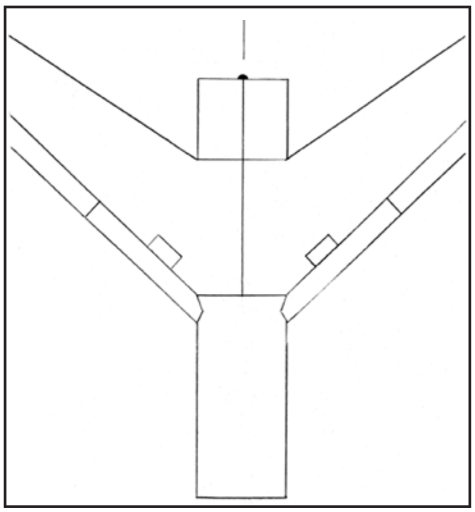
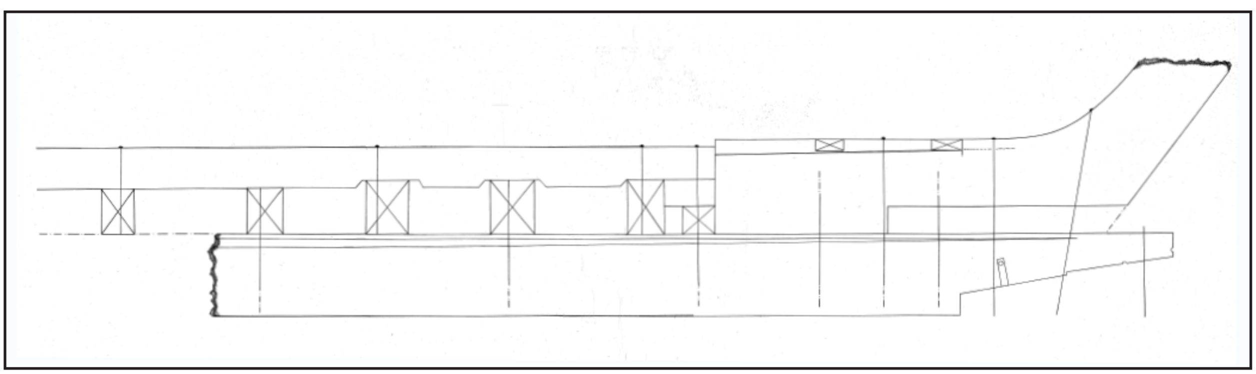
Archaeological Data Recovery of Site 44HT0125, Associated with the I-64 Hampton Roads Bridge Tunnel Expansion Project, City Of Hampton, Virginia

VDOT Project: 0064-M06-033; UPC: 115009, 115011; Activity Code: 612

VDHR File No. 2015-0783

W&MCAR Technical Report Series No. 37





Prepared for:
Virginia Department of Transportation

Prepared by:
William & Mary Center for Archaeological Research

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Abstract

From July 2021 through June 2022, the William & Mary Center for Archaeological Research (W&MCAR) and its subconsultants conducted archaeological data recovery of Site 44HT0125, an early nineteenth-century shipwreck in Hampton, Virginia. The Virginia Department of Transportation (VDOT) requested this study in association with the Hampton Roads Bridge Tunnel Expansion (HRBTE) project (0064-M06-033; UPC: 115009, 115011; Activity Code: 612; VDHR File No. 2015-0783).

Site 44HT0125 represents an uncharted shipwreck in the immediate vicinity of the North Island of the Hampton Roads Bridge Tunnel. Identified as an unanticipated discovery during dredging activities in November 2020, the site measures approximately 40 x 105 ft. (12.2 x 32.0 m) and consists of the remains of an early nineteenth-century vessel that sank along with its cargo in the shallow waters of the Hampton Bar. Remnants of the shipwrecked vessel, which include 12 floor timbers, two sections of keel, three sections of keelson, one futtock, one possible carling, five sections of plank, and a complex timber identified as a forefoot knee. , were recovered 0–3 ft. (0–94 cm) below the present seabed. Recovered material also included at least 33–41 tons of quarried gneiss blocks representing at least part of the vessel's cargo (probably more than 122 tons) and miscellaneous artifacts such as iron concretions, a bovine mandible fragment, and a sherd of saltglaze stoneware.

In January 2021, an assessment of the recovered vessel remains and cargo by R. Christopher Goodwin & Associates (Goodwin) concluded that 50 percent or less of the original vessel remains had been recovered during dredging activities. Subsequent research by VDOT staff suggested that the unrecovered portion of the vessel and site was likely destroyed during previous episodes of construction activities for the original tunnel crossing in the 1950s and/or 1970s. Site 44HT0125 was recommended eligible for the NRHP under Criteria A, C, and D for the important information it has yielded and for research potential. Upon review, the Virginia Department of Historic Resources (VDHR) concurred with eligibility under Criterion D for the information it has yielded regarding nineteenth-century ship construction and its potential to yield additional information relating to construction of the Hampton Roads portion of the nation's Third System (1816–1867) of coastal fortifications. Moreover, the site warranted no further underwater field investigations because of loss of integrity from multiple phases of bridge tunnel construction. Eligibility for the NRHP under Criteria A and C, however, required more information than provided in Goodwin's assessment report.

The current study provides information in support of NRHP eligibility under Criteria A and C from additional intensive documentary research and context development, measured drawings of diagnostic ship timbers, a visual reconstruction of the vessel, dendrochronological analysis of vessel timber samples, and geological analysis of the granite cargo to determine its source and compatibility with stone used for the construction of Fort Monroe and Fort Calhoun.

Analysis of vessel remains identified a distinctive element known as a forefoot knee. Other distinctive construction features include the pattern of fastening the floor timbers to the keel and/or keelson, limited use of trunnels and employment of iron fasteners. The combination of findings from documentary research, dendrochronological sampling, geological analysis, and analysis of vessel remains indicate that the Site 44HT0125 vessel was likely a schooner transporting a cargo of gneiss building stone from a quarry Port Deposit, Maryland for the construction of Fort Monroe ca. 1818–1834.

In view of the successful completion of data recovery as specified in the treatment plan, no further work is recommended at the site.

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Acknowledgments

The W&MCAR would like to express its appreciation to various federal and state governmental agencies, public and private institutions, and individuals who assisted this project.

This project was made possible through the Federal Highway Administration. Thanks are due to Dr. Owen Lindauer, Chief Archeologist/Project Development Specialist, under whose purview this project falls. The Environmental Division of the Virginia Department of Transportation (VDOT) deserves the highest praise for its support of this project. Special thanks are extended to Mr. Scott Smizik, Assistant Environmental Division Director; Ms. Larissa Ambrose, VDOT Environmental Manager for the HRBT Expansion Project; Mr. Antony Opperman, Cultural Resources Program Manager; and Mr. Will Moore, Lead Statewide Archaeologist. Staff in other areas of VDOT also provided valuable help, including Jim Utterback, HRBT Expansion Project Director; Allison Richter, Deputy Hampton Roads District Administrator; Christopher Hall, PE, District Engineer, Hampton Roads District; Mr. Joe Lomax, Interstate Maintenance Manager; Mr. Steve Stephenson, Contract Administration Supervisor, who supervised moving the ship timbers and granite to the Bowers Hill Maintenance Headquarters in the City of Chesapeake; Mr. Rick Tsikuris, Interstate Contract Monitor; Anthony Gibson, VDOT's Commercial Manager; and Tony Reynolds, Structure and Bridge Inspector, who assisted Tidewater Atlantic Research (TAR) on site by operating the equipment needed to hoist and move the larger ship timbers for analysis.

We would also like to acknowledge Ms. Rebecca Gwynn and Mr. Stephen Living of the Virginia Department of Wildlife Resources for arranging access and transportation to Fort Wool. We are also grateful to Mr. Chris Frye, Senior HRBT Project Manager of Vanasse Hangen Brustlin, Inc. for his leadership and guidance.

We are grateful to several experts and curators of the history and heritage resources of Fort Monroe, Fort Wool, and Hampton who shared their specialized knowledge and archival documentary materials under their care. At the Fort Monroe Authority, David Stroud, Director of Heritage Assets and Historic Preservation; Paul Presenza, Archaeologist & Cultural Resources Specialist of the Fort Monroe Authority; and Ali Kolleda, archivist of the Casemate Museum documentary collections, were especially helpful. Mr. Stroud and Mr. Presenza helped coordinate and guided visits by W&MCAR staff and Professor Bailey's team, and Ms. Kolleda pulled several useful documents for the project historian's research. At the beginning of the project, Michael Cobb, former director of the Hampton History Museum, met with W&MCAR staff at our office to share his extensive knowledge of Fort Wool, and provided images and a list of potentially useful sources based on his research for his book, *Fort Wool: Star Spangled Banner Rising* (2009).Thanks also go to Matthew Guillen, Reference Coordinator for the Virginia Museum of History and Culture, for scanning dozens of letters by Robert E. Lee while he served as lieutenant engineer at Fort Monroe and Fort Calhoun. Without Mr. Guillen's efforts, the manuscripts would have been unavailable to review due to a pandemic-related closure of the museum's library. Staff of National Archives in Philadelphia were quick to provide guidance and expedite a research appointment once the facility opened after a long closure due to the pandemic.

The W&MCAR conducted research in collaboration with a team of subconsultants. Professor Christopher Bailey, Ph.D., of the Department of Geology at William & Mary, performed geological analysis of the stone cargo. Dr. Carol B. Griggs, Senior Research Associate at the Cornell University Tree Ring Laboratory, provided dendrochronological analysis of samples from vessel

timbers recovered from the site. Dr. Gordon P. Watts, Jr., of Tidewater Atlantic Research (TAR), located in Washington, North Carolina, prepared a detailed analysis and interpretation of vessel remains. Each of the subconsultants wrote and illustrated their respective findings and interpretations as a chapter of this report. At the W&MCAR, Director Joe B. Jones provided general supervision of the project until he accepted a position outside of William & Mary on April 1, 2022. Following his departure, Archaeological Research Manager/Co-Director Dr. Elizabeth J. Monroe supervised the remainder of the project. Project Archaeologist Thomas F. Higgins III was responsible for preparing the research design and treatment plan for Site 44HT0125. Operations Manager/Co-Director David Lewes served as project historian and compiled and produced the final report. Eric Agin prepared the final report illustrations for the W&MCAR. Vessel remains, stone cargo, and miscellaneous artifacts were held temporarily by VDOT at their facility in Chesapeake, Virginia, until arrangement of final disposition. Copies of project documentation are stored at the W&MCAR facility in Williamsburg, Virginia, under W&MCAR project number 21-14, and the originals will be transferred to a permanent storage facility as directed by VDOT.

Glossary of Sailing Vessel Terms†

Amidships: The middle of a vessel, either longitudinally or transversely.

Apron: A curved timber fixed to the after surface of the stem or to the top of the end of the keel and the after surface of the stem; an inner stempost.

Bow: The forward part of a hull, specifically, from the point where the sides curve inward to the stem.

Breadth: The width of a hull; sometimes called beam, which is technically the length of the main beam.

Breast hook: A large, horizontal knee fixed to the sides and stem to reinforce and hold them together.

Butt joint: The union of two planks or timbers whose ends are cut perpendicularly to their lengths.

Cant frame: A framing member mounted obliquely to the keel centerline in the ends of a vessel; canting provided better frame distribution and permitted more nearly rectangular cross sections of the timbers along the vessel's incurving ends.

Carlings: Structural girders that reinforce the timber frame.

Ceiling planks: Boards used inside vessel for gunwales and decking.

Coaster: Any vessel carrying cargo from one coastal port to another. In the United States, the coasting trade was carried on almost entirely by sailing vessels.

Deadrise: The amount of elevation, or rising, of the floor above the horizontal plane.

† Definitions from J. Richard Steffy, "Illustrated Glossary of Ship and Boat Terms," in *The Oxford Handbook of Maritime Archaeology,* by Alexis Catsambis, Ben Ford, and Donny L. Hamilton (Oxford, England: Oxford University Press, 2014).

Deadwood: Blocks of timber assembled on top of the keel, usually in the ends of the hull, to fill out the narrow parts of the body of a vessel.

Fish plate: A metal plate used to join two timbers externally.

Flat scarf: The union of two timbers whose diagonal ends are cut off perpendicular to their lengths.

Floor: The bottom of a vessel between the upward turns of its bilges.

Floor timber: A frame timber that crcssed the keel and spanned the bottom; the central piece of a compound frame.

Forefoot: A curved piece between the forward end of the keel and the knee of the head.

Futtock: A frame timber other than a floor timber, half-frame, or top timber; one of the middle pieces of a frame; used between knees.

Garboard strake: The strake of planking next to the keel; the lowest hull plank.

Graving piece: A wooden patch, or insert, let into a damaged rotted plank.

Head: In a general sense, the forward part of a vessel; the extreme bow area.

Keel: The main longitudinal timber of most hulls, upon which the frames, deadwoods, and ends of the hull are mounted; the backbone of the hull.

Keelson: An internal longitudinal timber or line of timbers, mounted atop the frames along the centerline of the keel that provides additional longitudinal strength to the bottom of the hull; an internal keel.

Knee: An angular piece of timber used to reinforce the junction of two surfaces of different planes; usually made from the crotch of a tree where two large branches intersected, or where a branch or root joined the trunk.

Limber: Watercourse or channel alongside or central to the keel and atop the floor timbers for the purpose of supporting transverse ceiling planks.

Mast step: A mortise cut into the top of a keelson or large floor timber or a mortised wooden block or assembly of blocks mounted on the floor timbers or keelson, into which the tenoned heel of a mast is seated.

Molded: The various dimensions of timbers as seen from the sheer and body views of construction plans. The vertical surfaces of timbers such as the keel or frames. Normally, timbers are described in sided and molded dimensions, while planks and wales are listed in thickness and widths.

Mortise: A cavity cut into a timber to receive a tenon.

Port: The left side of a vessel when facing forward.

Rabbet: Generally the term refers to the grooves cut into the sides of the keel, stem, and sternpost, into which the garboards and ends of the outer planking are seated.

Rake: The inclination of the stem and sternpost beyond the ends of the keel.

Ribband: Long, flexible strip of wood most commonly used as a temporary keeper by nailing it across the outside of a standing frame during construction of a vessel.

Scantlings: The principal timbers of a vessel.

Scarf: An overlapping joint used to connect two timbers or planks without increasing their dimensions.

Schooner: A sailing vessel rigged with fore-and-aft sails on two or more masts. Usually refers to a vessel with two masts with the mainmast taller than the foremast; however, schooners were built with as many as seven masts. An effective vessel type for coasting trade because they required a smaller crew than a square-rigged vessel of comparable size.

Sided: The dimension of an unmolded surface; the distance across an outer frame surface, the forward or after surface of a stem or sternpost, or the upper surface of a keel or keelson.

Sloop: A sailing vessel with a single mast, typically fore-and-aft rigged, with a single headsail.

Standing knees: Curved connections between the floor, bilge, and side of vessel.

Starboard: The right side of a vessel when facing forward.

Stem: A vertical or upward curving timber or assembly of timbers, scarfed to the keel or central plank at its lower end, into which the two sides of the bow are joined.

Stern: The aft end of a vessel.

Stern post: Upward-curving timber that supports the rudder post and rudder assembly.

Stopwater: A wooden dowel inserted athwartships (across the vessel, from side to side) in the scarf seams of external timbers to prevent shifting of the joint or to discourage water seepage along the seams.

Stringers: Longitudinal timbers attached to inside surface of frames.

Tonnage: A measurement based on an arbitrary formula, intended originally to be a rough measure of cargo capacity.

Treenail/Trunnel: A round or multi-sided piece of hardwood, driven through planks and timbers to connect them. Tree nails were employed most frequently in attaching planking to frames. They were used in a variety of forms with expanding wedges or nails in their ends, with tapered or square heads on their exterior ends, or completely un-wedged and un-headed. When immersed, treenails swelled to make a tight fit.

1: Introduction

From July 2021 through June 2022, the William & Mary Center for Archaeological Research (W&MCAR) conducted archaeological data recovery of Site 44HT0125 in association with the Hampton Roads Bridge Tunnel Expansion (HRBTE) project at the request of the Virginia Department of Transportation (VDOT) (Project: 0064-M06-033; UPC: 115009, 115011; Activity Code: 612; VDHR File No. 2015-0783) in the City of Hampton, Virginia (Figure 1.1).

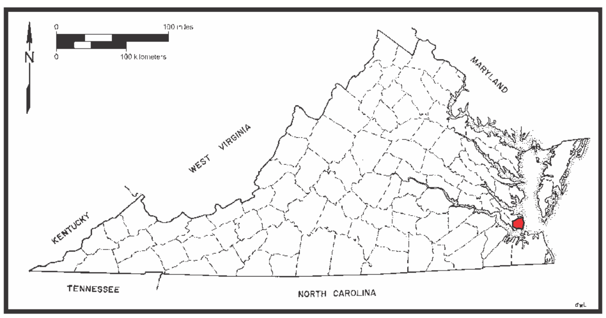

Figure 1.1. Project area location.

Site 44HT0125 represents an uncharted shipwreck in the immediate vicinity of the North Island of the Hampton Roads Bridge Tunnel that was identified as an unanticipated discovery during dredging activities in November 2020 (Figures 1.2 and 1.3). The site measures approximately 40 x 105 ft. (12.2 x 32.0 m) and consists of the remains of an early nineteenth-century vessel that sunk along with its cargo in the shallow waters of the Hampton Bar. Remnants of the shipwrecked vessel, which include large timber frame fragments, splinter wood strake and plank fragments, and a section of wooden keel, were recovered 0–3 ft. (0–94 cm) below the present seabed. In addition, 33–41 tons of quarried granitic gneiss blocks that represent part of the cargo of the shipwrecked vessel were recovered (Figures 1.4–1.8). A small assemblage of other miscellaneous artifacts recovered include iron concretions, a bovine mandible fragment, and a sherd of saltglaze stoneware.

The W&MCAR conducted research in collaboration with a team of subconsultants. Responsibilities of W&MCAR staff included development of the research design and treatment plan by Project Archaeologist Thomas F. Higgins III, as well as intensive documentary research and preparation of historical context by Project Historian David W. Lewes. Professor Christopher Bailey, Ph.D., of the Department of Geology at William & Mary, performed geological analysis of the stone cargo. Dr. Carol B. Griggs, Senior Research Associate at the Cornell University Tree Ring Laboratory, provided dendrochronological analysis of samples from vessel timbers recovered from the site. Dr. Gordon P. Watts, Jr., of Tidewater Atlantic Research (TAR), located in Washington, North Carolina, prepared a detailed analysis and interpretation of vessel remains. Each of the subconsultants wrote and illustrated their respective findings and interpretations as a chapter of this report.

Vessel remains, stone cargo, and miscellaneous artifacts were held temporarily by VDOT at their facility in Chesapeake, Virginia, until arrangement of final disposition. Copies of project documentation are stored at the W&MCAR facil-

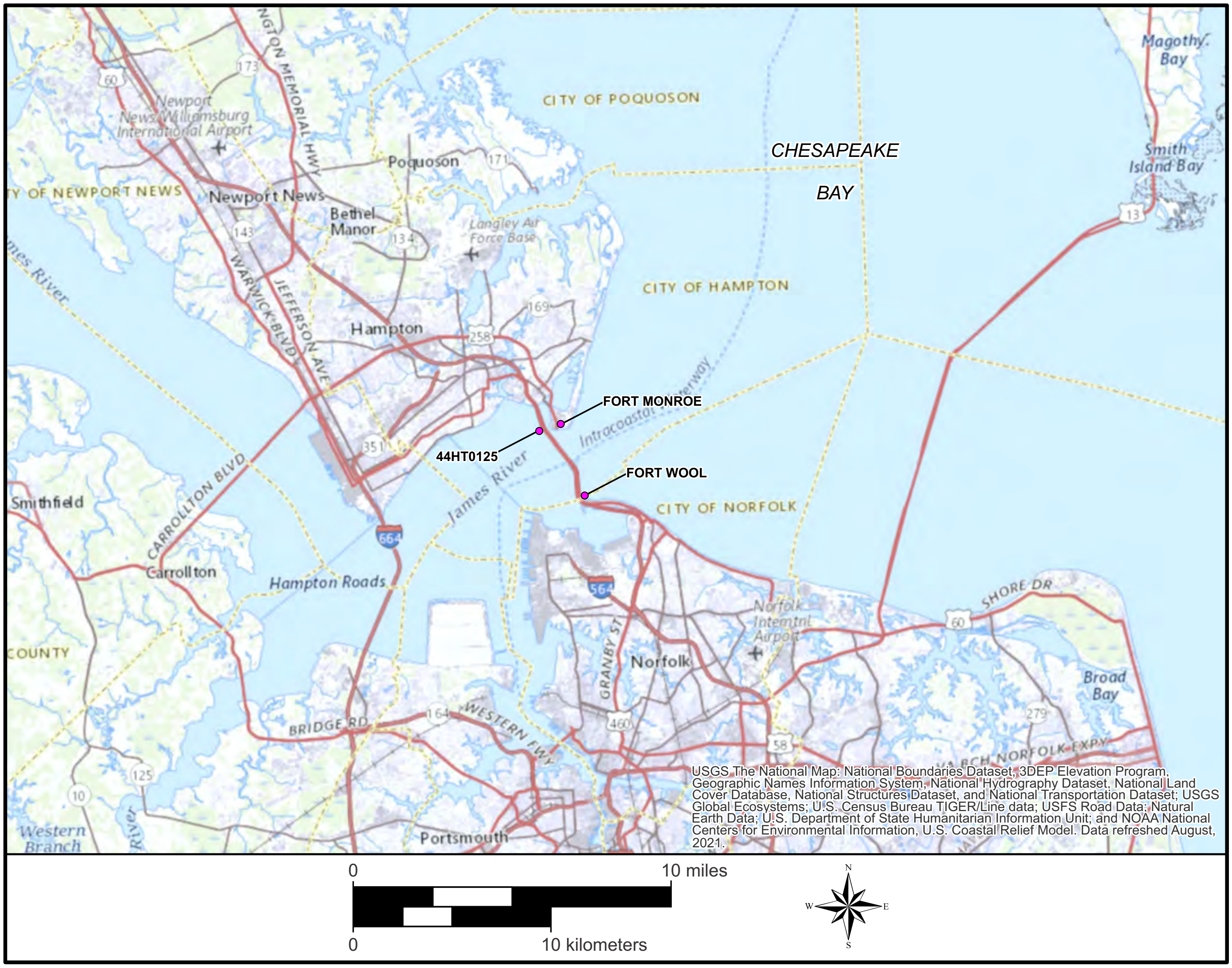

Figure 1.2. Project area and environs.

ity in Williamsburg, Virginia, under W&MCAR project number 21-14, and the originals will be transferred to a permanent storage facility as directed by VDOT.

This report was prepared with funding from the VDOT and the Federal Highway Administration. The contents of this report reflect the views of the W&MCAR, which is responsible for the accuracy of the data presented therein. The contents do not necessarily reflect the official views or policies of the VDOT or the Federal Highway Administration. This report does not constitute a standard, specification, or regulation.

Project Background

Site 44HT0125 was assessed by staff from R. Christopher Goodwin & Associates (Goodwin) in December 2020/January 2021, to ascertain the nature and historicity of the cultural remains and to provide findings and recommendations regarding the potential eligibility of the site for the National Register of Historic Places (NRHP)

Figure 1.3. Overlay of dredging plans on aerial imagery, showing the location of dredging activities and Site 44HT0125 relative to the North Island of the Hampton Roads Bridge Tunnel.

Figure 1.4. Keel from Site 44HT0125, 23 ft. in length.

Figure 1.5. Standing knee and other ship timber components from Site 44HT0125.

Figure 1.6. Quarried gneiss blocks from Site 44HT0125.

Figure 1.7. Detail of quarried gneiss blocks from Site 44HT0125.

Figure 1.8. Drill holes in quarried gneiss blocks from Site 44HT0125.

(Wright 2021). Their research suggested that the vessel was likely transporting granite to Hampton Roads for construction of Fort Monroe or Fort Calhoun (now Fort Wool) when it was swamped during a storm and sank on Hampton Bar. Goodwin staff concluded that the remnants recovered as part of the dredging activities represent about 50 percent or less of the original vessel. Subsequent research by VDOT staff suggested that the unrecovered portion of the vessel and site was likely destroyed during previous episodes of construction activities for the original tunnel crossing in the 1950s and/or 1970s.

Site 44HT0125 was recommended eligible for the NRHP under Criterion A for its potential association with the construction of Fort Monroe and/or Fort Calhoun and significant contributions to the broad patterns of history; Criterion C as an example of a largely unstudied vernacular vessel from the nineteenth century; and Criterion D for the important information it has already yielded and research potential. Upon review, the Virginia Department of Historic Resources (VDHR) staff concurred that Site 44HT0125 is eligible under Criterion D for the information it has already yielded regarding nineteenth-century ship construction and its potential to yield additional information relating to construction of the Hampton Roads portion of the nation's Third System (1816–1867) of coastal fortifications. Given that the integrity of Site 44HT0125 was severely affected by construction of the existing bridge tunnel in the 1950s and/or 1970s and that the recent dredging for the expansion has resulted in the removal of the remaining fragments of the vessel, VDHR concurred with VDOT's recommendation that the site warranted no further underwater field investigations. The VDHR acknowledged the possibility that Site 44HT0125 also could be eligible for the NRHP under Criteria A and C, although they contended that more information than is provided in the assessment report would be necessary before VDHR could concur with the additional eligibility recommendations (Holma 2021). The mitigation of adverse effects to the site called for the completion of data recovery investigations guided by a treatment plan and summarized in an archaeological data recovery report meeting the VDHR's *Guidelines for Conducting Historic Resource Surveys in Virginia* (revised 2017). The investigations and report needed to address research questions and issues to more thoroughly characterize and justify NRHP eligibility of the site with respect to applicable criteria. The investigation would also include measured drawings of diagnostic ship timbers, a visual reconstruction of the vessel, and geological analysis of the cargo rock to determine its source and compatibility with rock used for the construction of Fort Monroe and/or Fort Calhoun. Other specialized studies to be conducted on the ship timbers, as feasible and necessary, included dendrochronology and identification of the species and source of the wood used in construction of the ship. During the course of the data recovery, the W&MCAR could propose modifications to the research design if it discovered that important information exists that could not be effectively interpreted by the proposed research or if initial findings deviated drastically from expectations. In such a case, VDOT would then consult with VDHR to determine the best course of action.

Previous Research

Underwater archaeological surveys for the proposed bridge-tunnel expansion project were undertaken in 1999 and 2017. The survey areas included the area of the shipwreck, Site 44HT0125, although the site was not identified during those investigations (Cox 1999; Crowl 2017). Dredging for the HRBTE project in November 2020 encountered the remains, characterized as an "obstruction," of what would subsequently be interpreted as unanticipated discovery of Site 44HT0125. When rediscovered, the remains were initially misinterpreted as an insignificant obstruction partly because of errors and inaccuracies in the description and map-projection of the site's location. The archaeological remains were identified approximately 9 ft. (2.7 m) below sea level and 170 ft. (51.8 m) west of the North Island of the Hampton Roads Bridge Tunnel. Goodwin conducted an assessment of the unanticipated discovery in January 2021, focusing on the recovered materials from the dredging activity. The materials were recovered 0–3 ft. (0–94 cm) below the present seabed and from an area that measures approximately 40 x 105 ft. (12.2 x 32.0 m). Prior to being moved to the Bowers Hill Area Headquarters for archaeological data recovery, the material was stored at the Bainbridge Recycling Center, where the initial assessment was conducted. The recovered wooden elements identified during this initial assessment included 41 splintered wood strake and plank fragments, 20 large oak timber frame fragments, two large pit-sawn ceiling planks, and one each of an oak sternpost fragment and a section of a wooden keel. Goodwin's analysis of the wooden elements identified eight types of timber framing, including floor timbers, standing knees, futtocks, stringers, keel, ceiling planks, carlings, and sternpost. Some of the timbers have iron fasteners and/or iron stains where the plates once existed and through-bolts that remain relatively intact. Wright (2021:5) proposed that the dimensions of the standing knees (curved pieces of wood that serve as braces) are indicative of a flat-bottomed river barge or scow that was uniquely designed for maximum interior capacity and heavy payloads. Other details indicated that the vessel is vernacular in construction and perhaps hastily built, as reflected by the pit-sawn and hand-hewn treatment of the timbers. The recovered timbers are mostly white oak ("swamp oak"), which was the preferred wood for ship building in the Chesapeake. Numerous "old" scars and signs of weathering visible on several of the timbers suggested "years of hard service prior to sinking."

