

Provenance of the stone pavers in Christ Church, Lancaster County, Virginia

by

Marcus M. Key, Jr.,

Robert J. Teagle, Treleven Haysom

ABSTRACT

The goal of this paper is to determine the provenance of the stone pavers in the floor of Christ Church in Lancaster County. The church, finished in 1735, has cross-shaped aisles paved with fossiliferous limestone blocks. The geology of Virginia eliminates any potential local source for the stones. Historical documents suggest an English source. The distinctive clam and oyster fossils exposed in the stone pavers of the church allowed identification of the source rock: the Intermarine Member of the Durlston Formation of the Purbeck Limestone Group. These limestones are of Early Cretaceous age and outcrop along the Dorset coast of southern England. Known in the commercial quarrying industry as Purbeck Stone, these limestones were used extensively as paving stones in England and were exported to the North American colonies. Historical and archeological evidence suggest the stone pavers were not directly imported for use in Christ Church but were reused from the nearby Corotoman mansion which burned in 1729.

INTRODUCTION

In geoarcheology, the provenance of an artifact refers to the location of origin of the material used to make it. The location is a geologic deposit in the form of a quarry, mine, or rock outcrop. Geoarcheologists use a variety of parameters to determine the provenance of artifacts including paleontologic, lithologic, geochemical, and geophysical. The key is to choose a parameter with sufficient discriminatory ability to distinguish the various possible source localities of the artifact (Rapp and Hill 2006). Determining the provenance of the Stonehenge sarsens and blue stones is one of the most famous applications of this process (Johnson 2008).

This study uses the presence of fossils as the discriminating parameter for two reasons. First, the evolutionary process creates species with distinct temporal and geographic distributions (i.e. fossils are relatively unique in time and space). Second, fossils tend to be relatively unaltered from artifact use so they can be easily related back to their source rock. The goal of this project is to determine the provenance of the stone pavers in the floor of Christ Church in Lancaster County, Virginia using the fossils in the stones themselves along with the historical evidence.

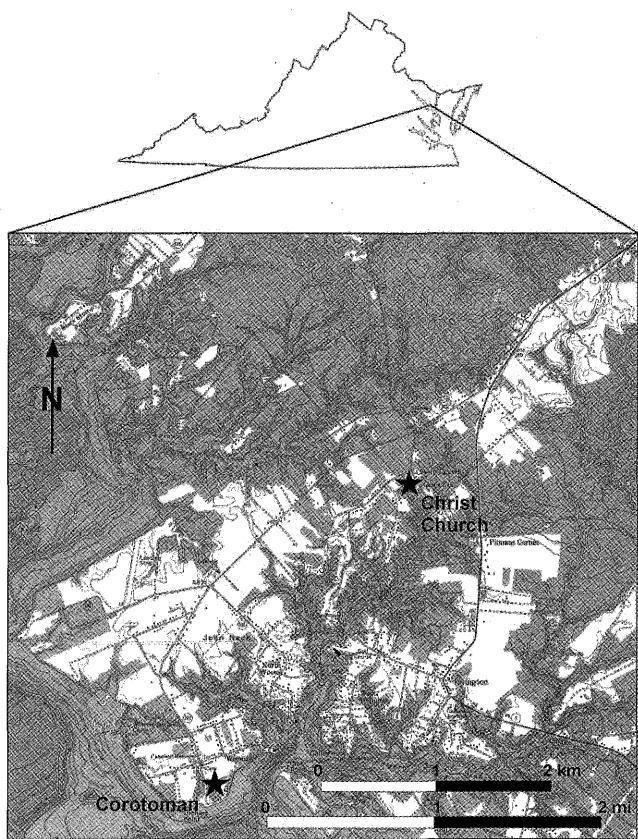


Figure 1. Map showing Virginia location of Christ Church relative to the Corotoman plantation house and navigable waters of the Corrotoman River to the west and the Rappahannock River to the south. Modified from Irvington 1992 7.5' USGS topographic quadrangle map.

Of all the Anglican parish churches constructed in colonial Virginia, none is as finely crafted nor as well preserved as Christ Church, Lancaster County. Begun in 1730 by Robert “King” Carter, the colony’s wealthiest and most powerful planter, Christ Church stood as one of Virginia’s most sophisticated buildings by the time Carter’s sons finished it in 1735 (Stanard 1908; Upton 1986; Brown and Sorrells 2001; Lounsbury 2002). The church rivaled anything in the capitol at Williamsburg in terms of architecture, materials, and craftsmanship. Its detailed brickwork, particularly its rubbed and gauged brick doorways, had few rivals in Virginia and perhaps colonial America. The classical, full entablature was among the most stylish produced in the colony. The handsome interior included high-backed box pews, a richly carved triple-decker pulpit and walnut altarpiece, and stone paved isles. With towering brick walls, vaulted ceilings, and large compass-headed windows, Christ Church cut an imposing figure in a Virginia landscape dotted by small, frame, earthfast buildings. Determined to leave a legacy for his parish as well as his God, Robert Carter created a building that his son John Carter described as having “none in this Country to be compared to it” (Carter 1734).

MATERIALS AND METHODS

Christ Church is registered with the Virginia Department of Historic Resources (ID number 051-0004), the Historic American Buildings Survey (HABS VA,52-KILM.V,1), and the U.S. National Park Service (National Historic Landmark Number 66000841). It is located in Lancaster County in the Northern Neck of Virginia in the Outer Coastal Plain physiographic province. The church is located at 37°40' 50.32"N latitude and 76°25' 23.36"W longitude, 2.1 km (1.3 mi) north of Irvington, Virginia (Figure 1).

Today Christ Church appears much like it did nearly three centuries ago. Included in its outstanding collection of original elements are the subjects of this study, the stone pavers lining the aisles. Laid directly on an earthen surface, these rectangular blocks run throughout the church, covering virtually all of the floor space

in the transepts, nave, and chancel area of the cross-plan design (Figure 2). Stone pavers do not cover 1) the pews and chancel flooring, which is made of pine, 2) David Miles’ burial marker at the center of the crossing, which measures 2.0 by 1.1 m (78 by 44 in) and is made of the same stone used in the rest of the church flooring, and 3) John Carter I’s burial marker in the northeast corner of the chancel, which measures 2.3 by 1.4 m (90 x 56 in) and is made of black marble. Therefore the total area underlain by pavers in Christ Church is 88 m² (950 ft²).

