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Sourcing the Early Colonial Knight's Black "Marble" Tombstone at Jamestown, Virginia, USA

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Abstract
The goal of this project was to determine the source of Jamestown's black "marble" knight's tombstone. From 1627, it is the oldest such tombstone in the Chesapeake Bay region. We used the fossils contained in archived fragments from the stone to identify its microfossils which included six species of foraminiferans. These co-occurred in what is now Belgium and Ireland during the Viséan Age, Middle Mississippian Epoch, Carboniferous Period. They did not co-occur in North America. Therefore, the knight's tombstone had to be imported from Europe. Historical evidence suggests Belgium, from where it was transshipped in London and on to Jamestown.

Keywords Geoarchaeology · Tombstone · Jamestown · Fossils · Sourcing · Virginia

Introduction

A dimension stone is a natural rock that has been worked to a specific size and shape such as a building stone or monumental stone. The provenance of a dimension stone refers to its geologic source, usually a quarry, mine, or rock outcrop. Knowing the source of stone materials helps understand ancient trade routes (Thibodeau et al. 2018). It is also important to know the provenance of a dimension stone as it assists

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in finding suitable replacement stone for the conservation of historic buildings. Identifying the source of building stones helps determine the factors that cause stone decay (Cassar et al. 2014; Přikryl and Smith 2005) and assists in recognizing and thus reducing the problems of poor substitute stone selection (Rozenbaum et al. 2008). This has become an essential component of the work of conservators as they attempt to find suitable replacement material for preservation and restoration work.

Various terms have been used over the years to refer to the rectangular flat stone slabs used to cover graves (e.g., tablet, table marker, grave cover, grave slab, box tomb, tomb slab, tomb table, memorial slab, slabstone, gravestone, ledger stone, and tombstone). They can be found inside churches, like the knight's tombstone in this study, or in churchyards or family cemeteries. They were either placed flush with the ground or above ground on a low brick base or mounted on a stone box or table (i.e., chest/altar) or table tomb, respectively (Burgess 1963; Little 1998; Ludwig 1966). The type of tombstone in this study is most often termed a ledger stone.

Although the tombstone in this study is black limestone, this type of tombstone is often described as "marble" in historical documents as a reflection of the commercial stone industry which uses the term marble as any carbonate rock capable of being polished (ASTM 2011; Marble Institute of America 2007). This contrasts with the geosciences where a marble refers to a recrystallized metamorphosed limestone (Dusar et al. 2009; Neuendorf et al. 2005). The ability of these limestones to take a polish is a function of their fine-grained, well-cemented, homogeneous composition.

In seventeenth-century Virginia, USA, one of the ways affluent English colonists exhibited their wealth and memorialized themselves was with engraved tombstones. Wealthy colonists in the Tidewater region of the Chesapeake Bay at this time preferentially selected black "marble" for their gravestones that was actually polished, fine-grained, black limestone (Crowell and Mackie 1990; Key et al. 2021b). The iconic knight's tombstone at Jamestown is one such stone. The goal of this project was to determine the source of this stone to help understand trade routes at this time.

Materials and Methods

Geoarchaeologists use various paleontological, lithological, geochemical, and geophysical parameters to determine the provenance of artifacts and building stones (Gilbert et al. 2017; Key et al. 2020, 2021a; Story et al. 2005), including tombstones (Key et al. 2021b; La Russa et al. 2010; Miriello et al. 2010; Siegesmund et al. 2010; Storemyr et al. 2007). A variety of petrographic, SEM-EDS, XRD, XRF, isotopic, and electron paramagnetic resonance techniques have been used to determine the chemical provenance of black "marble" dimension stone (Boulvain et al. 2020; Brilli et al. 2010, 2011; Marszałek 2014). A different approach was adopted for this study, focusing instead on the enclosed fossils.

Due to the evolutionary process, fossils are generally more unique through time and space on the planet than chemical compositions. Fossils are especially effective for determining the source of lithic artifacts (Key et al. 2014, 2019; O'Leary et al. 2017; Ward et al. 2019) as well as dimension stone (Hannibal et al. 2013; Key and Wyse Jackson 2014; Key et al. 2010, 2014, 2016, 2021b). Using fossils in this study was possible, because unlike a true marble where the constituent fossils are normally destroyed by the heat and/or pressure of metamorphism, the focus of this study (i.e., the black "marble" knight's tombstone) is technically limestone and preserves its fossils. It only reached diagenetic grade to at most anchizone grade alteration (Fielitz and Mansy 1999).