The dredging activity also brought to the surface blocks of building stone and a number of smaller artifacts. Goodwin estimated that the pile of stone stored at the Bainbridge Recycling Center comprised over 80 blocks of quarried rock that the Goodwin team assumed to be granite (Wright 2021:14). The largest piece of rock observed in the sub-assemblage measures 4.98 x 2.0 x 4.0 ft. (1.52 x 0.61 x 1.22 m). The specific identification and source of the rock was unconfirmed. There were granite quarries in Virginia (e.g., vicinity of Petersburg and falls of the James) and Maryland during the early nineteenth century with access to shipping the material to Old Point Comfort. The distinctive blueish-gray color of the rock, with biotite and white quartz inclusions, suggested that it had been quarried at Port Deposit, Maryland along the Susquehanna River (Wright 2021:15). In addition to the quarried blocks and the previously described wooden elements, the wreck yielded iron concretions, a bovine mandible fragment, and a saltglaze stoneware sherd.

The historical context of Site 44HT0125 corresponds closely to one of the long and active periods of fortification construction in Hampton Roads during the early nineteenth century. Near the close of the eighteenth century, the United States government began building and subsequently strengthening coastal defenses. This program of periodic fort construction and refurbishment lasted nearly three-quarters of a century. Over the course of this period there are three systems of fortifications (First System, Second System, and Third System) that are recognized, with each becoming more standardized and imposing in design through time until the advent and widespread use of rifled cannon during the mid- to late nineteenth century rendered masonry fortifications obsolete (National Park Service [NPS] 2021). In Hampton Roads, Fort Norfolk and Fort Nelson (ca. 1799) (which flanked both sides of the Norfolk Harbor) are examples of First System coastal defenses. Forts Monroe and Calhoun, built 20 years later, represent the Third System fortifications (Higgins and Downing 1991). Fortification construction had important economic ramifications for civilian contractors. Fort Monroe and Fort Calhoun, for instance, incorporated large quantities of cut blocks in their design construction, which depended on barges and other vessels to transport the stone from quarries to the building sites. "Barges, scow schooners, and uniquely designed sloops were hastily built and rigged by local sailors and river pilots to transport the needed stone to Hampton Roads" (Wright 2021:20). At Fort Monroe, an internal canal system served to control the mass transference of building materials into the larger construction site; quarried stone was moved by ox teams to the lay-down area where stone masons worked (Wright 2021:20). Meanwhile, the construction of Fort Calhoun relied on cargo-laden barges secured to buoys at the construction site, where the blocks were pitched over the sides of the vessels to gradually build an island upon which the fort was subsequently built. Although the flat-bottomed, shallow draft vessels used for hauling the stone were excellent for navigating shallow waters in inland waterways and small harbors, they were not designed for "open water, rough winds, and heavy waves" and "despite regular losses [due to adverse weather and other circumstances] these types of vessels continued to be built to meet the needs of the Federal Government" in its effort to build stone fortifications such as Fort Monroe and Fort Calhoun (Southall 1934; Wright 2021).

In summary, the initial assessment conducted by Goodwin interpreted the remains of Site 44HT0125 as remnants of an early nineteenth-century sailing barge, designed to carry heavy cargo, that was probably swamped during a storm and sank along with its cargo in the shallow waters of the Hampton Bar. The vessel was most likely en route to Fort Monroe and/or Fort Calhoun to deliver its payload of quarried building stone for the construction of the forts during the period of 1818–1835.

2: Research Design and Methods

Research Considerations

Site 44HT0125 offers a rare opportunity to study the remains of a unique type of early nineteenth-century commercial vessel and its cargo, and the relationship of these resources to the construction of Fort Monroe and Fort Calhoun. The stone cargo was likely destined for Old Point Comfort to be used in the construction of the two forts, which were part of the Third System of coastal fortifications built by the U.S. Government. Following less ambitious defensive schemes in the late eighteenth century, this system evolved in response to glaring deficiencies in coastal defenses made obvious during the War of 1812 by British depredations on coastal communities, especially in the Chesapeake Bay region. The Third System followed plans informed by an extensive study of needs performed by a commission of military engineering experts. The fortifications changed in design in the face of advances in military technology during the nearly six decades of their construction (1818–1867) and included adaptations for their various coastal settings. Common features throughout the period included "high vertical walls, masonry or stone construction, and casemated cannon emplacements" (NPS 2020).

Documentary research was designed to examine Site 44HT0125 within the context of this broader historical framework of coastal fortifications designed and constructed by the federal government in the nineteenth century, which will help to address the NRHP eligibility of the site under Criterion A. It focused on highlighting important construction details reflective of advancement in design and use of specific stone material used during the Third System period, such as represented by Fort Monroe and Fort Calhoun. Specifically, the research involved an examination of the use of quarried stone blocks in the construction of the two forts (Figures 2.1 and 2.2). This research relied on the sourcing the granite and granite-like material to explore the logistics of delivery of the quarried material via commercial shipping to the construction sites. Some of this information was available in the Historic Structures Report (HSR) for Fort Monroe (Lee and Hollister 2016). Background information indicated that loading, transporting, and unloading tons of building stone was laborious and dangerous work, and often damaging to the ship. The successful delivery of the heavy stone cargo and the safety of the crew and vessel depended on the skill of the boatmen, the nature and condition of the vessel, and the weather (Wright 2021). Amos Henley, an enslaved African-American laborer, who worked on a barge crew at Fort Monroe, was killed in 1821 during an accident while hauling stone with a windlass (Kelly 2019). In early April 1834 a barge carrying building stone was grounded and lost during a storm on Hampton Bar; the fate of the crew unknown (Southall 1934). The research design would test the assumption that Site 44HT0125 represents such a battered and worn vessel and cargo, sunk while en route to Fort Monroe or Fort Calhoun (Michael Cobb, personal communication).

Historical research explored how barges and barge-like vessels operated in the construction of Fort Monroe and Fort Calhoun. Previous research indicates that barge-related activities at

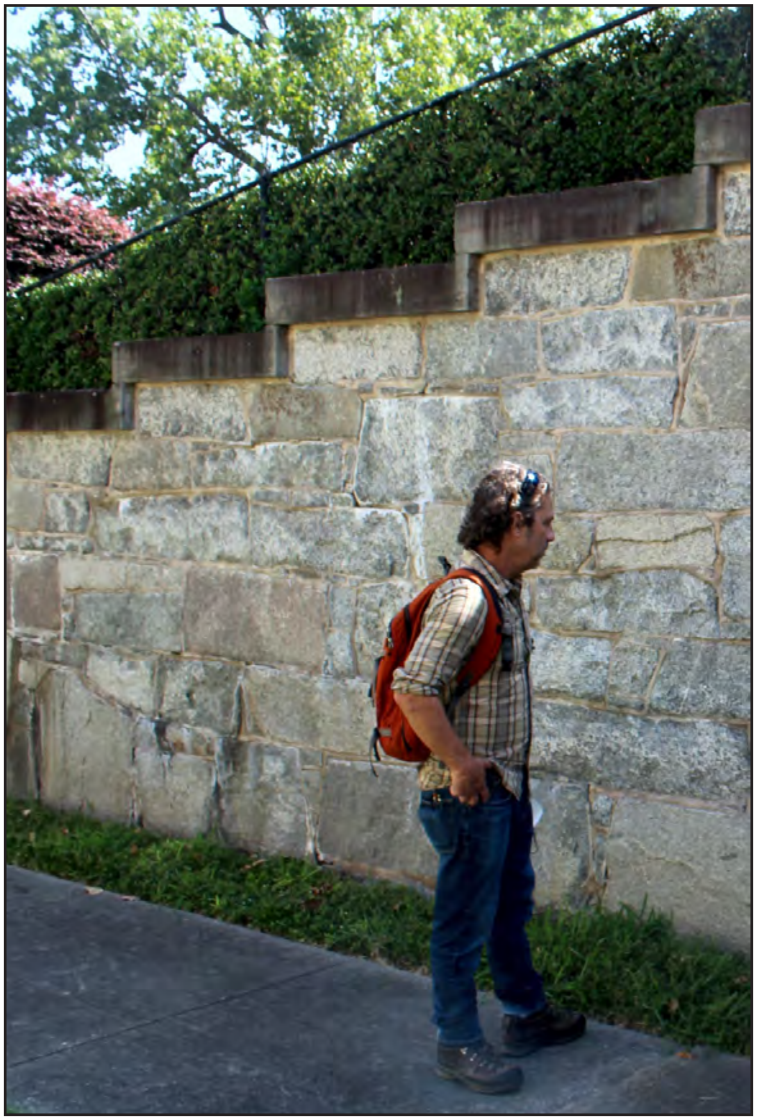

Figure 2.1. Professor Christopher Bailey, the project geologist, examining Port Deposit gneiss in the masonry of the Flagstaff Bastion of Fort Monroe.

Figure 2.2. Detail of masonry in the Flagstaff Bastion of Fort Monroe.

Figure 2.3. Examples of masonry in Fort Calhoun/Fort Wool.

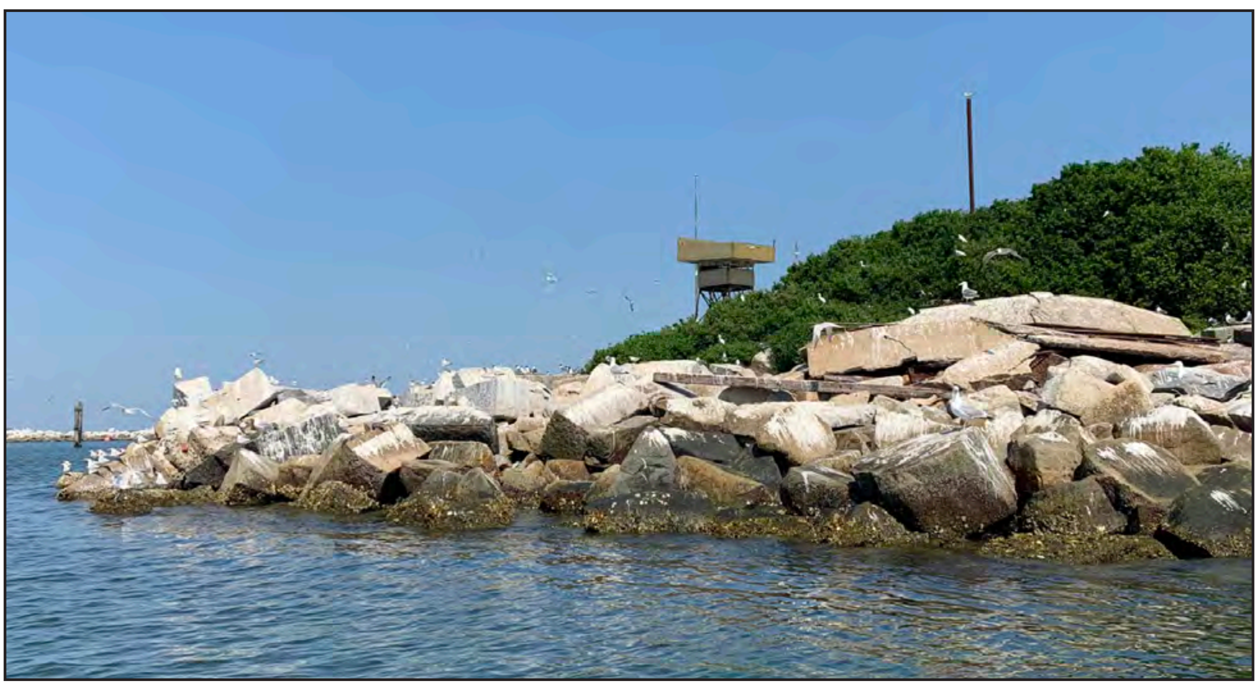

Figure 2.4. Stone block forming southeast portion of artifical island built up from underlying Willoughby Shoal for the construction of Fort Calhoun/Fort Wool.

Fort Monroe utilized a series of canals to access staging/work areas around the fort as it was constructed. Meanwhile, buoys were constructed at Fort Calhoun to secure the barges, given their vulnerability for loss during storms and other calamities due to the heavy cargo (Wright 2021:20). The moat at Fort Monroe actually began as a large canal used for the transportation of materials in the construction of the fort. It connected to a smaller, offshoot canal that extended to the wharves at the shoreline to the west. Ships would unload construction materials onto barges and then these flat-bottom, shallow draft vessels would transport the materials via the canals. The stone would then be unloaded by windlass onto heavy duty carts, wagons, or sleds and pulled by teams of oxen to the various work areas of the construction site or to a general lay-down area where the masons worked. Previous research indicated that the construction work on the fort was bustling at times and well orchestrated (Southall 1934). Work began on the masonry of the main fort (casemates) in 1821, during which 13,750 cubic yards of stone masonry were laid (Kelly 2016). Additional research sought to provide greater insight into the construction organization and activities at Fort Monroe and Fort Calhoun, especially as it relates to the commercial shipping of the stone blocks and the stonework at the two forts.

The research design consists of an interdisciplinary approach, including cooperation with experts in maritime archaeology, geology, and dendrochronology who contributed specialized research and analysis to the data recovery investigations. A primary goal of the project was to recover more data about the vessel structure, design elements, and age in an attempt to determine whether Site 44HT0125 was eligible for the NRHP under Criteria A and C. The preliminary assessment by Goodwin indicated that the recovered assemblage of ship timbers and stone cargo provides important clues about the type, function, and age of the vessel, as well as the source of the stone and the intended destination. Wright (2021:22) proposed that the vessel remains represent an early nineteenth-century sailing barge, "a rare exemplar of a vernacular commercial vessel form dating from the Federal period (1790–1835), and specifically from 1818–1835," the period when Fort Monroe and Fort Calhoun were under construction. Review of the assessment data and report suggested that the vessel was not originally constructed to be a barge but instead represented a heavily modified, older sailing vessel that was modified for use as a barge intended for transportation of the stone for the construction of Fort Monroe and Fort Calhoun (or possibly some other purpose) (Gordon Watts, personal communication 2021).

The primary task of the maritime archaeologist was to carefully re-examine the ship timbers with the objective of providing a better understanding of the vessel's design and uniqueness and any relationship the ship's cargo may have had with these aspects of the vessel. Previous research estimated that the ship carried a minimum of 122.5 tons of stone blocks, if not twice that, when it sank (Wright 2021:14). One interesting aspect to explore, and important for addressing the eligibility of the site under Criterion C, was the ship's vernacular attributes (e.g., the use of pit-sawn and hand-hewn timbers, angled elements from select tree trunks/limbs/roots) or modifications in relation to its cargo capacity and whether the ship may have been overloaded when it sank (Wright 2021:8). In addition to addressing these questions, it was hoped that the re-examination and documentation of the recovered shipwreck remains, including measured drawings of selected ship timbers, would provide a virtual reconstruction of the vessel, whether descriptive and/or graphic.

The dendrochronologist undertook analyses on selected ship timbers to provide a time frame for the felling of the trees used in construction of the ship, to identify the species and source of the wood used in its construction, and possibly even determine the location of the shipyard where the vessel was built (Worthington and Seiter 2016; Michael Worthington, personal communication 2021). These tasks involved coordination between the maritime archaeologist and dendrochronologist to select the best timbers to sample, depending on the condition of the individual timbers and the emerging data about the nature of the vessel. Previous research on the ship's design and attributes, along with documentary research, suggested that it dated to the Federal Period (1790–1835) and specifically from 1818 to 1835, the most intensive period of construction for Fort Monroe and Fort Calhoun as part of the Third System of coastal fortifications (Wright 2021:22). In the early 1830s, when young Lieutenant Robert E. Lee was stationed at Fort Monroe, ongoing construction work included the north wall, scarp and counterscarp walls, and casemated covered way at Fort Monroe, as well as construction of Fort Calhoun (Kelly 2019; Southall 1934). If the shipwreck dated to this period of construction, as the preliminary evidence suggested, then dendrochronology could help to either confirm or refine the age of the vessel and/or its dates of modification, which could then be compared to construction periods at Fort Monroe and Fort Calhoun. The HSR for Forts Monroe and Calhoun provides a yearly summary of construction activities at the forts, including references to the stonework, from 1819-1845, which could contribute to this study (Lee and Hollister 2016:11-16).

Another consideration of the research is the identification of the wood used in building the ship. The ship timbers appear to represent mostly white oak ("swamp oak"), along with some chestnut. White oak was the preferred type for shipbuilding in the Chesapeake (Wright 2021:8). Thus, a determination of the age and species of the wood and its source could contribute to the development of historic context of the vessel. Given indications that the ship may be of unique design and have vernacular characteristics, such information could be important. For example, Wright (2021:8) noted that,

> The standing knees (curved pieces of wood used as braces in the ship) associated with this vessel are considered "grown knees," as each was hewn from a natural crook or bend in a tree. Most appear to have been sourced from the intersection of a large branch and the trunk of a tree. Tree roots tended to provide the source for the 90-degree crooks. Construction of the vessel appears to have been rushed; most knees were fully squared and planed [and] many still exhibit rounded features defining the limb of the tree.

The quarried stone blocks from Site 44HT0125 have observable characteristics that may be important for the present study. For instance, the stone has a distinguishing blueish-gray color and inclusions that could reveal its source. In addition, several of the recovered stone blocks have distinctive drill holes, the analysis of which could reflect a specific method in the splitting the stone at a quarry (Gage and Gage 2005; SSNUS 2021).

The geological analysis for the current data recovery includes examination of the quality and suitability of the stone for various applications as part of the effort to confirm the intended destination and purpose of the stone cargo. There is currently some data available about the commercial sources of the stone used in the construction of Fort Monroe. One of the early contractors of the stone, Jacob Lewis & Company, agreed on March 7, 1819 to "supply eighty thousand perches (49,500 tons) of granite stones suitable for the building of walls of the most massive kind and size and quality as is generally made use of in the construction of large works" (Lee and Hollister 2016:46). In May and June of that year, the engineer at the fort rejected shipments of stone because of their inferior quality. Apparently, the stone did not meet the specifications for size, but also lacked "at best a good face and good bed and top" for proper bonding (Lee and Hollister 2016:46).

Documentary evidence suggested that there was no single source for the stone used in construction of Fort Monroe and Fort Calhoun (Calhoun 1825). Ships sailed from the Potomac and Susquehanna Rivers, and from Georgetown and Havre de Grace, Maryland, among other places. "The frequency of deliveries and turnaround time of one particular vessel suggest some stone might have come from the James River near Richmond" (Lee and Hollister 2016:44; Wright 2021). However, granite quarry operations in Maryland and the northeast were older and better established commercially than those in Virginia in the nineteenth century, so that much of the supply probably came from the northern/northeastern region of the country (Christopher Bailey 2021, personal communication). A large amount of granite or granite-like stone used in the construction of Fort Monroe was quarried at Port Deposit, Maryland, and shipped to Hampton Roads between 1820 and the 1840s (Kelly 2016). During the period between January 1, 1824 through February 21, 1825, however, quarries on the Potomac near Georgetown supplied nearly twice that destined for Fort Monroe as the quarries along the Susquehanna and provided most of the stone for Fort Calhoun as well (Calhoun 1825:5-7). To help track down the specific source of the Site 44HT0125 stone cargo, the geologist would conduct macroscopical and chemical analysis of selected samples of the cargo material and compare the data with material from known quarry sites in the region.

The comparative examination of cargo stone and construction stone at the forts began with a review of existing documentary information about the stonework at Fort Monroe and periods/episodes of its construction. Access to background information and to areas within the fort was facilitated by the cultural resource staff at the Fort Monroe Authority Casemate Museum. The physical and chemical attributes of the stone from Site 44HT0125 were compared with the similar material at different locations within Fort Monroe and Fort Calhoun to determine whether there was any similarity between the samples, and whether the stone recovered from the shipwreck was intended for use in exterior applications or corresponds to a specific period of construction (Cobb 2009; Lee and Hollister 2016; Wright 2021). As previously mentioned, the north fortification wall of Fort Monroe and other masonry components of the fort were under construction in the early 1830s (as was building the stone base at Fort Calhoun), so these may represent good locations for comparative study of granite samples with the stone cargo from Site 44HT0125 (Christopher Bailey, personal communication 2021; Kelly 2016; Lee and Hollister 2016). In addition, a core sample taken through the stone base of Fort Calhoun/Wool in 2007 was available for study by the geologist. It was anticipated that the geological analyses of the cargo material from the wreck, coupled with compatibility and sourcing studies, would contribute to the overall development of the historic context of Site 44HT0125, and to themes specifically related to the construction of Fort Monroe and/or Fort Calhoun as Third System coastal defenses and the patterns of regional commercial shipping in the early nineteenth century. As mentioned, the Third System of coastal fortifications (1818–1867) was more consistent in design and execution throughout the country than the First System (1794–1812) and the Second System (1812–1818) and had defining features such as masonry or stone construction, high vertical walls, and casemated cannons (NPS 2020).

Data Recovery Methods

Historical Background Review

Fort Monroe, the largest and most complex stone fort ever constructed in America, has always been a work in progress (Kelly 2019; Lee and Hollister 2016). In fact, within a couple of decades after the start of its actual construction in 1819, the fort began to undergo refurbishment and repair; even as the originally planned construction of the facility was coming to an end in the 1840s. The fort was modified to various degrees over the next century and a half. More recently, the transition of Fort Monroe from U.S. Army control to that of the NPS in 2011 prompted a renewed consideration and effort toward its long-term preservation. This included a thorough assessment of its condition and a previously unmatched program of archival research into its history. During the past decade, Fort Monroe was extensively studied and documented by the staff of the Historic Structures Research and Documentation Branch (HSRD), other branches of the Historic Architecture, Conservation, and Engineering Center (HACE), NPS, Northeast Region, and the Fort Monroe Authority staff. The results of that work are presented in the HSR for the property (Lee and Hollister 2016). The available HSR document and access to the Fort Monroe Authority Casemate Museum Library and Archives at Fort Monroe served as important sources of information for the W&MCAR Project Historian, David Lewes, and other team members in the data recovery project.

Fort Calhoun was studied in light of the project goals and available resources as well. Michael Cobb, a noted historian, author, and retired curator of the Hampton History Museum/Director of the Fort Wool Historic Site, shared his extensive knowledge about the history of the fort with Mr. Lewes and other team members and insight into important historical documentation.

The background review utilized the relevant documentary information (e.g., U.S. Army Engineer Record, historic maps) and research results compiled by the HSRD and others (Kelly 2019; Lee and Hollister 2016). In addition to research at the Casemate Museum and Archives, the National Archives at Philadelphia were searched for information that could contribute to the project. The resources at these facilities helped the project historian to further develop the historic context for Site 44HT0125 to allow for contextualization of the NRHP eligibility of the site under Criteria A and C.

Maritime Archaeology

Dr. Gordon Watts, Jr. and his team from Tidewater Atlantic Research, Inc. (TAR) utilized 3D photogrammetry of the 20 general framing timbers, two centralized framing timbers, and two pieces of planking. Agisoft computer software program was used to generate a high resolution 3D image of each timber and plank element for study from any observation point. Such information allowed detailed descriptions of the vessel elements, which aided in the interpretation and reconstruction of the vessel as well as identification of unique attributes. The researchers integrated the 3D imagery with historical vessel design data from late eighteenth- and early nineteenth-century shipbuilding plans and treatises to hypothesize a reconstruction of the Site 44HT0125 vessel from different perspectives. Vessel-specific historical research was carried out in the TAR maritime library, the Mariners Museum, and through other web-based resources and repositories. The findings include a description of each structural element and relationship to the overall design of the ship, a graphic reconstruction of the ship, a determination of the age and possible origin of the vessel, and specific design elements of the vessel that relate to the transport of the quarried granite block cargo.

Geological Analysis

In coordination with the Project Historian, Dr. Christopher Bailey, Professor in the William & Mary Department of Geology, began his study of the quarried granite blocks with a background review of historical and contemporary documents associated with the sourcing of stone for Fort Monroe/Fort Calhoun as well as stone quarries that operated in the Mid-Atlantic region (i.e., Central Virginia, Chesapeake Bay region in Maryland) during the early to mid-nineteenth century. This research was facilitated by a database compiled by William & Mary geologists on granitic rocks in the Richmond/Petersburg area. The background review was followed by fieldwork to collect data and document the stone resources. More specifically, fieldwork consisted of the collection of 12 stone samples, including four representative samples each from the stone cargo of the 44HT0125 shipwreck, Fort Monroe/Fort Calhoun, and stone quarries along the Chesapeake Bay near Havre de Grace, Maryland. The stone source at each location from which the samples were taken was catalogued, described, and photographed. Additionally, Dr. Bailey used hand-held XRF (x-ray fluorescence spectroscopy) to characterize the major element rock chemistry from surfaces of the rock. For each of the 12 samples (about 1–2 kg each) collected, petrographic thin sections were cut and prepared for whole rock chemical analysis (major, minor, and trace elements). He examined a core sample, stored at the Hampton History Museum, that was taken from the stone-filled base of Fort Calhoun (Fort Wool) 15 years ago prior to the installation of a flag pole base on the interior of the fort. The background research, data collection, and analyses were intended to identify and confirm the potential source of the quarried blocks and any physical/chemical correlation with the stone components of Fort Monroe and Fort Calhoun.

Project Archaeologist Thomas Higgins accompanied Dr. Bailey the day of his visit to the VDOT storage facility to collect data from the stone cargo. In coordination with David Stroud, Director of Heritage Assets and HPO, Fort Monroe Authority, and Paul Presenza, Fort Monroe Archaeologist, Mr. Higgins and Dr. Bailey visited Fort Monroe and collected stone samples and documented the process. Mr. Higgins also joined Dr. Bailey during a visit to Fort Wool in the fall of 2021 (after the end of bird nesting season at Fort Wool, a migratory seabird nesting site) to collect samples of stone from predetermined locations (based on prior coordination with the VDOT cultural resource staff). Mr. Higgins helped to document the analysis and sample collection process with digital photography and GPS of the sample locations.

Dendrochronology

Dr. Carol B. Griggs, of the Cornell University Tree Ring Laboratory, analyzed a series of wood core samples from selected ship timbers collected by Tidewater Atlantic Research, Inc. for the dendrochronology study. Oak and pine are suitable and, occasionally, tulip popular. The preliminary data from the Site 44HT0125 vessel ship timbers indicated that most of the elements are white oak with sapwood present, so that the assemblage was suitable for dendrochronological study. Given that the sampling process is destructive to portions of the timbers, the sample collection took place after the completion of data collection by the maritime archaeologist, so as not to impair that study. This timing allowed Dr. Griggs to consult with the maritime archaeologist regarding his findings. Detailed notes were taken concerning each wood core/slice sample and its context. Samples were analyzed by polishing them to a high standard, measuring ring widths under a microscope, plotting ring width series on semi-log graphs, and cross-matching against the Cornell University Tree-Ring laboratory computer database of local, regional, and national reference chronologies. Interpretations from the dendrochronological analysis included identification of the type and source of the wood used in the construction of the ship, the dating evidence for the vessel, and identification of the likely region of the shipyard where the vessel was constructed.

Report Preparation, Artifact Curation, and Public Participation

The W&MCAR compiled the final report with chapters by the consultants, historical context by the W&MCAR Project Historian, and introductory material, research design and methods, and general conclusions and recommendations regarding NRHP eligibility. The report of data recovery results follows the guidelines established by the Advisory Council on Historic Preservation (ACHP) and the VDHR (2017), *American Antiquity* style guidelines, and the Department of the Interior's 'Format Standards for Final Reports of Data Recovery Programs" (42 FR 5377-79, January 28, 1977).

Per guidance from the VDHR, the ship timbers, stone cargo, and other artifacts recovered during this project were not conserved or processed for curation. Following completion of the data recovery, the assemblage of recovered materials will be offered to the Fort Monroe Authority Casemate Museum to add to its collection. If the Casemate Museum declines to accept the assemblage, it will be offered to the Hampton History Museum or the Mariners Museum in the City of Newport News, Virginia.