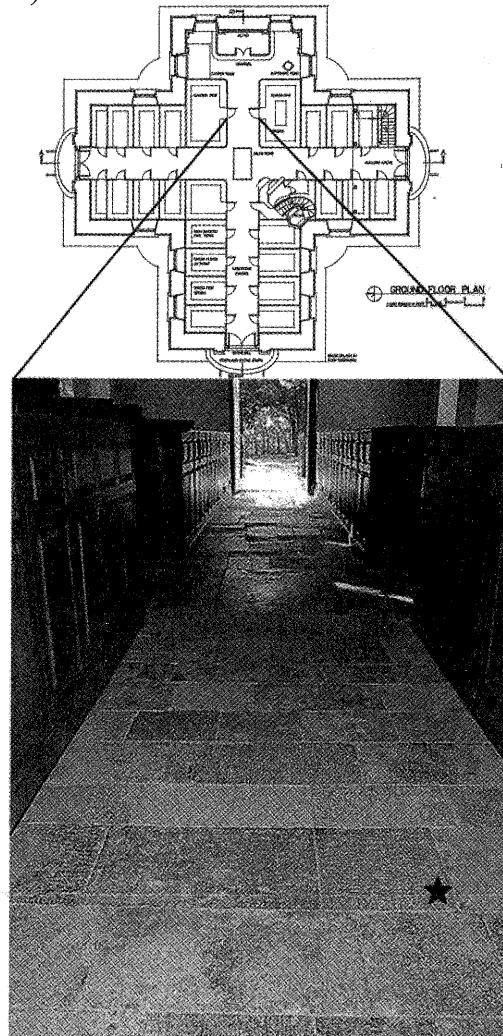


Figure 2. Top: floor plan of Christ Church showing the perpendicular aisles made of ‘limestone paving’. North is to the left. Modified from Historic American Buildings Survey (HABS VA,52-KILM.V,1-3). Bottom: floor of Christ Church showing varied shapes and sizes of Purbeck stone pavers. View is from the chancel toward the nave. Central aisle is 2.1 m (7.0 ft) wide. Star indicates stone paver with chisel marks oriented left to right. The largest stone at center of the crossing is David Miles’ tomb marker.

There are 352 stone pavers in the church. Most of the pavers lie as they have since first installed in the early 1730s. Church workmen skillfully set them in place without mortar, matching where they could stones of similar length or width to create thin, even joints that in many places run in a line all the way between pews. Of the 352 pavers, 325 (92%) appear to be in their original location and show no signs of repair. Only 27 (8%) have been repaired or replaced, and those that have been can be detected easily by the addition of replacement pavers and the modern concrete that fills their joints. The west transept has the most repaired pavers; the chancel has the least. Workmen in the early 1980s repaired most of these with just one or two stones added neatly in a rectangle to reform what likely was one paver originally. A few repaired pavers along the south transept and by the north door have a number of irregularly shaped and colored pieces patched together to cover an area that originally held one large paver. Such repaired areas were counted as one paver.

The length and width of each stone paver was measured to the nearest 1/8 in (1/3 cm). Most are 10-15 cm (4-6 in) thick. The smallest paver is 29.9 cm by 7.0 cm with an area of 0.021 m² (11.75 in by 2.75 in with an area of 0.220 ft²) and is located in the chancel. The largest is 118.1 cm by 97.2 cm (46.5 in by 38.25 in) with an area of 1.15 m² (12.4 ft²) and is located inside the door in the north transept. The largest stones lay in the middle of the aisles, especially along the south transept, the nave (west), directly in front of each of the three doors, and in front of the communion rail. The fact that some of the largest stones occur in the middle of the aisles is an artifact of the stones adjacent to the pews extending under the wooden pews by about 5 cm (2 in). The median size stone is 41.9 cm (16.5 in) on a side with an area of 0.16 m² (1.76 ft²). The mean size stone is 46.7 cm (18.4 in) on a side with an area of 0.23 m² (2.51 ft²). Apparently this was a size preferred by other builders in colonial Virginia. A 1756 advertisement for stone pavers for the Capitol in Williamsburg said the "Size of Stone that will best answer is 18 Inches Square" (Fleming 1756:4). Taking the total floor area covered by stone pavers (88 m²

(950 ft²) and dividing by the number of stones (352), the mean size of the stones is 0.25 m² (2.70 ft²). This is slightly larger than the actual stones as it includes the gaps in between the stones. If we add 5 cm (2 in) to the stones adjacent to the pews to account for their extending under the wooden pews, then the mean size of the stones is 0.24 m² (2.63 ft²).

GEOARCHEOLOGICAL APPROACH TO DETERMINE THE PROVENANCE OF THE STONE PAVERS

Due to the young age (< 65 Ma) and shallow burial of the exposed coastal plain sediments of Virginia, they are essentially unlithified (Wentworth 1930). As a result, there are effectively no rock outcrops and thus no source of building stone near Christ Church. The closest is 120 km (75 mi) up the Rappahannock River where Aquia Stone from the Cretaceous Potomac Group near Fredericksburg is exposed (Dicken et al. 2005). It was quarried for use as building stone from about 1750 to 1840 and used in the construction of several buildings in Washington, D.C., including the White House, the older portion of the Capitol Building, and the U.S. Treasury building (Sweet 1990). At Christ Church, Aquia Stone accentuates the frontispieces as well as the keystones and imposts of the compass windows (Nebblett 1994; Buck et al. 2003). Unfortunately, the Aquia is a younger, terrestrial, plant-rich sandstone (Hansen 1969) and does not contain anything like the older marine invertebrate fossils found in the limestone used in the floor of Christ Church. The next closest rocks are in the Piedmont which are even older, non-fossiliferous, metamorphic rocks and thus not candidates for the paving stones of Christ Church either. Therefore it was hypothesized that the stones for the floors were imported from England like most of the other goods at this time in general (Breen 2004) and for Christ Church in particular as summarized below.

Forty high-resolution digital pictures of the fossils in the stone pavers in the aisles of Christ Church were taken on 29 September 2007. To test the England provenance hypothesis, the images were sent to Paul Taylor, a paleontologist at the Natural History Museum in London, for identification. He was able to determine they were of Mesozoic age and referred us to Paul Ensom, a retired geologist

from the Natural History Museum in London who specializes on the Mesozoic limestones from the south coast of England. Ensom was able to identify the fossils as well as the source rock. This was possible despite the stone pavers having been worn by ~275 years of use. In fact in 1837, Bishop Meade noted his admiration for the stone floors in Christ Church: “In further evidence of the fidelity with which the house was built, I would mention that the pavement of its aisles, which is of large freestone, is yet solid and smooth as though it was the work of yesterday” (Meade 1857:118).

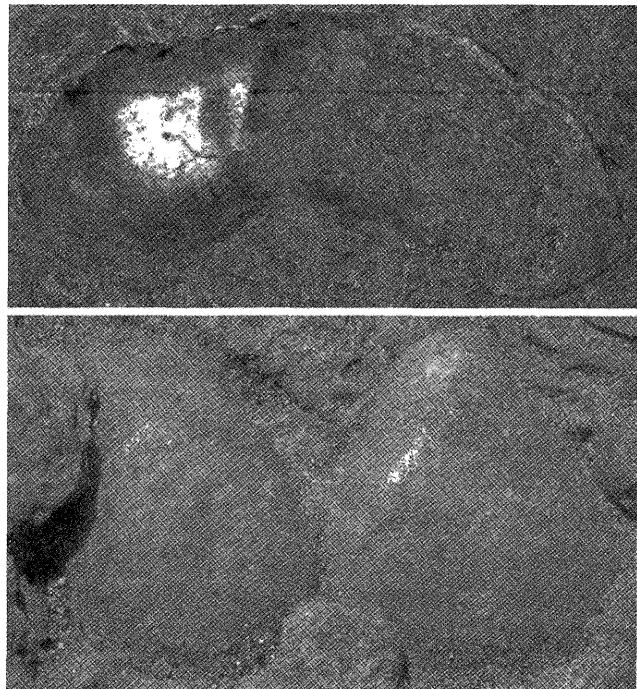


Figure 3. Fossils preserved in stone pavers of Christ Church. Top: left valve of the oyster *Praeexogyra distorta* (image is 4.0 cm across). Bottom: left and right valves of the clam *Neomiodon* sp. (image is 2.0 cm across).

