujian in south-east China.

Royal Court Theatre

The Royal Court theatre was built in 1888 and is a focal point for Sloane Square. There is little of geological interest in the exterior, but the interior has recently been re-modelled by architects Howard Tompkins. If it is open, the interior is worth a peak. The auditorium has a mural by artist Antoni Malinowski, completed in 2000 and painted in vermillion, the mercury sulphide pigment known to geologists as the mineral cinnabar. This is probably one of the largest artworks constructed of this spectacular pigment, only rivalled by the murals in the Villa of the Mysteries in Pompeii. Malinowski has a great interest in the materials used by artists including traditional artists pigments, many of which were derived from minerals. Cinnabar was found and mined for pigments in Almaden in southern Spain and at Monte Amiata in Italy over 2000 years ago. In the far east cinnabar was found in association with thermal spring deposits in China and that is the main source of pigment-grade mineral cinnabar today.

Court Lodge, 48 Sloane Square

Next door to the Royal Court Theatre is Court Lodge, housing Toni & Guy's hairdressers at 48, Sloane Square. The ground floor is clad with polished, rusticated igneous rocks, typical of the architecture of the late 19th Century. Three stones are used here. Firstly the arch and pilasters around the doorway and the arches enclosing the windows are of salmon pink **Peterhead Granite**. This stone was incredibly popular in Victorian architecture and can be seen on many buildings – particularly pubs – throughout the British Isles. It comes from Stirlinghill, north of Aberdeen and was brought south when the railways opened from Aberdeen to London in the 1880s. Geologically the Peterhead Granite is a 400 million year old pluton of the Cairngorm Suite, a post-tectonic Caledonian granite. It contains distinctive pink feldspar and smoky, dark

grey quartz. The other two stones are both varieties of Norwegian larvikite and marketed as Marina Pearl (grey) and Emerald Pearl (dark, bronzy green). These are both from Larvik in the southern part of the Oslo Graben and are monzonites associated with the formation of the Permian rift valley. They were intruded into a centred complex at 290 Ma. The most distinctive feature of larvikites are the 'schillerescent' feldspar crystals which flash peacock blue. This is caused due to refraction of light between thin layers in the crystallographic structure. For those interested in feldspars, technically they are oligoclase perthites. Larvikites were very popular decorative stones from the 1880s onwards and were shipped to Aberdeen to then be transported south by train. They are still quarried today and are Norway's national stone.



Turn right into the street running NW which leads to Cliveden Place, but is still part of Sloane Square.

Blandel Bridge House

On your right you will see the beautifully carved stone plaque demarking Blandel Bridge House at 56, Sloane Square. The River Westbourne once crossed the road here and was spanned by the eponymous Blandel Bridge (the river passes over the platform at Sloane Square tube station in a square-section pipe). The plaque is carved from a piece of finely laminated, red sandstone, with fine bedding laminations. Although composed primarily of quartz, the red colour is imparted by the iron oxide mineral hematite (Fe₂O₃). The



origin of this stone is unknown but it is probably a Triassic sandstone from Northern England or SW Scotland, perhaps from St Bees, Carlisle or Dumfries & Galloway.

Return to Sloane Square proper and cross the road onto the Square itself.

Chelsea War Memorial

The War Memorial stands at the eastern end of Sloane Square and commemorates the men and women of Chelsea who died in the First and Second World Wars. The style of the memorial is a 'cross of sacrifice', a much repeated form designed to be reproduced in a range of sizes by Sir Reginald Blomfield in 1918. Characteristically a bronze longsword is attached to one side. This style of memorial is found in most large war cemeteries and is used for town memorials in the UK, Commonwealth and the United States.

Like many of its brethren, this cross and its plinth is constructed from **Portland Whitbed**. Portland stone has traditionally been used for Commonwealth war graves and it is used on many war memorials in London and beyond (see Siddall, 2014). Whitbed is one of the three main varieties of the Portland Limestone building stones and the commonest seen in architecture. It is a white oolitic limestone with scattered shell fossils, mainly the oyster species *Liostrea* and spiny oysters. Both types can be seen here, along with many broken shell fragments, weathering proud of the oolitic matrix. Portland stone was deposited in shallow, tropical Jurassic seas at around 145 million years ago.

