Monticello's West Portico Steps:
New Archaeological Evidence

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Acknowledgements

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West Portico Steps Project

Introduction

The evocative West Portico of Monticello is one of the most widely-reproduced and instantly-recognized views of Thomas Jefferson's Albemarle County mansion. The so-called West Portico Steps are on the southwestern façade of Monticello, the image depicted on the U.S. nickel since 1938. As symbolic as these steps are, appearing on coinage, postcards, and souvenirs of many descriptions, the actual configuration of the steps during Jefferson's lifetime has remained a mystery. Contradictory drawn and painted images have aroused questions as to the material and number of the steps during the eighteenth and early nineteenth centuries; these images also render the cheek walls ambiguous in material and width, and their very presence alongside the steps. Photographic images from the late nineteenth and early twentieth centuries add to the puzzle, showing an earthen ramp where the steps now are. The origin and reason for the ramp were mysterious, with no known records of its construction or removal. Artists' renditions from the nineteenth century exist, but their mutual disagreement categorizes at least some of them as fanciful.

Archaeological research conducted in the spring of 1999 provides answers to some of these questions and produces a clearer picture of the West Portico that Jefferson knew. Monticello was built and rebuilt and was refined and altered as Jefferson pursued the passion he had for his house and its architecture. Constrained by the practical issues of workers, finances, and building materials, parts of Monticello were unfinished for decades, with significant construction phases being conducted as late as the 1820s. The West Portico was one of the last areas known to be under construction, and this archaeological research points to the fact that the steps were never in his lifetime finished in the form that Jefferson had intended.

The steps and cheek walls are currently brick with slate pavers. The brick steps were constructed in 1926, and the slate paving stones were added around 1938.

In April and May of 1999, the Monticello Department of Archaeology excavated a portion of the steps. The project was conducted in collaboration with the Monticello Department of Restoration, and consisted of the excavation of two 5 x 5 foot units, and the removal of backfilled sediment from a 5 x 6 foot unit that had been excavated in 1989. These three units were on the southern edge of the West Portico, along the south cheek wall. The combination of new archaeological data with information from previous excavations and from historic images and texts allows us to present here a newly complete history of the West Portico Steps.

Research Questions

The purpose of the archaeological investigation was to determine the configuration and building materials of the steps and the cheek walls during Jefferson's lifetime. Historical texts do not provide definitive answers to the questions of original building materials and cheek wall width, and the various contemporary depictions do not agree.

Synopsis of Results

Archaeological research identified four major versions of the West Portico steps prior to the 1920s construction. None of these had a set of masonry steps; the final phase provided the substructure for a set of masonry steps that was never built. The current cheek walls are narrower than the bases of the columns behind them, and excavation revealed that this is an original characteristic. The four phases can be assigned dates within Jefferson's lifetime. The phases and the evidence for them are discussed below in the presentation of the project's archaeological interpretations. For the reader already familiar with the West Portico Steps' components, they are summarized here as follows:

I. During the first phase the West Portico may have not extended as far west as it currently does. It is likely that the portico floor ended with the wall that now supports four of the six Doric columns (this wall is called the column-bearing wall throughout this report), and that either no steps existed at that time, or an ephemeral set of steps (probably wood) projected from that point. We see no sign

Figure 1. *The West Portico before excavation, April 1999.*

of a cheek wall from that period.

I. Subsequently the West Portico platform was extended westward with the addition of cheek walls and a head wall. This change would have warranted a new (or perhaps first) set of steps. These steps, like in Phase I, were either wooden or not constructed. That configuration, in either case, was intended to be temporary.

III. A major building phase took place to finish various elements of the West Portico, such as the columns, the floor, and the sub-structure for a set of masonry steps. The latter is a thick brick wall running along the western side of the original head wall. This was intended to support a new set of steps, likely stone, that were never built. Instead, the space was later backfilled with sediment, creating the earthen ramp visible in photographs from the late nineteenth and early twentieth centuries.

IV. Re-building of the south cheek wall occurred following the Phase III construction. This could have been during Jefferson's lifetime. This construction, with slightly narrower bricks, accounts for the small difference in width between the wall's footer and its middle courses. The top courses are narrower still, due to a twentieth-century re-building. Following this re-building, the earthen ramp was constructed.

The first of these four phases belonged to Jefferson's original Monticello (begun in 1770). The second phase may also belong to this early version of the house, or it may correspond to the second Monticello (begun ca. 1800). It is clear from the archaeological record that the building events of these two first phases were separate, but the evidence does not indicate whether the time that elapsed between them was "...days, weeks, months or years..." (Heath n.d.:26). Phase III is solidly dated to the early 1820s on the basis of historical evidence. Many documents describe the building events that took place in 1822-23. Phase IV occurred after Phase III, but by how much, we cannot say.

Historical Evidence

Monticello is much-recorded in drawn, painted and photographic images. Photographs document some of the West Portico's history from the late nineteenth and the twentieth centuries, but raise previously-unanswered questions about the steps during earlier periods. Nineteenth century drawings and paintings also elucidate yet obfuscate, raising more questions than they answer. Photographs and artists' renditions, by their contradictions, led at least in part to the 1999 excavations, where an independent source of evidence was sought to understand the discrepancies.

Photographs

A 1940 photograph shows colonial-costumed people seated on the steps that appear in their current form: brick with slate pavers[1]. The steps achieved this form in a phase of restoration that architect Milton Grigg undertook in 1938. Grigg altered the cheek walls and apparently installed the slate paving stones on the steps as well as re-seating the pre-existing slate paving stones under the roofed portico. The details of Grigg's changes to the cheek walls are included below, in the discussion of Phase VII at the West Portico.

A photograph from Franklin D. Roosevelt's July 4, 1936 visit to Monticello shows clearly that on this well-documented occasion, the steps were brick, with no pavers. This places the arrival of the slate pavers to a time between the years 1936-40; with Grigg's known work during this period, it seems safe to conclude that this addition was part of his enterprise.

There is considerable photographic evidence from the late nineteenth and early twentieth centuries showing the Portico before the extant brick steps were built in the 1920s. Photographs from this period show inconsistent levels of upkeep of the West Portico, variously revealing states of abandon and more formal states, including a time when a pair of lion statues topped the cheek walls (**Figure 13**). Most intriguingly, these early photographs do not show steps of any description. Rather, they show what appears to be an earthen ramp –in the less-tended states sporting an occasional shrub- leading from the West Lawn to the Portico. The earthen ramp had never been understood, and appeared incongruous with the house and with the masonry steps of the East Portico (e.g., Heath n.d.:8). The presence of these photographs contributed to the mystery surrounding the West Portico's history. Heath expresses the assumption of some of the viewers of these photographs, namely that a "new set of brick steps" was either overgrown or intentionally buried in the space of a few short decades between Jefferson's death and the first appearance of the ramp (which occurred in non-photographic depictions: see below) (n.d.:7-8). Other interpretations suggested that the ramp was "…a quick and economical substitution for a stair that had gone into ruin. [And that if] …that were true, it seems likely that the ramp replaced wooden steps rather than those of masonry" (Beiswanger, n.d.:2).

The earliest photograph located for the West Portico is a hazy image dating to the period 1860-75 (cover illustration). It shows an earthen ramp with two carriages parked beneath the portico roof. This is the earliest known photograph of the West Portico, and among the earliest of Monticello. Photographs of the West Portico did not become common until the early years of the twentieth century. Earlier representations of the steps are non-photographic ones, and filtered through the artists' motivations, skills, and perceptions, are as much social product as they are records of architecture.

Non-Photographic Depictions (Drawn and Painted Images)

During Jefferson's lifetime, several of his friends and associates who visited the house recorded the building and landscape. Other artists continued to render their versions until the turn of the twentieth century, at which point the popularity of photography eclipsed that of drawing and painting of the site.

The non-photographic images include embellishments by their respective artists, details either altered or added. Considerable variation in

[1] All photographs, except where noted, are found in the Monticello Department of Research image files.

Table 1. *Non-Photographic Depictions of the West Portico.*

Portico	Date	Artist	Copy of	Step Mat'l	No. of Steps	Cheek Walls
W	1802-06	Anna M. Thornton			7?	thick
W	1803 (prob)	Robert Mills			11	thick
W	1820	John Dix			4	thick
W	1824	Mary Girardin			3	thick
W	1825	Jane Braddick Peticolas			4	thick
W	ca. 1825	Jefferson Vail			5	thick
W	ca. 1825	Martha R. Woodward			4?	none
W	1830-35	George Cooke			6	none
W	1832	John H. B. Latrobe			4?	none
W	1833	Aaron Vail		grey; stone?	4?	thick
W	1851-71	J.D. Woodward		earth fill	-	crumbled
W	1853-57	Peter Kramer		earth fill	-	thick?
W	1857	Edward Boyer		earth fill	-	narrow?
W	1887	Henry Fenn		earth fill	-	narrow?
W	1899	M. Jones		smooth	-	narrow
W	late 1870s	unknown		earth fill	-	thick?
W	1820	Asher Brown Durand	John Dix		4	thick
W	1830s	unknown	Cooke		5	none
W	1845	Robert Sears	Cooke		9	none
W	1845	Henry Howe	Cooke		5	none
W	1850s	Sarah C. Melendy	Cooke		6	none
W	1850s?	unknown	Cooke		6	none
W	1896	unknown	Cooke		6	none
W	c. 1852	Richardson?	Cooke		4	none
W	c. 1856	unknown	Cooke		5	none
W	c. 1858	J. C. Buttre	Cooke		6	none
W	c. 1860	Benson J. Lossing	Cooke		5?	none
W	c. 1862	unknown	Cooke		6	none
W	c. 1880s	unknown	Cooke		6	none
W	late 1830s	unknown	Cooke		6	none
W	mid 19th c	unknown	Cooke (prob)		6	none

the renderings of components such as color of steps and cheek walls, number of steps, and presence and width of cheek walls, indicates that at least some of the artistic versions of Monticello are not true records of the architecture at the time.

In the scope of this project, a survey was conducted of the West Portico images recorded in the Monticello Department of Research (**Table 1**). There were sixteen original (not copied from other images) non-photographic depictions of the West Portico. These depictions can be divided between those that were drawn during or immediately following Jefferson's lifetime, mostly by friends and associates of the family (1835 and earlier) and those that were drawn significantly after his death (1850 or later), by individuals who presumably had less invested in presenting particular renditions of Monticello. In addition to these sixteen renditions, there were fifteen non-photographic depictions that were copies of earlier works. These derivatives are a distinct type of representation because their artists may have had no firsthand

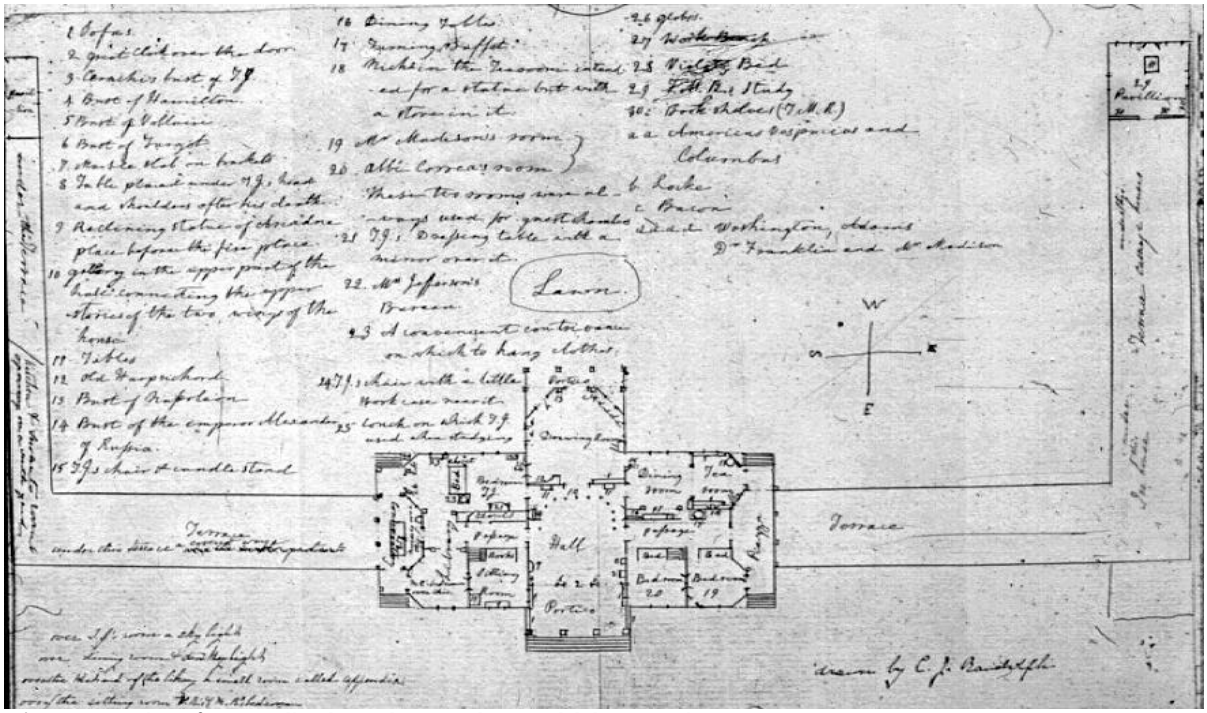

Figure 2. *Plan of Monticello, drawn by Cornelia Randolph, post July 4, 1826.*

observation of Monticello. All the post-1850 original depictions show cheek walls and an earthen ramp between them. There is similar unanimity among fourteen of the derivatives, which are copies of the Cooke view (1830-35) that exists in its published format, although the original has been lost; these all show no cheek walls and solid steps. By contrast, there is much more variability among renditions from 1835 or earlier. These works variously show the presence or absence of cheek walls, and steps numbering between three and eleven[2]. What does this variation signify? The non-uniformity in the images from 1835 and earlier may be a product of the need for that set of artists to render Monticello in a way that would be considered appropriate by Jefferson or members of his family. None of the images from Jefferson's lifetime shows an earthen ramp. Nor does any clearly show wooden steps, although the grey from Vail's image, for example, may be construed as painted wood. Similarly, none of the three early depictions shows the unfinished West Portico columns, although documentary sources indicate that these were not masonry, but rather trunks of tulip poplar trees until the summer of 1822 (McLaughlin 1988:332-3). All of the images from the 1835 and earlier group that show cheek walls show them as wide as the column bases, a configuration that we know from archaeological evidence did not occur. It is likely that the variability in the images represents a different solution by each of the artists to mitigate the temporary status or non-ideal nature of these West Portico elements.

