

## PORTLAND STONE: LONDON'S ICONIC BUILDING STONE

The Portland Stone Formation of the Portland Limestone Group (Portlandian [Tithonian], Upper Jurassic, 147 Ma) represents a shallowing-upwards sequence of sandy limestones, clays and oolitic limestones conformably overlying the deeper marine facies of the Kimmeridge Clay. It was laid down in a shallow marine, carbonate shelf developing shell shoals and patch reefs deposited in a tropical environment – in effect a coastline and shallow sea with shell and sand banks. The Portland Stone Formation on the Isle of Portland is distinct from the same strata found (and quarried) on the Isle of Purbeck, the Vale of Wardour, Oxfordshire and Buckinghamshire, and this 'type-Portlandian' series of building stones has been London's iconic building stone since the 17<sup>th</sup> Century.

### Some London Buildings with good 'exposures' of Portland Stone

Portland Stone first came to London in the 17<sup>th</sup> Century. One of the earliest buildings using Portland Stone Whitbed is the York House Watergate in Victoria Embankment Gardens. The Watergate was built in around 1626 by the master mason and architect Nicholas Stone. Whitbed was the first variety of Portland Stone used for masonry as it was weather resistant. The softer Basebed, devoid of large shell fragments, was used for sculpture. Following the Great Fire of London in 1666, Portland Stone became London's main building stone, much favoured by architects including Christopher Wren, Nicholas Hawksmoor and Robert Hooke. It was used for buildings including the new St Paul's Cathedral, the new churches of London and The Monument to the Great Fire. These buildings established Portland Stone's pre-eminence in London's architecture. In the 18<sup>th</sup> and 19<sup>th</sup>



Centuries, Portland Whitbed was used for constructing buildings including the Royal Naval College Buildings in Greenwich, Hampton Court Palace, Burlington House, University College London, The British Museum and many of the Government buildings on Whitehall. In the 20<sup>th</sup> Century, the more unusual varieties of Portland Stone, the Roach, Patch Reefs and the shelly varieties of the Whitbed have found their place in London's architecture. Originally dismissed as a high quality building stone because of its large cavities left by fossils, the Roach was first used in the Economist Plaza (1960-64) in St James's by the architects Alison and Peter Smithson. Since then it has blossomed as a building stone and has been used in the new Broadcasting House extension and in numerous other buildings. Shelly varieties of Whitbed have also become popular. These varieties of Portland Stone are crammed with current-aligned oyster fossils. A good place to see both the old and the new varieties of Portland Stone is on Monument Street in the City of London. Whitbed was used on the Monument to the Great Fire (by Robert Hooke and Christopher Wren, completed 1677), but just across the plaza at 24, Monument Street, a modern office block is clad with shelly Whitbed. Patch reefs occur in the Whitbed and Roach beds of the Portland Stone, and when encountered in the quarries, the quarrymen slab them and store them until there is enough stone to clad a building. This unusual facies of Portland Stone, rarely observed in the field, and crammed with fossil



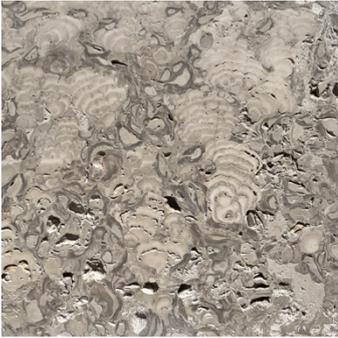
alge, can be seen cladding Caxton House on Tothill Street in Westminster and also in the Wilkins Court at University College London. The freestone qualities of Portland Base Bed have also found a role in the construction of war memorials. A good example is the Iraq-Afghanistan Memorial outside the Ministry of Defence on the Victoria Embankment. Finally, if you just want to visit one building constructed from Portland Stone, make it the Green Park London Underground Station on Piccadilly. Designed by Capita Symonds and Alacanthus LW architects with a carved frieze by sculptor John Maine, this building opened in 2011, and uses all the varieties of Portland Stone.