Sloane Square Paving

The square is paved with York Stone. This term is used generically to describe flagstones from the Pennines of Lancashire and West Yorkshire (and from nowhere near York). There are numerous quarries in this region which have been in operation for several hundred years – 40 were in operation in 1900. Many are closed but there are around 20 large, working quarries which still produce York Stone varieties to this day (Lott, 2012). The flags largely come from the Pennine Lower Coal Measures Group of Upper Carboniferous age, where they are interbedded with coal seams and shales. They are generally fluvial sandstones, laid down in braided river systems and are composed of quartz, with variable amounts of mica and organic matter. Liesegang banding is a common feature of these stones and is a post depositional feature. These are the concentric bands of iron which stain the surfaces of many of the flags and are the result of complex chemical reactions during the burial of these rocks. Of note here are the reservation of sedimentary structures on some of the slabs; ripples and load casts (below) are common and well-preserved on these hand-riven surfaces, made by splitting the flags along bedding planes using a hammer and chisel.



Sloane Square Fountain

A pleasant fountain, with a large, octagonal basin stands at the south west end of Sloane Square. The water flows from a bronze nymph on a pedestal in the centre of the basin. It was designed by Gilbert Ledward and installed in 1953. The basin is made out of **Portland Whitbed**. Exceptionally well-preserved oyster fossils weather proud of the stonework, and there is a good example of an almost perfect valve on the south side of the fountain. The bronze in the centre stands on a plinth of Cornish granite or the 'smallmegacrystic' variety. This has tabular, sub-aligned feldspars phenocrysts, around 2 cm long, set in a brown, quartz-rich matrix. This decorative stone is probably **Penryn Granite**, quarried from the Carnmenellis Pluton, although it may equally have been derived from the Bodmin Pluton. The Cornish granites form part of the large Cornubian Batholith, intruded at the end of the Variscan Orogeny at around 290 Ma.

Drinking Fountain

A small drinking fountain, for humans and dogs, stands at the north west corner of the square. It was installed by the Metropolitan Drinking Fountain and Cattle Trough Association in 1882, endowed by an anonymous widow in memory of her husband. In contrast to the Cornish granite used in the fountain pedestal described above, the pedestal and basin of this fountain are carved from 'Large-megacrystic' Cornish Granite with feldspar phenocrysts up to 10 cm in length. These stones were quarried from the Land's End Pluton at Lamorna Cove and also from the St Austell Pluton in the vicinity of Luxullyan. The exact provenance of this stone cannot be obtained from observation alone (below, left). The urn at the top of the fountain is made from a different granite, lacking the large megacrysts and containing slightly pinkish potassic feldspar and clots of black minerals. This is probably Craignair Granite from the 391 Ma Criffel-Dalbeattie Pluton located in Dumfrieshire in the Southern Uplands of Scotland, (below, right). This stone was commonly used by the Metropolitan Drinking Fountain and Cattle Trough Association, a foundation formed in 1859 to provide fresh drinking water to the people and animals of London. It is unknown but an unlikely fact that cows ever drank the waters of Sloane Square.



Cross over the road on the north side of the square to the building on the north east corner of Sloane Street.

Rag & Bone, 13-14 Sloane Square

This imposing building on the corner of Sloane Square and Sloane Street was possibly formerly a bank. It is designed in an Italianate style and constructed from **Portland Whitbed** with relatively sparse fossils. However, prominent cross-bedding is observed on many surfaces showing this stone to have formed in shallow, tidally dominated waters where shoals and dunes of oolite sands were forming in the late Jurassic seas.

Walk along Sloane Street to Holy Trinity Church, next door.

Holy Trinity Church

Holy Trinity Church, constructed in 1889 and designed by architect J. D. Sedding is the type of building that Eric Robinson always referred to as 'blood and bandages', i.e. one constructed of layers of red brick with intervening white stone dressings. Normally Portland Stone is used for the 'bandages', but in this case it is **Bath Stone**. Close inspection shows it to be a coarse-grained, cross-bedded, oolitic limestone, also rich in finely-comminuted shell fragments. Overall it has a pale yellow colour which immediately distinguishes Bath Stone from Portland Stone.



Turn right onto Sloane Terrace.