Written Documents

Historic sources provide inconclusive evidence of whether the West Portico Steps were ever built during Jefferson's lifetime. The plan of the house and dependencies drawn by his granddaughter, Cornelia Randolph, after Jefferson's death in 1826 shows a flight of steps on the East Portico, and the six columns on the West Portico (**Figure 2**).

[2]The current West Portico Steps configuration, dating to 1925-6, has seven steps.

However, it shows no steps leading from the West Portico. In stark contrast, Randolph's plan shows steps on all four Corner Terraces as well as the East Portico.

Throughout much of Jefferson's lifetime, Monticello was an unfinished structure. During the protracted period of construction, many of the individuals who visited or stayed at Monticello commented on the lack of various amenities, or on the inconveniences offered by the ongoing construction.

The West Portico was one of the last-finished areas of the house. Family letters from 1822 and 1823 discuss the completion of the portico, apparently including the columns and the floor. In November 1822 Elizabeth Trist, a Charlottesville friend of Jefferson's, wrote to her grandson, Nicholas Trist, that "Mr Jefferson has been finnishing [sic] his back Portico was careless took a wrong step fell and broke his arm at the wrist..."[3] This was also reported to Nicholas Trist in the same month by Virginia Randolph as a fall "...down one of the flights of steps leading from the terrace..."[4] The contradiction between these sources makes them unreliable as accounts of West Portico Step construction. However, a letter from Virginia to Nicholas in June 1823 indicates that whether or not Jefferson's fall was from the West Portico, work was occurring there during that period. She wrote, "Since the columns to the portico have been completed, Grand-Papa has had the great work bench removed from it, and a floor layed [sic]."[5]

Accounts of the work at the West Portico include a bill from John Gorman, the stonecutter who was engaged to quarry and cut the stone for the bases and capitals of the columns, and to lay the brick for the column shafts (McLaughlin 1988: 333, 447-8). He also laid the stone for the portico floor, this with the help of one of Jefferson's slaves, Thrimston Hern. This work occurred in 1822 and 1823.

An undated letter from Martha Jefferson Randolph to Thomas Jefferson Randolph described the chaos that the floor- laying entailed[6]:

> The floor of the portico is ript [sic] up and the red dirt in it all loosened and partly thrown out. Gorman says that he can do nothing [original emphasis] without Thrimston and that it will take him still a week. If it is possible to spare him so long for pity sake let him remain, as we shall all be mired in the very drawing room and dining room if we remain still after harvest in our present condition. Necessity has no law so that if you cannot do without Thrimston he must go, but you will be the death of me if you do take him in our present distress of most horrible dirt and discomfort.

These sources document the installation of the West Portico floor and columns, and place the work during 1822-3. In spite of the discussion of the work, its costs and inconveniences, any mention of the steps is notably absent. No known documents record either the unfinished nature or the completion of the steps, or what materials the steps may have been or were intended to be. The lack of observations on the finishing of the steps might imply that they were never completed, although it is clear that this area was being renovated at the end of Jefferson's life.

What the steps were like before the 1820s building campaign remains elusive. In an account of her 1809 visit to Monticello, Margaret Bayard Smith describes a family scene; "we seated ourselves on the steps of the Portico, and he [Jefferson] after placing the children according to their size one before the other, gave the word for starting and away they flew; the course round this back lawn was a qr. of a mile..." (Hunt 1906:76). Reading further, Bayard Smith states in the same sentence that when the children ended their race they "returned to the spot from which they started" and threw themselves into the open arms

[3] 1822 Nov. 28. Elizabeth Trist (Liberty) to NPT (West Point), DLC/NPT [reel 1/frame 420-422]. Transcription, Sara Bon-Harper.

[4] 1822 Nov. 12. VJR (Monticello) to NPT (Louisiana), DLC/NPT [reel 2; frame 141]. Transcription, Anna Koester.

[5] 1823 June 5. VJR (Monticello) to NPT (Louisiana), DLC/NPT [reel 2/frame 172]. Transcription, Anna Koester.

[6] 182? MJR to TJR (Tufton), ViU/Carr & Cary. Transcription, Anna Koester.

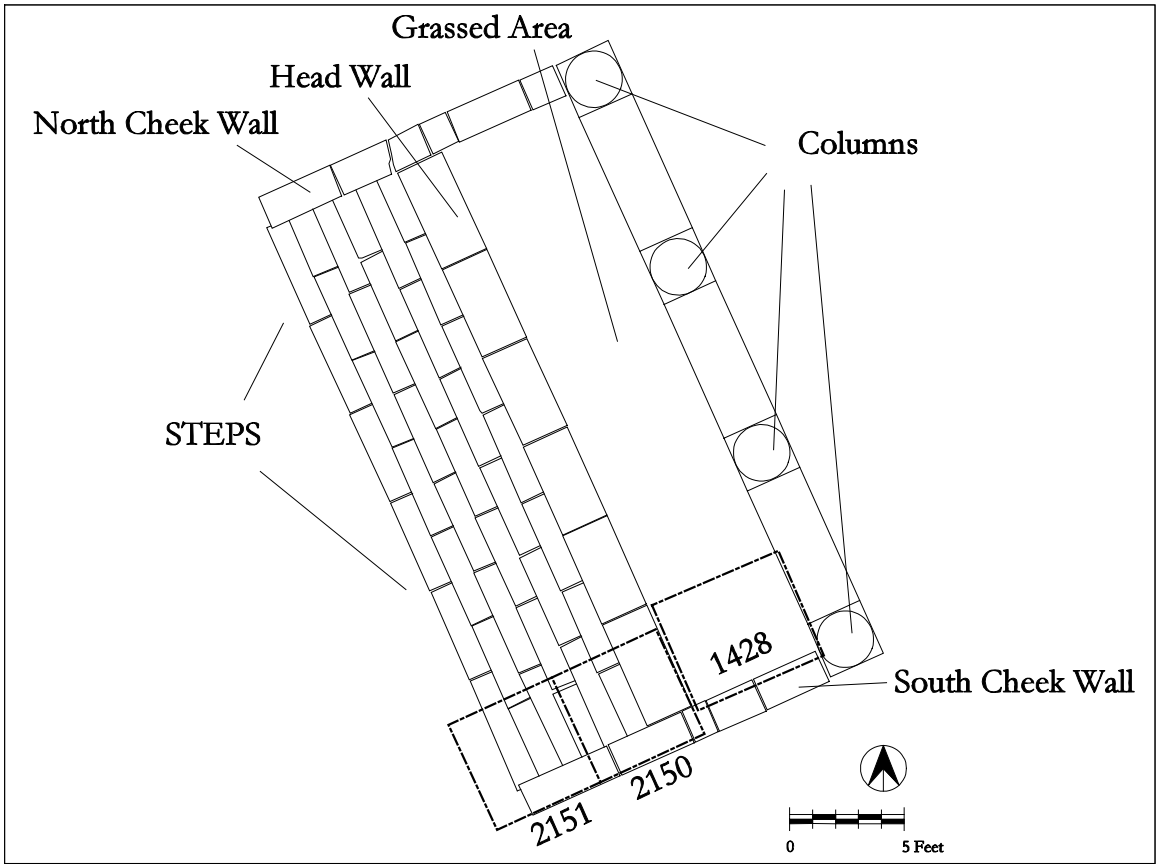

Figure 3. *Location of excavation units 1428, 2150, and 2151.*

of Jefferson who "...pressed them to his bosom and rewarded them with a kiss; he was sitting on the grass and they sat down by him, untill [sic] they too were rested" (Hunt 1906:76). It is impossible to interpret with certainty the West Portico that was the backdrop for Bayard Smith's vignette. The setting was clearly the back, or West Portico, and the mention of steps may be a suggestion that there were indeed temporary (wooden) steps at that point. Presuming that Bayard Smith does not contradict herself, the passage may be read that there were temporary steps and a grassed platform at the top. It remains however, that the purpose of the passage was the demonstration of Jefferson's delight in his grandchildren, not an architectural description. We may only tentatively make the interpretation of the temporary step and grassy platform configuration. It is also entirely likely that either Bayard Smith was not concerned with a self-contradiction, that she was speaking figuratively about the steps, or even that Jefferson moved himself while the children were hurtling about the West Lawn.

Archaeological Investigations

Methods

The 1999 investigation of the West Portico Steps began with the labeling and removal of the slate capping stones from the south cheek wall and portion of the steps to be excavated. These were set aside to be replaced at the completion of work. Following that, the 1920s brick and concrete steps were removed, first with hammer and chisel, and then more successfully using a jackhammer. Then the new units were laid along the South Cheek Wall and located on the Virginia State Plane

coordinate system[7]. Beneath the masonry steps, the units were excavated by trowel, and the sediment screened through quarter-inch mesh. All artifacts were kept and recorded. Stratigraphic contexts were identified and excavated in reverse depositional order, with sediment color and texture recorded according to departmental standards and the Munsell Soil Color Charts (Monticello Department of Archaeology 1999; Munsell Soil Color 1994). Sediment samples were taken from exposed profiles for chemical and phytolith analysis.

The West Portico Steps archaeological investigations of April and May 1999 included the excavation of two 5 x 5 foot units, and the removal of backfill from a 5 x 6 foot unit previously excavated by the Monticello Department of Archaeology in 1989 (Heath n.d.). The two new squares were excavation unit numbers 2150 and 2151, and the re-examined unit was 1428. All three were along the south cheek wall of the West Portico steps, and their locations are illustrated in **Figures 3** and **4**.

Interpretations

In the summer of 1989, unit 1428 was excavated, along with unit 1427 that mirrored it inside the north edge of the West Portico. That research was done to investigate the grassy platform between the columns and the top of steps. It had been unclear whether the grassy covering of that area was a Jeffersonian feature, or a later addition. Historic depictions of the west front of Monticello show the flat area, but do not indicate clearly the material that covered it, whether slate, wood, or grass. The 1989 excavations were similarly inconclusive regarding the surface of the platform. The evidence revealed at the time led to the conclusion that the area had been too disturbed to provide definitive clues for one surface or another.

[7]The coordinates of unit 2151 are NW: x=11,496594.670, y=3,891397.540, z=871.120; NE: x=11,496599.240, y=3,891399.570, z=871.140; SE: x=11,496601.270, y=3,891395.000, z=871.140; SW: x=11,496596.700, y=3,891392.970, z=871.120. Unit 2150 has the coordinates NW: x:11,496599.240, y=3,891399.570, z=871.140; NE: x:11,496603.810; y=3,891401.600; z=871.160; SE: x:11,496605.840, y=3,891397.030, z=871.160; SW: x:11,496601.270, y=3,891395.000, z=871.140.

The 1999 research was able to draw on data from two new excavation units and from the earlier ones. The unbackfilled unit 1428, and the two new excavation units together form a 16-foot long profile from the column-bearing wall to the ground at the bottom of the steps (**Figure 5**). New data from units 2150 and 2151 and the re-examination of the stratification from unit 1428 in light of this new evidence allow us to put together a more complete interpretation of the West Portico Steps. The definitions of the contexts from both phases of excavation and their stratigraphic organization are presented in Appendix 1, and their interpretation is discussed here with reference to a Harris matrix illustrating their stratigraphic relationships (**Figure 6**) (Harris 1989). These phases were also summarized above (pp. 1-2). The combined excavation evidence produces a chronology of the West Portico from Jefferson's first version of Monticello (1770s) through the addition of the slate caps on the steps, which probably occurred in 1938, under the direction of architect Milton Grigg.

The excavated and re-excavated areas provide evidence for the building events associated with the head wall, a later brick wall against the head wall, the cheek wall, and the wall under the four southwestern-most columns, which is called the column-bearing wall for purposes of this report. The sequence of these events is very clear in the newly excavated units, and is integrated into an expanded interpretation of unit 1428.

Phase I, 1770s

When Jefferson constructed Monticello in the 1770s, the West Portico consisted of a squared platform, which at first ended in the column-bearing wall. During this early period, the steps, if they were ever constructed, were likely wood. We can rule out masonry steps from this period, as masonry would undoubtedly have left its traces on the face of the column-bearing wall, and probably in the ground beneath. Any steps that existed then have been completely removed and their traces obliterated by subsequent building.

