

## Northeast Historical Archaeology

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Volume 23

Article 4

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1994

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### Recommended Citation

Kelso, Gerald K.; Dwyer, Alison D.; and Synenki, Alan T. (1994) "The Pollen Record Formation Processes of a Rural Cellar Fill: Identification of the Captain Brown House, Concord, Massachusetts," *Northeast Historical Archaeology*: Vol. 23 23, Article 4. <https://doi.org/10.22191/neha/vol23/iss1/4> Available at: <http://orb.binghamton.edu/neha/vol23/iss1/4>

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# The Pollen Record Formation Processes of a Rural Cellar Fill: Identification of the Captain Brown House, Concord, Massachusetts

## **Cover Page Footnote**

Many individual have contributed to this research effort. We particularly wish to thank Myra Harrison, Manager of the NPS Cultural Resources Center, Lowell, Massachusetts, and Linda Towle, former manager of the Cultural Resources Center, Archaeology Branch, who arranged local administrative support of the project and who encouraged publication of the results; Jeannine Disviscour, who contributed significantly to the excavations and sampling, and Mary Troy, also of the Cultural Resources Center, who copy-edited the original manuscript. The memory of Kurt Faust, who provided drafting support, is especially cherished. The National Park Service funded the David Brown project. The Department of Archaeology at Boston University provided laboratory facilities. Pollen laboratory equipment was provided by the National Science Foundation under Grant No. BNS-7924470 to Boston University.

# THE POLLEN RECORD FORMATION PROCESSES OF A RURAL CELLAR FILL: IDENTIFICATION OF THE CAPTAIN DAVID BROWN HOUSE, CONCORD, MASSACHUSETTS

Gerald K. Kelso, Alison D. Dwyer, and Alan T. Synenki

*Captain David Brown was a major participant in the April 19, 1775 skirmish at the North Bridge, Concord, Massachusetts, and his house stood very close to the battlefield. Diary entries record that his house was dismantled in 1868 and that the filling of the cellar hole began on October 16th of the same year. Archaeologists uncovered the cellars of two houses on the David Brown property: one cellar fill contained only probable 18th-century artifacts; the second contained 18th- to mid-19th-century artifacts. Pollen data indicating that the second cellar hole was filled in the fall link that cellar hole to diary entries, confirming the identification of the structure as the David Brown house.*

*Le capitaine David Brown fut un important participant à l'escarmouche qui eut lieu le 19 avril 1775 au North Bridge, à Concord (Massachusetts). Sa maison se trouvait très proche du champ de bataille. Selon le journal de Brown, sa maison fut démantelée en 1868 et le remblayage de la cave effectué à partir du 16 octobre de la même année. Les archéologues ont mis au jour les caves de deux maisons sur la propriété de David Brown: les remblais de la première n'ont révélé que de probables artefacts du XVIII<sup>e</sup> siècle tandis que ceux de la seconde contenaient des artefacts du XVIII<sup>e</sup> siècle au milieu du XIX<sup>e</sup>. Pour leur part, les données concernant le pollen indiquent que la seconde cave a été remblayée à l'automne, ce qui la rattache aux écritures du journal, confirmant ainsi l'identification du bâtiment comme étant la maison de David Brown.*

## Introduction

Captain David Brown (1732–1802) led one of the militia companies that faced the British at the North Bridge in Concord, Massachusetts, on the morning of April 19, 1775. David Brown's 39-acre homestead bordered a road that ran from the North Bridge to Groton, Massachusetts, and he fought the battle within sight of his own doorstep. This close association between the man, the battle, and the structure is a natural focal point for

visitor interpretation at Minute Man National Historical Park. David Brown's home no longer stands, and the National Park Service is interested in determining where it once stood.

The Brown homestead appears just northwest of the fork in the now lost "old Groton Road" on a 1754 map (FIG. 1), and his home may be the house (red in the original) on the left in the well-known Doolittle print (FIG. 2) of the skirmish at the North Bridge (Torres-Reyes 1969: 7). Trenching in that general location during the 1960s failed to

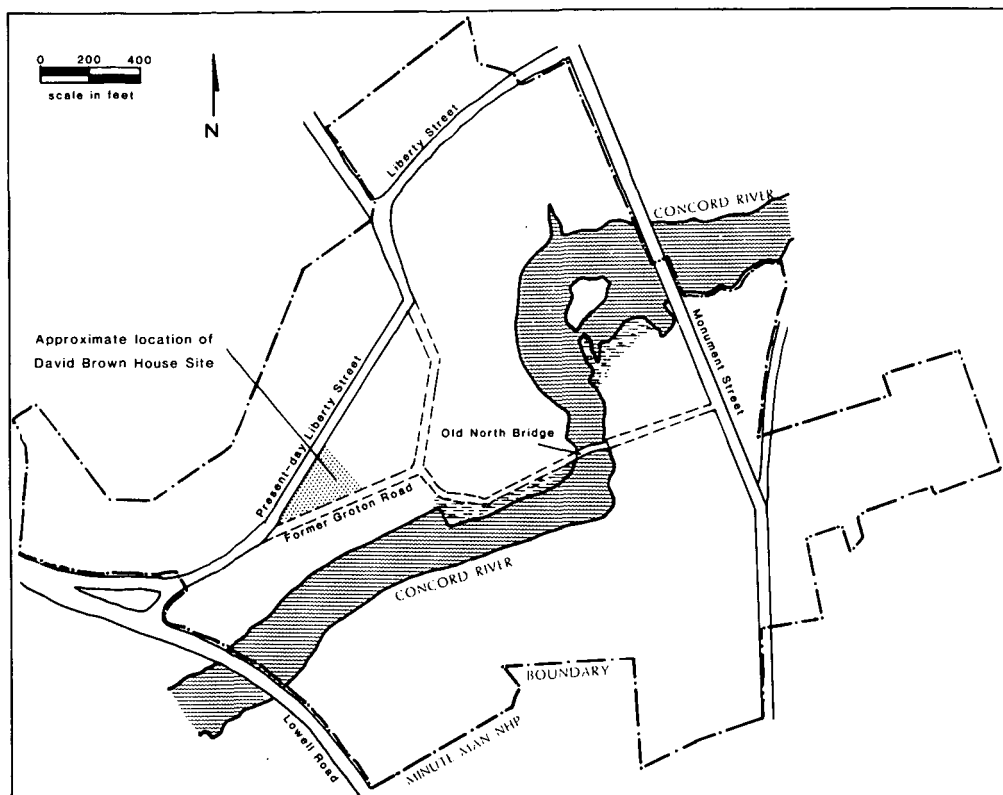


Figure 1. Map of the Old North Bridge area (after Malcolm 1990: fig. 3-1).

locate significant remains (Abel 1965). More extensive excavations a few years later unearthed a house foundation and a stone-paved barn cellar drained by stone-lined channels into an exterior reservoir (Tremmer 1970, 1973). The excavators identified these remains as the 1775 David Brown homestead with a post-1793 barn addition (Tremmer 1973: 40, 56, 63).

There appears to be little archaeological support for this interpretation, however. The house cellar was excavated in a single unit without stratigraphic control, and the only occupation-related artifacts uncovered inside the foundation were not diagnostic: a large "colonial type" key and five (possibly hand-wrought) nails (Tremmer 1973: 22). Three-quarters of the artifacts recovered at the site were

ceramic, but only 6% of these were being manufactured during the 17th and 18th centuries. Half of the remaining number of ceramics were whitewares. Most of these were recovered from a cistern and may date to the 1875 celebration of the battle's centennial. As part of the festivities, dinner was served to 4,000 people (Towle 1986: 263).