The Christ Church stone pavers most likely came from the Intermarine Member of the Durlston Formation of the Purbeck Limestone Group (PLG) based on the following two pieces of evidence. First, the presence of the fossil oyster *Praeexogyra distorta* (Figure 3, top) and the fossil clam *Neomiodon* sp. (Figure 3, bottom) in the stone pavers is indicative of the Intermarine Member of the Durlston Formation of the PLG (Batten 2002). Second, the Intermarine Member, which is part of the ‘Middle Purbeck’, is termed by quarry operators as the ‘Upper Building

Stones’ layer as it was and is commonly quarried as a source of Purbeck Stone (El-Shahat and West 1983; Ensom 2007; West 2008). It is an ideal source of building stone as its beds have an average thickness of 15 cm (6 in) (Benfield 1940).

PURBECK GEOLOGY

The PLG outcrops along the Dorset coast of southern England including what is termed the Isle of Purbeck (Figure 4). The Isle of Purbeck is technically a peninsula connected to the mainland to the west and bordered by the Frome River and Poole Harbour to the north and the English Channel to the east and south. The main area of Purbeck stone quarrying was and is south of the village of Corfe Castle and extending from Durlston Head in the east 20 km along the coast to idyllic Lulworth Cove in the west (Clifton-Taylor and Simmons 1987; House 1989; Stanier 1995). The area is part of the Dorset and East Devon Coast World Heritage Site.

Assigning the stone pavers to particular beds within the Intermarine Member of the Durlston Formation of the PLG is more problematic. The stone pavers containing the black-shelled oyster *Praeexogyra distorta* (Figure 3, top) may have come from Clements’ (1993) bed DB 125. The upper part of the bed is termed the Roach by quarry operators and the lower part the Thornback. DB 125 occurs in the middle of the Intermarine Member. Scattered and worn oysters are typical of the Intermarine Member (Radley 2002). The Roach-Thornback is a biosparudite limestone (El-Shahat and West 1983). The stone pavers containing the bland-shelled clam *Neomiodon* sp. (Figure 3, bottom) may have come from Clements’ (1993) bed DB 113, termed the Downs Vein by quarry operators. DB 113 occurs at the base of the Intermarine Member. The Downs Vein is also a biosparudite limestone (El-Shahat and West 1983).

The Intermarine Member of the Durlston Formation of the PLG was deposited in the Early Cretaceous Berriasian Stage, ~140-145 Ma (Ensom 2007; West 2008). At this time, what was to become southern England was located about 32°N latitude (Ge et al. 2002), compared to 50°N today. The Intermarine Member was deposited in semi-arid lakes and inter- to supra-tidal flats of a shallow

lagoon with salinities ranging from fresh to hypersaline, but dominantly brackish (El-Shahat and West 1983; Batten 2002; Radley 2002; Ensom 2007). The brackish nature of the water is supported by the presence of the euryhaline oyster *Praeexogyra distorta* and the euryhaline clam *Neomiodon* sp. (Batten 2002). The shallow nature of the lagoon is supported by the presence of numerous dinosaur trackways (Ensom 2007). Storms in this shallow environment led to the accumulation of death assemblages of broken and worn bivalves dominated by clams with scattered oysters (El-Shahat and West 1983; Batten 2002; Radley 2002; West 2008). These deposits were lithified into limestone through compaction, alteration of the aragonitic clam shells to calcite, and cementation.

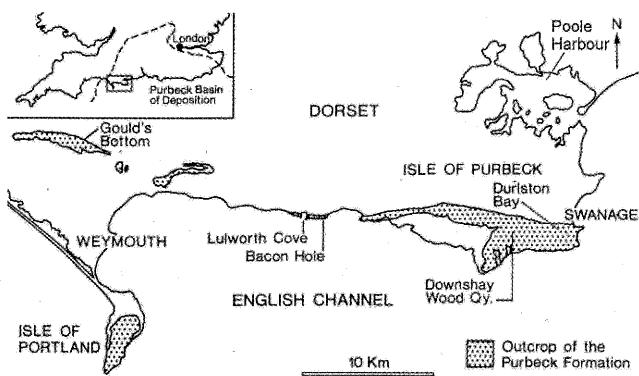


Figure 4. Map showing southern England location of Purbeck outcrops. Modified from El-Shahat and West (1983:Figure 1).

PURBECK QUARRYING

The PLG has been extracted from surface quarries and subsurface mines along an 8 km stretch of the Dorset coast of southern England south of Corfe Castle and west of Durlston Bay (Clifton-Taylor and Simmons 1987; Stanier 1995). The stone here is famous for its warm, cream to pale gold color (Clifton-Taylor and Simmons 1987). The PLG is most famous for its Purbeck Marble, the most widely used English ‘marble’ (Clifton-Taylor and Simmons 1987). Purbeck Marble is a freshwater gastropod-rich limestone from the Upper ‘Cypris’ Clays and Shales Member (Ensom 2007) or the Upper Ostracod Shales Member (West 2008) of the Peveril Point Member of the Durlston Formation of the Upper Purbeck (Westhead and Mather 1996). Despite it not being metamorphosed, this

limestone is often termed ‘marble’ by those in the commercial quarry and building stone industries as it takes a polish (Watson 1916; Elsden and Howe 1923; Davey 1976; Leary 1983; Clifton-Taylor and Simmons 1987; Stanier 1995).

Purbeck Marble was initially used by the Romans in England (Watson 1916; Elsden and Howe 1923; Beavis 1971). It reached its peak usage through the 12th, 13th, and into the 14th centuries when it was widely used in English Medieval churches and cathedrals as an interior decorative stone, often in slender contrasting columns (Watson 1916; DruDrury 1949; Leary 1983; Clifton-Taylor and Simmons 1987). It was used in the cathedrals of Canterbury, Durham, Ely, Lincoln, and Norwich, with its most lavish application in Salisbury Cathedral (Davey 1976), the tallest church in England. Its most famous application is in Westminster Abbey in London where it was used in the floor of the sanctuary and the tomb of Henry III (Elsden and Howe 1923).

The Purbeck Marble’s weathering properties vary. Some very good Medieval paving stones survive, but it was generally unsuitable for paving stone as it was susceptible to wear and decay (Watson 1916; Elsden and Howe 1923). In contrast, the PLG provided a better paving stone called Purbeck Stone. Quarrying of the Middle Purbeck building stones increased for the rebuilding of London after the Great Fire in 1666 (Lewer and Smale 1994). By the 18th century, when the stone pavers for Christ Church would have been quarried, much of the stone was mined underground near the villages of Langton Matravers and Worth Matravers. The PLG outcrops in the sea cliffs at Durlston Bay do not yield paving type material as it is too solid and not easily split for paving stone. The Purbeck paving and tomb slab trade eventually declined with the advent of concrete and asphalt paving (Benfield 1940). Both Purbeck Marble and Purbeck Stone are still quarried to provide new stone for repairs in cathedrals and churches (Robinson 1998).

