Building Birmingham: A tour in three parts of the building stones used in the city centre. Part 3. Around the shops from the 'Back of Rackham's' to the Bullring

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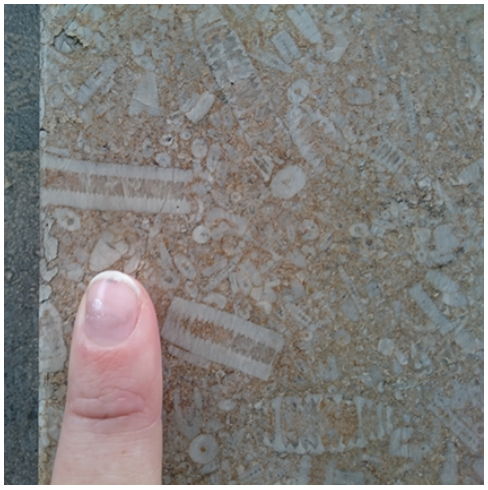
The name 'Birmingham' is derived from the Anglo-Saxon *Beormingahām,* alluding to the home of the Beormingas clan and their settlement here was probably established as early as the 7th Century A.D. However the centre remained a poor region until the later 12th Century when Peter de Bermingham, local lord of the manor, developed a market centre around his castle, in the area that is now the Bull Ring. From then Birmingham's economy began to take off and it became established as a small market town. The Bull Ring has also been shown to be an area of light industry at this time. Archaeological excavations carried out during the latest phase of construction in the early 2000s have revealed evidence of potters' workshops and leatherworks during the 13th Century.

This building stone walk focuses on the old centre of Birmingham, around the church of St Martin in the Bull Ring and the surrounding shopping malls. The area demonstrates continuity as a centre for trade and retail but the building materials used here have changed beyond those that would have been familiar to Peter de Bermingham and his family. The area has been transformed over the last two decades, and though the oldest part of the city of Birmingham, it is now the symbol of a new vibrant centre, with the covered markets replaced by glamorous shopping malls. Malls are modern cathedrals in terms of delivering the double whammy of decorative stones and public access. They are built to impress and the polished surfaces provide excellent opportunities for observing fossils, minerals and textures. This walk will take in the new shopping precincts of the Bullring and Grand Central as well as the surrounding retail areas. It will end by taking a detour to Holloway Circus to visit the Pagoda.

The main source on the architecture of the buildings visited, unless otherwise cited, is Pevsner's Architectural Guide to Birmingham (Foster, 2007). Information on public artworks is largely derived from Noszlopy & Waterhouse (2007). This is the third and final part in series of guides to the building stones of

Birmingham City Centre (see Siddall et al., 2016a & b), produced for the Black Country Geological Society. The walk extends the work of Shilston (1994), Robinson (1999) and Schroder et al. (2015).

This walk starts on Temple Row, and can be combined with the first walk in this series which ends at the Cathedral yard (Siddall et al., 2016a). The first stop is a small but well worthwhile diversion from the main route. Walk down Temple Street to the branch of the stationers Rymans at number 20.



Rymans, 20 Temple Street

The purpose of this diversion down Temple Street is to visit what appears at first glance to be the unassuming shop front of the stationers' Rymans. This is one of Birmingham's top fossils spots (left). It is clad with a limestone called **Derbydene.** This is an 'encrinite,' now a rather old-fashioned word, referring to a limestone predominantly composed of the fragments of crinoids. More correctly it would be called a biosparite today. However, here the crinoids are so spectacular that it seems fitting that we apply a rock name which draws attention to this. The crinoids here are big and cannot be missed, with ossicles a centimetre or so in diameter and articulated stem-sections up to ten or more centimetres in length. It is quarried from beds in the Lower Carboniferous Eyam and Monsal Dale Limestone Formations around the quarry district of Cromford in Derbyshire.

Now retrace your steps back up Temple Street towards the Cathedral and turn right into Temple Row to the Allied Irish Bank at 61 Temple Row.

Allied Irish Bank

The building on the corner of Temple Row and Needless Alley is properly called Union Chambers. It was designed in the 1930s by architects Ewan Harper, Bro. & Co. The ground floor has been remodelled to accommodate the Allied Irish Bank. Looking up, the building is clad in Portland Stone, but of main geological interest here are the decorative granites used to clad the lower floor. Several granites, probably added at different times, are used to clad this building, which is why this façade looks a bit patchy.

The bank's logo is fixed on to a blue, igneous rock. Although above eye-level, even from a distance, this is recognisable as one of the world's most popular decorative stones and also Norway's national stone. It has been quarried on a commercial scale since the 1880s and has become very popular. This is **Blue Pearl Larvikite**, one of several varieties of this stone quarried from the Larvik Plutonic Complex, located in the Oslo Rift in the Vestfold of southern Norway, some 80 km south of Oslo. The Larvik intrusions form a ring complex, intruded during the formation of the Oslo Graben in the Permian between 292-297 Ma. The 'Blue Pearl' variety, so-called because of its strong blue colouration, predominantly an optical effect brought about by the 'schillerescence' of the feldspars, belongs to the Tvedalan Sub-Type of the intrusion and is quarried in 14 locations around the villages of Tvedalen and Auen. Larvikites, like many rift-associated igneous rocks, have unusual mineralogy. The schillerescent feldspar is an oligoclase perthite. The rock is often referred to as a syenite, however due to this plagioclase component, it is more properly a monzonite by composition. The feldspathoid mineral nepheline is also present. The mafic phases are the black mica variety lepidolite, the pyroxene titanaugite and titanomagnetite.