Archival data compound the uncertainty by indicating the existence of at least two houses on the property during the 18th century and at least two barns at other times. The probate inventory following the 1768 death of David Brown's mother records an earlier house, in addition to the one then occupied, and strongly suggests that the earlier structure was torn down sometime between 1755 and 1768 (Malcolm

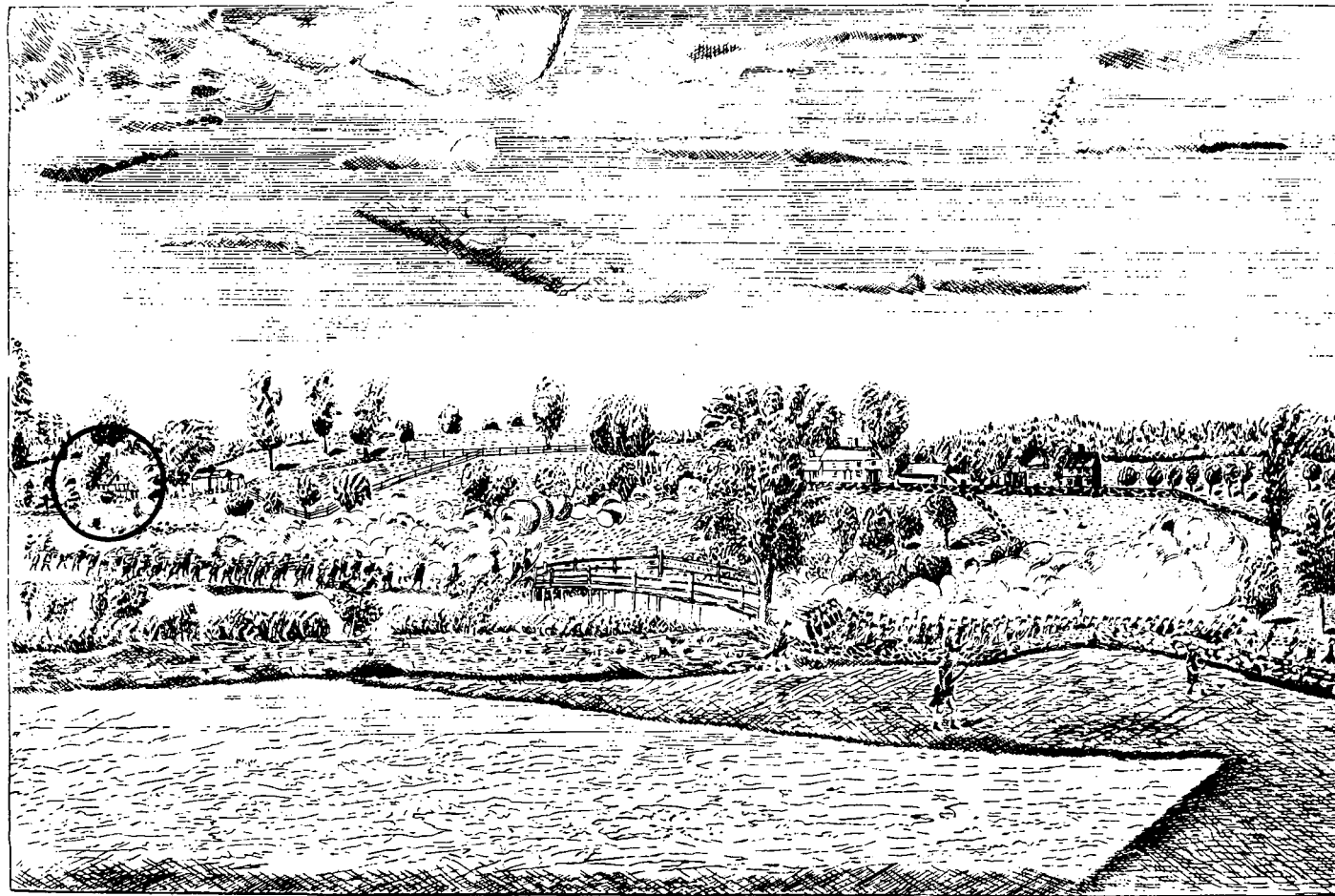


Figure 2. Doolittle's print of the skirmish at the North Bridge, 19 April 1775. The house circled at the left (red in the original) may be the 1775 David Brown dwelling.