Cadogan Hall

Cadogan Hall is an impressive building built in a Byzantine, Italian style. The architect was R. F. Chisholm and it was completed in 1909. The building is now the home of the Royal Philharmonic Orchestra, but it was originally built as the First Church of Christ, Scientist in London. The Christian Scientists were a sect founded in Boston, Massachusetts in 1879 by Mary Baker Eddy. The (alleged) science bit was the fact that one of the principle aims of the Church was to "reinstate primitive Christianity and its lost element of healing". The Church was extremely popular, especially amongst women, in the early 20th Century and many churches were built in the USA and Europe. The First Church in London was, as the name suggests, the first Christian Science church in the capital, and was built especially for the denomination. To commemorate the New England origins of the Church, the foundation stone was brought from Concord New Hampshire. In a rare instance of the origin of the building stone being recorded on a building, this fact is inscribed on the foundation stone, which was laid in 1904. This is situated at the west end of the Sloane Terrace façade. The main building stone used is **Portland Whitbed**, but granite is used for the foundation stone and the colonnades along the ground floor. New Hampshire's epithet is the 'Granite State' and the town of Concord is the main producer of this stone, working the Devonian (365 Ma) Concord Pluton, one of the New Hampshire Plutonic Suite (Harrison et al., 1987), post tectonic granites associated with the Acadian Orogeny, responsible for the construction of the Appalachian Ranges. **Concord Granite** has been quarried by the family firm of Swenson's since the early 20th Century. It is a pale buff-coloured, medium-grained, two-mica granite with a homogeneous, undeformed texture (below, left).

The granite used for the colonnade and sills is however a different stone. It has yellow-green, slightly kaolinised feldspars, milky white quartz and clots of mafic minerals, biotite and hornblende. It is slightly coarser grained than the Concord Granite. I have not been able to discover the origin of this stone, however it strongly resembles **Montorfano Granite** from Lago Maggiore in the Italian Lake District. A Lower Permian, pre-Alpine granite, this stone along with its more famous neighbour, the Baveno Granite, has been quarried from the 15th Century to the present day (Cavallo & Dino, 2015) and was widely exported in the 19th and 20th Centuries. This stone has a few spectacular xenoliths of a greenschist facies country rock with coronae of biotite. (below, right).



Return to Sloane Street.

Jo Malone & Anya Hindmarch Stores, 150 & 157 Sloane Street



Two stores, Jo Malone of the corner of Sloane Terrace and Anya Hindmarch on the corner of Wilbraham Place are clearly part of the same architectural scheme; Victorian shops with large windows with intervening granite pilasters. The socles to the pillars for both buildings are of **Emerald Pearl** larvikite. The pillars themselves are of red granites. These are typical of a number of granites quarried from the Kalmar Coast of eastern Sweden and consequently known as the Coastal Reds. The main granite used is a bright red granite with white to grey quartz, red feldspar and biotite. This is the variety known as **Swedish Balmoral**, part of the 1.8-1.6 Ga Småland Suite. A second, slightly darker red granite is also used on these buildings with distinctly opalescent, blue-violet quartz. This is possibly **Graversfors Granite** (left), also one of the Småland Suite extracted from near the town of Norrköping.

Chloë, 153 Sloane Street

153, Sloane street, currently occupied by Chloë, is opposite the Anya Hindmarch store on Wilbraham Place. The ground floor is clad in delicately carved **red sandstone**, very similar to that seen at Blandel Bridge House. Once again the provenance is unknown, but as above, it is probably a British Triassic sandstone.



131, Sloane Street

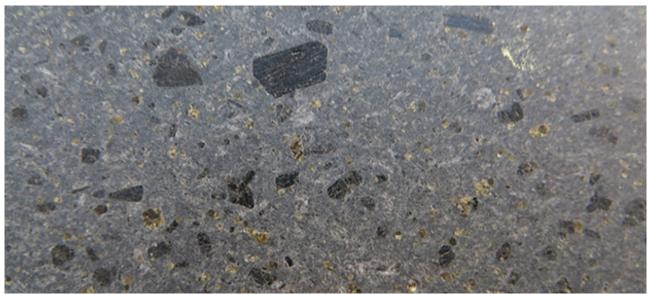
A spectacular combination of stones are used on the new building at 131 Sloane Square. The building is designed by architects Stiff + Trevillion, and the stones used are stated in the building's brochure. The main stone used is an orange-red sandstone. This is Permian Locharbriggs Sandstone from the New Red Sandstone deposits of Dumfries & Galloway. The stone has been worked since 1759 and the quarry is currently worked by Stancliffe Stone.



Locharbriggs Sandstone and Etna Lava Stone cladding on the façade of 131, Sloane Street.

