Appendix G: Specialized Analyses of Plant Remains

APPENDIX G

SPECIALIZED ANALYSIS OF PLANT REMAINS

G.1. Macro-botanical, Palynology, and Parasitology Pilot Study (New South Associates)

G.2. Pollen Analysis (Gerald K. Kelso, Patricia Fall, and Lisa Lavold-Foote)

G.3. Macro-plant Analysis (Leslie E. Raymer)

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REPORT ON PHASE I ARCHEOBOTANICAL, PALYNOLOGICAL, AND PARASITOLOGICAL ANALYSIS OF THE AFRICAN-AMERICAN BURIAL GROUND, NEW YORK, NEW YORK

Report submitted to:

John Milner Associates
309 North Matlack Street
West Chester, Pennsylvania

Report submitted by:

New South Associates
6150 East Ponce de Leon Avenue
Stone Mountain, Georgia 30083

Leslie E. Raymer - Project Coördinator

Co-Authors
Leslie E. Raymer - Archeobotanist; Gerald K. Kelso - Palynologist; Stephen A. Mrozowski, Leslie H. Driscoll, Kate I. Lommen, and Anne P. McGee - Parasitologists

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I. BACKGROUND AND RESEARCH OBJECTIVES

Soil samples were collected from several hundred Colonial-era African-American graves located within the African Burial Ground in Manhattan during a series of archeological investigations that were conducted at the location of the proposed Federal Courthouse site between 1991 and 1992. Samples were taken from coffin lids, coffin fill, grave shaft fill, and the stomach and pelvic regions of each of interment. Bulk samples from these proveniences were floated in a Shell Mound Archeological Project-type flotation device in order to retrieve macroplant remains for archeobotanical analysis. Smaller volume samples were retained for submission to specialists for palynological and parasitological analysis.

This study presents the results of exploratory macroplant, pollen, and parasitological analysis of soil samples from the Broadway African Burial Ground, New York City. The primary objective of this Phase I study was to determine if preservation was adequate to warrant largescale analysis and to evaluate the potential of the aforementioned analyses from the African-American burials for providing data (1) about the diet and health of the deceased; (2) about plants that might have been part of the burial customs among Colonial-era African-Americans in New York; and (3) about the landscape of the African Burial Ground. This preliminary report presents research methods, analysis results, and recommendations for additional study for macroplant, palynological, and parasitological analysis.

II. ANALYSIS PROCEDURES

MACROPLANT ANALYSIS

Macroplant remains collected by flotation from coffin lids and the sacrum area of 22 African-American burials are presented in this report. The flotation samples were processed by Mr. William Sandy in a Shell Mound Archeobotanical Project type flotation device. The volume of each flotation sample was approximately one liter. No recovery controls were added to the samples.

Each size-graded light fraction was fully sorted under low magnification (6-25x). All of the material that was greater than 2.0 mm was pulled from the sample matrices and was quantified by material type, weight, and count. Material that was smaller than 2.0 mm was sorted, but only charred and uncharred seeds were removed. Two heavy fractions were sorted in order to verify the flotation separation (Samples 1545.SAH; 1545.SBH), which seems to have been adequate.

Seeds and other plant parts were identified with standard reference texts (Martin and Barkley 1961; Montgomery 1977; USDA 1974) and a modern reference collection. The floral remains identified during this analysis and the potential uses of these plants are presented in Table 1. The plant remains recovered by flotation are tabulated in Appendix A.

Table 1. Common Names, Latin Nomenclature, Economic Uses, Seasonality, and Habitats.

Major Use	Common Name	Scientific Name	Family	Vegetative Type	Major Use	Edible Part
Condiment	Poppy	*Papaver sp.*	Papaveraceae	Annual/perennial herb	Ornamental	Seeds
Fruit	Elderberry	*Sambucus canadensis*	Caprifoliaceae	Shrub	Fruit	Fruit
Edible Herb	Catchfly	*Silene sp.*	Caryophyllaceae	Annual herb	Edible Herb	Leaves, shoots
Medicinal	Jimsonweed	*Datura stramonium*	Solanaceae	Annual herb	Weed	

Table 1. Common Names, Latin Nomenclature, Economic Uses, Seasonality, and Habitats.

Common Name	Medicinal	Ornamental	Poison	Weed	Habitat	Season of Availability
Poppy	X	X			Cultigen; rare escape	May-June
Elderberry	X	X			Moist soil, meadows	July-August
Catchfly	X			X	Waste places	May-September
Jimsonweed	X	X	X	X	Waste places, introduced	July-October

POLLEN ANALYSIS

Pollen extraction generally followed Mehringer's (1967) mechanical/chemical procedure. His first two HCL washes and HNO^3 step were eliminated, and the strength of the final NaOH wash was reduced to .05. Residues were mounted in glycerol for viewing. Benninghoff's (1962) exotic pollen addition method was employed in computing pollen concentrations per gram of sample. Pollen concentration figures were not calculated 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 control over corrosion factors. Unidentifiable pollen grains were not incorporated in any sum from which the frequencies of other types were computed, but the data for this pollen group, as a percentage of total identifiable and unidentifiable pollen, are presented for each sample in Appendix B-1.

A potentially significant range of pollen preservation within individual samples was noted, and the quantities of pollen grains normally preserved, pollen grains degraded but identifiable, and pollen grains perfectly preserved but probably not contaminants were tabulated as well. These data are also presented in Appendix B-1. The terms "corroded" and "degraded" are used interchangeably 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).

Archaeologists most frequently encounter plants under English names in their documentary sources. For their convenience the common English names for plant taxa are employed in both the text and the diagrams. Equivalent Latin names are introduced at the first mention of each plant, and a list of Latin/vernacular names is presented in Appendix B-2.

PARASITOLOGICAL ANALYSIS

The method employed during the parasitological analysis of the African Burial Ground samples was adopted from procedures developed by A.K.G. Jones (1985). This involved taking 3 grams of soil from each sample and then combining it with 42 grams of distilled water. This solution was left to sit for at least 24 hours to ensure that all soil particles were dissolved. Each solution was then filtered through metal mesh filter and then a second time through fine plastic mesh (500 microns). This filtering process separates the parasite ova which pass through the mesh from the larger soil particles. After filtering was completed, an aliquot of 0.15 ml was measured from the solution and placed in a sealed test tube. The entire aliquot was then scanned under a microscope at 160X magnification. The aliquot yielded an average of 3 cover-slipped slides and each was scanned in a methodical manner in order to ensure thorough examination. Results were recorded in a laboratory book after completion of each slide examination. These slides were then reviewed one last time to check the accuracy of the results.

III. MACROPLANT ANALYSIS

INTRODUCTION

This Phase I analysis focuses upon macroplant remains collected by flotation from coffin lids and the stomach and pelvic regions of 22 burials associated with the African Burial Ground located in Manhattan, New York City (Appendix A). Examination of macroplant remains from these contexts allowed an assessment of the success of the flotation process and macroplant preservation within the graves. This analysis concluded that preservation was adequate to warrant Phase II analysis.

RECOVERY

Macroplant remains associated with the African Burial Ground samples consisted of 745 uncharred seeds from three herbaceous plants, catchfly, jimsonweed, and poppy, and 1 uncharred seed from a fleshy fruit producing shrub, elderberry. Two seed fragments, which likely originated from fruit pits, were unidentifiable. The entire uncharred seed assemblage is analyzed in this study. Uncharred seeds are frequently excluded from macroplant analyses because they are interpreted as modern intrusions into archeological deposits (Lopinot and Brussell 1982; Miller 1989; Minnis 1981). Several studies have assessed problems associated with the long term preservation of uncharred seeds in open-air sites in mesic environments (Miksicek 1987; Miller 1989). Uncharred seeds are rarely preserved for many years in open-air, moist soils and are poorly preserved in open-air, dry soils (Miksicek 1987). However, when suitable environmental conditions exist, fresh seeds will last for long periods of time (Miller 1989: 50).

Because the African Burial Ground dates to the seventeenth and eighteenth centuries, the likelihood of recovering uncharred seeds from the archeological deposits is greatly increased. Extensive studies of macroplant assemblages from nineteenth-century archeological sites conducted by the author and others have shown that even the most fragile seeds are frequently preserved in both features and midden deposits, particularly when the sites are rapidly and deeply buried (Cummings 1993; Cummings and Puseman 1994, O'Steen et al 1995a, 1995b; O'Steen and Raymer 1995; Raymer 1993, 1995, 1996, 1997a, 1997b, 1998; Raymer et al 1997; Raymer and O'Steen 1993, 1994; Wheaton et al 1990).

The evidence suggests that the entire uncharred seed assemblage dates to the time of the Burial Ground's use. First, all of the samples originated from sealed, undisturbed contexts that were deeply buried beneath the modern land surface. The depth of these shaft burials, coupled with the thick layer of overlying fill, reduces the possibility of the insertion of modern seeds into these features after they were abandoned. Keepax (1977) and Bocek (1986), in separate studies of agents of postdepositional bioturbation, have shown that the majority of modern seeds are found in the upper 50 centimeters of a given soil column. Most of the graves were covered by far more than 50 cm of fill. The burials were sealed shortly after abandonment and subsequently deeply buried by later building episodes. These sealed shaft features provide optimal conditions for the long term preservation of uncarbonized seeds. Second, analysis of macroplant remains from 20 early to late nineteenth-century privies, cisterns, and other features excavated during Phase III data recovery of the Five Points Site, which is adjacent to the Broadway African Burial Ground, has demonstrated that huge quantities of uncharred seeds are preserved in archaeological deposits in the Burial Ground locality (Raymer 1998).

Further evidence lies with the seeds themselves. All of the seeds are obviously old. Two plant taxa, jimsonweed and elderberry, have durable seeds that often survive for many years in buried contexts. Indeed, jimsonweed and elderberry are virtually ubiquitous in nineteenth-century contexts (O'Steen and Raymer 1995; Raymer 1998). Two other plant taxa, catchfly and poppy, have more fragile seeds that are less likely to be preserved for long time periods in open settings. However, given the exceptional preservational environment of the African Burial Ground and the adjacent Five Points site, all of the macroplant remains are interpreted as archeological seeds that were either directly deposited within the graves as burial offerings or secondarily deposited as natural seed rain at the time the graves were filled.

ASSEMBLAGE COMPOSITION

This section presents a discussion of the fruit and herb seeds recovered from the African Burial Ground. The specifically identified seed taxa are broken into two categories, fruits and herbaceous weeds, based on their presumed economic importance. The first category represents definite economically important plants. The herbaceous weeds may represent ethnobotanical plant remains, however, it is equally likely that these plants represent naturally deposited yardweeds. The numbers, distribution, potential origins, uses, and natural environments of each plant taxon are discussed in this section.

Fruits

Economically important fruits are represented by a single elderberry seed fragment that was recovered from the lid sample of Burial 321 (sub-adult). Elderberry seeds are found in most nineteenth-century archeobotanical assemblages in the East (Cummings 1993; Cummings and Puseman 1994, O'Steen et al 1995a, 1995b; O'Steen and Raymer 1995; Raymer 1993, 1995, 1996, 1997a, 1997b, 1998; Raymer et al 1997; Raymer and O'Steen 1993, 1994; Wheaton et al 1990). Although this seed likely originated from the economic use of this plant in the Colonial period, it does not necessarily represent a plant placed with the coffin as a burial offering or a fruit consumed by the child buried in this grave prior to death. This seed may represent the incidental inclusion of discarded food remains that were present in the soil prior to the excavation of the grave. Analysis of flotation samples from fill overlying the coffins will aid in factoring out naturally deposited weed seeds and discarded food remains during Phase II archeobotanical analysis.

About 20 species of elderberries (*Sambucus* sp.) occur in the temperate and subtropical regions of both hemispheres. Five species are commonly cultivated (Bailey 1949). Elderberries grow in moist soils bordering field edges or swamps. This deciduous shrub or small tree, which grows from 5 to 30 feet tall, flowers in the spring and fruits in October. Elderberry trees are found throughout North America and Europe in moist woods, roadside ditches, thickets, stream banks, and marsh edges (Angier 1974; Coon 1963; Radford et al 1968).

Elderberries were principally grown in the nineteenth century for food, medicine, and ornamentation. Both native and imported varieties were planted as garden and yard ornamentals in the late eighteenth and nineteenth centuries (Favretti and Favretti 1990; Leighton 1987). Crellin and Philpott (1989) report that elderberry bushes were planted around American homes so that the plant would be readily available for the production of medicine. Both imported European elder (*Sambucus nigra*) and native elderberry (*S. canadensis*) were employed in nineteenth-century domestic medicine in America. Elderberry was used to treat skin conditions, as a purgative, and as a diuretic (Crellin and Philpott 1989). Its popularity apparently declined in the latter half of the nineteenth century (Griffith 1847). The dried inner bark was commonly prescribed as a purgative in the past. Ointments made from the crushed leaves were applied to bruises and sprains and thickened fruit juice was administered internally for coughs and colds. The dried flowers, which were once listed in the United States Pharmacopoeia, were used as a topical treatment for sunburn, to relieve itching, and to remove freckles (Coon 1963). Elderberry has been used in folk remedies as a cureall for "abrasions, asthma, bronchitis, bruises, burns, cancer, chafing, cold, dropsy, epilepsy, fever, gout, headache, neuralgia, psoriasis, rheumatism, skin ailments, sores, sore throat, swelling, syphilis, and toothache" (Duke 1992:423).

The primary edible portions of the elderberry are its fruits and flowers. The fruits were eaten fresh, made into wine and tea, processed for jellies and jams, added to pancake and muffin batter, and used as pie filling. The flower clusters were added to pancake, waffle, and muffin batter, made into tea, battered and fried as fritters, made into tea, and made into sweet-smelling wine (Fernald and Kinsey 1958; Gillespie 1959; Hall 1976; Medve and Medve 1990; Peterson 1977). Green blossoms were pickled and served in place of capers (Bryan and Castle 1974; Hedrick 1972). Unlike the fruit trees represented in the macroplant assemblage, which were almost certainly purchased at markets, the elderberries may have been planted near the Broadway block, since these weedy shrubs are easily propagated in crowded urban settings. The fruits were probably also available for purchase in New York City markets.

Herbaceous Plants

Three herbaceous plants, including catchfly, poppy, and jimsonweed, are represented in the Burial Ground macroplant assemblage. One plant, poppy, almost certainly represents a cultivated plant. Catchfly and jimsonweed, on the other hand, may represent either naturally occurring yard weeds or economically important edible (catchfly), medicinal (catchfly, jimsonweed), or ornamental (jimsonweed) herbs. With this in mind, the documentary evidence on the historic utilization of these taxa and their condition and distribution within the archeological deposits were carefully assessed. The evidence suggests that all of these plants were deposited during the seventeenth and eighteenth centuries, however, the ethnobotanical versus natural origins of these taxa is more problematical.

Catchfly

Catchfly, *Silene* sp., is represented by two seeds found in a sample collected from the coffin lid of Burial 122, an adult female. This genus, which is represented by sixteen native American and naturalized European species in the northern United States and Canada, consists of both annual and perennial herbaceous plants that are found in both moist and dry conditions within woods, fields, and waste places throughout the Northeast. Cox (1985) and Gillespie (1959) list one species of catchfly, *Silene cucubalis,* as an edible potherb whose young shoots can be parboiled, creamed, or eaten alone as a pea-like green vegetable. Cox (1985) discusses a second species of *Silene,* fire pink (*S. virginica*), as a medicinal herb whose root has been used in the treatment of intestinal worms. This plant was not apparently highly regarded as a medicinal remedy, as no mention of its use as a medicinal herb was found in other medicinal plant books reviewed for this project (Angier 1978; Coon 1963; Crellin and Philpott 1989; Duke 1992; Foster and Duke 1990; Grieve 1931; Justice 1939; Krochmal and Krochmal 1973; Krochmal et al 1969; Massey 1942; Millspaugh 1884; Phelps Brown 1993).

Jimsonweed

Jimsonweed, *Datura stramonium,* is a widely naturalized endemic weed that was imported from Europe and grows abundantly on garbage heaps (Millspaugh 1884). This plant, which is extremely poisonous, was planted in nineteenth-century gardens as an ornamental flower and is recorded as a narcotic, medicinal herb (Crellin and Philpott 1989; Leighton 1987). Although this plant may represent an ornamental or medicinal herb that was deliberately placed within the graves, it is more likely that it represents a non-economic weed that grew in the disturbed setting of the burial ground.

Seven hundred and forty-two jimsonweed seeds were recovered from 36 of the 53 samples submitted for Phase I analysis. Jimsonweed was recovered from 77 percent of the burials (17 of 22 burials) analyzed as part of this preliminary archeobotanical study. This taxon was absent from 3 sub-adult (Burials 45, 201, 203), 1 adult male (Burial 101), and 1 adult female (Burial 295) inhumations. The recovery of the majority of the jimsonweed seeds from coffin lid (561 seeds) contexts, coupled with its high ubiquity in the flotation samples, suggests that this taxon was a naturally occurring weed growing on the Burial Ground property at the time the graves were excavated. Under this scenario, naturally deposited jimsonweed seeds were incorporated into the grave fill when the grave shafts were excavated and subsequently backfilled.

Alternatively, the jimsonweed seeds may have originated from the deliberate placement of jimsonweed flowers on the coffins as burial offerings. The question of the natural versus ethnobotancal origins of this taxon can be answered by examining soil samples collected from grave fill overlying the coffins. If jimsonweed is abundant in fill samples, then it strengthens our contention that these seeds are naturally deposited weed seeds.

Jimsonweed is recorded as a medicinal herb that although extremely poisonous, was used as an antispasmodic, topical treatment for skin conditions, antiasthmatic, and sedative (Crellin and Philpott 1989; Krochmal and Krochmal 1973; Krochmal et al 1969). All parts of the plant are to some degree toxic, especially the seeds. The most common use of this herbaceous weed was as a treatment for the spasmodic coughing associated with asthma. The plant was burned and the smoke was inhaled by the asthma sufferer. The plant juices, flowers, leaves, and roots were also made into salves and poultices that were variously used as topical treatments for sores, boils, pimples, swellings, and skin ulcers (Crellin and Philpott 1989; Krochmal and Krochmal 1973). Crellin and Philpott (1989) reiterate the value of this plant as an inhalant for asthma patients and state that jimsonweed cigarettes are available today in some parts of the world.

Poppy

A single poppy seed came from a flotation sample collected from the stomach region of Burial 133, a sub-adult. This seed likely was either ingested shortly before death or derived from poppy flowers placed in the coffin. If the seed originated from flowers added to the coffin as a burial offering, then this interment likely took place in the late spring or early summer (Table 1). This seed is the only unquestionably ethnobotanical herbaceous plant identified during Phase I macroplant analysis.

Poppies (*Papaver* sp.) are one of the best known garden flowers in the United States. About 45 species, most of which are Old World natives, are found in the Northern Hemisphere (Bailey 1949). Poppies are commonly cultivated in Europe and Asia for their capsules, which are utilized in the production of opium and opium-based drugs such as morphine. Some species are cultivated in the United States and Europe for their edible flowers and leaves (Britton and Brown 1970; Root 1980). Whole poppy seeds are commonly added to breads and cakes as a flavoring (Root 1980). Poppies were common constituents of late eighteenth and nineteenth-century ornamental gardens in the United States, and were also cultivated in home gardens as a culinary and medicinal herb (Favretti and Favretti 1990; Leighton 1987).

Opium, or white, poppy (*Papaver somniferum*), was one of the most commonly used drugs in the nineteenth century (Phelps Brown 1993). In the form of laudanum, opium was regularly prescribed for pain relief and as a sedative. Opium and its derivatives were used as a hypnotic, sedative, topical astringent, expectorant (cough medicine), and antispasmodic. It was also used in the treatment of diarrhea and dysentery, and in the treatment of intestinal worms (Grieve 1931; Phelps Brown 1993).

IV. POLLEN ANALYSIS

Introduction

This pollen study presents the results of exploratory palynological analysis of samples from the Broadway African Burial Ground, New York City. The objectives of this study were to determine if pollen preservation was adequate to permit analysis, and, provided pollen preservation proved adequate, to evaluate the potential of the pollen spectra from the African-American burials for providing data: (1) about the diet of the deceased; (2) about plants that might have been part of the burial customs among African-Americans; and (3) about the landscape of the African-American Burial Ground. To achieve these objectives samples from the stomach areas and the coffin lids of three burials selected selected by Dr. Warren R. Perry of the Foley Square Laboratory for analysis.

Results

Both the coffin lid and stomach samples contained, for the most part, the same kinds of pollen. The pollen concentrations per gram of matrix of the stomach and coffin lid samples of each burial were, with the exception of Burial 119, more similar to each other than to those of other burials. This suggests that much of the pollen recovered from both the stomach areas and coffin lids was derived from the matrix of the individual graves. Variations noted among the spectra of the coffin lids and stomach samples suggest that significant differences between the two sample sources may be recovered in future analysis. These are: (1) somewhat larger quantities of oak(*Quercus*) pollen on the coffin lids than in the stomach areas of three of the four burials; (2) the presence of Eurasian cereal-type pollen in three of the coffin lid samples; (3) exceptionally high percentages of three morphological varieties of carrot family (Apiaceae) pollen in the stomach area of Burial 45; and (4) differences in the relative quality of pollen preservation that may prove useful in further analysis.

Pollen Preservation Factors

Pollen concentrations in the Broadway African Burial Ground samples ranged from 168 to 583 pollen grains per gram of matrix (Appendix B-1). These figures are low relative to the quantities of pollen in modern surface samples but are fairly normal for the older pollen spectra in the deeper portions of natural soils and historical archaeological sites in the northeastern United

States. One hundred pollen grains per sample could be tabulated from seven of the eight samples and fifty pollen grains could be tabulated from one sample (Appendix B-1). Much time and most of the extraction residue was consumed in achieving the sums in all eight samples, and the original plan to tabulate 400 pollen grains per sample had to be abandoned.

A relatively small quantity of extraction residue was recovered from six of the eight samples. A modified pollen extraction method employing smaller quantities of matrix and smaller centrifuge tubes with pointed bottoms will recover more residue and will be employed in future analysis. This should increase the total quantity of pollen recovered and should permit larger counts. It will not, however, increase pollen concentrations and will not decrease tabulation time.

Early in the counting process it became apparent that the quality of pollen preservation within individual samples was quite variable. Nineteen to 43 percent of the pollen in the Broadway African Burial Ground samples were recognizable as pollen grains, however, the grains were too degraded to identify to plant taxon (Appendix B-1). Some pollen grains were degraded, but identifiable to taxon. Other pollen grains were relatively well preserved, but took the basic fuschin stain in a way that indicated that they had weathered to some extent. A significant quantity of pollen grains were perfectly preserved, but lacked the cytoplasma and light pink color when stained with basic fuschin that are characteristic of modern pollen introduced as contaminants during the sampling and extraction process.