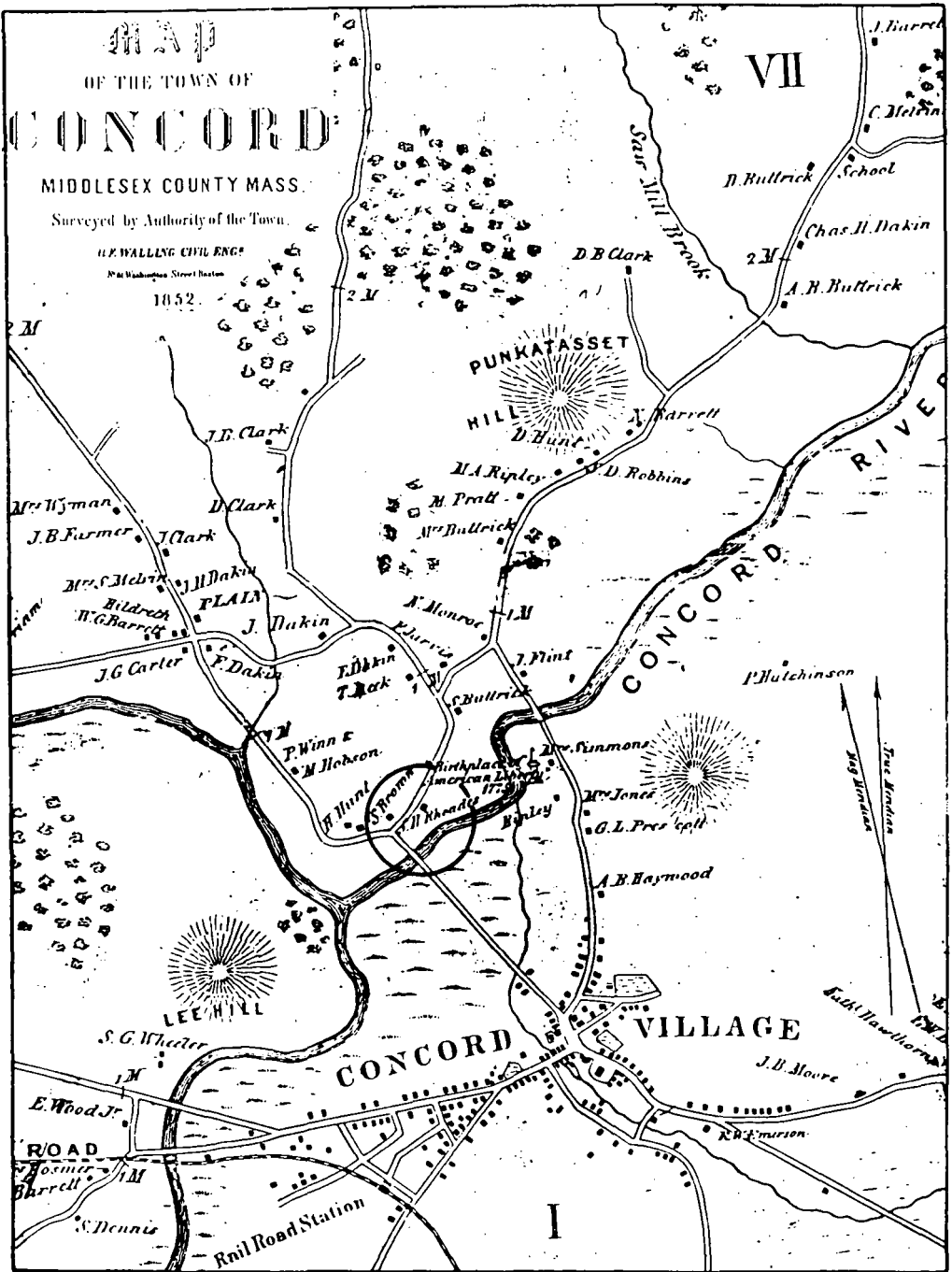


Figure 3. 1852 H. F. Walling map of the town of Concord. The location of Rhoads house, dismantled in 1868, is circled. (Original on file at Cary Memorial Library, Lexington, MA.)

1985: 122; 1990: 25; Towle 1986: 255). Town of Concord documents authorizing the creation of Liberty Street in 1793 indicate that the new road ran between David Brown's house and barn, with the barn north of the road and the house to the south (Malcolm 1990: 33). A mid-19th-century diary also records the presence of a second barn, this one south of Liberty Street (Towle 1986: 274). It was moved across Liberty Street in 1867 and is still standing (Keyes 1885: 75; Towle 1986: 274). Construction features indicate that this barn was built after c. 1820 (Orville Carrol, personal communication, 1988). Barn cellars are more characteristic of the 19th century than they are of the 18th (Hubka 1984: 62), and paved cellars draining to reservoirs were considered an agricultural advancement in the first half of the 19th century (Poore 1844: 98). The cellar that Tremer (1973: 41–42) excavated appears to be that of the post-1820 barn.

Documents and archaeology appear to account for the barns. The pollen data that ultimately provided the link between the archival and archaeological data and identified David Brown's 1775 house are the focus of this report.

### Archival Data

Malcolm (1985, 1990) and Towle (1986) have assembled a chain of tax, probate, deed, and personal records indicating that David Brown's property, including his house and barns, passed to his wife Abigail and his son Joseph upon his death in 1802. The property was sold to Josiah Davis in 1822, who resold it to three men: Samuel Hoar, John Keyes, and Nathan Brooks in 1823. In 1824, Samuel Hoar bought out the other two men and rented the property to various tenants until 1849. That year he sold it to Samuel H. Rhoades, who

occupied the property until he in turn sold it to George Keyes in 1867 (FIG. 3). George Keyes moved the barn from the south side of Liberty Street to its present location north of the road in 1867 and dismantled the house in 1868. The description of the structures on the property remained unchanged from 1822 to 1867, and it is highly probable that the Samuel Rhoades house that was torn down in 1868 was the structure occupied by David Brown in 1775.

Simon Brown, the father-in-law of George Keyes, chronicled the modification of the Brown/Rhoades property in a diary that remains in the possession of the Keyes family. Summaries of the entries relevant to this study (Towle 1986: 270–274) are listed in Table 1. The entries that are most significant for the pollen analysis are those indicating that the filling of the cellar hole commenced in mid-October 1868 and was completed by April 1869, after which the site was seeded for pasture or mowing meadow.

### New Archaeological Data

New excavations undertaken to locate and identify this second house yielded four deposits of building and domestic debris that appeared to be associated with the dismantling of the Rhoades house and a pit that appeared to be a cellar hole. The apparent cellar was centered 40 ft (12 m) south of Liberty Street and 88 ft (26.4 m) southwest of the house excavated by Tremer (1970, 1973). It had been robbed of its wall stones, but its flagged floor was intact (Dwyer and Synenki 1990: 63). Artifacts in this cellar hole were a mixture of 18th- and 19th-century materials. Several buttons manufactured after c. 1860 were found in the cellar hole fill, while the wire nails and machine-

Table 1. Chronological summary of significant modifications to the Brown/Rhodes property as recorded in Simon Brown's diary (after Towle 1986).

11 April 1867	George Keyes purchased the Rhoades property.
24 April 1867	Plowing behind the yellow barn. Rubbish cleared out of the cellar of the yellow barn on the Rhoades lot.
25 April–24 May 1867	The yellow barn was moved across the road.
27 April 1867	Plowing, harrowing, and leveling on the Rhoades property.
11 May 1867	Rhoades family moved out.
27 May 1867	Manure hauled from the old barn cellar.
7 September 1867	Demolition of the "old red house" began with the dismantling of chimney.
14 December 1867–28 January 1868	Interior of house dismantled.
8 February–23 March 1868	Superstructure dismantled.
23 April 1868	Leveling around the old barn cellar.
16 October 1868	Filling of Rhoades house cellar hole commenced.
22 April 1869	Area over cellar cleared up, manured and prepared for sowing.
24 April 1869	Grass seed planted.

made glass—predictable in a late 19th-century deposit—were absent (Dwyer and Synenki 1990: 68). An 18th- to mid-19th-century trash deposit was apparently mined to fill the cellar hole, but this did not necessarily occur during the 1860s. Thus, after the most recent National Park Service excavations, the question of which of the two investigated cellar holes was the one that lay under the house that sheltered Captain David Brown on the eve of the American Revolution remained unanswered.

#### **Pollen Analysis at the David Brown Site**

The cellar walls and/or building foundation were removed from the most recently discovered cellar hole, and the

remains, where sampled (EU N10W15, FIG. 4), consisted of a fieldstone floor set in what appears to be glacial outwash sand. A thin sheet, c. 1 cm deep, of dark loam-like sediment overlying the floor was overlain by roughly 30 cm of mixed clay and brick debris from the dismantling of the house. This was in turn overlain by a uniform fill in which only the surface humus zone could be distinguished (FIG. 5).

#### **Pollen Analysis Methods**

Pollen samples were collected from the following locations: immediately under the granite cellar floor stone in EU N10W15 (sample f1), the dark fill between the floor stones in EU N10W15 (sample f2), the scrapings of a com-



