

Going, going ... Urban Geology at the end of an era at Euston Station

In the next few years, Euston Station will be, in planning strategy parlance, 'regenerated', and already the hoardings are going up. This will update the current, tired old 1960s buildings and make space for the coming of the locally much-despised HS2 link to the north of England. In the meantime, this guide is an opportunity to look at the surprisingly interesting urban geology of the area around the station. Catch it quick, it won't be there for long.

The original Euston Station was built in the late 1830s by railway engineer Robert Stevenson along with architects William Cubitt, Philip Hardwick and his son, P.C. Hardwick. This station was demolished in 1961-2, to make way for a much larger building, serving trains to Scotland, north-west England and North Wales. This was not without protest; the infamous Euston Arch was also destroyed at the time and many fought for the preservation of this icon of early Victorian architecture. Its destruction heightened debate on the edifices of Britain's industrial past that were being swept away in the name of modernism. The current station, which opened in 1968 was constructed by Taylor Woodrow Construction, with the plaza and surrounding offices designed by Seifert & Partners were built during the 1970s. The architecture, both past and present is described in Pevsner (Cherry & Pevsner, 1998) and in Stamp (2010). The latter book also contains restored photographs of the old station's exteriors and interiors.

Time Benches

The four stone 'Time Benches' stand in front of the main station plaza in the forecourt surrounded by food outlets, and they are easy to miss. Camden Council have received a pledge from the HS2 developers that the benches will be temporarily removed during station reconstruction, but that a place will be found for them in the new development. These four items of functional sculpture were highlights of Eric Robinson's geological walks in the north Bloomsbury area (Robinson, 2008).



The Time Benches were originally commissioned for the Garden Festival in Gateshead in 1990 and later removed to their current locality here at Euston Station. Sculptor Paul de Monchaux was born in Montreal, Canada in 1934 and studied at UCL's Slade School of Fine Art from 1955-58. He became Head of Sculpture at Camberwell School of Art in 1965, holding the post until the mid 1980s. De Monchaux works in wood and bronze, but also in British stones, including Swaledale Limestone (i.e. *Sea Lily*, 1985) and the beautiful shelly limestone Purbeck Spangle (i.e. *Bridge*, 1990). Images of his work can be seen in the catalogue to his 2013 exhibition at the Piper Gallery (Tobin, 2013). The stones used here represent classic examples of English geology and are described here from west to east. Each bench stands on a base of the same stone, inscribed with the name, geological age and provenance of the stone used.

At the western end of the plaza, we encounter the first bench carved from **Merrivale Granite**, from Dartmoor. Given this is the hardest stone used here, surprisingly, the inscription on the base has not stood the test of time well and it is only legible in raking light. Merrivale Granite comes from the Dartmoor Pluton. Intruded at ~ 280 Ma, the Dartmoor granite is part of the Cornubian Batholith of SW England. This suite of intrusions marked the closing stages of the end-Palaeozoic Variscan Orogeny. It is a Porphyritic granite with a few megacrysts, the latter twinned and zoned. Prominent are white K-feldspars in matrix of grey quartz and muscovite. Some feldspars are partially kaolinised and greenish or pinkish in colour. Overall the granite is a pale grey-brown in colour.

The next Time Bench is of a dark, red sandstone, quarried from St Bees near Whitehaven in Cumbria. This is of early Triassic age and represents the time following the Variscan Orogeny when land was emergent and deserts developed over the super continent of Pangaea. The resulting New Red Sandstones of the Permo-Triassic represent aeolian and fluvial sandstones. The St Bees Formation belongs to the Sherwood Sandstone Group and are sheet flood deposits, up to 600 m thick. The river sources were the Variscan Massifs to the south. **St Bees Sandstone** is composed of hematite- (iron-oxide) stained quartz with a small amount of mica. Some blocks show rip-up clasts and cross-bedding. The main quarries are Birkhams, which has been in operation since 1821, and Bankhead, both located close to St Bee's Head.



We take a step backwards to the Lower Palaeozoic and the Ordovician for the next Time Bench, constructed from the green slate of the Lake District. This particular example comes from Burlington Stone's Elterwater Quarry near Ambleside, and is marketed as **Elterwater Slate**. The slates belong to the Seathwaite Fell Sandstone Formation, part of the Borrowdale Volcanic Group. These sandstones are formed from volcanic ashes, predominantly fine grained, which were deposited and partially reworked in a caldera lake environment. Many examples show sedimentary structures consistent with this such as ripples, laminations and cross-bedding as well as deformation consistent with a turbulent tectono-magmatic environment; slumping, syn-sedimentary faulting and mud volcanoes. Where these structures are well developed, the stones are marketed as 'ornamental slates'. The green colour is imparted by the minerals chlorite and epidote and the slaty cleavage developed in the final stages of oblique Caledonian collision, during the Silurian Acadian Orogeny. Numerous quarries in the Coniston and Ambleside area have extracted these stones since the Roman period. Their main use until recently has been as roofing slates.