We now turn to the granites which are used to clad the verticals around the door and between the windows. Unfortunately one of the main stones used is a granite of unknown origin, with blotchy, white plagioclase phenocrysts in a matrix of pale brown potassic feldspar, grey, translucent quartz and clots of black biotite mica. Also used are a very pale coloured leucogranite and a brown granite with strongly aligned phenocrysts. The leucogranite is a variety of **Sardinian Granite**, with phenocrysts of slightly yellowish feldspars. This colour effect is partly due to incipient alteration of these minerals to form clays. Some of these crystals also show zoning. Grey quartz and black biotite are also present. This stone is quarried from the Buddosò Pluton, located in the north east of the island of Sardinia. It was intruded during the Variscan Orogeny 300 million years ago.

The darker-coloured, foliated granite is a variety of **Cornish Granite**. This texture is generally referred to as the 'small-megacrystic type' due to the brick-shaped feldspar phenocrysts, and granites with this texture were mainly acquired from the Carnmenellis and Bodmin Plutons. At 300 Ma, the Cornish Granites are the same age as the Sardinian Granite above, and related to the same mountain-building event, the Variscan Orogeny. Both suites of granites were intruded late into this orogenic phase. Unlike the Sardinian Granites which contain only biotite mica, the Cornish granites are two-mica granites and silvery muscovite is a distinctive component of the stone used here. Biotite is present in black flakes, showing a weak alignment. Plagioclase and grey quartz are also present in the groundmass.

Above, left to right, brown granite, Sardinian Granite and Cornish granite. All images are at the same scale, field of view = 15 cm.

Next door, just across Needless Alley are the offices of the CBRE.

CBRE Building, 55 Temple Row

This building, between Needless Alley and Cherry Street formerly housed the Bank of England, and was designed by Fitzroy Robinson & Partners (1972). It is now occupied by CBRE, a firm of California-based

property developers. Two stones are used here; an unusual variety of Portland Stone and a brown granite. The Portland stone is best seen from 'exposures' at eye-level on the Needless Alley façade. This stone is packed with fossil fragments. It is **Fancy Beach Whitbed,** a variety of Portland Stone which is much richer in fossils than normal Whitbed. It can be distinguished from the Roach facies in that the latter is dominated by cavities where fossils have been completely leached out. Fancy Beach Whitbed is packed with fossils but not all of these are leached out. The facies is particularly rich in the oyster *Liostrea* sp. and also debris of the algae *Solenopora portlandica*. The main shell variety that are leached moulds and casts are from the bivalve *Trigonia*. This facies named and worked by Albion Stone is mainly quarried in Jordan's and Inmosthay Quarries on the Isle of Portland. Like all varieties of Portland Stone, this is an oolitic calcarenite of late Jurassic age.

Blaubrun Granite is used to clad the entrance façade at the top of the steps. 'Blaubrun' literally translates from the German as 'blue-brown', referring to the brown potassic feldspars and bluish, strained quartz. This blue colour is an optical effect. Blaubrun is a coarse-grained, ancient granite from Sweden, one of the 1.8 Ga Flivik-Hökhult Suite, with the main quarries located in the Ångeholm Pluton. This suite of intrusive igneous rocks is part of the Transcandinavian Igneous Belt and emplaced in the Småland region of south east Sweden. They are exposed along the coast and the quarries are only accessible by boat. The rock also contains biotite and plagioclase.

Cross Cherry Street to 43 Temple Row.

43 Temple Row

Originally built in 1980 for the Trustee Savings Bank by James A. Roberts Associates, this building is now occupied by Lloyds Bank. The most famous rapakivi granite, **Baltic Brown**, is used to clad this building and this continues along the façade on Cherry Street, providing excellent surfaces at eye-level to examine the textures and mineralogy of this rock. 'Rapakivi' is a Finnish word meaning 'rotten rock'; a name coined due to the rubbly, surface weathering encountered in the Wiborg Batholith from whence this rock is quarried on the Finnish-Russian border. However the phrase 'rapakivi granites' applies to a range of anorogenic granites intruded between 1.6 and 1.5 billion years ago in a zone extended from the Baltic Shield to the Southern USA. The variety we see here is the most well known and belongs to a group of rapakivi granites called wiborgites. These have the classic 'ovoid' textures of rounded, pink-brown potassic feldspars,

rimmed by green plagioclase. Modern understanding of megacrysts in granitic melts is moving away from the interpretation that these are primary melt features and it is generally understood that these represent sub-solidus crystal growth.