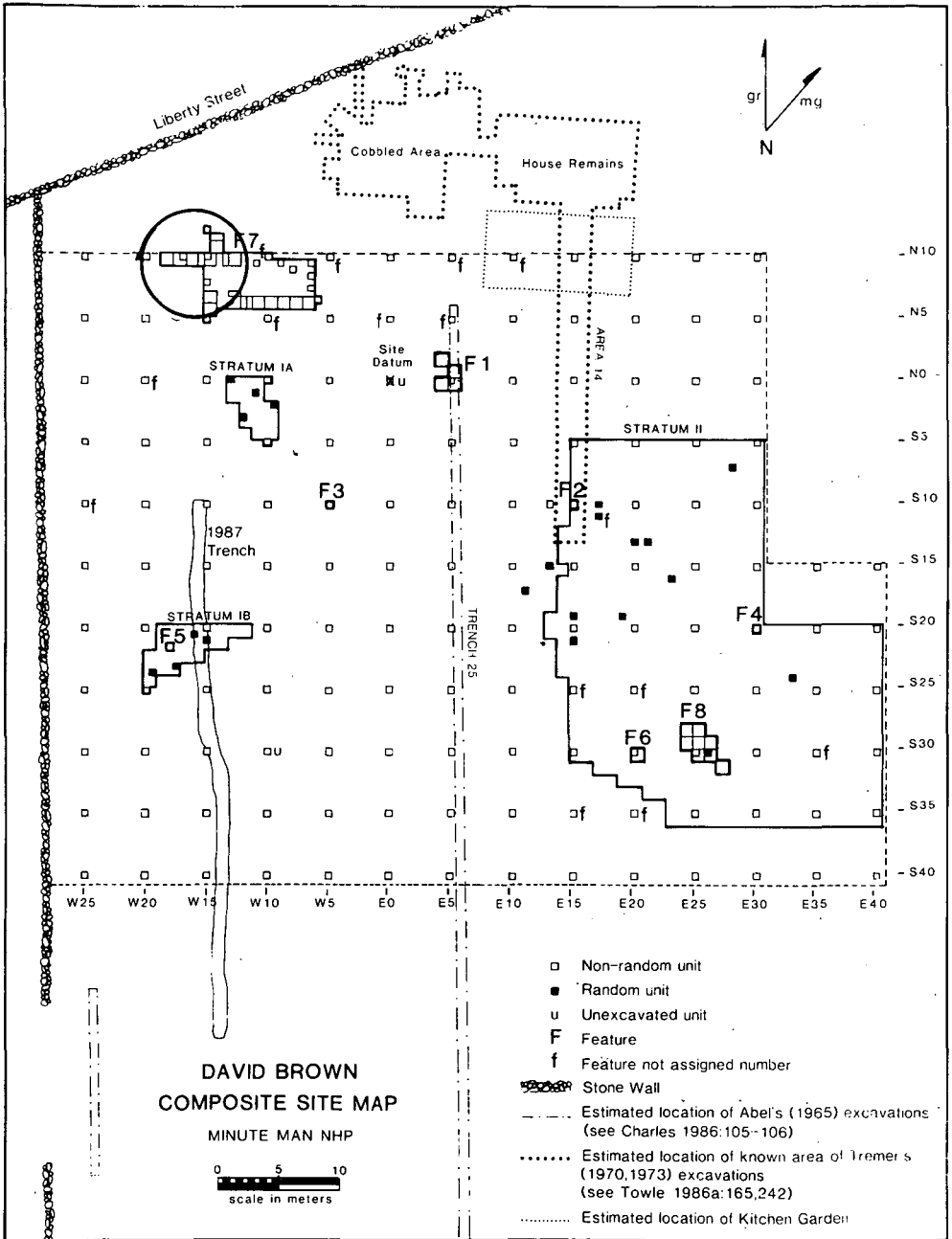


Figure 4. David Brown house composite site map. Pollen profile location circled is in N10/W15.

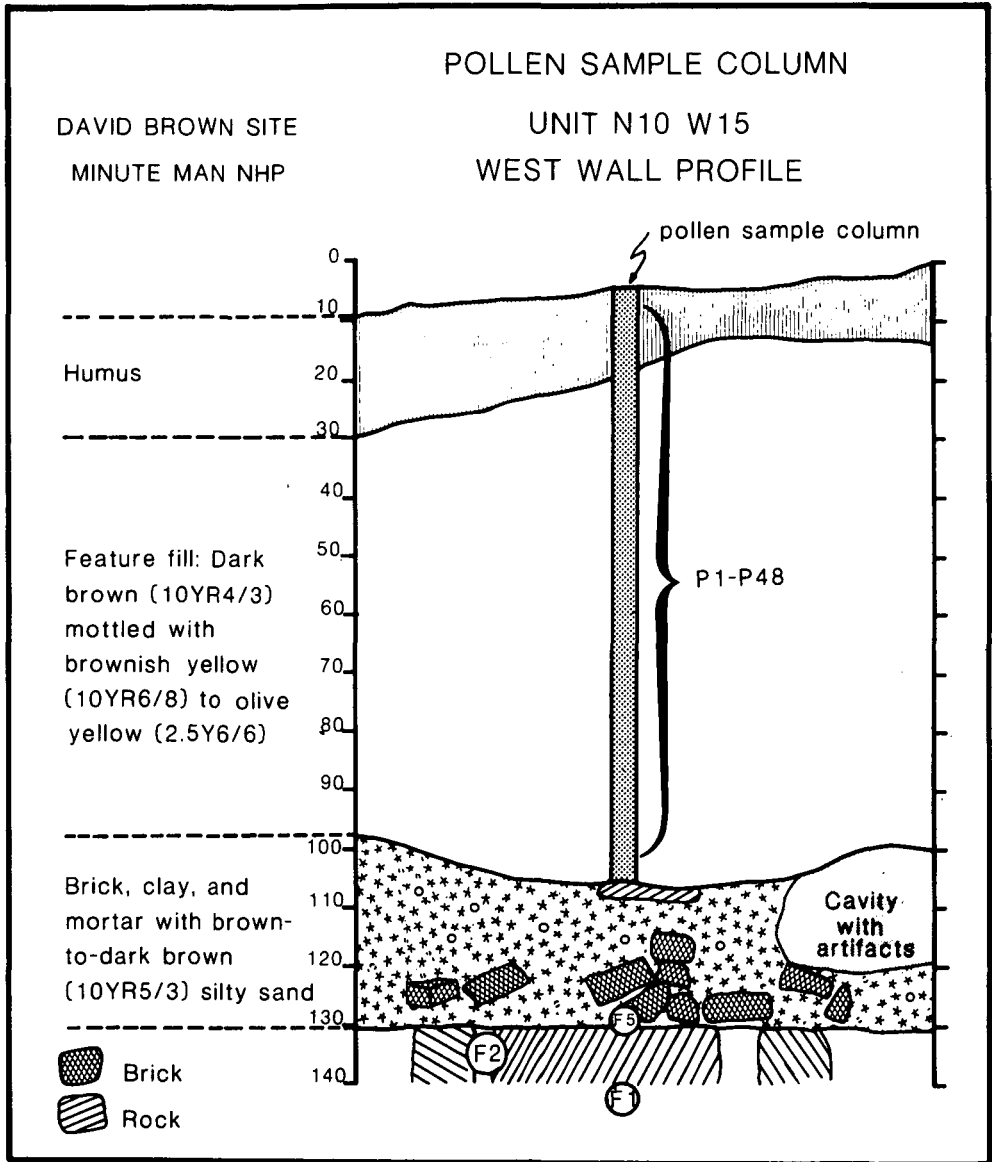


Figure 5. Cellar hole stratigraphy at pollen column location.

pacted dirt floor directly under a metal pan in EU N6.5W8 (sample f3), the scrapings of the upper surface of the metal pan in EU N6.5W8 (sample f4), and the 1 cm of cellar fill between the stone floor and the clay and brick dismantling debris in EU N10W15 (sample f5). No suitable pollen matrices were evident among the voids in the clay/brick dismantling debris, but a profile of 48 contiguous (no interval) samples (p1-p48) were collected from the cellar fill above the clay/brick layer (FIGS. 4, 5).