The builder's trench for the column-bearing wall was uncovered during the original excavation of unit 1428. That trench (**Figure 4**, element 7; context 1428N in **Figure 6**) was cut by

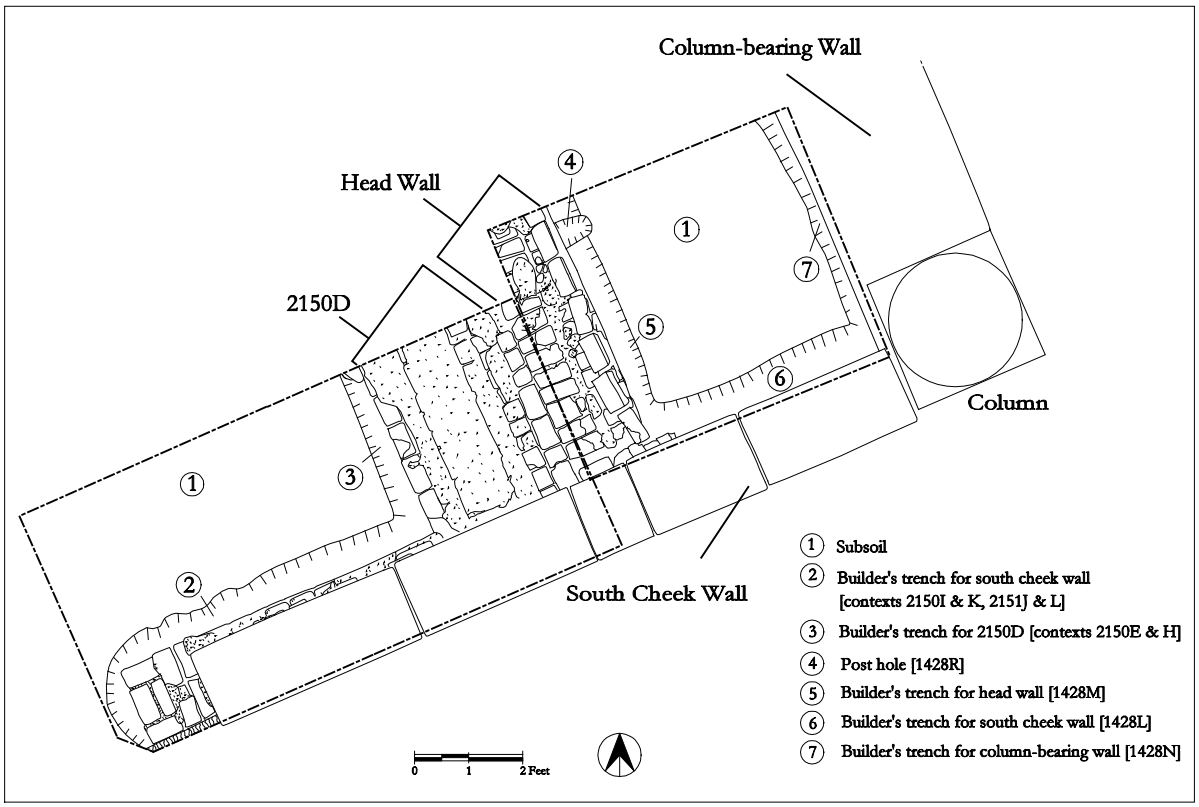

Figure 4. *End of excavation, units 2151, 2150, and 1428.*

the later builder's trench (**Figure 4**, element 6; context 1428L in **Figure 6**) for the south cheek wall. There is no sign of cheek walls from this earliest period. The existing cheek walls (discussed in more detail in Phase II, below) abut the column- bearing wall (with no bonding between them). Based on builder's trench evidence and this joint between the walls, it can be concluded that the cheek walls were built later, in tandem with the more westerly head wall. The current cheek wall foundations, from Phase II, appear to be the original ones, and did not replace any earlier versions.

Phase II

The second phase at the West Portico may have occurred as a later addition to Jefferson's first Monticello. Alternatively, it may correspond with the construction of the current version of Monticello (ca. 1800). At this time, the West Portico platform was extended westward with a cheek wall, head wall, and probable new set of steps. The cheek wall and head wall were planned together, as evidenced by the joint between them. They are keyed into one another, with a series of alternating recessing and abutting bricks in the lowest three courses, and keyed courses above that. Investigation into the crumbling joint of the upper courses suggests that the walls were built together, as the mortar seems to be not only identical in appearance, but also contiguous between the two walls.

However, the 1989 excavation of unit 1428 recorded the fill of the builder's trench for the south cheek wall (**Figure** 4, element 6; **Figure 6**, 1428L-2151J/L-2150I/K) as being cut by the trench for the head wall (**Figure** 4, element 5; **Figure 6**, 1428M). That evidence indicates that at least between the head wall and column bearing wall, the south cheek wall builder's trench was dug and filled in before the head wall builder's trench was dug. The best reconciliation of the complex evidence for the sequence of these two walls is to propose that the south cheek wall's lowest three

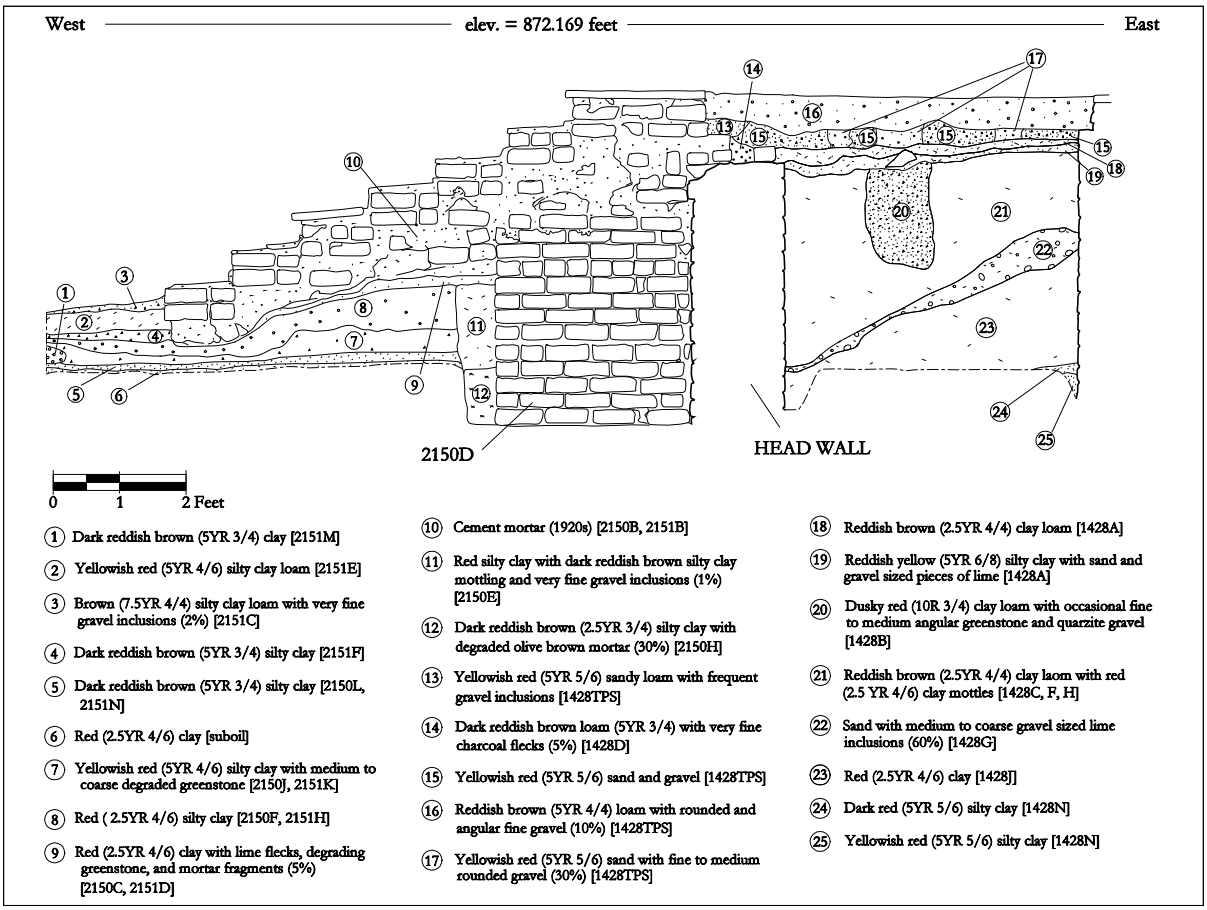

Figure 5. *North profile, West Portico Steps excavations.*

courses were built and the trench filled in, then the head wall builder's trench was dug and the first three courses built, and then the two walls were constructed together from there up. The alternating recessed bricks in the first three courses of the two walls, with keyed courses above, support this conclusion.

THE WEST PORTICO FLOOR SURFACES

The building of the head wall and cheek walls created a new platform (the current grassed area) extending west from the floor surface of the roofed portico. The surface of the platform was either wood planking over earth fill or simply earth fill, and the floor of the roofed area of the portico was probably similar until it was paved in slates in the early 1820s. The filled platform area was created when the cheek walls and head wall were built, and a space was created by them and the column-bearing wall. The deposition of this fill (**Figure 5** layers 19, 20, 21, 22, 23, or contexts 1428A, B, C, F, H, G, and J in **Figure 6**) was probably a final step in the construction of the surrounding walls.

Based on phytolith and artifactual evidence, stratum 19 (**Figure 5**, or in **Figure 6**, context 1428A) is likely the highest level of intact Jefferson-period fill. This might have been as an earthen surface stepped down from the portico floor surface, or an earthen surface with a wooden deck above it. Phytolith analysis of several samples from the north profile of unit 1428 supports either of these interpretations, and is discussed in Appendix 4 (Sullivan, 2000). Sediment layer 18 has a TPQ of 1864, provided by the presence of non-leaded clear glass in the equivalent stratum in the other 1989 excavation unit, the one along the north cheek wall, unit 1427 (context A). This

supports the interpretation that the area was open above level 19 or was disturbed at some point post-1864.

THE STEPS

As in the previous phase, there is no archaeological evidence of steps during Phase II. Jefferson himself, in July 1809, mentions both the N.E. and S.W. portico steps as starting and ending points of a survey of the mountaintop (N-219, Nichols 1978). While suggestive, the reference is not conclusive, and does not provide any details about the step area. In Phase II, either the steps were wooden, or they were never constructed. As previously, it is certain that masonry steps belonging to these walls would have left discernible traces on the surrounding masonry or in the ground. Sediment layer 7 (in **Figure 5**, or