There is evidence of Purbeck Stone being exported by ship for use as paving stones around the time of the construction of Christ Church. In 1724, Daniel Defoe wrote in his famous travelogue, *A Tour Through the Whole Island of Great Britain*, that

Purbeck stone was ‘us’d in London in great quantities for paving court-yards, alleys, avenues to houses, kitchins, foot-ways on the sides of the high streets, and the like; and is very profitable to the place, as also in the number of shipping employ’d in bringing it to London’ (Furbank and Owens 1991:83). The Purbeck limestones in general and the Roach-Thornback and Downs Vein in particular are ideal for paving stones as they require minimal splitting due to the thicknesses of individual beds. In the Roach-Thornback, they range from 10 to 30 cm (4 to 12 in), whereas the Downs Vein’s range in thickness is 3-38 cm (1-15 in) with most in the range of 15-20 cm (6-8 in)(Benfield 1940; Leary 1983; West 2008). Perhaps not coincidentally, the thickness of the Christ Church stone pavers (10-15 cm (4-6 in)) falls exactly in this range. Today in the dimension stone industry, Thornback is referred to as Purbeck Thornback Limestone. It is an officially registered building stone by the Building Research Establishment of the UK. Thornback is still available commercially, often for use in walls, headstones, and even as paving stones in churches (Leary 1983; Knowles 2005).

Once the raw stone was removed from the quarry, the quarryman/mason selected the best face which was chiseled smooth to achieve a flat surface, whereas the other side was left more or less rough. Some of the stone pavers in Christ Church exhibit the marks of the original chiseled face (Figure 2). The Christ Church stone pavers were quarried, not simply fieldstones as termed by Dowdley (1969). This type of hand-made paver was sold by the square foot and this measurement usually cut (using a simple Roman numeral system) on the middle of the underside, for example: 111- = 3 ½ ft². In addition, but less commonly, the quarryman/mason sometimes cut his personal mark. These are usually based on the letters of his name. As the undersides of the stone pavers were not accessible in the church, the presence or absence of any markings was not determined.

The floor of Christ Church may contain more than one type of Purbeck Stone (i.e. possibly from beds DB 125: Roach-Thornback and DB 113: Downs Vein), which is typical of such a

floor. Not only was each quarry producing several different sorts of stone, but a plethora of small quarries were supplying several merchants who mixed the stone up. Around the 1760’s there were about 200 such small independent quarries supplying about a dozen exporting merchants who arranged the shipping (Hardy 1910; Hutchins 1973).

The proximity of the quarries to ports for shipping added to the marketability of PLG stone (Clifton-Taylor and Simmons 1987). The quarries are less than 6 km (4 mi) west of the port town of Swanage, 15 km (9 mi) southwest of the port at Poole, and 30 km (20 mi) east of the port at Weymouth (Figure 4). The Christ Church stone pavers were probably loaded onto vessels in Swanage Bay and then transshipped at Poole or Weymouth (Figure 4) for the trans-Atlantic voyage. This is supported by historical documents detailed below which show the builder of Christ Church, Robert Carter, ordered stone pavers from a merchant in Weymouth. The stones may have been organized into courses on site in Virginia or that work may have been done at the quarry in England. If the latter, one would expect a third mark on the underside of each stone indicating to which course it belonged.

APPROACHES TO DETERMINE PROVENANCE OF THE STONE PAVERS

Christ Church may have been the second home for these stone pavers. It is plausible Robert Carter had first employed them at Corotoman (Virginia Department of Historic Resources site number 44LA13), the brick mansion he built at his home plantation on the Rappahannock River in the early 1720s. In a landscape dotted by small, frame, earthfast buildings, Corotoman stretched 27 m (90 ft) long by 9 m (30 ft) wide and rose two stories over a basement (Kornwolf and Kornwolf 2002). A second-story arcaded loggia ran the full length of the river façade and sheltered a 3 m (10 ft) wide arcaded loggia embellished with a central pavilion and smaller end pavilions (Kornwolf and Kornwolf 2002). Rubbed brick pilasters, pediments, and arches highlighted doorways and windows. Marble mantel surrounds and delft fireplace tiles adorned the interior. At the time, there was no house like it in Virginia (Hudgins 1985; Green et al. 2001).

Probably sometime in the summer of 1721, workmen laid Corotoman's stone pavers (Wharton 1950; Dowdley 1969; Hudgins 1985; Noël Hume 1994). In the English (i.e., half) basement, they spread them across each of the three main rooms and around the smaller rooms surrounding the chimneys at each gable end as well as across the arcaded loggia. We used Hudgins' (1985) scaled plan drawings of Corotoman's foundation to measure the area of these rooms excluding the walls. The five rooms on the ground floor of Corotoman and the arcaded loggia that were underlain by pavers totaled 240 m² (2600 ft²). Besides paving the basement floor and the arcaded loggia, Robert Carter's workmen used the stone blocks to create an intricate drainage system. After building up the basement's west side by adding clay to increase the site's natural eastward slope, the men placed 30 cm by 45 cm (12 in by 18 in) pavers into a shallow channel they dug along the foundation's northern and southern walls. Next to them, they laid and mortared bigger pavers set 3 cm (1 in) higher in the clay subsoil. Water thus moved away from the basement's center into these channels running east. It then flowed into a drainage tunnel set in the east wall that carried the water out into nearby Carter's Creek. Additionally, a paved gutter system for the arcaded loggia ran through the mansion's southeast corner and connected to the main drainage tunnel 9 m (30 ft) east of the house (Hudgins 1985).

Getting all these stones for Corotoman to Virginia had proven more difficult than Robert Carter planned. Around the spring of 1720 he had ordered "1,000 foot of Bd. Paviour" from Edward Tucker. That July, in perhaps a slight modification of building plans for Corotoman, Robert Carter wrote again, asking Tucker instead to "Send me in two Thousand foot" of stone pavers (Carter 1720; Wright 1940:16; Hudgins 1985).

Tucker was a merchant, sometime mayor of Weymouth in Dorset County, England, as well as a Member of Parliament (Sedgwick 1970). More importantly, Tucker would have had contacts with the Purbeck Stone merchants in

Swanage as he also held the office of surveyor of His Majesty's quarries in Portland (Clapinson and Rogers 1991). Tucker did not send Portland Stone to Carter probably because the Portland limestones are softer, finer grained, and more homogeneous making them in demand more for finer, carvable dimension stone than mere stone pavers. At Weymouth, Tucker was only 30 km (20 mi) west of the Purbeck quarries. In addition, Tucker owned a fleet of at least four ships (Brimpton, George & Mary, Portland, and Princess Amelia) that regularly imported tobacco from Robert Carter to Weymouth and Poole and exported English manufactured goods back to Carter. Based on the frequency that the ships Princess Amelia, Brimpton, and Robert & John entered and exited the ports of Weymouth and Poole together on the same dates carrying in convoy Virginia tobacco (e.g., Exchequer of the King's Remembrancer 1721), Tucker probably also owned the Robert & John, possibly even named after the Carter brothers with whom he traded extensively. This connection between Tucker and the Carters is supported by the fact that at least one of Tucker's ships, the Princess Amelia, was built in the Rappahannock River and registered at Williamsburg in 1720 (Board of Customs, 1736).

In the spring of 1721, the stone pavers for Corotoman were probably loaded onto vessels in Swanage Bay and then transshipped at Poole or Weymouth (Figure 4) for the trans-Atlantic voyage. Tucker's ships regularly imported Virginia tobacco into and transshipped from both ports from 1720 to 1722 (e.g., Exchequer of the King's Remembrancer 1720). According to Hudgins (1985) the ship was the Portland captained by William Russell out of Weymouth. This inference is largely based on Carter's letter to Tucker written 27 May 1721: "I have received Yors. by Capt. Russel & Wilson, the latter had 15 weekes passage by Stress of weather he was forc'd to heave over board three or four hundred foot of my Stones..." (Carter 1721:97; Hudgins 1985:96-97).