A modified version of the Mehringer (1967) alluvium extraction method was employed in this study. Carbonates were removed from c. 25 g of matrix by stirring the matrix in a 500 ml beaker while adding hydrochloric acid (HCL) until the reaction stopped. The pollen was concentrated and separated from the heavy sediment by swirling the matrix, still in the HCL, with a stirring rod until a strong vortex developed. It was then allowed to settle for about one minute, and the fluid was decanted, before the swirling motion stopped, into a 250 ml beaker. The fluid was then swirled into a 50 cm test tube and centrifuged for three minutes. This swirling step was repeated 3-6 times. The samples were then washed twice in distilled water and placed in 50% hydrofluoric acid (HF) overnight to eliminate sand. The next day the samples, still in the HF, were placed in a boiling water bath for 30 minutes, centrifuged, and given two distilled water washes. Concentrated HCL was then added (to break colloids caused by the HF) and the test tubes were placed in a hot water bath until a few bubbles appeared. After centrifuging and two distilled water washes, 0.5% sodium hydroxide (NaOH) was added, and the test tubes were placed in a boiling water bath for three

minutes. Finally, the samples were washed in distilled water until they decanted clear.

Residues were mounted in glycerol for viewing, and the pollen was identified at 400 $\times$ , with problematical grains examined under oil immersion at 1000 $\times$ . A minimum of 400 pollen grains was tabulated for each sample. Pollen concentrations per gram of sample were computed following Benninghoff's (1962) exotic pollen addition method as an aid in evaluating pollen record formation processes, but pollen concentration figures were not computed for individual taxa. These would not be meaningful in the absence of chronological control over sedimentation rate and might be mistaken for pollen influx data. All pollen grains too degraded to be identified were tabulated to provide further control over corrosion factors. Unidentifiable pollen grains were not incorporated in any sum from which the frequencies of other types were computed. The data for this pollen group, as a percentage of total identifiable and unidentifiable pollen, and the data for corroded oaks, a prominent pollen type that retains its identity while readily degrading (van Zeist 1967: 49), are presented in the diagrams in Figures 6 and 7. The terms "corroded" and "degraded" are used interchangeably here and refer to any kind of pollen deterioration other than tearing. They are not intended as references to the specific classes of deterioration defined under these terms by Cushing (1964) and Havinga (1984).

The open line bars in the pollen diagrams (FIGS. 6, 7) are percentages computed from separate sums for arboreal and non-arboreal pollen types. This separation helps to differentiate regional and local pollen types to some extent, and it reduces the statistical distortions that the contributions of

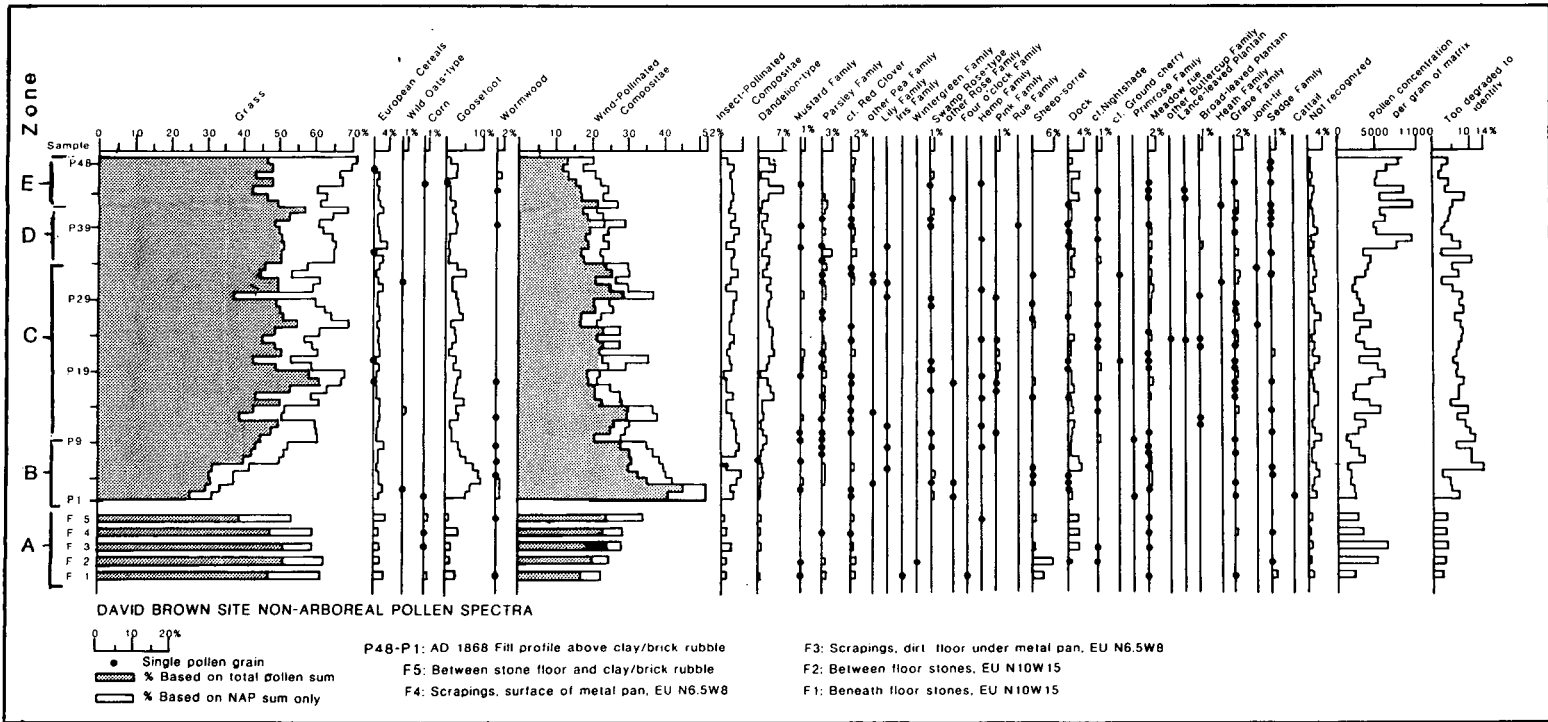


Figure 6. David Brown site non-arboreal pollen spectra. A= Cellar Floor Pollen Zone, B=Early Filling Pollen Subzone, C=General Fill Pollen Subzone, D=Possible Agriculture Period Pollen Subzone, E=Post-Agricultural Pollen Subzone.