However the quarry companies have been successful in marketing this stone as paving, cladding and as a sculptural stone.



The fourth and final Time Bench is **Portland Roach** (above). This is a very distinctive, late Jurassic (Tithonian) limestone from the Portland Limestone Formation. The most frequently encountered varieties of Portland Stone in London's buildings are Whitbed and Basebed (Best Bed) which are compact in appearance. In contrast, Roach is full of holes. It does not take long to realise that these have distinct forms and they are the casts and moulds of shells, which were composed of aragonite and have subsequently been dissolved away. The main fossils are Portland Screw (*Aptyxiella portlandia*) and trioniid species bivalves (*Laevitrigonia gibbosa* and *Myophorella incurva*); these were known by the quarry men as "'osses 'eads'" (horses' heads), plus other bivalves such as *Protocardia dissimilis* and *Liostrea expansa* oysters. The later were originally formed as calcite and have been preserved intact. The Roach was used by Victorian military engineers for forts as the large holes left by the fossils enabled it to absorb the impact of cannon balls, but otherwise it was not commonly used for building stone until the mid-20th Century.

Around Euston Plaza

Also of geological note around the plaza are the statue of Robert Stevenson by Carlo Marochetti (1871), or rather its plinth, of **Peterhead Granite**. This is a stone very commonly used such contexts. It is a salmon-pink granite from Stirlinghill Quarries in Aberdeenshire.



Behind Stevenson, All Bar One café-bar has gabions filled with 'Caledonian Cobbles' (above). The ice ages, over the last half million years have been the main force in modifying the British landscape that we see today and this is perhaps most obvious in the glaciated landscapes of the Scottish Highlands. These cobbles would have been eroded from the bedrock and rounded during transportation by the ice age glaciers and ice sheets that covered Scotland. They would have been deposited in tills (boulder clays) and then weathered out of the soft clayey matrix and accumulated on beaches and in river valleys. There is quite an

industry in 'quarrying' these stones, grading them in terms of size and then selling them for hard landscaping as 'Highland Cobbles' or 'Caledonian Cobbles' (below).

Looking around the plaza, the multi-storey office buildings Grant Thornton House, 1, Euston Square, Network Rail's offices at 1, Eversholt Street and the linking structure The Podium are clad with **Rustenburg Bon Accord**, a 2 billion year old gabbro from the Bushveld Complex of South Africa. Although black and shiny from a distance, close inspection of this stone at pavement level shows it to be composed of more or less equal amounts of black pyroxene and grey plagioclase, the latter forming crystals around the size and shape of rice-grains. This gabbro is from the Rustenburg Layered Suite, a series of gabbros which overlie the platinum-rich Merensky Reef. The gabbro was initially quarried as a waste product, but has become a very popular building stone since the 1950s. The porches of these buildings are paved with a lower Cretaceous, cream coloured limestone, rich in shell fragments and cross cut by brown stylolites. This is **Perlato Sicilia** from Custonaci in north western Sicily. It is best seen on the disused entrance to 1, Euston Square, on the west side of this building. This office complex was designed by architects Richard Seifert & Partners and constructed between 1974 and 1978.



The interior of Euston Station does not boast much of geological interest. The Central Hall and Shareholders Meeting Room of the original station, designed by P. C. Hardwick had spectacular marble columns and fireplaces, all now sadly lost (see photos in Stamp, 2010). In the main station concourse, the floor is paved with a terrazzo which uses chunks of serpentinite set in a green-stained concrete.

Euston War Memorial

The station's War Memorial is located on a roundabout at the entrance to the bus station. Designed by Reginald Wynn Owen in 1921, it was erected to commemorate the men and women of the London Midland and Scottish Railway lost in World War II and those of the London and North Western Railway lost in the First World War. 'A stone obelisk on a granite base, guarded by four bronze figures' (Cherry & Pevsner, 1998). The obelisk is **Portland Whitbed**. The bronzes have stained the Whitbed green with copper carbonate salts. Corrosion of bronzes is driven by rainwater and exacerbated by acid rain in the modern city environment. The blue and green stains observed on bronzes are commonly the copper sulphate hydrate

minerals brochantite and antlerite, but copper carbonate hydrates azurite and malachite may also form on the limestone plinths (Scott, 2002).