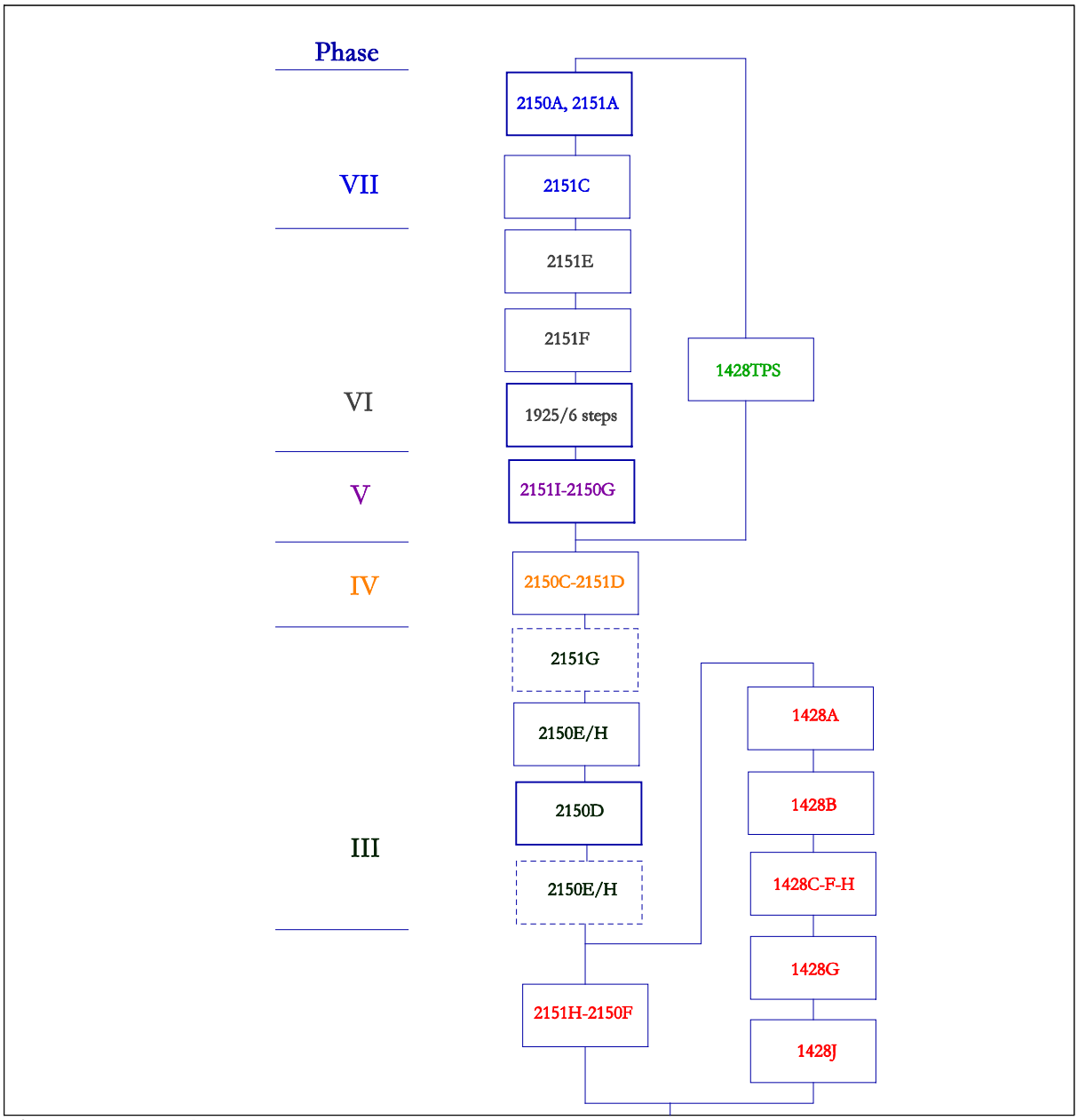

Figure 6. *(continued on next page).*

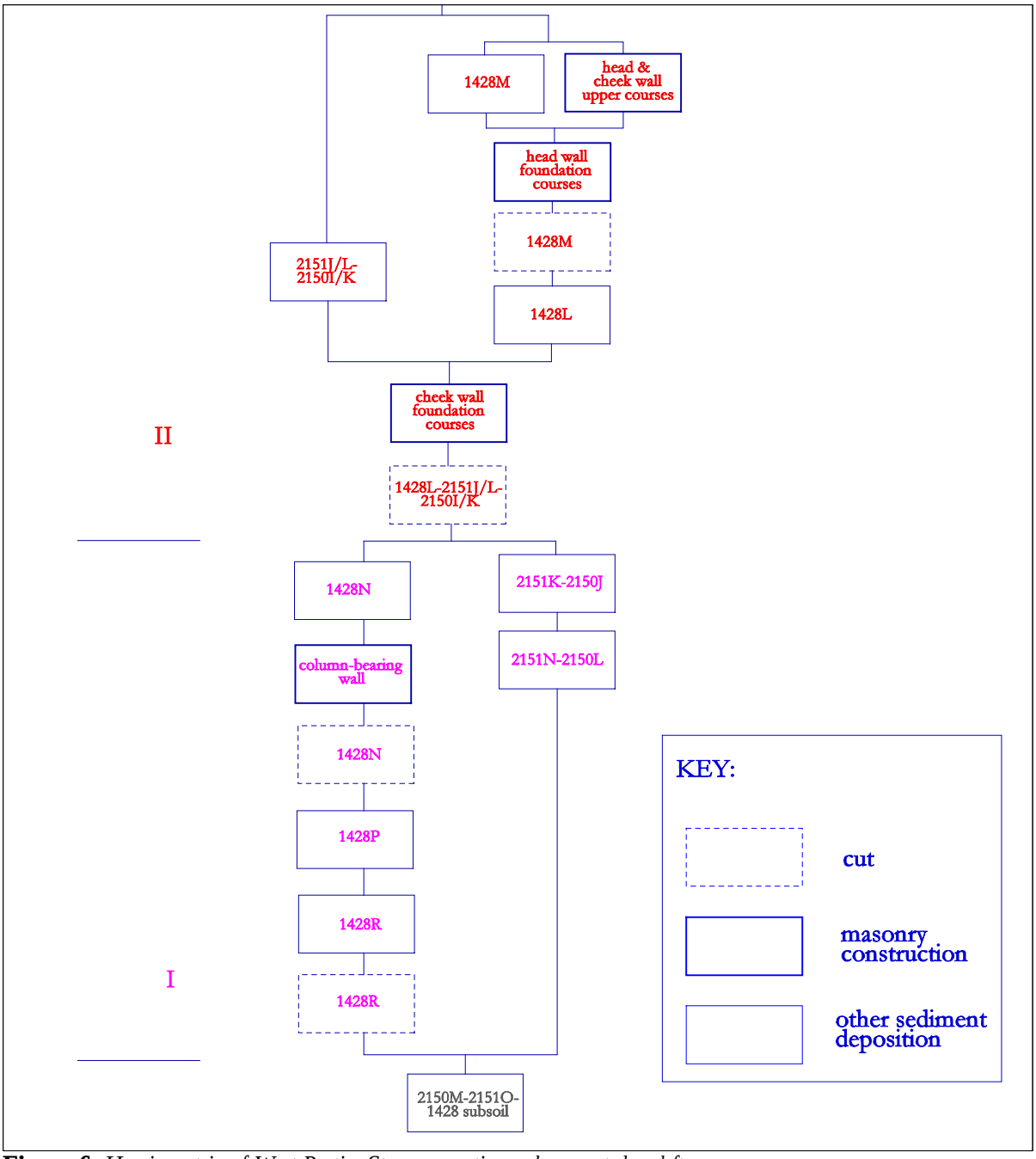

Figure 6. *Harris matrix of West Portico Steps excavations; phases noted on left.*

2150J and 2151K in **Figure 6**,) was present at the beginning of this phase, and layer 8 (contexts 2150F and 2151H) was deposited during the course of it. Layer 7 was cut by the builder's trench for the South Cheek Wall. Layers 7 and 8 were cut by contexts 2150E and H, the builder's trench for the secondary head wall (2150D). Layer 7 may have been fill from the construction of the first Monticello. The artifacts present in contexts 2150J and 2151K (layer 7, **Figure 5**) are all

Figure 7. *Section through 2150D, revealing pocket in Jefferson-period headwall.*

Figure 8. *South cheek wall, north face.*

building-related debris (brick, mortar, lime, iron, and slate), which supports this hypothesis.

The presence of these clay layers provides strong negative evidence for any masonry steps during this period. These intact deposits bear no marks indicating that they supported any steps. Masonry steps would likely have had some supports extending below these levels. Wood steps, if they were constructed like the wooden steps on the corner terraces of Monticello, may have rested on the ground surface without subsurface construction. The corner terrace steps were built up from the ground on arched brick pavings (Metz et al. 1999). No evidence of such elements occurs here, although it cannot be definitively stated that such evidence would have been deep enough to be preserved.

The 1809 Margaret Bayard Smith reminiscence supports the possibility that there may have been some steps during this time, and the archaeological investigation presents evidence that if these did exist, they were non-massive and

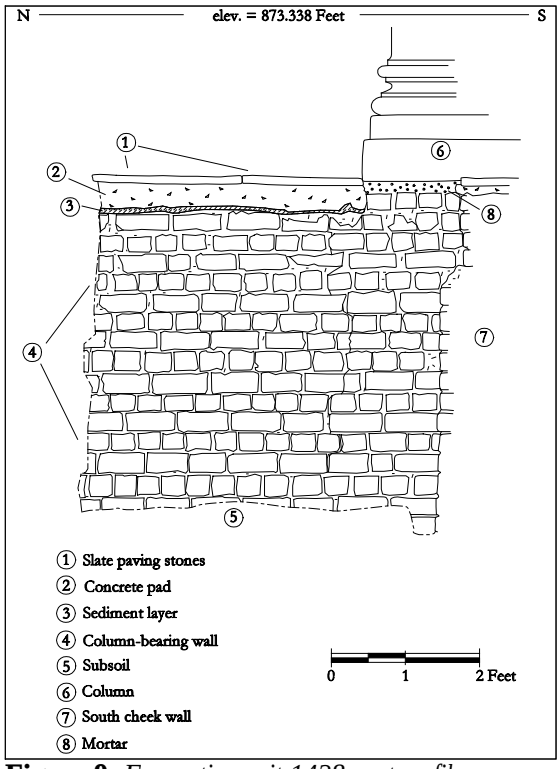

Figure 9. *Excavation unit 1428, east profile.*

likely temporary. Physical evidence that might support this is a pocket chiseled into the west side of the Jefferson-period head wall. This pocket was hidden by a later wall (2150D, see below), and was only revealed during the course of these archaeological excavations by the removal of a section of that later wall. This pocket, located approximately two feet from the cheek wall, may have supported the wooden framework for temporary steps (**Figure 7**).

CHEEK WALLS

The cheek walls were built during Phase II, cutting existing clay layer 7 (contexts 2150J and 2151K). The cheek walls as they were built in this construction phase were approximately as wide as they are today (1.5 feet). The footings of the south cheek wall are visible in that wall's builder's trench (2150 I and K, and 2151 J and L; **Figure 4**, element 2, and **Figure** 8). Enough of the original masonry is intact to conclude that these are the original footings at their original proportions. The only adjustments in the width of the cheek wall were above the foundation courses, with rebuilding once during Jefferson's lifetime or soon thereafter (Phase IV, below) and reseating of bricks in the post-Jefferson years. The former adjustment made the wall's middle courses narrower, and the latter activity, also discussed in Phase IV, caused unevenness on the north face of the wall and not a significant change in wall thickness. The western end of the south cheek wall was altered in length during the 1820s, and is discussed below.

Phase III, early 1820s

A large-scale building campaign took place at the West Portico beginning in 1822. The elements of the phase are grouped by the use of a greenish mortar, and dating of the phase is based on historical documents, and is confirmed by stratigraphic evidence from excavation. Letters by family and visitors discuss the work, and Jefferson's records indicate the materials and personnel involved. According to the documentary evidence, the 1820s building phase includes the installation of the brick and plaster columns replacing the tulip poplar trunks reported to have stood there before that time, as well as the laying of the portico floor. The columns and the floor were probably both completed at about the same time (spring-summer of 1823). Association

Figure 10. *End of excavation facing east, showing section through 2150D.*

can similarly date the greenish mortar in the several other places it occurs. As well as on top of the column-bearing wall under the columns, the mortar is seen on top of the thick wall (2150D) that was built against the Jefferson-period head wall, and on rebuilding at the end of the south cheek wall.

THE COLUMN-BEARING WALL AND WEST PORTICO FLOOR SURFACE

The column-bearing wall (**Figure 9**) is constructed of typical Jefferson-period brick, with the exception of a row of slightly recessed bricks on top of the wall, directly beneath the southernmost column. The recessed bricks are laid with the same greenish mortar associates with the 1820s work. There is no evidence of mortar on top of the wall, and the fact that the top of the all is about .33 feet below the present floor suggests that there was a wooden floor supported by joists. Later, the space was probably filled with sediment as a support for the floor stones.

The slates of the West Portico were originally laid in the 1820s. At that time they may have been seated on the earth fill of the portico. The stones that now pave the portico floor may be replacements, perhaps from the late nineteenth century, and were seated on a concrete pad in 1938 or soon after. Closer examination of the slates was out of the scope of the present study, but might reveal further information about their origin and history. Currently above the column-bearing wall and under the concrete pad is an unexcavated sediment layer that may be a part of the construction fill of the portico platform.

WALL, 2150D

The greenish mortar, along with two other mortars, appears in a wide brick wall, identified in excavation as context 2150D. This brick feature is 2.8 feet wide (a length equal to four stretchers) and runs along the west face of the early Jefferson period head wall. It was present along the length of head wall exposed in excavation, and might be presumed to continue along the entire length of the West Portico headwall. This is supported by photographic evidence revealing the very top of 2150D showing through the fill of the earthen ramp (**Figures 13** and **14**). The construction of 2150D cut through contexts 2150F, J, L, and M, and 2151H, K, N, and O (**Figure 5** layers 5, 6, 7, and 8).

During excavation, two-foot wide section of bricks (**Figures 7** and **10**) was removed from the wall in order to examine its profile and relationships with surrounding elements. Mortar occurs only between the courses of this wall; the bricks within courses are not bonded with mortar. The wall has two different colors of brick as well as three different mortars. Two of the mortars are similar in texture, but one is the distinctive olive green color mentioned above, while the others are grey. These are mixed in the same courses, without one appearing to pre-date or post-date the other.

The mortars appear to be experiments at producing a hydraulic cement, or what was then called "Roman cement." Jefferson spent a considerable amount of energy researching possible methods for making a hydraulic cement that would serve to waterproof the four cisterns that drained the roofs at Monticello (McLaughlin 1988:302-4). The documentary record indicates that between 1815 and 1822 Jefferson researched and obtained materials that would be appropriate for this use. The historical documents do not mention the application of these experiments in places other than the cisterns, but it appears that the mortars present in 2150D are exactly that.

An examination of the mortars was conducted by D. S. Lane and P. E. Stutzman at the National Institute of Standards and Technology, which revealed that the three mortars from 2150D and a mortar sample from the North Cistern differed from each other, but that all contained elements that might have been used in attempts at producing a hydraulic cement (see Appendix 3).

There are at least two notably different colors of brick used in this phase. Both are fairly fine-grained, and are more homogenous in texture than the brick identified with early Jefferson-period building (as in the main exterior walls of Monticello). The 1820s bricks vary in measurement, from 2.9 to 3.2 inches in width, 6.4 to 6.9 in length, and 1.7 to 2.0 in depth. These may have been bricks that Jefferson purchased, rather than had made, for use during this building phase.

A microscopic examination of these bricks and comparison with brick samples from the arches under the corner terrace steps, reveals that one of the brick types from 2150D is nearly identical to the corner terrace arch brick. The arch bricks are securely dated to the late Jefferson period on the basis of stratigraphic and artifactual evidence. The similarity between the bricks from these two locations lends further support to the dating of 2150D as a late-Jefferson period feature.

Context 2150D is a massive structure. If it extends across the span of the West Portico head wall, it may contain roughly 5,000 bricks. It is unlikely that it was constructed purely as a laboratory for the hydraulic cement experiments. As a part of the 1820s push to complete the West Portico, the wall seems to have been intended as the foundation for a planned set of masonry steps. The building phase including 2150D was never completed, and the superstructure was not installed. Instead, the area was eventually backfilled with sediment, creating the earthen ramp that appears in mid-nineteenth century

Figure 11. *Brick support pier under the East Portico Steps (1977).*

artists' renditions, and in late-nineteenth and early-twentieth century photographs. Judging from the robusticity of 2150D, the superstructure was intended to be massive, not a relatively lightweight (wooden) construction. Monticello's East Portico has a slightly different construction for the support of its masonry steps. When the stone steps were reset in 1977, it was revealed that a series of brick piers supported the stones. Unlike the West Portico's 2150D that is a continuous wall, these are a series of supports, holding up the stones at several points across the length of the steps (**Figure 11**).

During the construction period of the 1820s and in fact upon Jefferson's death in 1826 there may have been temporary wooden steps, as there may have been during previous configurations. There is no remaining archaeological evidence in either case for this, as the sediment that formed the earthen ramp was mostly removed for the construction of the modern cement and brick steps (see below). Contexts 2150C and 2151D (**Figure 5** layer 9) are the only remnants of the fill piled against the brick feature (2150D) to form the earthen ramp. The only other evidence that can be called on is the lack of depictions of a temporary set of steps. While the earthen ramp is recorded in drawings and photographs, no images of the West Portico clearly captured phases with wooden steps. The Vail and Braddick views present steps that might be interpreted as painted wood, although this interpretation is ambiguous.