Tivoli Travertine is used under the portico around the entrance, to clad the uprights between the plate glass doors. This stone comes from the enormous quarry complexes at Bagni de Tivoli near Rome in Italy. The quarries work the deposits of the former volcanic Lake Tiburtinus, and the Romans, who used this stone for the construction of the Colosseum and many other buildings, called it Lapis Tiburtinus. It is an ivory-coloured, beautifully banded travertine, the calcium carbonate precipitated from warm, geothermal waters and modified by algal mats. The biological side of this partnership is largely responsible for the delicate structures observed when this stone is examined closely. The Tiburtinus Travertine deposits are Pleistocene in age, the youngest only 30 thousand years old.

Follow Cherry Street to Corporation Street and turn left in front of House of Fraser (formerly Rackham's) department store. Do look at the beautiful slabs of Baltic Brown en route!

House of Fraser Department Store

Along Cherry Street, the block that is 43 Temple Row steadily merges into the House of Fraser Department store, facing onto Corporation Street. The shop is largely clad with a fine- to medium-grained grey granite of unknown origin. It is composed of white, milky quartz and feldspar with abundant black biotite and minor muscovite. The feldspars are slightly altered and sometimes appear to be brown. Around the shop windows are strips of red **Balmoral Granite**, which like Baltic Brown described above, is another popular Finnish Stone, and again is part of the suite of rapakivi granites. These varieties, lacking the distinctive ovoids, are know as pyterlites. Balmoral is quarried from the Vehmaa Batholith, near Turku on the coast of SW Finland. Mineralogically it is composed of brick-red potassic feldspars, very dark, smoky quartz, plagioclase, biotite and hornblende. It has been marketed as 'Balmoral' since 1903, a time when Scottish-style baronial architecture was very popular in Scandinavia and Finland and also because the stone was marketed to the British Isle through the port of Aberdeen.

Turn left along Corporation Street and walk to The Square Peg pub on the corner of Bull Street.

The Square Peg Wetherspoons Public House

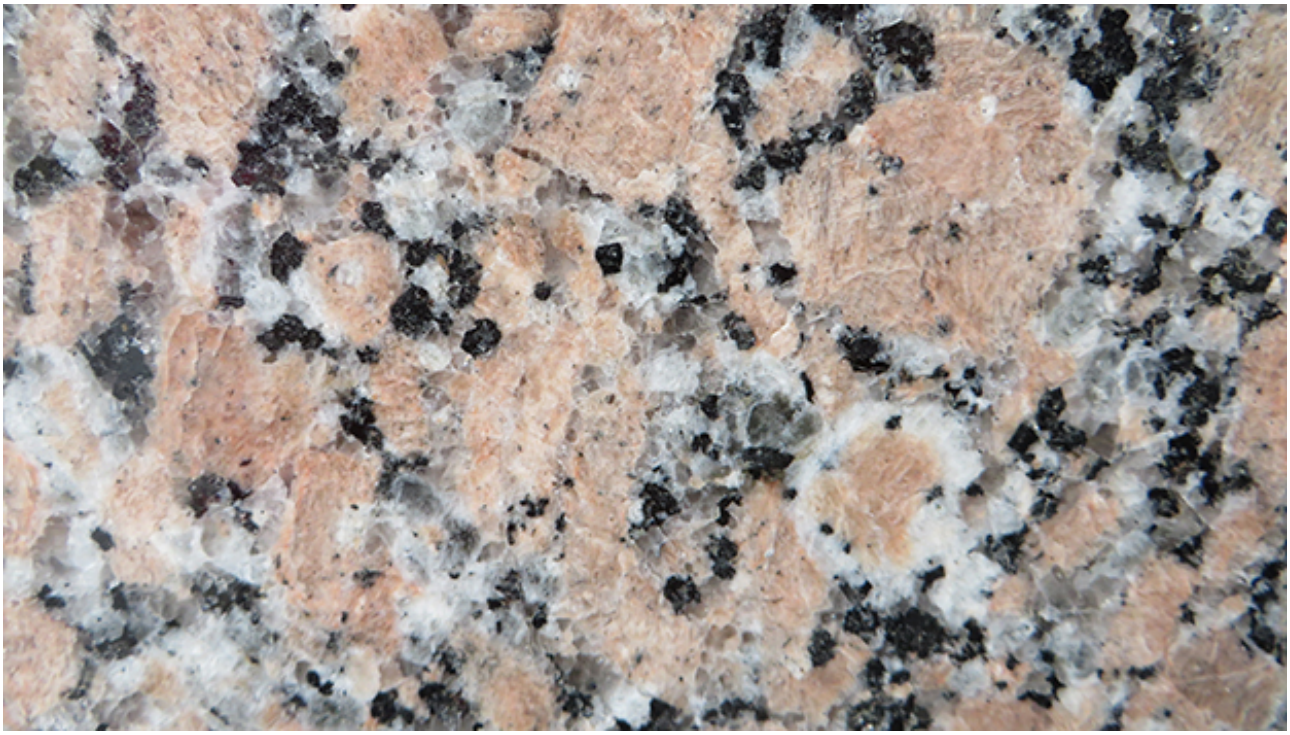
The ground floor façade of this enormous pub is clad with a spectacular pink granite. We continue the Finnish theme as this is another rapakivi granite from Porkkala on the southern coast of Finland and is therefore called **Porkkala Granite**. It is a wiborgite variety with ovoids of rose-pink potassic feldspar rimmed with white plagioclase. These are not as well defined as in Baltic Brown and this is partly because this stone has also been deformed, having been emplaced along a fault zone. Translucent, pale-grey quartz and biotite are also present. A Portuguese granite, **Rosso Porriño** has been used to patch this stone on the Bull Street façade; this is finer-grained, equigranular granite, also rose pink, composed of pink potassic feldspar, plagioclase, grey smoky quartz and biotite. Like the Cornish and Sardinian granites, it too was emplaced during the end-Carboniferous Variscan Orogeny.