The black "marble" knight's tombstone was found in Jamestown, Virginia (Fig. 1). Jamestown was established in 1607 and was the first permanent settlement in the first English colony of Virginia in America (Kelso 2017; Yonge 1904). Jamestown is in the flat coastal plain physiographic province of the mid-Atlantic region of North America (Fenneman 1928). It sits on the north shore of a brackish estuary named James River, 70 km upstream of its mouth at the Chesapeake Bay with ready access

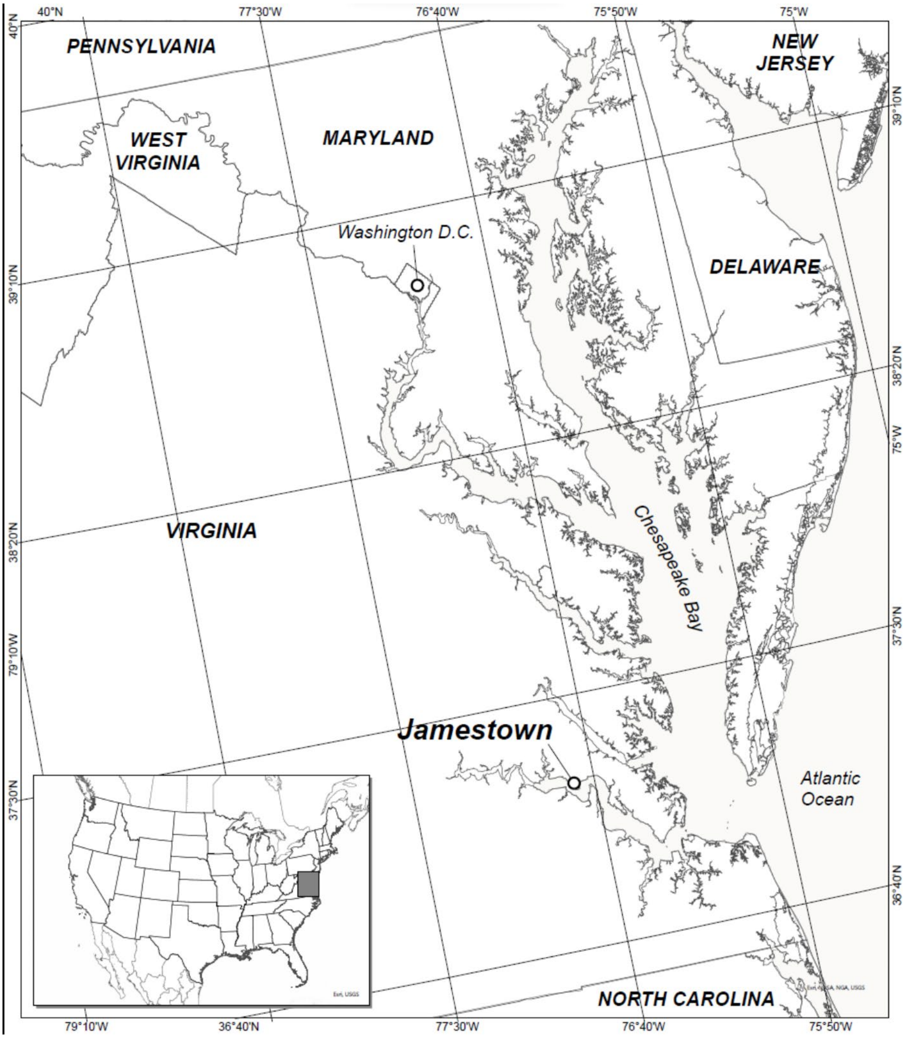

Fig. 1 Location of Jamestown archaeological site in Virginia in the mid-Atlantic region of the USA

to the Atlantic Ocean (Figs. 1 and 2). The capital of the Virginia colony moved from Jamestown to Williamsburg in 1699, and Jamestown reverted to a small agricultural community. This move has been attributed to disease and saltwater intrusion into the ground water table due to its low elevation (0–4 m) (Kelso 2017).

The knight's tombstone (Fig. 3) was originally laid in the floor of Jamestown's 1617 church. It was relocated in the 1640s during construction on the same site to the southern entrance, in the chancel, of the brick church perpendicular to the long axis of the church (Fig. 4), so the original placement was lost (Jamestown Rediscovery 2021a, b; Kelso 2006, 2017). It was rediscovered in 1901, repaired, and placed in the chancel of the present-day Memorial Church constructed in 1906 (Crowell and Mackie 1990). Since 2019 with the remodeling of Jamestown Memorial Church, the tombstone's location is in the chancel of the church (latitude 37.208535ºN and longitude 76.778284ºW) oriented parallel to the long axis of the church (Fig. 4).