These differences in pollen preservation suggest that the samples contained pollen of a number of different ages. The pollen deposited on the surface of soil deposits and open archaeological sites that are not sheltered in some way from the natural elements is carried down through the site matrices by percolating rainwater (Dimbleby 1985:5). As the pollen moves it is attacked and progressively destroyed by oxygen in the groundwater and by aerobic fungi (Tschudy 1969; Goldstein 1960). This results in a pollen profile in which there are relatively large quantities of well preserved pollen at the top of the profiles and progressively lower concentrations of pollen down through the matrix. The quality of pollen preservation also declines down through the profile, and eventually a point is reached at which no identifiable pollen remains.

Havinga's (1984) experiments indicated that signs of pollen degradation can be seen among pollen grains in soils after only a few months burial. Pollen, however, will be preserved by rapid, deep burial (Schoenwetter 1962; King et al. 1976; Dimbleby 1985). The perfectly-preserved pollen grains from the African Burial Ground resembled the pollen caught by the deposition of an episodic fill in the 1607 fort at Jamestown Island, Virginia (Kelso, unpublished data). The perfectly preserved pollen grains in the Burial Ground samples appear to be pollen deposited in the coffin or on the clothing of the deceased before burial and pollen deposited on the surface of the burial ground at the grave site a very short time before internment.

This pollen was preserved by incorporation in the grave fill. The well-preserved, but not perfectly-preserved, pollen grains may have been deposited on the ground surface or on some material in the coffin sometime before internment, while the pollen grains that were degraded-but-identifiable probably came from further down in the soil profile into which the grave was originally excavated. The pollen grains that were too degraded to identify would have been even deeper in the soil profile when the grave was dug, and could have been several hundred years old at the time of the burial (Kelso et. al. 1995).

Arboreal Pollen Spectra

The African Burial Ground pollen spectra contained most of the same pollen types previously observed in seventeenth through nineteenth-century soil pollen sequences from Boston and New York City (Kelso and Beaudry 1990; Kelso and Wall 1993; Kelso 1994a). They appear to reflect the mixture of tree pollen from the extra-local and regional pollen rain and pollen contributed by local grasses and weeds that is characteristic of urban or suburban sites during the historical era. Most of the tree pollen in these historical deposits blew in from off site, and variation in the arboreal pollen types among the samples is a statistical function of differences in the herb and pollen contributions.

Tree pollen percentages go up in some samples because there was less herb pollen and down in others because there was more herb pollen, not because there were fewer or more trees in the source area. The oak pollen spectra from Burials 45, 12, and 115 are examples of this. There were large percentages of oak pollen that was degraded-but-identifiable on the coffin lids of these three burials compared to the pine counts and most of the herb frequencies. This damaged oak pollen did not come from the pollen rain deposited near the top of the profile shortly before the graves were dug. It came from deeper in the profile and dates to the period when oaks dominated northeastern forests before historical land clearance (Braun 1950; Davis 1965) allowed herb populations to expand in the area.

Age difference may also partially account for the relatively large percentages of perfectly preserved pine (*Pinus*) pollen and comparatively low percentages of degraded pine pollen in all of the burial samples. Pines were a major secondary succession tree on abandoned agricultural land in the Northeast (Davis 1965; Russell 1976). The good pine pollen preservation relative to the poor oak preservation suggests that there was a larger pine population later in the history of the area, after the plot had become a burial ground.

Non-Arboreal Pollen Spectra

Relative age may also account for the comparatively small percentages of perfectly preserved ragweed-type (*Ambrosia*-type); the large percentages of degraded ragweed-type in the burials; and the comparatively large proportions of perfectly-preserved grass family (Poaceae) in the pollen spectra from the burials. Ragweeds are better adapted to withstand the water and temperature stress of bare, disturbed ground than most other weeds, and they are, consequently, the premier agricultural weed of eastern North America (Bazzaz 1974).

In urban or suburban situations ragweed reflects soil disturbance caused by human activity (Solomon and Kroener 1971). These plants produce large quantities of pollen, some of which is rather widely dispersed (Wodehouse 1971; Raynor et al. 1968, 1973, 1974). Experimental data, however, indicate that the majority of ragweed pollen grains come to earth within three meters down wind of their source. Over 90 percent are no longer airborne at nine meters. The pollen contributions from ragweed dominated plots fall to normal background concentrations within 110 meters.

Soil disturbance destroys the perenniating organs of grasses, and increases in grass pollen are usually interpreted as reflecting soil stabilization (Behre 1983). Grass pollen is also generally larger than ragweed-type pollen and should not travel as far. Both the grass and ragweed type pollen in the Broadway samples probably originated fairly close to the grave sites. The relatively poor preservation of ragweed-type pollen and the good preservation of the grass pollen suggests that the area was somewhat disturbed when the older (i.e., deeper) spectra in the grave site pollen spectra were deposited but that the soil was relatively stable, possibly intentionally maintained, at the time the graves were dug.

Seasonal Pollen Data

There are suggestions of season of interment among the Broadway African Burial Ground pollen spectra. Potentially significant amounts of perfectly-preserved pine were noted in all eight samples. Six of the eight samples also contained exceptional quantities of perfectly-preserved grass family pollen. The pattern among the grass counts is not perfect, but these spectra may indicate that the burials took place in the late spring or early summer. Seasonality data were also recovered in the pollen spectra from three late seventeenth-century lead-coffin burials from

Historic St. Mary's City, Maryland (Kelso, unpublished data). Contrasting pollen spectra in these coffins indicated that the man, woman, and child interred at St. Mary's City were buried at different seasons.

Potential Ethnobotanical Pollen

Small quantities of pollen from weedy herbs appear in the spectra of even the best-kept lawns (Kelso 1993a). The percentages of most of the other herb types in the African Burial Ground pollen spectra are too small to confidently interpret in such a short sample series. A notable exception is the carrot family counts from the stomach area of Burial 45, a sub-adult. These are much higher than those previously observed in any pollen spectrum by the analyst. The members of the carrot family are insect pollinated. The pollen of such plants is securely held in the flower by the sticky oils and resins by which it is transferred to the insect vector (Faegri and van der Pijl 1968), and that portion not carried away generally falls to the ground with the flower very close to the point of origin (Kelso 1993b). A few grains of carrot family pollen are usually present in northeastern historical pollen counts, but it is not a major element in natural pollen spectra. Root crops, moreover, become woody and inedible by the time they reach anthesis. The cultivated members of the carrot family are customarily harvested long before they reach the flowering stage.

The relative prominence of carrot family pollen in the stomach area of this burial, and the virtual absence of this group of types from the coffin lid sample, strongly suggests that either this child ingested flower parts from these plants shortly before death, possibly in some form of medication, or that the floral portions of some members of the carrot family were placed in the coffin. The presence of more than one morphological variety of carrot family pollen implies that more than one kind of flower was involved and suggests that the pollen reflects some sort of floral tribute. Burial 45 was that of a sub-adult. The presence of the carrot family pollen may simply reflect a token of particular affection for a child. It also raises the possibility that there may have been variations in burial practices with the age of the deceased.

The two percent Eurasian Cereal-type pollen noted in the coffin lid samples of burials 45, 112, and 119 might also be ethnobotanical in origin. Rye (*Secale*) is wind-pollinated, or anemophilous. It produces large quantities of pollen and disperses it widely. In Europe, rye is regarded as one of the most reliable indicators of cultivation (Behre 1983:227) and should be so in North America as well. The other three Eurasian cereals, wheat (*Triticum*), barley (*Hordeum*), and oats (*Avena*), are autogamous (self-pollinating), therefore, little pollen escapes until the grain is threshed (Vuorela 1973:10).

These cereal types are rare, or completely absent in Old World peat profiles, even when cultivation went on quite close by (Behre 1983:227). In modern samples they are more likely to be found dispersed with chaff along transportation routes within farms than in fields (Vuorela 1973:12). Significant quantities of pollen from these taxa have, however, been found in previously cultivated soils where agricultural waste and manure have been applied as fertilizer (the "plaggen" soils of European terminology), in threshing spoil, and in historic barn deposits (Behre 1983; Kelso 1994b; Kelso and Miller 1996).

The Eurasian cereal-type pollen in these samples might reflect agriculture on the property before it became a cemetery. Where Eurasian cereal-type has been previously noted in North American historical-era agriculture-related sites, however, it has been accompanied by relatively high percentages of ragweed-type pollen (Kelso 1994; Kelso and Miller 1994). That is not the case here. The size of most of the pollen grains also suggest that they do not have an agricultural origin.

Eurasian cereal pollen is distinguished by its size (ca. 40 to 60 microns diameter). One of these pollen grains was 49 microns in diameter and might be that of rye The rest, which were 44 microns at the greatest diameter, measured toward the lower end of the of the Eurasian cereal portion of the grass pollen size scale, where Eurasian cereal pollen sizes overlap with those of some genera of native grasses (i.e., *Andropogon, Agropyron, Echinochloa, Elymus*). Data from a larger sampling of burials may resolve this question.

V. PARASITOLOGICAL ANALYSIS

Introduction

In 1997, the Center for Cultural and Environmental History of the University of Massachusetts, Boston was contracted to conduct an analysis of soils for human intestinal parasites recovered from the African Burial Ground in New York City. In all, 20 samples were processed from as many burials. Samples were collected from both the pelvic and stomach areas of each burial. Of the 20 burials examined 6 were from adult males, 6 were from adult females, 5 were from sub-adults whose gender could not be determined, and 2 from which neither the age or sex could be determined (Table 2).

Table 2. Parasitological Sample Provenience.

Burial Number	Catalog Number	Sample No.	Sample Location
11	267/SBR	1	Adult Male Pelvis
12	253/SBR	2	Adult Female Stomach
17	357/SBR	3	Sub-Adult Stomach
18	310/SBR	4	Stomach
23	383/SBR	5	Adult Male Pelvis
30	410/SCR	6	Stomach
31	409/SCR	7	Sub-Adult Pelvis
32	420/SBR	8	Adult Male Pelvis
45	598/SRR	9	Sub-Adult Stomach
55	792/SBR	10	Sub-Adult Pelvis
68	807/SBR	11	Adult Male Pelvis
105	848/SAR	12	Pelvis
107	850/SBR	13	Adult Female Pelvis
115	858/SBR	14	Adult Female Stomach
119	864/SBR	15	Adult Male Stomach
122	867/SBR	16	Adult Female Pelvis
132	877/SBR	17	Adult Male Stomach
134	879/SBR	18	Adult Female Stomach
138	883/SBR	19	Sub-Adult Pelvis
142	887/SBR	20	Adult Female Pelvis

The analysis of soils associated with human burials is relatively new in parasitology. Archeologists interested in health and disease related questions have for some time collaborated with parasitologists. This collaboration has focused primarily on the analysis of human remains (e.g. Ruffer 1910; Ferreira et al. 1983; Jones 1986), coprolite studies (e.g. Callen and Cameron 1960; Fry and Hall 1969; Jones 1983; Reinhard 1985, 1988; Faulkner 1991) and the study of privy or cesspit soils (Pike and Biddle 1966; Hevly et al. 1979; Greig 1985; Reinhard et al. 1986; Reinhard 1992; Taylor 1985; Driscoll 1994). In recent years the growth of parasitological analysis in historical archeology has increased and created new opportunities to examine the close relationship between patterns of disease and factors like gender, class, and ethnicity (Reinhard et al. 1986; Mrozowski et al. 1989; Reinhard 1992; Driscoll 1994). Despite these advances in the field, archaeoparasitology is just now beginning to realize its potential for examining issues relating to the growth of urban society and culture (Mrozowski 1988, 1996; Driscoll 1994) or the co-evolution of parasites and their hosts (e.g. Toft et al. 1991).

Given the embryonic stage of its development, experimentation remains an important part of the field's future. This experimentation will come in two forms. It is important that new methods be explored for both the extraction and interpretation of parasitological remains. Although methods of extraction have proven successful (see below) new contexts may present different challenges that require research into new methods. This has certainly been the case in palynology, for example, where new extraction techniques have proven successful in finding pollen in contexts not previously thought to be conducive to organic preservation (e.g. Kelso et al. 1995). The same is true of parasitology. Although contexts such a privies have consistently proven to be rich environments for the preservation of intestinal parasite ova, experimentation with other contexts must also continue. The current study represents just such an opportunity.

Results

Despite repeated scanning, no evidence of parasite ova were found in any of the 20 samples that were processed. This may be due to a lack of organic preservation, movement of ova through the soil, or the more obvious answer that none of the population were infected. Given the wide-spread parasite infection levels suggested by other studies, (e.g. Driscoll 1994; Reinhard et al. 1986; Reinhard 1992), the latter interpretation seems unlikely. What is most likely is that preservation conditions are not conducive for parasite ova to survive.

It is our conclusion, however, that we should not allow the matter to rest solely on the results of the 20 samples examined. Parasite ova have been recovered from contexts that were not considered conducive to their survival in the past (e.g. Wilson and Rackham 1976; Jones et al. 1988). Therefore the initial results from the African Burial Ground indicate that experimentation with different recovery methods would be the most productive avenue to pursue. Given the significance of the African Burial Ground and the questions surrounding the overall health of the population we recommend that further parasitological analysis be conducted. The results to date suggest that preservation of parasite ova is not likely. Different recovery methods might, however, produce better results. Although the methods employed in the present study have proven fruitful in the examination of soils recovered from other archaeological sites, other extraction techniques could produce better results.

VI. RECOMMENDATIONS FOR PHASE II ANALYSIS

Macroplant Analysis

Phase I macroplant analysis has demonstrated that seed preservation is adequate to warrant analysis of additional flotation samples. Evidence of the preservation of burial offerings or ingested food remains is provided by the recovery of a poppy seed from the stomach region of Burial 133. The recovery of large quantities of jimsonweed seeds from 77 percent of the flotation samples, 2 catchfly seeds from the Burial 122 coffin lid sample, and 1 elderberry seed fragment from the Burial 321 coffin lid sample is indicative either of naturally deposited seeds (catchfly, jimsonweed, perhaps elderberry) and discarded kitchen trash (elderberry) inserted into the grave shafts at the time of the interments or plant offerings placed on the coffins and/or with the bodies when they were buried.

The four to one dominance of jimsonweed seeds in coffin lid versus stomach/pelvic region samples, combined with the greater ubiquity of this taxon in coffin lid contexts (74% of lid samples and 56% of stomach/pelvic region samples contained jimsonweed), argues against the insertion of jimsonweed plants into the coffins at the time of burial. The highly poisonous nature of the seeds, which are inedible and are not included in medicinal preparations made from this plant, argues against the ingestion of jimsonweed seeds prior to death. Jimsonweed seeds found within the coffin fill and body cavities were probably postdepositionally inserted into the coffins after they collapsed. No differences in the distribution of this taxon by sex or age were noted. The question of the natural versus ethnobotanical origins of jimsonweed and elderberry seeds found in coffin lid samples can only be resolved by examination of soil samples from the grave fill overlying the coffins.

Phase II analysis of flotation samples from the Broadway African Burial Ground should include as many unfloated soil samples as possible. Additionally, samples selected for Phase II analysis should include samples taken from grave fill overlying the coffins as well as those from coffin lids and body cavities. Analysis of a larger burial population, combined with the addition of samples from grave fill overlying the burials, will increase the likelihood of recovering additional economic plants and aid in the interpretation of the natural versus ethnobotanical origins of the recovered plant taxa. The inclusion of as yet unfloated soil samples will allow for a more precise analysis, because: (1) the samples will be floated under the direct supervision of the archeobotanist; (2) sample volume will be recorded prior to the flotation of each sample; (3) recovery controls will be added to a subsample of the flotation samples to verify the success of the flotation process; and (4) a fine mesh (either 1.0 or 0.8 mm) heavy fraction trap, which will greatly increase the likelihood of the retention of small seeded taxa that fail to float, will be employed during flotation.

Pollen Analysis

This exploratory pollen analysis has demonstrated that pollen preservation in the Broadway African Burial Ground samples is adequate to warrant analysis of further burials. Both land-use and ethnobotanical pollen data were recovered. The presence of large amounts of carrot family pollen in the coffin of the sub-adult (Burial 45) may reflect a token of particular affection of one family for a child, but it could reflect different burial customs according to age. No differences by sex were noted, but the sample size was very small.

Analysis of a larger burial population will permit a statistically valid examination of such research questions. It will also permit a more sophisticated analysis of the evolution of the landscape within the burial ground. Seasonal patterns of mortality may also be evident among a larger body of data. Few, if any people are allergic to pine pollen, the pollen-count charts published in newspapers by allergists normally exclude this type. An investigation of season of mortality may require the collection of new seasonal pollen data or access to the raw pollen data of allergy clinics in the New York City area.

Information on the preservation of both the coffins and the bodies, the relative social status of the deceased in the African-American community, and chronometric dates for the interments will have to be considered in evaluating pollen sources during future analysis. It will also be necessary to investigate African-American ethnobotany.

Parasitological Analysis

Because no ova of intestinal parasites were recovered from the 20 samples provided to UMass Boston by New South Associates for Phase I analysis, the question arises as to whether it is valuable to continue with analysis of the additional 80 samples scheduled for Phase II study. A review of the methods used, other methods available, and the possible results is helpful in establishing whether to proceed with additional parasitological analysis.

First, the method used in the Phase I parasitological study was a quantitative one (with results in ova/g of soil sample). This is the best method for determining whether a sample has enough ova in it to suggest that it is of fecal or part fecal origin. Few or no eggs does not preclude such an origin, rather, many would definitely suggest that it was. However, this means that if the number of eggs in a gram of soil is small, they might not have been picked up in the soil samples measured out for testing, but could still be present in the soil.

To insure that every egg in a given soil bag submitted for analysis is captured and counted, concentrative (qualitative) methods must be used. Briefly, this concentration can be accomplished by methods using either the Zinc Sulfate Centrifugal Flotation Technique or Formalin-Ethyl Acetate Method. While these methods are more difficult, they may lead to the discovery of ova or cysts that are present occasionally or in very small numbers. The quantitative method provides a clue as to the nature of the soil and therefore gives investigators an indication of whether they think other methods are worth pursuing. In this case, however, we know that we are dealing with human remains and the decision to pursue the problem qualitatively is of another nature.

Second, the lab at UMass Boston will have a better idea of which samples to select for study and analysis methods to pursue if information on exact sample collection methods and sample location is provided. Drawings of where (exactly) in reference to the human remains the samples were taken, the condition and description of the soil in and around the remains, the conditions of burial, and any other information would be helpful.

Third, since archeological parasitology is a relatively new area of inquiry, there is as yet no uniformly accepted methodology for such investigations. This is particularly true in the case of grave remains. As with many aspects of archeology, each decision is case-specific and as the number of cases build up, perhaps protocols will arise.

Finally, although the likelihood of recovering good parasitological data from this site seems (based upon the preliminary results) to be poor, the importance of the site makes the significance of biological data that might be present considerable indeed, and any and all possible parts of data-gathering and interpretation (including parasitological) are truly rare opportunities to gain insight into these peoples' lives.

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Appendix A. Macroplant Analysis Data

Appendix A. Flotation Sample Macroplant Remains.

Burial	Catalog Number		Age/Sex	Location	Sample Weight	Jimsonweed	Elderberry	Poppy	Catchfly	Unidentifiable Fragment	Notes
12	253	SAL	Adult Female	Coffin Lid	0.44	110					Wood charcoal, bark, mica
12	253	SBL	Adult Female	Stomach	0.18	55					Wood charcoal, mica, sand
40	489	SAL	Adult Female	Coffin Lid	0.09	1					mica, sand, wood charcoal
40	189	SBL	Adult Female	Stomach	0.02	0					mica, sand
45	598	SAL	Sub-Adult	Coffin Lid	None	0					No sample matrix
45	598	SBL	Sub-Adult	Stomach	None	0					No sample matrix
55	792	SAL	Sub-Adult	Coffin Lid	0.36	113					mica, uncharred wood, 4 bone
55	792	SAH	Sub-Adult	Coffin Lid	na	8					picked heavy fraction
55	792	SBL	Sub-Adult	Pelvis	0.15	33					uncharred wood, mica
55	792	SBH	Sub-Adult	Pelvis	na	1					picked heavy fraction
68	801	SAL	Adult Male	Coffin Lid	0.04	0					mica, sand
68	801	SAH	Adult Male	Coffin Lid	na	0					picked heavy fraction
68	801	SBL	Adult Male	Pelvis	0.02	1					mica, sand
73	815	SAL	Adult Female	Coffin Lid	0.07	4					mica, wood charcoal, sand
73	815	SBL	Adult Female	Stomach	0.04	7					sand, wood charcoal, mica
101	843	SBL	Adult Male	Stomach	0.10	0					uncharred/charred wood, sand
107	850	SAL	Adult Female	Coffin Lid	0.11	12					uncharred wood, sand, wood charcoal
107	850	SBL	Adult Female	Pelvis	0.19	0					sand, wood charcoal
114	857	SAL	Adult Male	Coffin Lid	0.09	15					sand, wood charcoal
114	857	SAH	Adult Male	Coffin Lid	na	3					picked heavy fraction
114	857	SBL	Adult Male	Stomach	0.33	3					sand
115	858	SAL	Adult Female	Coffin Lid	0.05	2					wood charcoal, sand
115	858	SBL	Adult Female	Stomach	0.15	4					uncharred wood, wood charcoal, minor bone
119	864	SAL	Adult Male	Coffin Lid	0.15	3					sand, mica, wood charcoal
119	864	SBL	Adult Male	Stomach	0.01	0					no seeds
119	866	SAL	Adult Male	Stomach	0.13	19				1	wood charcoal
122	867	SAL	Adult Female	Coffin Lid	0.19	47			2		mostly seeds, some wood charcoal
122	867	SBL	Adult Female	Pelvis	0.17	39					mostly seeds, some wood charcoal
122	867	SBH	Adult Female	Pelvis	na	1					picked heavy fraction
132	877	SAL	Adult Male	Coffin Lid	0.13	0					wood charcoal, 1 bone, mica
132	877	SBL	Adult Male	Stomach	0.05	7					bone, wood charcoal, mica
132	877	SBH	Adult Male	Stomach	na	2					picked heavy fraction
133	878	SAL	Sub-Adult	Coffin Lid	0.06	18					sand, minor charred wood
133	878	SBL	Sub-Adult	Stomach	0.08	6		1			abundant bone (some green), uncharred wood
134	879	SAL	Adult Female	Coffin Lid	0.09	1					uncharred plant remains, sand
134	879	SBL	Adult Female	Stomach	0.06	0					uncharred wood, sand, minor bone

Appendix A. Flotation Sample Macroplant Remains.