We searched The Diary, Correspondence, and Papers of Robert "King" Carter of Virginia, 1701-1732 (Berkeley 2009), and all references to a Captain William Russell were to a surveyor on the western frontier of Carter's property. We searched the Weymouth and Poole port records for the

spring of 1721, and none list the Portland as departing for Virginia during that time. Carter's 27 May 1721 letter to Tucker lamenting the loss of some of the stone pavers for Corotoman refers to Captains Russell and Wilson (Carter 1721). A William Russell is not explicitly mentioned. In the years 1717-1723, there are numerous references in Carter's correspondence with Tucker to a Captain Giles Russell of the Brimpton. In addition we found a record for Tucker's ship the Brimpton, captained by Giles Russell, departing Weymouth on 1 February 1721 for Virginia (*Exchequer of the King's Remembrancer* 1721). This is 16 weeks before Carter's (1721) letter referring to the 15 week voyage. The reference in Carter's letter to a Captain Wilson accompanying Captain Russell, suggests the Brimpton sailed in convoy with the Robert & John as this is the only other Tucker ship with a Captain Wilson, in this case Thomas Wilson.

Despite the loss of some of the stone pavers for Corotoman, Carter did not mention the stones again nor ask for a new shipment to replace those lost; instead he turned quickly to the tobacco market and the disappointing prices at which Tucker had sold some of the previous year's shipments (Carter 1721; Hudgins 1985). It is possible Carter ordered more pavers from Tucker at a later date, but no letters survive to document this. It is also possible that enough survived the crossing, or that Robert Carter had others on hand from previous (undocumented) orders or construction projects, to complete the paving of his basement and loggia floors.

Despite this setback, work continued on Corotoman as documented in Robert Carter's diary. Construction neared an end in 1725. On 2 February of that year, he recorded that the bricklayer had begun his marble floor in the central passage that separated his parlor to the west and bedchamber to the east. Carter had imported white marble for this work. We found no references in his letterbooks or diaries about the source of these white marble tiles. The archeological report does not give any provenance either (Hudgins 1985). The front steps going up to the first floor were also made

of Purbeck stone (Hudgins 1985). On 1 December 1725, Robert Carter wrote that the roof of Corotoman had been tarred, a good indication that work had come to a close (Hudgins 1985).

Like Christ Church a decade later, Corotoman stood out as one of the colony's most important structures, rivaling any house or public building in Virginia. But unlike Christ Church, it was destined for a short life. In late January to early February 1729, a fire destroyed Robert Carter's new house. The Maryland Gazette of 11 February reported that "The fine, large House of Col. Carter, on Rappahannock, was also burnt lately. The Particulars of his Loss we can't give you, but we are inform'd it is very great" (Hudgins 1985:101).

After the fire, Robert Carter moved back into his "Old House," a single-pile, three-room brick building he had constructed in 1690 that stood slightly west of the Corotoman mansion site. He did not rebuild Corotoman. Instead, now in his mid-60s and suffering from gout, poor vision, and other maladies, he turned his remaining energies to another project, one he had envisioned for several years (Hudgins 1985; Kornwolf and Kornwolf 2002).

As his father John had done in 1670 when he built the first Christ Church, Robert Carter desired to build a new church for the parish he had served faithfully for four decades as vestryman and churchwarden. Even before he finished Corotoman, in fact, Carter had established a brickyard at the church site. Here brick maker James Bryan produced some 400,000 bricks between 1724 and 1726. In August 1726, when he first drafted his will, Robert Carter set these bricks aside along with £200 for the church whenever the vestry undertook the project. By 1730, with work still not underway and the anguish of Corotoman's loss fresh in his mind, Robert Carter made a proposal to the vestry to build the new church at his own expense (Ball 1835; Meade 1857).

The vestry of Christ Church Parish gave Robert Carter liberty to use whatever of the 1670 church he wanted and to cut timbers from the glebe lands (Ball 1835). From his Corotoman plantation, Robert Carter drew on skilled craftsmen and

laborers along with an assortment of specialized tools and building materials necessary to undertake a structure the scale of Christ Church. And in the burned-out shell of his mansion, it is difficult to imagine Robert Carter did not see a rich source of paving stones, ready to be reused for what likely would be the last of his building projects.

As it was, Robert Carter did not live to see Christ Church completed. He died at age 69 on 4 August 1732, some two years into construction. His sons oversaw the remaining work. On several occasions, John and Charles ordered objects for the new building from London merchants, but their letters suggest these were for outfitting the church rather than for large items like paving stones. (Carter 1733, 1734; Lidderdale 1734). Nothing in Robert Carter's letters during the roughly two years he was still living and work was underway on the church mentions anything about stone pavers. Moreover, there are no accounts of paving stones amid the myriad of tools, building supplies, and craftsmen listed at Corotoman, much of which certainly went into work on the church.

Rather than order more pavers from England, it is possible, perhaps even probable, that Robert Carter or his sons (depending on when the church workmen actually paved the aisles) simply turned to the Corotoman ruin for their supply of stone. Archeological explorations at Corotoman suggest this may have taken place. In the 1930s, a local amateur James Wharton dug through much of the mansion's western side in search of relics. He reported that all the stone pavers that could be removed were taken up and sold, but this would have only affected the western portion of Corotoman which he excavated (Wharton 1950; Noël Hume 1994). In 1969, Ivor Noël Hume did some small test excavations, and William Kelso in 1976 did a more extensive survey of the site (Hudgins 1985). The most extensive work was done by Carter Hudgins and his team which excavated the Corotoman complex from 1977 to 1980 (Hudgins 1981, 1985).

Working through complex stratigraphy, Hudgins' team found evidence that Robert Carter as well as his heirs and successors had begun salvaging items from the ruin shortly after the fire. After Robert Carter's death in 1732, salvage work continued over the next two decades. On the basis of ceramics in the upper layers of salvage backfill, the remaining walls were pushed into the basement which was filled and leveled by about 1770 (Hudgins 1985).

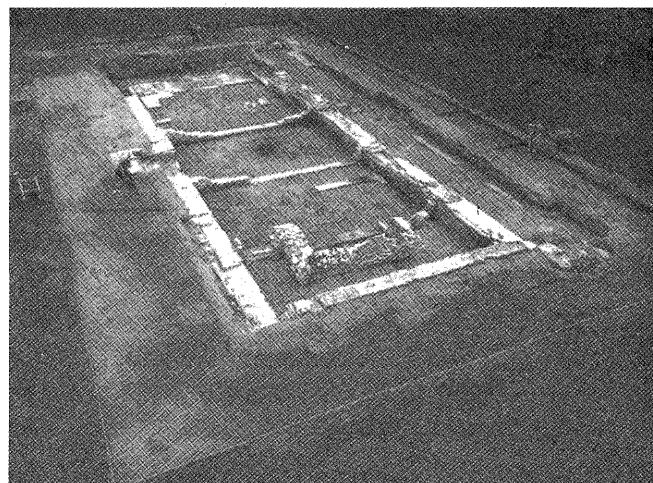


Figure 5. Final Corotoman archeological site photograph taken in November 1978 of the excavated foundation. Note persons for scale. North is to the lower left. Modified from the original in the Virginia Department of Historic Resources

By the third quarter of the 18th century, most of Corotoman's bricks from the walls and stone pavers from the basement and arcaded loggia had been carried away, but salvaging continued through the 19th century (Hudgins 1985). For example, the field laboratory used for the 1977-1980 excavations was located in an early 20th century house in Weems that had a walk made from Corotoman stone pavers. It is probable that the foundation for the circa 1800 addition to the adjacent "Spinner's House" may have come from the Corotoman ruin and that the foundation of two eighteenth-century buildings between the mansion ruin and the river probably also contain Corotoman brick (Hudgins 1985). The final Corotoman archeological site photograph, taken in November 1978 of the excavated foundation (Figure 5), shows only 57 (<10%) of the original estimated 700 pavers remaining. The locations of the missing pavers are indicated by indentations in the clay layer into

which the pavers were set and mortar lines that mark the boundaries (Hudgins 1985). The salvaging of stone pavers shortly after the fire, and the obvious usefulness they would have had for the church, suggests Robert Carter or perhaps his sons directed workers to harvest them from the mansion and haul them to the church site.