Carved depressions present on the top of the knight's tombstone (Fig. 3) originally held engraved monumental brass inlays, but those were missing at the time of discovery. They may have been removed or destroyed when the church burned during Bacon's Rebellion in 1676. Examination of five ledger stones from churches in England in the summer of 2023 revealed only one had its original brass inlay. All the others were missing. The carvings reveal the bolt holes that once affixed the inlays to the stone. In the upper right-hand corner of the stone is a shield, whose brass inlay would probably have depicted the family crest. Across from that is what appears to be a scroll and in the middle a person standing on a rectangular pedestal which likely contained the funerary inscription. The outline of the person (see Fig. 3) likely depicts an English gentleman in armor as the carving on the upper right side of the body looks like the edge of a sword with part of the hilt projecting beyond the natural body outline, and perhaps that of a shield similarly projecting out on the left hand

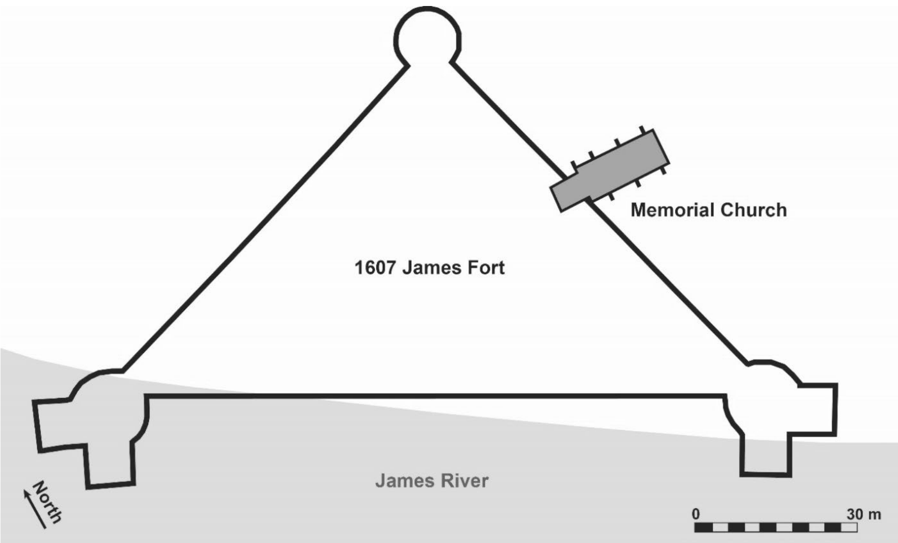

Fig. 2 Location of Jamestown Memorial Church relative to the 1607 James Fort and the James River

Fig. 3 The 1627 knight's tombstone from the chancel of Jamestown Memorial Church, Jamestown, VA, USA. Stone is 172 cm long by 80 cm wide. Photo credit - Courtesy of Jamestown Rediscovery (Preservation Virginia)

side as viewed. This supports the interpretation as being a grave marker for a knight, hence the informal name of the tombstone. This type of inlaid brass was popular in sixteenth-century gravestones to commemorate individuals of high rank (Crowell and Mackie 1990; Jamestown Rediscovery 2021b, c; Yonge 1904).

Two knights died during the life of Jamestown's second church (ca.1617 to ca.1639). One was Sir Thomas West (The Lord De La Warr), the colony's first resident governor. He died in 1618 on the transatlantic voyage to Jamestown and was