Burial	Catalog Number		Age/Sex	Location	Sample Weight	Jimsonweed	Elderberry	Poppy	Catchfly	Unidentifiable Fragment	Notes
154	899	SAL	Adult Female	Stomach	0.02	2					sand, wood charcoal
187	988	SAL	Sub-Adult	Coffin Lid	0.42	168					all seeds
187	988	SAH	Sub-Adult	Coffin Lid	na	4					picked heavy fraction
187	988	SBL	Sub-Adult	Stomach	0.49	2					clay, sand
187	988	SCH	Sub-Adult	Coffin Fill	na	15					picked heavy fraction
200	1165	SAL	Adult Male	Coffin Lid	0.05	17					mica, sand, wood charcoal
200	1165	SBL	Adult Male	Stomach	0.04	2					minor bone, sand, mica
201	1168	SAL	Sub-Adult	Coffin Lid	0.05	0					sand, mica
201	1168	SBL	Sub-Adult	Stomach	0.04	0					moderate bone, sand, wood charcoal
203	1174	SAL	Sub-Adult	Coffin Lid	0.06	0					tiny bone, some with greenish cast
203	1174	SBL	Sub-Adult	Stomach	0.11					1	tiny bone, some with greenish cast
295	1366	SAL	Adult Female	Coffin Lid	2.84	0					uncharred wood, soil
295	1366	SBL	Adult Female	Stomach	0.15	0					silt
321	1545	SAL	Sub-Adult	Coffin Lid	0.10	15	1				sand grains, wood charcoal, minor bone
321	1545	SBL	Sub-Adult	Stomach	0.01	0					1 bone, sand
321	1545	SAH	Sub-Adult	Coffin Lid	10.78	1					Unsorted Heavy Fraction
321	1545	SBH	Sub-Adult	Stomach	167.47	1					Unsorted Heavy Fraction
				Total:	186.18	742	1	1	2	2	

Appendix B. Pollen Analysis Data

Appendix B-1. Raw Pollen Sums: Broadway African American Burial Ground, NYC
c=corroded but identifiable p=perfect but not contaminant

SAMPLE	B-45 C-lid: 598-SAP.	B-45 Stom. 598-SBP	B-12 C-lid: 253-SAP	B12 Stom. 253-SBP	B-115 C-lid: 858-SAP	B-115 Stom. 858-SBP	B-119 C-lid: 464-SAP	B-119 Stom. 464-SBP
	Sub-Adult		Adult Female		Adult Female		Adult Male	
Pollen Type								
Quercus	18 c-10 p-1	8 c-2 p-1	34 c-16 p-4	19 c-7 p-3	14 c-7 p-1	11 c-2	8 c-3	21 c-3 p-3
Castanea	11 c-3	3	3 c-1	4	1 c-1	2	2	4 p-2
Pinus	5 p-1	7 p-3	11 c-1 p-3	6 p-2	5 c-1 p-3	11 p-5	13 p-6	5 p-3
Tsuga	——	——	1	——	——	——	——	——
Cupressaceae	1	1	4 p-1	3 p-1	1	7 p-5	1	——
Carya	3 c-1	1	2	5 c-2	2 c-2	3	5 p-1	3 p-2
Betula	1 p-1	2 c-1 p-1	——	——	——	——	3 c-1 p-2	1
Corylus	——	——	1 c-1	——	——	——	2	1
Alnus	1	——	——	——	——	2 p-1	——	1
Acer rubrum	——	1	——	——	——	——	——	——
Acer saccharum	——	1	1	——	——	1 p-1	——	——
Populus	2	——	2	——	——	——	1	——
Ulmus	——	——	1	——	1	——	——	——
Lierodendron	1	——		——		——	——	——
Rhamnus	——	——	——	1 p-1	1 p-1	——	1	——
Liquidambar	——	——		——	——	——	——	1
Total Arboreal	42 C-14 p-3	24 c-3 p-5	60 c-19 p-8	37 c-9 p-6	24 c-11 p-4	37 c-2 p-12	35 c-4 p-9	36 c-3 p-11

Appendix B-1. Raw Pollen Sums: Broadway African American Burial Ground, NYC
c=corroded but identifiable p=perfect but not contaminant

Ambrosia-type	9 c-6 p-1	2	4 c-2 p-1	8 p-1	7 c-5	5	5	7 p-1
Aster-type	4 p-1	1	——	2	1	4	6	3 p-2
Liguliflorae	4 c-1 p-1	1	3 c-1 p-2	4 p-1	5 c-3	3 c-2	——	2 p-1
Artemisia	1 p-1	——	2 p-1	1	1 p-1	3 p-3	1	1
Cheno-Ams	1 p-1	2	1	2 p-2	1	16 p-1	1 p-1	1
Poaceae	17 c-1 p-6	12 p-2	15 p-7	27 p-14	1 p-1	16	29 c-2	38 c-2 p-17
Eurasian cereal-type	2 p-1	——	2 p-2	——		——	2	——
Apiaceae: *Cryptotaenia*-type	——	21 p-17	——	2 p-1	2 c-1 p-1	11 c-1	2	2 p-2
Apiaceae: *Bupleurum*-type	——	9 p-6	——	——	——	——	——	——
Apiaceae: *Daucus carota*-type	2 c-1	7 p-2	5 c-1 p-2	1 p-1	——	——	3 c-1	3 p-1
Total Apiaceae	2 c-1	37 p-25	5 c-1 p-2	3 p-2	2 c-1 p-1	11 c-1	5 c-1	5 p-3
Solanaceae: cf. *Solanum*	1 p-1	3 c-1	——	——	——	——	3	——
Solanaceae: cf. *Physalis*	1 c-1	——	——	1	1	——	——	1
Total Solanaceae	2 c-1 p-1	——	——	1	1	——	3	1
Plantago lanceolata	——	1	——	——	——	——	——	——
Plantago major	1 p-1	2	——	——	——	——	2	——
Fabaceae	——	5 p-1	——	6	1	——	1	——
Polygonum pennsylvanicum-type	1	——	——	——	——	——	——	——

Appendix B-1. Raw Pollen Sums: Broadway African American Burial Ground, NYC
c=corroded but identifiable p=perfect but not contaminant

Rumex acetosella/ acetosa-type	——	——	——	——	——	——	——	1
Caryophyllaceae	——	1 p-1	1 p-1	——	——	——	——	——
Berberis	——	1	1 p-1	——	——	——	——	——
Sambucas-type	——	1 p-1	——	——	——	——	——	——
Ericaceae	——	1	——	——	——	——	——	——
Thalictrum	1 p-1	——	——	——	——	——	——	——
Rosa-palustrus-type	——	——	——	——	——	——	1	——
Cyperaceae	2 c-2	2	——	2	4 p-1	2 p-2	2	2
Typha latifolia-type	——	——	——	1 p-1	——	——	——	——
Ephedra-torryana-type	1 p-1	——	——	——	——	——	——	——
Not identified	9 c-1 p-7	4	6	5	1	3	6	3
Raw sum	100	100	100	100	50	100	100	101
Too-degraded to identify	56	47	61	52	38	24	39	25
Pollen concentration per gram of matrix	318	371	547	583	168	279	543	252

Appendix B-2. Latin and Vernacular Plant Names.

ARBOREAL	
Pinus	pine
Carya	Hickory
Cupressaceae	cedar/juniper
Quercus	oak
Castanea	chestnut
Betula	birch
Alnus	alder
Corylus	hazel
Acer saccharum	sugar maple
Leriodendron	tulip tree
Liquidambar	sweet gum
Rhamnus	buckthorn
Acer rubrum	red maple
NON-ARBOREAL	
Fabaceae	pea family
Poaceae	grass
Triticum, Hordeum, Avena, Secale	Eurasian cereal-type
Chenopodiaceae/Amaranthus (Cheno-Ams)	goosefoot family/amaranth type
Asteraceae	ragweed family
Artemisia	mugwort
Ambrosia-type	ragweed-type
Aster-type	insect pollinated Asteraceae
Liguliflorae	dandelion-type
Apiaceae	carrot family
Cryptotaenia-type	onewart-type Apiaceae
Bupleurum-type	modesty-type Apiaceae
Daucus carota-type	wild carrot-type Apiaceae
Solanaceae	nightshade family
Rosa palustrus-type	marsh rose-type
Caryophyllaceae	pink family
Plantago major-type	broad-lance-leaved plantain
Plantago lanceolata-type	lanceolate-lance-leaved plantain
Cyperaceae	sedge family
Ephedraceae	joint fir
Ericaceae	heath faily
Berberis	barberry
Thalictrum	meadowrue
Typha latifolia	narrow-leaved cattail
Polygonum pennsylvanicum-type	Pennsylvania smartuyweed-type
Rumex acetosella-type	sheep-sorrel-type
Sambucus-type	elderberry-type

G.2. Palynology of the African Burial, New York, Phase II

PALYNOLOGY OF THE AFRICAN BURIAL GROUND, NEW YORK CITY PHASE II

Cryptotaenia canadensis

Report submitted to:
Office of Research Administration
Howard University
2400 Sixth Street, NW
P. O. Box 1071
Washington, D.C.

by:

Gerald K. Kelso[1], Patricia Fall[2] & Lisa Lavold-Foote[2]

[1] 2865 E. Cinnabar Ave
Phoenix, Arizona 85028
&
[2] Department of Geography
Arizona State University

January 2006

SUMMARY FOR MANAGEMENT

Pollen analysis was undertaken on 80 grave fill, coffin lid, and stomach area samples from the graves of 31 persons interred in the African Burial Ground in order to recover data providing information about (1) the diet or medicines of the deceased, (2) plants that might have been part of the burial customs of Africans during the colonial period, (3) the season the interments took place and (4) the landscape of the African Burial Ground. Adequate pollen to analyze was recovered from 62 of the 80 samples, including at least one sample from 28 of the 31 graves. Multiple samples with an adequate quantity for analysis were recovered from 24 of the 31 graves. Twenty three of the 74 pollen types identified were contributed by trees and the taller woody shrubs, while 48 came from herbs and shorter shrubs (non-arboreal pollen types). Aquatic plants contributed four of the non-arboreal pollen types. Only four of the 23 tree pollen types—chestnut, cedar family, pine, and oak—and only six of the 48 non-arboreal pollen types—ragweed-type, honewort-type, goosefoot-type, chicory-type, pea-family, aster-type (*Aster*-type), and grass family--were represented among the samples with sufficient consistency for the analyst to be confident in any temporal or spatial patterns that might be observed. The pollen contributions of wetland plants, although sparse, were examined for qualitative landscape data; and Eurasian cereal-type (commonly termed Cerealia by European palynologists), buckwheat (*Fagopyrum*), and cotton (*Gossypium*) counts are discussed because of the potential economic associations of these pollen-types.

There are two constraints to defining ethnobotanical data and the season of interment for the individuals buried in the African Burial Ground. One problem is that the differences between the stomach samples and the grave fill and coffin lid samples may reflect distinctive vegetation assemblages in separate locations—Burial Ground and living or body preparation sites—rather than consumption of the parent plants or seasonal over-representation in the stomach samples. The second problem is that most of the pollen in the comparative samples—grave fill and coffin lids—is probably not contemporaneous with the stomach samples. The pollen in each of the comparative samples is a random segment of the rapidly changing vegetation record of the proto-historic and colonial periods that had percolated down into the soil over the previous 200 years and during the period between the day that the grave was filled and time that the Burial Ground was built over. Ethnobotanical data and season of interment were defined by comparing percentages of given pollen type in stomach samples with the average stomach sample percentage for that type.

Much of the landscape interpretation of the African Burial Ground data is based on comparison of the spectra with a contemporaneous segment of a profile from the Old Merchant's House, Manhattan, to the north on 4th Street. The pollen data registering the African Burial Ground landscape suggest that the flora was dominated by grass with some insect-pollinated herbs, such as relatives of goosefoot, chicory, asters; members of the pea sub-family; and, probably, some ragweed. Land clearance and tree removal on Manhattan and in the surrounding region are registered among the average total tree pollen percentage, but it does not appear that there were trees actually within the Burial

Ground during the period from which we have data. The sedge pollen data suggest that the ground within the cemetery was moist, but not marshy, and does not register any changes in soil moisture across space or through time. One trend that is evident among the data recording landscape is a small increase in weedy taxa—aster relatives, goosefoot relatives, and chicory relatives—during the period in which the Late Group burials were interred. There is no similar increase in ragweed-type, suggesting that the increases in the other weedy types were not caused by cultivation or continuous soil disturbance. Non-cultivated plants related to asters, goosefoot, and chicory are most commonly found on formerly, but not actively, disturbed ground, and the larger quantities of these pollen types probably came from plants that colonized the landfill that was dumped in the area at the end of the 18th century (Chapter 3). Pollen counts that may reflect the human use of plants (ethnobotanical data) were noted among the honewort-type, grass family, pea family-type, goosefoot-type, chicory-type, thorow wax-type, and Queen Anne's lace-type spectra. The 16 percent goosefoot-type in the Burial 115stomach sample, compared to the one percent on the coffin lid, appears to record an incident of the consumption of goosefoot or amaranth seed or leaves in some form shortly before death. This may also be indicated by the 11.9 percent pea-family pollen in the Burial 192 stomach sample and the 12.6 percent of the same type in the Burial 392 stomach sample; as well as the 43.4 percent, the 58.9 percent, 52.2 percent, and 60.2 percent, respectively, grass pollen in the stomachs of Burials 155, 207, 366, and 6. The pea sub family pollen is insect-transported and very likely of ethnobotanical origin. It could be from flowers placed in the coffins. The pollen of non-domesticated grasses, on the other hand, is wind-transported and the high counts of this type could also be the product of seasonal over-representation at the place where the bodies were prepared for burial. No patterns definitely indicating the habitual consumption of particular plants were evident among the pollen spectra.

Some herb pollen data from the African Burial Ground almost certainly indicate human use of the parent plants for non-dietary purposes. Chicory-type percentages from Burial 194 were high in both the stomach sample (20.3%) and the coffin lid sample (15.7%) compared to the grave fill sample (8%) and probably record flowers of some member of the Liguliflorae sub-family used in the funeral ceremony. Honewort percentages also appear to be significantly higher in stomach samples than the grave fill samples in Burials 45, 115, 151, 210, and 392 and in the stomach and coffin lid samples of Burial 270. It is unlikely that these counts reflect consumption of the parent plants. They are more reasonably attributed to flora tributes, quite possibly composed of some species of Cryptotaenia, placed in and on the coffins. The Burial 45 bouquet appears to have also contained thorow wax and may have included Queen Anne's lace as well. Four of the six individuals to receive flora tributes—Burials 151, 210, 270, and 392–were males, and the median ages at death of three of the seven individuals–Burials 151, 210, and 392—fell in the 40 to 49 years bracket. While these numbers are small, they do suggest a preference for supplying flowers for the graves of adult men. The honewort component of the bouquets could have been gathered in the Burial Ground itself, and the decline in the pollen of this type could reflect alterations in funerary customs or the quantities of the parent plants in the cemetery.

The pollen counts providing ethnobotanical data may also record the season of interment of the individual involved. The grass counts of the Burials 155, 207, 366, and 6 stomach samples, if derived from consumed seed rather than more grass at the mortuary preparation location, suggest June, July, or August interments, and the pea sub-family percentages from the stomachs of Burials192 and 392 suggest May to August interments. The goosefoot-type pollen in the Burial 115 stomach is probably derived from food that would have been harvested during late Summer or early Fall. These resources could, of course, have been consumed from stored resources at some other time.

Season of interment determinations based on floral tributes rather than dietary elements may be less biased by the question of storage. The high honewort frequencies of the Burials 45, 115, 151, 210, and 392 stomach samples, as well as the Burial 270 coffin lid and stomach samples imply a June to September interments for those individuals. The chicory-type pollen in and on the Burial 194 coffin appears to also indicate summer burial (May and September). Although probably derived from the background pollen rain rather than food or floral tributes, the relatively high percentages of ragweed-type pollen in the stomachs of Burials 147, 192, and 415 suggest that those individuals died during the Fall, before the first heavy frost. The data were not adequate to suggest season of death for any other individuals.

INTRODUCTION

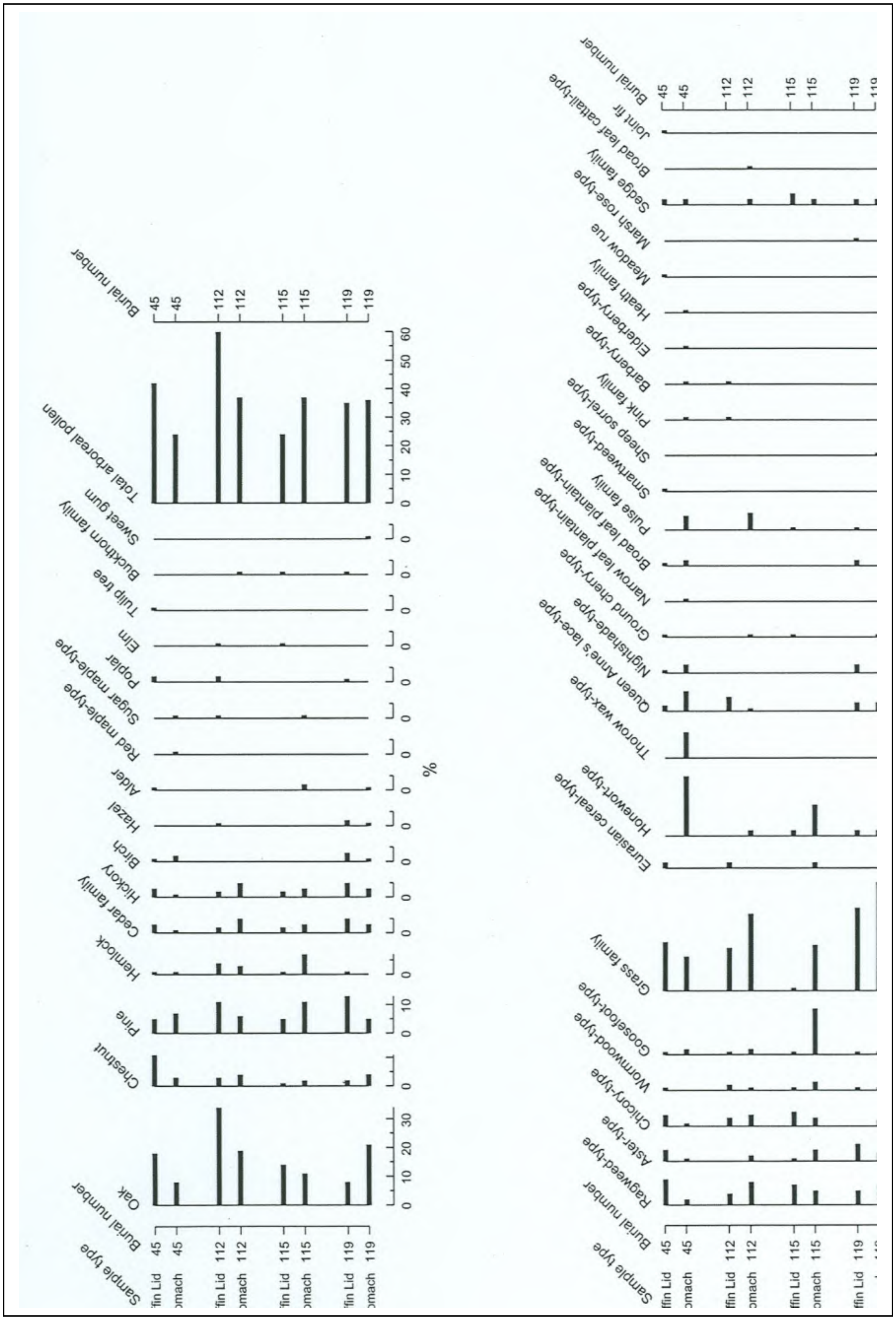
Soil samples were collected from the grave shaft fills, coffin lids, coffin fills, and the stomach and pelvic regions of several hundred graves excavated during the 1991-1992 data recovery archaeology operations at the African Burial Ground site. Eighty of these samples were selected for pollen analysis in "Phase II" (i.e. following a 1998 pilot study that included four others). The objective of pollen analysis of matrices from the African Burial Ground was to recover information about (1) the diet or medicines of the deceased, (2) plants that might have been part of the burial customs of Africans during the colonial period, (3) the season the interments took place and (4) the landscape of the African Burial Ground.

The Exploratory Pollen Study

An exploratory pollen analysis was undertaken during Phase I of the African Burial Ground investigation (Raymer, et. al., 1998) to ascertain whether sufficient well-preserved pollen could be recovered to permit economical analysis of a representative selection of samples and to evaluate the potential of the samples for providing data relative to the four objectives listed above. Samples from the stomach areas of the burials of two adult females (Burials 12, and115), one adult male (Burial 119), and one sub-adult (Burial 45) were analyzed in this exploratory study, and the results were compared with the pollen spectra of coffin samples taken from the coffin lid for each burial (Figure 1, Table 1).

The results of that investigation were: (1) sufficient pollen for meaningful analysis can be recovered from the burial ground matrices, (2) the oaks (*Quercus* spp.) that dominated the general area during the prehistoric period (Kelso and Wall 2005) had been reduced in numbers, and pine (*Pinus* spp.) populations had apparently increased, (3) Eurasian-cereal-type pollen suggests that the area may have been cultivated prior to establishment

Figure 1. African Burial Ground Phase I Pollen Spectra



of the burial ground, (4) grass (Poaceae) was relatively important in the flora immediately around the graves at the time of the internments, and (5) pollen contributed by at least three different genera of plants belonging to the carrot family (Apiaceae) were over-represented (30 percent of the sum) in the sample from the stomach are of the sub-adult (Burial 45). This pollen was attributed to a floral tribute buried with the individual. The results of the Phase I pollen analysis were considered sufficient to warrant further study of matrices from the burial ground.

METHODS

Extraction and Tabulation.

Eighty pollen samples from grave shaft fill, matrix collected from coffin lids, and matrix taken from the stomach areas of 31 burials were analyzed during Phase II of the African Burial Ground pollen analysis. Pollen extraction generally followed Mehringer's (1967) mechanical/chemical procedure. His first two HCL washes and HNO^3 step were eliminated, and the strength of the final NaOH wash was reduced to 0.5 percent. The process was completed by heavy liquid separation using zinc bromide (ZnBr, sg=2.0). Residues were mounted in glycerol for viewing. Benninghoff's (1962) exotic pollen addition method was employed in computing pollen concentrations per gram of sample. Pollen concentration figures were not calculated 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 that were too degraded to be identified were tabulated to provide information about post-deposition pollen destruction. Unidentifiable pollen grains were not incorporated in any sum from which the frequencies of other types were computed (Figures 2a, 2b, 3a, and 3b), but the data for this pollen group, as a percentage of total identifiable and unidentifiable pollen, are presented in the pollen diagram for pollen record formation processes (Figure 4). The terms “corroded” and “degraded” are used interchangeably 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). All pollen grains that were notably better preserved that the rest of the spectrum in each sample were also tabulated, in anticipation that these might register season of interment by indicating plants that were in anthesis while either the coffin or the grave was open (Kelso and Miller 1993). These proved too few to be significant and are not presented in the diagrams.