3: Historical Context

For centuries prior to construction of Fort Monroe, the point of land overlooking the shipwreck site and Hampton Roads was a focus of settlement and strategic interest. Before the arrival of English settlers in Hampton Roads in 1607, the lower portion of the James-York Peninsula lay within the territory of the Kecoughtan Indians. Until the 1590s, the Kecoughtan had thrived as an independent tribe in territory that may have extended from Old Point Comfort (Fort Monroe) to the Warwick River in present-day Newport News (Tyler 1952:13). According to accounts by native inhabitants collected by English writers in the 1610s, the Kecoughtan territory had once included a 3-acre town with 300 houses and up to a thousand people. The inhabitants had cleared two or three thousand acres in the vicinity for horticultural plots that supplemented their hunting, fishing, and gathering subsistence (Brown 1891:I:503–504; Strachey 1953:68). When the elderly Kecoughtan weroance ("leader") died in the mid-1590s, however, the mamanatowick ("great king") Powhatan took the opportunity to subject the population to his paramount chiefdom, comprising 32 groups with a population of 12,000 and territory extending across Virginia's Tidewater as far north as the Potomac River. Powhatan had his men kill the succeeding weroance and expel most of the Kecoughtan to the Piankatank River and other areas already under his control (Rountree 1989:118–119).

When Capt. John Smith visited the Kecoughtan community in September 1607, it had a reduced population under the leadership of Powhatan's son, Pochins (Rountree 1989:117). Smith observed a settlement containing 18 houses spread across 3 acres (Haile 1998:150). Smith's description of the landform seems consistent with the present site of Fort Monroe (Higgins et al. 1995:11, 13) (Figure 3.1). Kecoughtan most likely consisted of a dispersed settlement, typical of this period. Ethnohistorical and archaeological research documents scattered complexes of small, low-density sites (Blanton et al. 2005; Moore and Lewes 2005; Rountree et al. 2007:171). These loose groupings of homesteads, comprising several hundred people, were often scattered along a mile or more of riverbank (Rountree et al. 2007:33). William Strachey described such a pattern in his 1612 *History of Travel into Virginia Brittania*:

> Their habitations, or towns, are for the most part by the rivers or not far distant from fresh springs, commonly upon the rise of a hill, that they may overlook the river and take every small thing into view which stirs upon the same. Their houses are not many in one town, and those that are stand dissite and scattered, without form of a street, far and wide asunder (Haile 1998:635).

Every few years, as cultivation depleted the soils in a family's garden plots, the lightly built house of bent poles covered with bark or deerskins and the horticultural plots would be shifted to a new location several hundred yards away. At the time of Smith's visit, the most densely populated portion of Kecoughtan appears to have been a small complex of habitations around the weroance's house on the spit of land now occupied by Fort Monroe (Higgins et al. 1995).

Figure 3.1. Vicinity of Old Point Comfort and the Kecoughtan community in the early seventeenth century (Smith and Hole 1624).

Settlement to Society (1607–1750)

Upon settling at Jamestown in 1607, the first English colonists in Virginia recognized the strategic military and commercial importance of the point of land that overlooks the shipwreck site and one of the world's largest natural harbors—Hampton Roads. A fortified battery of guns at this strong point could ward off Spanish naval assaults on the settlements at Jamestown and elsewhere along the lower James River. The English named the point of land where Fort Monroe now stands Cape Comfort because of the relief they felt on discovering the adjacent deep channel of Hampton Roads to accommodate their ocean-going ships. The present name, Old Point Comfort, came into use in the eighteenth century after the naming of a New Point Comfort at the mouth of nearby Mobjack Bay (Lee and Hollister 2016:26).

In 1609, only two years after establishing the Jamestown settlement 35 miles up the James River, the English built Algernon Fort on Old Point Comfort. The triangular wooden stockade contained quarters for a garrison of 40 men, a magazine, and a storehouse. Weaponry included up to seven artillery pieces of various sizes as well as small arms (Lee and Hollister 2016:27). Following an attack by the Kecoughtan Indians, the fort was the scene of treachery. Virginia's newly arrived governor, Sir Thomas Gates, invited a party of Kecoughtan Indians to an English musical performance and had his men murder five of them (Morgan 1975:81). In 1610, Gates assumed complete control of Kecoughtan territory and drove away all of its native inhabitants (Starkey 1936:9).

These early English settlers recognized the point's special strategic value due to its location only a mile across from Willoughby Shoal. "By reason of the shoals which lie on the south side," colonist-historian William Strachey noted, "this fort easily commands the mouth of the river" (Strachey quoted in Haile 1998:418). Captain John Smith referred to the spit where Fort Monroe now stands as a "little Ile fit for a Castle" (quoted in Weinert and Arthur 1989:3).

After Algernon Fort burned in the late winter of 1612, the garrison worked on a replacement in the same location through the spring. In addition to fortifying the point against enemy ships, the colonists built two additional forts. Fort Charles may have stood at Strawberry Banks or possibly to the southwest along the west bank of the Hampton River, while Fort Henry was situated farther inland, somewhere on the east side of the Hampton River. The purpose of both was to stave off Indian attacks from the wooded hinterland (Brittingham and Brittingham 1947; Percy 1922:268; Tyler 1952:223–224).

Over the next decade, the English colony did not have the resources to maintain fortifications and especially ordnance in permanent readiness at the mouth of Hampton Roads. Various reports mention two to four artillery pieces at the point through the late 1620s, but the replacement of Algernon Fort had decayed. It was not until 1630 that Old Point Comfort saw the construction of a new more substantial fort, completed in 1632. The General Assembly enacted "castle duties" consisting of taxes on cargos coming into the colony and on the first crop of each new immigrant. Despite these measures, the fort at Old Point Comfort soon fell into decay as the government diverted the special tax revenues to other projects. As a direct result of this neglect, Virginia shipping on the James River fell victim to costly raids during the Anglo-Dutch Wars, one in 1667 and another in 1673. An attempt to build another fort at Old Point Comfort following the first attack failed after a hurricane destroyed the foundation and carried away building materials while the project was still under construction (Weinert and Arthur 1989:5-12).

Beginning with the War of the Spanish Succession in the early eighteenth century, Virginia governors sought to rebuild the fortifications at Old Point Comfort to protect the colony from potential European enemies. Virginia's people and their legislative representatives responded with indifference, however, until 1728. At that session, the General Assembly voted to build a fort of sand-filled brick cribs. When completed in 1736, Fort George appeared impressive with its outer walls of masonry. Modest expenditures by a reluctant legislature in 1744 provided enough funds for basic repairs. Only five years later, however, a hurricane revealed the weakness of the outer brick walls of the sand cribs. Although the garrison survived the storm in its quarters, floodwaters swept away most of the fortification (Figures 3.2 and 3.3). After this disaster, only a caretaker remained at the ruined fort to watch over the ordnance. Eventually, he received an increased salary from the legislature for his initiative to maintain a navigation light on the point (Weinert and Arthur 1989:13-17).

Colony to Nation (1750-1789)

During the Revolutionary War, Fort George remained a ruin, leaving Hampton Roads and the James and York Rivers open to British depredations. When the British were on the verge of defeat in October 1781, Lord Cornwallis chose Yorktown and Gloucester for a last defense rather than Old Point Comfort. The spit of land lacked a good source of drinking water for his large force, and materials to build fortifications were not available nearby. Nevertheless, Admiral de Barras, commander of the French Atlantic Fleet supporting the Allied ground forces, found it worthwhile to position naval artillery on Old Point Comfort as a precaution against any British naval force that might come in aid of Cornwallis. After the British surrender, the French removed their guns, and Old Point Comfort remained unarmed and unfortified until the years following the War of 1812 (Weinert and Arthur 1989:17-18).

Early National Period (1789–1830)

Very early in the history of the American Republic, political and military leaders recognized the need for a system of defenses to protect strategic locations along the Atlantic Coast. Notably, in 1791, George Washington called for the construction of coastal fortifications. Initially, Congress ignored the suggestion and in general saw no need for an organized national defense (Weinert and Arthur 1989:21). With the Wars of the French Revolution spilling into the Atlantic Ocean and threatening American commerce, however, in 1794 Congress appropriated $173,000 for construction of coastal fortifications and purchase of 200 guns. The commitment to protect harbors also supported the growth of the Navy. The Naval Armament Act funded the Navy's first six frigates. When the United States suspended relations with its old ally of the American Revolution, the Quasi-War with France ensued. Equipped with warships, the new Navy was able to protect American merchantmen in the Caribbean from French privateers (USS *Constitution* Museum 2019). The 1794 appropriation marked the beginning of what is known as the First American System of Coastal Defenses (1794-1803).

During this stage, the United States had few trained engineers and continued to rely on some of the French military engineers who had served the Allied armies during the American Revolution. With the fall of the Bourbon monarchy, many of these expatriate engineers no longer held allegiance to the French Revolutionary regimes that followed and were eager to find employment in the United States. Although a few fortifications from this period survive, the emphasis was on impermanent construction of logs and earth. During this stage, there were no defenses at Old Point Comfort; the Old Point Comfort Lighthouse was the sole federal project in Hampton Roads of this period, funded in 1798 and built 1802-1803 (Lee

Figure 3.2. Detail from a late eighteenth-century map showing the vicinity of Old Point Comfort and remnant fortifications from Fort George (W.P.M. 1780).

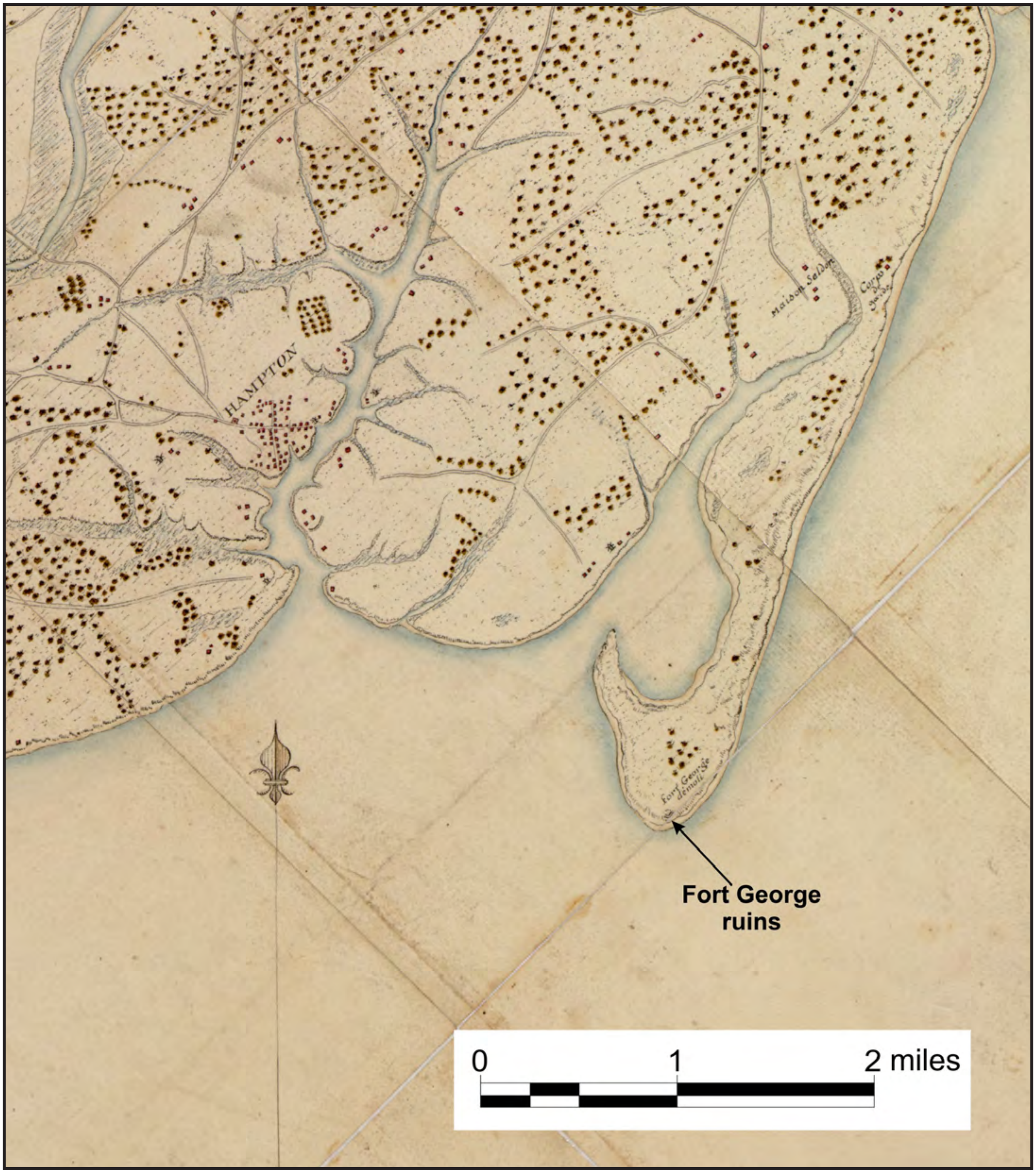

Figure 3.3. French military map of Hampton area showing "demolished" Fort George during the American Revolution (Anonymous 1781).

and Hollister 2016:31-32). The entire scheme ended under the Administration of Thomas Jefferson, who favored a fleet of 177 gunboats to operate as needed near the coast and thereby minimize the need for coastal fortifications. With an annual cost of $2.8 million to maintain the so-called "mosquito" fleet, however, Jefferson's plan proved unsustainable (Brown 2015:9-14).

Interest in the need for coastal defenses revived following the *Chesapeake-Leopard* affair of 1807. This capture of the *Chesapeake* by the British frigate HMS *Leopard* underscored the continued dangers to American shipping despite the young nation's official neutrality in the Napoleonic Wars. The British commander justified the action by removing some crew of the American ship who had deserted from the British Navy. The assault had cost the lives of four American sailors and wounded 17 others; in addition, the British Navy tried and executed one of the four deserters after a trial in Nova Scotia. American shipping was vulnerable to the navies of both Britain and France, each trying to interdict the trade of the other with American commerce in order to gain an advantage in the wars. Policy makers feared that enemy vessels would not restrict their actions to commercial vessels on the high seas but might also seek to enter American national waters and even make incursions into coastal harbors. In 1808, Jefferson realized the need for renewed efforts to fortify key assets along the coast, and Congress appropriated a million dollars for this purpose (Brown 2015:14-16).

The *Chesapeake-Leopard* Affair and the ensuing surge of funding ushered in the Second American System of Coastal Defenses (1808-1812). After the establishment of the United States Military Academy and its engineering school in 1802, design of the new fortifications relied more heavily on American engineers. Permanent fortifications built of masonry characterized the second system, though designs often combined masonry outer walls with earth-filled ramparts. In the lower Chesapeake region, the government focused attention on fortifications close to its Navy anchorage in Norfolk. Fort Norfolk on the Elizabeth River and Fort Nelson protecting the Portsmouth Naval Hospital were two products of the Second System, but the Navy had only a small portion of the 65 gunboats that were essential to the area's defensive planning (Figure 3.4). In addition, the absence of fortifications on Old Point Comfort and near Cape Henry and Cape Charles left the Chesapeake Bay and Hampton Roads open to enemy fleets, with disastrous consequences in the ensuing War of 1812 (Lee and Hollister 2016:31, 32).

On June 22, 1813, coastal batteries at Craney Island and a combined force of militia and sailors thwarted a British amphibious attempt to capture the port of Norfolk and the frigate USS *Constellation* (see Figure 3.4). Stung by the defeat, the British and particularly the *Chasseurs Britanniques,* a group of French Royalist mercenaries, visited their revenge on the residents of Hampton in a well-documented rampage of looting, murder, and rape (Rouse 1968). With the *Constellation* and other American vessels trapped in Norfolk, the British used Lynnhaven Bay as an anchorage, with the Old Point Lighthouse possibly serving as a lookout post, as they raided with impunity along the Chesapeake Bay and its tributaries (Shackelford 1952:458). In August 1814, the British fleet under Adm. George Cockburn supported a sack of Washington, D.C. by British Army units under Maj. Gen. Robert Ross. The withdrawal of American forces allowed the British free rein to burn many of the capital's major public buildings (George 2000:105–110). The exposure of major coastal rivers and ports and the ensuing humiliation of the entire federal government leaving its capital city to the depredations of a foreign army underscored the need to invest in substantial, effective coastal defenses.

The conclusion of the War of 1812 and the Treaty of Ghent ushered in the Third American System of Coastal Defenses (1816-1867). With the goal of creating an effective, comprehensive,

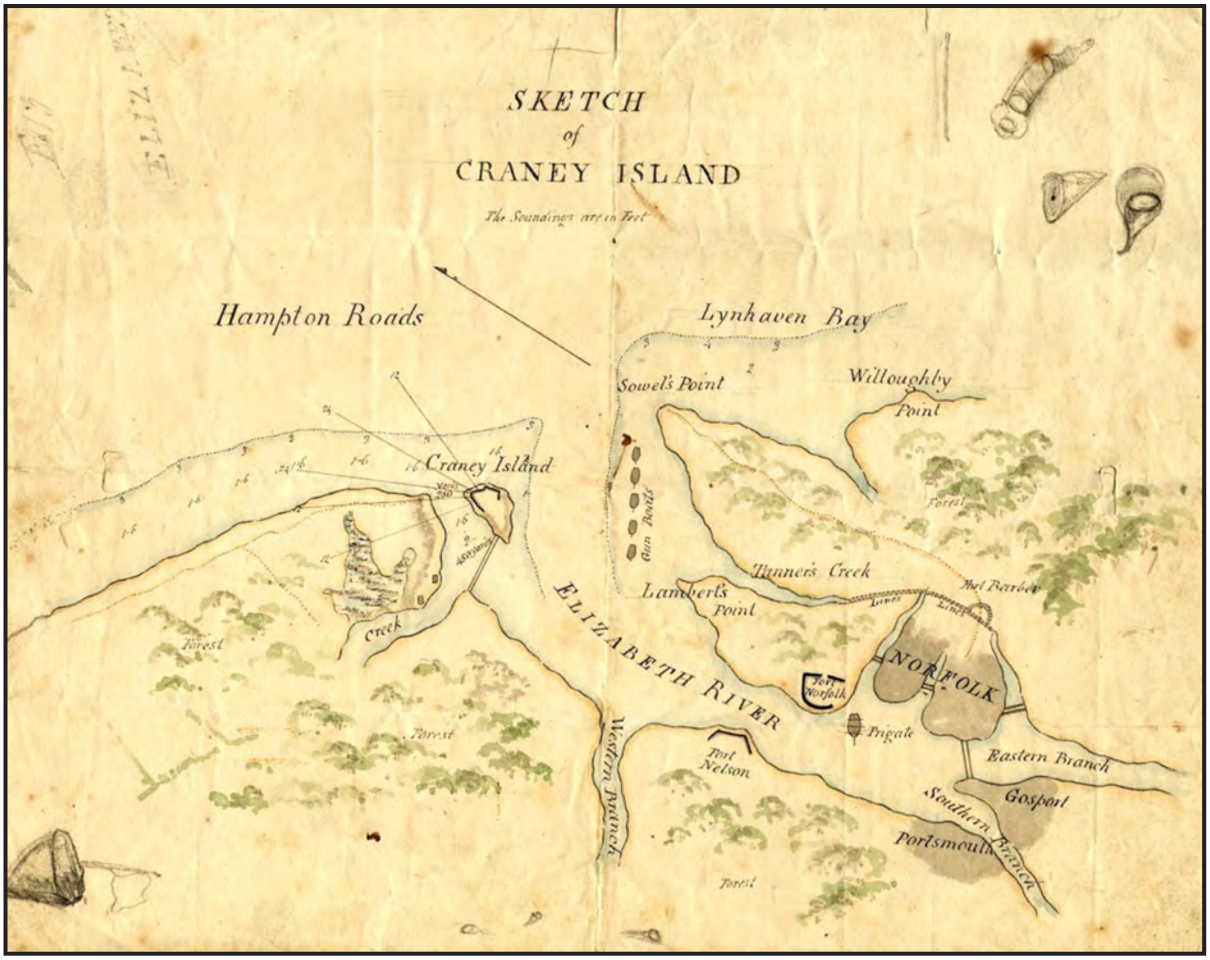

Figure 3.4. Map of the vicinity of Norfolk during the Battle of Craney Island, June 22, 1813 (Anonymous ca. 1813).

and integrated system, acting Secretary of War George Graham formed a Board of Engineer Officers (also known as the Fortifications Board) in November 1816, selecting four members from the Army and one from the Navy. Together, they conducted a careful review of existing fortifications and potential new fortification sites that required months of travel. Following this research phase, they provided recommendations for improvements, new fortifications, and a broad coastal defense strategy. Even though American engineers were available (trained at West Point since the establishment of the United States Military Academy in 1802), Graham did not select Gen. Joseph G. Swift, the Army's Chief of the Corps of Engineers, to lead the board. Instead, he chose Simon Bernard, a recently immigrated French officer (Lee and Hollister 2016:33). Bernard had been a fiercely loyal officer of Napoleon Bonaparte and even had pleaded to follow the emperor into exile on the island of St. Helena in 1815 (Figure 3.5). When Napoleon's British captors refused, Bernard rejected an offer to serve the Russian czar and instead determined to continue his career in the United States (Lesnard 2020:103). Enclosing a letter of recommendation from the Marquis de Lafayette, Bernard wrote to Henry Jackson, the American chargé d'affaires in France. Bernard impressed Jackson as well as government officials in the United States with his education at the renowned French engineering school, the *École polytechnique* (then known as the *École centrale de travaux publics*), and an ample portfolio of bridges, roads, and fortifications built for Napoleon's campaigns. Through an Act of Congress in April 1816, he received a commission as brevet brigadier general and an appointment as Assistant Engineer with the same compensation as the Chief of the Corps of Engineers (Planchot 1962:88-89).

The board recommended construction of 53 forts along the Atlantic and Gulf coasts, and the government followed through with construction of 42 of these proposed works, mostly on existing islands and manmade islands (NPS 2020). With its broad set of objectives and an ample schedule, the board provided continuity and centralization of planning. The members decided on the priority of sites for construction, chose officers to supervise the building projects, and provided design specifications. The Chief Engineer reviewed plans, and the Secretary of War gave the final approval (Brown 2015:21). A key characteristic of the Third System fortifications that contrasted with the preceding systems included a commitment to brick and stone construction for durability and greater security against enemy naval artillery. Sophisticated designs incorporated strong protected interior spaces called casemates, built of arched masonry (Figure 3.6). The sturdy construction also allowed the stacking of casemates with openings for artillery. Multiple stories of gun positions allowed the defenders to concentrate overwhelming firepower from as many as a hundred guns on a single front, which overmatched the broadsides of guns on even the largest warships (NPS 2020).

Figure 3.5. Brevet Brigadier General Simon Bernard, Assistant Engineer in the United States Army Corps of Engineers and designer of Fort Monroe and other key coastal fortifications, here depicted in his uniform of Napoleon Bonaparte's Grande Armée (Casemate Museum Collection).

With the support of Congress (through annual appropriations), President James Madison, and then President James Monroe, the Third System received enough funding for construction of substantial fortifications that fit within the broader scope of a national defense strategy. As articulated by President Madison, the vision for the new system involved an "adequate regular force, the gradual improvement of the naval force, and…improving all the means of harbor defense" (quoted in Brown 2015:20). The regular army force would receive support from militia units as needed. Other infrastructure improvements would include a network of interior lines of communication such as roads and canals, allowing for efficient movement of military personnel and materiel behind the coastal defenses. By 1821, the Board had completed its research and issued a report elaborating on these general principles. By this time, the Board no longer included two of its original members. General Swift had resigned

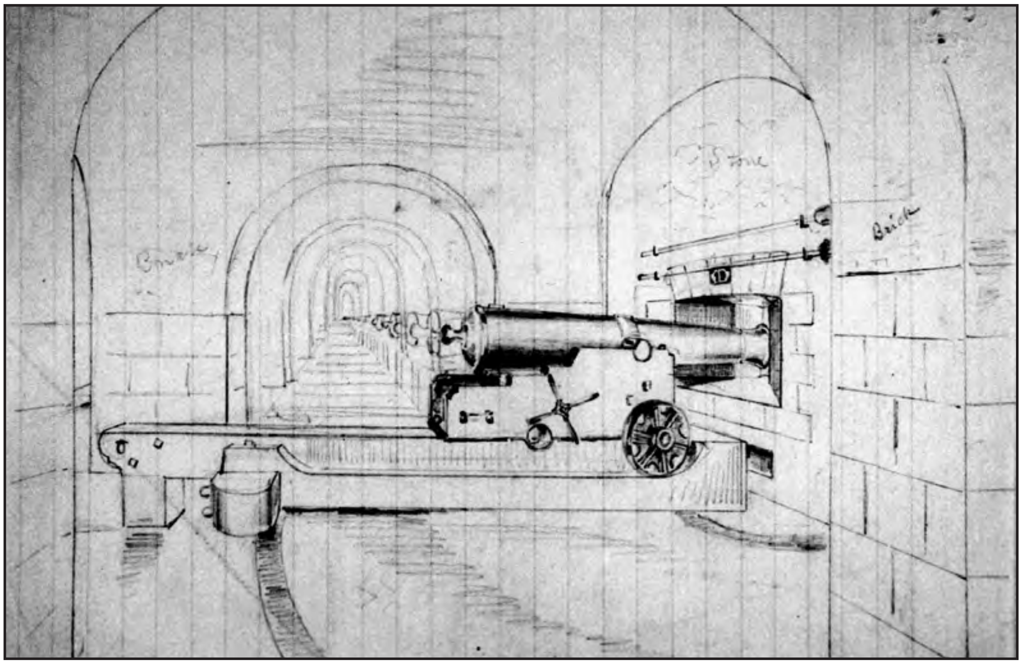

Figure 3.6. Sketch of Fort Monroe casemates with artillery in the Water Battery (no longer extant) (Davis ca. 1861–1865).

from the Army in November 1818, and Lt. Col. William McRee in March 1819. Both men, along with Maj. Joseph Totten (who continued his career in the Corps of Engineers), resented the leadership of the board by a foreigner, Bernard (Weinert and Arthur 1989:26-28).

Specific to the defense of the Chesapeake Bay, the report laid out objectives for situating fortifications at the entrance of Hampton Roads. Their purpose would be,

> …to close this road against an enemy and to secure it to the United States; to secure the interior navigation between the Chesapeake and the more southern States; to make sure of a naval place of arms, where the navy of the United States may protect the Chesapeake and the coasting trade; to cover the public docks, etc., at Norfolk, and those which may be established in James River; and to prevent an enemy from making a permanent establishment at Norfolk (Weinert and Arthur 1989:28).

Even though the fortifications at the entrance to Hampton Roads could not prevent an enemy fleet from using Lynnhaven Bay as an anchorage, their presence was key to dissuading a land attack on Norfolk. "But if Hampton road [*sic*] is fortified," the board members reasoned, "[the enemy's] march…may be turned by our forces crossing at Hampton road, and he will find impossible to take permanent quarters in the country." Cost was another convincing factor. An estimated $1.8 million to build the fortifications was a "trifling sum if compared with the magnitude of the advantages which will be procured and the evils which will be averted" (Board of Engineers 1821 annual report, quoted in Weinert and Arthur 1989:28).

Given the commercial and strategic importance of the Chesapeake Bay and the Navy's installations at Norfolk and Portsmouth, the defense of Hampton Roads received the highest priority, along with Mobile Bay and New Orleans (Cobb 2009:44). While the Fortifications Board prepared recommendations for the lower Chesapeake Bay and other areas, senior officers of the Navy also discussed options for defenses.

An early suggestion to build a fortification on an artificial island in the Middle Ground between Cape Charles and Cape Henry proved impractical because of high costs and vulnerability from shifting currents and shoals (Figures 3.7 and 3.8). Commodores John Rodgers and Stephen Decatur agreed that fortifications on Old Point Comfort and on an artificial island on Willoughby Shoal/Banks would be effective against an enemy fleet trying to enter the James or Elizabeth River through Hampton Roads. With the support of a flotilla, long-range guns in the fortifications could also threaten enemy vessels headed up the Chesapeake Bay (Shackelford 1952:459-461).