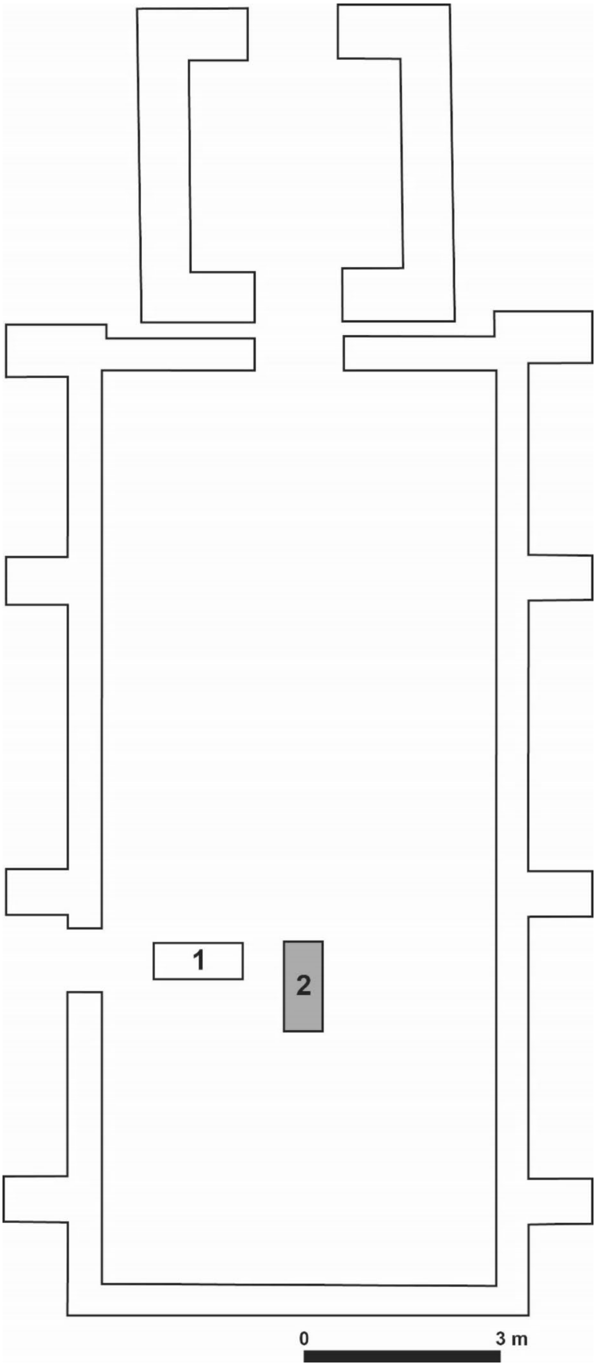

Fig. 4 Original (1) and relocated/current location (2) of the knight's tombstone relative to the Jamestown Memorial Church foundations

buried there. There is no archaeological or historical evidence connecting the knight's tombstone to Sir Thomas West. The other knight was governor Sir George Yeardley. The tombstone likely belonged to Yeardley based on a reference to it in the 1680s will of his step-grandson, Adam Thorowgood II. Thorowgood requested that his own black "marble" tombstone be engraved with the crest of Sir George Yeardley and have the same inscription found on "the broken tomb," indicating that the stone was originally damaged in the seventeenth century as seen in the oldest photograph from 1905 (Jamestown Rediscovery 2021a, b, d; Stanard 1917; Yonge 1904). Assuming the knight's tombstone was George Yeardley's, then it is the oldest black "marble" tombstone in the Chesapeake Bay region, USA (Fig. 5) and may be the oldest surviving tombstone in America (Appell 2017). It is the only known tombstone in the English colonies with engraved monumental brass inlays (Crowell and Mackie 1990; Key et al. 2021b).

George Yeardley was born ca. 1588 in Southwark, London. He left England for Virginia in 1609 but was shipwrecked and stranded in Bermuda until 1610 when he finally arrived in Jamestown. He served as captain of Lt. Governor Sir Thomas Gates' guard. He briefly served as deputy or Lt. Governor of Virginia in 1616 before returning to England in 1617. Yeardley was appointed governor of Virginia in the fall of 1618 following the death of the incumbent governor, Sir Thomas West. To bolster his social standing, Yeardley was knighted in 1618 by King James I and sailed back to Virginia in 1619 to take his position as Lord Governor. He resigned the governorship in 1621 until he was reappointed Virginia's royal or Crown Governor in 1626. He survived the famine resulting from the driest seven-year episode (1606–12) in the 770 years from 1606 to 1984 in the Tidewater region of Virginia (Stahle et al. 1998) as well as the 1622 Indian massacre. He died in 1627 of unkown causes and was bur-

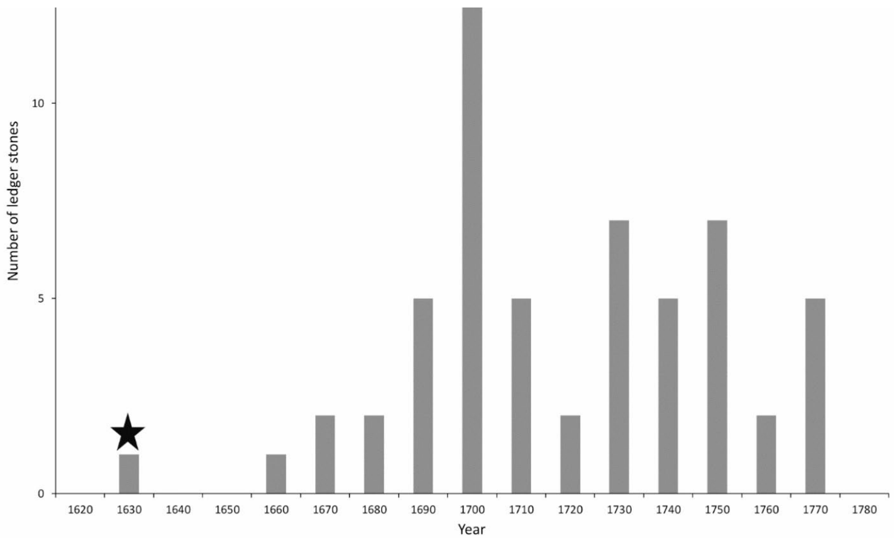

Fig. 5 Number of colonial-era black "marble" limestone ledger stones from the Chesapeake Bay American colonies. The knight's tombstone is the oldest and indicated by the star. Modified from Key et al. (2021b, Fig. 3A).

ied in Jamestown's parish church (Baldwin 2008; Bernhard 2011; Bridenbaugh 1980; Jamestown Rediscovery 2021a, d; Kelso 2017).