The grey stone is far more exotic and not frequently used in London's buildings. It is a basalt from Mount Etna on Sicily, and marketed as Etna Lava Stone. The basalt flows of Etna have been exploited for building stone since antiquity and comprise vesicular and non-vesicular olivine basalts. A non-vesicular variety is

used here, flow banding is visible in the slabs from street level. According to the development's brochure, this stone is also used for interior flooring. Etna became active around 500, 000 years ago and has erupted on a very regular basis subsequently, producing regular new supplies of building stone (see Punturo et al., 2006). The variety used here is striking porphyritic containing phenocrysts of ~ 7 mm length of euhedral clinopyroxene and anhedral to subhedral yellow-green olivines. According to the literature, hornblende-phyric basalts are uncommon of Etna, however some of the examples observed here appear to show the 60° cleavage intersection diagnostic of this group of minerals.



Etna Basalt, field of view is ~ 6 cm. Euhedral, black pyroxene crystals and olive green olivines,

Return to Sloane Square and turn right.

J. Crew, 16 Sloane Square

This red and yellow brick building has foundations of a black, igneous rock. This is a medium-grained gabbro, composed of grey plagioclase feldspar and black pyroxene and magnetite. From a distance, this appears to be a homogeneous black stone, but close inspection makes the 'salt and pepper' effect of the feldspars and mafic minerals clear. This is probably one of the gabbros from the Bushveld Complex, a layered, basic intrusion in south Africa, and may be the variety **Nero Impala**. If so, this makes this rock the oldest used in Sloane Square area, at 2 billion years old.

Peter Jones Department Store

A piece of classic, art deco retail architecture, Peter Jones was designed by J. A. Slater & A. H. Mobberley in 1937. The front elevation of Peter Jones is mainly steel and glass and at first site, seems of no geological interest. But walk around to the rear entrance on Cadogan Gardens. This part of the store was extended in the 1960s, and the stonework here probably dates from that time. The main stone used here is white-cream **Tivoli Travertine** from near Rome in Italy. This is a young rock deposited between 115 - 30 thousand



years ago in a thermal spring environment. To the right of the entrance with its mosaic on the porch floor, the shop window has a lone pillar clad in a grey metamorphic rock, **Otta Schist** from Norway. This stone is also used as panels cladding the King's Road façade of the store too. The schist has a sheen caused from sheets of aligned muscovite and large fans and 'bowtie' textures formed of needle-shaped crystals of actinolite (left). Otta Schist is a metasediment, formed during the Caledonian Orogeny around 400 million years ago. This is a very commonly used building stone in Norway, but was popular in the UK in the 1960s and 70s. It

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has subsequently declined in use here but examples like this occasionally crop out.

Return to Sloane Square, crossing over the King's Road to the south side of the square.

Hugo Boss, 38 Sloane Square

The large and imposing block that is now occupied by the Hugo Boss store is a classic London **Portland Whitbed** building. Some good examples of oyster fossils with thick laminated shells are present. Oysters secrete calcite unlike many other molluscs which secrete aragonite. Unlike aragonite, calcite is geologically stable and therefore these shells do not recrystallise during the process of fossilisation, leading to exceptional preservation of the shell structure.

Barclays Bank, 29-30 Sloane Square

Walking back towards the King's Road, we encounter Barclay's Bank with its plate glass window surrounded by a jade green, brecciated serpentinite, which also extends to surround the doorway of 29 Sloane Square. The main supply of serpentinite 'marbles' also known in the building trade as 'ophicalcites' is the French and Italian Alps, with the main quarrying area centered around the Val d'Aosta. Here various stones known generically as 'Verdi Alpi' are quarried from the Late Cretaceous ophiolites of the Combin and Zermatt-Saas Alps. They are composed of serpentine-group minerals, tremolite, actinolite and calcite veins. From the colour of this rock, the serpentine mineral is probably the jade-coloured antigorite (below).



Turn left into the entrance passage to Duke of York Square.

Duke of York Square

Duke of York Square is a 'retail court' and open public space designed by Paul Davis & Partners with landscape architecture by Elizabeth Banks Associates working with stone contractors Stonewest (CABE, 2011). The passage entrance to Duke of York Square from Sloane Square is cut into a Victorian façade with square section, engaged pilasters of Peterhead Granite. The Square was developed in the year 2000 and the columns and façade are of yellowish architectural ceramic. However the two columns at the entrance sit of pedestals which are cubes of Balmoral Granite. This is a stone which comes in a fine and coarse-grained variety, of which this is the coarse. Balmoral Granite is quarried from the Vehmaa Batholith in SW Finland, not far from the town of Turku (see Selonen et al., 2011). This is an ancient rock, almost 1.6 billion years old. It is a variety of rapakivi granite called a pyterlite and composed of red potassic feldspar, quartz, plagioclase, biotite and hornblende.