In 1817, the War Department formed a Board of Commissioners for Chesapeake Bay to design and implement construction of coastal fortifications specifically for the region. The six-member board included Bernard, Swift, two other army engineer officers, and two naval officers. After completing a survey of the vicinity of Hampton Roads, on January 24, 1818 the board recommended,

> …the occupation of Rip Rap Shoal with a castellated fort; the channel between that shoal and Old Point Comfort with a boom raft [navigation obstruction, probably a chain to be stretched between the fortifications]; and Old Point Comfort itself with an enclosed work; the whole to be so located as to affort (*sic*) mutual protection, and to embrace in total, the power to resist any force which may be brought against the pass into Hampton Roads (Board of Commissioners' report, quoted in Weinert and Arthur 1989:30).

Testament to the importance of the entrance to Hampton Roads, Bernard himself designed Fort Monroe—a showcase of military engineering and the largest and most sophisticated coastal fortification ever constructed in the United States. Along with this seven-bastioned structure, Bernard also

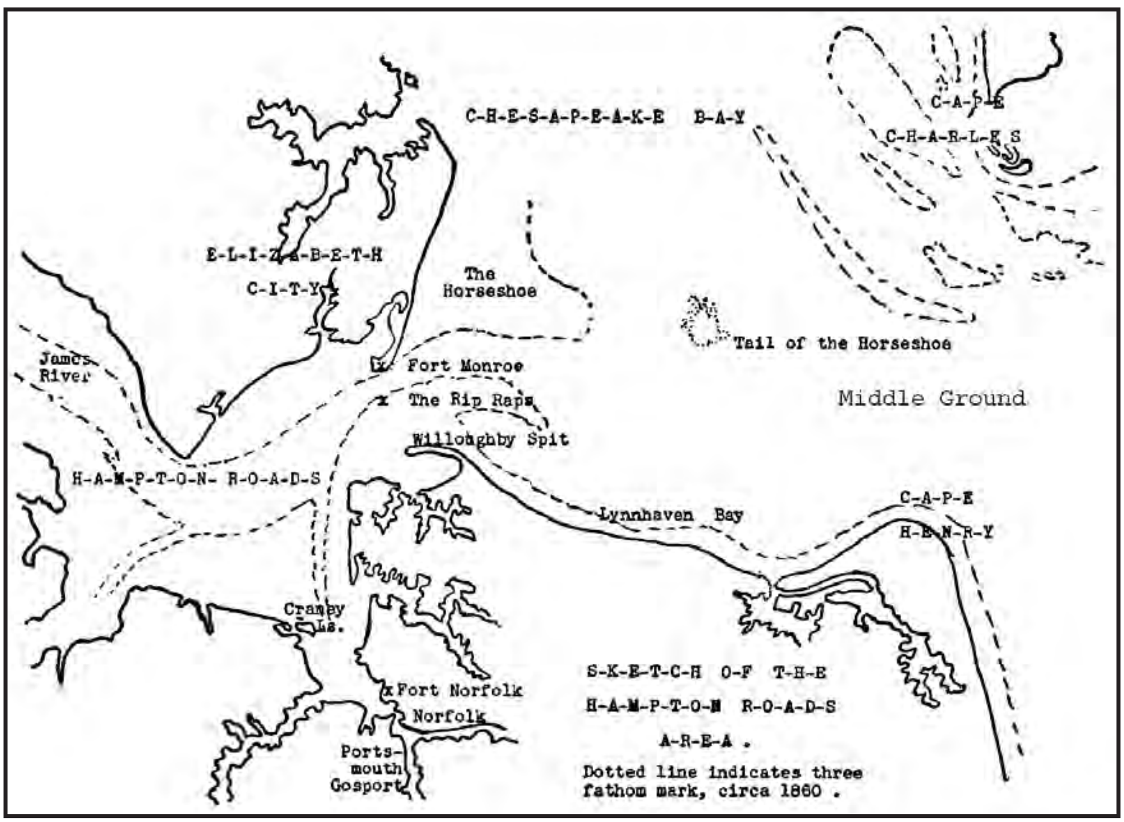

Figure 3.7. Map of the mouth of the Chesapeake and Hampton Roads showing settings considered and chosen for coastal defenses (Shackelford 1952:460).

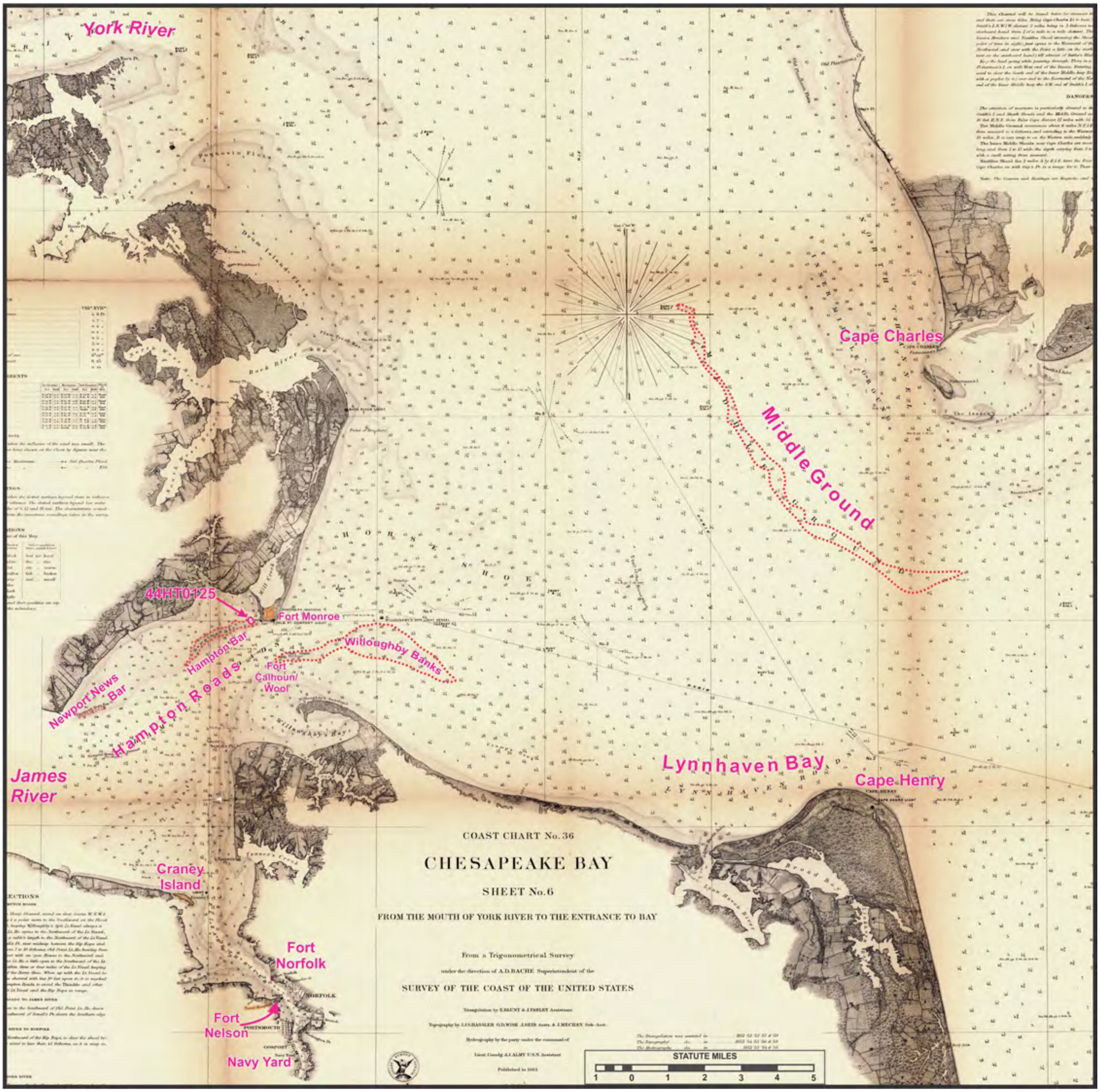

Figure 3.8. Map showing key features and military assets in the lower Chesapeake Bay that influenced the siting of coastal defenses following the War of 1812 (United States Coast Survey 1863).

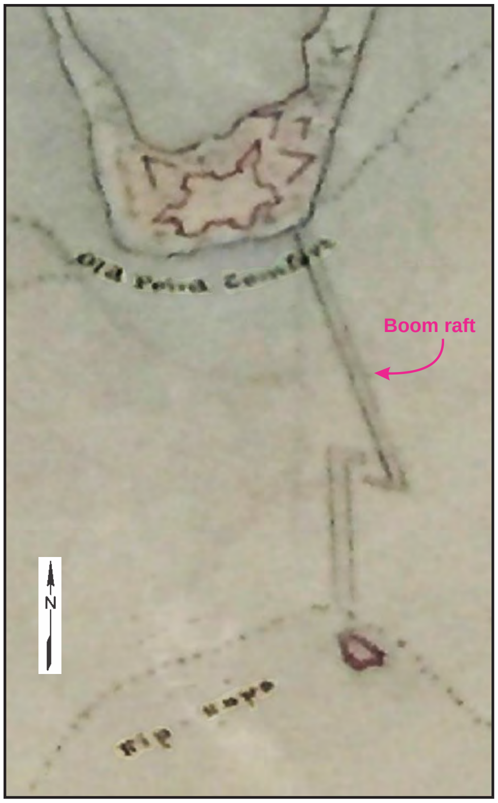

Figure 3.9. Sketch of fortification plan for the entrance to Hampton Roads, ca. 1817 (Poussin 1818, from Lee and Hollister 2016:36).

Figure 3.10. Plan drawing showing fortification on Old Point Comfort and the Rip Raps (Poussin 1818, from Lee and Hollister 2016 38).

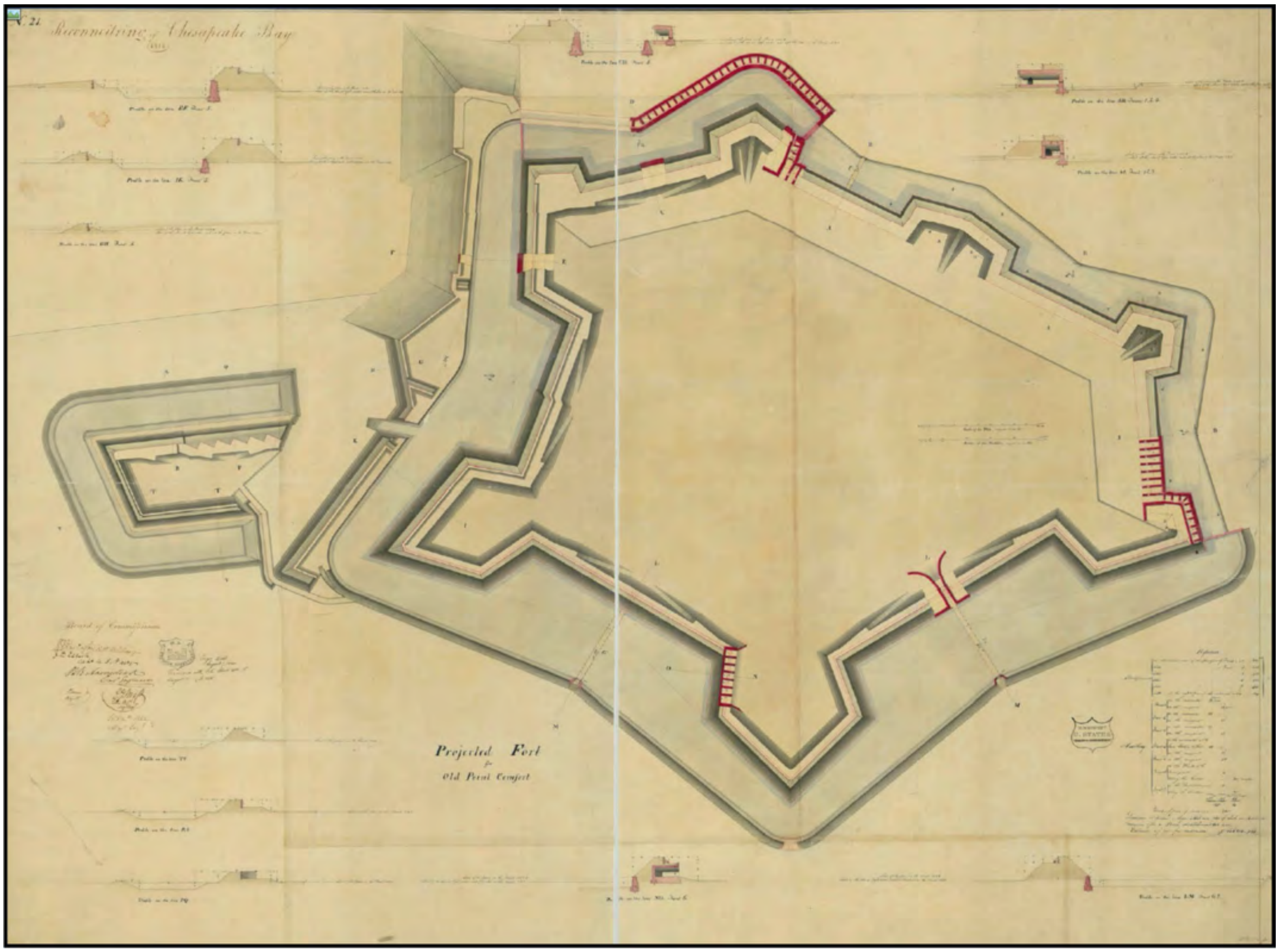

Figure 3.11. Detailed plan drawing of "Projected fort for Old Point Comfort" (Poussin 1818, from Lee and Hollister 2016:38).

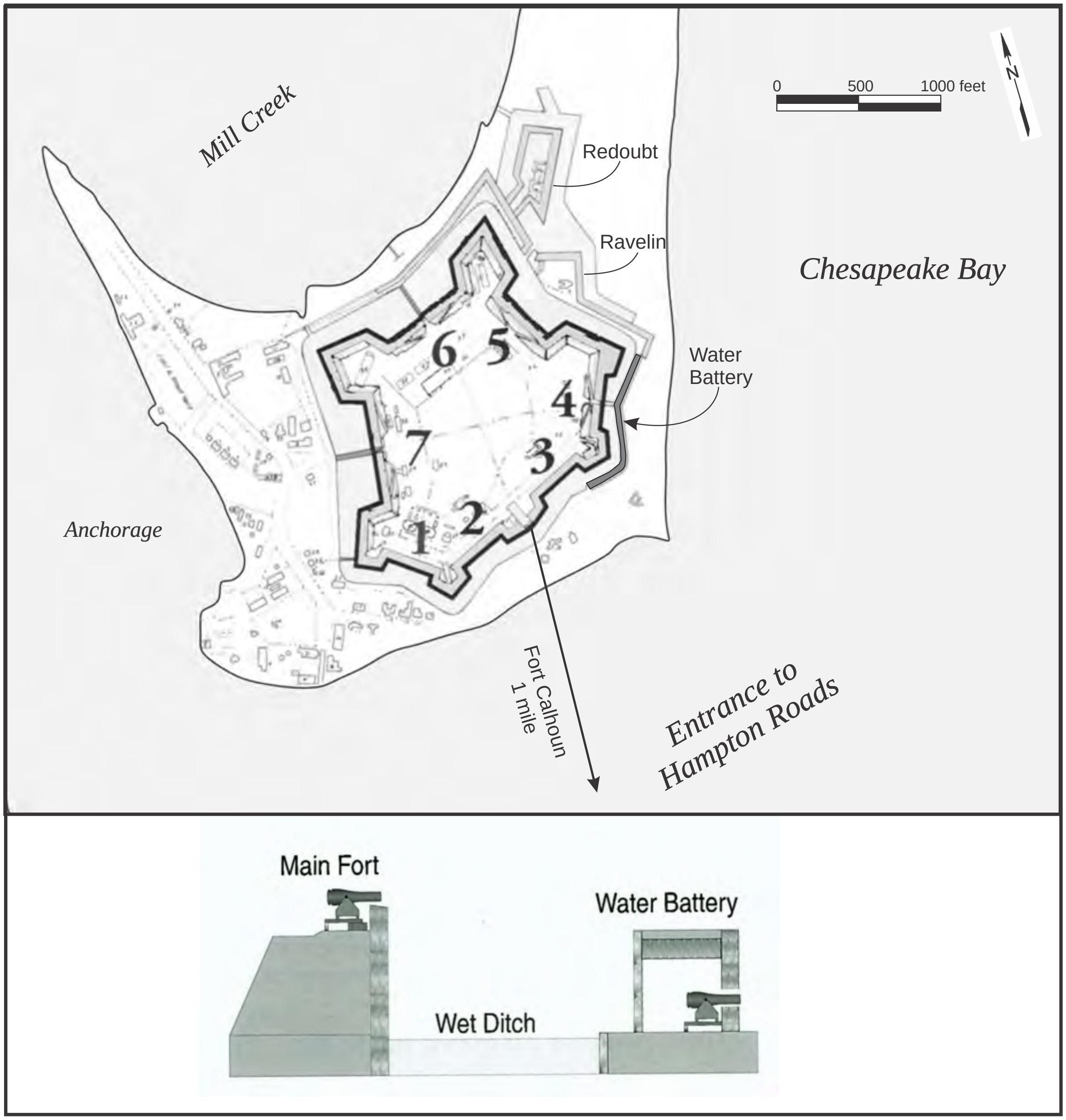

Figure 3.12. Plan of Fort Monroe with labeled fronts and outer works (Weaver 2001:130).

designed four-sided and five-sided coastal forts in Rhode Island (Fort Adams), Brooklyn (Fort Hamilton), North Carolina (Fort Macon), and Alabama (Fort Morgan) (Selin 2014). Bernard favored masonry fortifications with bastions. He modeled Fort Monroe after his design for a masonry fort in the town of Toul along the Moselle River in France (Whichard 1959:I:194).

A rough sketch map of the fortifications at the entrance to Hampton Roads prepared during the board's survey shows the boom raft (probably never installed), a fortification with six bastions, a forward defense on the spit at Old Point Comfort, and the works on the artificial island on the Rip Raps (Lee and Hollister 2016:36) (Figured 3.9 and 3.10). In conjunction with the 1818 commissioners' report, Bernard's aide de camp, Capt. William T. Poussin, prepared drawings based on the brigadier general's concept plan. The layout of Fort Monroe shows its seven bastions on six sides; the longest side (Fronts 2 and 3) had an extra bastion in the middle (see Figure 3.11). In addition, a wet moat surrounded the entire fort. Bernard designed this irregular footprint as an adaptation to the landform to maximize effectiveness, with the long side and its three bastions facing the entrance of Hampton Roads. He augmented the firepower in this general direction with the sides oriented at 45-degree angles to either end of the long front (Weaver 2001:130-131) (see Figure 3.12). Fronts 1–3 had casemates for a tier of guns below the guns mounted *en barbette* along the parapet. Front 4 of the fort only had guns *en barbette*, but a water battery in front of the moat provided the second tier of artillery facing this direction (Figure 3.13). Whereas Front 4 alone could have accommodated only 28 guns, the wider expanse of the water battery presented 40 guns. Front 5, facing the only land access to the fort, was fronted by a redoubt with its own moat and a ravelin (detached triangular outwork). Fronts 6 and 7 included sally ports and covered Mill Creek and the anchorage south of the fort (Klepper 2010:8-4; Weaver 2001:130-131) (see Figure 3.12).

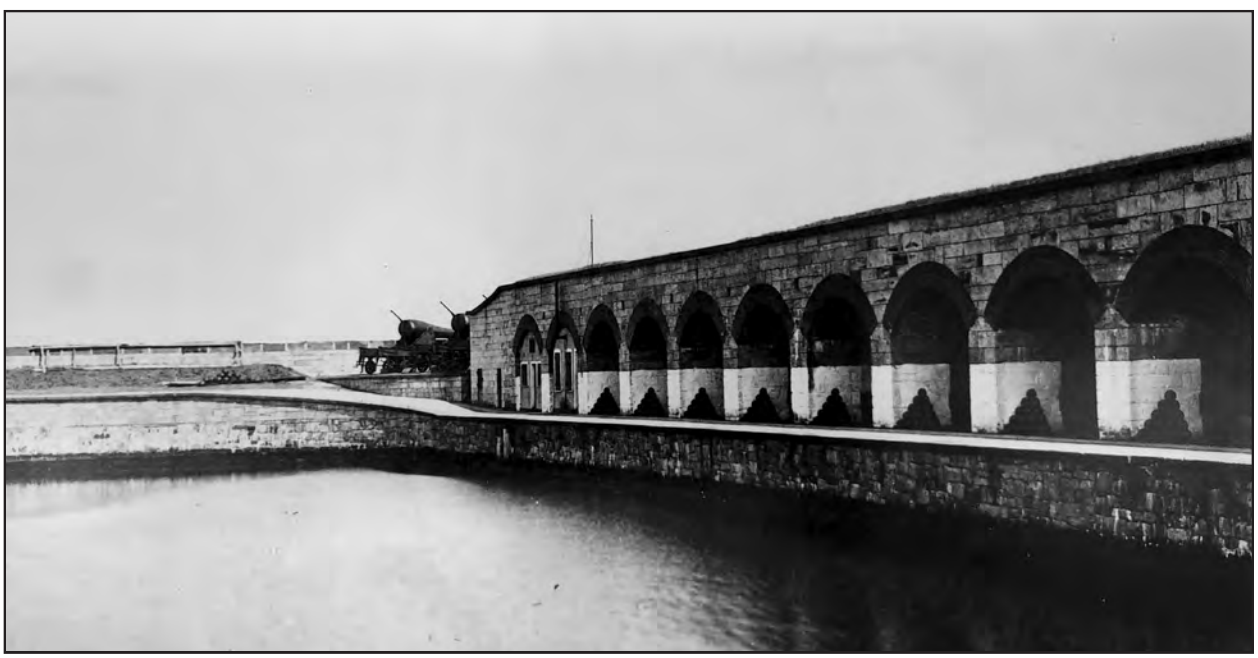

Figure 3.13. View of the Fort Monroe water battery located on the exterior of the moat, taken in 1868 (no longer extant) (Anonymous 1868).

Unlike the efficient construction of the Fort Monroe, progress on Fort Calhoun proved to be such a daunting challenge that this small fortification never reached completion. It would stand on an artificial island of about 15 acres built up with stone deposited on Rip Raps Shoal (Figure 3.14; see Figure 3.8). Building the island on the soft underlying shoal took years longer than anticipated, with repeated phases of island building as this artificial landform sank several inches into the bottom sediments with the weight of construction materials for the fort. The original design called for three stories of guns in casemates and emplacements for guns *en barbette* above the casemates The plan for the fortification was the shape of a very shallow V with the base pointing toward Fort Monroe, a mile to the northwest (Figures 3.15 and 3.16). By November 1825, the filling had raised enough dry ground above the high tide water level at Fort Calhoun for the installation of cranes and a rail system for dragging loads of stone to different areas of the construction site (Shackelford 1952:461) (Figure 3.17). Due to problems with the island settling, however, the original fortification only reached one casemate high plus half of the height of the second tier of casemates above (Figures 3.18 and 3.19). A good example of a contemporary, completed fort with three tiers of casemates is Fort Alexander I, an island fort in the harbor of St. Petersburg, Russia (Shiva 2016) (Figure 3.20).

Beginning in February 1818, the newspapers of Alexandria, Virginia published multiple advertisements for stonemasons needed to begin work on the fortifications at Old Point Comfort. Due to the scale of the project, the availability of local labor, whether free or enslaved, was insufficient for the task. Some of the first may have been 22 men who sailed aboard the sloop *Ocean* on March 3, 1818 (*Baltimore Gazette & Daily Advertiser* 3/4/1818).). The Engineer Department let a contract for masonry construction to Bolitha Laws, who employed both free and enslaved laborers at the site. Census information indicates that he had a labor force of 79 individuals in 1820; of these, 29 were enslaved. Engineer correspondence related to Fort Monroe mentions 16 "Black laborers belonging to Bolitha Laws" (Kelly 2019:4). Whether part of Laws' labor force or not, at least one contingent arrived on the sloop *Patriot* from Alexandria on December 5, 1819 (*Alexandria Gazette and Daily Advertiser* 12/7/1819). In February and September 1819, Laws had placed numerous newspaper advertisements in Alexandria newspapers for the hire of "a number of bricklayers and stone masons, to whom constant employment and good wages will be given" (*Alexandria Gazette & Daily Advertiser* 2/6/1819). In 1820, he advertised for 20 stone masons and 20 general laborers, mentioning that "blacks will be preferred" for the laborer positions (*Alexandria Gazette & Daily Advertiser* 6/21/1820).

As work got underway in mid-June 1818, President James Monroe visited Norfolk and then sailed over to inspect the site of the new fortifications at Old Point Comfort. He toured the construction area with an entourage of government officials, including the Secretary of the Navy Benjamin W. Crowninshield, then-regional Army commander Gen. Winfield Scott, as well as Brig. Gen. Joseph Swift, Brig. Gen. Simon Bernard, and various members of the Chesapeake Bay commission (*Baltimore Gazette & Daily Advertiser* 6/16/1818).

The supply of stone for construction of the fortifications came from a variety of sources. One early contract for supplying construction stone was with Freese's or Friese's quarry at Port Deposit. On July 15, 1818, Robert Fisher and Simon Friese placed an advertisement in a Baltimore newspaper to announce their immediate need for 20 vessels "to carry *Stone* from Port Deposit to Old Point Comfort," agreeing to pay a freight charge of $2 per perch (a unit of measure equivalent to 0.92 cubic yards). The terms called for the ships to land the stone on the wharf at Old Point Comfort. Interested ship owners could contact a Mr. Fisher

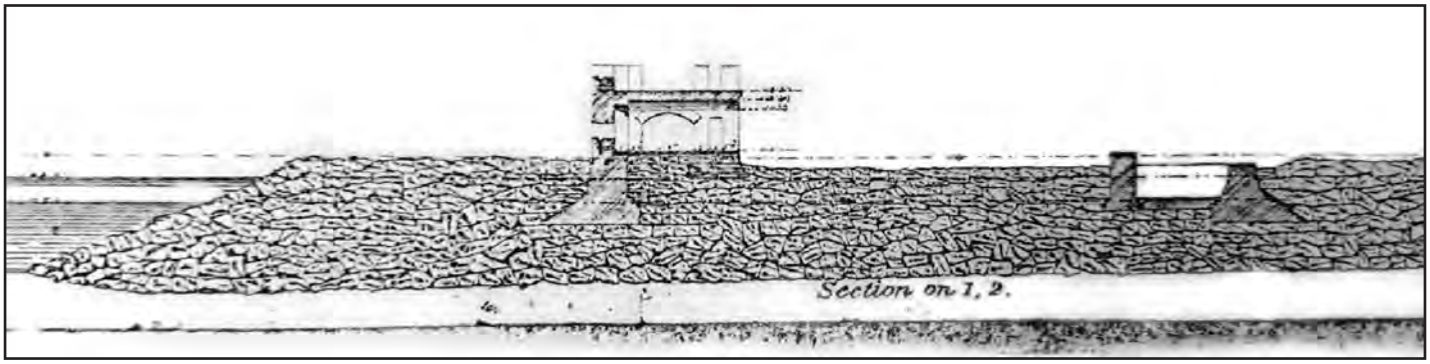

Figure 3.14. Schematic profile drawing with representative casemate to illustrate relative depth of stone base for Fort Calhoun/Wool (dotted lines indicate surface level and high water level) (1886 Engineers' drawing in Cobb 2009:64).