Modifications to the West End of the South Cheek Wall

The west end of the south cheek wall was modified during the green mortar phase of the early 1820s. A construction trench was excavated around the end of the wall so that the masonry could be modified. Since it cannot be assumed that the end of the wall above grade was the same as the end in the footer courses, it is unclear what the modifications were. The excavation for the work (which together with its fill comprises context 2151G) cuts the original builder's trench for the cheek wall (context 2151J and 2150I, see **Figure 6**) as well as a layer of construction fill (2151H). Either some of the end bricks were

removed, or those still present were reset. Green mortar adheres to the end bricks, and was present in the fill of the cut. The cut for this work intrudes 2151H and was sealed by 2151F.

Phase IV, re-building of the south cheek wall, creation of the earthen ramp

After the construction of wall 2150D late in Jefferson's lifetime, the South Cheek Wall was partially re-built on the same footer. It was most likely a different building phase than the 1822-3 construction, because the work does not appear to have been done in the same greenish mortar as the other elements in that phase. The south cheek wall rebuilding might have occurred very soon after the construction of 2150D, even before sediment layers were deposited against 2150D to form the earthen ramp. That the wall is neatly laid further supports the interpretation that both faces of the wall were visible at the time of the rebuilding. The result of the rebuilding is that the lowest five courses of the wall are wider by about one tenth of a foot than the middle courses. The wall is a consistent two bricks wide from the footer through these courses, and the difference in width comes from the use of narrower bricks in the later re-building. The wall was also re-built in 1938, and this made the top courses narrower still. After the cheek walls (or at least the South Cheek Wall) were rebuilt from the fifth or sixth course up, the space between the two cheek walls was filled with sediment as a substitute for the intended masonry steps. This may have been very late in Jefferson's life, or it may have occurred upon his death. The use of earthen ramps may have been an acceptable way of producing economical entrances to even grand country estates during Jefferson's lifetime. The cost of hiring stone masons was prohibitive, and the alternatives probably very attractive. A relatively intact comparative example exists today at Barboursville, the home of Virginia Governor James Barbour. Although the house burned in 1884, the ruins as well as contemporary photographs reveal that this house, designed by Jefferson for Barbour in 1814, had earthen ramps at both front and back entrances (**Figure 12**). Most of the earthen ramp fill was dug out for the construction of the current West Portico Steps (Phase VI), so that the only remaining contexts of this fill are 2151D and 2150C.

Figure 12. *Earthen ramp at Barboursville (Orange County, Virginia, 1999).*

Phase V, post-1820s

The north face of the south cheek wall is irregular below the current stair level. This irregularity is the result of rebuilding from the outside (south side) of the wall that may have occurred at any time after the backfilling that created the earthen ramp, either before or after the concrete and brick steps were built in 1925-6 (see below). Rather than removing the earthen fill or steps to provide access to the wall from both sides, the work was done from the accessible south side. The bricks were reseated while only the wall's south face was accessible, so the bricks on the hidden face of the wall were not aligned as smoothly (**Figure 8**). The mortar-rich sediment along the wall resulting from the repair (contexts 2151I and 2150G) intrudes into the edge of the fill of the builder's trench for 2150D (2150E), placing this event to post-1820s (see **Figure 6**).

Photographs from this period show the earthen ramp, the cheek walls, and the single stepped rows of bricks along the top of 2150D (**Figures 13** and **14**).

Phase VI, 1925-6

When the TJMF purchased Monticello in 1923, it appears as though one of its first acts was to remove the earthen ramp and to construct a massive set of brick steps laid in cement mortar. In construction that occurred in 1925 or 1926, the now-famous West Portico steps were installed. Photographs taken during the 1920s clearly show that the steps had no pavers, and were solely brick. Both excavation and photographic evidence indicate that the south Cheek Wall did not cover

Figure 13. *Holsinger photograph of the West Portico (undated).*

Figure 14. *Holsinger's 1912 photograph of lion statue on north cheek wall of the West Portico.*

the bottom step at this time. The wall extended to the edge of the second step, but the lower step was not bounded by cheek walls. The footer courses of the wall were present, but the 1920s steps were built over them, and the wall extended west later. A cement layer at ground level in the cheek wall indicates that the above-ground courses were built over the west end of the wall (and edge of the bottom step) later. This means that the end of the wall was nearly two feet further east than the below-ground footers. Presumably, this applies to the north Cheek Wall as well as south.

Phase VII, Milton Grigg Phase (1938)

A significant phase of restoration work at the West Portico was conducted beginning in 1938 under the direction of architect Milton Grigg. Grigg repaired the cheek walls, as they had deteriorated due to water damage. On June 10, 1938 he wrote to Stuart Gibboney, then president of the TJMF, that he had begun replacing some of the "modern brick" used on the West Portico. Presumably this brick was in the cheek walls, which had suffered damage at several points in their history. It appears as though Grigg replaced the top courses of the cheek walls, and also extended them westward to cover the bottom step. Layer 16 (**Figure 5**) is fill associated with Grigg's work. Grigg also re-seated the slate paving stones under the roofed portico platform in order to prevent further water damage to the cheek walls. As discussed above, photographic evidence points to the likelihood that at this time Grigg also installed the slate paving stones on the steps.

Conclusions

The 1999 West Portico Steps Project was able to provide conclusions about the configuration and materials of the steps during the past two centuries. From new archaeological investigations combined with prior archaeological work and documentary research, it is clear that there were no masonry steps at the West Portico before the current ones, which were built in 1925-6 by the TJMF. During Jefferson's lifetime, there were likely temporary wooden steps leading from the roofed Portico to the West Lawn. In 1822-3, Jefferson mounted his final building campaign at the West Front of Monticello, and finished the floor and columns. At that time, he also built the substructure for a set of masonry steps, which were never completed. This substructure is a massive brick wall (context 2150D) discovered during excavation in the spring of 1999. About the time of Jefferson's death, either slightly before or slightly after, plans for the masonry steps were abandoned, and earthen fill was placed against 2150D to form a ramp to the West Portico from the West Lawn.

This research sheds light on a mystery that stemmed from conflicting images of the steps during Jefferson's lifetime, and puzzling images – artistic from the nineteenth century, and photographic almost entirely from the twentieth- that later showed an earthen ramp. It provides an explanation for these conflicting and mysterious depictions of the West Portico Steps, and shows Monticello as Jefferson's long-time work in progress.

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Appendix 1. List of Excavated Contexts

Appendix 1, Table 1. *Excavation Unit 2150.*

Context	General Description	Sediment Description
2150A	slate capping on steps and cheek wall	greyish green (gley 4/2) slate; mortar
2150B	modern masonry (1920s), concrete and brick	red (10R 4/8) brick; mortar
2150C	clay layer with mortar and stone inclusions	dark red (2.5YR 3/6) clay; pink (5YR 3/6) sandy mortar; light olive brown (2.5Y 5/4) decomposed stone
2150D	brick construction, massive wall	red (2.5YR 4/8) brick; dark yellowish (10YR 4/4) mortar; white (2.5YR 8/1) mortar
2150E	builder's trench for 2150D, top layer of fill	reddish brown (2.5YR 4/4) clay; yellowish brown (10YR 5/6) silt
2150F	clay layer under 2150C	reddish brown (2.5YR 4/3) clay loam
2150G	mortar-rich repair trench along S. cheek wall	dark reddish brown (2.5YR 3/6) clay; brown (10YR 4/3) silty sand; very pale brown (10YR 8/4) sand
2150H	builder's trench for 2150D, lower layer of fill	dark reddish brown (2.5YR 3/4) silty clay; olive brown (2.5Y 4/4) silty sand mortar
2150I	builder's trench for S. cheek wall, top layer of fill	dusky red (10R 3/4) silty clay
2150J	bright clay layer under 2150F	red (2.5YR 4/6) silty clay
2150K	builder's trench for S. cheek wall, lower layer of fill	red (2.5YR 4/6) silty clay
2150L	variegated clay layer under 2150J	red (2.5YR 4/6) silty clay; olive brown (2.5Y 4/3) silt; red (2.5YR 5/8) clay
2150M	subsoil	red (2.5YR 4/6) clay

Appendix 1, Table 2. *Excavation Unit 2151.*

Context	General Description	Sediment Description
2151A	slate capping on steps and cheek wall	greyish green (gley 4/2) slate; mortar
2151B	modern masonry (1920s), concrete and brick	red (10R 4/8) brick; mortar
2151C	topsoil - grassy area on western edge of unit	dark reddish brown (5YR 3/3) loam
2151D	clay layer with mortar and stone inclusions	dark red (2.5YR 3/6) clay; pink (5YR 8/3) sandy mortar; light olive brown (2.5Y 5/4) decomposed stone
2151E	clay fill layer, western edge of unit, under 2151C	dark reddish brown (5YR 3/3) silty clay loam
2151F	fill layer, western edge of unit, under 2151E	dark reddish brown (5YR 3/4) silty clay
2151G	mortar/brick/loam fill of repair trench for rebuilding the W. end of S. cheek wall	red (2.5YR 4/6) silty clay; dark red (2.5YR 3/6) silty clay loam
2151H	clay surface under 2151D and 2151E	red (2.5YR 4/6) silty clay
2151I	repair trench along S. cheek wall	dark reddish brown (2.5YR 3/6) clay; brown (10YR 4/3) silty sand; very pale brown (10YR 8/4) sand
2151J	builder's trench for S. cheek wall, top layer of fill	dusky red (10R 3/4) silty clay
2151K	bright clay layer under 2151H	red (2.5YR 4/6) silty clay
2151L	builder's trench for S. cheek wall, lower layer of fill	red (2.5YR 4/6) silty clay
2151M	crumbly fill in W. edge of unit	red (2.5YR 4/6) silty clay
2151N	variegated clay layer	red (2.5YR 4/6) silty clay; olive brown (2.5YR 4/3) silt; red (2.5YR 5/8) clay
2151O	subsoil	red (2.5YR 4/6) clay

Appendix 1, Table 3. *Excavation Unit 1428*

Context	General Description	Sediment Description
1428TPS	topsoil	brown loam and sand and gravel fill
1428A	fill layer	red brown clay loam with charcoal, plaster, mortar, slate
1428B	scaffolding hole	brown red clay loam with mortar, stone, charcoal
1428C	Jefferson-period fill layer	mottled red-orange clay
1428D	fill layer	brown loam with mortar and charcoal
1428E	builder's trench for repair of south cheek wall	brown sandy loam with charcoal and mortar
1428F	Jefferson-period fill layer	brown loam with orange clay mottles, quartz, greenstone, and charcoal
1428G	Jefferson-period fill layer	brown sandy loam with slate, mortar, greenstone, brick, and orange clay inclusions
1428H	fill layer	mixed fill comprised of 1428F and 1428G
1428J	earliest post-construction fill layer	hardpacked clay with mortar, slate, and limestone fragments
1428K	burned layer	brown red clay loam with charcoal, mortar, brick
1428L	builder's trench for south cheek wall	orange clay with mortar
1428M	builder's trench for Jefferson-period head wall	loosely packed orange brown clay with mortar
1428N	builder's trench for column-bearing wall	brown sandy loam with mortar, brick
1428P	construction debris layer	mottled clay with scorch marks - yellow, red, white clay with brick and mortar fragments
1428R	post hole	brown red loam
subsoil		

[8] Sediment descriptions for previously-excavated contexts are from excavation records held in the Monticello Department of Archaeology. Newly taken sediment descriptions from the re-excavated north profile are found in **Figure 5**.

Appendix 2. Finds from 1999 excavations

context	material	form	subform/ware	description	manufacturing technique	applied decoration	count	tpq
2150C	glass	window glass			other		4	
2150C	iron	nail	rosehead		wrought/forged		1	
2150C	limestone	stone			quarried/cut		7	
2150C	brick	brick frag			other		2	
2150C	conglomerate	slag/clinker			waste		2	
2150C	mortar, lime	mortar			other		1	
2150C	mortar, sand	mortar			other		3	
2150D	mortar, lime	mortar			other		5	
2150E	brick	brick frag			other		4	
2150E	mortar, sand	mortar			other		2	
2150E	glass	window glass			other		1	
2150E	slate	stone			quarried/cut		1	
2150E	limestone	stone			quarried/cut		1	
2150F	iron	nail	headless	pointed end	wrought/forged		1	
2150F	brick	brick frag			other		4	
2150F	mortar, lime	mortar			other		2	
2150F	mortar, sand	mortar			other		1	
2150F	limestone	stone			quarried/cut		1	
2150F	slate	stone			quarried/cut		1	
2150G	glass	window glass			other		2	
2150G	mortar, sand	mortar			other		1	
2150G	brick	brick frag			other		1	
2150G	mortar, sand	mortar			other		1	
2150G	mortar, lime	mortar			other		1	
2150H	brick	brick frag			other		2	
2150H	glass	window glass			other		6	
2150H	charcoal	organic subst			other		1	
2150H	glass	window glass			other		1	
2150H	glass	brick frag			other		7	
2150H	slate	stone			quarried/cut		2	
2150H	mortar, lime	mortar			other		5	
2150H	mortar, sand	mortar			other		2	
2150I	brick	brick frag			other		5	
2150I	mortar, sand	mortar			other		1	
2150I	brick	brick frag			other		1	
2150J	brick	brick frag			other		8	
2150J	mortar, lime	mortar			other		1	
2150J	brick	brick frag			other		6	
2150K	iron	nail	rosehead	chisel point	wrought/forged		1	
2150K	glass	window glass			other		3	
2150K	slate	stone			quarried/cut		1	
2150K	mortar, lime	mortar			other		1	
2150K	brick	brick frag			hand made		1	
2150K	brick	brick bat			hand made		1	