Continue along Bull Street and enter the Minories. Once open, this shopping centre was glazed over and remodelled by Peter Hing & Jones Architects in 1993.

The Minories

Synthetic stone, including terrazzo flooring, are mainly used in the interior, but once again we see the wiborgite **Porkkala Granite** used to great effect, this time highly polished to clad the walls. This surface makes examination of textures much easier. The other stone used here is a strongly banded, migmatitic, black and red gneiss used as circular features at the bases of the lamps. Unfortunately the precise origin of this stone is unknown but it is very probably from Brazil. Such stripy gneisses are often marketed under the

generic name '**Juparana**' named after a lake in Espirito Santo State, Brazil close to some of the earliest quarries for this type of stone.



Porkkala Granite at The Square Peg. Field of view = 15 cm.

Walk straight through The Minories and leave via the exit onto The Priory Queensway. After a few tens of metres, turn left onto Colmore Circus Queensway and the imposing, post-modern, office block building of The Wesleyan.

The Wesleyan and General Assurance Building

This immense office tower is also designed by Peter Hing & Jones and was completed in 1991. Foster (2007) describes it as a 'poor quality' attempt at post-modernism, and I am inclined to agree with him. However my agreement is short lived, as Foster goes on to say that the building is clad with synthetic stone. It most certainly is not! This building, very much of its time, exploited the then, new to the market, spectacular granitoids and gneisses of Brazil. Shilston (1994) identifies this stone as **Rosa Tramonto**, and indeed there is a polished sample of 'Rosa Tramonto' in the Dudley Museum (Cat. 017606) which is certainly very similar and it would be easy to draw conclusions here. However 'Rosa Tramonto' is not a standard stone name; it may well have been a 'local' name given by the stone contractors. I have not been able to further provenance this variety of 'Juparana' gneiss. Nevertheless, it is a beautiful stone, a coarse-grained granitic gneiss-migmatite, composed of potassic feldspar and biotite.

Continue on, crossing Bull Street to the east end of Colmore Row.

Colmore Gate to 8 Colmore Row

On the corner of Bull Street and Colmore Row stands a fourteen-storey tower with office and retail space designed by Seymour Harris Partnership and built between 1990-92. It is almost entirely clad in Norwegian **Blue Pearl Larvikite** as described above at the Allied Irish Bank. The shimmering schillerescence of the oligoclase perthite feldspars are clearly observed on these polished surfaces.

Turn left into the Great Western Arcade and continue walking through the arcade to the entrance on Temple Row.

Great Western Arcade

The Arcade is one of the last surviving examples of Birmingham's Victorian shopping arcades. It was constructed in 1876, designed by architect W.H. Ward and built over the tracks of the railway lines coming out of Snow Hill station. It underwent refurbishment and restoration in the 1980s by Douglas Hickman of the John Madin Design Group. The façade to the entrance on Temple Row, is in a Renaissance style, with carved pilasters, capitals, and figures personifying Art and Industry above the arch. All of this is carved in **Bath Stone** freestone. One of the UK's most famous building stones, Bath Stone is quarried around the eponymous city from the Oxfordian Chalfield Oolite Formation, part of the Jurassic Great Oolite Group. As the name suggests, it is an oolitic limestone, but it also contains variable amounts of shell debris. Bath Stone can be distinguished from Portland Stone in that it is a pale golden-yellow colour.

From The Great Western Arcade, cross Temple Row and continue through the North Western Arcade back onto Corporation Street. If this arcade is closed (i.e. on a Sunday), then walk back to Cherry Street and take that route back onto Corporation Street. Turn right on Corporation Street and then left onto Union Street. Our route is now to take us to the shopping malls at the heart of Birmingham's 21st Century shopping district.

WH Smith Union Street

Whilst walking down Union Street, it's worth stopping outside WH Smith to look at the **Carrara Marble** cladding on the exterior. A wide variety of marbles are quarried from this nappe stack of Mesozoic limestones exposed in the Massa and Carrara regions of coastal Tuscany in Italy. The variety seen here is a variety known as Arabescato Marble (left), essentially it is a tectonic breccia, formed

along a thrust plane, that was subsequently deformed and metamorphosed during the emplacement of the carbonate Tuscan Nappes in the Oligocene and Miocene. This is a calcite marble, metamorphosed at greenschist facies. The grey matrix is rich in very fine grained iron pyrite.