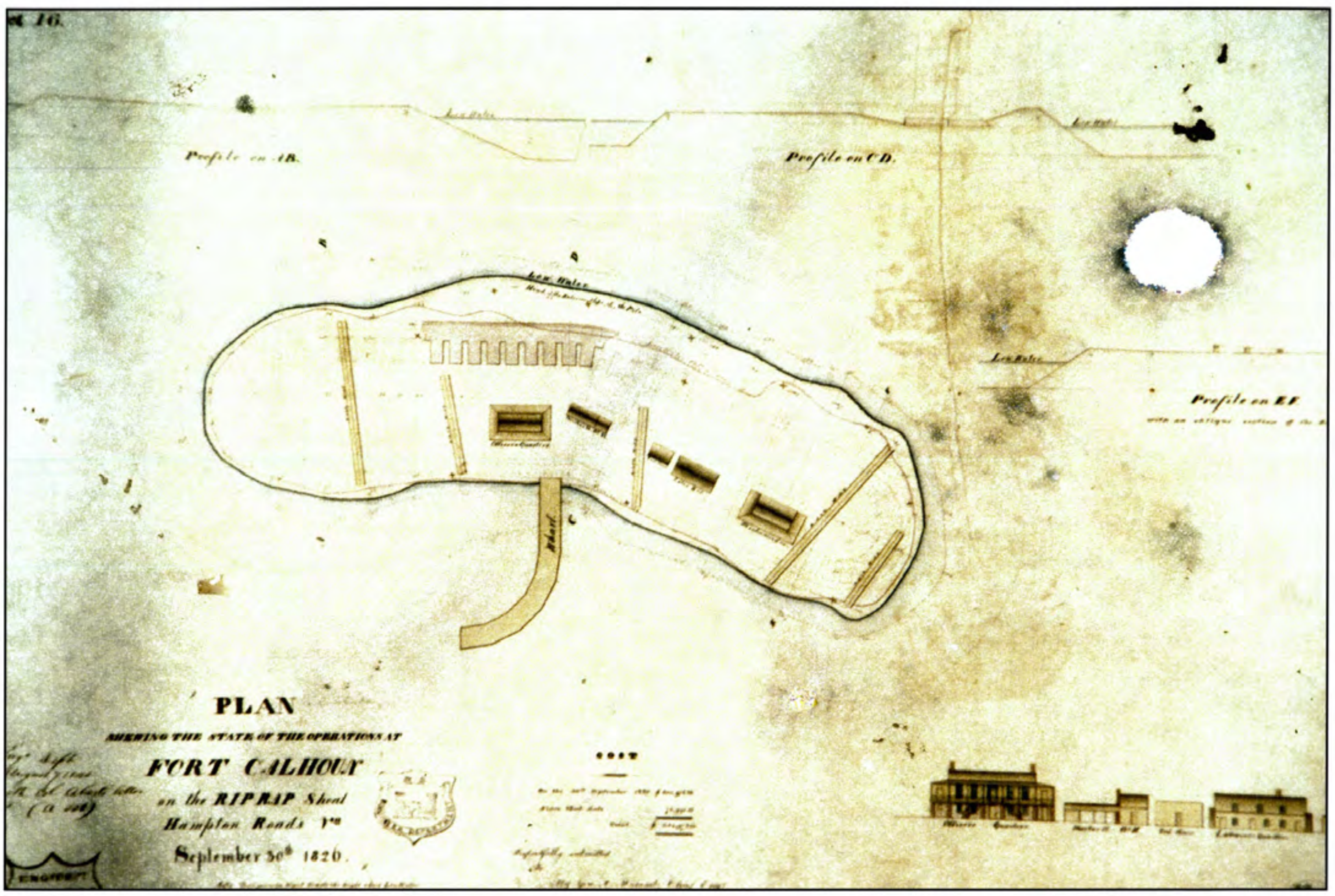

Figure 3.15. Plan of the progress on Fort Calhoun/Wool fortification and buildings as of September 1826 (image scanned from original in National Archives, courtesy of Michael Cobb; see Cobb 2009:65).

Figure 3.16. Aerial view of Fort Wool, 1990s (courtesy of Michael Cobb).

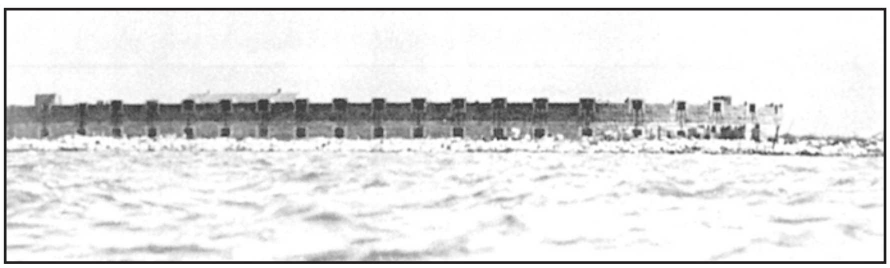

Figure 3.17. Fort Wool, ca. 1900, showing the greatest extent of casemate completion (Cobb 2009:125).

Figure 3.18. Detail view of exterior of casemates at Fort Wool, showing maximum height reached (Cobb 2009:68).

Figure 3.19. Interior of a casemate at Fort Wool, 1990 (photograph by J. Charles, courtesy of Michael Cobb).

Figure 3.20. Example of a completed fort with three rows of casemates and positions for guns en barbette (Fort Alexander I on the Gulf of Finland near Kronstadt Naval Base and St. Petersburg, Russia [Shiva 2016]).

at Spear's Wharf in Baltimore or "the subscriber," Simon Friese, at Port Deposit (*Baltimore Patriot & Mercantile Advertiser* 7/15/1818). A man named Simon Friese appears in an 1819 Baltimore city directory as a "stone mason" (Jackson 1819). He may be the same individual or part of the same family associated with "Freese's Quarry," which supplied granite for construction of Fort Monroe in 1824–1825 according to a Congressional report. The report listed Edward Emmons as the contractor, supplying stone from Freese's Quarry, located on the "east side of the Susquehannah River, one mile and a half above schooner navigation" (Calhoun 1825:7).

Occasional quarrying of granite, or more precisely gneiss, occurred at Port Deposit in the late eighteenth century. By the early nineteenth century, the quarrying industry began to flourish on the hillside behind the town, as demand for building stone in Baltimore increased (Figures 3.21 and 3.22). Quarries opened on similar gneiss deposits across the river during this period as well. As early as 1822, a quarry owner in Havre de Grace and his agent in Baltimore advertized for the hire of "a number of VESSELS" for delivering local stone to Old Point Comfort (*Baltimore Patriot & Mercantile Advertizer* 5/21/1822). Builders prized the material from the lower Susquehanna for its soundness in large engineering projects, while its appealing colors and textures made it a prime choice for house building (Figure 3.23). In 1829, the Maryland Canal Company opened a granite quarry at Port Deposit in 1829 (active until the mid-twentieth century). The town grew on a narrow strip of floodplain with the quarries behind. Eventually, the town expanded into the quarried areas (Blumgart 1996:71, 73, 213).

Not mentioned in the engineer's blotter or correspondence is the quarrying firm of Ebenezer McClanahan, which steadily increased production beginning in the 1830s and shipped 15,000 perches (371,250 cubic feet) to various destinations in 1837. The McClanahan Granite Company flourished through the early twentieth century, benefiting from improvements in railroad transportation connecting Port Deposit to major cities such as Philadelphia, Baltimore, Washington, and Harrisburg. Transportation on light vessels remained the most economical means for shipping to more distant markets like Richmond and Hampton Roads (Blumgart 1996).

An early stone contract with Elijah Mix, executed on July 18, 1818, generated significant controversy and eventually led to a Congressional inquiry concerning its propriety. Unlike other contracts executed by the Chief Engineer's Office, no advertisement preceded the Mix contract for 150,000 perches of stone. The federal government had not yet standardized procurement policy for the Engineer Department, but it was becoming common practice to publish advertisements to invite bids for large contracts (*Congressional Serial Set* 1, Report 109).

By December 1818, although stone was arriving on a regular basis from multiple sources, the Engineer Department advertised a request for proposals for additional contracts to supply 80,000 perches of building stone and 2,000 tons of white free stone "of the most durable quality". The deadline for proposals was February 28, 1819 for contracts with firms that could deliver stone before January 1, 1821 (*Alexandria Gazette & Daily Advertiser* 12/9/1818). In addition, the department sought contracts for delivery of Thomastown lime (for mortaring) to Old Point Comfort from February through April and then to Fort Washington (on the Potomac) later in the year; each construction site required 2,000 casks (*The Alexandria Herald* 2/1/1819). That summer, the Engineer Department placed another advertisement for the supply of 80,000 casks of 5 bushels, with at least 10,000 casks scheduled for delivery by mid-September. The department also required the supplier to post a $10,000 bond to ensure delivery (*The Alexandria Herald* 7/28/1820).

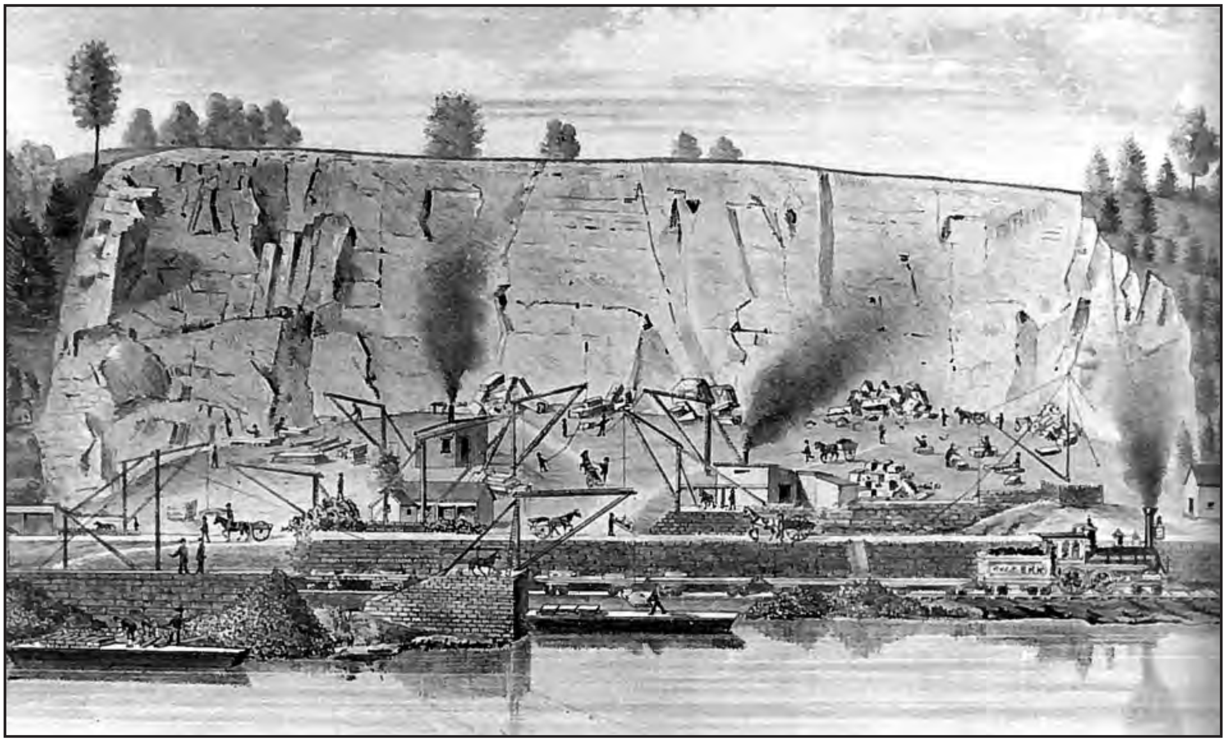

Figure 3.21. Late nineteenth-century sketch of the McClanahan quarry at Port Deposit, on the left bank of the Susquehanna River about five miles upstream of its confluence with the Chesapeake Bay (Blumgart 1996:212).

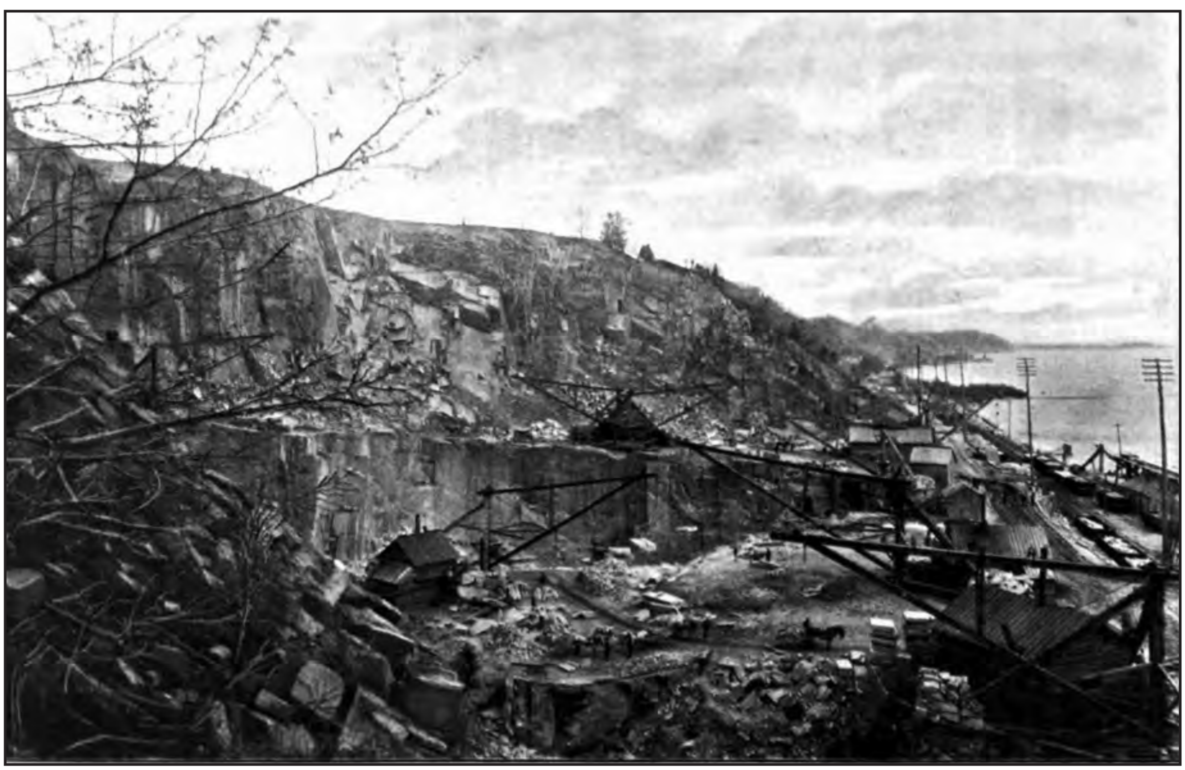

Figure 3.22. View of quarrying operation at Port Deposit in late nineteenth century (Maryland Geological Survey 1898).

Figure 3.23. Gneiss from Port Deposit quarry used in local construction in Maryland (Blumgart 1996:72).

Supplies of stone on a large scale were arriving by August 31, 1819, when some 20 to 30 vessels and their cargoes destined for Old Point Comfort moored in the "Bite" of Craney Island to take shelter from an approaching storm (*Baltimore Patriot & Mercury Advertiser*).

Due to activity associated with construction of Fort Monroe and the Rip Raps, regular weekly steamboat service between Washington, D.C., and Norfolk included a stop at Old Point Comfort (*The Alexandria Herald* 8/22/1820).

One early contract for the supply of stone was to Young & Carter of Fredericksburg. Correspondence between the Engineers' office in Washington and Maj. Charles Gratiot, the engineer in charge at Old Point Comfort, indicates that by mid-March 1819 the government had executed a contract for free stone (rock that lends itself to cutting in any direction). In October, Gratiot received instructions from his superior to render assistance to the firm's shippers in unloading the stone. On December 6, the Engineers' Department reported a $3,000 advance to the firm for the supply of free stone (Engineer Correspondence, Oversize Box 1, Casemate Museum).

Stone also came from quarries on the Potomac River. In August 1822, John Donahoo advertised for the hire of vessels to transport stone from Georgetown to Old Point Comfort. Donahoo noted that he could be contacted at Patterson's quarries in Little Falls (on the left/north bank), presumably the source of the material (*Alexandria Gazette & Daily Advertizer* 8/22/1822).

Reports of Shipwrecks Related to Work on Fortifications, 1817–1823

Despite an abundance of information in the fortifications' engineering records about the vessels arriving with stone cargo, the documents examined at the Casemate Museum and the National Archives in Philadelphia contain no reports of stone cargo vessels wrecked on Hampton Bar. The only identication of a wreck reported in engineering records was a fortuitous discovery of a brief report from 1817 discovered in a box of of miscelleous brief reports at the main National Archives branch in Washington, D.C. while conducting research for another project. As an alternative source to engineering records, research also focused on brief reports of shipping news published in Alexandria and Baltimore newspapers. During the period of construction, newspapers in these busy port cities provided information that was vital to the flow of maritime commerce, especially through notices of ship arrivals, losses, and the connection of suppliers to ship owners/freight carriers. Through 1823, reports of three wrecks associated with the stone supply to the forts appeared in the newspapers available in searchable databases of scanned newspapers for these cities (America's Historical Newspapers; Library of Congress: Chronicling America). There were additional reports of wrecks involving the transport of stone to Old Point Comfort, but some could be excluded because the article confirmed that the location of sinking was not Hampton Bar. In another, the vessel could be eliminated because it sank on Hampton Bar while carrying a cargo of wooden staves, not stone (*Baltimore Patriot & Mercantile Advertizer* 3/23/1820). In addition, evidence of another wreck occurred in the Congressional record because of an award approved in 1853 to an owner whose vessel sank "while in the employ of the United States in transporting stone to the Rip Raps" (*Congressional Record,* Chap. CXIV).

An 1816 chart of the lower York River and Hampton Roads shows the location and extent of Hampton Bar during this period (Figure 3.24). At the request of the Board of Navy Commissioners studying the options for defenses of the lower Chesapeake, Navy Chaplain David Phineas Adams prepared the chart based on surveys he conducted during his year-long posting in Norfolk. Although Adams refers to the chart as a "hasty sketch" in his note to Commodore Stephen Decatur written in the lower left corner of the chart, he provides most detailed depiction of the Hampton Roads shoreline and its hazards before the mid-nineteenth century. Though a chaplain, Adams was also a Harvard-trained former professor of mathematics and astronomy who had taught at what is now Columbia University. During his service as a Navy chaplain in the War of 1812, he took command of three prizes captured by the frigate U.S.S. *Essex* off Cape Horn and prepared the first detailed charts of those coastlines as well (Cox 2015).

During the first stages of site preparation for Fort Monroe in 1817, Capt. Frederick Lewis, the engineer in charge, submitted a report summarizing progress on the first year of construction. As a wharf in a cove known as "Hawkins Hole" or "Mother Hawkins Hole" neared completion, interruptions occurred due to "the arrivals of cargoes of stone, and by the sinking of a sloop laden with that material near & in front of it" (Lewis 1817). On the 1816 chart, Hawkins Hole could refer to the waters between the Old Point Comfort landform and the smaller bar northeast of Hampton Bar (see Figure 3.24).

On November 25, 1819, the schooner *Handy* "loaded with stone for Old Point Comfort" sank at an unspecified location that could have been Hampton Bar (*Alexandria Gazette & Daily Advertiser* 11/25/1819). Two factors are suggestive. First, the rescue vessel took the survivors to Norfolk, which presumably would have been close to the site of the wreck; even though Hampton was very close to Site 44HT0125, the planned destination of rescue ship may have been the much larger port of Norfolk. A second factor was the relatively shallow water where the *Handy* sank. The schooner's captain, Thomas Kelly, reported that he, a Mr. Greene, and another individual clung to the rigging for nine hours after the hull had submerged, so that the water must have been shallow enough for the mast to rise above the surface as the vessel rested on the bottom. There were seven individuals aboard, perhaps all crew members; four of them drowned.

Figure 3.24. Early nineteenth-century chart showing shallow hazardous areas in Hampton Roads, including Hampton Bar just west of Old Point Comfort, the site selected for construction of Fort Monroe (Adams 1816).

One wreck, on October 18, 1821, did not occur on Hampton Bar but nonetheless is worth mentioning to illustrate the hazards of the stone unloading operation. Captain Cox's schooner *Fame* (110 tons capacity, out of Baltimore) had unloaded some of its stone cargo "alongside the Pile at Rip Raps" when a strong gale came up suddenly. The wind must have pushed the schooner against the rocks. With the impact, the vessel "broke in two, and filled so quick as not to allow time to the crew to save even their cloathing [*sic*], but compelled them to make a precipitate escape to the pile of Rocks." Eventually, the boat belonging to Fort Calhoun's engineer, Captain Dumas, rescued the men. The vessel had "gone entirely to pieces" so that only the masts were recovered (*Baltimore Patriot & Mercantile Advertizer* 10/21/1821).

Sometime in 1822, the schooner *Relief* sank in an unreported location "while in the employ of the United States in transporting stone to the Rip Raps" from Georgetown. It was not until 1853 that the Committee on Claims of the U.S. House of Representatives awarded Captain Huffington $2,000 for the loss of his vessel (H.R. 363, 32nd Congress, 2/23/1853). In this case, the government appears to have been contracting directly with the freight enterprise and assumed liability for the loss. The more common arrangement was for contracts with stone suppliers, who then were responsible for arranging transportation. Given the cumbersome flow of currency and payments during this era, the engineer at Old Point Comfort would pay the captain in cash for the satisfactory delivery, and the captain handed over the payment to the stone supplier upon returning to home port. The captain then received his payment from the supplier (Engineer Department 1819).

A heavy storm in early April 1823 wrought havoc on shipping in the lower Chesapeake. On its way from Baltimore to Edenton, North Carolina, the schooner *Polly Ashbee* stopped in at Norfolk after losing both of its anchors and its cable. The next morning, April 3, revealed an unnamed schooner, "laden with stone" aground on Hampton Bar with the "sea making a fair breach of her" (*Baltimore Patriot & Mercantile Advertizer* 4/5/1823). Given the dire condition, it is possible that the vessel sank as a total loss on the bar.

Antebellum Period (1830–1860) and Civil War (1861–1865)

By 1834, much of the masonry work at Fort Monroe was complete. The Chief of Engineers' 1834 annual report indicated that, "all of the permanent parts of this work were completed last year. The casemates were ready for guns, and the quarters prepared for housing the garrison" (Weinert and Arthur 1989:34-35). At this point, large amounts of granite cargo logged in by the engineers were carrying material to build up the artificial island at the Rip Raps or for the construction of Fort Calhoun.

During this period, Lt. Robert E. Lee was in charge of construction at Fort Calhoun (Figure 3.25). His station at Old Point Comfort lasted from May 7, 1831 to November 1, 1834. While supervising construction on the island, he lived at Fort Monroe initially, then moved to Fort Calhoun for most of 1834. There were long absences in 1833 and 1834 while he took part in survey expeditions in Ohio (Shackelford 1952:463).

In a letter Lee wrote to his commanding officer and close friend, Capt. Alexander Talcott, there is a brief description of an April 7, 1834 storm event involving multiple wrecks. Author Douglas Southall Freeman quoted from the letter in a footnote of his four-volume biography of Lee:

> Two vessels carrying stone went on Hampton bar and one of them split open. Two ran aground near the mouth of Mill creek but were gotten off that night. One large schooner was lost at the head of the bar and a child, two women, and a man with a broken thigh were rescued while she was sinking (excerpt of April 7, 1834 letter in Freeman 1934:I:120, footnote 38).

Figure 3.25. Portrait of Lt. Robert E. Lee painted in 1838 soon after his service as a military engineer at Fort Monroe and Fort Calhoun (1831–1834) (courtesy of Michael Cobb).

The footnote in Freeman's work, though represented as a direct quote, is actually a very liberal paraphrase. Review of the original manuscript letter reveals that Freeman condensed Lee's paragraph and omitted several details that are of interest in determining whether any of the vessels might correspond to Site 44HT0125. The letter began with a summary of relatively minor storm damage at both fortification sites. Lee also reported that the engineers' "ship of operations" that ferried men and supplies to Fort Calhoun had "weathered the Gale in the handsomest manner." Lee then began to sign off with "love to all" because he had to soon board a boat, but resumed with a description of the disaster involving five cargo vessels:

> There are 2 stone vessels — Hooper & Philadel — on the Bar[.] The 2nd sp[l]it open. The 1st [now], [Bilged] &c. The James Eleanor & Gibraltar, stone vessels, were aground near the mouth of the Creek deserted by the crew, got off last night & it is not known where they are. Another large Schooner from Phil[a] bound to Petersburg with iron pipes, lost at the head of the Bar, we took off of her 2 women, child & a man with his thigh broken Saturday, She was [then] [sinking] (Lee 1834).

From this unedited text, it is evident that one large schooner "was lost" on Hampton Bar, but it could not correspond to Site 44HT0125 because it had a cargo of iron pipes intended for delivery to Petersburg. The other four vessels, all carrying cargoes of stone, were smaller schooners. One of these potentially could represent Site 44HT0125. The *Philadelphia* was completely destroyed or "split open", while the *Hooper* suffered relatively minor damage and the *James Eleanor* and *Gibraltar* "got off" the bar, although Lee did not know where they went afterward.

An account of the same event appeared three days later in the *Alexandria Gazette,* filling in additional details about the vessels, including the captain's last name after the name of the vessel:

> *Disasters by the Gale.* — The schooner Philadelphia, Outten, from Port Deposite [*sic*], with a cargo of stone for the Rip Raps, was run foul of by an Egg Harbor schooner on Friday night, which struck her adrift, and she ran on Hampton Bar and sunk. The schooner which ran foul of the P. also ran ashore on Hampton Bar, and was afterwards seen with her colors flying in the main rigging. A female passenger was landed from her.
>
> We have since learnt that the above schooner is the Mark, from Philadelphia, with cast iron pipes for the Aqueduct at Petersburg. She is full of water—crew saved.
>
> The schr. Gibralter [*sic*], Hubbard, from do, with stones for the Rip Raps, is supposed to have sunk. Her crew having abandoned her.
>
> The schr. Mary E. Hooper, Keene, from Port Deposite with stone for the Rip Raps, sunk on Hampton Bar.

> The schr. James Eleanor, James, is ashore on Hampton Bar—apprehensions are felt for her safety (*Alexandria Gazette* 4/10/1834).

The news report indicates that the grounding of the *Philadelphia* and the larger schooner *Mark* first involved a collision near Fort Calhoun. Captain Outten may have moored near the island in the hope of waiting out the storm when the *Mark* "ran afoul" of her and caused her to slip her moorings. Both vessels then headed to the treacherous shallow bar. From the accounts of both Lee and the news reporter, it is clear that the *Philadelphia* broke apart and sank. If the *Mark* eventually sank, there was time enough for a rescue party to carry off survivors.

The news report described the *Mark* as "an Egg Harbor schooner", sailing out of Philadelphia. Egg Harbor may indicate a port in New Jersey that could have given its name to a special design of schooner or rigging. This vessel had a cargo of cast iron pipes for delivery to Petersburg for construction of an aqueduct. The *Mark* was the "large schooner" that Lee had described but not named, and he mentioned rescuing four individuals from the vessel (*Alexandria Gazette* 4/10/1834).

Other information from the news report is consistent with Lee's description of events, though not as detailed in the eventual outcomes—the survival of at least two vessels, the *James Eleanor* and the *Gibraltar*. The reporter does add one useful detail by writing the full name of Captain Keene's schooner, the *Mary E. Hooper* rather than just the *Hooper* as Lee hastily wrote it.

By 1834, with the completion of Fort Monroe, all deliveries of stone shifted to building the periodically sinking island on the Rip Raps and for its fortification structure. Given that the geological analysis below in Chapter 4 identifies the shipwreck's cargo as the particular type of stone used in the construction of Fort Monroe and not in Fort Calhoun, wrecks that postdate the completion of Fort Monroe can be eliminated as representing Site 44HT0125.

From its completion through the Civil War, Fort Monroe remained a strategic point of military control over Hampton Roads and southeastern Virginia. Determination to hold onto the fort early in the Civil War provided a staging area for the Union Army's Peninsula Campaign and allowed the federal government to maintain control of its gains in southeastern Virginia early in the war.

A map prepared during the Civil War shows the Hampton Bar with dangerously shallow depths extending west from the southern end of the western shoreline of Fort Monroe. A detail view of an 1863 chart shows a narrow gap between Hampton Bar and the Old Point Comfort landform that mariners had to carefully navigate through to avoid mishap. Several reports of vessels running aground on the bar appear during this period (Appendix A). In favorable weather, the vessel could be hauled off or floated off the shallows on a rising tide. In heavy weather, however, a hard impact with the shallow bottom could destroy a vessel and cause human casualties.