Walking into to the passage, portions of the walls are clad with a polished pale grey granite which extends into the open air of the square on the foundations of the buildings where it has a predominantly axed-

dressed finish. Unfortunately I do not know the provenance of this stone. It has a slightly porphyritic texture with phenocrysts of slight yellowish potassic feldspar in a medium-grained matrix of white feldspar, translucent grey quartz and black biotite.

The first buildings we encounter in the square are built from yellow brick on foundations of grey granite. The second block, however, is clad on the ground floor in a white, coarsely oolitic limestone with abundant shell fragments. This is a Portuguese limestone called **Moca Crème**. It comes from the Lusitanian Basin, a middle Jurassic Limestone of the Valverde Formation.

The paving in the square is **Moorfield Hard York Stone**, a fine-medium grained sandstone with strong, dark rust coloured, liesegang banding. The colour of the flags varies from buff to grey, showing oxidised and reduced areas. This 'York Stone' variety comes from the Millstone Grit Group rather than the Pennine Coal Measures. It is quarried at Crosland Hill in Huddersfield from the Rough Rock of the Rossendale Formation. These strata underly the Coal Measures and like them are Upper Carboniferous fluvial sandstones. The stone was supplied by Johnson Wellfield Quarries.

The square opens up at the western end into a paved space alongside the Saatchi Gallery (formerly the Royal Military Asylum). The Moorfield Hard York Stone continues here as the main paving material, but it is countered with street furniture and paved strips of grey, fine grained **Pietra Serena**. This is a stone from near Florence in Tuscany, Italy. It is an Oligocene-Early Miocene turbiditic sandstone, part of the Alpine Tuscan Nappe. This was one of the great building materials of Renaissance Italy, with many monumental buildings constructed of this stone, especially in Florence.



Moorfield Hard York Stone and Pietra Serena in Duke of York Square.

Statue of Sir Hans Sloane

A statue of Sir Hans Sloane stands at the east end of the square. Sloane, physician, naturalist and collector was born in Ireland in 1660. He travelled to London and then France to study medicine. After a sojourn in Jamaica, where he met and married his wife, Elizabeth Langley Rose, he eventually settled in Chelsea where he was instrumental in the development of the Chelsea Physick Garden and his Cabinet of Curiosities

became the founding collection of the British Museum. He died in Chelsea in 1753 and is buried at Chelsea Old Church. One of his daughters, also named Elizabeth, married Charles Cadogan, who inherited Sloane's land in Chelsea and the Cadogan family remain the landowners here to this day.

The statue standing in Duke of York Square could easily be mistaken as one contemporary with Hans Sloane's life. However it was in fact erected in 2007 by sculptor Simon Smith. It is made from **Portland Whitbed** and has the characteristic slight yellow colour typical of relatively fresh Portland Limestone. This is fairly typical Whitbed, an oolitic limestone with scattered fossils. These include broken shell fragments and also so good examples of sections through articulated oyster shells. Some good examples can be seen on the coving of the plinth, below the artist's signature at the back of the statue.

The King's Road was originally constructed in the 17th Century as a driveway to Hampton Court Palace. As such it ran through the countryside and market gardens before becoming developed into the retail and residential area we know today in the mid 19th Century. Cross over the road to the imposing shop front at number 72, King's Road.

72, King's Road

This impressive building, currently occupied by the clothing and accessories company '& Other Stories', was formerly the Colville Tavern, a public house, constructed in 1844. The geological interest lies in the pillars between the shop windows. These are made from red granite with grey granite pedestals and foundations. Original stonework is in situ on the Blacklands Terrace façade. Here we have a classic pairing of pink **Peterhead Granite** and grey **Cairngall Granite**. The latter stone is from an intrusion cross-cut by the Peterhead Pluton, the Forest of Deer Granite, a 470 Ma syn-tectonic Caledonian Granite. It is a grey, unfoliated granite with blotchy-appearing white feldspar phenocrysts. Cairngall was quarried at Flushing, Aberdeenshire. Both Peterhead and Cairngall are no longer quarried. Indeed the Cairngall Quarry at Flushing is now a rifle range. Clearly similar stones were sourced to replace the granites used on the King's Road façade. Here the pink granite is the fine grained variety of Finnish Balmoral Granite standing on a foundations of a grey granite of unknown provenance.

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Locations of the buildings described above and brief details of the stones used can also be found in the London Pavement Geology archive: <u>http://londonpavementgeology.co.uk</u>