Whatever their source, Christ Church was one of more than a dozen parish churches in colonial Virginia to pave its aisles with stone (Rawlings 1963; Davis and Rawlings 1985). Vestries often referred to these pavers as flagstones. In April 1763, for example, vestrymen planning the new Wicomico Parish church in adjacent Northumberland County, which was modeled directly on Christ Church, Lancaster County, called for the “Allies (i.e. Aisles) to be laid with good Flagg Stone” (Overholt and Johnson 1998:103, 123-124). Similarly, the agreement between undertaker (i.e. builder) Daniel French and the vestry of Truro Parish in Fairfax County in April 1769 stipulated that the “Isles” in the new church be “laid with flagg-stone, well squared and Jointed” (Truro Parish 1974:115-116). Unfortunately, Christ Church’s first vestry book, which covered the period 1665-1759, disappeared sometime around 1840.

Most vestries simply instructed undertakers or churchwardens to lay the aisles with stone or flagstone. For example, the vestry of Christ Church Parish in nearby Middlesex County in October 1731 levied 11,284 pounds tobacco for the churchwardens “for the use of the Parish to lay the Iles of the three Churchs with Stone & make an Addition to the Upper Church.” (Chamberlayne 1927:227). A few vestries actually specified the particular type of stone they wanted. For example in March 1733, vestrymen at Bristol Parish in Prince George County, Virginia planned a 60 ft long by 25 ft wide church with an aisle 8 ft wide “Laid with portland stone or Bristol marble.” A year later they shortened the aisle to 6 ft wide and ordered it “Lay’d with white Bristol stone” (Chamberlayne 1898:69-72). Similarly in New Kent and James City counties, Virginia, Blissland Parish’s vestry agreed in February 1733/34 with undertakers John Moore and Lewis

Deloney to construct a 60 ft long by 20 ft wide church whose aisles were to “be Laid with white Bristol Stones” (Chamberlayne 1935:55). Portland “stone” and Bristol “marble/stone” refer to the Portland Limestone Formation and the Great Oolite Series, respectively, both Jurassic aged limestones from southern England. Both originate geographically and stratigraphically close to the Purbeck Stone used in Christ Church.

Parish churches were not the only public buildings to incorporate stone pavers. A number of important structures in Williamsburg used them, including both Capitol buildings. In 1756, an advertisement in the Virginia Gazette appealed for “About 280 Feet of Purbeck, and 80 feet of blue Shrosberry Stone, for compleating the Piazzas of the Capitol in Williamsburg” (Fleming 1756:4). This was the second capitol constructed at Williamsburg. The first had burned in January 1747, but it, too, had Purbeck stone pavers. Robert Carter knew this first capitol well. He was Speaker of the House of Burgesses in 1699 when the Assembly voted to move the capital from Jamestown, where the old capitol building had recently burned, to Williamsburg and construct a new state house there. The plans called for the floors of several key rooms to be paved in stone, but the records fail to mention a specific type of stone, as the advertisement for the second Capitol building did (Hening 1823; Moorehead et al. 1954).

Purbeck stone was also used in other places in the English colonies of the Americas. These include stone pavers in the 1678 Maryland Statehouse, 17th century ledger slabs (flat cut stones used to cover graves and/or as memorials like David Miles’ tomb marker in Christ Church seen in Figure 2) in a Barbados cemetery, 17th century stone pavers in Jamaican forts, 18th century headstones in Newfoundland, and 18th century stone pavers in the Charleston Courthouse, South Carolina.

While Robert Carter and his fellow burgesses made plans for the Capitol, back in Lancaster County Carter was busy working on another building project, the county’s second courthouse, which was to be constructed at a new port town (later named Queenstown) across the Corotoman River from his home plantation. He agreed in November 1698 to

build the courthouse and a jail there for 45,000 pounds tobacco. A year later, the justices directed him to pave the courthouse's floor and porch with paving stones. Like many vestry books, the court order books did not specify the source of the stones, leaving it up to Robert Carter to supply them (Lancaster County Order Books, 24 November 1698 and 14 December 1699, Orders Book 4, 1696-1702:105-106, 199). As he would do at Corotoman a quarter century later, it is likely he turned to his London merchants for a shipment of pavers. This building experience, as well as his role in the capitol's construction and his observation of pavers both in England during his youth and throughout Williamsburg, served Robert Carter well when it came time to begin work on Christ Church in 1730.

SUMMARY OF EVIDENCE FOR A COROTOMAN ORIGIN OF THE STONE PAVERS

Though there is no written documentation, there are several pieces of circumstantial evidence that suggest that some if not all the pavers in Christ Church were reused from Corotoman:

1. The timing of the 1729 Corotoman fire predates the construction of Christ Church, and Robert Carter did not rebuild Corotoman. Construction of Christ Church began in ~1730 with the church finally finished by 1735. Thus the pavers in Corotoman were available for reuse in Christ Church.
2. Both Christ Church and Corotoman were financed and constructed by Robert Carter, and thus he was free to transfer the pavers from Corotoman to Christ Church.
3. There is detailed documentation of other goods being ordered from England for the construction of Christ Church, but there is no documentation of pavers being ordered for the church. There is historical evidence of pavers being ordered for Corotoman. Thus it is likely the stone pavers used in Christ Church came from Corotoman.
4. All but 10% of the original ~700 stone pavers were removed from Corotoman, and thus they may have been available for reuse in Christ Church. Some may have been removed during Wharton's work, but these would have been confined to the west portion of Corotoman, leaving enough for Christ Church.

5. Excluding the paved drainage system, the total area of pavers in Corotoman (240 m² (2600 ft²)) is greater than that in Christ Church (88 m² (950 ft²)). Thus there were more than enough pavers from Corotoman, even accounting for possible breakage from the fire. Fire causes thermal expansion and cracking of building stones (Chakrabarti et al. 1996). This could have reduced the usable number of paving stones in Corotoman. Despite this, the relatively confined areas of potential breakage from fire visible in Figure 5 suggest there were more than enough paving stones in Corotoman to cover the floor of Christ Church.

6. The total number of pavers in Corotoman is greater than that in Christ Church. There were about 640 pavers removed from Corotoman. Therefore, Corotoman could have supplied more than enough pavers for Christ Church which contains 352.