Continuing on to High Street, opposite us is The Pavilions Shopping Centre, which is currently scheduled for closure and redevelopment. Whether the granite façade will be preserved is not known.

The Pavilions, High Street

This development dominates the south side of High Street and was built in 1986 by Chapman Taylor Partners and its granite-clad façade epitomises the style of post-modern architecture. It is clad with a dark and pale pink granite. Unfortunately most of this is above eye-level, however the dark pink granite can be seen in the engaged pillars between shop fronts. Finnish **Balmoral Granite** is used again here. We have previously seen this stone in the window surrounds at The House of Fraser department store. The pale pink granite used is probably **Rosso Porriño** (as seen at The Square Peg).

Turn right on High Street towards the entrance to the Bullring. Next door to Waterstones bookshop is the Nationwide Bank (Building Society).

Nationwide Bank

The façade of this bank is clad in panels of a greenish grey gneiss, unfortunately of unknown origin. It is clearly a banded, metamorphic rock at greenschist facies. Mineralogically the green colour is almost certainly imparted by chlorite, and tiny, needle-like crystals of actinolite are visible. Muscovite is also present, but the overall surface sheen of this rock suggests that it is also rich in carbonate minerals. Making this most probably a calc-silicate gneiss, derived from the complex metamorphism of a sequence of clastic and carbonate sediments.

Rotunda

The 24-storey high Rotunda is probably one of the most iconic buildings of the Bullring and Birmingham and became listed in 2000. Completed in 1965 by architect James Roberts, it is the only survivor of the 1960s Bull Ring Centre. The ground floor is clad, mosaic-like, with brick shaped blocks of white **Carrara Marble**. These have a naturally broken surface which does catch the light well and makes for an interesting texture. This variety is white with faint, grey streaks, it is known as Carrara 'Sicilian' Marble (the links with Sicily are unknown and probably tenuous). Similarly to the Arabescato variety described at WH Smith on Union Street (above), this marble is derived from the Apulian Tectonic Window.

We will not yet enter the covered Bullring Mall, but we can pat the head of the bronze bull (see page 1) at the entrance before heading down the walkway towards St Martin's Square.

Street Furniture

Seating in the form of stone cubes are found scattered along the walkway down through the centre of the Bullring towards the church of St Martin's. These are made of an attractive, purplish-coloured metamorphic rock. **Vizag Blue** is a garnet-bearing migmatitic gneiss from the Eastern Ghats Mobile Belt of north east India. It is quarried in several localities around the towns of Srikakulam, Tekkali and Patapatnam in the state of Andra Pradesh and it is named after the local civic centre, Visakhapatnam, which is often shortened to 'Vizag'.

The migmatites are part of a suite of very high grade metamorphic rocks of charnockitic composition, containing the minerals garnet, plagioclase and potassic feldspars, biotite, orthopyroxene and opalescent quartz. The Eastern Ghats Mobile Belt represents a series of deep crustal rocks accreted during multiple orogenic events during the Palaeoproterozoic, between 1.5 and 2 billion years ago. The attractive colour of this stone and its ability to take a high polish has made it very popular as a decorative stone not only in shopping malls, but it has also become a stock material for monumental masons.

St Martin in the Bull Ring

A church existed here at the time of Peter de Bermingham in the 12th Century although it was first recorded in 1263. A history of this Medieval church's evolution into the Victorian building standing today is recorded by Foster (2007). The bulk of the modern church was completed in 1875 under the supervision of architect J. A. Chatwin. Post World War II restorations and additions were carried out between 1950 and 1960 by Philip and Anthony Chatwin. The church is built in **Grinshill Stone**, although Foster (2007) notes that the spire, largely untouched by Chatwin and encased by P. C. Hardwick in 1855 was built of an undifferentiated 'grey-brown sandstone'. Grinshill Stone is one of the Lower Triassic sandstones of the English Midlands. Typically, these stones are red, with quartz grains well-coated with haematite. However, unusually, Grinshill is a buff-coloured sandstone, derived from the Helsby Sandstone Formation of the Sherwood Sandstone Group. It is a cross-bedded arkosic sandstone, composed predominantly of quartz and feldspar and free of

iron. It is quarried from Grinshill near Wem in Shropshire. Although used locally since at least the Medieval period, it was worked on an industrial scale from the 19th Century, with over 30 quarries in operation.

Slabs of **Hauteville Limestone** are used as paving in front of the church porch. This has a distinctive yellow to pink colour variation, enhanced by abundant bioturbation. Hauteville is a Lower Cretaceous limestone quarried from the eponymous French village. As the name suggests, the quarries are located high in the French Jura and it is quarried seasonally; the quarries are buried in snow in the winter months. Hauteville Stone is variably fossiliferous, and a few examples are seen here. The surfaces of these slabs are rather battered, but look for the large (10 cm) long section through a helically coiled ammonoid, *Turrilites costatus*, right on the very edge of a slab, up against the paving stones of St Martin's Square. The black stone immediately adjacent to the Hauteville is the pyroxene-phyric, Cretaceous basalt from China, marketed as **Black Pearl** (below).