Presentation.

Palynologists usually present their data in pollen diagrams. These diagrams are graphic representations of the quantities and relative age of the pollen recovered from the study site. The quantities of pollen in each sample are represented by the horizontal axis. These quantities are percentages. The longer the bar to the right of the vertical line for each pollen type, the greater the percentage of that kind of pollen in the particular sample. Relative depth is usually the same as relative age and is represented by the vertical axis of each pollen diagram. In the diagram of an archaeological or natural soil profile, oldest pollen is at the bottom, and the youngest pollen is at the top.

Figure 2a. African Burial Ground Phase II Tree Pollen Spectra, Burials 6-221.

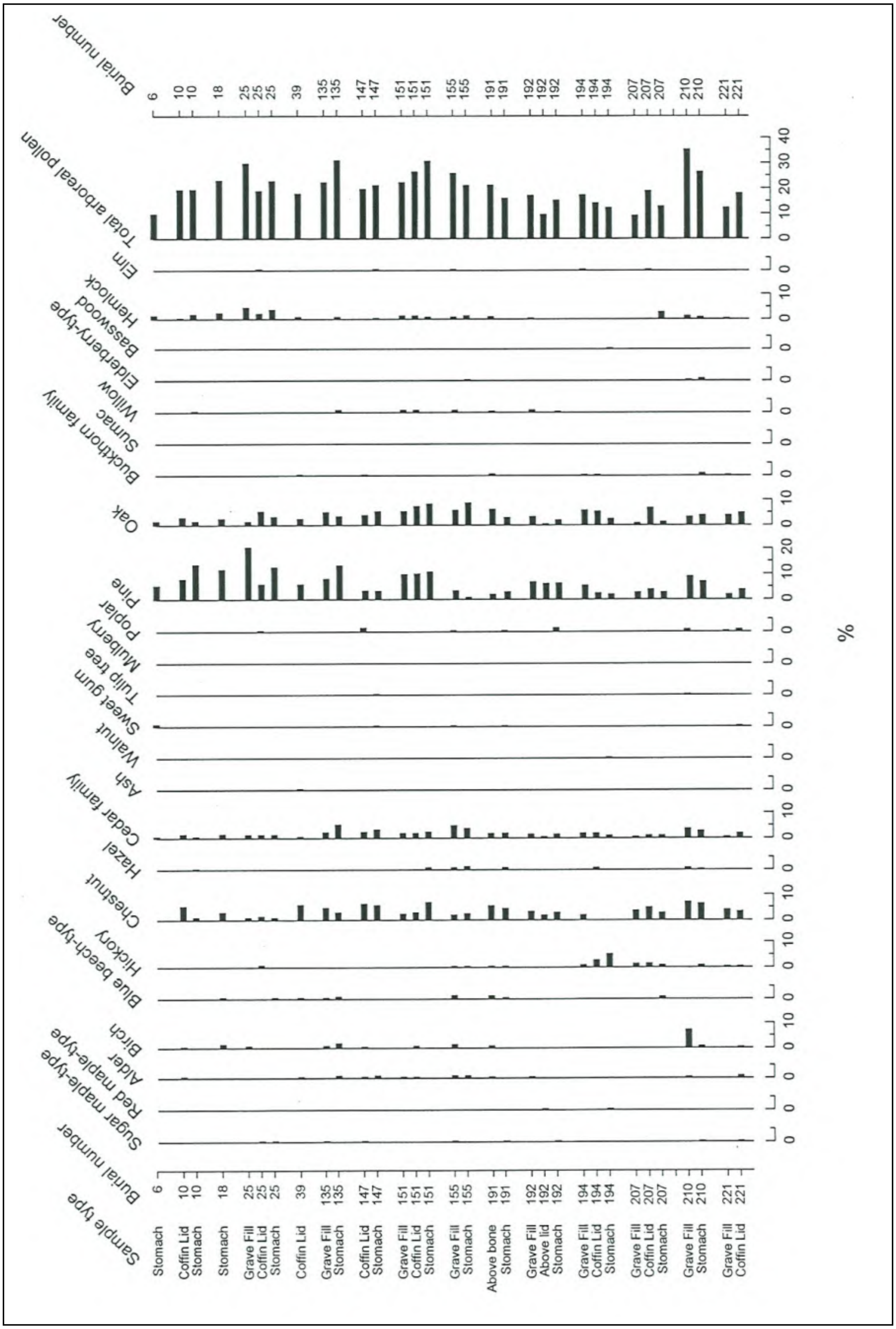


Figure 2b. African Burial Ground Phase II Tree Pollen Spectra, Burials 241-415.

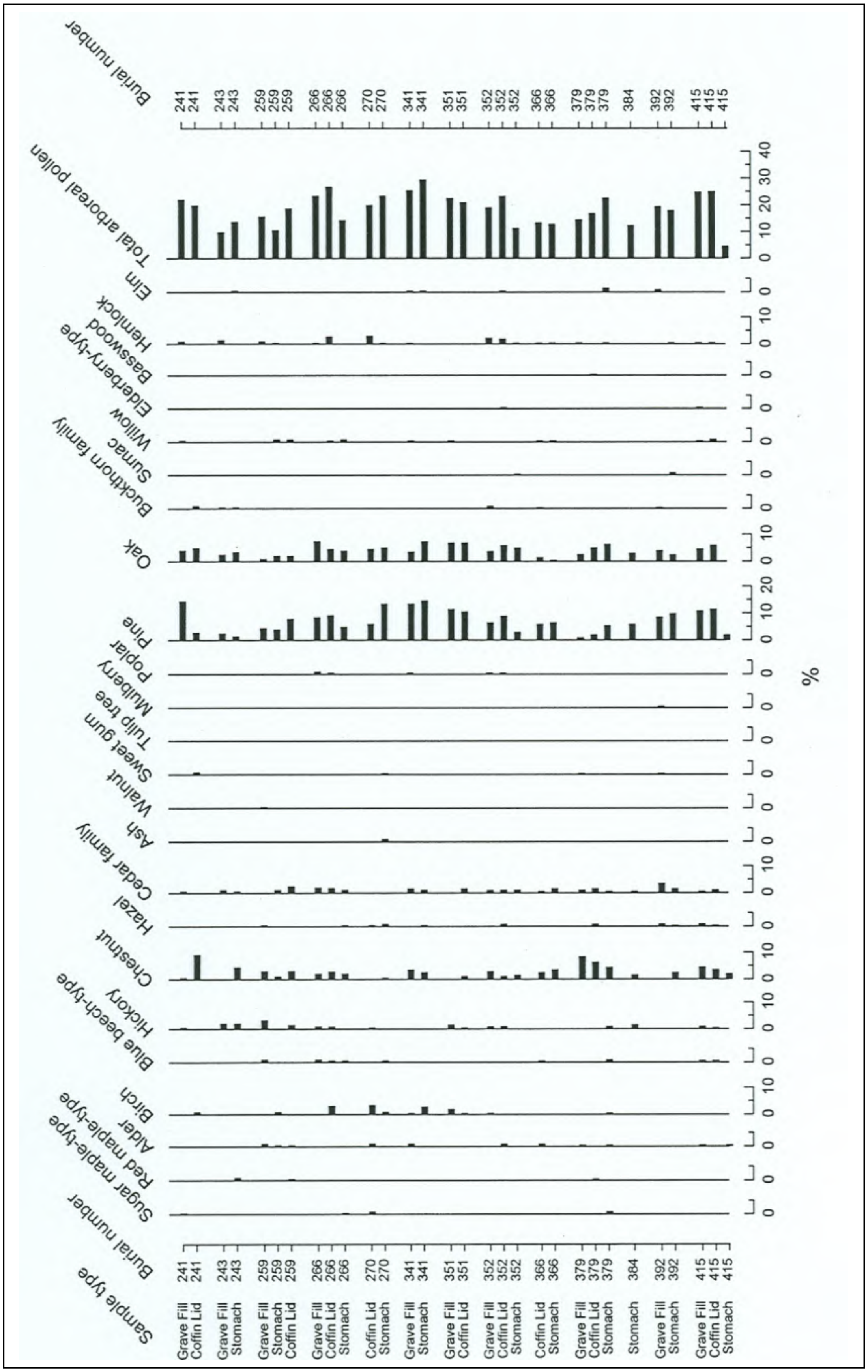


Figure 3a. African Burial Ground Phase II Herb Pollen Spectra, Burials 6-221, Part a, Ragweed to Broadleaf Plantain.

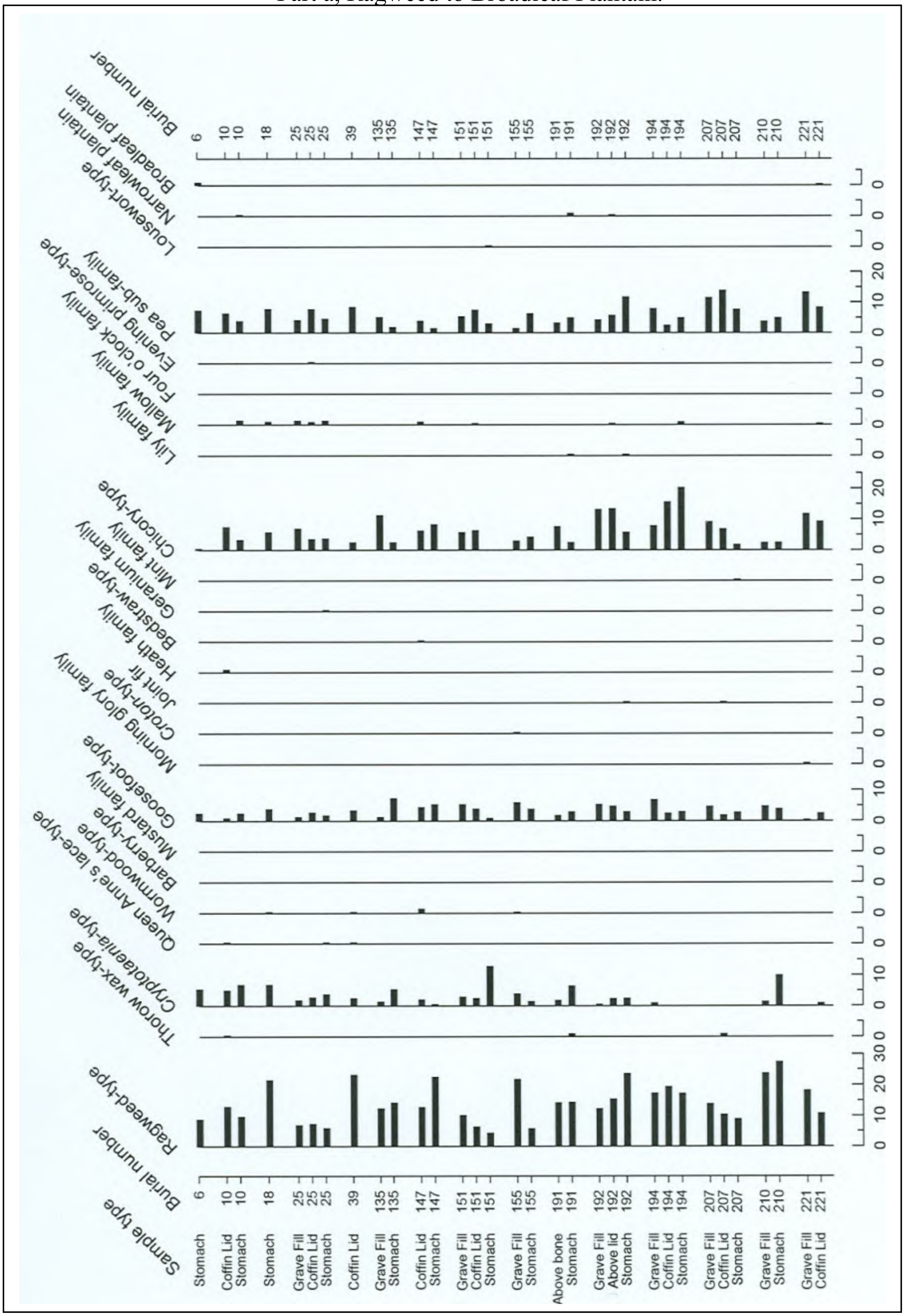


Figure 3a. African Burial Ground Phase II Herb Pollen Spectra, Burials 6-221, Part b, Milkwort Family to Unknown D..

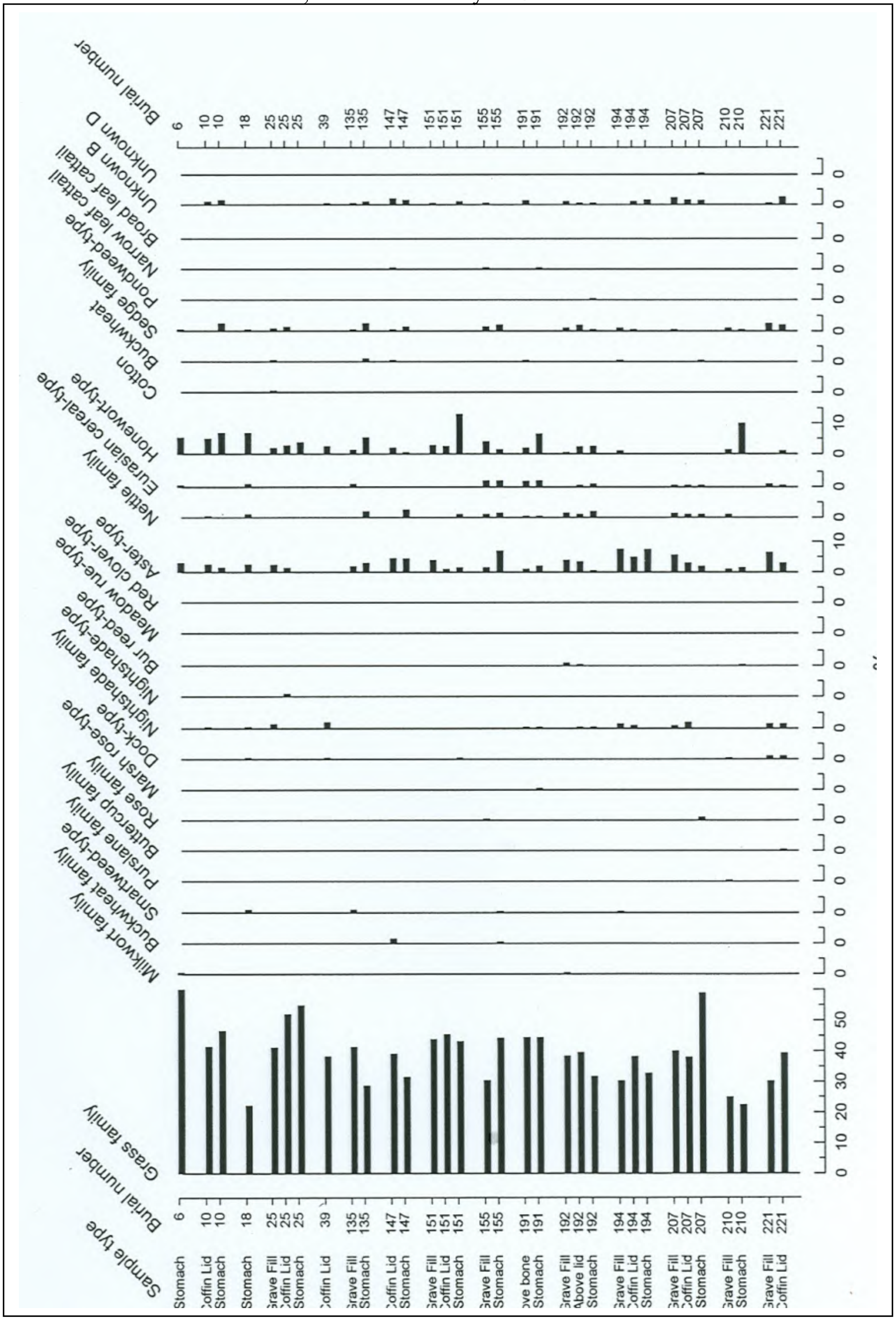


Figure 3b. African Burial Ground Phase II Herb Pollen Spectra, Burials 241-415, Part a, Ragweed to Broadleaf Plantain.

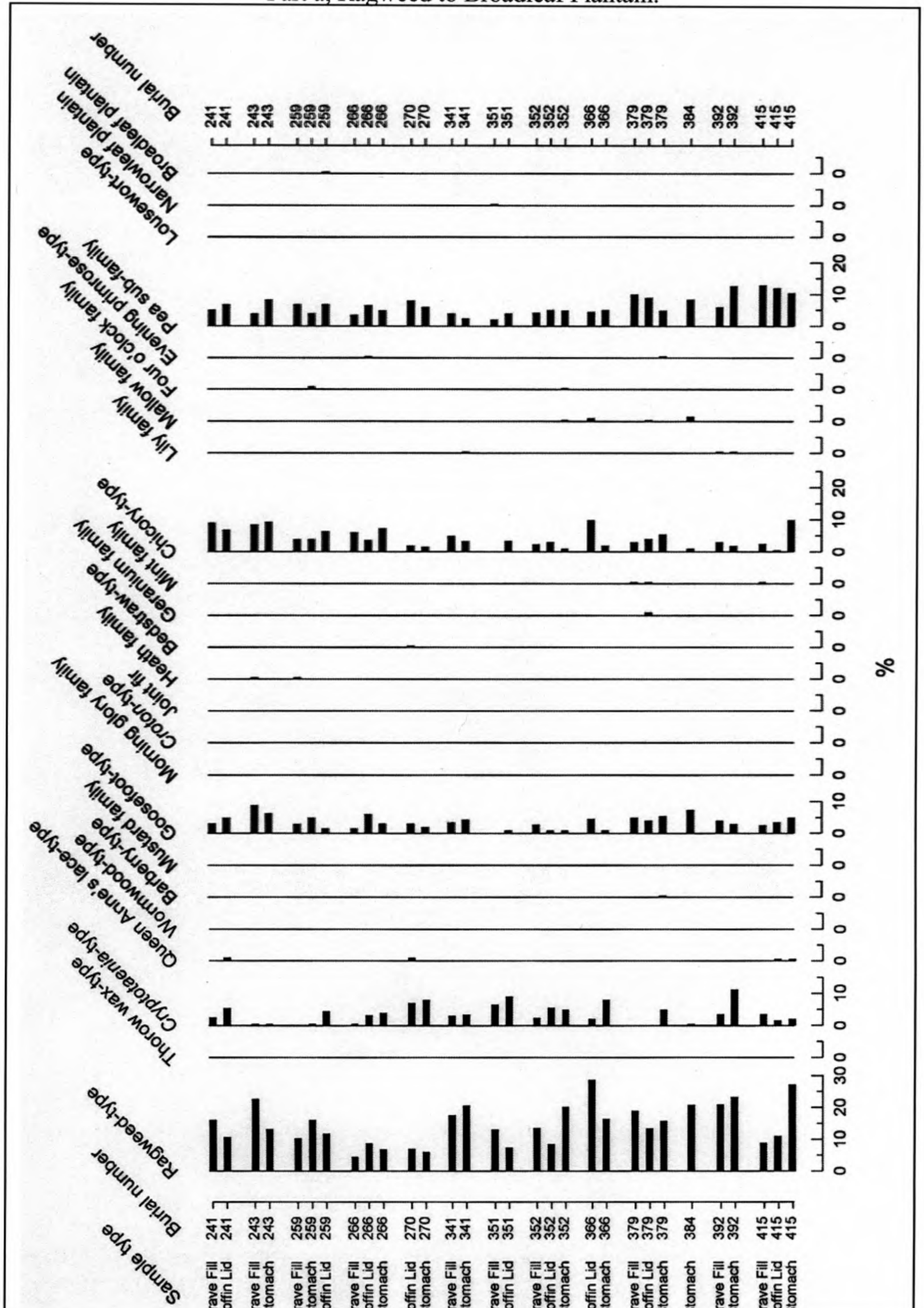
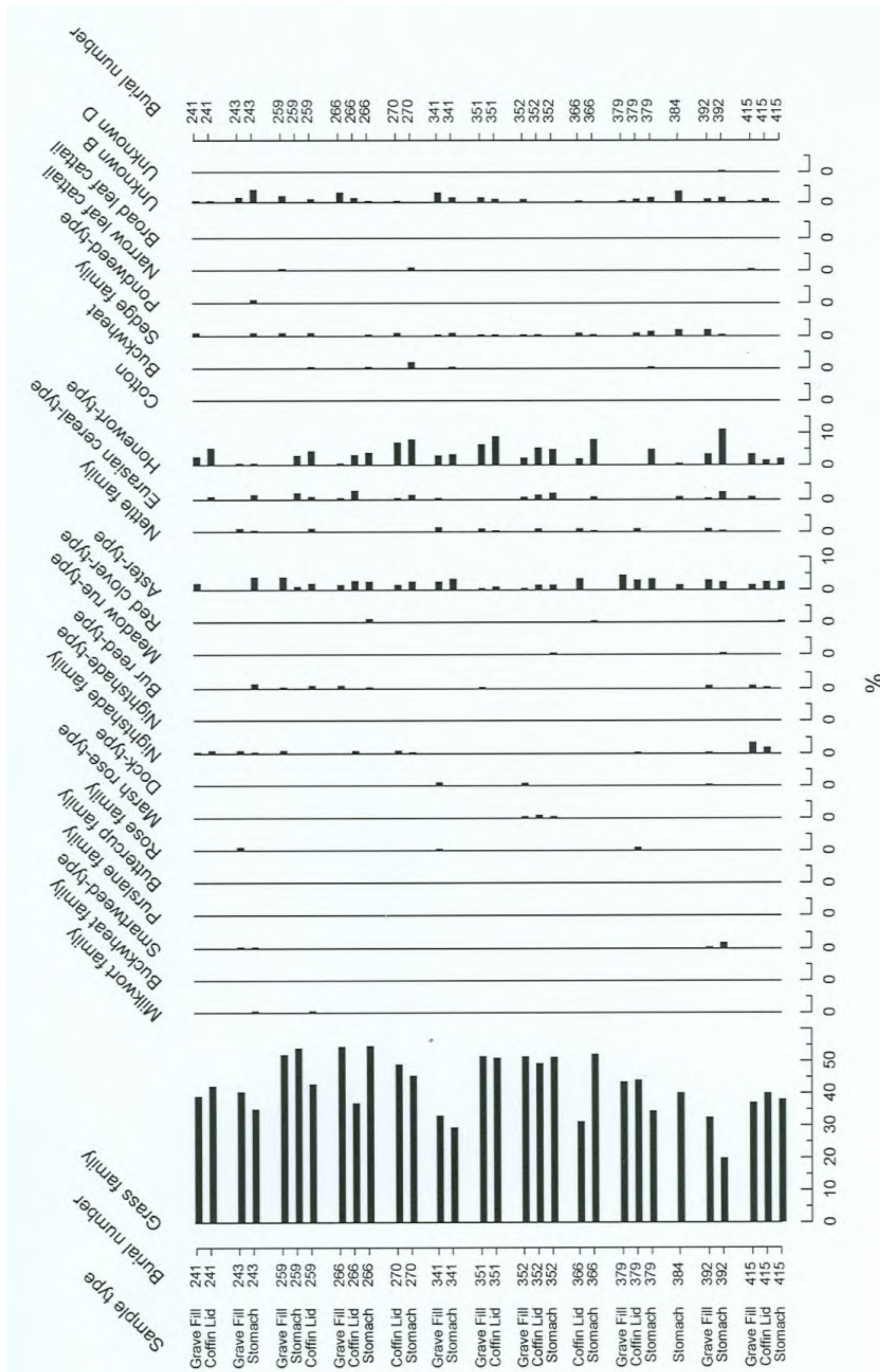


Figure 3b. African Burial Ground Phase II Herb Pollen Spectra, Burials 241-415, Part b, Milkwort Family to Unknown D.