Length, width, and thickness of the tombstone was measured to the nearest 0.1 cm. Length and width were determined with a metal tape measure, and thickness was measured with metal, long-jaw calipers. Three replicate measurements were made of each and averaged: one toward the head, one in the middle, and one toward the foot of the stone. When possible, cracks were avoided or taken into account while measuring.

The standard Munsell (2009) rock color classifications of both weathered and fresh surfaces of the stone were determined. The type of limestone was determined using Dunham's (1962) standard hand sample-based carbonate classification system.

Two archived fragments of the knight's tombstone were selected to make thin sections to identify its microfossils. Taken from the bottom of the stone, their location was not visible to the public. The two fragments (JR 4045 A and JR 4045D.4) were $<1.0\times1.0\times0.5$ cm. The ~0.5 cm^3 samples were set in vacuum-evacuated epoxy plugs to prevent fracturing during the thin sectioning process. Polished petrographic thin sections were made of each. The lithology of each polished thin section was determined using Folk's (1959) standard thin section-based limestone classification system.

There undoubtedly is more lithologic and paleontologic variation that was undetected by our small samples as they represent only a small volume of the entire tombstone. This drawback was non-negotiable as this stone has great historical value, and therefore, we wanted to minimize this method of destructive sampling. The thin sections and remnants are housed at Historic Jamestowne.

As indicated in the acknowledgments, images of the fossils were sent to specialists who identified the microfossils in the thin sections. They were identified to the genus or species level that allowed for the highest resolution paleobiogeographic and biostratigraphic ranges to be determined from the Paleobiology Database (PBDB 2019).

Results

The knight's tombstone (see Fig. 4) measures 171.9 cm long by 80.4 cm wide by 12.2 cm thick (i.e., 68 in × 32 in × 5 in). Compared to other colonial era black "marble" tombstones from the Chesapeake Bay colonies, it is on the shorter and narrower ends of the size range but of average thickness (Fig. 6). Lithologically in hand sample, it is a wackestone (Dunham 1962) and in thin section, a packed biomicrite (Folk 1959). Based on Munsell's (2009) rock color classification, the interior of the tombstone is 1 for gley 2.5/N (i.e., black) and weathers to 1 for gley 5/N (i.e., gray). This is a function of the oxidation of the finely disseminated organic carbon within the rock's matrix which alters the original internal black color to a light gray patina on the exterior (Dusar et al. 2009; Marszałek 2014; Tourneur 2020; Wardzyński 2004).

Six species of microfossils were found in the thin sections (Table 1; Fig. 7). All were foraminiferans (i.e., single celled amoeboid protists). They were *Endothyra* sp., *Omphalotis minima*, *Omphalotis* sp., *Globoendothyra* sp., *Paraarchaediscus angulatus*, and *P. concavus*. The *Endothyra* and *Globoendothyra* specimens could not