context	material	form	subform/ware	description	manufacturing technique	applied decoration	count	tpq
2150K	brick	brick			hand made		1	
2150K	brick	brick frag			other		4	
2150L	brick	brick frag			other		37	
2150L	coarse earthen	hollow form	coarseware		wheel thrown	lead glaze	1	
2150M	glass	window glass			other		1	
2150Z	iron	nail	machine square		cut		1	1805
2150Z	glass	window glass			other		1	
2151B	brick	brick frag			other		1	
2151C	aluminum	closure	beer/pop bottle		crown cap		1	1897
2151C	iron	nail	machine round h	pointed end	drawn		1	1860
2151C	iron	nail frag			drawn		1	
2151C	copper alloy	coin			stamped		1	1921
2151D	glass	window glass			other		1	
2151D	coarse earthen	hollow form	bk-gz redware		wheel thrown		1	
2151D	slate	stone			quarried/cut		1	
2151D	conglomerate	concrete			other		1	
2151D	brick	brick frag			other		1	
2151D	brick	brick frag			other		1	
2151E	iron	nail	l-head	blunt cut end	cut		1	
2151E	iron	nail	l-head		cut		2	
2151E	iron	nail	machine square		cut		4	1805
2151E	iron	nail	indet head		unid		1	
2151E	iron	nail frag		blunt cut end	cut		2	
2151E	iron	nail frag			cut		4	
2151E	iron	unid hardware			unid		1	
2151E	iron	wire			drawn		1	
2151E	copper alloy/fe	finial			cast		1	
2151E	glass	light bulb	clrless lead		machine made		1	1895
2151E	glass	light bulb	clrless lead		machine made		1	1895
2151E	glass	light bulb	clrless lead		machine made		1	1895
2151E	glass	light bulb	clrless lead		machine made		1	1895
2151E	glass	light bulb	clrless lead		machine made		1	1895
2151E	glass	mirror			other		1	
2151E	glass	container	unidentified	amber	non-empontilled		1	
2151E	glass	container	unidentified	amber	non-empontilled		1	
2151E	glass	container	unidentified	amber	non-empontilled		1	
2151E	glass	container	unidentified	amber	non-empontilled		1	
2151E	glass	container	unidentified	amber	non-empontilled		1	
2151E	glass	container	unidentified	amber	non-empontilled		1	
2151E	glass	container	unidentified	amber	non-empontilled		1	
2151E	glass	container	unidentified	amber	non-empontilled		1	
2151E	glass	container	unidentified	amber	non-empontilled		1	
2151E	glass	container	wine bottle		non-empontilled		1	
2151E	glass	container	wine bottle		non-empontilled		1	
2151E	glass	light bulb		black	machine made		1	1895
2151E	glass	window glass			other		74	
2151E	refined earthn	flat form	pearlware	blue	press molded	printed under	1	1785
2151E	refined earthn	unid	yellow ware		press molded	undecorated	1	1825
2151E	refined earthn	unid	pearlware		press molded	undecorated	1	1775
2151E	refined earthn	unid	creamware		press molded	undecorated	1	1762
2151E	refined earthn	unid	pearlware	blue	press molded	printed under	1	1775

context	material	form	subform/ware	description	manufacturing technique	applied decoration	count	tpq
2151E	bone	tooth	pig		natural/unwrkd		1	
2151E	brick	brick			other		3	
2151E	mortar, sand	mortar			other		10	
2151E	stoneware	tea pot	black basalt		press molded		1	1750
2151E	stoneware	tea pot	black basalt		press molded		1	1750
2151E	slate	stone			quarried/cut		9	
2151E	copper alloy	coin			stamped		1	
2151E	silver	coin			stamped		1	
2151E	nickel	coin			stamped		1	
2151E	mortar, lime	mortar			other		3	
2151E	conglomerate	light bulb			machine made		1	1895
2151E	aluminum	foil			rolled/sheet		3	
2151E	plastic	unid hardware		green	synthetic		1	
2151E	plastic	unid hardware		yellow	synthetic		1	
2151E	metal	unid hardware			rolled/sheet		1	
2151F	stoneware	bowl	black basalt		press molded		1	1750
2151F	stoneware	tea pot	black basalt		press molded		1	1750
2151F	stoneware	hollow form	black basalt	engine-turned	press molded		1	1750
2151F	stoneware	hollow form	black basalt		press molded		1	1750
2151F	stoneware	hollow form	black basalt		press molded		1	1750
2151F	glass	window glass			other		29	
2151F	glass	unid	clrless non-ld		non-empontilled		1	
2151F	glass	pharm bottle	bottle; clrless non-ld		non-empontilled		1	1864
2151F	glass	wine bottle			empontilled		1	
2151F	glass	wine bottle			empontilled		1	
2151F	glass	bottle	unidentified	amber	empontilled		1	
2151F	glass	bottle	unidentified	amber	empontilled		1	
2151F	slate	stone			quarried/cut		4	
2151F	brick	brick frag			other		5	
2151F	limestone	stone			quarried/cut		2	
2151F	iron	nail	rosehead	chisel point	wrought/forged		2	
2151F	iron	nail frag		chisel point	wrought/forged		1	
2151F	iron	nail	machine square	blunt cut end	machine-cut		1	1805
2151F	iron	nail frag		blunt cut end	machine-cut		1	1805
2151F	iron	nail	indet head		unid		3	
2151F	iron	nail frag			unid		2	
2151F	brick	brick frag			other		6	
2151F	mortar, sand	mortar			other		5	
2151F	limestone	stone			quarried/cut		1	
2151F	mortar, lime	mortar			other		1	
2151G	glass	unid	clrless non-ld		non-empontilled		1	
2151G	glass	window glass			other		6	
2151G	slate	stone			quarried/cut		2	
2151G	brick	brick frag			hand made		1	
2151G	mortar, lime	mortar			other		1	
2151H	glass	table glass	stemmed glass; clrless lead	opaque twist	free blown		1	1750
2151H	charcoal	organic subst			other		20	
2151H	limestone	stone			quarried/cut		1	

context	material	form	subform/ware	description	manufacturing technique	applied decoration	count	tpq
2151H	coarse earthen	hollow form	bk-gz redware		wheel thrown		1	
2151J	brick	brick frag			other		3	
2151J	mortar, lime	mortar			other		6	
2151K	brick	brick frag			other		101	
2151K	brick	brick frag			other		12	
2151K	iron	nail frag			unid		1	
2151K	mortar, sand	mortar			other		2	
2151K	slate	stone			quarried/cut		1	
2151L	mortar, lime	mortar			other		1	
2151L	brick	brick frag			other		18	
2151L	mortar, lime	mortar			other		11	
2151L	brick	brick bat			other		1	
2151N	brick	brick frag			other		63	
2151N	brick	brick frag			other		44	
2151N	brick	brick bat			hand made		1	
2151N	brick	brick bat			hand made		1	

Appendix 3. Mortar analysis

Examination of Monticello Mortars
April 2000

D.S. Lane
Virginia Transportation Research Council
Charlottesville, VA

Findings are reported of an examination of three mortars taken from brick work of a massive wall at the southwest portico of Monticello and the mortar lining of the north cistern.

Background

Between 1808 and 1822, Jefferson was searching for a cement that would remain stable in the presence of water, a characteristic needed for lining the cisterns on the estate. Materials that set and harden in the presence of water are referred to as hydraulic cements. His notes and records indicate that he was well-informed regarding the important issues in manufacturing a cement with good hydraulic properties; for instance, his library contained a copy of John Smeaton's *Narrative of the Building, and a Description of the Construction of the Eddystone Lighthouse*, published in 1791 (Monticello 1974).

Smeaton is regarded as the father of the English cement industry, and one of the early pioneers in the development of modern hydraulic cements (Klemm 1989:2). He identified clay (or argillaceous material) as being essential to impart hydraulic properties to lime (Bogue 1955:7). The importance of clay in this regard results from the fact that it contains aluminum and silicon in the form of aluminosilicates. While clay materials typically need to be he fired to decompose the aluminosilicates into forms that will react with lime; there are some materials containing silicon and/or aluminum that occur naturally in forms that will readily react with lime. Materials that react with lime in the presence of water to form a cement are called pozzolans. Smeaton reportedly experimented with a natural pozzolan composed of trass (pumice) that he obtained from Holland. Ultimately, however, he settled on an argillaceous limestone that performed very well after being calcined (Klemm 1989:2).

The Monticello notes indicate that Jefferson had received a formulation for hydraulic lime from J. Correa de Serra that consisted of adding a reddish pozzolan to the common lime mortar of the period. The notes suggest that this formulation had been used successfully on cisterns in Charlestown. Jefferson had plans to try this formulation in the summer of 1815 as the existing cistern lining was failing to hold water. The notes further indicate that he lost the formulation and inquired about obtaining another copy but there is no indication that he received or actually tried the formulation.

In 1818, Jefferson inquired of William J. Coffee about the possibility of obtaining tarras, the pozzolan discussed by Smeaton. In reply, Coffee recommended the use of Parker's Roman cement, produced by burning broken septarian nodules (impure argillaceous carbonate) at temperatures higher than used for burning lime (Klemm 1989:4). Jefferson purchased a supply of Roman cement in 1819 and in 1821 reported that the cistern lined with it was performing well and ordered more to line the other cisterns. In 1822, Jefferson obtained a supply of a "shale cement" but was not satisfied with its performance; however, he remained pleased with the performance of the Roman cement as a cistern lining.

The manufacture of natural hydraulic cement was introduced to the U.S. about 1818 by Canvass White, an engineer involved with the construction of the Erie Canal (Klemm 1989). According to Snell and Snell (1996), he observed the manufacture of natural cements while travelling in England an on his return began experimenting with New York limestones and settled on a source available at Chittenango, southeast of Syracuse in

Onondaga Co. NY. They report the cement produced from this source was used in canal construction as early as 1818 and remained in production until 1840. White patented the cement under the name "Water Proof Cement" in 1820, calling for the use of "argillo ferruginous limestone" calcined as for lime and then pulverized (Klemm 1989:19). In the 1820s or 1830s, a natural cement plant was developed along the James River at Balcony Falls to provide hydraulic cement for use in construction of the James River and Kanawha Canal.

Monticello mortars

A massive brick wall at Monticello's southwest portico stands about four feet high. It is uncertain when this wall was constructed. Its bottom courses are bedded with a fairly hard, very light-gray mortar. Several courses in the middle section of the wall are bedded with a friable, gray-brown mortar. The top courses are again bedded with a light reddish gray, fairly hard mortar. The differences in mortar characteristics within the wall suggest that it may have been constructed during the period when Jefferson was experimenting with mortar formulations to provide good hydraulic properties for use in lining the cisterns.

Samples of the three mortars distinguishable in the massive wall were examined along with a sample of mortar lining the north cistern. The microstructural and chemical characteristics of these mortars are described. The characteristics of the mortars are compared and contrasted with each other within the context of the history of the development of hydraulic cements. The composition and features of the mortars are consistent with cementing materials known to be used in the early 19th century. The mortar samples examined lacked evidence of the mineralogical assemblages that would be expected had modern portland cement been used in the construction.

Procedures

Examinations were performed at the National Institute of Standards and Technology (NIST) using a scanning electron microscope in backscattered electron (BSE) mode equipped with an electron probe microanalyzer with an energy-dispersive spectrometer (EDS). The mortar samples were vacuum saturated with an epoxy resin and then cut and a surface finely lapped for examination. The majority of examinations were conducted using BSE imaging for morphological characteristics and EDS microprobe analysis to determine the elemental composition of the phase of interest. Elemental analysis is reported using standard chemical notation:
Ca – calcium; Si – silicon; Al – aluminum; Mg – magnesium; P – phosphorus; K – potassium; Na – sodium.

General comments

Each of the four mortars examined is readily distinguished from the others by a combination of hydrate morphology and phase composition.

Cistern

Parker's Roman cement is reported by Klemm (1989:4) to have had a composition similar to that of American natural cements that are characterized by high Mg content. Bogue (1955:8) reports that the nodules used by Parker had weathered from limestone cliffs along the Kentish coast. Pettijohn (1975:431) in a discussion of phosphorites (rocks with high P content) states that marine deposits, such as the nodule layers of the English Chalk, are often associated with greensands (glauconite, a micaceous alumino-silicate with vary amounts of K, Na, Ca and Fe, Mg). The cistern cement hydrate fits well with what would be expected of Parker's cement given a raw material composition induced from these references. Alternative hypotheses for the Si-Al-K phase and significant P content are that the Ai-Al-K phase is a mica flake introduced with the mortar sand and the P was introduced by the use of bone or bone ash in the raw materials. The relatively low Ca content of the hydrates is curious because of the presumed calcareous nature of the septaria and consequently remains an issue for further investigation.

B2

The B2 mortar hydrates have a similar chemical signal to that of the cistern cement except that it exhibits a much stronger Ca signal and lacks P. This suggests the use of a different set of raw materials that would provide the primary elements needed for a successful cement, for instance, an argillaceous dolomitic limestone as was used later to produce natural cements. The poor hydraulic nature of this cement probably results from a failure to fire the raw materials at a sufficiently high temperature, a common occurrence in the early stages of cement production according to Klemm (1989:4).

B1

The B1 and B3 hydrates have similar elemental signals, predominantly Ca and Si, with some Al in B3. The morphology of B1 and the presence of very fine grained, relatively pure Si component suggests that it was a lime mortar with an added pozzolanic material. If the raw materials (lime and pozzolan) of B1 were heated together, it was to an insufficient temperature to form calcium silicate phases.

B3

In B3 the elemental signal and hydrate morphology suggests that the raw materials contained Ca, Si, and Al, and that the raw materials (e.g. lime and clay) were heated together to temperatures high enough to produce calcium-silicate and calcium-aluminate phases in a process Louis Vicat described as lime twice kilned (Klemm 1989:5).