Reconstruction through World War II (1866–1945)

Charts of Hampton Roads document the bar and adjacent shipping channels with frequent editions in the late nineteenth and early twentieth centuries (1872, 1878, 1899, 1921, 1930), all showing the narrow opening between the bar and Old Point Comfort as a means to access the shoreline on the west side of the fort, as well as the Hampton Flats behind the bar and Hampton Creek leading into downtown Hampton. By 1941, dredging work across the flats had created a 12-ft.-deep channel leading nothwest to Hampton Creek (Figure 3.27).

Figure 3.26. Overlay of 1860s nautical chart, showing the location of 44HT0125 (Bache 1863).

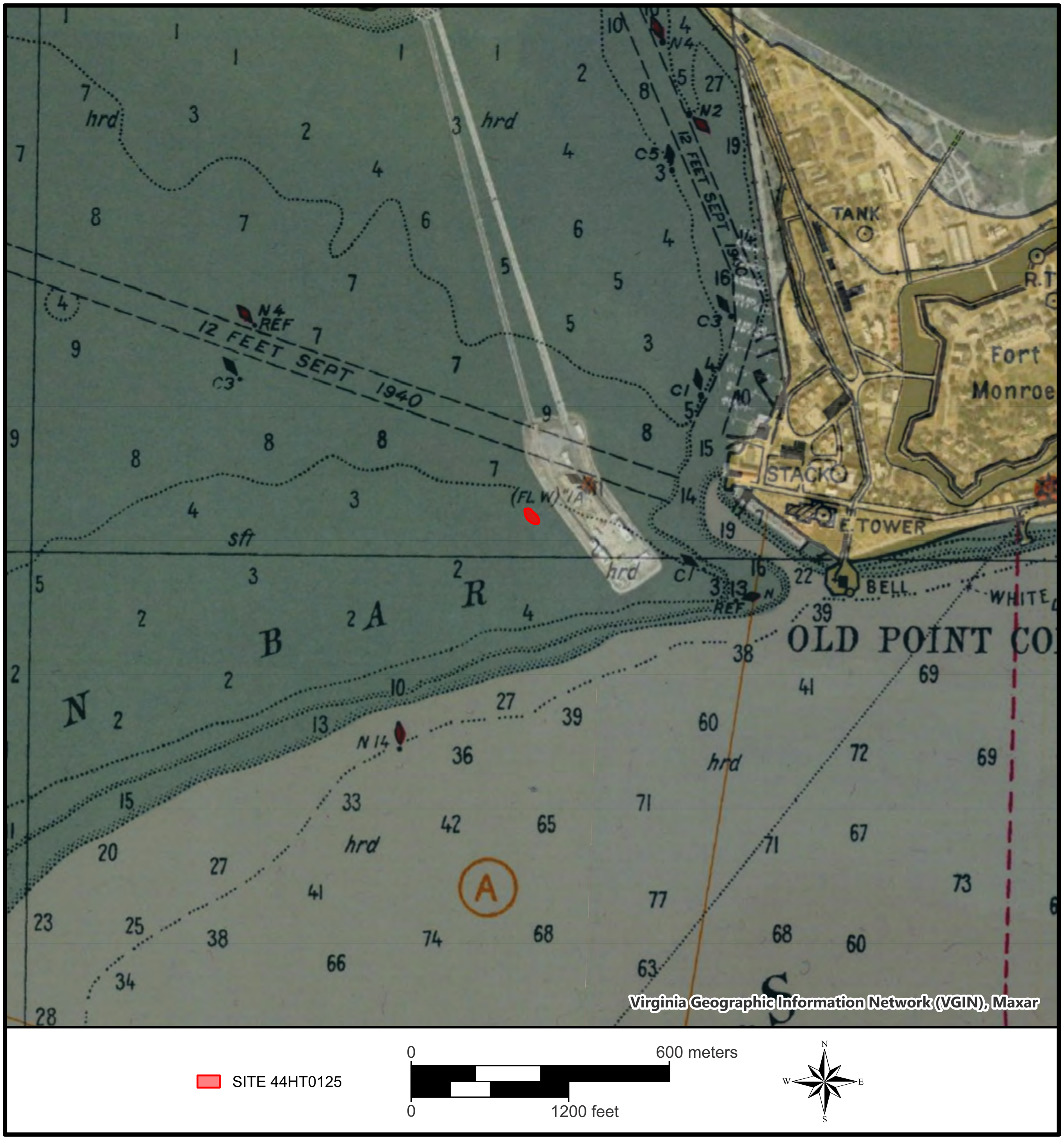

Figure 3.27. Overlay of 1941 nautical chart, showing the location of Site 44HT0125 (USCGS 1941).

New Dominion to Present (1946 to Present)

By the 1960s, the construction of the original Hampton Roads Bridge Tunnel had created the need for a major alignment modification of the channel. Since the approach to the tunnel cut across the previously dug 12-ft.-deep channel, a new segment of channel was dredged through the eastern portion of Hampton Bar so that vessels could gain access into Hampton Flats and Hampton Creek. This dredging occurred only a few hundred feet west of Site 44HT0125. A chart drawn in 2020 shows that the channel remained in the same location and is within the corridor for the current expansion tunnel (Figure 3.29).

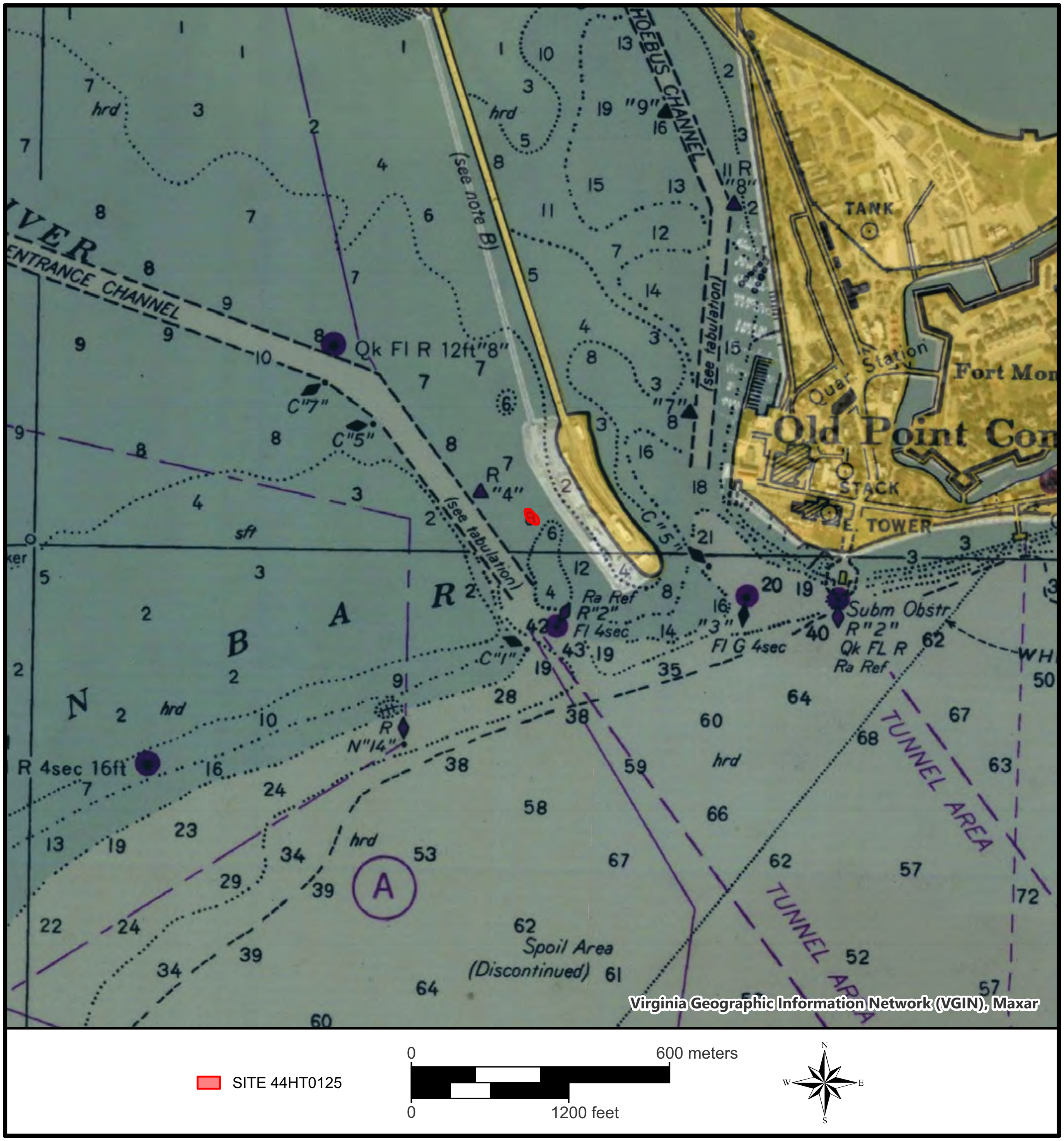

Figure 3.28. Overlay of 1960s nautical chart, showing the location of Site 44HT0125 (USCGS 1966).

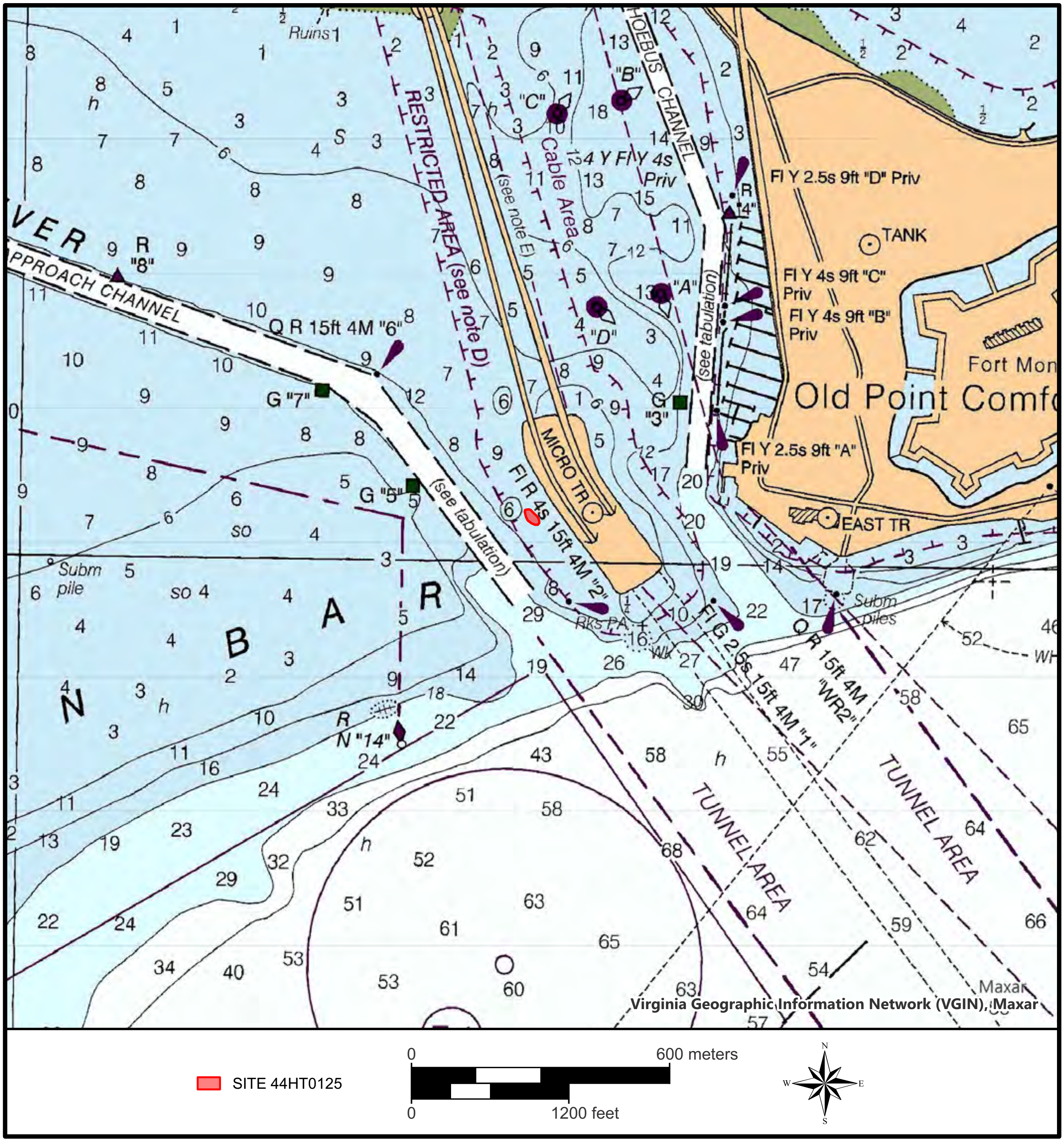

Figure 3.29. Location of Site 44HT0125 on 2020 nautical chart (USNOSCS 2020).

4: Geological Analysis of Stone Cargo

Introduction

A significant number of quarried stone blocks were recovered from a nineteenth-century shipwreck during the site investigation at the north edge of the Hampton Roads Bridge Tunnel expansion project (HRBTE). After recovery, these stone blocks were transported to a VDOT storage yard in Chesapeake, Virginia. This study focuses on (1) describing the stone recovered from the Site 44HT0125 and (2) determining the geological provenance of the stone and its intended destination in Hampton Roads (see Figures 1.2 and 1.3).

In summary, the samples from the shipwreck are almost exclusively a distinctive medium- to coarse-grained weakly- to well-foliated granitic gneiss. These samples, based on their meso-scale (hand sample) and micro-scale (thin section) mineralogy and texture, as well as their whole rock geochemistry are a match with the ***Port Deposit Gneiss*** exposed along the ***lower Susquehanna River in the northern Maryland Piedmont*** (Figure 4.1). Rocks identical to those recovered from the shipwreck have long been quarried (since the late eighteenth century) at or near Port Deposit for dimension stone. Due to Port Deposit's proximity to the Chesapeake Bay, this stone was shipped to many locations. The vast majority of stone at Fort Monroe consists of Port Deposit Gneiss, whereas at Fort Wool most of the fort's stone superstructure is not Port Deposit Gneiss, although blocks of Port Deposit Gneiss were used as foundation stone on Rip Raps Island.

Method and Research Plan

In mid-August 2021, I examined and photographed rocks at the VDOT storage yard site (Figure 4.2A). While on site, I measured geological structures in the blocks and collected samples for petrographic and geochemical analysis. In late August, I toured Fort Monroe to examine stone, glean the history of the site from Fort Monroe staff, and collected two rock samples that had spalled off interior walls of casemates.

In late October, I visited Fort Wool by boat (transport courtesy of the Virginia Department of Wildlife Resources) and examined the original nineteenth-century stone walls, casemates, and parapets. Additionally, I collected a set of representative samples from loose rock abutting the exterior of the fort. In December 2021, I completed two days of fieldwork in the Port Deposit area along the lower Susquehanna River in Maryland (see Figure 4.1). Here I examined outcrops and old quarries along both sides of the river, measured geological structures, and collected representative samples.

At William & Mary, samples were cut into billets for petrographic thin sections and their density measured (Table 4.1). Petrographic thin sections (~40 x 25 mm) were made via a commercial vendor. Other pieces of the samples were crushed and then powdered for whole rock geochemical analysis using a portable X-ray fluorescence (XRF) spectrometer (Bruker TRACER 5) in the William & Mary Geology department; this analysis measured major elemental abundance and

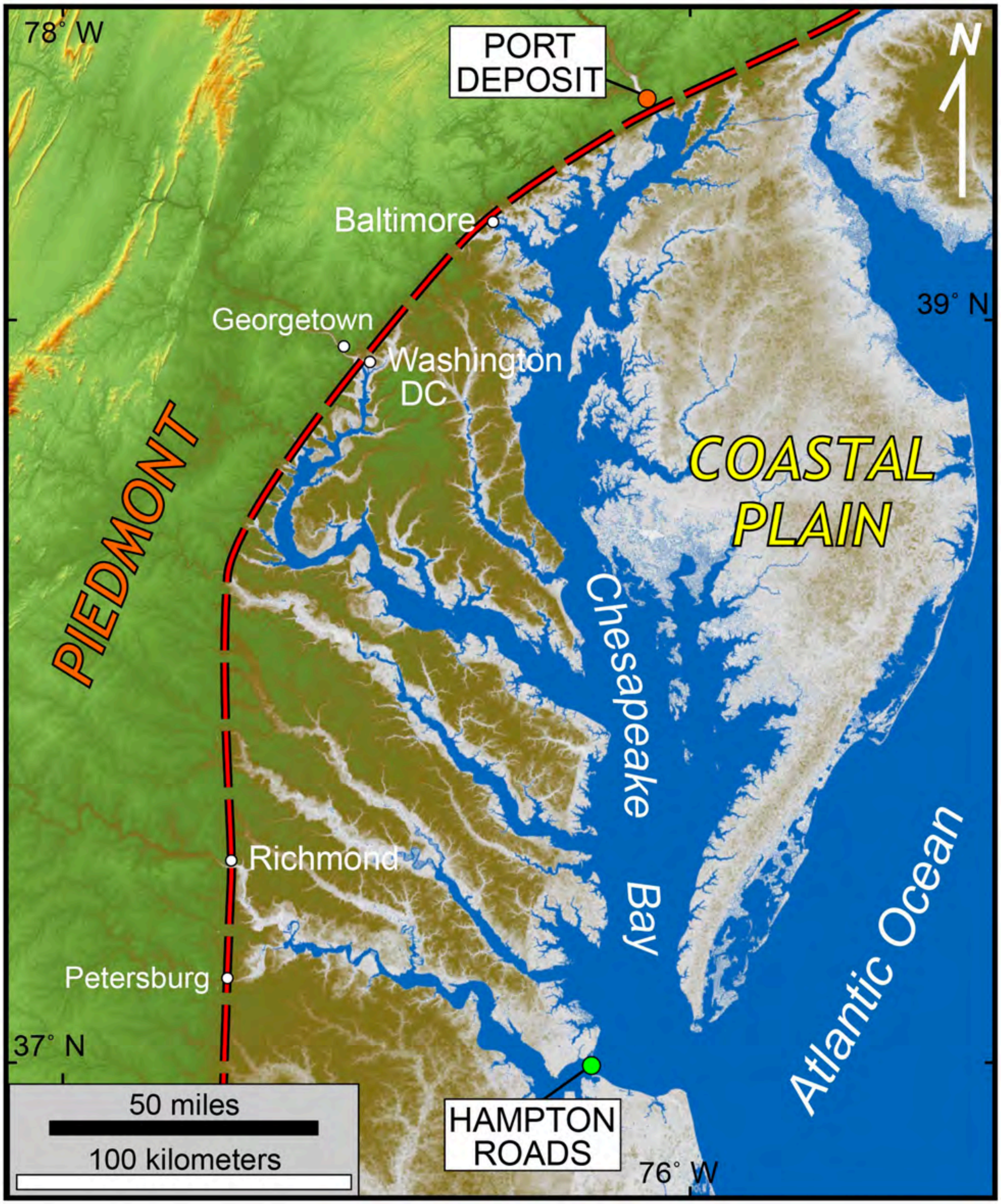

Figure 4.1. Overview map with the Hampton Roads study site and Port Deposit illustrated. The dashed red line is the base of the Fall Zone.

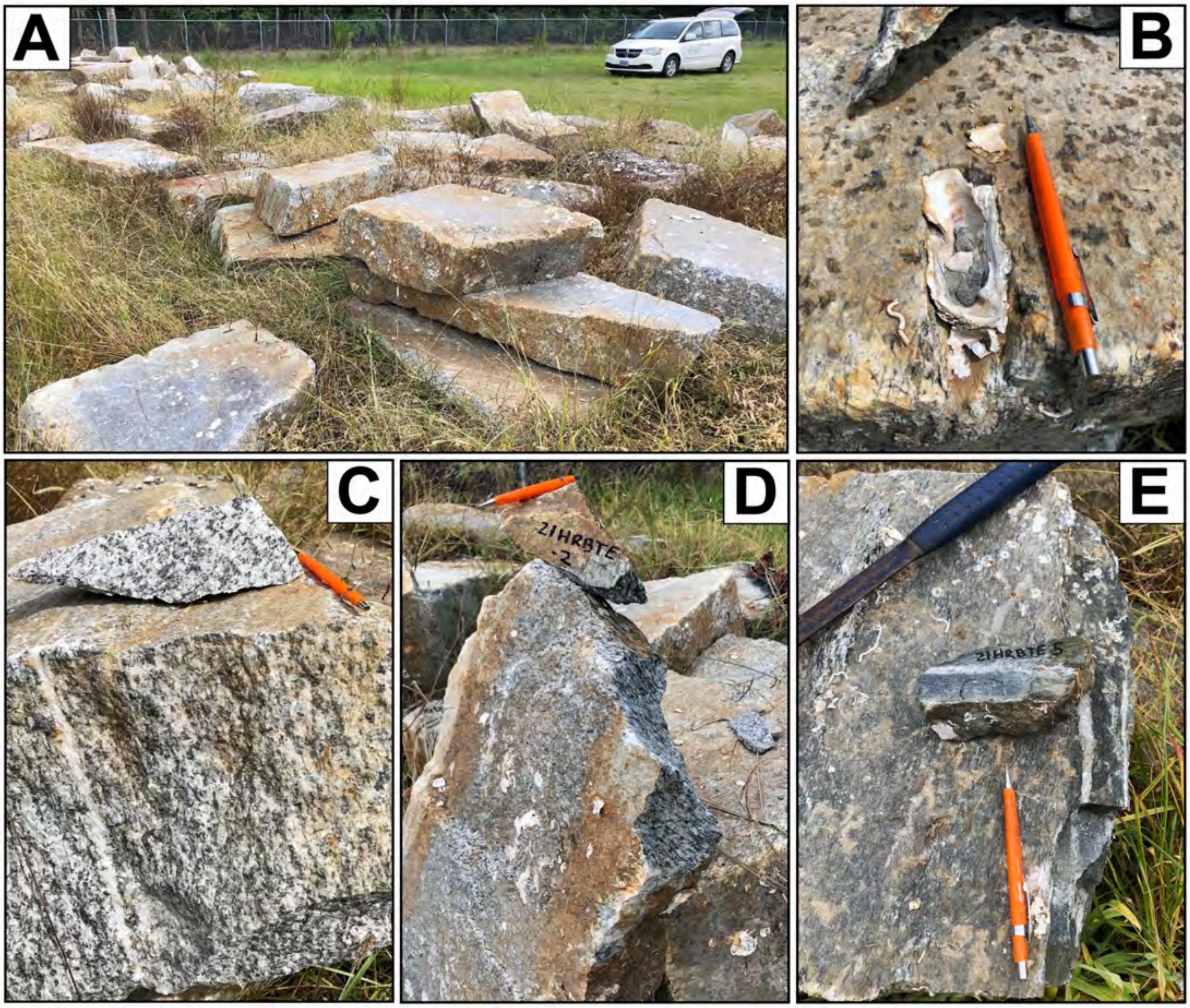

Figure 4.2. Views of cargo material recovered from Site 44HT0125 A) Overview of recovered blocks at VDOT storage facility. B) Oyster shell in a tool mark from quarried block (pencil is 15 cm). C) Coarse-grained, moderately foliated granitic gneiss. D) Coarse-grained, foliated granitic gneiss. E) Fine-grained, epidote-biotite gneiss with quartz segregation layering.

	Shipwreck Samples				Fort Monroe Samples		Fort Wool Samples				Port Deposit Samples			
	21HRBTE-1	21HRBTE-2	21HRBTE-3	21HRBTE-5	21FM-1	21FM-2	21FW-1	21FW-3B	21FW-4	21FW-5	21PD-1	21PD-2	21PD-3	21PD-4
UTM Zone	Zone 18S	Zone 18S	Zone 18S	Zone 18S	Zone 18S	Zone 18S	Zone 18S	Zone 18S	Zone 18S	Zone 18S	Zone 18S	Zone 18S	Zone 18S	Zone 18S
Easting	376880	376880	376880	376880	383850	383850	384090	384090	384090	384090	401750	404426	402870	403470
Northing	4070460	4070460	4070460	4070460	4095990	4095990	4094210	4094210	4094210	4094210	4385030	4384245	4386060	4385530
Location	block in VDOT storage facility	block in VDOT storage facility	block in VDOT storage facility	block in VDOT storage facility	loose piece from interior of SE casemates	loose piece from interior of SE casemates	from loose rubble/blocks at WNW of island	from loose rubble/blocks at WNW of island	from loose rubble/blocks at WNW of island	from loose rubble/blocks at WNW of island	old quarry off of Stafford Rd.	rubble from stone wall just south of Town Hall	from NW wall of large old quarry NW of town	outcrop on Rock Rd. Road
Rocktype	granodioritic gneiss	granodioritic gneiss	granodioritic gneiss	epidote amphibolite	granodioritic gneiss	granodioritic gneiss	granodioritic gneiss	diorite/ gabbro	granodiorite	granite	granodioritic gneiss	granodioritic gneiss	granodioritic gneiss	granodioritic gneiss
Color														
Mineralogy	plag, qz, bt	plag, qz, bt	plag, qz, bt	hbl, ep, plag	plag, qz, bt	plag, qz, bt	plag, qz, bt	plag	plag, qz, bt	plag, kf, qz	plag, qz, bt	plag, qz, bt	plag, qz, bt	plag, qz, bt
Grainsize	medium	medium	medium	fine	medium	medium	medium	medium	medium	fine	medium	coarse	medium	
Fabric	weak to moderate foliation	moderate foliation	moderate foliation w/ shear bands	equigranular with banding & qz vein	moderate foliation	moderate foliation	moderate foliation	massive	weak fabric at best	massive	moderate foliation	weak to moderate foliation	weak to moderate foliation	moderate foliation w/ shear bands
Density (g/cm3)	2.7	2.7	3.0	3.2	2.7	2.7	2.8	2.8	2.7	2.5	2.7	2.7	2.8	2.6
Whole Rock Chemistry (%)	**21HRBTE-1**	**21HRBTE-2**	**21HRBTE-3**	**21HRBTE-5**	**21FM-1**	**21FM-2**	**21FW-1**	**21FW-3B**	**21FW-4**	**21FW-5**	**21PD-1**	**21PD-2**	**21PD-3**	**21PD-4**
SiO2	71.1	69.8	67.5	55.5	72.3	68.2	71.4	55.2	73.5	75.8	68.5	70.1	67.9	72.3
Al2O3	13.8	14.3	14.8	18.4	14.5	14	13.2	11.2	13.7	14.8	14.4	13.9	14.5	13.4
Fe2O3(T)	2.0	2.6	3.0	12	1.9	2.0	2.2	8.7	4.0	2.7	3.9	2.7	3.00	2.9
MgO	0.2	0.3	0.2	0.4	0.2	0.3	0.3	0.9	0.3	0.2	0.6	0.3	0.4	0.3
CaO	2.3	3.2	2.7	6.2	2.7	2.8	3.6	6	3.5	2.3	4.4	2.8	2.9	3
Na2O	4.5	4.2	5.3	2.3	4.3	3.9	5.00	3.3	4.5	3.2	4.9	4.7	3.9	5.6
K2O	1.1	1.3	1.0	1.5	1.8	2.1	1.1	0.4	1.2	6.3	1.00	1.3	1.9	2.1
TiO2	0.2	0.2	0.1	0.2	0.2	0.1	0.2	0.2	0.3	0.2	0.3	0.2	0.3	0.3
Total Alkalis	5.6	5.5	6.3	3.8	6.1	6.0	6.1	3.7	5.7	9.5	5.9	6	5.8	7.7

Table 4.1. Summary of geological sample analyses.

area reported as oxides (see Table 4.1). I utilized a portable XRF spectrometer in the field, but due to the medium- to coarse-grained nature of the rock the results had high scatter from spot to spot. In the lab, powdered rock samples yielded much better (reproducible) results.