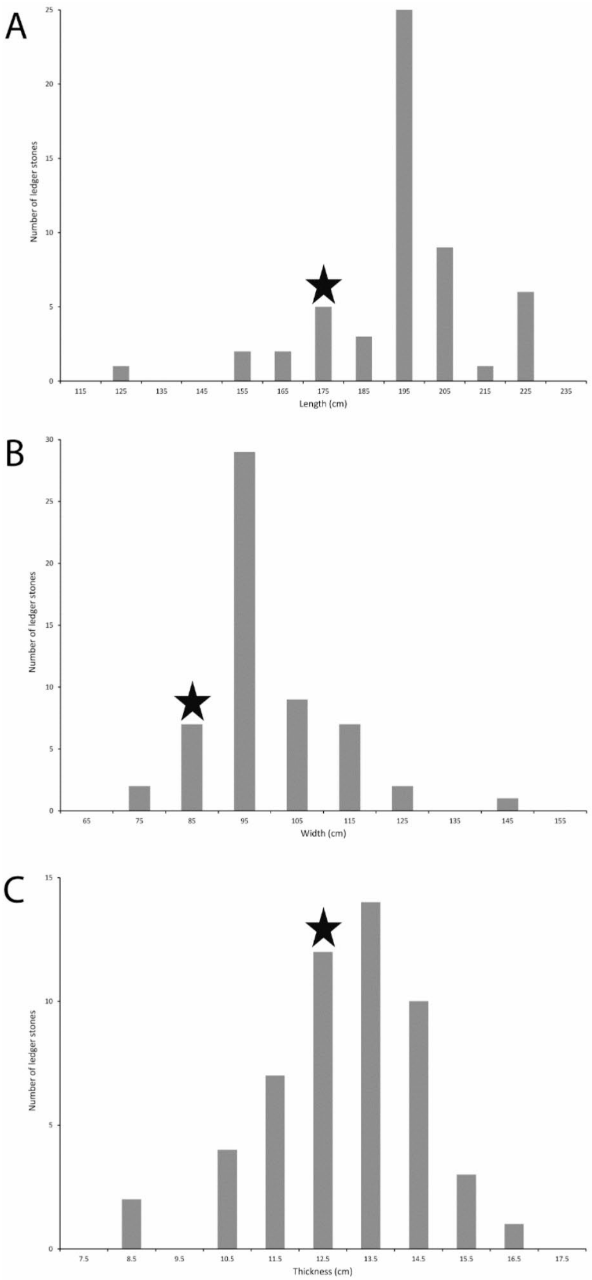

Fig. 6 Length (**A**), width (**B**), and thickness (**C**) of colonial era black "marble" limestone ledger stones from the Chesapeake Bay American colonies. Length and width data grouped in 10 cm bins. Thickness data grouped in 1 cm bins. The knight's tombstone is indicated by the stars. Modified from Key et al. (2021b, Fig. 3B-D).

be identified to the species level. Therefore, their genus level paleogeographic and stratigraphic ranges are broader than those identified to the species level (Fig. 8; see Table 1). *Endothyra* contains multiple species and has been found in North America and Europe (PBDB 2019). As a result, its stratigraphic range extends from the Lower Mississippian (Tournaisian Age of the Lower Mississippian Epoch of the Carbonifer-

Table 1 Geographic and stratigraphic ranges of the microfossils identified in the knight's tombstone. Genus-level data are from the Paleobiology Database and augmented by the primary literature for species*

Foraminiferan taxon	Geographic range	Stratigraphic range
Endothyra sp.	Midwestern North America, Europe (including Belgium, England, and Ireland)	Tournaisian Age of the Lower Mississippian Epoch of the Carboniferous Period to the Rhaetian Age of the Upper Triassic Period
Globoendothyra sp.	Western North America, Europe (including Spain, France, Belgium, Wales, and Ireland)	Mississippian to Pennsylvanian Epochs of the Carboniferous Period
*Omphalotis minima**	Europe (including Belgium and Ireland)	Viséan Age of the Middle Mississippian Epoch of the Carboniferous Period
Omphalotis sp.	Europe (including Belgium, Ireland, United Kingdom, and France), Egypt, and Uzbekistan	Carboniferous Period
*Paraarchaediscus angulatus**	Europe (including Ireland)	Viséan Age of the Middle Mississippian Epoch of the Carboniferous Period
*Paraarchaediscus concavus**	Europe (including Ireland)	Viséan Age of the Middle Mississippian Epoch of the Carboniferous Period

ous Period, 359 million years ago) to the Upper Triassic (Rhaetian Age of the Upper Triassic Epoch, 201 million years ago) (PBDB 2019). This duration of 158 million years (Cohen et al. 2022) makes it ineffective for sourcing the knight's tombstone. *Globoendothyra* also contains multiple species and has been found in western North America and Europe (PBDB 2019). As a result, its stratigraphic range extends from the Mississippian (358.9 million years ago) through the Pennsylvanian Epochs (298.9 million years ago) of the Carboniferous Period (PBDB 2019). This duration of 60 million years (Cohen et al. 2022) also makes it ineffective for sourcing the knight's tombstone.

In contrast, the *Omphalotis* and *Paraarchaediscus* species are much more useful for constraining the source of the knight's tombstone (see Table 1) as the species level information is more specific than the genus level. *O. minima* lived in what is now Europe (including Belgium and Ireland; PBDB 2019) during the Belgian Livian substage of the Viséan Age of the Middle Mississippian Epoch of the Carboniferous Period (Poty et al. 2006) giving it an age of 340–336 million years ago (Aretz et al. 2020). *Paraarchaediscus angulatus* and *P. concavus* also only lived in what is now Europe (PBDB 2019). These species lived during the Holkerian to Asbian substages of England and Ireland and their Belgian equivalents, the Livian to lower Warnantian substages) (Pracht and Somerville 2015; Somerville 2008). This was during the Viséan Age of the Middle Mississippian Epoch of the Carboniferous Period, 340–332 million years ago (Aretz et al. 2020; Haq and Schutter 2008).