Plaques commemorating WWII are a pale yellowish-brown Bath Stone. This can be seen to be an oolitic limestone with a rare fossil fragments present. Both Portland Stone and Bath Stone are British Jurassic oolitic limestones. The plaque commemorating WWI is a coarse-grained blue-grey granite. The carving looks very fresh and may be a replacement for the original as the monument has undergone some restoration in the recent past. I do not know the origin of this stone. It is composed of prominent white-grey, subhedral feldspars, biotite and grey quartz. There are a few, pinkish, partially kaolinised feldspars. If this stone is a recent addition, it is possibly a granite from Galicia in Northern Spain, perhaps the variety Gris Morazzo or similar.



The steps are constructed of **Cornish Granite**. This is a two-mica granite with particularly large and prominent muscovite crystals. It is a medium to coarse grained granite with a scatter of small feldspar megacrysts. The granite is iron-rich and has developed a rusty, orange patina as a result. This may have been derived from any of the Cornish intrusions and unfortunately has no distinguishing features. The paving on the steps is **York Stone** from sandy flags intercalated in the Pennine Lower Coal Measures Group quarried in Lancashire and West Yorkshire.

Lodges on Euston Road

Two lodges, constructed of **Portland Whitbed**, are sited on either side of the road entrance to the bus station in Euston Square Gardens. These have been converted to bars, the Euston Tap and the Cider Tap. These structures are the only remains of the Victorian Station and were designed by architect J. B. Stansby (1869-70). They are cube-shaped buildings with elaborately carved insignia of the railway company (LNWR) and plaques inscribed with the names of destinations served by the station, including my home town of 'Carnarvon'. Unfortunately the line stops at Bangor these days.

The Euston Arch

It is remarkable that half a century after its demolition, The Euston Arch is still very much in people's memories. Therefore it is worth describing here. It was an oversized entrance to the Victorian Station was designed by Philip Hardwick and installed in 1838. Technically, it is not an arch. It was a monumental propylaeum in a rather domineering version of the Doric style, more Albert Speer than Callicrates; it stood at 22 m height and the columns were 13.5 m in height (Cherry & Pevsner, 1998; Stamp, 2010). It was not a light and airy structure. The Arch was not positioned on the Euston Road as many imagine, at the entrance to the current bus station. It was located at more or less the locations of the entrances to platforms 9 and 10 in the present main concourse. Following demolition in the 1960s, various chunks of the monolithic components of the Arch were dumped in various places including a canal, the Prescott Channel, tributary of the River Lea in East London and the grounds of the home of the demolition contractor, Frank Valori. Architectural Historian Dan Cruickshank has estimated that 60% of the original arch could be reclaimed and it is the hope of The Euston Arch Trust that it will be resurrected in the design of the new station.

The Arch was built from Bramley Fall Stone. The original quarry is in Bramley Fall Park, just west of Leeds. The quarry is now abandoned and inaccessible and further extraction of stone from this site would not be possible. Geologically, Bramley Fall is the Rough Rock, the uppermost unit of the Rossendale Formation of the Millstone Grit Group. This unit belongs to the Yeadonian (Bashkirian) Stage of the Upper Carboniferous, and is a coarse-grained, gritty sandstone deposited in a fluvial-deltaic environment (Waters et al., 2000; Lott, 2012). The Rough Rock is an extensive strata which is quarried in various localities across West and South Yorkshire and is known after its various quarry localities as Crossland Hill, Meanwood, Spinkwell, Spout House and Brown Edge Stones.



The Euston Doric Arch; http://en.wikipedia.org/wiki/Euston_railway_station#mediaviewer/File:Euston_Arch_1896.jpg

Should the Euston Doric Arch be reconstructed, around 40% of the structure will need to be cut and fitted with the reclaimed stones. The Euston Arch Trust have been in negotiation with Mone Brothers who operate Blackhill Quarry, near Bramhope, just to the northwest of Leeds. Mone market the stone from Blackhill as Bramley Fall Stone and have recently supplied material for the restoration of Blackfriars Bridge.

However, although this is a similar stone and it will be a fair match, it is not Rough Rock. Blackhill Quarry is in the Midgely Grit, of Marsdenian Age which underlies the Rough Rock (Burgess et al., 2003).

Stop Press: Blocks salvaged from the original Euston Arch are currently on display in Euston Square Gardens (March 2015). These are well worth a look both to examine the somewhat ferruginous Bramley Fall Stone up close and also to obtain some idea of the scale of the architectural elements (below).



Above: fragments of the Euston Arch in Euston Square Gardens in March 2015.

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