Recovered Blocks

At the VDOT facility in Chesapeake, approximately 75 quarried blocks recovered from the shipwreck were being stored. Blocks range in size from smallish ~10 x 25 x 35 cm (0.01 m^3) upwards to ~50 x 60 x 120 cm (0.4 m^3). The approximate total mass of the recovered blocks is estimated between 30,000 and 37,000 kg (33 to 41 tons). Many blocks are approximately rectangular (sub-rectangular) in shape.

Block Size Estimate Method

Avg. block volume (0.3 x 0.5 x 1.0 m) = 0.15 m^3

Avg. block volume (0.15 m^3) x Avg. rock density (2,700 kg/m^3) = 405 kg/block

405 kg/block x 75 blocks = 30,375 kg (~33 tons)

Area Estimate Method

Area of blocks = 140 m^2 coverage with ~33% occupied by rock = 46 m^2 of rock

46 m^2 of rock x 0.3 m (avg. rock height) = 13.8 m^3

13.8 m^3 x 2,700 kg/m^3 = 37,260 kg (~41 tons)

Shipwreck Samples

Blocks at the Chesapeake VDOT storage facility have abundant tool marks from the quarrying process and the outside surface of many blocks are encrusted with oysters and calcareous worms (see Figure 4.2B) which is not surprising since these blocks were in the subtidal zone of the Hampton Bar for approximately two centuries.

The predominant rock recovered from the shipwreck is a medium- to coarse-grained, weakly to well-foliated granitic gneiss (see Figure 4.2C, D). The mineralogy consists primarily of white plagioclase feldspar, clear quartz, and blackish-brown biotite. Quartz veins (~1 to 4 cm wide) are also present. The only other rock type observed on site was a fine-grained biotite-epidote gneiss (see Figure 4.2E), which is in contact with the coarse-grained granitic gneiss on a block. Most of the blocks are sub-rectangular in shape and typically bound on two sides by parallel joints/fractures (see Figure 4.2A).

Five hand samples were collected and four of these were slabbed/cut for petrographic examination. HRBTE 1, 2, 3, and 4 are medium- to coarse-grained granitic gneiss (see Table 4.1). HRBTE 5 is a fine-grained banded epidote-biotite rich gneiss (Figure 4.3D; see Table 4.1). In hand sample, the foliation is particularly evident (see Figure 4.3). Biotite forms dark aggregates that are well aligned defining the foliation. In some samples, the foliation forms asymmetric shear bands/S-C structures (see Figure 4.3B, C). The epidote-biotite rich gneiss is compositionally banded with a ~1 cm wide polycrystalline quartz layer (see Figure 4.3D).

In thin section, the granitic gneiss consists of plagioclase feldspar that commonly contain fine-grained inclusions, recrystallized quartz aggregates, and aligned biotite aggregates (Figure 4.4). Accessory minerals include K-feldspar, muscovite, epidote, titanite, apatite, and opaque minerals. Shear bands are defined by well-aligned biotite and recrystallized quartz with a strong crystallographic preferred orientation (see Figure 4.4D). The fine-grained gneiss is composed well-aligned biotite with larger blocky epidote grains that collectively define a strong fabric.

Fort Monroe and Fort Wool

Rocks used at Fort Monroe are primarily composed of a medium- to coarse-grained biotite-

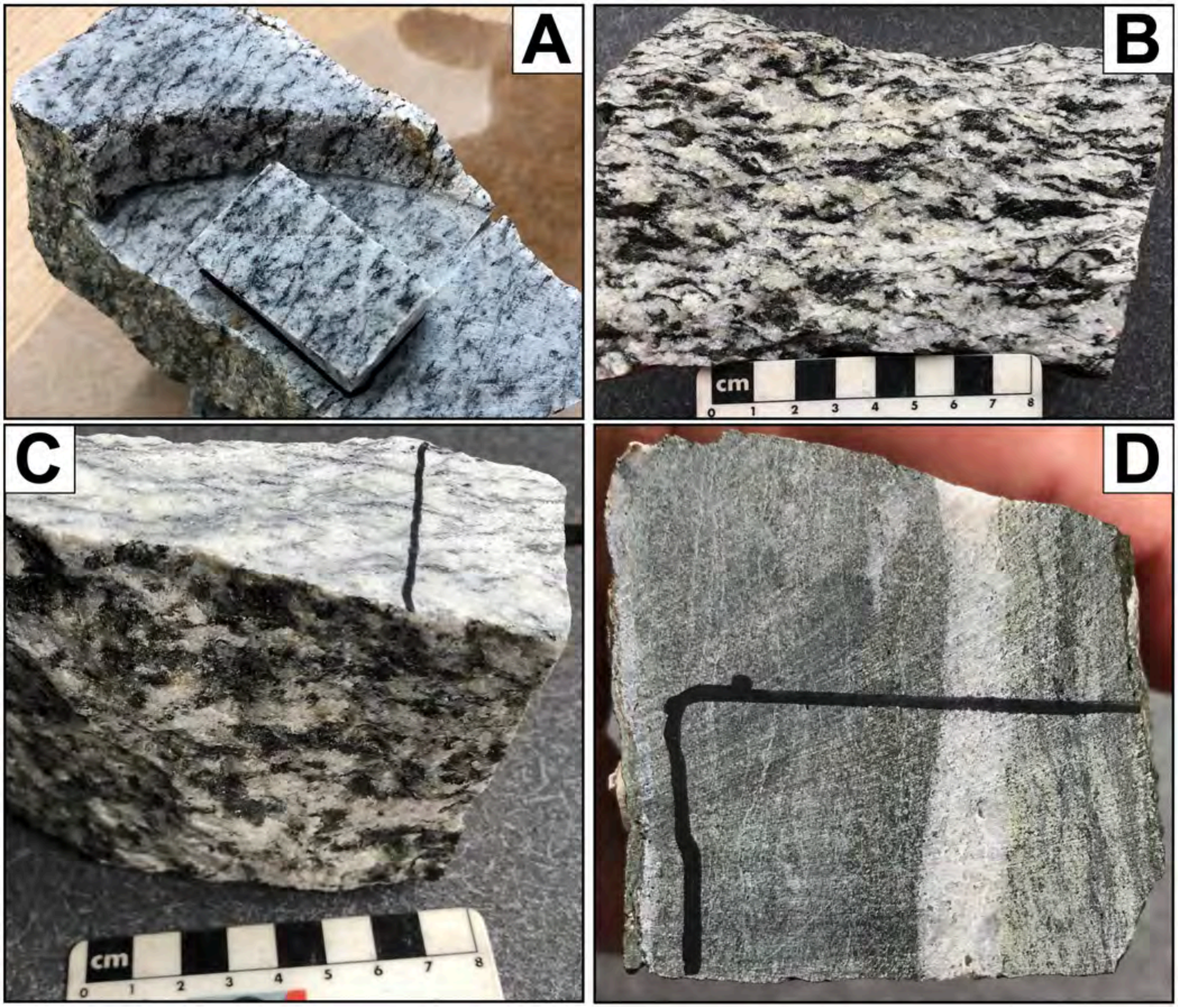

Figure 4.3. Hand samples collected from recovered shipwreck blocks. A) Sample and thin section billet (~2.5 x 4.0 cm) from HRBTE-1, B) coarse-grained well-foliated granitic gneiss from HRBTE-2, with weakly developed shears bands C) slabbed sample from HRBTE-3, the surface is perpendicular to foliation. D) cut slab of banded epidote-biotite rich gneiss from HRBTE- 5.

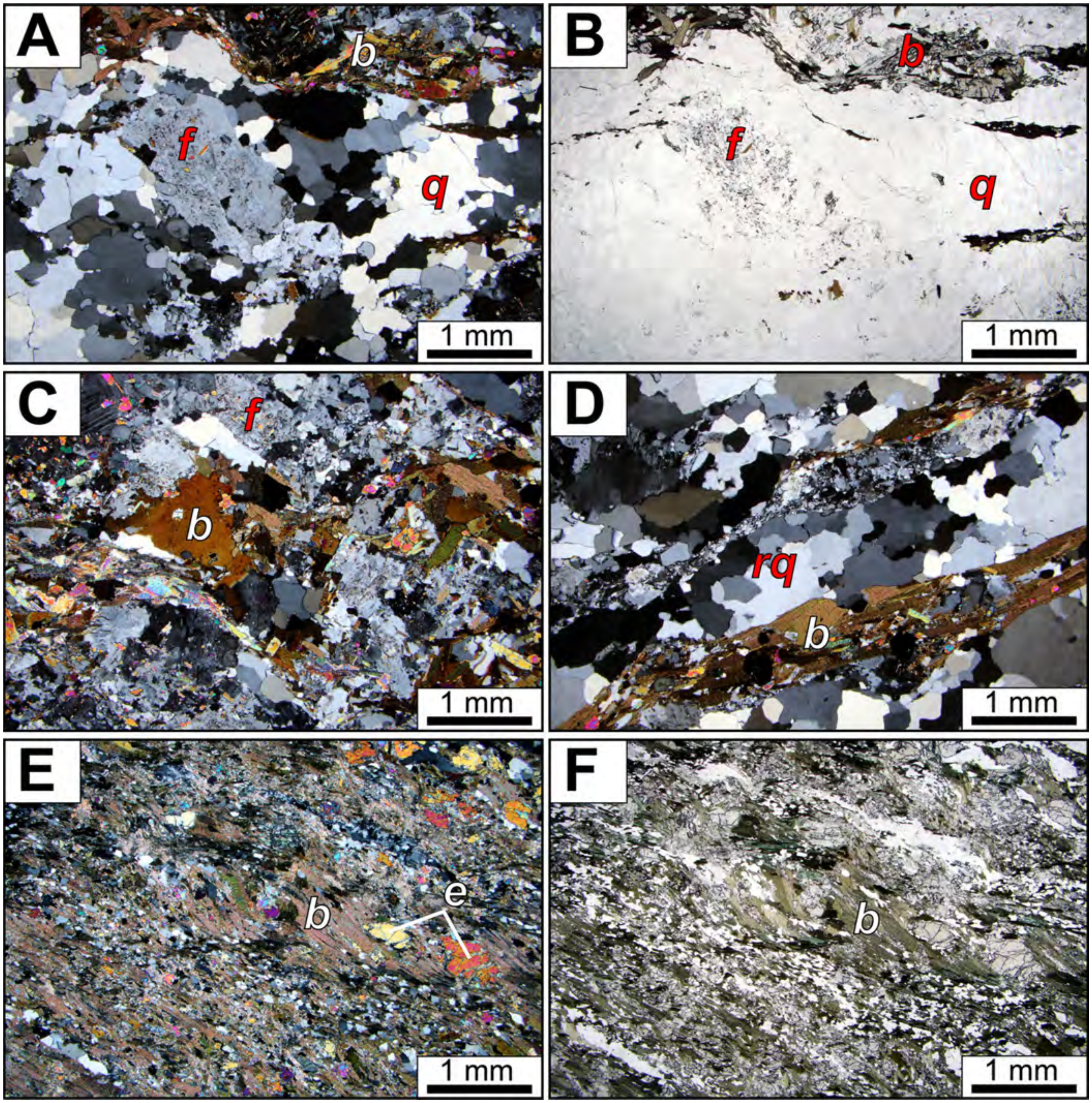

Figure 4.4. Petrographic thin sections. A) Sample HRBTE-1 with feldspar (f) phenocryst, polycrystalline quartz (q), and biotite aggregate (b) in cross polarized light. B) Sample HRBTE-1 in plane polarized light. C) Sample HRBTE-2 with feldspar (f) and biotite (b) in cross polarized light. D) Sample HRBTE-3 with strongly aligned biotite and recrystallized quartz (rq) from shear band in cross polarized light. E) Sample HRBTE-5 a fine-grained gneiss with well-developed foliation, biotite (b), epidote (e) in cross polarized light. F) Sample HRBTE-5 in plane polarized light.

bearing granodioritic to granitic gneiss although there is a diversity of other rocks (primarily granite) used throughout the structure. Large worked ashlar blocks of granodioritic to granitic gneiss occur on both exterior and interior walls (Figure 4.5A, B). Smaller rubble of the same rock is used through the interior and is common in the southern casemates. Two hand samples were collected from fallen blocks in the interior of the southern casemates (see Table 4.1). These samples are nearly identical to samples recovered from the shipwreck.

Rip-Raps Island is an artificial island constructed during the 1810s and 1820s, upon which Fort Wool was built (see Figure 1.3). The island itself consists of heterogenous rock rubble, some of which includes worked blocks. The rock rubble contains numerous blocks of medium- to coarse-grained foliated granodioritic to granitic gneiss (see Figure 4.5C), similar to that at Fort Monroe and also recovered from the shipwreck. However, there is a diverse array of rubble blocks from multiple sources that compose the rock rubble at Rip Raps Island. Fort Wool's nineteenth-century superstructure is constructed from large highly worked stone blocks. The upper courses of stonework are a dark gray, hornblende-bearing gabbro while the lower courses are a whitish to pinkish gray, medium-grained granite (see Figure 4.5D). Neither of these rock types occur in the shipwreck. The gabbro looks similar to the Georgetown Intrusive Suite exposed along the Potomac River immediately west of Washington DC, and the granite looks similar to some varieties of the Petersburg Granite exposed in the Fall Zone along the Appomattox and James rivers in central Virginia.

Geology of the Port Deposit Area

The Port Deposit Gneiss is a metamorphosed plutonic igneous rock exposed in the eastern Piedmont region of northern Maryland (Figure 4.6). The Port Deposit pluton intruded older volcanic rocks of the James Run and Canal Road formations (Lesser 1982; Orndorff 1999; Sinha et al. 2012) and is in tectonic contact with the Conowingo Diamictite/Canal Run Formation to the west and northwest (see Figure 4.6). Sinha et al. (2012) report a U-Pb zircon age of 477 ± 5 Ma for the Port Deposit pluton and infer it to be part of an Ordovician volcanic arc complex that was accreted to North America during the Taconian Orogeny. Chemically, the Port Deposit pluton ranges from granite to diorite with plagioclase far more common than K-feldspar (Lesser 1982). These rocks were deformed and metamorphosed to gneissic rocks during the late Paleozoic Alleghanian Orogeny (Orndorff 1999).

Dimension stone quarries operated along both sides of the Susquehanna River near Port Deposit since the late eighteenth century. These quarries are located below the Falls of the Susquehanna River (at the base of the Fall Zone) and at sea level thereby providing a means to transport (by ship) quarried blocks to distant locations. The Port Deposit Gneiss is a distinctive black and white stone that's been used in numerous building projects in the Mid-Atlantic region (Kuff and Brooks 1985). Commercial product and export of blocks had begun by 1816. The main, and longest working, quarries were on the northeastern bank of the Susquehanna River. Production continued into the mid-twentieth century.

I visited a number of old quarries and as well as historic buildings and other stone structures in the Port Deposit area. Old quarries expose variably foliated granodioritic gneiss similar to that recovered from Site 44HT0125 (Figure 4.7). Jointing is prominent at many quarries (see Figure 4.7A), which provides natural fracture planes for blocks that are effectively parallel. Both at the mesoscale (hand sample) and microscale (thin section) the samples from the shipwreck are similar to rocks described near Port Deposit, Maryland.

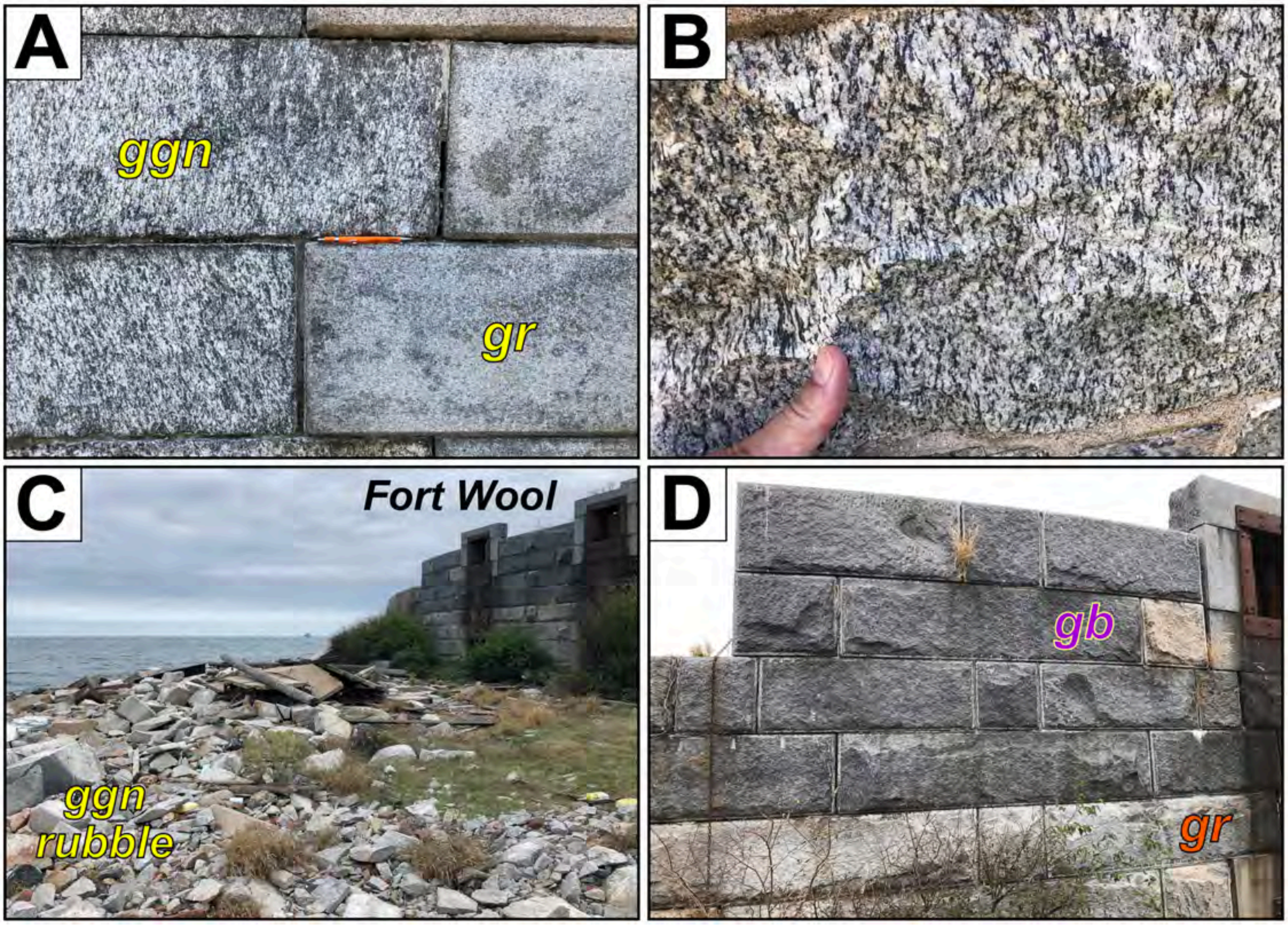

Figure 4.5. Views of building and fill stone at Fort Monroe, Fort Wool, and Rip-Raps Island A) Cut ashlar blocks on an exterior wall on the East Parapet at Fort Monroe, ggn- granitic gneiss (similar to those recovered from shipwreck), gr- medium-grained equigranular granite. B) Foliated granitic gneiss from an interior wall in the south casemate at Fort Monroe. C) view to the east from the west edge of Rip-Raps Island, ggn rubble is composed of granodioritic gneiss. D) upper superstructure of Fort Wool, top four courses of stone are a medium-grained hornblende gabbro (gb), lower courses and trim are granite (gr).

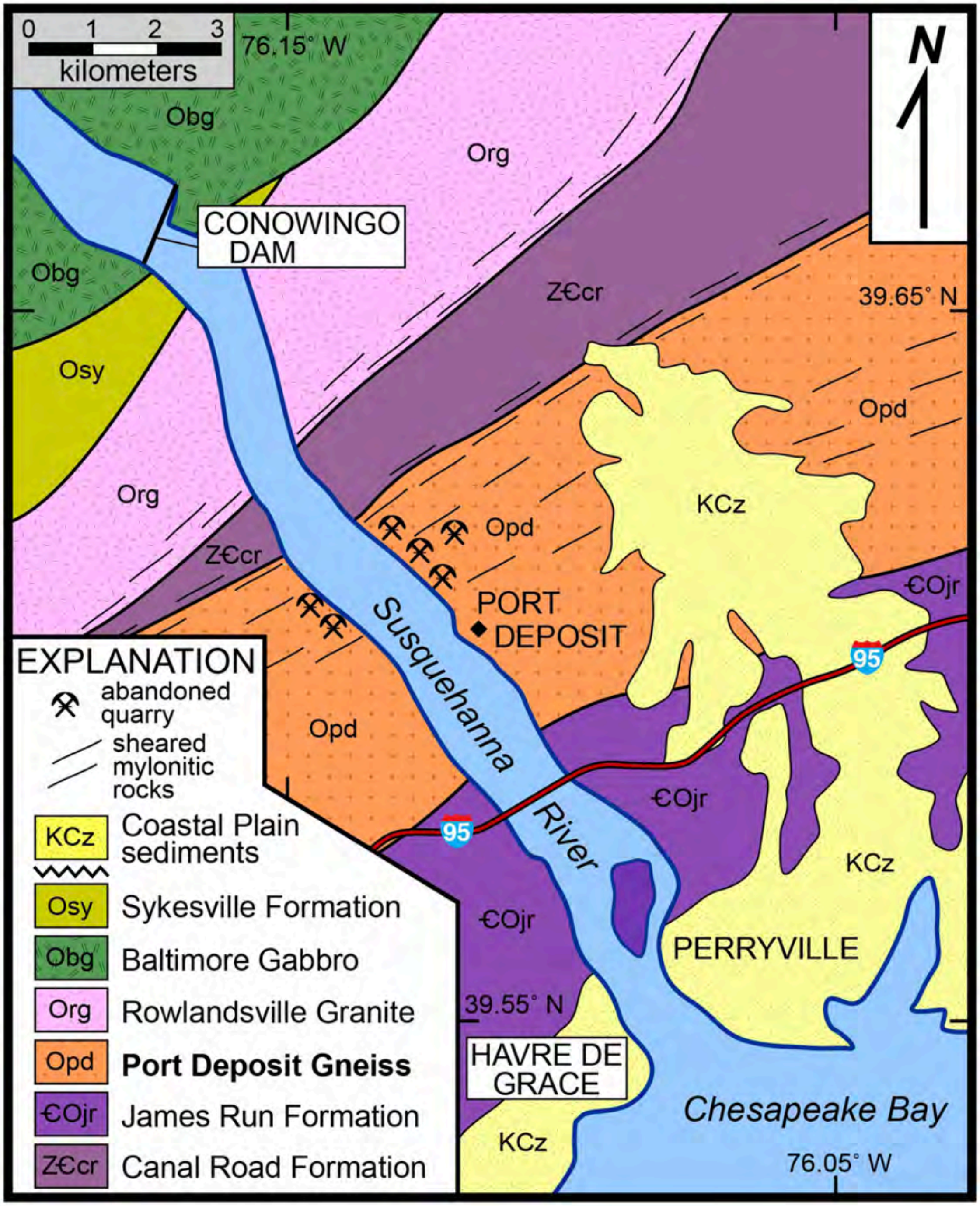

Figure 4.6. Simplified geologic map of the Port Deposit area in northern Maryland (modified from Orndorff 1999 and Lesser 1982).

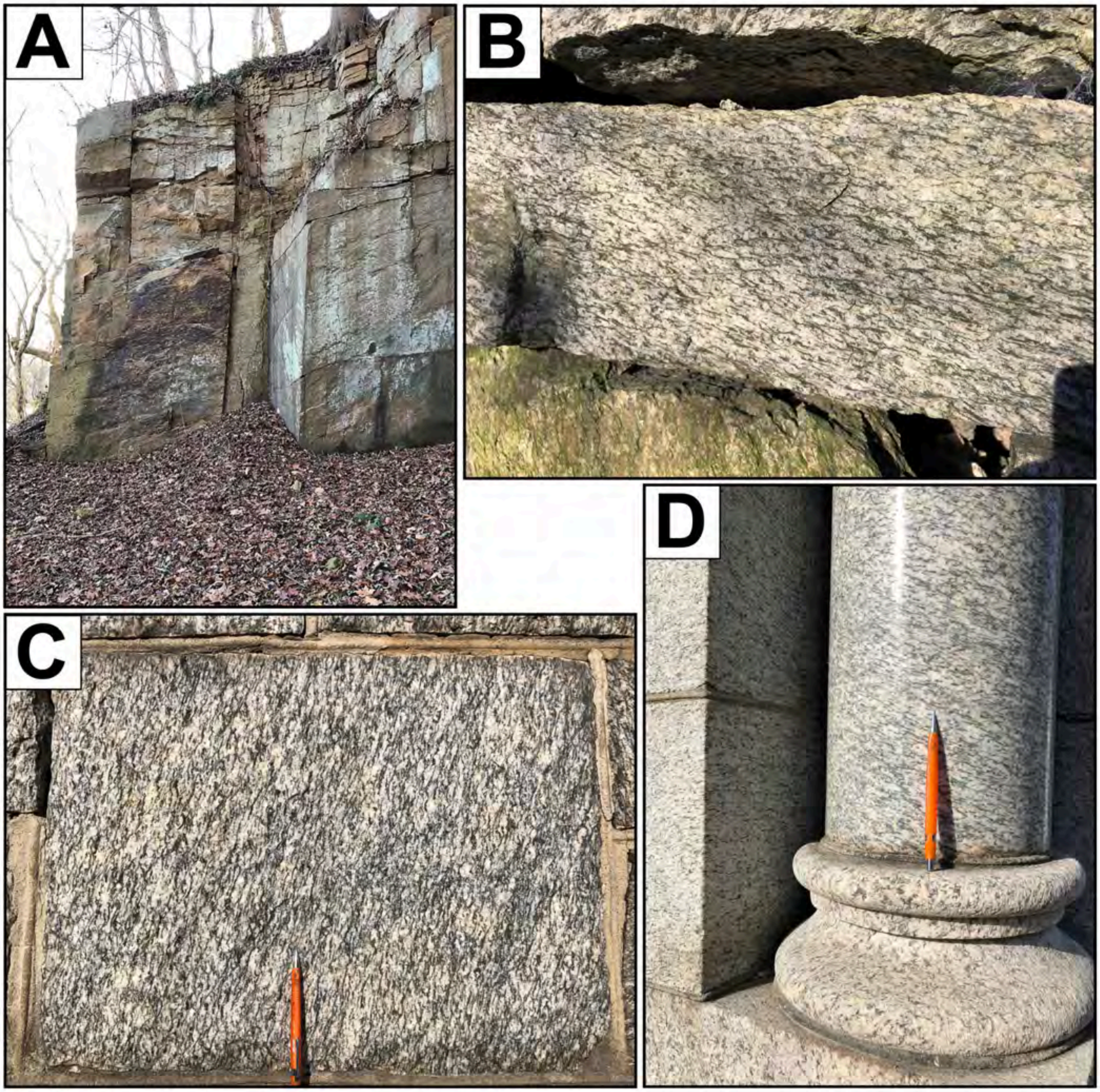

Figure 4.7. Photos from the Port Deposit area. A) old quarry with steeply dipping joint faces cutting foliated granodioritic gneiss. Height of wall is ~4 m. B) Close up of foliated granodioritic gneiss with shear bands from quarry picture in A. C) worked block of foliated granodioritic gneiss on the Port Deposit Town Hall. D) polished decorative column with base and ashlar block in Port Deposit.

Whole Rock Geochemistry

Whole rock major element chemistry of three gneissic samples recovered from the shipwreck range from 67 to 71% SiO_2 with total alkalis between 5 and 6% (Figure 4.8; see Table 4.1). These samples are quite similar to both outcrop samples collected at Port Deposit (this study) and from data reported by Lesser (1982) (see Figure 4.8). On the total alkali-silica diagram, gneissic samples from the shipwreck plot in the granodioritic field, while samples from Port Deposit (this study and Lesser 1982) show somewhat more variably in composition (granodiorite to granite). The banded epidote-biotite gneiss from the shipwreck (olive green diamond) has 55% SiO_2 and lower alkalis than the granodioritic gneisses. Based on these data, the samples from the Site 44HT0125 shipwreck and from the Port Deposit Gneiss are effectively identical. The narrow range of chemical variability from the shipwreck likely indicates the load was sourced at a single site, whereas Lesser's samples came from a number of locations scattered across the Port Deposit area.