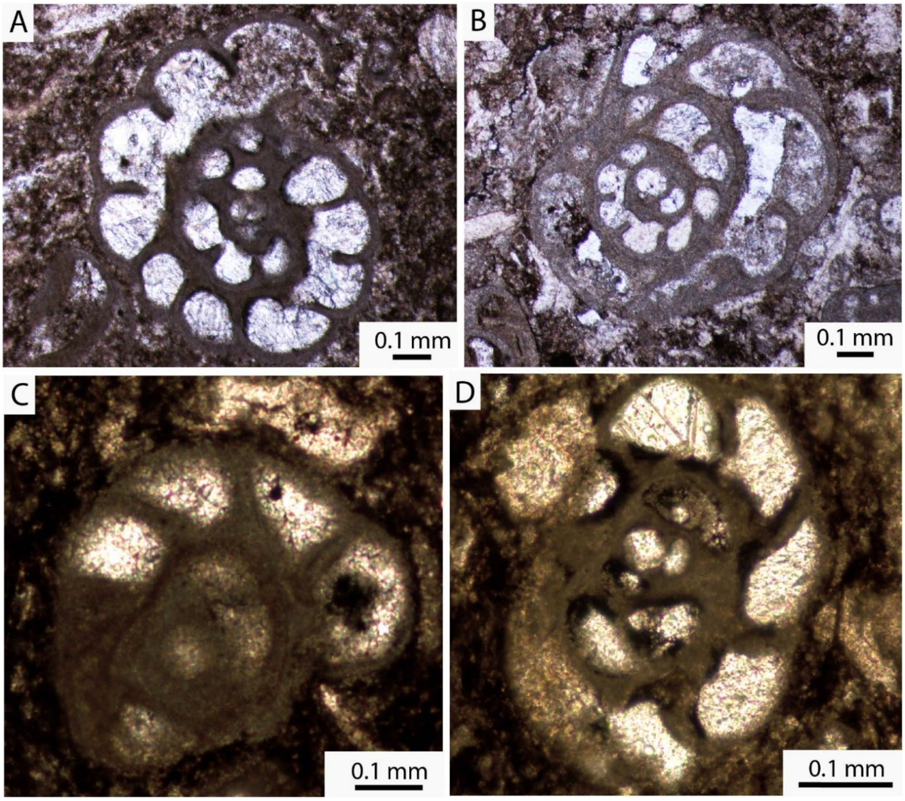

Fig. 7 Four species of microfossils found in the thin sections of the knight's tombstone. All were foraminiferans (i.e., single celled amoeboid protists). They were *Endothyra* sp. (**A**), *Globoendothyra* sp. (**B**), *Omphalotis minima* (**C**), and *Omphalotis* sp. (**D**)

Therefore, based on the four species of microfossils found in the knight's tombstone, its source rock is most likely 340–336 million years old (Fig. 8) and from Europe, probably Ireland or Belgium (Fig. 9). These species did not co-occur anywhere in North America. The knight's tombstone had to be imported from Europe. Historical evidence of similar colonial tombstones around the Chesapeake Bay suggests the source was Belgium (Fig. 9; Key et al. 2021b).

Discussion

What is known as Belgium today is historically the most common source of Lower Carboniferous black "marbles" and has been since Roman times (Dimes 1990; Drake 1993; Dreesen et al. 2018; Dubois 2017; Groessens 1981, 1987; Monfils 1982; Netels 1982; Renwick 1909). Belgian black "marble" ledger stones were exported to Sweden, Poland, Madeira, France, Scotland, and most notably, to England (Bath 2018, Bertram 1996; Burgess 1963; Dimes 1990; Drake 1993, Drake 2002; Dunning 1944; Groessens 1981; Wardzyński 2006; Watson 1916). From the Middle Ages and into the

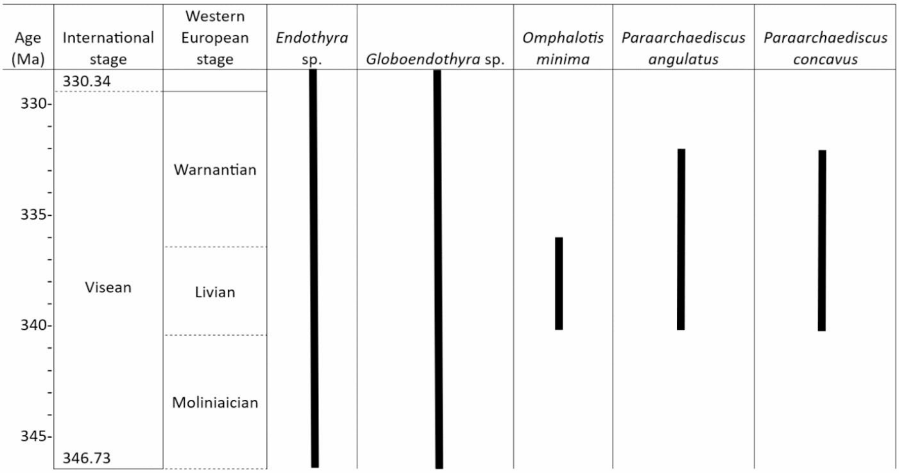

Fig. 8 Stratigraphic correlation chart of the Viséan Age of the Middle Mississippian Epoch of the Carboniferous Period with the Western European regional substage nomenclature and showing the stratigraphic ranges of the foraminiferans found in the black "marble" knight's tombstone from Jamestown, Virginia, USA. Ma = millions of years ago. Modified from Aretz et al. (2020, Fig. 23.5).