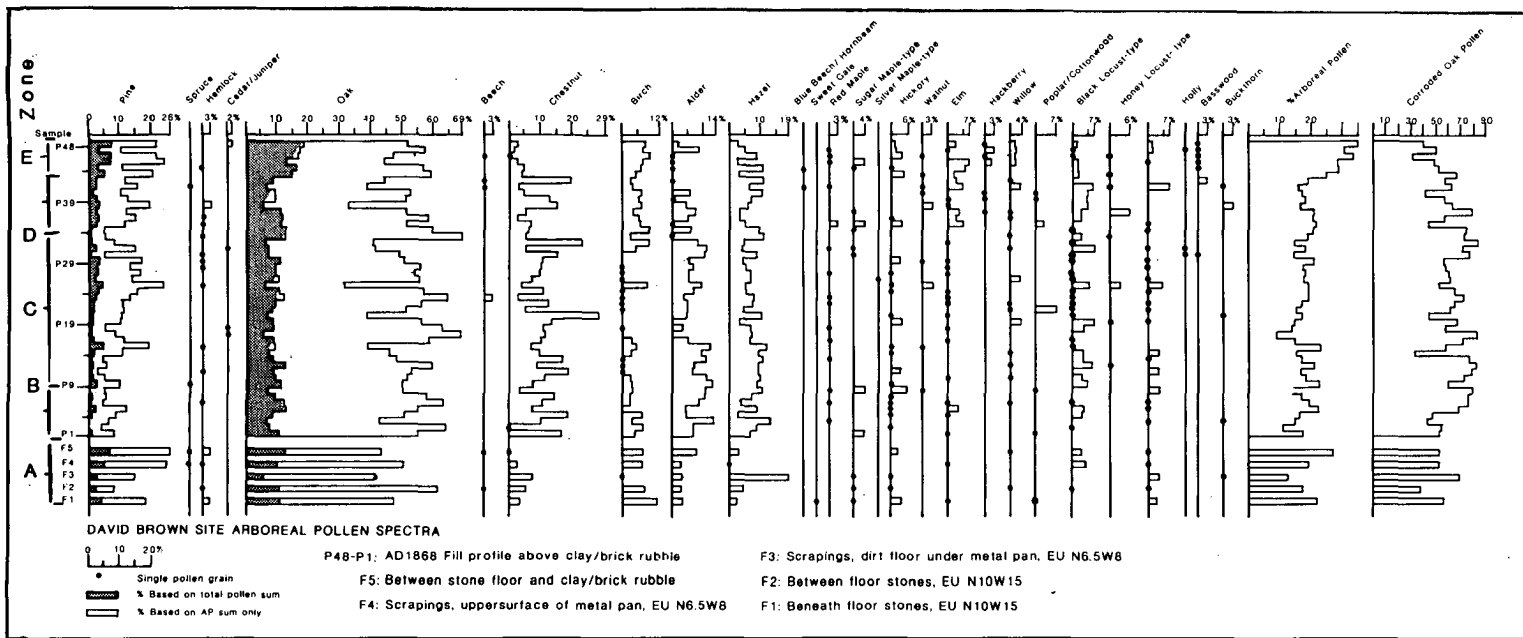


Figure 7. David Brown site arboreal pollen spectra. A=Cellar Floor Pollen Zone, B=Early Filling Pollen Subzone, C=General Fill Pollen Subzone, D=Possible Agriculture Period Pollen Subzone, E=Post-Agricultural Pollen Subzone.

Table 2. Translation of vernacular and Latin botanical names.

Arboreal		Non-arboreal	
Latin	vernacular	Latin	vernacular
<i>Pinus</i>	pine	Gramineae	grass
<i>Quercus</i>	oak	<i>Avena fatua</i>	wild oats
<i>Fagus</i>	beech	Cerealia	European cereals
<i>Castanea</i>	chestnut	<i>Zea mays</i>	corn
<i>Betula</i>	birch	Chenopodiaceae	goosefoot family
<i>Corylus</i>	hazel	Compositae	ragweed family
<i>Alnus</i>	alder	<i>Artemisia</i>	wormwood
<i>Acer saccharinum</i>	silver maple	wind-pollinated Compositae	ragweed-type
<i>Acer saccharum</i>	sugar maple	Liguliflorae	dandelion-type
<i>Acer rubrum</i>	red maple	insect-pollinated Compositae	goldenrod-type
<i>Carya</i>	hickory	Liliaceae	lily family
<i>Juglans</i>	walnut	Primulaceae	primrose family
<i>Ilex</i>	holly	<i>Rumex acetosella</i>	sheep-sorrel type
<i>Celtis</i>	hackberry	<i>Rumex mexicanus</i>	dock-type
<i>Robinia</i>	black locust	<i>Rosa palustris</i> -type	swamp rose type
<i>Gleditsia</i>	honey locust	Rosaceae	rose family
<i>Ulmus</i>	elm	Solanaceae	nightshade family
<i>Picea</i>	spruce	<i>Solanum</i>	nightshade
<i>Tsuga</i>	hemlock	<i>Physalis</i>	groundcherry
Cupressaceae	cedar/juniper	Rutaceae	rue family
<i>Ostrya</i>	hornbeam	Caryophyllaceae	pink family
<i>Carpinus</i>	blue beech	Cruciferae	mustard family
<i>Platanus</i>	sycamore	Leguminosae	pea family
<i>Salix</i>	willow	<i>Trifolium</i>	red clover
<i>Populus</i>	poplar/cottonwood	<i>Melilotus</i>	white clover
<i>Myrica</i>	sweet gale	<i>Medicago</i>	alfalfa
<i>Tilia</i>	basswood	<i>Thalictrum</i>	meadow rue
<i>Rhamnus</i>	buckthorn	Ranunculaceae	buttercup family
<i>Nemopanthus</i>	mountain holly	<i>Plantago-major</i> -type	broad-leaved plantain
		<i>Plantago lanceolata</i> -type	narrow leaved plantain
		Vitaceae	vine/grape family
		Pyrolaceae	wintergreen family
		Umbelliferae	parsley family
		Ericaceae	heath family
		Cyperaceae	sedge family
		<i>Typha</i>	cattail
		Nyctaginaceae	four-o'clock family
		<i>Ephedra</i>	joint fir

pollen types, reflecting different phenomena, induce in each other. It has the disadvantage of producing potentially misleadingly high percentages in some instances from small counts among the minor types. The solid colored portion of the diagrams registers

relative frequencies based on the identifiable pollen of all types.

Historical archaeologists most frequently encounter plants under their English names in the documentary record, so the common New England names for plant taxa are employed in both the

text and the diagrams. The scientific name of each pollen taxon follows the English name the first time a plant group is mentioned, and a translation of Latin and vernacular names is provided in Table 2.

### Pollen Analysis Results

Two general pollen deposition intervals are evident in the cellar hole. The oldest of these is a floor zone below the clay and brick debris layer (FIG. 5). This zone records the pollen rain of the occupation period and incorporates samples f1–f5. The fill above the clay and brick debris constitutes the second pollen zone. It incorporates samples p1–p48. Subzones within each of these general deposition intervals reflect shifts in pollen sources and transport mechanisms.

#### The Cellar Floor Pollen Zone

This zone is marked with the letter A at the left side of the pollen diagrams (FIGS. 6, 7). It is distinguished from the deposits above the clay and brick debris layer by more uniform grass (Gramineae) pollen frequencies; by dandelion-type (Liguliflorae), aster-type (insect-pollinated Compositae), chestnut (*Castanea*), alder (*Alnus*), and hazel (*Corylus*) percentages that are generally lower; by pine (*Pinus*) and sheep-sorrel-type (*Rumex acetosella*-type) pollen counts that are generally higher; and by the presence of corn pollen (*Zea mays*) in a larger proportion of the samples.

The floor stones were placed on clean glacial sand. Definite European types—sheep-sorrel and European cereal (Cerealia)—were present under the stones. The entire pollen zone must date to the historical era. Two different pollen deposition regimens are evi-

dent in this zone. Pollen concentrations per gram of matrix are higher in the samples (f2, f3) between the floor stones and directly on the dirt floor, than in the remaining three samples from the zone. Pine and general arboreal pollens are better represented in the three samples (f1, f4, f5) from under and slightly above the floor than they were between the stones and directly on the floor under the metal pan.