Specific observations

Massive wall, SW portico

1B - Upper courses

Ca-Si phases; some fine siliceous material (15 micron) with apparent reaction rim. Mg concentrated in discrete crystallites. Appears to be a lime-based mortar with fine siliceous material (**Appendix 3, Figure 1**).

2B – Middle (5) courses, very friable mortar

Mortar very porous. Mg-Si-Al and Si-Mg-Al phases; also Ca-Mg-Al-Si, and carbonated Ca. Appears to be a lime mortar distinguished from 1B and 3B by the high Mg content (**Appendix 3, Figure 2**).

3B – Lower (8) courses

Si-Ca phases with some interstitial Ca-Al-Si. Matrix appears much more uniform than 1B and 2B. Si-CA phase has rounded borders. Mg concentrated at discrete locations. The rounded Si-Ca phases exhibit morphology reminiscent of dicalcium silicate (a phase present in modern cements). Ettringite, a calcium alumino-sulfate was present in some air voids, but the hydrate phases were relatively free of sulfate, suggesting an external source for the sulfate (**Appendix 3, Figure 3**).

Cistern lining

Si-Mg, Mg-Si-Al, Mg-Si-Al phases predominate with some Si-Mg-Al-Ca-P and Si-Al-K. Hydrate phases strongly carbonated (presumably by atmospheric CO_2). Overall weak Ca signal, and strength of P signal suggests it is of significance (**Appendix 3, Figure 4**).

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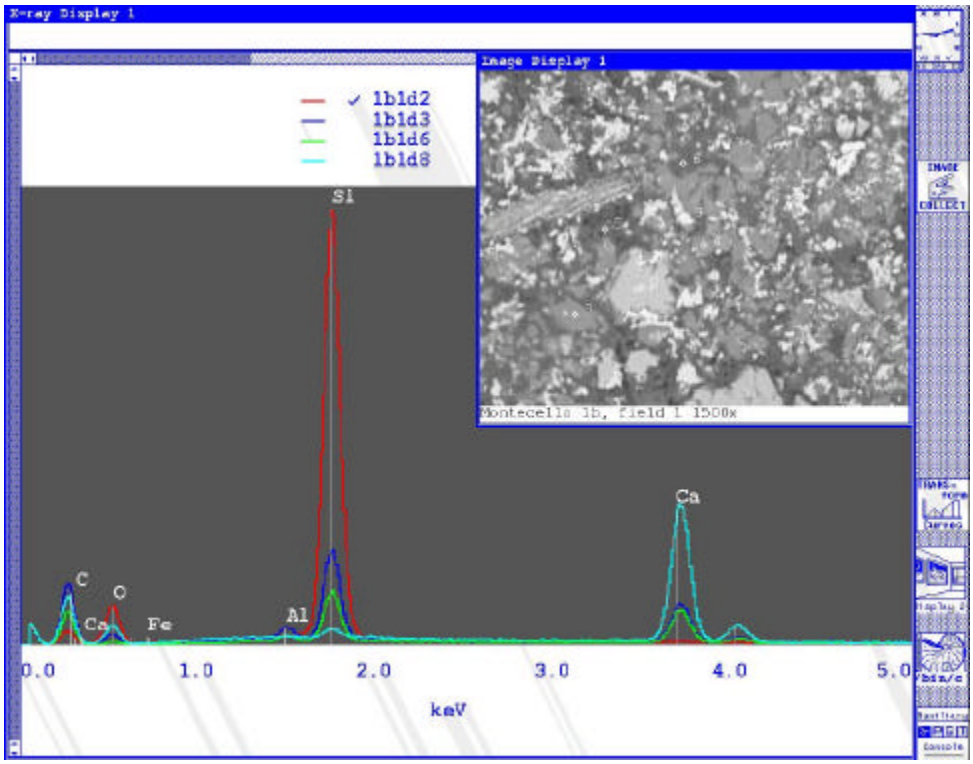

Figure 1. *EDS of mortar B1, BSE image of field in upper right.*

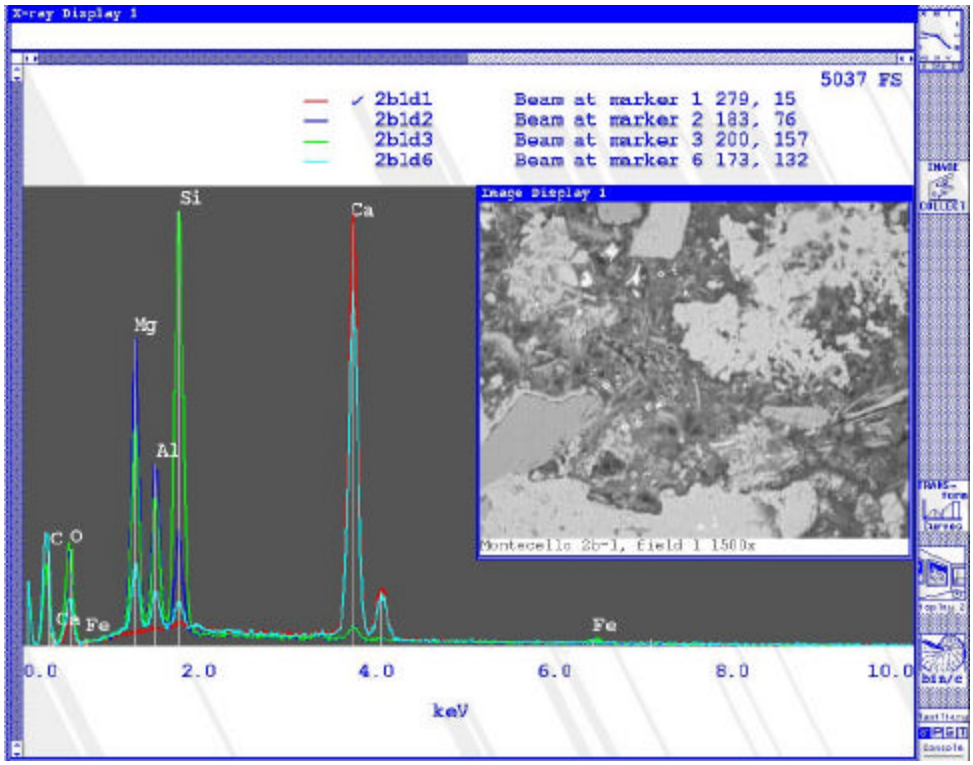

Figure 2. *EDS of mortar B2, BSE image in upper right.*

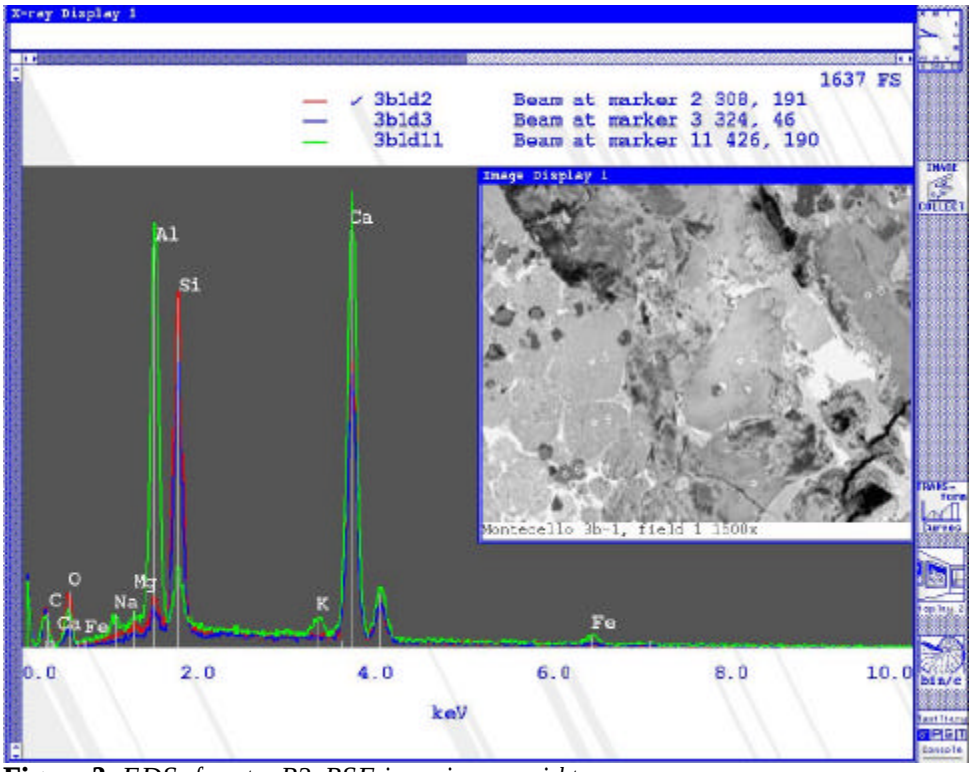

Figure 3. *EDS of mortar B3, BSE image in upper right.*

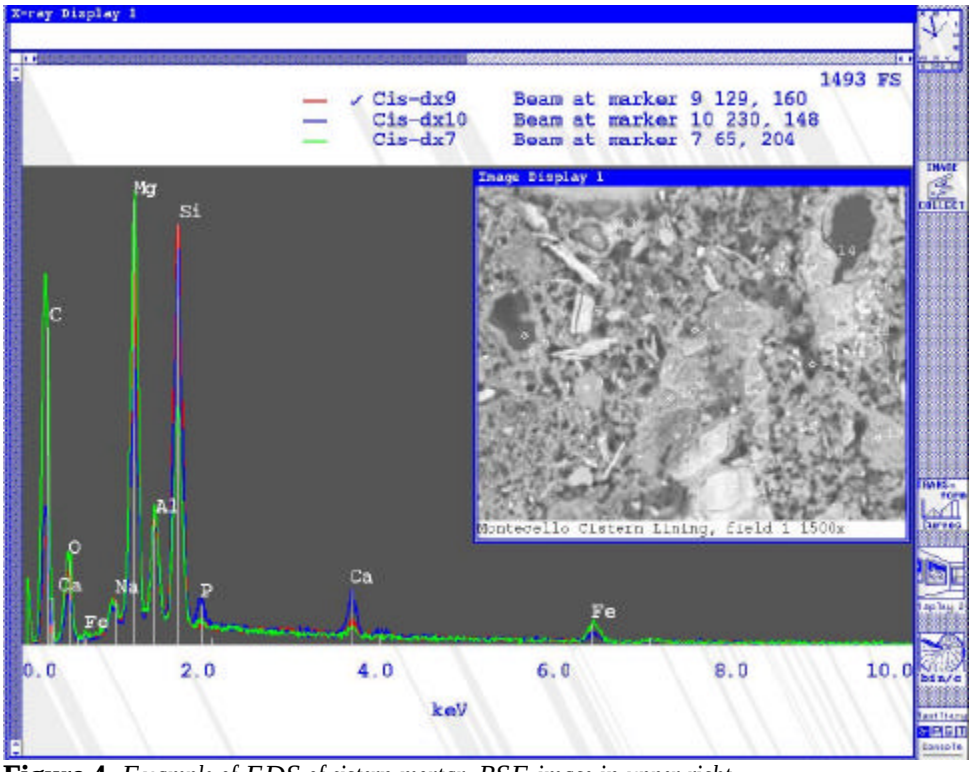

Figure 4. *Example of EDS of cistern mortar, BSE image in upper right.*

Appendix 4: Phytolith Evidence

Phytoliths from sediment samples from the north profile of unit 1428 were analyzed by Kelly Sullivan in the Department of Archaeological Research, Colonial Williamsburg Foundation (Sullivan 2000). The phytolith samples were processed by standardized techniques outlined in Piperno (1988) with modifications appropriate for the Piedmont clay soils found at Monticello. The slide-mounted phytoliths are viewed at 400x magnification, and described according to shape. The first two hundred phytoliths are counted and categorized. Where possible, these are identified to subfamilies for the grasses (Pooidea, Panicoidea, Chloridoidea, and Bambusoidea), to arboreal dicots (the dicotyledonous trees), or to one of two families of herbaceaous plants (Cyperaceae, or sedges and Compositae, alternatively called asteraceae, the largest family of vascular plants). Phytolith analysis currently cannot identify individual phytoliths to the genus or species level.

