## THE CATHEDRAL ROCKS – THE EARTH MATERIALS USED IN THE CONSTRUCTION OF SALISBURY CATHEDRAL

Field Meeting, Saturday, 31<sup>st</sup> March, led by Steve Hannath, Wiltshire Geology Group.

## Peter Smith



We met together, on this last day in March, in the cloister corner of the west corridor close by the main visitor entrance. It soon became apparent that Steve was going to have to compete for our attention with the glorious sounds of the Salisbury Musical Society who, with the

We meet up

Chelsea Opera Group, were rehearsing a choral concert that was to be performed that evening. Steve need not have worried, for the music of Elgar and Szymanowski and the singing of the choir in that most beautiful place, only added to the enjoyment of listening to what he had to tell us.



Musical Society and Opera Group

He began, tongue in cheek, by making the rather startling claim that there had been, in total, four cathedrals in the area, beginning with Stonehenge! The second was that built at Old Sarum below the motte and bailey Norman castle. It was erected on the authority of William's Archbishop of Canterbury, Lanfranc. Both castle and cathedral were built of stone from Caen; the preferred building stone of the Normans in England. A finegrained, light creamy-yellow Jurassic oolitic limestone, it was also being used in the structure that was to become the Tower of London and by Lanfranc in the rebuilding of Canterbury. In the event, the Old Sarum Cathedral was partially destroyed by fire when struck by lightning in a storm and was re-built and enlarged on the same site. (Number3!) Towards the end of the 12<sup>th</sup> Century the church and garrison were no longer existing peaceably side by side and when eventually the clergy under Bishop Poore were kept out of the cathedral by the soldiery, Poore obtained permission from the Pope to construct a new cathedral on the present site. Work began in 1219 on the cathedral, a start having already been made on the close. Some of the Caen stone was re-used from Old Sarum and also recycled was Hurdcott green sandstone with its giveaway specks of alauconite, the dark green silicate mineral that gives it its greenish-grey colour. This recycled material (rubble work) tends to be found in what originally were out of the way places so that, for example, a very evident piece of Hurdcott may be seen today in the wall of the Refectory Restaurant that was originally the back wall of the cloisters along with some flint and brick. Hurdcott was also often used for the upper part of the foundations.



Hurdcott stone in wall of refectory restaurant

The new location was not, on the face of it, an auspicious one although William Golding's account of one version of the legend that sought to explain the choice may, I think, be discounted! It was that, "Bishop Poore was standing on a hill overlooking the confluence of the local rivers when the mother of Jesus appeared to him, told him to shoot an arrow and build her church where the arrow fell. The arrow flew more than a mile into the middle of a swamp. There, with complete indifference to such things as health, foundations, access and general practicability, the Cathedral was built". More prosaically, the BGS Sheet 298 for Salisbury shows that the Cathedral sits just on River Terrace Deposits of sand and gravel, flint and chalk, with silt and clay. Wessex Archaeology's account of the Time Team excavations in February, 2009, agrees that the underlying geology is river gravel over Upper Chalk and adds that the site was traditionally believed to be a virgin site, which has important implications architecturally.

During the course of our visit Steve produced what can only be described as a very long dipstick which he inserted into a hole in the Cathedral floor to prove to us and to an intrigued group of passing children that there



*Steve proves that there is water beneath our feet!* 

was a depth of water there. This was thought to be some 15% of water by volume to the gravel, 9m in depth. Earlier he had claimed that the Cathedral floated and that that was the reason it still stood! There were built foundations, of course, as already indicated, but they did not go below the level of the summer water table. Those for the four main Purbeck marble columns at the Nave and Transepts Crossing that were eventually going to bear the weight of the added tower and spire being founded like all the others at a depth of just 1.2m. These four each exert a force of approximately164 tonnes per square metre on the hard, well-sorted gravel terrace.