7. The size of pavers in Corotoman is similar to that in Christ Church. There were generally two sizes of pavers used in Corotoman, a smaller rectangular paver roughly 30 cm by 46 cm (12 in by 18 in) and a larger square paver roughly 46 cm by 46 cm (18 in by 18 in) (Hudgins 1985). The most common length or width of a Corotoman paver was 46 cm (18 in) which is similar to the mean of the Christ Church pavers, 46.7 cm (18.4 in).

8. Superficial markings on some of the pavers suggest they may have been exposed to fire. If the Christ Church stone pavers had been reused from Corotoman, there should be evidence of fire. In the final Corotoman archeological site photograph (Figure 5), a dark amorphous spot is visible in the central passage and another two in the adjacent chambers. These are burn marks left by the fire as the timbers collapsed into the basement and continued to burn there (Hudgins 1985). Some of the Christ Church stone pavers have dark spots whereas others have reddish ones suggesting oxidation by fire. Others have what appears to be melted lead that may have dripped on the pavers during Corotoman's burning. Lumps and drops of melted lead were found on some of the Corotoman pavers which presumably came from the burning roof with its lead flashings and gutters or from burning windows which originally may have had individual panes of glass held in place by lead strips (Wharton 1950; Hudgins 1985; Noël Hume 1994).

SUMMARY AND CONCLUSIONS

Geological, historical, and archeological evidence suggest the stone pavers used in the floor of Christ Church came from the Purbeck Limestone Group of Dorset, southern England. The absence of viable source rock in eastern Virginia and historical documents from the builder of Christ Church (Robert Carter) suggest the stones were imported from England. The presence of distinctive clam and oyster fossils in the stone pavers points to the Early Cretaceous Intermarine Member of the Durlston Formation as the source. Known in the commercial quarrying industry as Purbeck Stone, this limestone was used extensively as stone pavers in England and exported to the North American colonies. Historical and archeological evidence suggest the stone pavers were not imported expressly for Christ Church but were reused from Robert Carter's nearby Corotoman mansion which burned in 1729.

ACKNOWLEDGEMENTS

We would like to thank the following: 1) Dickinson College Department of Geology faculty and students for help with digital photography of the fossils in the floor of Christ Church, 2) Paul C. Ensom (Wivenhoe, England) for identifying the fossils and the source formation, 3) Carter Hudgins (Department of History and American Studies, University of Mary Washington, Fredericksburg, Virginia) for sharing his recollections of his Corotoman excavations, 4) Patrick Wyse Jackson (Department of Geology, Trinity College, Dublin, Ireland) for sharing his knowledge of the geology and history of building stones, and 5) Jerry Hawley and Betsy Woods (Historic Christ Church, Irvington, Virginia) for assisting with the measurements of the stone pavers.

REFERENCES CITED

- Ball, J.
1835 Letter from Joseph Ball to St. Leger Landon Carter, 3 February 1835, Carter-Minor-Blackford Papers, Box 8, James Monroe Law Office Museum and Memorial Library, Fredericksburg, Virginia.
- Batten, D. J.
2002 Palaeoenvironmental setting of the Purbeck Limestone Group of Dorset, southern England. *Special Papers in Palaeontology* 68:13–20.
- Beavis, J.
1971 Some aspects of the use of Purbeck Marble in Roman Britain. *Proceedings of the Dorset Natural History and Archaeological Society* 92:181-204.
- Benfield, E.
1940 Purbeck Shop; A Stoneworker's Story of Stone. Cambridge University Press, Cambridge.
- Berkeley, E., Jr.
2009 The Diary, Correspondence, and Papers of Robert "King" Carter of Virginia, 1701-1732.
- Board of Customs
1736 Port of Weymouth, Collector to Board, Virginia Colonial Records Project, Survey Report Number 14500, Library of Virginia, Richmond.
- Breen, T.H.
2004 The Marketplace of Revolution: How Consumer Politics Shaped American Independence. Oxford University Press, Oxford.
- Brown K. L., and N. T. Sorrells
2001 Christ Church: Lancaster County, Virginia. Lot's Wife Publishing, Staunton, Virginia.
- Buck S., C. Lounsbury, and A. Maul
2003 Color Washes and Penciling on Brick and Mortar Joints in the Chesapeake. Colonial Williamsburg Foundation, Williamsburg, Va.
- Carter, J.
1733 Letter from John Carter to Micajah Perry, 4 September 1733, Executors' Papers, Plummer-Carter Letterbook, Alderman Library, University of Virginia, Charlottesville.
- Carter, J.
1734 Letter from John Carter to Micajah Perry, 8 August 1734, Executors' Papers, Plummer-Carter Letterbook, Alderman Library, University of Virginia, Charlottesville.

- Carter, R.
- 1720 Letter from Robert Carter to Edward Tucker, 13 July 1720, Robert Carter Letter Book, 1720 July-1721 July, BR 227, Huntington Library, Art Collections, and Botanical Gardens, San Marino, California.
- Carter, R.
- 1721 Letter from Robert Carter to Edward Tucker, 27 May 1721, Robert Carter Letter Book, 1720 July-1721 July, BR 227, Huntington Library, Art Collections, and Botanical Gardens, San Marino, California.
- Chamberlayne, C. G.
- 1898 The Vestry Book and Register of Bristol Parish, Virginia, 1720-1789, privately printed, Richmond, Virginia.
- Chamberlayne, C. G.
- 1927 The Vestry Book of Christ Church Parish, Middlesex County, Virginia, 1663-1767, privately printed, Richmond, Virginia.
- Chamberlayne, C. G.
- 1935 The Vestry Book of Blisland (Blissland) Parish: New Kent and James City Counties, Virginia, 1721-1786, privately printed, Richmond, Virginia.
- Chakrabarti, B., T. Yates, and A. Lewry
- 1996 Effect of fire damage on natural stonework in buildings. *Construction and Building Materials* 10:539-544.
- Clapinson, M. and T. D. Rogers
- 1991 Summary Catalogue of Post-Medieval Western Manuscripts in the Bodleian Library Oxford. Acquisitions 1916-1975, vol. I, nos. 38674-720, University of Oxford; Tucker Family Papers, MSS. Don. B. 16-28, c. 101-34
- Clements, R. G.
- 1993 Type-section of the Purbeck Limestone Group, Durlston Bay, Swanage, Dorset. *Proceedings of the Dorset Natural History and Archaeological Society* 114:181-206.
- Clifton-Taylor, A., and J. Simmons
- 1987 The Pattern of English Building. 4th ed. Faber and Faber, London.
- Davey, N.
- 1976 Building Stones of England and Wales. Bedford Square Press, London.
- Davis, V. P., and J. S. Rawlings
- 1985 The Colonial Churches of Virginia, Maryland, and North Carolina: Their Interiors and Worship. Dietz Press, Richmond, Virginia.
- Dicken, C. L., S. W. Nicholson, J. D. Horton, S. A. Kinney, G. Gunther, M. P. Foose, and J. A. L. Mueller
- 2005 Preliminary integrated geologic map databases for the United States: Delaware, Maryland, New York, Pennsylvania, and Virginia, USGS Open File Report 2005-1325
- Dowdley, C.
- 1969 The Virginia Dynasties: The Emergence of "King" Carter and the Golden Age. Little Brown, Boston, Massachusetts.
- Dru-Drury, G.
- 1949 The use of Purbeck Marble in Mediaeval Times. *Proceedings of the Dorset Natural History and Archaeological Society* 70:74-98.
- Elsden, J. V., and J. A. Howe
- 1923 The Stones of London. *Colliery Guardian*, Holborn.
- El-Shahat, A., and I. West
- 1983 Early and late lithification of aragonite bivalve beds in the Purbeck Formation (Upper Jurassic - Lower Cretaceous) of Southern England. *Sedimentary Geology* 35:15-41.
- Ensom, P. C.
- 2007 The Purbeck Limestone Group of Dorset, southern England. *Geology Today* 23:178-185.
- Exchequer of the King's Remembrancer
- 1720 Poole Port Books, volume II, p. 339, Virginia Colonial Records Project, Survey Report number 13121, Library of Virginia, Richmond
- Exchequer of the King's Remembrancer
- 1721 Weymouth Port Books, volume II, p. 339, Virginia Colonial Records Project, Survey Report number 9714, Library of Virginia, Richmond, Va
- Fleming, J.
- 1756 Wanted. *Virginia Gazette* 27 August 1756:4, column 2.
- Furbank, P. N., and W. R. Owens
- 1991 Daniel Defoe: A Tour through the Whole Island of Britain. Yale University Press, New Haven.