Hauteville Limestone and Black Pearl Basalt paving, St Martin's Square.

Return now to the new Bullring mall which can be accessed via Selfridges or the entrances on the walkway.

Bullring

This area of Birmingham has been a market place since Peter de Bermingham bought a licence to trade in the 12th Century. Many of us who knew Birmingham in the later half of the 20th Century will remember the Bull Ring Centre well, a functional if not beautiful architectural conglomeration. Plans were in place by the late 1990s to redevelop this area and demolition and building works began in 2000 with the mall opening three years later, reincarnated as the one-word Bullring. The mall is designed by retail specialist architects Benoy Group. Foster (2007) remarks that the new complex is '*retail architecture at an uncomfortable moment of transition*'. Nevertheless, shopping malls are always good places to see decorative polished stone, and this makes the Bullring well worth a visit. The stone contract was carried out by engineers Chapman Taylor along with Stone Cladding International, a firm well-known for supplying particularly decorative, arguably 'glitzy' stones, many from exotic localities. The Mall is arranged on three levels which are continuous on the Lower Level but split into two 'wings' on the Middle and Upper Levels by the

walkway leading down to the church of St Martin's. Paving stones, which vary in design and stone used from level to level, are the main use of decorative stones in the Bullring.

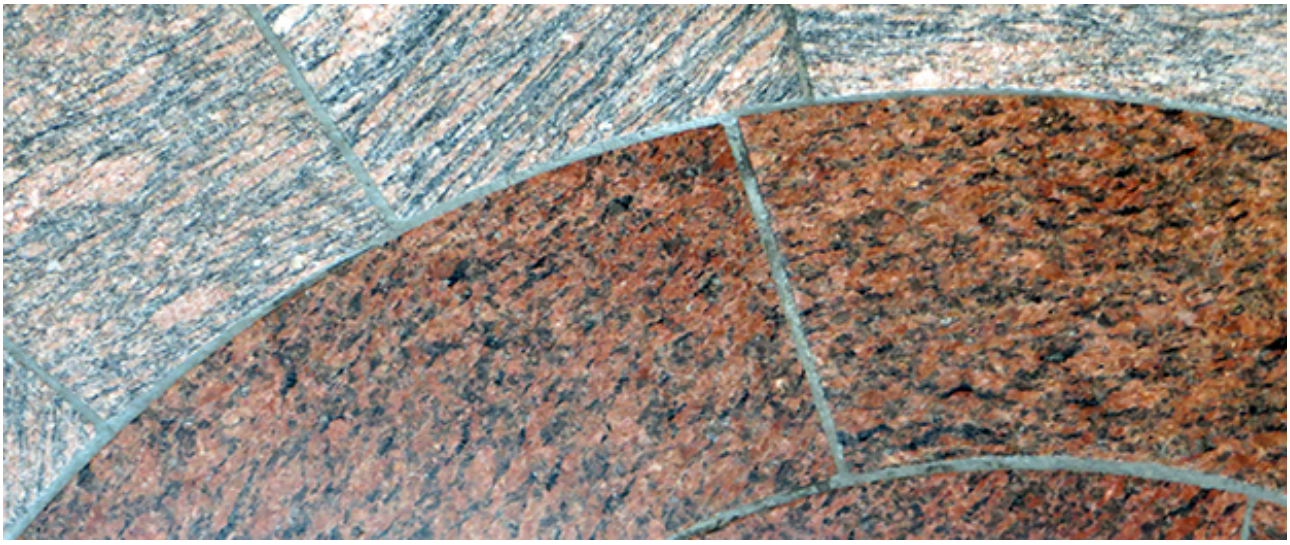
The main paving stone used throughout the complex is a yellow-coloured Spanish, mid-Cretaceous limestone. This is generally marketed as **Yana Limestone** which is a corruption of one of the places of origin, La Jana near Tarragona in southern Spain. It is worked on a large scale from the Aptian Benassal Formation. Texturally this unit is variable in both colour and fossil content. Colour ranges from yellow through cream and even pale pink and the stone is sometimes mottled with these colours. It is variably fossiliferous, with fossils – dominantly the oyster *Toucasia* sp. – concentrated in shell lags. Gastropods and ammonites are also present. Some slabs are entirely devoid of fossils, others are packed full with them.

The migmatite **Vizag Blue**, described above, is used on the Lower Level of the mall as supports for the escalators at each end of the main concourse. It is also used for paving on the Upper Level of the Mall. A good place to see it is near to the information point at the 'Debenham's end' where it is used in lozenge-shaped decorative paving (below). It is found here along with one of its associated rocks, a gneiss marketed as Orissa Blue. The Eastern Ghats Mobile Belt extends through Andra Pradesh into Orissa (Odisha) State, parallel to the coast of the Bay of Bengal. **Orissa Blue** is paler in colour but essentially the same mineralogy (and age) as Vizag Blue. Texturally it is different and distinctive, with large, brick-shaped porphyroblasts of plagioclase aligned in the gneissose matrix. It too is very rich in red garnets.