Relative depth among the African Burial Ground pollen samples is not the same as relative age. Here the pollen at the top of the stratigraphic sequence (the grave shaft fill) is really the oldest pollen in the sample series, while the pollen that fell on the coffin lid during the burial ceremony (diagramed between the grave fill and the stomach samples) is actually the youngest. The pollen inside the coffin should be intermediate in age but is stratigraphically located at the bottom of the sample series. This does not adversely effect interpretation; because the pollen in the coffin, where uncontaminated by grave fill, reflects the pollen rain or human activities at the point where the bodies were prepared rather than the pollen rain in the graveyard. In addition, the coffin lids were exposed to the pollen rain of the cemetery area only briefly before being covered by grave fill. The spectra on the lids should differ significantly from that of the grave fill only where flowers or other pollen bearing materials were placed on the coffin.

Three basic pollen diagrams are presented for the data recovery phase of the African Burial Ground study. Figures 2a and 2b provide the tree pollen in graphic form: Figures 3a and 3b, in two parts (a and b) each cover herb pollen; and Figure 4 furnishes information about well preserved pollen grains that were not recognized as well as the pollen record formation process indicators "Pollen Concentration per Gram of Matix," pollen grains and "Too-degraded-to Identify." To facilitate analysis simplified pollen diagrams were organized according *Age of the Individual at Death* (Figure 5), *Stomach Pollen by Sex* (Figure 6), *Location within the Burial Ground* (Figure 7), and *Chronological Age within the Burial Ground Sequence* (Figure 8).

Figure 4. African Burial Ground Pollen record Formation Process Indicators

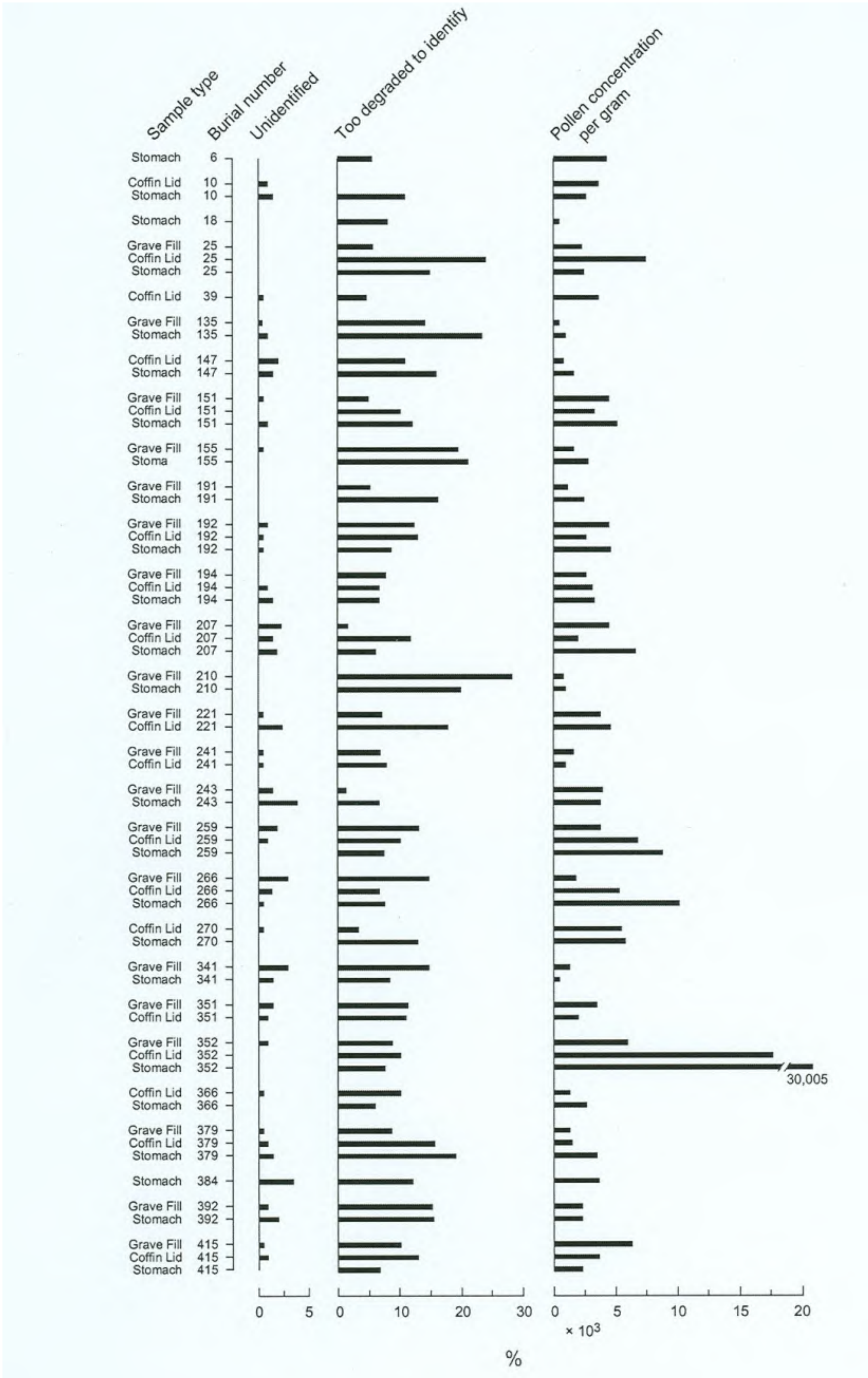


Figure 5. African Burial Ground Pollen Spectra Phase II, by Age of Individual at Death.

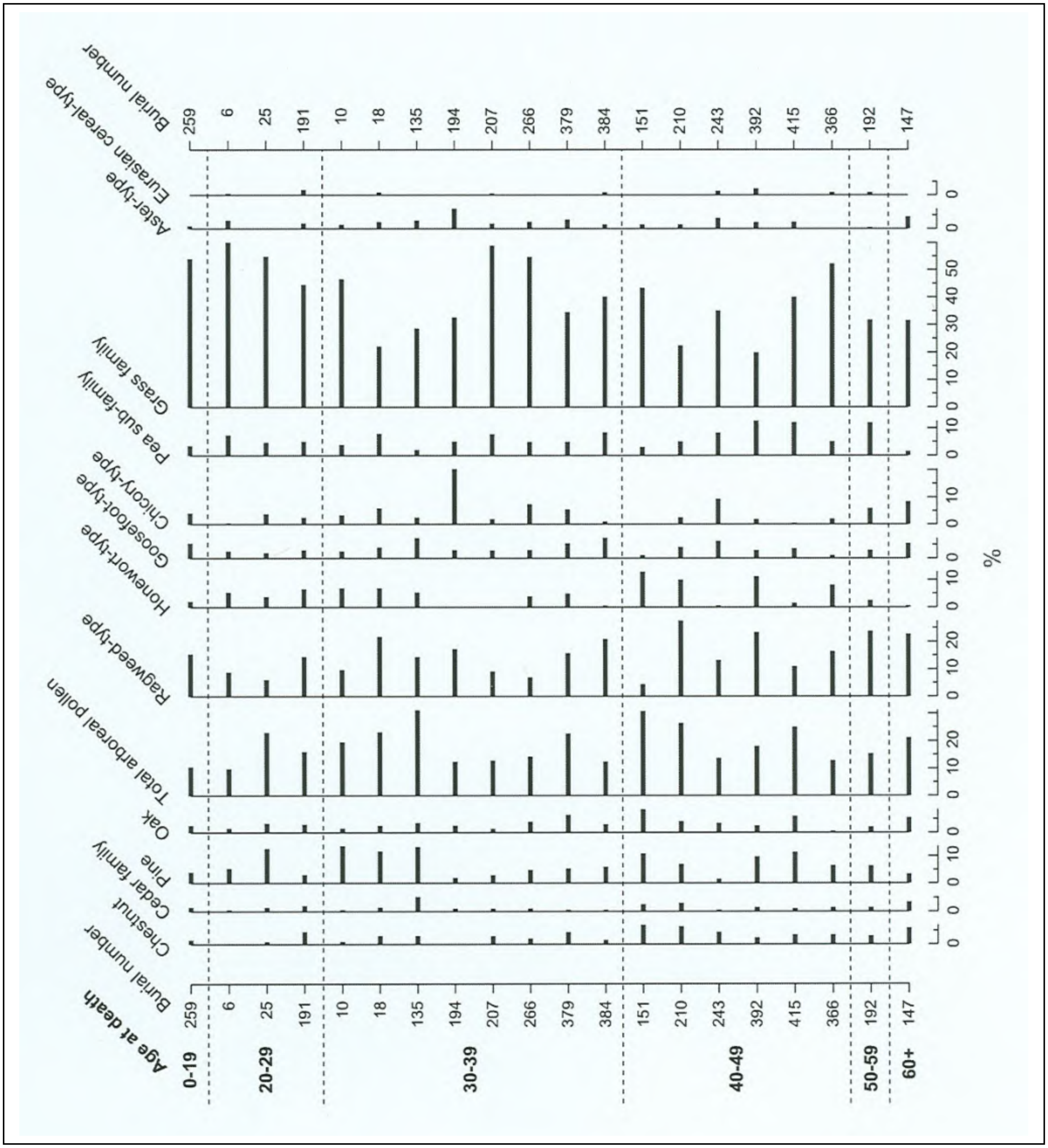


Figure 6. African Burial Ground Phase II, Stomach Pollen by Gender

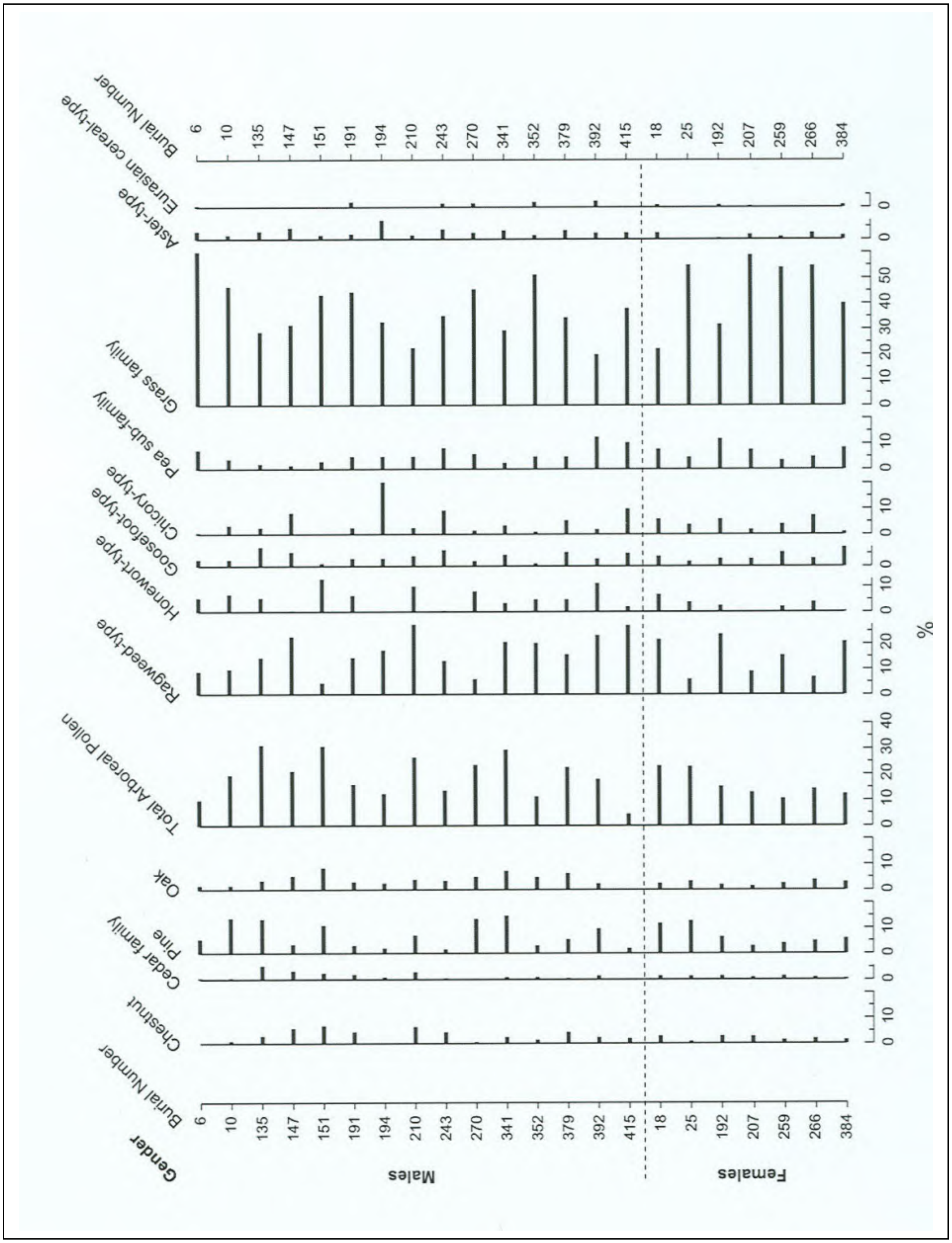


Figure 7. African Burial Ground Spectra Phase II, by Location Within the Burial Ground.

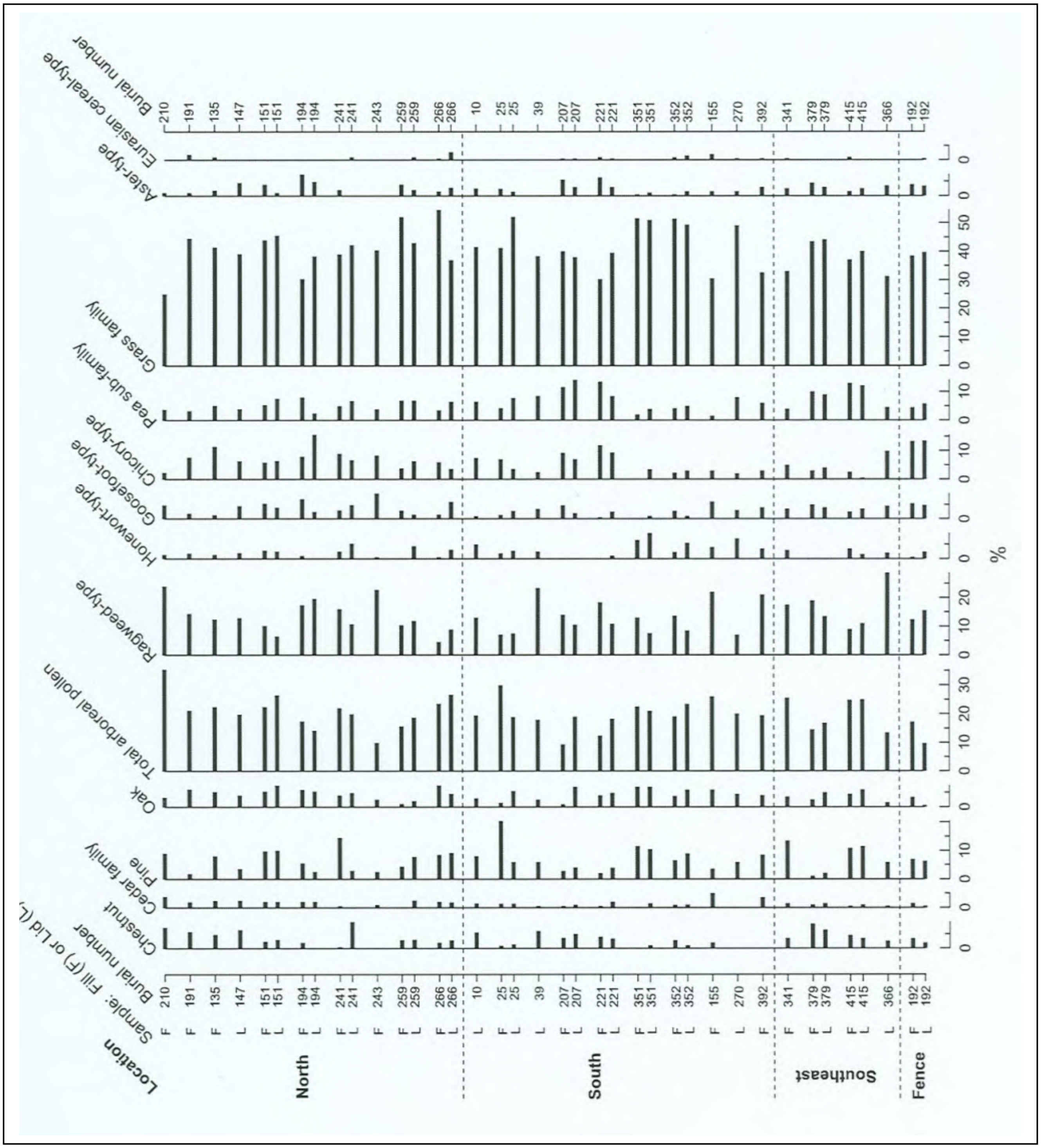
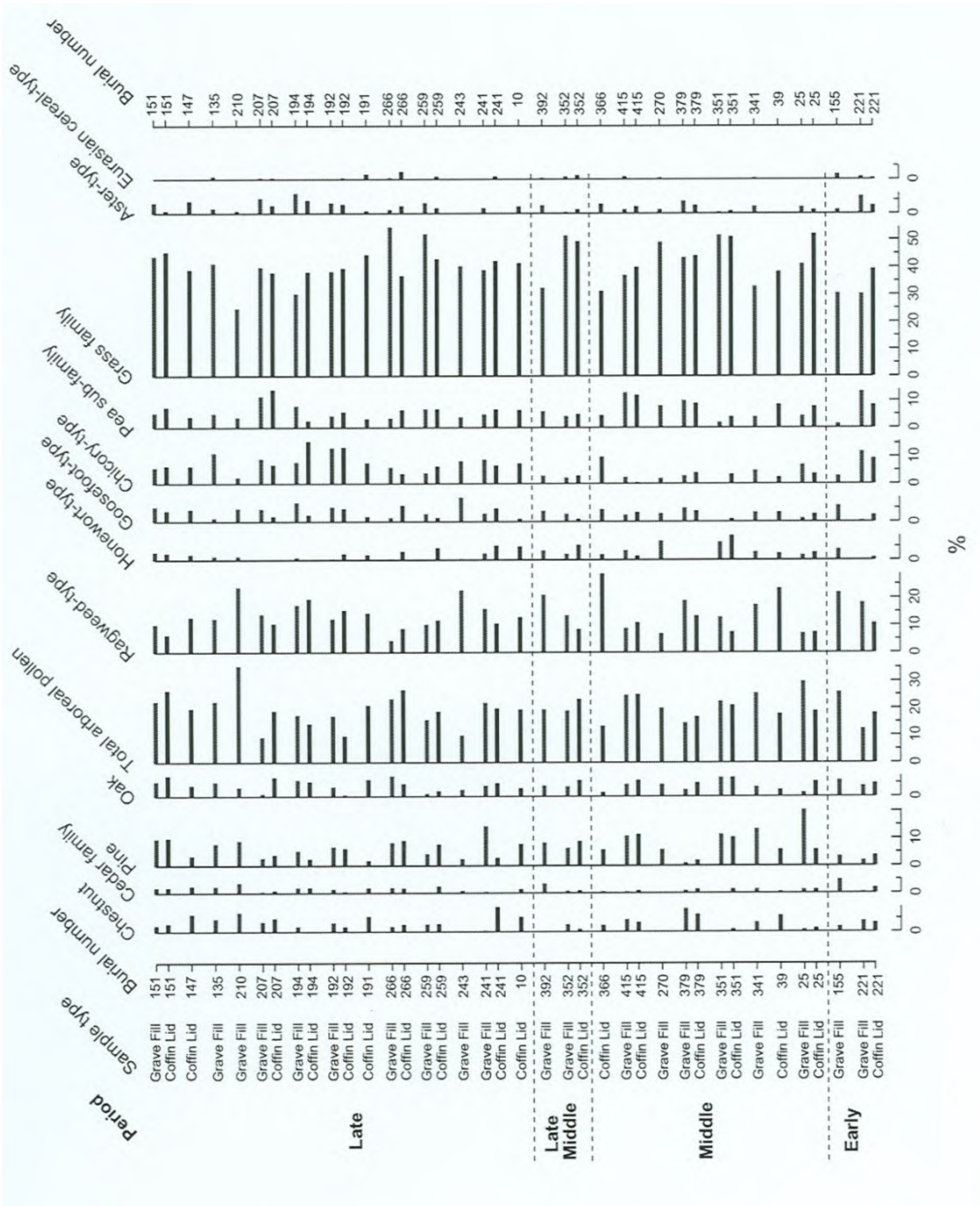


Figure 8. African Burial Ground Spectra Phase II, by Temporal Group.



Archaeologists most frequently encounter plants under English names in their documentary sources. For their convenience the common English names for plant taxa are employed in both the text and the diagrams. Equivalent Latin names are introduced at the first mention of each plant, and a list of Latin/vernacular names is presented in Table 2. Individual palynologists differ in their recognition of particular pollen types. Patterns are, therefore, more important than actual numbers when comparing data provided by different analysts. The analysis to follow will, therefore, focus on data collected during Phase II of the African Burial Ground study. Only four burials were analyzed in Phase I and only the ethnobotanical data from that portion of the study will be used here.