Locally produced pollen spectra are dominated by herb pollen and generally display higher pollen concentrations than the tree-dominated regional pollen spectra (Janssen 1973: 33). The more concentrated, herb-dominated pollen spectra directly on top of the floor (f3) and between the floor stones (f2) appear to be locally produced and were tracked into the structure with dirt from the landscape surrounding the structure during the occupation period. The thinner, tree-dominated pollen spectra of the sub-floor and above floor samples (f1, f4, f5) appear to reflect intervals during the construction and dismantling of the house. At these times, the cellar hole stood exposed to the elements and consequently received a larger proportion of its pollen from the regional spectrum.

The pollen data also reflect some change in the local flora. Sheep-sorrel-type, a weed favoring poor soil (Muenscher 1955: 174; Fernald 1970: 571), is clearly more prominent in the samples from under (f1) and between (f2) the stones than it is in the later samples from higher in the zone. There it is replaced by dock (*Rumex mexicanus*-type), a weed of waste ground and pastures with a preference for richer soils (Fernald 1970: 568). The soil around the structure was evidently more fertile during the later occupation and dismantling periods than early in

the occupation. This may be the product of waste deposition—broadcast garbage or cattle and barnyard fowl droppings—during the occupation.

#### *The Post-Dismantling Pollen Zone*

Four pollen subzones are evident among the spectra of the David Brown cellar gross fill deposition interval (samples p1–p48). These subzones are marked with the letters B, C, D, and E at the left side of the pollen diagrams (FIGS. 6, 7). One subzone is basic and records the pollen already in the fill when it was placed in the cellar hole. The other three reflect floral changes that are the by-products of human activities during and after the filling of the hole, and are imposed on the basic fill spectrum. The basic fill spectrum is not evident at either the top or the bottom of the profile where presentation of the data should logically begin. It must, however, be considered first if the other pollen subzones are to be clearly understood.

#### *The General Fill Pollen Subzone*

This pollen subzone spans the profile from about sample p10 up through about sample p36, and it is marked with the letter C at the left side of the pollen diagrams (FIGS. 6, 7). The general fill pollen subzone is characterized by chestnut, alder, hazel, insect-pollinated Compositae, and dandelion frequencies that are generally higher than in the floor zone; by pine pollen frequencies that are somewhat lower; and by fewer occurrences of corn pollen. The contrast between this profile subzone and those of the floor zone could reflect either the abrupt replacement of local herb and tree populations between the dismantling of the superstructure and the filling of the cellar, or a distant source for most of the

above-floor fill. The second explanation is more likely because the dismantling of the Rhoades farm (1867–1869) was too rapid for the total replacement of tree taxa (Fowells 1965).

#### *The Early Filling Pollen Subzone*

Samples p1–p9 comprise the deepest pollen subzone within the fill, marked with the letter B at the left side of the diagrams (FIGS. 6, 7). Relatively high ragweed-type (wind-pollinated Compositae), goosefoot family (Chenopodiaceae), and mugwort (*Artemisia*) contributions, and low grass (Gramineae) percentages, pollen concentrations, and pollen degradation measures (too degraded to identify and corroded oaks) characterize this zone. Distribution of the types within the subzone are significant. Ragweed-type and mugwort are most numerous in the deepest two to three samples and then drop off abruptly. Ragweed-type then declines steadily up to sample p9. Goosefoot appears to be statistically depressed by the over-representation of ragweed in the deepest two samples. This type peaks after ragweed-type drops off and then declines parallel to ragweed-type up to sample p9. Grass frequencies rise as ragweed-type and goosefoot decline. Pollen concentrations and both pollen degradation measures are relatively low in samples p1–p4 and then rise abruptly in sample p5 and above.

Ragweeds, prolific pollinating members of the Compositae, are known for their ability to colonize the harsh environment of newly plowed ground (Bazzaz 1974: 12). Increases in this type are considered *prima facie* evidence for soil disturbance related to Euro-American agriculture in the upper sections of New England lacustrine



pollen sequences (Davis 1965: 382). Some pollen of this type is incorporated, via convection currents, into the regional pollen spectrum, but the majority of the grains come to earth within a few meters of the parent plants (Raynor, Ogden, and Hayes 1973: fig. 4; 1974: fig. 4). The ragweed-type pollen in this subzone was probably produced very close to the cellar hole. Goosefoot and mugwort, like ragweed, favor disturbed soils. Both are prominent on waste ground and neither has a reputation for long-distance transport. Most ragweed, mugworts, and many members of the goosefoot family are late summer and fall pollinators (Fernald 1970: 590–600, 1468–1470, 1519–1525). A heavy frost is required to terminate ragweed pollen production, and few other taxa are in anthesis at this time. The pollen in this subzone therefore must have been deposited very late in the growing season.

The abrupt increase in pollen concentration and both pollen degradation measures above sample p4 indicate that pollen record formation processes must also be considered in the interpretation of this subzone. Abrupt changes in these three measures in soil profiles record a change in the deposition regimen when an episodic fill is suddenly deposited on a natural surface or on another episodic fill (Kelso 1993: 88). These measures strongly suggest that the profile matrix below sample p5 is local sediment, incorporating locally produced pollen, slumped or sheetwashed into the cellar hole, and that the profile matrix in sample p5 and above is artificial fill incorporating pollen exotic to the cellar hole locus. The goosefoot and ragweed-type pollen contributions taper off up through sample p9 and are replaced by increasing percentages of the grass pollen native to the introduced fill.

This appears to reflect locally shed pollen caught as the fill was tossed into the hole, with the decline of these types recording the wane and end of the anthesis season. This suggests that the filling process may have occurred over several days, at least.

#### *The Possible Agricultural-Period Pollen Subzone*

This pollen subzone occupies the stratigraphic interval between samples p34 and p43. It is marked with the letter D at the left side of the pollen diagrams (FIGS. 6, 7). This subzone is defined on the basis of higher pollen concentrations per gram of matrix, higher and more regular grass, red clover-type, birch, and elm pollen contributions, lower and more regular wind-pollinated Compositae percentages, and depressed goosefoot, chestnut, and alder pollen counts. These changes appear to reflect the intrusion of locally produced pollen into the existing pollen spectrum of the imported fill after the cellar hole was filled completely.

Among the non-arboreal spectra, local grass and clover pollen statistically diluted the relative frequencies of the ragweed and goosefoot pollen that was brought in with the fill. Among the arboreal sums, the pollen contributions of local birches and elms statistically depressed the percentages of the alder and chestnut pollen imported in the fill.

These changes do not appear to reflect natural herb and tree population around the cellar hole. In natural situations the pollen deposited at the surface should be progressively destroyed by oxygen and aerobic fungi as it leaches into a deposit. This produces a spectrum with more, better-preserved pollen at the top of the fill than in deeper samples (Dimbleby 1985: fig. 3;

Kelso 1993: 70, fig. 1). Such a spectrum does not appear in the sample p34–p43 pollen subzone. The transition at sample p34 is quite abrupt and must be interpreted as a cultural phenomenon.