It was here, near the water meadows of Harnham fed by the river Nadder and the Hampshire Avon, that the site was prepared in the 1190s. That it was a virgin site meant that it was possible to build the main body of the Cathedral, in the 38 years between 1220 and 1258, in one unified architectural style, that of Early English Gothic. It was to the nearby guarries of Chilmark and Tisbury that the medieval masons turned for their main supply of building stone. Some 60,000 tons of Chilmark stone together with a further 10.000 tons of Purbeck marble from the Isle of Purbeck in Dorset. Both were used in the construction to which was added a further 6,500 tons of Chilmark stone when the tower and spire were completed c1320. The highest 49m of the spire were clad in 200mm thick stone slabs but in the 1950 rebuild the top 9m of Chilmark were replaced by Clipsham stone from Rutland.

Steve made the important point that the word, "Chilmark", has come to be used as a generic name that covers stone from the Vale of Wardour's Portland Stone Formation, laid down in the Upper Jurassic as a marine deposit, whether from the main outcrop up to 12m thick around Tisbury (the Tisbury Member of lower building stones) or from the valley or "ravine" South East of Chilmark where a higher 5m thick freestone was exploited in the past. The Chilmark Member is distinguished by abundant ooliths, less sand and lack of glauconite.

Just east of the town of Tisbury is Chicksgrove quarry and close by, a furrowed and ridged hill, known locally as Dumpling Down, from which, it is said, came the "Chilmark" stone in medieval times for the building of Salisbury Cathedral. This would accord with Steve's statement that the Chilmark mine is not medieval in origin. Be that as it may, Chicksgrove is the premier supplier of stone for restoration today, quarried only from the Tisbury member.

The great feature of Early English Gothic is that it imbues a building with spaciousness, grace and light as it soars heavenward as high as the medieval masons dared go. This was achieved at Salisbury with solid blocks or "drums" of unpolished Purbeck limestone piled high to form the pillars to a height of 7.8m at the capitals and decorated with completely detached columnar lengths of polished Purbeck "marble". Not marble in reality, but highly polished limestone. A polishable, fossily limestone, as it has been described. It is found in the overlying Durlston Foundation of the Purbeck Group of largely early Cretaceous age having freshwater strata at the top that gives way to marine strata at the base. The two principle "marble" beds sit near the top in the Peveril Point Member.

Purbeck marble has also been used as flooring at Salisbury where some 15,000 tons were laid down. Particularly where polished, fossils of the Viviparus genus of freshwater snail together with fossils of the larger genus Unio, may be clearly seen, both in the slender



Mell gets close to Viviparus

columnar lengths or in the flooring.

With the addition of the tower and spire, which would give Salisbury the tallest masonry structure in Britain, huge additional pressure was brought to bear on the existing columns. Steve pointed out evidence of the sinking of the

Purbeck limestone at the Crossing, particularly at the North-West corner where five sections of the slender decorative "marble" lengths



Fossils of the genus Unio in Purbeck marble flooring

appear to bend out at the top (some 60cm to the South-West) although they are not, in themselves, bearing any weight. It would be more accurate to say that they have slipped out of true or become displaced. It should be mentioned here that the limestone that was



Purbeck marble columns appear to bend

destined to become the polished Purbeck marble columnar lengths was quarried from beds horizontally in order to achieve this. The largest slab of Purbeck marble in the world, according to Steve's account, is to be found in the Morning Chapel and is laid into the floor as a monument to Bishop Wyeville who became bishop at about the same time as the spire was completed. It measures approximately 3.90m x 1.40m although it was damaged, probably during a move, and now bears evidence of a repair. Steve mentioned that

Purbeck marble had also been used as a string course outside as a form of damp course which was a bit of a puzzle until I read that, used in this way, it can help to shed water from the wall face. Alongside the bishop's



Perhaps the largest slab of Purbeck marble in the world

giant slab lies a monument to Philadelphia Pyle dated 1714 which is in Tournai marble or Belgian Black, a carboniferous limestone which will also take a polish and which, Steve told us, could possibly have come from Ireland! Interestingly, Tournai marble was also used for one of the three coffin lids (that no longer cover either coffins or bones) that were brought from Old Sarum in 1226. It commemorates the Norman Bishop, Roger le Poer. A slab of the same stone also marks the site of the shrine (destroyed by Henry VIII) of St. Osmund in the Trinity Chapel.