Analysis

Comparative Methods. Historical-era landscape analysis in the temperate zone is a comparative process. One application of this process involves comparing the pollen spectra at a particular point in a soil profile against the deeper (i.e., earlier) pollen counts and the more shallow (i.e., later) pollen counts from the same profile. A hypothetical example of this exercise would be a profile in which tree (arboreal) pollen declines through time while that of ragweed-type (*Ambrosia*-type) increases, only to give way to larger quantities of aster-type (Tubliflorae) that are succeeded in turn by Poaceae (grass family) pollen. Ragweeds are uniquely adapted to the to the harsh temperature and moisture regimen of plowed ground (Bazzaz 1974); while the insect-pollinated members of the Asteraceae (Aster family) (such as asters, sunflowers, and goldenrod) tend to be secondary succession plants and are found on formerly disturbed or less frequently disturbed ground. Plowing destroys the perreniating organs of the grasses and increasing grass frequencies are usually interpreted as indicating a further progression of soil stability (Behre 1983:234, 229). The hypothetical pollen sequence described above would be interpreted as agricultural forest clearance followed by plowland abandonment and the development of pasture, meadow or waste ground.

We do not have a pollen profile from the African Burial Ground with which to compare our burial samples. We do, however, have basic temporal groupings for burials, permitting the pollen counts to be grouped into a general sequence of Early, Middle, Late Middle, and Late interments (Figure 8). These groups of counts may reflect some vegetation changes on the site through time.

The African Burial Ground landscape data may also be interpreted by the analogue method. In this approach the vegetation formerly on the ground under investigation is reconstructed by comparing the pollen spectra under study with the pollen spectra of modern vegetation assemblages (Mehringer 1967:Figure 3; Webb 1973) or with pollen spectra from other sites that can be attributed to specific kinds of groundcover or human activities. Human land use modifies the availability of the environmental parameters--temperature, moisture, nutrients, sunlight, to name a few -- upon which plants depend. Vegetation, consequently, responds sensitively to cultural changes. In this age of herbicides there are few, if any, legitimate modern analogues with which to compare the pollen spectra of historical-era land use. We do have pollen records of 17th, 18th, and 19th century landscapes in the Northeast, including pollen spectra correlated with documented land-use practices, with which to compare the African Burial Ground pollen spectra.

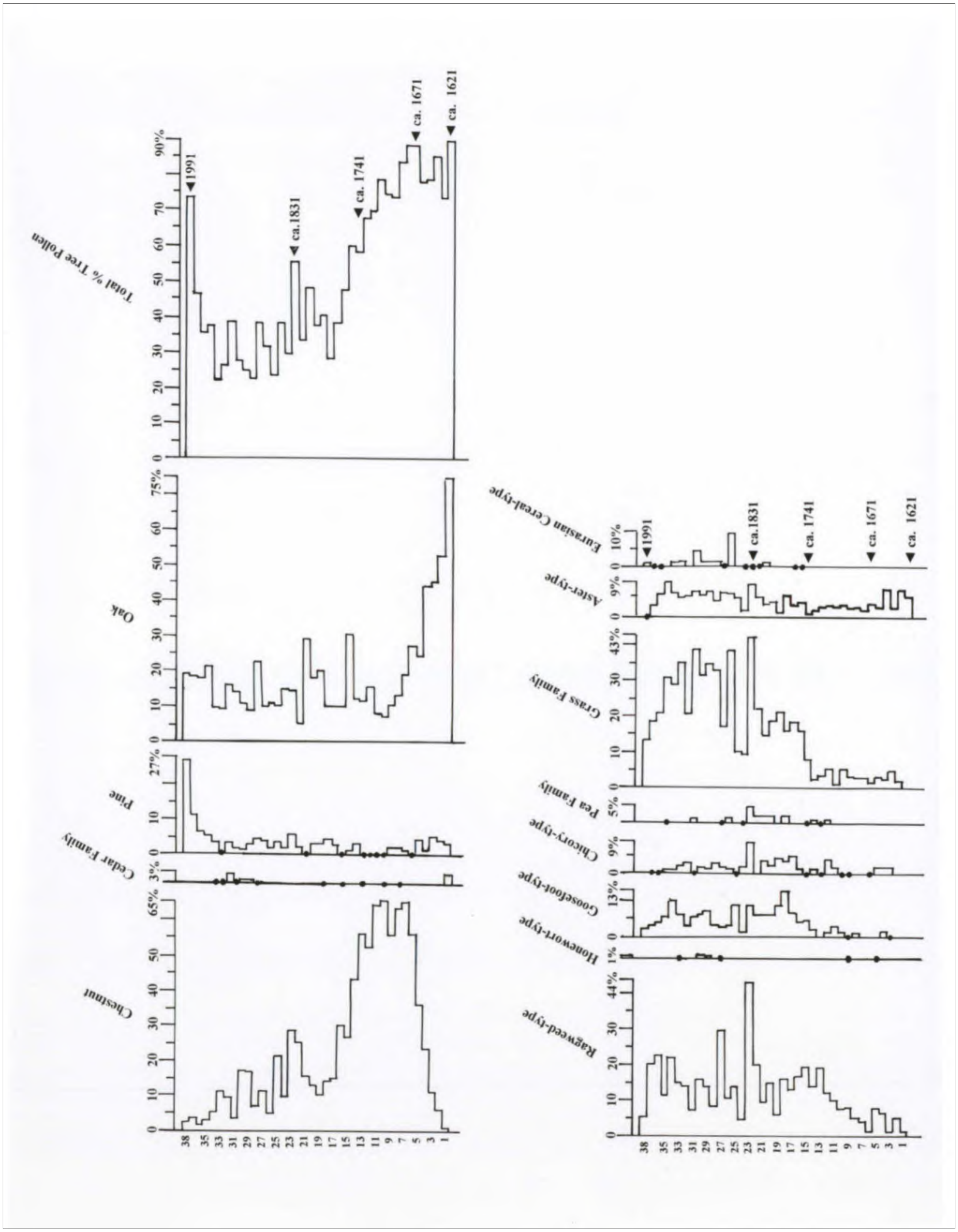
Most significantly, a soil profile covering the period from before Dutch land clearance to 1993 at the Old Merchant's House on 4th Street in Manhattan approximately 1.5 miles to the north of the African Burial Ground (Kelso and Wall 2005) is available for comparative study.

Pollen Production and Dispersal. The pollen of insect (zoogamous) plants is carried directly from one flower to another by the living vector. Such plants invest their reproductive energy in nectar and showy flowers that attract insects and are quite frugal in their pollen production. The pollen of such plants adheres to the outer surface of the anther until it is carried away by a pollinator (Faegri and van der Pijl 1979:17), and the pollen that is not collected by the vector subsequently falls to the ground with the remnants of the flower (Kelso 1993:84). Wind-pollinated (anaemophilous) plants produce much larger quantities of pollen and disperse it widely. Their reproductive strategy is to hit the stigma of a plant of the same species shotgun style. An anther of insect-pollinated red clover (*Trifolium pratense*), for instance, contains approximately 220 pollen grains, while an anther of wind-pollinated sorrel (*Rumex acetosa*) contains about 30,000 (Erdtman 1969:118).

Tree pollen is shed in the canopy. In forested areas some of the pollen is drawn upward by the higher wind velocities above the canopy and is more likely than herb pollen to be caught in convection currents and lofted into the upper atmosphere. Atmospheric pollen data indicate that some pollen grains of these types are dispersed far beyond the range of the parent trees (Potter and Rowley 1960:5). Tree pollen is more prominent than herb pollen the regional and extra-local components of the pollen rain and dominates the sequences from lakes. These, consequently, reflect the status of the vegetation over broad areas. Tree pollen also dominates the pollen rain deposited on relatively bare land surface in natural areas (Martin 1962:Figure 2) and on bare lots in urban situations (Mrozowski and Kelso 1987:Figure 9-1). This is evident in the spike of 58 percent tree pollen during the 1830s construction period at the Old Merchant's House, New York City (sample 23, Figure 9; Kelso and Wall 2005).

Most of the tree pollen that is not drawn up into the atmosphere is transported within the forest trunk space. This falls to earth within 20 to 30 meters of its source (Anderson 1967:273). The dispersal diagrams of pollen transported from forests out into open areas (Tinsley and Smith 1974; Edwards 1982:7, Figure 2) indicate that the oak pollen contribution to surface samples declines by 63 to 67 percent where initially sampled at 33 feet from the woodland edge and remains low and relatively uniform across the open space. This a product of progressive loss of tree pollen from the wind stream and masking by the high pollen production of the herbs, particularly grasses, at the sampling locations in the meadow. At the Old Merchant's House oak pollen made up 75 percent of the pollen deposited during the period immediately prior to the beginning of Dutch land clearance on Manhattan Island, and tree pollen as a whole made up 89 percent of the pollen rain (Figure 9). This declined to an average of 35 percent during the post-clearance and urban garden interval at the site.

Figure 9. Old Merchant's House Pollen Spectra Applicable to African Burial Ground Interpretation.



The presence of ornamental trees can, however, be detected in pollen profiles from grass dominated urban situations. The growth of a spruce tree planted in 1936 in the side lot of the Kirk Street Agents House in Lowell, Massachusetts, and development of a birch that sprouted, a little earlier, 80 feet away are registered among the pollen spectra at the top of the profile from that site (Kelso 1993:Figure 19). Some of the trees that are represented among the African Burial Ground pollen spectra -- oak, chestnut, walnut (*Juglans*), hickory (*Carya*), and mulberry (*Morus*) for example -- yield edible products. Most of the consumable portions of these taxa are, however, encased in a shell that would probably not have retained much pollen (Bohrer 1972:Table 7), and would be removed prior to utilization.

Herb pollen originates closer to the ground than tree pollen, and is subject to greater loss from the wind stream by impact with vegetation and the ground. Even the wind-borne concentration of ragweed pollen, the most notorious of allergens, falls to background levels within 145 meters of its source (Raynor, Ogden, and Hayes 1968:Figure 1). Herb pollen, consequently, more accurately reflects the vegetation close to the sampling point than tree pollen (Janssen 1973). The pollen contributions of the insect-pollinated herbs should be most precise of all in this respect.

If the pollen from a non-ornamental tree or herb whose flowers are not likely to have been used in funerary bouquets is particularly prominent in a coffin lid sample, the data may indicate that the parent tree or plant was an element of the landscape relatively close to the grave site, depending on the pollen dispersal range of the particular taxon. These data will, in most cases, also indicate season of interment. If the pollen from a tree or herb whose flowers are not likely to have been used in funerary bouquets and whose parts are unlikely to have been eaten is particularly prominent in an intestinal tract sample the data indicate that the parent tree or plant was an element of the landscape, but at the place where the person lived or the body was prepared for burial. Intestinal tract counts of this type should also indicate season of interment, because distance from the Burial Ground is not important in studies of seasonality.

Pollen Preservation. Pollen preservation is a problem for those attempting to research historical era landscapes and plant-related cultural processes with samples taken from site matrices. The pollen deposited on natural ground surfaces is moved down through the deposit by percolating groundwater (Dimbleby 1985:5, Figure 3), disassociating it from the matrix and from the material culture with which it was deposited. The moving pollen is also attacked and progressively destroyed by aerobic fungi (Goldstein 1960), by oxygen in the groundwater (Tschudy 1969), and by repeated wetting and drying (Holloway 1989). These processes limit the age of the palynological landscape data that can be recovered from unprotected soil deposits in the northeastern United States to about 200 years (Kelso 1994, 1995; Kelso and Harrington 1989).

Particular matrix environments; such as soil compression, rapid sedimentation, the presence of metal corrosion products, the presence of objects that are flat or deposited concave side down, and quick, deep burial in or under features; will preserve at least some pollen from percolation and complete degradation (Schoenwetter 1964, van Zeist

1967, King, Klipple and Duffield 1975, Dimbleby 1985, Kelso 1993, Kelso, et. al., 1995, Kelso, Ritchie, and Misso 2000). Rapid, deep burial should have helped preserve the pollen in and immediately on top of the African Burial Ground coffins. The grave fill samples would have been subject to renewed pollen percolation and degradation after the graves were closed. Construction over the Burial Ground should have provided some protection to pollen deposited between the interment of particular individuals and the landfilling and construction over the plot during the late 1790s and early 1800s (see Chapters 2 and 3).

The African Burial Ground was located close to the Collect Pond, and the wetlands surrounding the pond may have extended into the cemetery. Many of the graves were at or below sea level. A fluctuating water table was observed during excavations and may have affected the pollen in the graves from the time of individual interments (see Chapter 3). This varying soil moisture may have partially offset the protection afforded by the rapid, deep landfilling over the burial ground.

It should be noted that the pollen in the samples from the grave shaft matrices will have been mixed to some extent during excavation and filling of the graves, but will not have been homogenized. The fill will probably not have gone back into the grave in the same stratigraphic order as it was removed. Only a small portion of the matrix--50 to 100 grams-- was collected from each fill, and the pollen in these small fill samples, and in any samples contaminated by fill, reflects the pollen rain that fell on the Burial Ground over some unknown interval during several hundred years prior to interment. Most of the pollen in the stomach samples will not be contemporaneous with that in the grave fill and coffin lid samples. The grave fill and the coffin lid samples can also be expected to differ from each other to at least some extent.

Statistical Constraint. The problem of statistical constraint must be taken into account when interpreting the percentages of individual pollen types in each sample. Percentages are based on tabulating a fixed numerical sum, generally 200 in this project, of pollen grains in each sample. When the amount that one pollen type contributes to this sum goes up or down, the percentages of the other types present must statistically adjust down or up to fill out 100 percent, even if the actual amount of the responding types that fell on the sampled spot did not change. In stratigraphic sequences the analyst can gain some control over this problem by examining the percentages of the other types in the same sample. If the percentages of most of the other types are somewhat lower or larger in the sample, compared to what appears to be normal for that portion of the profile, it is probable that the contribution of the pollen type in question actually increased or decreased. If, however, the percentages of only one or two other types are lower or higher than normal, it is probable that the pollen type in question is responding to statistical constraint from a decrease or increase in the other type. This phenomenon will be more difficult to factor out of the African Burial Ground counts. In the absence of a profile, it is not feasible to determine what should be normal for a particular time.

Season of Interment. The basic assumption of pollen studies of seasonality is that the pollen of the plants that were in anthesis at the time that the deposit was sealed will be over represented in the spectrum in the matrix under investigation, when compared to the general archaeological site spectrum. Wind-transported pollen is most useful in such studies because it is produced in large quantities. In burial studies, the pollen in or on the coffin is compared to known pollination periods of the plants in the study area and to the pollen spectrum of the grave fill or to the annual pollen spectrum preserved in matrices contemporaneous with the burial.

Two pollen seasonality studies suggest that it may be feasible to ascertain the season of interment for at least some of the persons buried in the African Burial Ground. One of these is an investigation of grave pit fill and the pollen recovered from inside three 17th century lead coffins excavated from the Great Chapel at Saint Mary's City, Maryland (Kelso and Miller 1993). In this study most of the pollen in the coffins was perfectly preserved, while the pollen in the pit fill was poorly preserved. An over-abundance of ragweed-type (*Ambrosia*-type) in a woman's coffin indicated a Fall interment, and excess pine (*Pinus*) and oak (*Quercus*) pollen in a child's coffin suggested burial in late April or early May. The pollen in a third coffin containing the remains of a middle-aged man was not dominated by any pollen type and included a number of economic pollen types. This suggests that that the coffin materials had been stored in a barn, and the spectrum has been interpreted as indicating a winter burial.

Comparable seasonality data were also recovered in an exploratory analysis of the mud mortar between the stones of a cellar constructed in A.D. 1638 at St. Mary's City, Maryland (Kelso1995). The north wall of this structure had collapsed, but the other three walls were intact. The south 65 percent of the west wall was constructed of well-laid flat stones, while the north 35 percent was rubble masonry. The mud mortar pollen spectra from the east and south walls were dominated ragweed-type (*Ambrosia*-type) and goosefoot/amaranth- type (Chenopodiaceae/*Amaranthus*-type) pollen, registering a Fall construction. The mortar from the well-constructed portion of the west wall was dominated by oak (*Quercus*) pollen, indicating that it was built in the Spring. No pollen type was comparatively more important in the mortar from the rubble masonry portion of the west wall and the mortar from the entry on the south end of the structure. This appears to be an annual average of the seasonal pollen rains, and suggests that the mud mortar was mixed in the winter.

Most of the pollen grains in the grave shaft fills and in the coffin lid samples at the African Burial Ground are probably not contemporaneous with the pollen in the stomach samples. The search for data reflecting season of interment among the spectra will have to proceed by comparing individual stomach sample percentages of given types with what appears to be normal for the stomach samples of that type and by comparing the percentages from individual coffin lid samples with what appears to be normal for the other coffin lid samples and grave fill samples. Counts that appear to be abnormally higher than average may be interpreted as originating during the period of anthesis of the parent plant. The stomach pollen counts will have to be compared with those of the grave fill and coffin lid samples for the same burial, to insure that the pollen is not contamination from the grave fill.

Ethnobotanical Pollen (diet and plants used for other purposes). Pollen studies of diet have been largely focused on pollen in preserved human fecal material (coprolites), in storage spaces, and on food processing equipment in arid lands (Martin and Sharrock 1964; Hill and Hevly 1968; Bohrer 1972). The guiding premise of such studies is that the pollen of economic plants will be better represented in such media than it is in the adjacent archaeological site matrix. Privies are the primary source of such data in the Northeast (Reinhardt, Mrozowski, and Orloski 1986; Kelso1998).

One experimental investigation of the effects of human gastro-intestinal processes on the distribution of pollen in coprolites confirmed the assumption that pollen grains of individual natural foods, broccoli for instance, eaten during a meal are recognizable as a cluster of counts in a fecal sample series (Williams-Dean 1978). Another study demonstrated that the pollen ingested with a single meal is not uniformly dispersed through the fecal specimens resulting from that meal and that only one out of three pollen concentrations of a given pollen type in a series of fecal samples is proportional to the amount of pollen actually ingested (Kelso and Solomon 1976; in press). The results of the Kelso and Solomon experiment (1976) have led several analysts to propose pollen concentrations of 100,000 to 1,000,000 pollen grains per gram of a particular pollen type as the threshold figure indicating that plants producing that pollen type were consumed (Reinhardt, Hamilton, and Hevly 1991:123; Sobolik 1996:928).

Recognizable coprolites were not preserved with the African Burial Ground interments. Samples from the gastro-intestinal tract areas of the bodies were substituted for coprolites in the search for ethnobotanical data. It is rare for pollen concentrations approaching those suggested by Reinhard, Hamilton, and Hevly (1991:123) and Sobolik (1996:928) to be recovered from archaeological soil deposits in the eastern United States, and the quantities of ethnobotanical pollen in the coffins have undoubtedly been diluted by pollen intruded from the grave shaft fill. Ethnobotanical pollen at the African Burial Ground will have to be defined by comparing the pollen spectra of particular intestinal tract samples with the average for that particular type in all stomach samples, on the supposition that the average is as close as we can come to a homogenized annual pollen contribution for the type. In this approach, the percentages of particular pollen types that are noticeably higher in a particular intestinal tract sample than the average for the type can be interpreted as evidence of either food or medicine consumed or floral tributes placed in the coffin. The count will also have to be compared to those of the grave shaft fill and with the samples that were taken from coffin lids to determine if it is derived from pollen in the grave fill. The percentages of particular pollen types that are noticeably higher in a coffin lid sample than in the grave shaft fill and/or the intestinal tract sample can be interpreted as possible evidence of a floral tribute placed on the coffin.

RESULTS

Sixty two of the 80 Phase II pollen samples contained sufficient pollen to analyze (Tables 3-5). Twenty of these were from grave fill, 18 were from coffin lids, and 24 were stomach area samples. Eight of the 18 samples that did not yield enough pollen to analyzed came from grave shaft fill, three were collected from the coffin lids, and seven were from stomach areas. Pollen was recovered in sufficient quantities to analyze from one or more samples of 28 of the 31 burials investigated. Multiple samples with an adequate quantity for analysis were recovered from 24 of the 31 burials. Four of the 28 burials in which pollen was recovered from at least one sample have been assigned to the Early Group, nine are assigned to the Middle Group, three burials have been placed in the Late Middle Group, and twelve are in the Late Group. Ten of the 28 burials analyzed came from the north zone of the cemetery, 12 were excavated in the south zone, five were found in the southeast zone, and one was found just along the fence line.

Seventy four pollen types were identified during the tabulation phase of the investigation (Tables 3 and 4). Twenty three of these pollen types were contributed by trees (Figures 2 and 2b) and the taller woody shrubs (arboreal pollen types), while 48 came from herbs (Figures 3a and 3b (each with parts a and b) and shorter shrubs (non-arboreal pollen types). Aquatic plants contributed four of the non-arboreal pollen types.

Only four of the 23 tree pollen types—chestnut (*Castanea*), cedar family (Cupressaceae), pine (Pinaceae), and oak (*Quercus*)—and only six of the 48 non-arboreal pollen types—

ragweed-type, honewort-type (*Cryptotaenia*-type), goosefoot-type (Chenopodiaceae-*Amaranthus*), dandelion-type (Liguliflorae), pea-family (Fabaceae), aster-type (*Aster*-type), and grass family—were represented among the samples with sufficient consistency for the analyst to be confident in any temporal or spatial patterns that might be observed. These are the pollen types that are presented in the simplified diagrams (Figures 5-8). The possibility exists that the wetlands around the Collect Pond and Little Collect Pond extended into the cemetery (see Chapter 3). The pollen contributions of wetland plants, although sparse, may contribute some information pertinent to this question. The Eurasian cereal-type (commonly termed Cerealia by European palynologists), buckwheat (*Fagopyrum*), and cotton (*Gossypium*) counts must also be discussed because of the potential economic associations of these pollen-types.

Arboreal Pollen Types.

<u>Oak</u>. The oak pollen counts ranged from one half of one percent (Burial 366-stomach) to nine percent (Burial 155-stomach). The majority of the samples contained five percent or less oak pollen. Among the 22 burials in which oak pollen was found in multiple samples; the largest counts occurred in the stomach sample in eleven cases, in the grave fill in six cases, and on the coffin lid in five cases. In all but a few cases there was less than two percent difference between the oak counts of the samples from a given burial, and the higher percentages in the stomach samples may not be significant. The largest spread of oak pollen percentages is the difference between the seven percent of this type on the coffin lid, the nine tenths of a percent in the grave fill, and the one and four tenths of percent in the stomach of Burial 207. Most of the 25 species of oaks listed by Fernald

(1970:I:617-625) pollinate in April and May, and Burial 207 could have been a Spring interment. It is equally possible that the coffin lid sample is derived from a portion of the grave fill with an early spectrum in which oak was prominent (see Figure 9, pre-Dutch clearance spectra in samples 1-4). There are also no counts that are sufficiently prominent to interpret as evidence of ornamental oak trees within the Burial Ground (Figure 7).