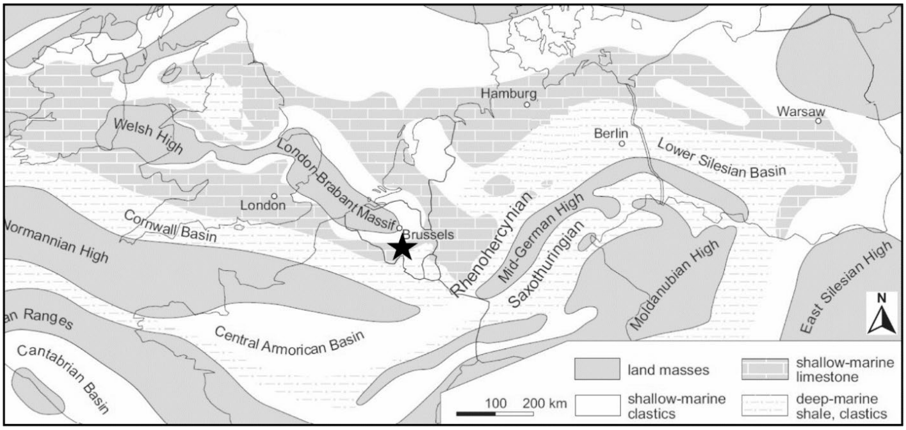

Fig. 9 Palaeogeographic map of northern Europe during the Viséan Age with star indicating location of the black "marble" knight's tombstone source rock in Belgium relative to London, England where it was was transshipped to Jamestown, Virginia, USA. Modified from Ginter et al. (2015, Fig. 1).

mid-seventeenth century followed by a later resurgence in the eighteenth and nineteenth centuries, black "marble" was in vogue among the English who were wealthy enough to afford it to commemorate their dead (Jameson 2016). The jet-black Belgian "marbles" were the most in demand and expensive (Jameson 2016). Successful Virginia colonists who had lived in London would have been familiar with the latest English fashions and tried to replicate these in the colonies. For colonists like Yeardley, a black marble ledger stone not only commemorated his accomplishments and virtues but boldly proclaimed his family's elite position in colonial life (Carson et al. 1994). The cost to import the stone to Jamestown, even using it as ballast, would have added greatly to the cost of the stone itself, the carving for the brass inlays, and the fabrication and fitting of the brass inlays. Whoever was buried under the knight's tombstone was a prominent member of the Jamestown settlement.

Historical and archaeological evidence reveals the importation of manufactured goods into colonial Maryland and Virginia from Europe, mainly England, starting in the seventeenth century (Nash 2005). One of the best documented examples can be found in the building stones, hardware, glass, and paint imported from England for use in Virginia's colonial capital in Williamsburg (Whiffen 1958). Expensive manufactured items such as ledger stones were more likely to be imported from England than cheaper and more locally obtainable items such as bricks (Townsend 1904). In Virginia, up to 1780, tombstones were largely imported from England, whereas in Maryland, after 1740 more started coming from Philadelphia (Crowell and Mackie 1984; Key et al. 2021b). It is hoped that the results of this study help refine the geography and timing of the seventeenth-century North Atlantic trade routes between Continental Europe (especially Belgium), England, and colonial Virginia.

Two other black limestone ledger tombstones were found in the graveyard outside of Jamestown Memorial Church (Key et al. 2021b). They belonged to William Sherwood who died in 1697 and Mrs. Sarah Blair who died in 1713. Thanks to another archived fragment, we were able to thin section William Sherwood's tombstone. It contained the foraminiferans *Earlandia moderata*, *Endothyra bowmani*, and *Omphalotis* sp. These species also co-occurred exclusively in the Mississippian Epoch of present-day Belgium, not in North America (PBDB 2019). This supports the conclusions above for transatlantic trade routes from continental Europe to Jamestown. These were undoubtedly not direct, but through London (Key et al. 2021b). For example, William Sherwood's will explicitly requested a "marble" tombstone from London (Stanard 1917; Yonge 1904). We hypothesize it was quarried and cut to size in Belgium, shipped down the Meuse River, across the English Channel to London where it was carved and the brass inlays installed, and finally shipped on to Jamestown as ballast. This trade route was a small piece of the rapidly expanding Atlantic world of geopolitical colonial trade (Appelbaum and Sweet 2005:map 1; Campbell 2021; Jordan 2005; Mancke and Shammas 2005).

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Data Availability All data from this study are presented in Table 1.

Declarations

Conflict of Interest On behalf of all authors, the corresponding author states that there is no conflict of interest.

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