## STRATIGRAPHY OF THE QUARRIED STONE (from top to bottom)



**Roach** is a coquina in an oosparite matrix dominated by fossils of the bivalve *Laevitrigonia* sp. and the high-spired gastropod *Aptyxiella portlandica*. The latter fossil is almost confined to this bed and arguably defines it. If it does not contain *A. portlandica*, it is not Roach! Other fossils may also be present but are subordinate. The Roach is notable for the complete dissolution of aragonitic fossils by meteoric waters, leaving casts and internal moulds which were given the names 'osses' eads (Trigonids) and the Portland Screw (*A. portlandica*) and forming mouldic porosity. Although the porosity is high, it is not linked therefore the Roach is perhaps surprisingly strong and weather resistant. The beds show low levels of compaction and the boundary with the underlying Whitbed is transitional.



**Patch reefs**, up to 4 m high and 8 m diameter occur as bioherms in the Roach and Whitbed. These reefs are known from most of the quarries on the Isle of Portland but are unknown in mainland outcrops. They are boundstones and lithologically distinct from Roach. The main framework builders are the red algae *Solenopora portlandica* and the bivalves *Liostrea* and *Plicatula*. *Solenopora* algae range in size from 1 – 30 cm with 'cauliflower-like' heads. In some reefs the bryozoan *Hyporosopora portlandica* also occurs as well as a wide variety of encrusting and 'nestling' fauna and associated trace fossils (including borings of *Gastrochaenolites torpedo* and *Lithophaga*). Interstices are infilled with micritic calcite and ooids.



**Whitbed** An even textured oobiosparite with scattered shell fossils which are predominantly the spiny oyster *Liostrea*. Large shells of *Camptonectes* and *Isognomon* may also be present (but not abundant) along with the large ammonite *Titanites* sp. Trace fossils are also present and burrows are common. Bedding planes may show branching *Thalassinoides* and other trace fossils. The unit forms massive beds, but some facies show well-developed cross-bedding. Whitbed is the 'standard' variety of Portland Stone and considered to be the best weatherbed. It is of considerably variable thickness across the Isle, from less than 1 m at Portland Bill to 4 m in the Jordans/Bowers Mine.



**Shelly Whitbed** Shell-rich beds occur in the Whitbed which are crammed with calcite fossils in an oobiosparite matrix. Fossils are typically *Liostrea* sp. oysters but can also include reef debris rich in *Solenopora portlandica* fragments. Both varieties may show scattered mouldic porosity from *Laevitrigonia gibbosa* etc. which often leads to this facies as being mistaken as Roach. *Aptyxiella portlandica* is absent from this unit. Shells are current aligned, and well cross-bedded 'raggy' facies also occur. These shelly varieties are marketed today as Fancy Beach, Grove and Perryfield Whitbed.

**The Curf** is a soft flinty limestone which lies between the Whitbed and the Base Bed but was not quarried for stone. The name 'curf' was used in miner's language to describe the undercutting of a coal seam.



**Base Bed** is also called the Best Bed, Lower Tier or Bottom Bed. This is an oolitic limestone (oobiosparite), with few macrofossils although there may be abundant, finely broken-up, fossil fragments present. This unit is largely massive and therefore an excellent freestone, however it is less weather-resistant than the Whitbed. The name is simply derived from it forming the base of the sequence. The alternative name Best Bed, probably refers to its qualities as a sculptural stone.