The grass sub-families are particularly important in environmental reconstruction. The C_3 and C_4 photosynthetic pathways are adaptions to different conditions of heat and sunlight. The C_3 plants are adapted to cooler conditions and less sunlight, whereas the C_4 plants are adapted to sunnier, warmer conditions. Therefore, the Pooideae, which are C_3 plants, are generally found in temperate to cool environments, and at higher latitudes or elevations (Twiss 1992). Members of this sub-family include the European cultigens of wheat, oats and barley. The Panicoid and Chloridoid sub-families, which are C_4 plants, are common in the tropics and sub-tropics (Twiss 1992). The Panicoidea thrive in warmer conditions with moderate moisture (Twiss 1992). Maize or corn (*Zea mays*) is an example of a Panicoid grass. Chloridoid grasses, on the other hand, tend to be found in warm, arid to semi-arid environments, including areas such as pastures or other open grasslands (Twiss 1992). Most Chloridoid species tolerate the extremes of high temperatures and aridity better than the other grasses. Finally, the Bambusoideae are best suited for wet environments,and are found exclusively within the

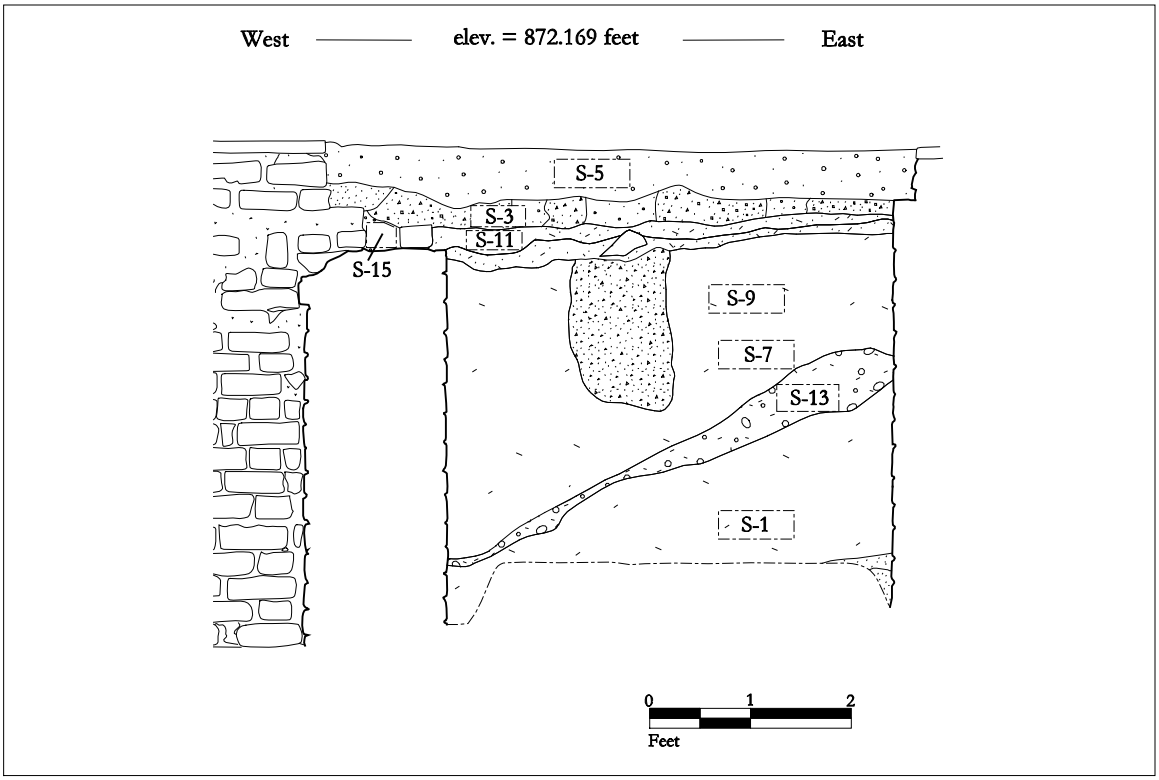

Figure 1. *Location of phytolith samples.*

tropics and sub-tropics. Rice is one member of this sub-family.

An additional, if secondary division in agricultural contexts in the New World is that C_3 grasses, the pooids, are associated with European grain crops, and the C_4 grasses, which are the panicoids and chloridoids, include the indigenous North American grass *Zea mays*, or maize. Therefore the proportions of these crops secondarily chart the ratios of crops introduced by European settlers to the previously established native American crops.

Eight phytolith samples were submitted for analysis. Six of the West Portico Steps samples yielded quantifiable data. Five of them (WPS 1428S-3, WPS 1428S-5, WPS 1428S-11, WPS 1428S-13, and WPS 1428S-15) had the full 200 phytoliths, and a final one (WPS 1428S-7) had 83, deemed sufficient for study. The locations from which these samples were taken is shown in **Appendix 4, Figure 1**. Two additional samples had too few phytoliths to quantify (WPS 1428S-1 and WPS 1428S-9). These last two samples were both from clay fill layers, with WPS 1428S-1 the deepest of the fill layers sampled for phytolith study **(Appendix 4, Figure 1)**. Perhaps these two samples did not contain numerous phytoliths because the source of the sediment used in these fill layers was subsoil. WPS 1428S-7, which had a larger but not standard number of phytoliths, is from the same depositional unit as WPS 1428-9. Either there is some other explanation than a subsoil source for the lack of phytoliths in samples 1 and 9, or the difference between 7 and 9 can be accounted for with mixing of phytolith-containing sediment with the redeposited subsoil that made up that fill layer.

Figure 2 is a scatterplot of the logged ratios of chloridoid to panicoid grasses (X axis) by trees to grasses (Y axis) (Aitchison 1982). Therefore the higher number on the axis Y axis represents a higher proportion of trees, and the higher number on the X axis represents a greater number of grasses adapted to hot and dry conditions compared with those adapted to warm tropical to sub-tropical conditions.

Figure 3 is a scatterplot of the ratios of pooid to panicoid plus chloridoid grasses (X axis) by the ratios of trees to grasses (Y axis). The Y axis therefore, is the same indicator as in **Figure 2**, but the X axis reveals the presence of C_3 grasses compared with C_4 grasses. As suggested above, the high ratio of C_3 to C_4 grasses seen by the cluster of four samples indicates a cooler, more temperate environment, and perhaps a greater presence of introduced rather than indigenous plants.

On both scatterplots, two of the six samples do not cluster with the other four. WPS 1428S-13 is an unusual sample in that it is extremely high in arboreal phytoliths, and it is extremely low in all grasses, and devoid of pooids and panicoids. The context that provided this sample is part of construction fill of the Portico area, and the matrix of the context is clearly construction-related. The context is composed of sand with 60% gravel-sized lime inclusions. The usual Piedmont clay and clay loam components are missing from this deposit. It likely originated as construction waste, and was tipped into the fill as a method of disposal, further indicated by the slope of the context. The context, never exposed as a ground surface, must have acquired its arboreal phytoliths in an incident of short duration, such as a rapid dumping of leaves or other tree parts.

WPS 1428S-7 is also very high in tree phytoliths and low in grasses. Also a fill layer, this context was clearly not exposed to the surface, so the phytoliths that are present must either have come from the source of the sediment or an incident of introduction of plant material, such as leaves.

The remaining four samples cluster tightly. The oddity of samples 7 and 13 make it difficult to assess the remaining cluster of samples. Therefore grass counts from these four West Portico samples are considered in comparison with those from other mountaintop samples (**Figure 4**). These comparative data are a set of phytolith samples from the Corner Triangles, the probable planting beds from the Corner Terraces at Monticello (samples which were processed by the same laboratory as the West Portico samples, using the same methods). The grasses from the four West Portico phytolith samples were analyzed with the grasses from eight Corner Triangle samples. The data were counts of the various grass phytolith shapes, some of which can be attributed to grass

sub-families such as Chloridoid, Panicoid, or Pooid.

The twelve sets of data were analyzed in a correspondence analysis (Baxter 1994). The first two dimensions contribute 55.37% and 16.03% of the variation respectively, together totalling 71.4%

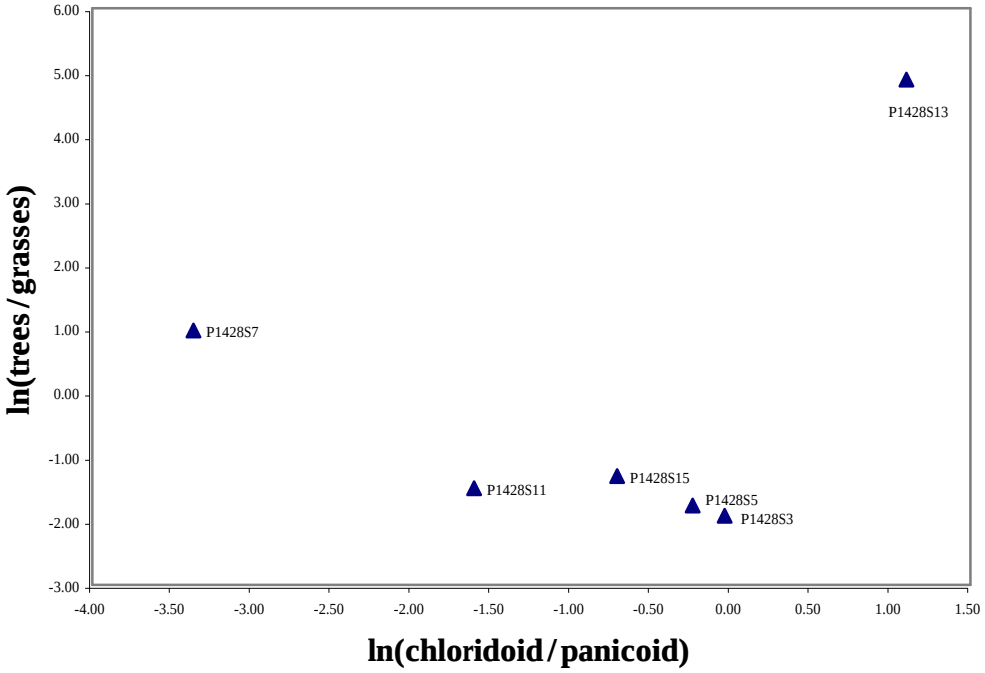

Figure 2. *Plot of ratio of chloridoid to panicoid grasses (X axis) by the ratio of trees to grasses (Y axis).*

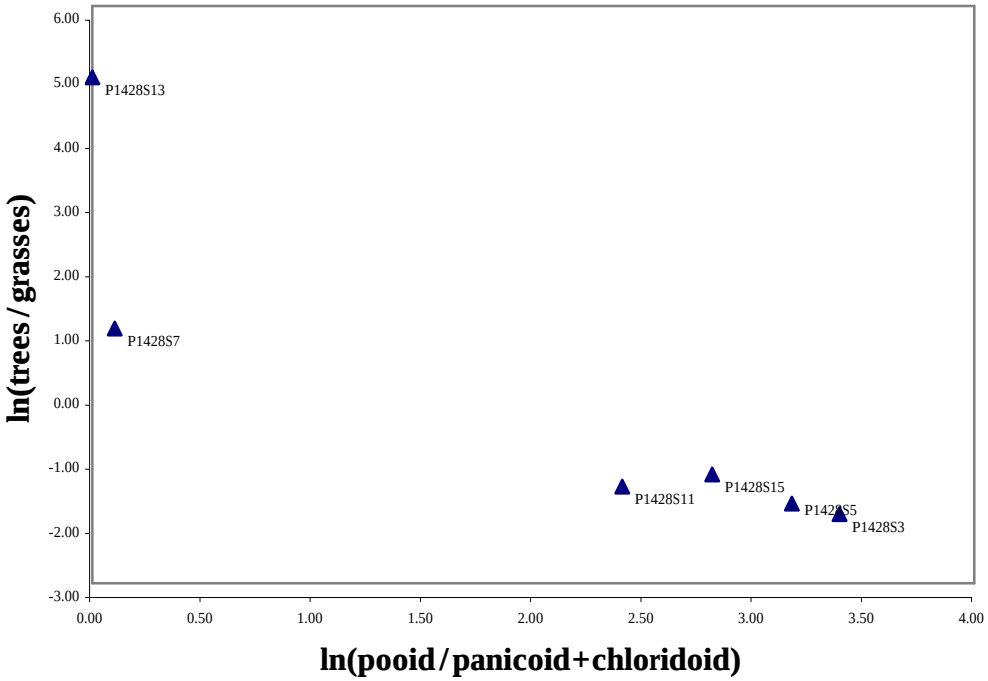

Figure 3. *Plot of ratio of C_3 (pooid) to C_4 (panicoid and chloridoid) grasses (X axis) by trees to grasses (Y axis).*

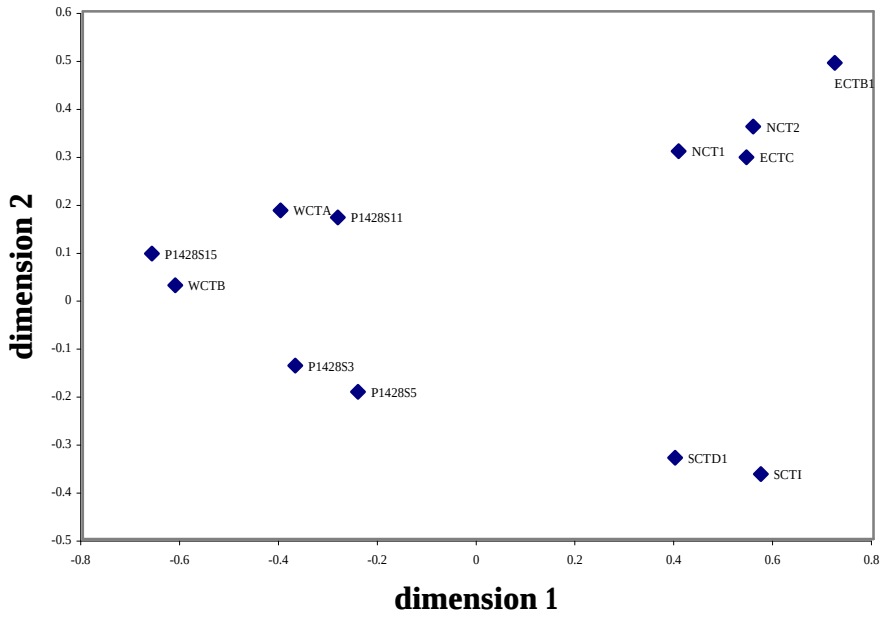

Figure 4. *Correspondence analysis showing relationshop of West Portico phytolith samples to West Corner Terrace phytolith samples; dimension 1 contributes 53.37% of the variation, and dimension 2 contributes 16.03%.*

of the variation **(Figure 4**). Of these twelve sets of phytolith counts, we see that the West Portico phytoliths most closely resemble the West Corner Terrace samples. Independent evidence indicates the disturbance of the West Corner Triangle by Milton Grigg in the 1930s. The similarity of the West Triangle samples to the West Portico ones (WPS 1428S-11, S-15, S-3, and S-5) suggests modern disturbance for these stratigraphic layers, too. What this means for the West Portico interpretation is that it is likely that layer 19 was the top of the original Jefferson-period sediment, and the layers above that are either significantly disturbed or newer deposits. Most likely, these are twentieth century deposits, as was the fill of the West Triangle. As discussed above, this would imply either an earthen surface stepping down from the portico floor, or a wooden deck above sediment fill.

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