No patterns are evident among the oak counts in the chronological pollen diagram (Figure 8). The average oak pollen percentages for the burials from each period do, however, suggest that more oak pollen was falling on the ground during the early period (5.22%) compared to the middle (3.91%), Late Middle (3.95 %), and Late (4.27 %) periods. This difference is slight, but the smaller later figures are consistent with the overall pattern for tree pollen and could record the forest clearance characteristic of the Colonial Period in the Northeast (Figure 9; Davis 1965:397).

<u>Cedar family</u>. Members of the cedar family contributed only single pollen grains (0.5 percent) to eight samples (Burial 6-stomach, Burial 10-stomach, Burial 39-lid, Burial 207-grave fill, Burial 221-grave fill, Burial 241-grave fill, Burial 243-stomach, Burial 366-grave fill, Burial 379-stomach). Forty two of the samples that could be analyzed contained two percent or less cedar family pollen. The highest cedar percentage (Burial 135-stomach) was 5.4 percent, which is only 3.9 percent larger than the average stomach sample content of 1.5 percent. Multiple samples from five burials (Burials 25, 192, 194, 207, and 352) contained the same percentage of this pollen type. Among the 15 burials where there were differences between samples, equal numbers (five) were highest from

the grave fill, coffin lids, and stomach locations. The difference between the quantities of cedar family pollen in the majority of the samples did not exceed one percent, and the spread between percentages of this type in the samples from a single grave exceeded one and one half percent in only two instances (Burial 10 and Burial 221).

These figures indicate that cedar was not an important element in either the tree flora of the African Burial Ground pollen catchment or in the pollen rain of the places where the bodies were prepared. No data relative to season of interment could be extracted from the counts, and none of the counts were large enough to suggest cedars growing in the graveyard. The average cedar pollen contributions to the four temporal groups were 3.14 percent for the Early Group, 0.83 percent for the Middle Group, 0.66 percent for the Late Middle Group, and 1.23 percent for the Late Group. The pattern of these figures is not entirely consistent with that of the other tree pollen types and the total tree pollen contribution, but it does suggest more cedar trees in the pollen rain source area during the earlier 18th century.

Chestnut. No chestnut pollen was tabulated in seven samples (Burial 6-stomach, Burial 194-lid, Burial 194-stomach, B243-grave fill, Burial 270-lid, Burial 351-grave fill, and Burial 392-grave fill) and the highest count of the type was nine and two tenths percent (Burial 241-lid). Forty of the 55 samples in which chestnut pollen was found contained less than five percent of this type, and only two samples (Burial 210-grave fill and Burial 241-lid) contained more than seven percent. The highest percentages came from grave fill in eight of the 19 burials where chestnut occurred in two or more samples, from lids in eight burials and from the stomach area in burials cases. The highest chestnut percentage from a stomach sample was 5.9 percent (Burial 147). This is only 3 percent larger than the 2.9 percent average for stomach samples of this pollen type. In the majority of burials, the highest and lowest counts were separated by less than two percent, and the only notable spread in chestnut representation is the 8.7 percent difference between the single grain (one half of one percent) in the grave fill of Burial 241 and the 19 grains (9.2 %) on the coffin lid of the same burial. Before they were almost obliterated by a blight between 1905 and 1950 (Anderson 1974), American chestnuts pollinated in June (Fernald 1970 540), and the Burial 241 coffin lid count suggests a spring interment for that individual.

No pattern is discernable among the chestnut counts in the chronological diagram (Figure 8), but the average chestnut percentage for the late period coffin lid and grave fill samples was slightly higher, at 3.75 percent, than the percentages for the Late Middle (2.47%), the Middle (3.1%), and Early (2.85%) periods. Chestnuts are stump sprouters. They proliferated after the initial land clearance on Manhattan Island during the third decade of the 17th century (Figure 9) and again as trees returned to the in the cut-over woodlots of southern New England during the 19th century (Pailette 1982:458). The differences between these spectra are small but could reflect similar changes in the regional or extra-local tree cover.

<u>Pine Family</u>. The pine counts from the African Burial Ground are somewhat higher and appear to be a little more variable than the counts of the other tree pollen types. The type

appeared in 60 of the 62 samples containing adequate pollen to analyze and the percentages of this type range between no pollen (Burial 221-stomach) and 20.4 percent (Burial 25-grave fill). The largest counts occurred in the grave fill in eight of the 24 burials where pine pollen was recovered from multiple samples, in seven of the coffin lid samples, and in nine of the stomach samples. The spread between the percentages of this type in four burials was 14.4 percent (Burial 25), 11.8 percent (Burial 241), nine and one half percent (Burial 415), and seven and one half percent (Burial 270). The differences between the counts were, however, less than two percent in 11 of the 24 burials where comparisons could be made. The most prominent pine pollen count from a stomach sample was only 13.7 percent (Burial 10), only 6.6 percent higher than the stomach pine average of 7.1%, and no sufficient case can be made for any interment taking place while pines are in anthesis.

The average pine percentage for the Late Period (6.0%) is lower than those for the Late Middle (8.1%) and Middle (8.5%) Periods, but higher that that of the Early (3.23%) Period. The low Early Period pine count might be a random product of having only two samples dating to that era. The average pine pollen percentages for the four areas established by the excavators are 6.68 percent for the North Area, 7.24 percent for the South Area, 7.4 percent for the Southeast Area and 6.6 percent for the burial along the fence. Pine pollen will blow thousands of miles (Potter and Rowley 1960:5), but most of that which is shed ends up as a yellow powder on the ground around the edge of the canopy. The area pine percentages from the different parts of the African Burial Ground are quite similar, suggesting that all such pollen is derived from the well-homogenized, regional pollen rain. There is no evidence of pine trees growing in the Burial Ground itself.

Total Arboreal pollen. Thirty five out of 62 African Burial Ground samples contained between 15 and 25 percent tree pollen. Nine samples contained over 25 percent and five samples contained less that 10 percent. The lowest tree pollen count was four and one half percent (Burial 415-stomach) and the highest was 35.4 percent (Burial 210-grave fill) tree pollen. The average combined grave fill and coffin lid percentages geographically across the Burial Ground were 21.2 percent for the North Area, 19.5 percent for the South Area, 19.9 percent for the Southeast Area and 13.5 percent for the burial along the fence. The averages for the North, South, and Southeast areas differ by no more than 1.2 percent. Ornamental trees should have distorted these averages and the uniformity of the total tree pollen percentages suggests that the tree pollen that fell on these three areas is all derived from the regional background pollen rain. There do not appear to have been any trees in the African Burial Ground itself.

The average pollen percentage of the combined 23 arboreal pollen percentage declined in the Late Middle (13.6%) and Late (14.0%) Groups from the Middle (21.2%) and Early (20.71%) Groups. The total tree pollen falling on the Old Merchant's House area of Manhattan Island dropped from almost 90 percent to a little over 26 percent during the 17th and 18th centuries (Figure 9). The shift in the average tree pollen deposition at the African Burial Ground probably also records land clearance and progressive urbanization of Manhattan Island. The change in the African Burial Ground spectrum is not as large as that at the Old Merchant's House because the grave fill pollen spectra are mixtures of several hundred years of pollen rain that include pollen from the tree-dominated prehistoric period. No data relative to season of interment could be extracted from the total tree pollen counts.

Herb (Non-Arboreal) Pollen Types.

Ragweed-type. Palynologists normally discuss the pollen grains of most of the wind-pollinated members of the Aster Family (Asteraceae) as a single pollen type, here called "ragweed-type." Ragweeds and their close relatives are prolific pollinators, and this pollen type was present in all samples that contained sufficient pollen to permit analysis. The lowest count of this type was 6.1 percent (Burial 25-stomach) and the highest was 28.7 percent (Burial 366-coffin lid). Two ragweed-type pollen spectra are available from 14 of these 24 burials, and three counts of this type are available from the other 10 burials (Figure 3a, parts a and b). In eight of these cases the highest ragweed-type pollen percentages were found in grave fill samples, in six cases the largest counts of this type were found in lid samples, and in nine cases the largest quantities were found in stomach samples. The ragweed-type frequency was only one tenth of one percent larger in the stomach sample (14.5 %) of Burial 191 than in the sample from "above the bone" (14.4 %), suggesting that both counts came from the grave fill. The largest divergence was the 18.3 percent difference between the grave fill sample (8.9 %) and the stomach sample (27.2%) of Burial 415. In 16 of the 24 burials from which multiple samples could be tabulated the difference between the highest and lowest percentages is six percent or less. When only the lid and grave fill samples are considered, the difference between the spectra is six percent or less in 11 of 13 samples. This supports the inference that most of the pollen on the coffin lids came from the grave fill. The most prominent exception to this is Burial 366. No pollen was recovered from the grave fill of this burial, but it might be significant that the ragweed-type percentage on the coffin lid of this body exceeded that of the stomach sample by 12.3 percent. The average ragweed percentage of the Burial Ground stomach samples was 16.2 percent. Only two stomach samples, those of Burials 210 (27.5 %) and 415 (27.2 %), exceed this by what appears to be a significant amount (11.0-11.3%).

Ragweeds and their close relative are not normally eaten. The wind-pollinated members of the aster family growing in the Northeast reach anthesis late August (Fernald 1970:1468-1470) and continue to pollinate until the first killing frost. The prominent ragweed-type counts on the Burial 366 coffin lid and in the stomachs areas of Burials 210 and 415 stomach could reflect interment late in the year. The Burials 366, 210, and 415 counts could also indicate different numbers of plants producing this pollen type in the African Burial Ground and at the places where the bodies were prepared for burial.

Ragweeds are well adapted to the harsh temperature and moisture regimen of cultivated fields (Bazzaz 1974), and ragweed-type pollen is the premier indicator for the introduction of European plow agriculture in North American pollen diagrams (Davis 1965:397). Ragweed pollen is also prominent in the disturbed soils of urban situations (Figure 9). The average ragweed-type pollen representations in the Late (14.19%), Late Middle (15.0%), and Middle (14.15%) Groups are similar, but the ragweed-type contribution during the Early period (9.1%) is four to almost five percent lower (Figure 3). This could reflect less soil disturbance during the Early Period, when there were fewer burials and, possibly, fewer persons visiting the Burial Ground. The grave fill and coffin lid pollen spectra are a mixture of the pollen that fell on the Burial Ground during several hundred years prior to the excavation of the grave, and it is equally probable that the lower ragweed-type frequency during the Early Period is the product of statistical suppression by the inclusion of larger amount of the tree-dominated prehistoric pollen spectrum in the Early Period sample. Data were available from only two burials from the Early Period, and this lower figure could also be a function of the random inclusion of a single burial with low ragweed percentages.

There are some differences in the average ragweed-type percentages for the four areas established by the archaeologists: North (15.76 %); South (14.18 %), Southeast (18.1 %), and on the fence line (13.9 %). The high figure for the Southeast area appears to be the product of the chance inclusion of a single abnormally high frequency (28.7 %) in one burial (No. 366) out of only four reported for the area.

<u>Goosefoot-type</u>. The pollen grains produced by the goosefoot family (Chenopodiaceae) and the amaranths (*Amaranthus*) are difficult to distinguish. They are combined here and presented under the “goosefoot-type” category. A large number of Native American tribes consumed the seeds and leaves of plants producing goosefoot-type pollen (Hendrick 1970:160), and are reported to have employed the green portions of a number of such plants in treating a wide range of ailments (Moerman 1986:698-699). Europeans

and Colonial-era Euroamericans also used the leaves of some species--*Chenopodium album*, *C. auriciomun*, *C. bonus-henricus*, and *C. caspitatum* for instance--as pot herbs and salad ingredients (Hendrick 1970:160). Goosefoot seed retains abundant goosefoot-type pollen (Bohrer 1972:Table 7), making it possible to recognize evidence for the consumption of goosefoot seed in prehistoric coprolites.

Goosefoot-type pollen was present in all of the analyzable Phase II samples except the Burial 351 grave fill sample. Goosefoot-type was represented in two or more samples from 23 of the 28 Phase II burials in which the type appeared. The lowest representation of this type was the one half of one percent tabulated in the Burial 221 grave fill sample and the highest was the 16 percent in the Burial 115 (Phase I) stomach sample. The average difference between counts of this type within a burial series was 2.8 percent, and the largest difference was the 4.5 percent spread between the grave shaft and coffin lid samples of Burials 194 and 266. The goosefoot-type percentage was highest in the grave fill samples of 10 burials, in the coffin lid samples of six burials, and in the stomach samples of seven burials. Among the Phase II burials the stomach sample count did not exceed the amount of the type in the grave fill and on the coffin lid by more than 3.3 percent, and no coffin lid sample exceeded its associated stomach or grave fill sample by more than 3.5 percent (Figure 3).

Only one percent goosefoot-type pollen was tabulated in the Burial 115 coffin lid sample during Phase I (Figure 1), and the 16 percent of this type in the stomach sample probably reflects food or medicine ingested not long prior to death. Only young goosefoot leaves would have been consumed in salads or as potherbs. These should not bear significant amounts of pollen, and it is probable that this high goosefoot-type count came from seed. A single high count, such as that in the Burial 115 stomach sample, suggests ingestion for a specific, possibly medicinal, purpose. Intestinal parasites were common among colonial period Americans (Narva 1995), and this relatively large goosefoot-type count might record the consumption of a remedy known as "wormseed" (*Chenopodium ambrosioides, var. anthelminticum*). How soon after harvest this might have been eaten cannot be determined. Plants producing goosefoot-type pollen generally pollinate in the late summer or fall (Muenscher 1980:180). It is also possible that the Burial 115 goosefoot-type count reflects plants in anthesis during this period at the place where the body was prepared for interment.

The highest goosefoot percentage from any Phase II stomach sample was the 7.4 percent in Burial 384, and this exceeded the goosefoot stomach samples average (3.8 %) by only 3. 6 percent. This suggests that none of the other goosefoot type percentages can be interpreted as indicating consumption of the parent plants or a late summer or fall burial for any other burial.

The quantities of goosefoot-type pollen among the African Burial Ground samples are similar to the percentages of this pollen found in the 19th century deposits in the backlots of the Kirk Street Agent's House and the Boott Mills Boarding House at Lowell, Massachusetts (Kelso, Mrozowski, and Fisher 1987: Figures 6-2, 6-3, and 6-4; Kelso, Fisher, Mrozowski, and Reinhard: 1989:Figure 12-9 and 12-10). They are also comparable to the goosefoot-type percentages deposited during the domestic occupation period (samples 24-38) in the backlot of the Old Merchant's House, New York City (Figure 9). Experimental data indicate that 95 percent of the goosefoot-type pollen emitted by a given source came to earth within 150 feet of the emission point (Raynor, Ogden, and Hayes 1973: Figure 4). Counts from a historic-era kitchen midden at the Kirk Street Agent's House indicate that pollen grains of this type are detectable in contemporaneous deposits six feet from the source but cannot be distinguished in matrices 40 feet away (Kelso, Mrozowski, and Fisher 1987: Figures 6-2, 6-3, and 6-4). It appears probable that the African Burial Ground goosefoot-type counts reflect the pollen contribution of the goosefoot-family/amaranth population of the Burial Ground itself; or, in the case of the stomach samples, the normal contribution of these plants to the general pollen rain of 18th century New York City.

Figure 8 suggests that there was a modest increase in the population of plants shedding goosefoot type pollen in the Burial Ground during the late period. The grave fill and coffin lid matrices are most likely to reflect the pollen rain on the cemetery itself. Eleven (58 %) of the 19 Phase II grave fill and coffin lid counts of the Late Group exceeded four percent, and the average for the period was 4.1 percent. Only five (25%) of the 20 Phase II counts from the combined Late Middle, Middle, and Early Groups exceeded four percent; and the average for the periods were: Late Middle (2.3%), Middle (3.1%), and Early (3.75 %). The Early Group Count is only 0.26 percent lower than the later period count, but it is based on only three counts from two burials. It may not be statistically reliable.

The average goosefoot-type percentages for the four areas established by the archaeologists--North (4.9 %); South (2.9 %), Southeast (3.9 %), and along the fence (3.9 %)—might suggest that on the average there were more plants shedding goosefoot-type pollen in the North portion of the Burial Ground than elsewhere. The counts are, however, all small, as are the differences between them. The high and low average percentages from these areas may be accidental statistical products of the low numbers of burials analyzed.

Chicory-Type. Chicory (*Cichorium* spp.) and its close relatives are members of the Liguliflorae sub-family of the aster family (Asteraceae). The pollen that they produce is distinctive but hard to separate by genus and species. It is presented here under the term "chicory-type." These plants contributed pollen to 58 of the 62 Phase II samples from which quantities of pollen adequate to analyze were recovered. The lowest representations of the chicory-type were the 0.5 percent in the Burial 10 coffin lid sample, in the Burial 379 grave fill sample, in the Burial 379 coffin lid sample, and in the Burial 415 grave fill sample. The highest count was the 20.3 percent found in the Burial 194 stomach sample. This exceeded the average stomach sample percentage for chicory-type (4.7 %) by 15.6 percent. The leaves of dandelions (*Taraxacum officinale*) and other members of the Liguliflorae were widely consumed as spring greens in Europe and North America during the 18th, 19th, and early 20th centuries (Hendrick 1972:563). The high chicory-type percentage from the Burial 194 stomach sample might register these plants in the individual's diet a short period before death.

The second highest chicory-type, count, 15.7 percent came from the coffin lid sample of the same burial (194). Both the stomach and coffin lid samples are both noticeably higher than the 8 percent of the type from the Burial 194 grave fill sample. The pollen grains of most members of the Liguliflorae sub-family are insect transported, and the high quantities of the type in and on the Burial 194 coffin probably did not blow into the grave during the burial ground portion of the funeral. Many of the 24 genera that Britton and Brown (1970:304-338) illustrate for the Liguliflorae produce attractive flowers and it is possible that the high pollen counts of this type in and on the Burial 194 coffin originated with a floral tribute. The genera growing in the New York City area variously pollinate between May and September (Britton and Brown 1970:304-338), and the Burial 194 interment may have occurred during the summer.

The counts from burials with more than one sample containing chicory-type pollen were equally divided among the grave fill, coffin lid, and stomach area samples (eight each.). This distribution suggests that most of the chicory-type pollen was derived from the normal pollen rain rather than from plants manipulated by humans. Eight coffin lid and grave fill samples and two additional stomach samples yielded 9.0 percent to 13.5 percent Liguliflorae-type pollen, in addition to the Burial 194 spectra. In contrast only one sample from the Old Merchant's House contained more than five percent chicory-type: and the majority of the samples from that locus contained 2.0 percent, or less, of the type. The single high count at the Old Merchant's House, nine percent (Figure 9), dates to the construction period (sample 23), when weeds would be expected to proliferate on the disturbed soils of the locus (Kelso 1993:84). It appears probable that the grave fill and coffin lids at the African Burial Ground reflect plants growing on the premises. The non-arboreal pollen spectrum (Figure 3a) does not suggest that any other plants were part of the bouquet placed in or on the Burial 194 coffin, and it is possible that the flowers were gathered in the graveyard itself.

The patterns on the chronological pollen diagram (Figure 8) suggest that the population of plants producing chicory-type pollen may have been larger during the Early and Late periods in the Burial Ground. This observation appears to be supported by the average representation of this pollen type in Early Group burials (6.83 %), for the Middle Group (4.61 %), for the Late-Middle Group (4.38 %), and for the Late Group (7.53 %). This inference is also supported by the numbers of pollen samples in which the type is prominent in the temporal groups. The chicory-type content of 15 of the 19 Late Group coffin lid (Burial 194 excluded) and grave fill samples exceeded 4 percent (79 %) and seven of the 19 samples exceeded eight percent (37 %). The comparable figures for the combined Late-Middle and Middle Groups were three samples out of 16 (19 %) that exceeded 4 percent and one out of 16 (6 %) that exceeded 8 percent. The Early Group data consists of only three counts, two of which were from the same burial and may not accurately reflect the pollen rain of the time.

A visual examination of the location diagram for the Burial Ground (Figure 7) indicates that there were more samples containing over four percent chicory-pollen among the burials from the North Area (80%), than in the South Area (40 %) or the Southeast Area

(33 %). The two similar counts–grave fill (13.3 %) and coffin lid (13.8 %)–from the Fence area were recovered from one burial and may be a matter of chance. If they are discarded, the chicory-type averages for the three remaining areas—North (7.23 %), South (4.66 %), Southeast (5.9)—tend to support the inference that there were more of the parent plants in the north part of the Burial Ground. These averages are, of course, small and based on data from a limited number of burials. The differences between them are not great, and they cannot be considered definitive.

Pea sub-family. The 57 genera of the pea sub-family (Papilionaceae) of the pulse family (Fabaceae) that Fernald (1970:881-883) lists for the northeastern United States flower between May and August. Most are insect pollinated, and the few exceptions (Faegri and van der Pijl 1979:135, 136) are self pollinated (autogamous). These plants produce little pollen and do not disperse it widely. Pollen attributable to the pea sub-family was noted in 60 of the 62 African Burial Ground samples containing sufficient quantities of pollen to permit analysis. The highest frequency of this pollen type was 14 percent on the Burial 207 coffin lid and the lowest counts were 1.5 percent in the Burial 147 stomach sample and the Burial 155 grave fill sample. The type was most important in the grave fill sample of six burials, in the lid samples of 10 burials, and in the stomach sample of 8 burials, and the average difference between the counts from individual burials was only 2.8 percent. The average pea sub-family content for the grave fill samples was 6.0 percent. For the coffin lid samples the average was 6.8 percent, and for the stomach samples it was 6.2 percent.

The pea-sub-family pollen percentages of the stomach samples of Burials 392 (12.6 %) and Burial 192 (11.9 percent) exceed the average stomach sample percentage (6.2%) by what may be a significant amount. The pea sub-family percentage in the stomach sample from Burial 192 was also rather higher than that of the grave fill (4.4 %) and the coffin lid sample (5.8%). The quantities of this pollen type in the stomach area of Burial 392 and the grave fill (8.4 %) and coffin lid (6.0 %) of the same burial were also different. The Burials 192 and 392 stomach counts may reflect the consumption of plants producing this pollen type by these two individuals a short time before death. Pea-sub-family products can be stored for a considerable time, and these counts do not necessarily register the season of death. The third highest pea sub-family stomach area count, 10.4 percent in the Burial 415, is exceeded by the 12.0 percent of the same type on the coffin lid and the 12.9 percent in the grave fill. The pea sub-family pollen in this stomach sample is probably derived from the grave fill. In general, no patterns that can be interpreted as indicating consistent human use of these plants are evident among the spectra.