Grass and clover are meadow and pasture plants. In 1869, George Keyes planted his new property with grass (TAB. 1, last entry), and a photograph taken between 1883 and 1907 shows that the David Brown site was still being used to grow hay at that time (Dwyer and Synenki 1990: fig. 4–11). Hay quality deteriorates as weeds take over meadows that are not part of a regular crop rotation scheme (Russell 1976: 366). The meadow still exists and has probably been plowed under more than once. Pollen is naturally deposited on the soil surface and percolates into the soil. As it moves it is attacked and destroyed by oxygen in the groundwater (Tschudy 1969) and aerobic fungi (Goldstein 1960). Most of the pollen in a natural soil profile is concentrated in the upper 4 cm, and pollen concentrations decline toward the bottom of the sequence (Dimbleby 1985: fig. 3; Kelso 1993: 70, fig. 1). The plowing under of the high pollen concentrations at the surface would increase pollen concentrations at the bottom of the plow zone. This would account for the abrupt changes in the pollen spectra and the relative uniformity of the grass, ragweed, and clover counts in the sample p34–p43 pollen subzone. A plowzone was visible around this depth in the walls of the shovel test pits dug on the site, but could not be seen within the cellar excavation.

#### *The Post-Agricultural Pollen Subzone*

The latest pollen subzone of the David Brown cellar fill sequence incorporates the segment of the profile from

sample p43 to the surface. It is marked with the letter E at the left side of the pollen diagrams (FIGS. 6, 7). The post-agricultural pollen subzone is characterized by higher percentages of pine, oak, and total arboreal pollen and lower percentages of grass, wind-pollinated Compositae, and chestnut pollen among the spectra computed from the total sum of all pollen present (solid-bar histograms in Figures 6 and 7). Pine may rise slightly in relative frequencies based on arboreal pollen only, but oak remains steady, while declining wind-pollinated Compositae and rising grass pollen trends are evident among the spectra computed from non-arboreal pollen alone (hollow-bar histograms in Figures 6 and 7).

When trends of the same pollen types in these two kinds of percentages conflict, a statistical constraint is usually at work. The contributions of some types are really changing while the representation of others rise and fall proportionately to fill out the fixed numerical sum and total 100%. Among the non-arboreal pollen types, ragweed declines in both sums. This means that there were actually fewer ragweeds in the source area and decreased soil disturbance is almost certainly indicated. This is probably related to a decrease in active agriculture. The percentage of grass is statistically responding to less ragweed in the non-arboreal sum by increasing, but is responding to more arboreal pollen in the total sum by declining. Actual grass cover on the sampling locus probably changed little. It is possible that regional rather than local events are indicated in the ragweed shift.

The increases among the arboreal types in the total sum are mirrored in both grass and ragweed, the major non-arboreal pollen types at this locus. The rise in arboreal pollen reflects a real in-

crease in tree populations and is a manifestation of the mid-19th- to early 20th-century reforestation phenomenon recorded in declining ragweed and increasing tree pollen counts at the top of lake and marsh pollen cores across New England (Davis 1965: 382; Braun 1950: 424; Russell 1976: 461, 527). Basswood (*Tilia*) and willow (*Salix*) pollen grains are insect-transported. Both they and elm (*Ulmus*) tend to be somewhat under-represented in surface spectra (Janssen 1966: 813). The concentration of these types, plus hackberry (*Celtis*) and possibly walnut (*Juglans*), in the upper profile suggests the development of the current tree population that replaced the more open landscape recorded in late 19th- and early 20th-century photographs of the area (Dwyer and Synenki 1990: fig. 4-11).

#### Pollen Analysis Summary

Two major pollen zones—floor and fill—are evident among the David Brown cellar hole pollen spectra. Sub-zones caused by both natural and cultural factors are visible within each of these major zones. In the floor-zone periods, greater pollen concentrations occur in samples directly associated with the floor and reflect the long interval in which the floor was incorporated in an occupied space. Larger proportions of pine and general arboreal pollen below and immediately above the floor distinguish periods when the cellar hole was open to the atmosphere during construction and dismantling. The floor-zone spectra may be further divided into early and late groupings on the basis of a shift in dominance from nitrophobic sheep-sorrel to nitrophilic dock, which reflects improved soil fertility during the occupation.

Four pollen subzones are evident in the cellar fill. The deepest of these overlaps with the upper pollen samples of the floor zone and records the development of a weedy flora in the vicinity of the cellar during the dismantling of the house. The lower quantities of pollen types characteristic of the exotic fill in the deeper two or three samples of this weedy zone suggest that the 1 cm of sediment between the floor and the clay and brick debris and the 8 cm above the clay and brick are sheetwash or slump into the hole. This, in turn, implies brief periods of inactivity after dismantling and during the filling process. No great hiatus occurred, however.

The intrusion of wind-transported Compositae pollen, shed in the fall of the year into spectra otherwise undistinguishable from the general fill, is evident in the upper 8 cm of fill of the weedy layer. This indicates that such pollen was still in the air when filling began in earnest and tapered out as both the season and filling progressed. This also suggests that the filling was a relatively continuous, rather than instantaneous, process consuming some part of one fall.

A probable plowzone incorporating a very modest increase in grass pollen representation near the top of the profile agrees with photographic evidence that shows the site used as a meadow during the late 19th and early 20th centuries. Pollen data reflecting the abandonment of agriculture on the site, regional reforestation, and the pathogenic destruction of the American chestnut population are present, but are chronologically indistinguishable in the earthworm-homogenized humus at the top of the profile.

## Discussion

Most New Englanders lived on farms well into the 19th century, and the farmstead may be the most common variety of historical archaeological site in the Northeast. Finding and identifying one particular farmstead cellar hole out of the many dotting the countryside is not a particularly inviting task, even when its general location is known. The David Brown homestead is a case in point. An archaeologist, acting on the best available information, found a cellar hole containing a few probable 18th-century artifacts and identified it as the dwelling occupied by David Brown during the Revolutionary War.

Subsequent documentary research indicated the presence of at least one other dwelling on the property, placed David Brown's barn on the other side of the road, established the existence of a 19th-century barn on the same side of the road as the David Brown house, and recorded that the house occupied by David Brown in 1775 was dismantled in 1868. A diary entry indicating that the filling of the David Brown house cellar hole began on October 16, 1868 is of particular relevance to this research.

Recent excavations at the David Brown homestead have exposed the cellar hole of a second house. This cellar hole contained a mixture of 18th- and early 19th-century artifacts, including buttons manufactured during and before the 1860s, but no later materials. This second cellar hole appears to have been filled during the third quarter of the 19th century, suggesting that it, rather than the first excavated structure, is the remains of the 1775 David Brown dwelling. Pollen data support this interpretation.

The Simon Brown diary (TAB. 1) records the filling of the Brown/Rhoades cellar hole in October of 1868, and the pollen spectra from the cellar hole fill lying immediately above the chimney debris contain unusually large amounts of pollen from fall pollinating weeds. The pollen data link the diary entries that chronicle the dismantling of the Brown/Rhoades house to the cellar hole excavated by Dwyer and Synenki (1990), confirming that these remains are those of the dwelling occupied by David Brown when he fought in the battle at the North Bridge.

## Acknowledgments

Many individuals have contributed to this research effort. We particularly wish to thank Myra Harrison, Manager of the NPS Cultural Resources Center, Lowell, Massachusetts, and Linda Towle, former manager of the Cultural Resources Center, Archeology Branch, who arranged local administrative support of the project and who encouraged publication of the results; Jeannine Disviscour, who contributed significantly to the excavations and sampling, and Mary Troy, also of the Cultural Resources Center, who copy-edited the original manuscript. The memory of Kurt Faust, who provided drafting support, is especially cherished. The National Park Service funded the David Brown project. The Department of Archaeology at Boston University provided laboratory facilities. Pollen laboratory equipment was provided by the National Science Foundation under Grant No. BNS-7924470 to Boston University.

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