Two samples from Fort Monroe and two samples from Fort Wool plot within the field of other Port Deposit granodioritic gneisses (see Figure 4.8). At Fort Wool, we also analyzed two different rock types: a medium-grained, massive gabbro with 52% SiO_2 (purple square) and a fine-grained equigranular pinkish granite with 76% SiO_2 and high K_2O (yellow square). We suggest these are not from the Port Deposit area. The gabbro is likely from the Georgetown Intrusive Suite which has long been quarried along the Potomac River near Georgetown, the granite may be from the Petersburg batholith and quarried from near Richmond or Petersburg.

Structures in the Shipwreck Blocks Compared to Structures in the Port Deposit Gneiss

Nearly all of the blocks at the VDOT storage site are pseudo- to sub-rectangular in shape (see Figure 4.2A). Typically, faces on opposite sides of a block are parallel and likely natural fractures (joints), some blocks have two sets (four faces) of natural joints. Some faces on the blocks may be exfoliation joints, which are well-developed near the earth's surface in old quarries at Port Deposit (see Figure 4.7A). The blocks also contain a penetrative fabric (foliation, as discussed above) (Figure 4.9). At the storage site, I measured the 3D orientation (strike, dip, and direction) of both the foliation and joints in blocks. Based on these data, I could compare the orientation of these structures in the blocks to the actual orientation of foliation and joint sets at Port Deposit.

In the Port Deposit area, the main foliation in the granodioritic gneiss strikes 030° to 050° and typically dips 65° to 75° to the southeast (based on my field observations). The Port Deposit Gneiss is cut by multiple joint sets: the predominant set strikes 310° to 320° and is subvertical, while two minor joint sets strike 070° and dip ~80° to the southeast and 270° and dip ~80° to both the northeast and southwest, respectively (Figure 4.10; see Figure 4.9).

Blocks at the storage site are lying in whatever orientation they were placed when delivered to the site. For individual blocks, I stereographically rotated the foliation from its orientation in the storage yard to its actual orientation in the Port Deposit area. As part of this stereographic operation, I also rotated the block faces into the orientation they would be with the foliation "back" in its natural attitude. This facilitates comparison to structural orientations in the Port Deposit area (see Figure 4.10). Stereographic analysis also enables the angles between block faces or structures to be determined.

Based on these stereograph rotations and block faces angles, the geometry between the foliation and fracture faces in the stone blocks recovered from the shipwreck is similar to the actual orientation in the quarries at Port Deposit. The structural orientation evidence provides another indicator as to the stone's provenance at Port Deposit (Table 4.2).

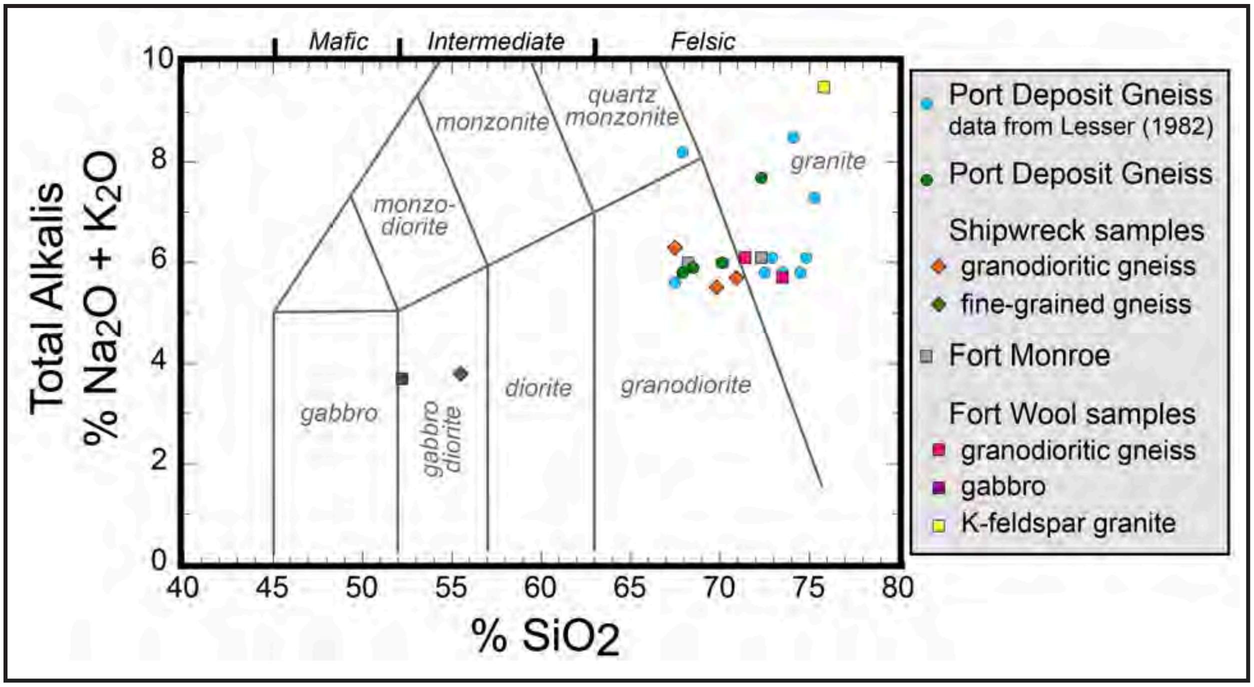

Figure 4.8. Total Alkali-Silica diagram for shipwreck samples, Port Deposit Gneiss, as well as Fort Monroe and Fort Wool samples.

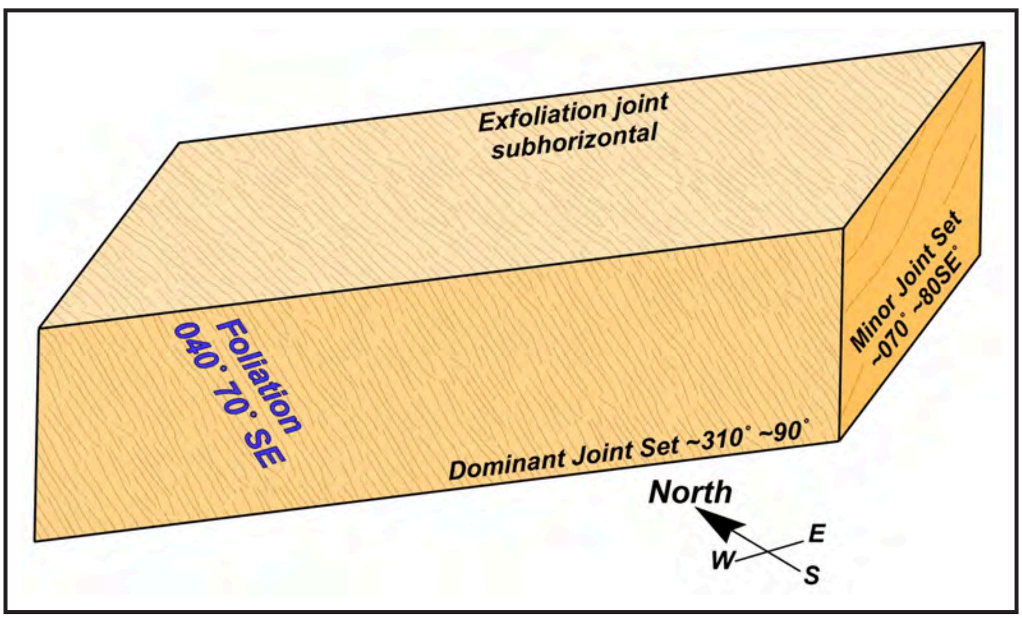

Figure 4.9. Schematic block of Port Deposit Gneiss from the HRBTE shipwreck. Blocks are typically faced by two joint sets and an exfoliation joint. Foliation is a penetrative feature that occurs throughout the rock. Orientations given in their actual orientations from the Port Deposit area.

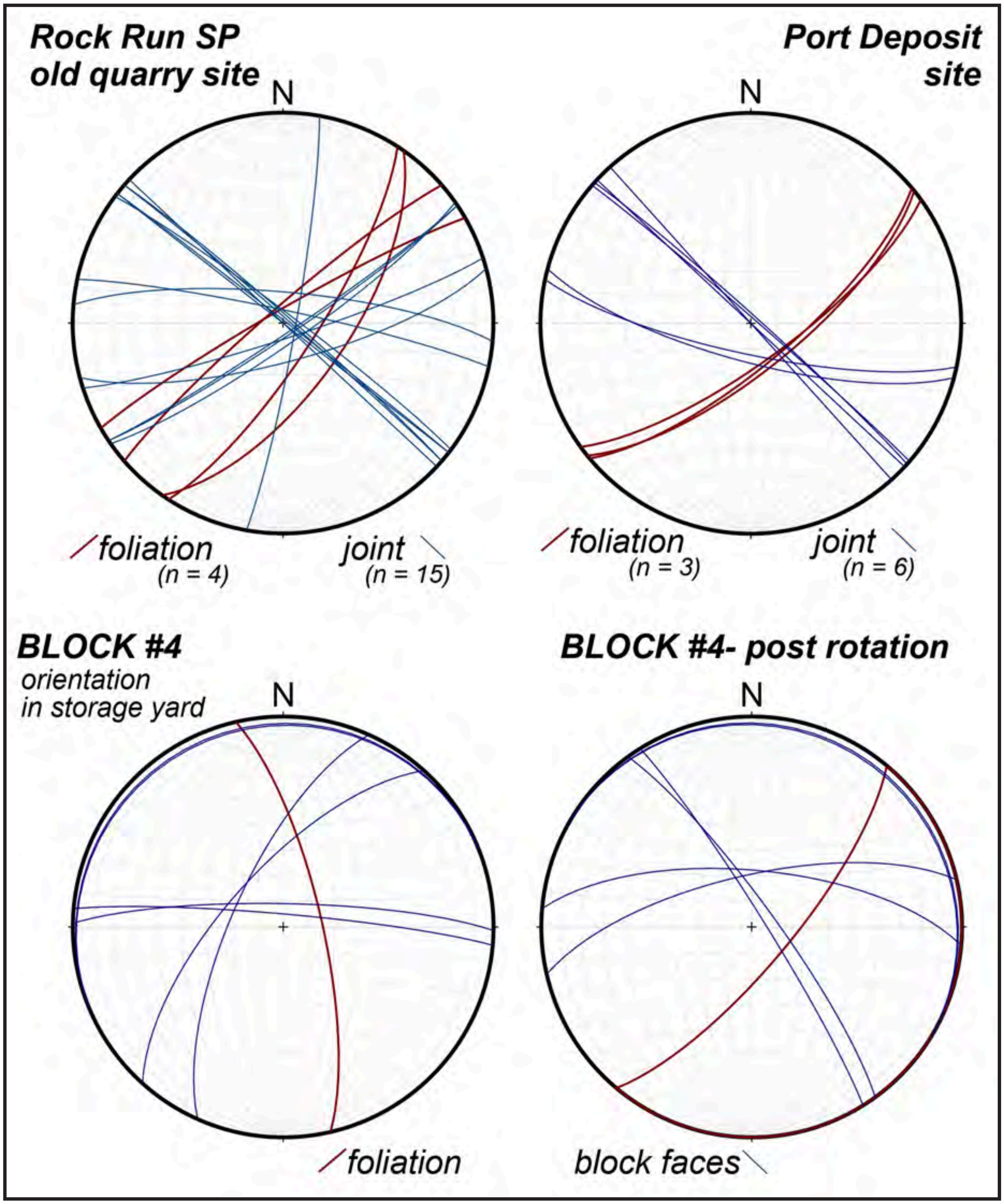

Figure 4.10. Top - stereograms of foliation and joints from two sites in the Port Deposit area. Bottom - stereograms of fabric elements in the storage yard (left) and the orientation of those structures after rotating the foliation back to its orientation in the Port Deposit area. Note the joints align with those in the Port Deposit area.

Port Deposit Rock Run site on SW side of Susquehanna River

Foliation - strikes 030° to 050°, dips 65° to 75° SE or ~85° NW

Joint sets

Dominant set - strikes 310° dips sub-vertical (~90°)

Subordinate set - strikes 055° dips 80° to 90° SE

Minor set - strikes 072° dips 75° to 85° SE

Minor set - strikes 280° dips 80° to 85° NE

Angles between

Foliation + Dominant set = 85° or 95°

Foliation + Subordinate set = 37° or 143°

Dominant set + Subordinate set = 56° or 124°

Port Deposit site on NE side of Susquehanna River

Foliation - strikes 050°, dips 75° SE

Lineation - rakes 15° NE or 054° 15°

Joint sets

Dominant set - strikes 310° to 320° dips sub-vertical (~90°)

Subordinate set - strikes 105° dips 78° SW

Angles between

Foliation + Dominant set = 86° or 94°

Foliation + Subordinate set = 52° or 128°

Dominant set + Subordinate set = 37° or 143°

Site 44HT0125 Rock Sample Structures

Sample- #4 Big Flatty

Foliation - 347° 75° E

Faces/Fractures - 275° 85° N 271° 81° N
222° 68° NW 204° 70° NW
247° 04° NW 248° 05° NW

Angles between

Foliation + Face 1 = 73° or 107°

Foliation + Face 2 = 65° or 115°

Foliation + Face 3 = 76° or 104°

Sample- #3 Capstone

Foliation- 096° 71° S

Faces/Fractures - 353° 88° E
110° 72° S
174° 12° W

Angles between

Foliation + Face 1 = 78° or 102°

Foliation + Face 2 = 13° or 167°

Foliation + Face 3 = 69° or 110°

Face 1 + Face 2 = 65° or 115°

Face 1 + Face 3 = 80° or 100°

Face 2 + Face 3 = 67° or 11

Table 4.2. Sample structural orientation data.

5: Dendrochronological Analysis of Samples from Vessel Timbers

Samples from the Site 44HT0125 vessel were sent for analysis to the Cornell Tree Ring Laboratory, Cornell University, in July 2022. For tree ring dating, the samples included large cross-sections from eight timbers. For species identification, 10 small cubes were cut from the same eight timbers and from two additional timbers. The sampled timbers were chosen and prepared by maritime archaeologist Gordon Watts (TAR) with consultation from Elizabeth Monroe (W&MCAR). Figure 5.1 illustrates a sample prepared for dendrochronology.

Methods and Results

The transverse surfaces of the eight cross-sections were prepared for ring-width measurements by using 40-grit to 400-grit sandpaper. Radial, tangential, and transverse surfaces on the 10 small cubes were prepared with a razor blade to identify cell structure and species. Water was brushed over all surfaces where necessary to enhance contrasts in color and details of their components.

Species Identification

The wide rays, ring structure, and substantive tyloses in the earlywood vessels of the 10 samples indicate that all are of oak (*Quercus* sp. L.) and of the white oak group, *Leucobalanus*. Determining species within that group is very difficult (e.g., Panshin and de Zeeuw 1970), but from the overall use of white oak species in any construction and our experience with samples from known species, most samples are primarily white oak, *Q. alba*. At least one, possibly two, other species may be represented in three of the eight cross-sections: floor timbers 5, 6, and 9 are possibly chestnut oak, *Q. prinus*, and/or swamp white oak, *Q. bicolor* (Table 5.1). The two samples sent for species identification alone are of *Q. alba* (see Table 5.1).

Dendrochronology

Ring-widths were measured under a microscope on a moving table with 0.01-mm accuracy and recorded on a computer. For one sample, two radii were measured and those sequences were combined into a single sequence for that sample. The outer rings of each sample were carefully inspected for the presence of any sapwood rings and possible waney edge (just below the bark). White oaks often have a visible band of ~8–15 lighter-colored sapwood rings, but within the sapwood, only four to six of the outermost rings have no tyloses in the earlywood vessels and indicate a waney edge. Unfortunately, the open vessels and sapwood rings in general are softer than the heartwood rings and thus more vulnerable to deterioration.

Standard dendrochronological procedures were used to compare the sequences and combine them into one or more tree-ring chronologies (e.g., Cook and Kairiukstis 1990). The procedures include detrending each tree-ring sequence to remove the idiosyncratic ring growth unique to each tree. The detrended sequences were compared to each other, both visually and statistically, to find matching growth patterns. When a significant match was found, the sequences were relatively dated and averaged to construct a tree-ring chronology. This process continued until all samples were compared. The five sequences that are most

Sample	Provenience and Description	Ring Counts and Lengths (in bold) of Measured Radii	Calendar Years
FFK	Forefoot Knee. Three-quarter cross-section, 45 x 38 cm. Pith present. Ring measurements of first 146 inner rings are less accurate due to narrow ring widths. *Quercus* cf. *alba.* 11 sapwood rings.	A = p+145+**185**+11v A1 = 325 +**15**+1v A2 = 323 +**17**+1v B = p+130+**198**+1v Ai = p+1+**176**+165v **All** = p+1+**340**+1v	**1476p–1817v**
KT1	Keel Timber 1. Squared cross-section pith with pith in center. 41.5 x 18.5 cm. *Quercus* cf. *alba.* Seven possible sapwood rings. Outer ring is continuous on one side, which generally indicates a waney edge, but all included rings contain tyloses.	A = p+1+**140**+1vv	**1673p–1814v**
KSTA	Keelson Timber A. Squared cross-section, 20.5 x 19.5 cm. *Quercus* cf. *alba.* No sapwood rings.	A = 10+**99**+1vv	**1701–1809vv**
FL1	Floor Timber 1 Squared cross-section, 21 x 18 cm. *Quercus* cf. *alba.* No sapwood.	A = p+10+**152**+1vv	**1641p–1804vv**
FL5	Floor Timber 5. Squared cross-section, 20 x 18.5 cm. *Quercus* sp. No sapwood and no pith.	A = 2+**241**+1vv	**1560–1803vv**
FL6	Floor Timber 6, Squared cross-section of a half-section, 26 x 19 cm. *Quercus* sp. No sapwood.	A = p+2+**178**+1vv	**1622p–1803vv**
FL9	Floor Timber 9, Squared cross-section, 24.5 x 17.5 cm. *Quercus* sp. No sapwood.	A = p+10+**205**+1vv	**1585p–1801vv**
FL12	Floor Timber 1 Squared cross-section, 22.5 x 19 cm. *Quercus* cf. *alba.* No sapwood.	A = p+1+**140**+1vv	**1667p–1809vv**
P1	Plank 1, *Quercus* cf. *alba*	(species ID only)	
P6	Plank 6, *Quercus* cf. *alba*	(species ID only)	

Terms used above: p = pith present; #x + N + #y - **N** is the number of rings measured and the #s are the number of rings present but either not measurable or truncated, #x = before and #y = after the measured rings; "vv" = unknown number of rings missing out to bark; v = outer ring close to bark, generally with a range of 0 to ~5 rings missing (subjective); W = waney edge, with only bark removed; B = bark present.

Vessel Oak Chronology **N= 340** **1477-1816**

Includes all cross sections: forefoot knee, keel timber 1, keelson timber A, and floor timbers 1, 5, 6, 9, and 12.

Table 5.1. Description of the dendrochronology samples.

Figure 5.1. Cross-section of the keel timber 1 sample. The dimensions of the portion shown here are 26 x 18.5 cm; the whole sample is 41.5 x 18.5 cm. Note the same rings running along the upper edge, and suggestion of a slightly different ring color of the outer seven rings. The outermost incomplete ring on this sample dates to 1814, but all rings contain tyloses so at least the outer four to six rings are missing. Note the overall increase in rings widths from pith to outer rings, a normal phenomenon of closed-forest tree growth, where rings become larger as the tree is increasingly exposed to sunlight. The darker color in most of the sample is due to age and use in a vessel but may be caused partially by any substance used to waterproof the wood.

similar are the forefoot knee, keel timber 1, keelson timber A, and floor timbers 1 and 12. Floor timbers 5, 6, and 9 may be different oak species, but the slight differences in ring structure may be a result of the overall narrow ring growth and the suppression/release growth common in closed forests and unique to each tree (see Figure 5.1). Despite these slight differences, the sequences of all eight vessel samples crossdate securely and were averaged into a Vessel Chronology of 340 years in length (Figure 5.2; see Table 5.1).

The vessel chronology was compared with all calendar-dated reference oak chronologies from the Mid-Atlantic and southern New England states, including eastern Pennsylvania (E. R. Cook); northern New Jersey (Cook); the southern Hudson Valley, New York (Cook); Albany, New York (Cook and Griggs); eastern Massachusetts (Cook); and central New York (Griggs). Of these six chronologies, the vessel chronology is most similar to the eastern Pennsylvania chronology, which dates the chronology at 1596–1816 (Figure 5.3). Two other chronologies that have satisfactory visual matches and significant statistics at the same dates are the southern Hudson River Valley in southeastern New York and northern New Jersey. The vessel chronology has no significant scores with the other three chronologies.

This collection contains two remarkable characteristics. One is the 342 rings in the forefoot knee timber, representing one of very few oak trees with a lifespan of over 300 years in the

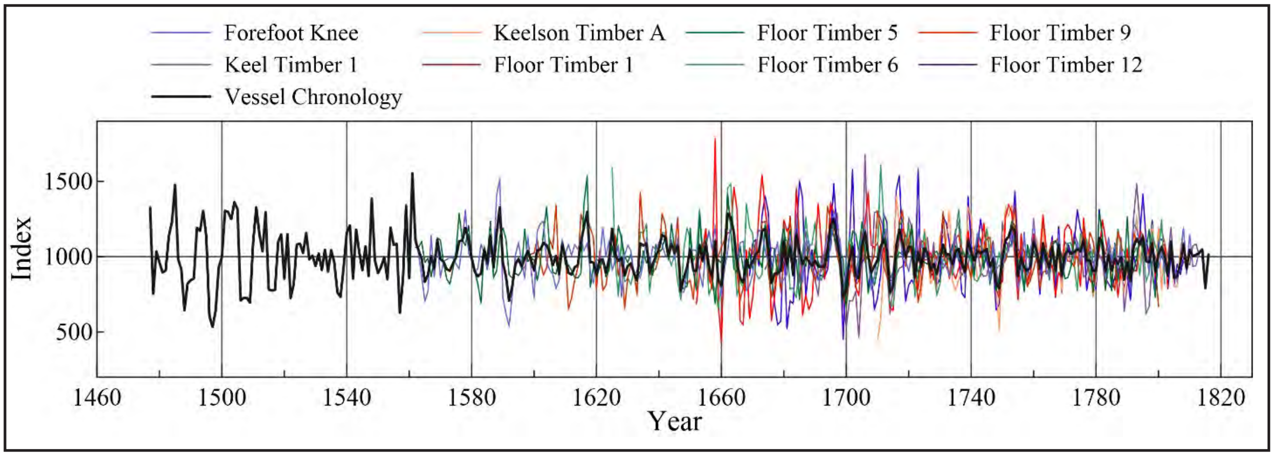

Figure 5.2. The eight relatively dated tree-ring sequences and their average in the Site 44HT0125 vessel chronology. Intercorrelation for the sequences is 0.364 and, while low for that statistic (~0.45 - 0.55 is normal), the low values are not uncommon in oaks, especially for different species. The calendar dates of the sequences are explained in the text and Figure 5.3.

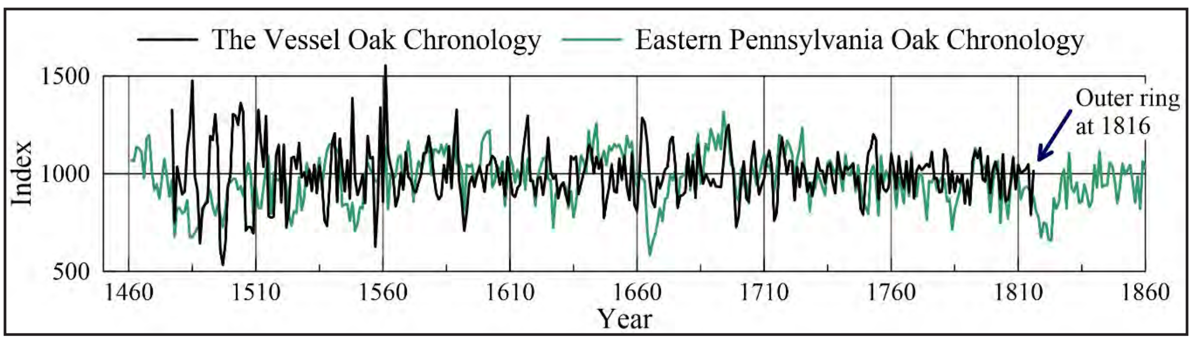

Figure 5.3. The Site 44HT0125 vessel chronology placed in time at 1477–1816 (N = 340) by matching growth patterns in the Eastern Pennsylvania Chronology (E. R. Cook). Supporting statistics include a t-score of 7.04, correlation coefficient of 0.36, and trend coefficient of 66.7%, all with p <0.01, with 221 years of overlap. Note that the first 50 years of both chronologies are composed of only one to three samples and juvenile growth, but the narrow rings overall represent the same years.

tree-ring databank of eastern North America. Secondly, four other samples have more than 175 rings (see Figure 5.4 and Table 5.1). For the late 1700s to mid-1800s, few sampled timbers from historic buildings in Pennsylvania, New York, and New Jersey are more than 150 years old due to the rapid deforestation of the Atlantic seaboard from European settlement from the late 1600s to mid-1700s (e.g., Defebaugh 1906–1907). The lifespan, narrow rings, suppression-release growth, and northeastern Pennsylvania origin of the vessel timbers indicate a primary forest environment in a location not easily accessible to the lumber industry prior to the American Revolution in the late 1700s. These locations, including the mountains in northeastern Pennsylvania and southeastern New York, were far from the main river valleys used to transport logs to the Delaware and Chesapeake Bays (Defebaugh 1906–1907). Only when demand increased were the remote areas deforested.

Wood timbers from a shipwreck found beneath the World Trade Center (WTC) in New York City indicate that that ship was built in 1773 or soon after and constructed from timber also from eastern Pennsylvania but in its southeastern sector, near Philadelphia (Martin-Benito et al. 2014). Only two of their 27 timbers contain over 175 rings if all 27 were felled at the same time. The WTC chronology crossdates satisfactorily both visually and statistically with the Site 44HT0125 Vessel Chronology (t-score of 4.55, correlation coefficient of 0.30, and trend coefficient of 65.4%) but not closely enough for the timbers to have come from the same source. This supports the interpretation that the origin of the Site 44HT0125 vessel timbers is a more remote location, most likely in the northeastern sector of eastern Pennsylvania.

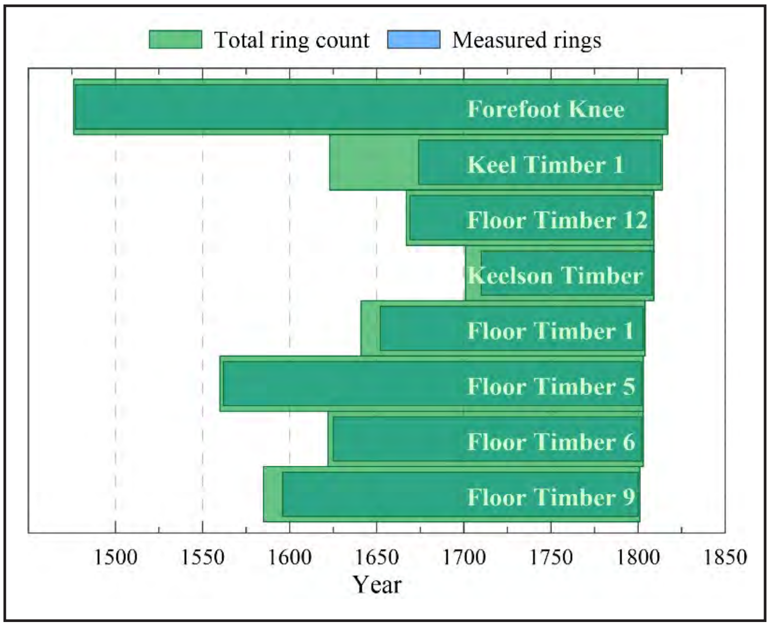

Figure 5.4. Length of measured ring-width sequences and their ring counts over time. The five samples with a lifespan of more than 175 years are those with a start date of 1645 or earlier (felled 1820 or later).