Rosso Tigrato is another metamorphic rock, this time from Brazil. It has a tiger-striped appearance, due to being composed of a finely banded pink and black gneiss with narrow injections of granite which are rotated parallel to the foliation. This stone is again used in decorative paving in the mall, most notably in the roundels at each end of the main concourse on the lower level. This is another migmatite, a 'Juparana'

with a granitic composition; the pink colouration being imparted by potassic feldspars and biotite as the main mafic phase. It is from the Archaean São Francisco Craton, quarried near Ruy Barbosa in Bahia State.

The stone used as the centre of this roundel (above) is **Vånga Granite**, a rich wine-red granite from Skåne in southern Sweden. The Vånga Pluton is one of a suite of 1.4 Ga granites intruded into the Blekinge Province of Mesoproterozoic metasediments. The granite is strongly deformed, and this can be seen from the elongated, red potassic feldspars and intervening 'schlieren' of black biotite mica.



This is a very popular stone, used for cladding buildings but also for paving both internally and externally. It is extractable in large slabs and blocks, due to the outcrop having a system of widely spaced joints. Vånga is also used for the cylindrical seats near the Lower Level exit from the Mall onto Smallbrook Queensway and the Bus Station outside Grand Central.

Cinza Rajado is also named by Stone Cladding International as a stone used here in the Mall. This marketing name is mainly used for a Brazilian marble but it is applied here to a yellow and black striped gneiss which is used for areas of flooring. A good place to see this is on the Lower Level of the mall, outside Costa Coffee. This is almost certainly derived from Brazil and almost certainly Archaean in age but its origin is unknown. 'Rajado' is Portuguese for 'brindled' and that is certainly a good description of this stone (NB. 'cinza' means grey).

*From the western (Debenhams) end of the Bullring, a linkway on the upper level leads through to Grand Central Mall. Good slabs of **Yana Limestone** are seen in the paving of this route.*

Grand Central & New Street Station

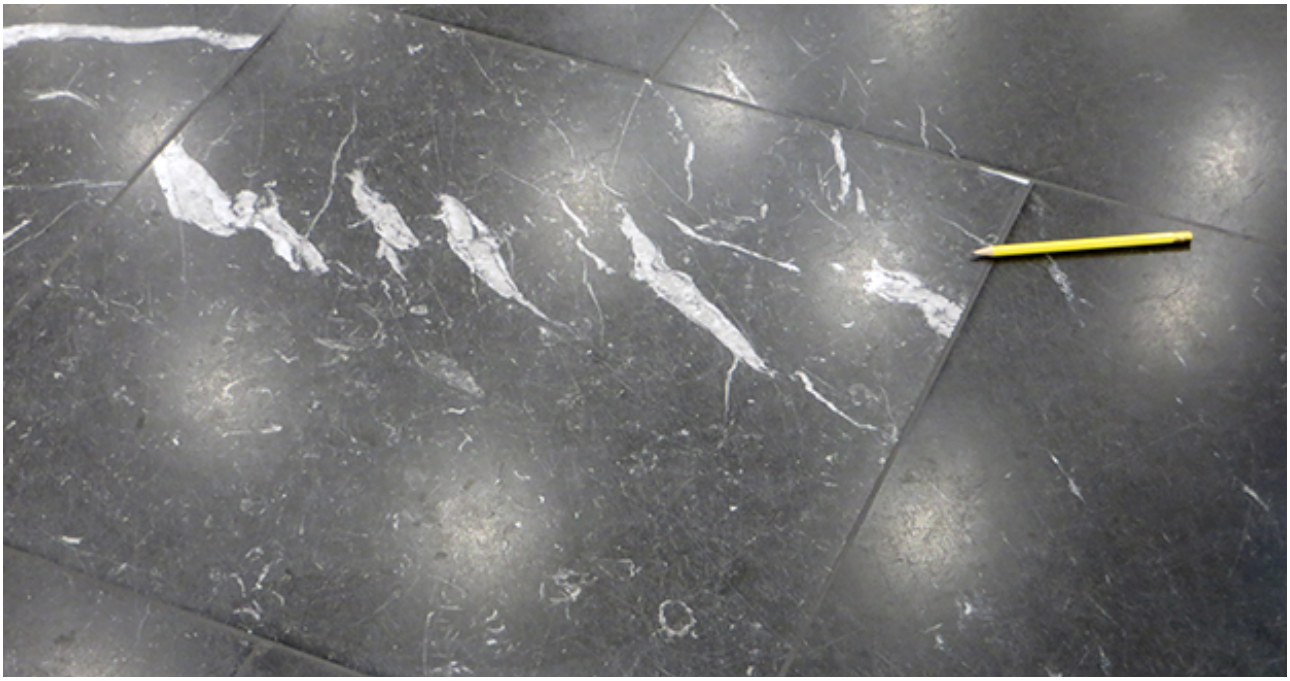
The building development which encompasses the remodelled New Street railway station and its enclosing shopping mall, Grand Central, opened in 2015. It was designed by architecture firm AZPML, headed up by Alejandro Zaera-Polo and Maider Llaguno (Mairs, 2015). Most of the structure is steel and plaster, with a tetrafluoroethylene plastic roof. Stones are used for paving and provide a feast for fossil spotters.