- Ge, S., S. J., Lydon, and J. Watson
 2002 *Sphenobaira ikorfatensis* (Seward) Florin from the Lower Cretaceous of Huolinhe, Eastern Inner Mongolia, China. *Palaeontology* 46:423-430.
- Green, B., C. Loth, and W. Rasmussen
 2001 Lost Virginia: Vanished Architecture of the Old Dominion. Howell Press, Charlottesville, Virginia.
- Hansen, H. J.
 1969 Depositional environments of subsurface Potomac Group in southern Maryland American Association of Petroleum Geologists Bulletin 53:1923-1937.
- Hardy, W. M.
 1910 Old Swanage or Purbeck Past and Present: A collection of articles, topographical, historical, antiquarian, biographical and anecdotal. Dorset County Chronicle Printing Works, Dorchester.
- Hening, W. W.
 1823 The Statutes at Large; Being a Collection of all the Laws of Virginia, Volume III. Philadelphia, Pennsylvania.
- House, M.
 1989 Geology of the Dorset Coast. Geologists's Association, London.
- Hudgins, C. L.
 1981 The 'King's' Realm: An Archaeological and Historical Study of Plantation Life at Robert Carter's Corotoman. M.A. Thesis, Department of History, Wake Forest University, Winston-Salem, North Carolina.
- Hudgins, C. L.
 1985 The King's Realm: An Archaeological and Historical Analysis of Robert Carter's Corotoman. Mary Washington College, Fredericksburg, Virginia.
- Hutchins, J.
 1973 History and Antiquities of the County of Dorset. J. B. Nichols and Sons, Westminster, England.
- Johnson, A.
 2008 Solving Stonehenge: The New Key to an Ancient Enigma. Thames and Hudson, London, England.
- Knowles, K.
 2005 Stone in Archaeology Database. rb_2005/index.cfm. Version: 20 February 2009.
- Kornwolf, J. D., and G. W. Kornwolf
 2002 Architecture and Town Planning in Colonial North America. Johns Hopkins University Press, Baltimore, Maryland.
- Leary, E.
 1983 The Building Limestones of the British Isles. Her Majesty's Stationery Office for the Building Research Establishment, London.
- Lewer, D., and D. Smale
 1994 Swanage Past. Phillimore and Co., Chichester.
- Lidderdale, R.
 1734 Letter from Robert Lidderdale to Charles Carter, 12 December 1734, Papers of Charles Carter of Cleve, Carter-Minor-Blackford Papers, James Monroe Law Office Museum and Memorial Library, Fredericksburg, Virginia.
- Lounsbury, C.
 2002 Christ Church in The Early Architecture of Tidewater, Virginia: A Guidebook for the Twenty-third Annual Vernacular Architecture Forum Conference. Colonial Williamsburg Foundation, Williamsburg, Virginia.
- Meade, W.
 1857 Old Churches, Ministers, and Families of Virginia, Volume II. J. B. Lippincott, Philadelphia, Pennsylvania.
- Moorehead, S. P., O. M. Bullock, and H. Dearstyne,
 1954 Architectural Report: The Capitol, Block 8, Building 11, Volume 1, Part 2. Colonial Williamsburg Foundation, Williamsburg, Virginia.
- Neblett, N. P.
 1994 Christ Church, Lancaster County, VA.: Historic Structure Report. Historic Christ Church, Irvington, Virginia.
- Noël Hume, I.
 1994 Here Lies Virginia: An Archaeologists View of Colonial Life and History. University Press of Virginia, Charlottesville, Virginia.
- Overholt, J. L., and A. C. Johnson
 1998 The History of Wicomico Parish including 1703-1795 Vestry Minutes. Wicomico Parish Church, Wicomico, Virginia.

- Radley, J. D.
- 2002 Distribution and palaeoenvironmental significance of molluscs in the late Jurassic - early Cretaceous Purbeck Formation of Dorset, southern England: A review. *Special Papers in Palaeontology* 68:41-51.
- Rapp, G. R., and C. L. Hill
- 2006 Geoarchaeology: The Earth-Science Approach to Archaeological Interpretation. 2nd ed. Yale University Press, New Haven.
- Rawlings, J. S.
- 1963 Virginia's Colonial Churches: An Architectural Guide. Garrett and Massie, Richmond, Virginia.
- Robinson, E.
- 1998 The stones cry out. Dorset Geologist's Association Newsletter April 1998:2-3.
- Sedgwick, R.
- 1970 The History of Parliament: The House of Commons, 1715-1754. Her Majesty's Stationery Office, London, England.
- Stanard, W. G.
- 1908 Christ Church, Lancaster County, Virginia. In Colonial Churches in the Original Colony of Virginia, edited by W. M. Clark, pp. 229-242. Southern Churchman Company, Richmond, Virginia.
- Stanier, P.
- 1995 Quarries of England and Wales. Twelveheads Press, Truro.
- Sweet, P. C.
- 1990 Present and future dimension stone industry in Virginia. In Proceedings of the 24th Forum on the Geology of Industrial Minerals, edited by A. W. Zupan and A. H. Maybin, pp. 129-135. South Carolina Geological Society, Columbia, South Carolina.
- Truro Parish
- 1974 Minutes of the Vestry: Truro Parish, Virginia, 1732-1785. Pohick Church, Lorton, Virginia.
- Upton, D.
- 1986 Holy Things and Profane: Anglican Parish Churches in Colonial Virginia. MIT Press, Cambridge, Massachusetts.
- Watson, J.
- 1916 British and Foreign Marbles and Other Ornamental Stones. Cambridge University Press, Cambridge.
- Wentworth, C. K.
- 1930 Sand and Gravel Resources of the Coastal Plain of Virginia. Virginia Geological Survey Bulletin 32:1-146.
- West, I.
- 2008 Durlston Bay - Middle Purbeck; Geology of the Wessex Coast.
- Westhead, R. K., and A. E. Mather
- 1996 An updated lithostratigraphy for the Purbeck Limestone Group in the Dorset type area. *Proceedings of the Geologists' Association*, London 107:117-128.
- Wharton, J.
- 1950 King Carter, The Man. *Rappahannock Record*, Kilmarnock, Virginia.
- Wright, L.
- 1940 Letters of Robert Carter 1720-1727: The Commercial Interests of a Virginia Gentleman. Huntington Library, San Marino, California.