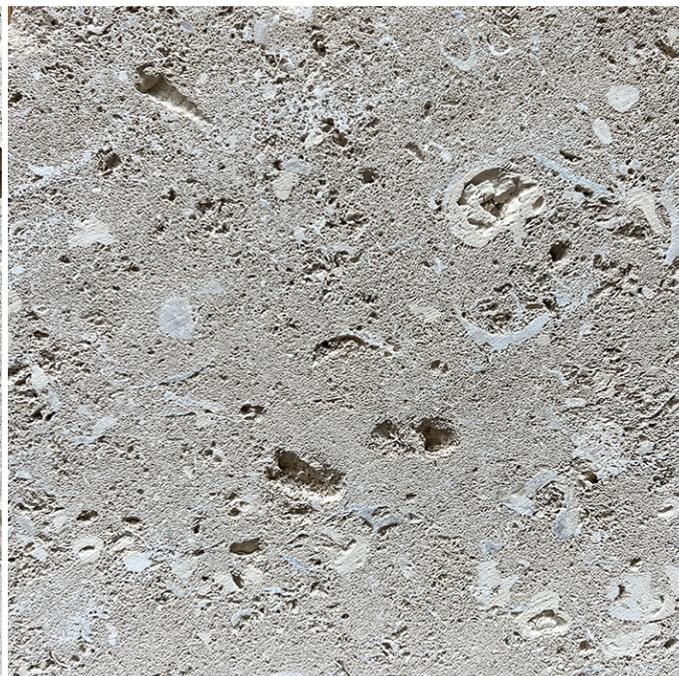
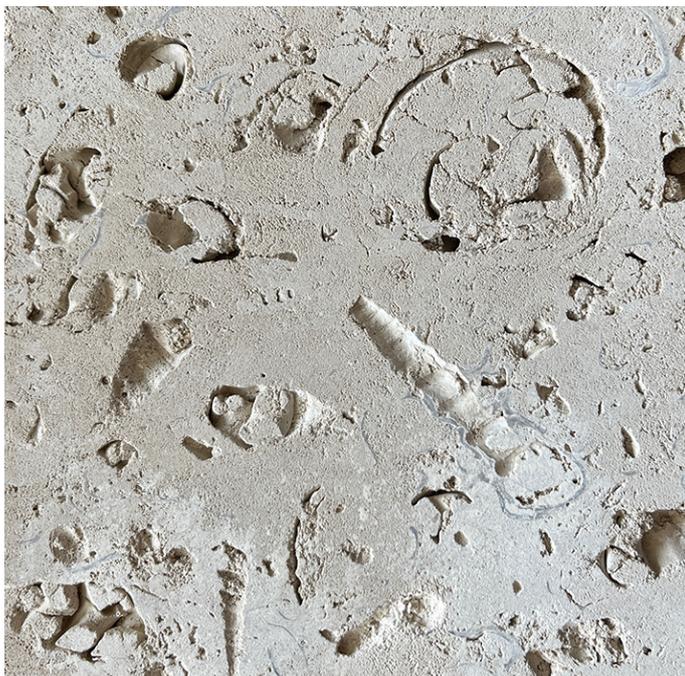
**Portland Stone was designated an [UNESCO/IUGS Global Heritage Stone](#) in 2016**

# SAMPLES OF PORTLAND STONE

Freestone Member, Portland Stone Formation (Portlandian, Upper Jurassic)

Jordan/Bowers Mine, Isle of Portland, Dorset, England

Oobiosparite Limestone



Left: Bowers Roach. Note the casts of the 'Portland Screw' gastropod, *Aptyxiella portlandica*.

Right: Jordan's Whitbed with broken oyster fossils and rolled fossils of the alga *Solenopora portlandica*.



Left: Grove Whitbed, packed with fossil oyster shell fragments and a few fragments of *S. portlandica*.

Right: Bowers Basebed, with sparse fossil shell fragments.