Two contrasting stones are used, Jura Marble and Nero Marquina. **Jura Marble** is not a true marble in the geological sense, but the term 'marble' has long been used in the building industry to describe any carbonate rocks which take a good polish, regardless of whether or not they have been metamorphosed. This stone is a nice example of a polished limestone. It is a readily available and relatively cheap stone, and is currently very popular, it can be seen in many shopping malls worldwide. It is derived from German Jura in Central Bavaria, in the Altmühltal National Park. It belongs to the Late Jurassic Treuchtlingen Formation and has many well preserved fossils; ammonoids and belemnites are very common, the belemnites are particularly well-preserved and dark brown in colour. The Treuchtlingen seas were dominated by sponge biostromes and fossils of these are very abundant in the rock, as mottled, brown, sometimes ring-shaped structures. These were colonized by millions of calcite-encrusted tubiphyte worms and these can be seen as millimeter-size white flecks throughout the rock.

Jura Marble. A belemnite and sponge fossils, surrounded by tubiphyte worm casts.

A black Spanish limestone, marketed as **Nero Marquina** is also used here. This is Mid-Cretaceous in age and comes from Marquina, in the Basque country of NE Spain. Like the Jura Marble, it takes a mirror-like polish, much enhanced by the blackness of the stone. It is a bituminous limestone with a micritic matrix, but fossils are preserved as white and include fragments of rudist and other bivalves and corals. Also the formation was weakly deformed and evidence of this are excellent, conjugate sets of *en echelon* tension gashes, infilled with white calcite, along with other veins. Good examples of these are seen in the 'island' of Nero Marquina close to the entrance to the linkway to the Bullring, outside Costa Coffee.

Julie attempting the near impossible task of photographing the highly reflective surface of Nero Marquina.


En echelon tension gashes and rudist fossils in Nero Marquina limestone.

Outside New Street

The main station concourse with its grey and white striped paving and the pedestrian areas around New Street and Grand Central have been designed by Atkins Landscape Architects 2015 with stone contractors, Hardscape. As is customary these days, cheap and hardwearing Chinese granites are used for paving, setts and kerbs.

Kobra Granite is used on the paving, steps, planters and benches (many of which double up as counter-terrorism blockades) around the exterior of the station. This is a dark grey, fine-grained micro-granodiorite, composed of plagioclase, quartz and hornblende. It is quarried near Changle in Fujian Province. **Royal White Granite** is also used for contrasting paving and kerbs. It is a pale grey granite, coarse grained and composed of white feldspars, grey quartz and biotite, streaked with very coarse-grained pegmatites (below). It is quarried from Puning in Guangdong Province to the south of Fujian. Both of these granites are associated with a Mesozoic continental arc complex which extends along the continental margins of SE China. Numerous series of granitoids were intruded into this region during the Cretaceous, between 130-80 Ma. Several of these coastal range granites are quarried and shipped out of the port of Xiamen.

A final detour from the shopping malls around New Street Station, takes us along Hill Street, turning left onto Smallbrook Queensway to Holloway Circus. This roundabout features a small park called Thomas Gardens, but is best known for the slightly unexpected landmark of a Chinese pagoda. The area can be accessed from underpasses around the Circus.

Holloway Circus

The pagoda stands as a gift to the City of Birmingham, presented in 1998 by the owner of a chain of Chinese supermarkets, Woon Wing Yip OBE. Chan (2005) interrogates the philosophy of this pagoda as a gift in an interesting article which explores both the concepts of gifting and multiculturalism, particularly in Birmingham at a time shortly after the return of Hong Kong to China by the British, leaving many Hong Kong citizens feeling stateless. Mr Wing Yip was inspired to donate the pagoda after discovering that Anthony Gormley's Iron: Man in Victoria square had been a gift to the city from the Trustee Savings Bank in 1992. Pagodas are associated with Buddhist shrines in China, where they act as watchtowers, allowing a 360° view. Mr Wing Yip was very keen to point out that the pagoda should not be seen as a religious symbol, but it should be as a beacon on this busy gateway to the city centre.

Standing 40 ft high, the pagoda is constructed of **Silver Grey Granite** which was quarried and worked in Fujian, SE China, although samples of the stone were sent in advance of construction to the UK for testing their load-bearing strength at the Birmingham Industrial Research Laboratories. Silver Grey Granite is also known under the standard Chinese stone nomenclature G603. G standing for granite, and 6 represents the province of Fujian. This is a two-mica granite, with white feldspars and grey quartz. Like the stones seen around New Street station, this is one of the voluminous plutons intruded into the SE China continental margin, during the collision of a series of allochthonous terranes throughout the Mesozoic.

The surrounding gardens were originally planted with plants found in Fujian. A number of large boulders of granite and granite migmatite (a granite that has been suddenly frozen during the process of melting) are used as garden ornaments. The 'Fu Dragons' are of concrete.

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Grand Central and New Street Station concourse, with striped paving of Kobra and Royal White Granites.