The pointed arch was used exclusively in the vaulting of this Early English Gothic period and Calcareous tufa or calc. tufa, a soft porous rock of precipitated limestone formed in a similar way to stalactites and stalagmites and probably from Somerset, was used in the construction of the quadripartite fans at Salisbury. It was plastered from below and decorated in such a way that the design appears to be brick and it



Quadripartite fans built with calcareous tufa

was plastered from above as may be seen by anyone taking the Tower Tour so that the calc.tufa is effectively sealed in and hidden. However, it was not exclusively used for this purpose and Steve mentioned that even brick was sometimes used. In the 15<sup>th</sup> Century, the beautiful lierne vault of the Decorated Period replaced the wooden ceiling at the Crossing and records show that the Hazelbury stone for the ribs was brought from the Box area and was also used for the new flying buttresses at the North-East corner of the tower. Bath stone was used for the 16<sup>th</sup> Century Audley Chapel. Another oddity is the Lepine limestone from near Poitiers that had been used as a substitute for Caen stone and may still be seen.

Steve discussed restoration and repair at some length and mentioned that medieval masons were, "not fussed about colour matching", particularly on outside repairs. In filling putlog holes (literally holes in the masonry to take the ends of scaffolding logs) no attempt was made to match materials. However, it is clear that they did have a high level of expertise based on what must have been long experience of working the stone. Where it mattered (and that was almost everywhere) the Ashlar blocks were used both inside and out but with any sort of rubble in between. Indeed, their neat chisel marks on otherwise apparently smooth stone block faces as in the north-west corner where the "rock box" is to be found, are a wonder to behold. Of course, mistakes were made and the grain of the stone was not always read correctly when cutting it, resulting in later spalling damage, that is, fragmentation or separation of the surface after long exposure to the elements, particularly through frost damage and by acid rain. The action of the latter brings about a chemical change to the carbonate binder in the limestone which breaks down into the sulphates that do the damage. A chalk pit at nearby Harnham was the source of the raw material for the making of the lime mortar to which gallet was added (that is, chips of stone) to stop the lime from squeezing out.

Attempts were made in the past to protect the stone as evidenced by the orange-brown patina of the West Porch which research has shown was given the Greco-Latin empirical treatment, a preparation that included bone as a hardening agent but which also gave a pleasing aesthetic quality to the stone by the addition of the ochre colour. In modern times the restored North Porch has had new columns of Purbeck marble which, with the application of heated Renaissance wax (a standard conservation material that has a highly efficient water resistance) should keep them in good condition for a very long time. A secondary advantage of this treatment is that the columns have been given the rich dark colour which makes such an attractive contrast to the Chilmark stone. The Purbeck bases were repaired with layers of coloured lime mortar built up slowly to the shape of the original and colour matched by the addition of the correct amount of stone dust.

Between 1886 and 1869 the West Front doorway was the subject of Sir George Gilbert Scott's restoration when South Devonshire marble (probably Ashburton) was used rather than Purbeck to replace pillars there. It is no more a marble than is Purbeck and like Purbeck it is fossiliferous. The choice was something of a penny-pinching exercise according to Steve, but no doubt the difference in price of £498 was a more



Salisbury Cathedral on the day of the field trip

worthwhile saving in Victorian times than it would be now! It is interesting to note that £82,000 was spent overall during the restoration work by Scott and his successor; a period that spanned twenty-five years. In this account of earth materials, mention should be made of Salisbury's medieval tiles. The muniment room is not open to the public but beneath protective boards lies a tiled pavement dating from 1260 and the Wessex Archaeology report on the Time Team investigation mentions that a small number of scattered decorated floor tiles were found which bore seven different motifs, five of which are similar to designs of tiles found at Clarendon Palace, a hunting lodge of the Norman Kings near Salisbury and later a favourite royal residence upon which Henry III lavished a great deal of money. The magnificent circular chapel floor from Henry's private apartments now in the British Museum and the Salisbury tiles would both seem to have been produced at the Clarendon kiln.

which was also, like Henry's pavement, removed to the British Museum.

Thanks to Steve Hannath for a most interesting afternoon in a wonderful setting. "The whole building still stands. It leans. It totters. It bends. But it still stands...a perpetual delight, a perpetual wonder." Again, in conclusion, the words of William Golding.

## <u>References</u>

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