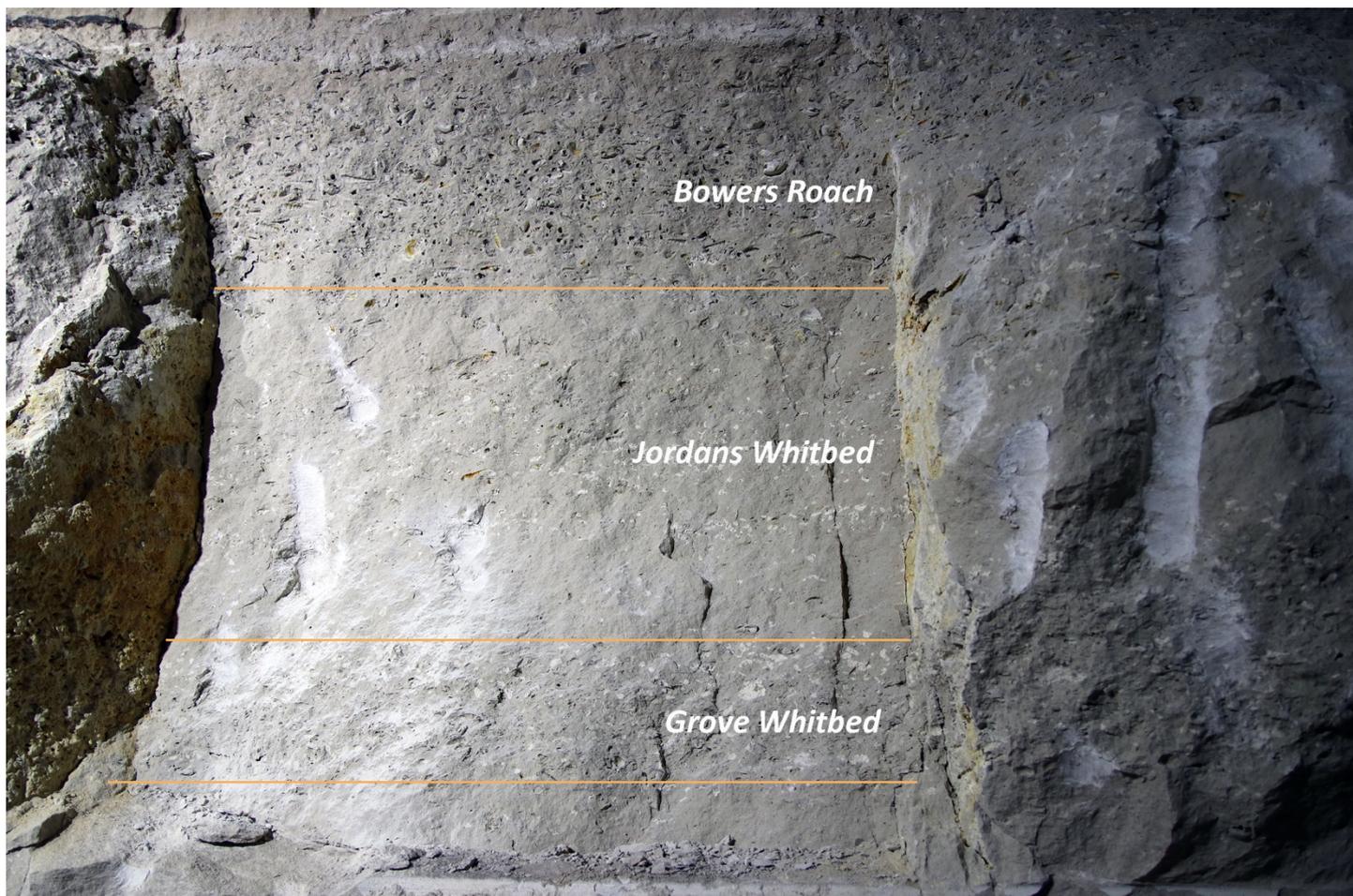
Many thanks to [Albion Stone PLC](#) for supplying these samples.

# ALBION STONE'S JORDANS/BOWERS PORTLAND STONE MINE

Freestone Member, Portland Stone Formation (Portlandian, Upper Jurassic)

Jordan/Bowers Mine, Isle of Portland, Dorset, England

Oobiosparite Limestone



*Above:* Stratigraphy of the upper part of the Portland Freestone Member as exposed in Jordan/Bowers Mine.

*Below:* Views of the interior of the Jordan/Bowers Mine.



*Photos:* Ruth Siddall

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