At the Old Merchant's House pea sub-family pollen was present in only 27 of the 38 samples. The highest counts–7. 5 percent in sample 23 and 8.0 percent in sample 25–date to the mid-1830s construction and immediate post-construction periods, when weeds would be expected to proliferate in the area. The average pea sub-family representation for the total Old Merchant's House profile was 2.6 percent, and the average for the 18th century samples was 1.8 percent. These figures contrast with the presence of the type in 60 of 62 African Burial Ground samples and with the average of 6.3 percent for the

Burial ground grave fill and coffin lid (all 18th century) samples. It appears probable that there was a significant population of pea sub- family members growing on the African Burial Ground property.

The average pea sub-family pollen percentages for the four temporal groups identified at the African Burial Ground—Late (5.6%), Late Middle (5.2%), Middle (6.58%), and Early (6.2%)—suggest that there may have been slightly fewer of the parent plants on the locus during the 2nd half of the 18th century, but this is not evident in a visual inspection of the chronological diagram (Figure 3). The location diagram (Figure 7) does suggest that there were more of these plants in the South and Southeast portions of the Burial Ground than in North and Fence areas, and the average pollen percentages for the areas—North (4.97%), South (6.78%), Southeast (7.67 \%), and Fence (5.1%)—appear to support this inference. It should be noted, however, that these figures are drawn from a small number of burials, and that larger numbers from the South and Southeast areas are a function of four, possibly random, relatively high pea sub-family counts in two burials from each area.

<u>Grass Family</u>. The grass family is the most prominently represented non-arboreal pollen type among the African Burial Ground spectra (Figure 3). This type was present in all samples that contained sufficient pollen to permit analysis. The lowest grass pollen count was 16.7 percent (Burial 310-grave fill) and the highest was 60.1 percent (Burial 6-stomach). Thirty to 55 percent grass pollen was tabulated in 55 out of the 62 samples and slightly over half of these fell in the 35 percent to 45 percent range.

Grass pollen data from multiple samples are available from 24 of the African Burial Ground interments. The highest percentage occurred in the grave fill in seven of the remaining 23 samples, on the coffin lid in nine burials, and in the stomach sample in seven burials. Two grass pollen spectra are available for comparison from 14 of these 24 burials and three counts of this type available from the other 10 burials (Figure 3). The difference between the highest percentage in a given burial and the other count, or counts, was less than six percent in 20 of the 34 samples, and less than 12 percent in another 3 samples. The grass pollen percentages of from the stomach areas of Burials 6 (60.1%), 25 (54.9 %), 207 (58.9%), 352 (51.9 %), and 366 (52.2 %) were 9.4 percent to 17.6 percent higher than the average for grass in stomach samples (42.5 %).

Both of the Burial 191 samples from which pollen was recovered, “above the bone” and stomach, contained identical quantities of grass pollen (44.5 percent) and both probably derived from the grave fill. The coffin lid grass sample percentage (49.3 %) and the grave fill percentage (51.4 %) from Burial 352 are also similar to the stomach sample count, suggesting that all three are derived from pollen in the grave fill. The Burial 25 coffin lid sample is only 2.8 percent smaller than the stomach sample while the grave fill percentage is 13.7 percent smaller. This suggests that the Burial 25 stomach and coffin lid counts are from the pollen rain of the time of interment and that the individual was buried during June, July, or August, when the majority of the wild grasses in the Northeast pollinate (Fernald 1970:94-236).

The grass pollen percentages in the coffin lid (38.0 %) and grave fill (40.0%) samples from Burial 207 and the coffin lid sample (31.2%) from Burial 366 are both considerably smaller than the respective stomach samples. The seeds of wild grasses are widely gathered resources (Hendrick 1972), and these counts could register elements in the diet of the deceased individuals. These explanations may also apply to the 60.1 percent tabulated for the stomach area sample of Burial 6, but no comparative data are available for this interment. There is no way of knowing whether the grass products were consumed or used immediately after harvesting. If they were used immediately Burials 6, 207, and 366 were also interred during the summer.

Grass pollen is wind transported. Native grasses do not, however, produce massive quantities of pollen (Wodehouse 1971:46). Experimental data (Raynor, Ogden, and Hayes 1972:Figure 9) indicate that 50 percent of the grass pollen emitted by a known source comes to earth within 10 meters (32 feet) of the edge of the source and that 90 percent of it is lost within18 meters (58 feet) of the source. It is an important pollen type in almost all historical-era pollen profiles from the northeastern United States, but ragweed percentages are generally higher than those of grasses on areas known to be waste ground. In those pollen profiles for which the documentary and archaeological landscape history indicates that people were planting or encouraging and maintaining grass, the common weed pollen-types (such as ragweed type aster-type and goosefoot type) percentages are lower than on contemporaneous waste ground and grass pollen dominates the herb pollen spectrum. Five examples of this are 1) the peak in grass pollen counts and decline in ragweed that mark creation of a late 1820s to mid-1830s lawn under the Boott Mills Boarding House backlot at Lowell, Massachusetts; 2) the marked increase in grass pollen percentages and the proportional decline of ragweed after the 1836 installation of grass sod in the sidelot of the Kirk Street Agent's House at Lowell, Massachusetts; 3) the marked increase in grass pollen percentages from eight percent to 50 percent, as those of ragweed-type declined when pasture was created on the hillsides at Great Meadows, Pennsylvania; 4) the solid block of high grass pollen frequencies that record the 1868 sowing of meadow over the David Brown House cellar hole in Concord, Massachusetts, and 5) the large increase in the grass percentages and suppression of the weed contribution (Figure 9) after grass was planted during the early 1830s in the central beds of the Old Merchant's House, Manhattan, New York City (Kelso 1993: Figures 7 and 19; Kelso 1994:Figure 5; Kelso, Dwyer, and Synenki 1994, Figure 6; Kelso and Wall 2005). We do not have data from the pre-cemetery period at the African Burial Ground with which to compare our grave fill and coffin lid samples, but the percentages of grass and ragweed pollen in the Burial Ground spectra are proportional to the percentages of these two types during the period of well-maintained lawn at the Old Merchant's House (Figure 9). The larger percentages of grass pollen compared to ragweed pollen at the Burial Ground suggest that grass was a significant element in the groundcover on the area.

The combined grave fill and coffin lid grass pollen percentages for the Early Group (32.6%), the Middle Group (41.5 %), the Late Middle Group (41.5 %), and the Late Group (40.1 %) suggest that there was less grass on the African Burial Ground in the early portion of the 18th century. The percentages of ragweed-type, the second most prominent herb pollen type, were also lowest during the Early Period. The tree pollen percentages among the Burial Ground spectra were highest during the Middle and Early periods, with oak and cedar highest during the Early Period. The regional (mostly tree) pollen contributions to the spectrum of a particular locus go up statistically when the local pollen production (mostly by herbs) decreases. The data suggest, but do not establish, that there was less ground cover on the Burial Ground during the Early Period. The grave fill and coffin lid pollen spectra are a mixture of the pollen that fell on the Burial Ground during several hundred years prior to the excavation of each grave, and it is equally probable that the lower grass frequencies during the Early and Middle Periods are the products of statistical suppression by the inclusion of larger amount of the tree-dominated prehistoric pollen spectrum samples from those times.

The grass pollen averages for the four spatial zones on the African Burial Ground are 40.3 percent for the North Area, 41. 4 percent for the south Area, 36.8 percent for the Southeast area, and 39.0 percent for the fence line burial. These data suggest that there might have been more grass on the average over the 18th century in the South Area. The difference between these percentages are, however, small and are probably not significant.

Aster-type. The pollen produced by most of the insect-pollinated members (Tubliflorae) of the aster family (Asteraceae) is difficult to separate below the sub-family level. With a few exceptions, the pollen grains of this sub-family are combined into a single pollen type that is labeled "aster-type." The pollen of sunflowers (*Helianthus* spp.), a prehistoric cultigen that is still grown in many parts of the Unites States (Hendrick 1972:298-300), can be distinguished from that of other members of the sub-family, but was not noted among the African Burial Ground Pollen spectra. Many members of this sub-family produce showy flowers to attract the insect pollen vectors. A number, asters (*Aster* spp.) and marigolds (*Calendula officinalis*) for instance, have been domesticated as ornamentals, and their wild relatives would also be equally suitable in funerary flower arrangements. Most members of the Tubliflorae pollinate between late August and the first killing frost, usually in October (Fernald 1970: 1416-1438). Abundant pollen does adhere to the seed of sunflowers hulls (Bohrer 1972:Table 7) and probably sticks to the seeds of other insect-pollinated members of the aster family.

Aster-type pollen was present in 58 of the 62 African Burial Ground that contained sufficient pollen to analyze, and multiple samples containing this pollen type were available from 21 burials. The highest count of this type was the 7.4 percent in the Burial 194 grave fill sample, and the largest difference between samples in a single burial was the 4.5 percent difference between the grave fill sample (1.5%) and the stomach sample (6.9%) from Burial 155. The stomach samples from Burials 194 and 155 were only 4.3 to 4.8 percent larger than the average of Aster-type percentages in all stomach samples. The differences between these stomach samples and the average should have been larger if these individuals had consumed some Tubliflorae product before death or if flowers from this sub-family had been included in a floral funerary tribute. The aster-type percentage, moreover, of the stomach samples were larger than that of the grave fill and coffin lid samples in only eight of the 21 burials with multiple samples contain this pollen type; and, excluding Burial 155, these stomach samples were higher by an average of only 0.84 percent. Only in Burial 266 was the aster-type percentage of the coffin lid sample (2.8%) higher than that of the grave fill (1.5%) and the stomach sample (2.5%). The aster-type counts do not provide evidence of a significant use of the parent plants in the diet of the persons interred in the Burial Ground or in floral tributes provided by survivors.

Most non-domesticated plants producing this pollen type are waste ground plants. They proliferate on stabilizing soil, after active disturbance has ceased. Historical-era pollen data from the rear of the Kirk Street Agent's House backlot indicate that aster-type pollen does not travel great distances from the parent plants. At that site pollen from a population of such plants that developed immediately after construction was clearly evident in a profile taken six feet away, but not in a profile taken forty feet away (Kelso, Mrozowski, and Fisher 1987: Figures 6-2, 6-3, and 6-4). These comparative data from the Kirk Street Agents House suggest that the aster-type pollen recovered from the grave fill and coffin lid samples came from plants growing within the Burial Ground.

Comparative data from the Old Merchant's House, New York City are also applicable to the interpretation of the Burial Ground Aster-type pollen spectra. Three of the four aster-type counts in the pre-clearance spectra (samples 1 to 3) from the Old Merchant's House profile (Figure 9) were relatively high (6-8 %) for that site. The type declined during the clearance and probable active plow agriculture period (samples 5-15); indicated by the proliferation of pollen from stump-sprouting chestnuts; increased irregularly during the period of greater soil stability, probably a waste ground or pasture interval, indicated by the increase in grass pollen (samples 16-22); peaked and declined during the house construction period of the early 1830s (samples 23-24); and became a consistent component of the counts during the well-maintained garden period (samples 26-38). The regularity of the garden period counts suggests that some of the aster-type pollen came from ornamental plants in the beds bordering the grass lawn area where the pollen profile was collected. The African Burial Ground aster type counts are comparable to those of the waste ground period at the Old Merchant's House, but appear to be rather more irregular than those from the garden interval at that site. This supports the inference that the aster-type pollen in the Burial Ground samples came from local plants. It also suggests that the plants shedding aster-type pollen in the Burial Ground were not, at least consistently, cultivated.

A visual inspection of the chronological diagram (Figure 8) suggests that there may have more plants producing aster-type pollen in the Burial Ground during the early period and that there may been a slight increase in the Burial Ground population of these plants during the late period. One out of three aster-type counts from the Early Group and six out of the 19 from the Late Group exceeded four percent, while only 1 out of 16 aster-type counts from the combined Late Middle and Middle Groups exceeded that figure. The average combined grave fill and coffin lid aster-type percentages of the Late (2.5 %), the Late Middle (2.1 %), Middle (2.0 %), and Early Group (3.1 %) are small, but appear to support this inference. The higher average for the Early Group is attributable to one high count from the Burial 221 and may not be significant.

The average aster-type percentages for the four areas established by the archaeologists–North (2.32 %); South (2.33 %), Southeast (3.29 %), and Fence (3.65 %)–might suggest that on the average there were more plants shedding goosefoot-type pollen in the Southeast and Fence portions of the Burial Ground than in the North and South Areas. The counts are, however, all small, as are the differences between them. Only four burials were analyzed from the Southeast Area, only one was available from the Fence Area, and the average for the other two areas differ by only 0.01 percent. The higher percentages form the Southeast and Fence Areas may be accidental statistical products of the low numbers of burials analyzed.

Wetland Pollen Types

Four pollen types attributable to plants that generally grow in wetlands or in generally moist earth were noted among the African Burial Ground herb pollen spectra. These are sedge family (Cyperaceae), pondweed (*Potamogeton*), bur-reed / narrow-leaf cattail (*Sparganium*/*Typha angustifolia*)-type, and broad-leaf cattail (*Typha latifolia*).

<u>Pondweed.</u> Pondweed is an aquatic plant (Fernald 1970:65) and is a common plant in ponds and streams throughout the northeastern United States. The flowers emerge from the water for pollination in July through September. The extent to which pondweed pollen is dispersed in the air does not seem to have been studied, but in one similar aquatic, the male flowers must be wafted against the female flowers to effect pollination (Wodehouse 1965:298, 300). The three grains of this pollen among the African Burial

Ground spectra all came from stomach samples (burials 192 and 243) and were probably ingested with water.

Bur-reed/narrow-leaf cattail-type. Bur-reed and narrow-leaf cattail pollen are difficult to reliably differentiate. These two types and broad-leaf cattail all favor marshland or shallow water. Cattails are prolific pollinators, producing approximately 174,000,000 pollen grains per inflorescence (Erdtman 1943:176). Cattail pollen is also widely dispersed and has been captured from the air stream miles from where the plants were growing (Wodehouse 1971:43). The bur-reed/narrow-leaf cattail pollen type was tabulated in 12 samples from eight burials. The counts ranged from 0.5 percent to 1.5 percent, with the single 1.5 percent count from the Burial 243 stomach sample. A single grain of this pollen type was recovered from the Burial 266 stomach sample and none from five of the 10 grave fill and coffin lid samples. The remaining five grave fill and coffin lid samples yielded two pollen grains (1.0 percent) each. These quantities appear to too small to register marsh or standing water in the burial ground.

Bur-reed/narrow-leaf cattail-type pollen was not recovered from any Early Group grave fill or coffin lid samples and averaged 0.5 percent for the Middle Group, 0.88 percent for the Late Middle Group and 0.83 percent for the Late Group burials in which the type appeared. The average for this type from North zone was 0.88 percent and for the South, Southeast and fence zones 0.75 percent each. There does not appear to be any evidence of changes in the population of the plants producing bur-reed/narrow leaf cattail type through time or for the direction from which this pollen came.

Broad-leaf cattail. Broad-leaf cattail was noted in single samples from five burials. The highest count, 1.0 percent from the stomach sample of Burial 270, and the single pollen grain of the type (0.5 percent) from the stomach sample of Burial 191 were probable ingested with water before death. The single grains of the type recovered from the remaining four samples, three grave shaft and one coffin lid, reflect the pollen rain on the cemetery. No broad-leaf cattail pollen was recovered from Late Middle Period samples or from the grave analyzed in the Fence zone. The average representation of the type for the Early and Middle Groups was 0.5 percent, and 0.75 for the Late Group. The type averaged 0.5 percent each in the North, South and Southeast zones. None of these data can be interpreted as indicating the presence of broad-leaf cattail within the confines of the cemetery, as reflecting changes in the size of the parent populations through time, or as suggesting the direction from which the pollen came. The smaller representation of broad-leaf cattail compared to bur-reed/narrow-leaf cattail does not necessarily reflect a larger population of the last named plants in the vicinity. Broad-leaf cattail pollen is dispersed as tetrads (four joined pollen grains) and bur-reed/narrow-leaf cattail is dispersed in monads (single pollen grains). Broad-leaf cattail pollen is, consequently, heavier and may not travel as far as bur-reed/narrow leaf cattail type.

Sedges. The sedges are wind pollinated. They distribute their pollen, however, over very short distances and are the best indicator of local conditions among the four. Handel (1976) studied the pollen dispersal of two species of sedges common in the state of New York by treating anthers of a natural population with a normally absent element and tracing the pollen subsequently shed with neutron activation analysis. He found a 30-fold decrease in activity within 0.15 meters from the inoculated culms and a further 50 percent decrease by 0.5 meters. Only a few pollen grains appear to have traveled beyond one meter from the parent plants.

Sedge family was found in 38 samples from 22 burials and is the best represented of these four mesic condition indicators. Fourteen of the samples containing this type came from grave fill, 10 came from coffin lids, and 14 were from stomach areas. A single grain of sedge pollen (0.5%) was found in 15 of the 38 samples. The highest counts were the two and one half percent found in the stomach samples of Burials 10 and 135 and in the Burial 221 grave fill sample. The sedge pollen in the stomach samples, unless it is contamination from grave fill, was probably ingested with water. The mean sedge pollen content of the grave fill and coffin lid samples (averaged as one sample for each grave) containing this type was one percent (1.0%).

At Great Meadows, Pennsylvania, an intermittently wet meadow, significant percentages of sedge pollen (7 to 24 percent) were found only in the lowest, most frequently flooded areas (Kelso 1995:Figures 11-14) and disappeared abruptly from the record where the ground was even slightly higher. This suggests that the African Burial Ground sedge counts reflect some soil moisture, but they do not appear to indicate that the marshy area around the Collect and Little Collect ponds extended into the cemetery. Sedges are very adaptable. In the Northeast they will sprout and set seed in mud puddles on the compacted soil of building sites and poorly maintained dirt parking lots. Small quantities of sedge pollen (0.25-1.0%), probably from such sources, marks the 1845-1847 construction period at the Kirk Street Agent's House in Lowell, Massachusetts. It is possible that the African Burial Ground sedge pollen records intermittently wet conditions in low spots on the cemetery grounds.

Sedge pollen was found in samples from two of the four Early Group burials analyzed (average 1.9 percent), in six of the eight Middle Group burials (average 1.15 percent), one of the two Late Middle Group burials (2.0 percent) and 10 of the 12 Late Group burials (average 0.8 percent). The type was recovered from five of the 10 burials analyzed from the North zone of the cemetery average 0.75 percent, from seven of the 10 South zone burials (1.2 percent), from four of the five Southeast zone area burials (0.88 percent), and from the single burial (1.45 percent) analyzed from the fence line. The differences between the percentages for each temporal group and area are small, and the numbers of burials in which the type was noted are not vastly disproportionate to the number of burials analyzed for each area and time period. Sedge pollen does not appear to provide good evidence for greater ground moisture in any part of the burial ground or for significant changes in the condition of the ground through time.

Established Ethnobotanical Pollen Types.

Four pollen types that may be derived from economic plants were identified during Phase II of the African Burial Ground pollen analysis. These are honewort-type, buckwheat, cotton, and Eurasian cereal-type.

Honewort-type. The ethnobotanical status of honewort-type is based on the importance of this kind of pollen (21 percent) in the stomach sample for the adolescent individual (Burial B-45) analyzed during the Phase I. No honewort-type pollen was identified in the lid sample from this burial. The honewort-type percentage, moreover, in the Burial 45 stomach sample is almost eight times the honewort-type average (2.7% percent) for the other seven exploratory samples and 21 times the average for this type on the coffin lids. It was also notable that 81 percent of the honewort-type pollen in the Burial 45 stomach sample was exceptionally well preserved, while the only other well-preserved honewort-type pollen found among the Phase I samples consisted of a single grain in the stomach area of Burial 112 and a single grain from the Burial 115 coffin lid. The well-preserved honewort-type pollen in the Burial 45 stomach sample did not come from the existing pollen in the grave fill. It was in the coffin before the coffin was closed and was preserved by the rapid, deep burial of the coffin. Honewort and the other members of the carrot family are pollinated by insects. The high percentage of such pollen in the Burial 45 stomach sample can only have been introduced with the flowering parts of the parent plants. This was most probably done by a human agent.

No exceptionally well-preserved pollen grains were tabulated among the 11 percent honewort-type pollen in the Burial 115 stomach, and this sum was not was interpreted as ethnobotanical during the Phase I exploratory analysis. This count is, however, over five times larger than the two percent of this type found in any other exploratory phase sample, except that found in the stomach area of Burial 45. It probably reflects some human activity involving the parent plants.

Honewort-type pollen was present in 53 of the 62 African Burial Ground Phase II samples (87 %) with adequate pollen to analyze. The honewort-type content of the grave fill samples containing the type averaged 2.5 percent of the pollen in the 53 samples where it appeared. The highest percentage of honewort-type in any grave fill sample was the 6.5 percent of Burial 155 and the most prominent coffin lid count of this pollen type was the 9.0 percent from the same burial. Honewort-type appeared in only six of the 35 profile samples (17 %) in the ca. 1588-1993 Old Merchant's House profile (Figure 9), and averaged only one half of one percent (0.5 %) for the samples in which it did appear. It is probable that there were plants producing honewort-type pollen growing in the African Burial Ground.

Data from the Phase II analysis suggest human manipulation of plants producing honewort-type pollen. The average honewort-type percentage for stomach samples was 4.9 percent. The honewort-type content of the stomach samples from Burial 151 (12.9%), from Burial 210 (10.0 %), and Burial 392 (11.2 %) exceed this by what appear to be significant amounts. The Burial 151 grave fill (2.9 %) and coffin lid (2.5 %) percentages, the Burial 210 coffin lid (1.4 %) percentage, and the Burial 392 grave fill (0.5 %) and coffin lid (3.5%) percentages were relatively low; suggesting that the higher honewort-type percentages in the stomach samples did not originate in the grave fill.

Honewort grows in the New York City area (Kapp 1969:127), and the greens and roots of plants shedding honewort-type pollen are edible (Hedrick 1972:201). It is possible that the persons whose remains have been numbered Burials 45, 151, 210, and 392 had ingested some food or medicine incorporating plants closely related to honewort within three to five days before death (Kelso and Solomon, in press). The data concerning the consumption of honewort, however, referred only to the use of Japanese honewort (*Cryptotaenia japonica*) in Japan. Honewort is an attractive plant (USDA CRYPT5 2004); and it appears probable that the pollen of this type in the Phase I Burials 45 and 115 stomach sample and the Phase II Burials 151, 210, and 392 stomach samples is derived from the remnants of a floral tribute interred with the individual. It is also possible that the 7.0 percent honewort-type pollen on the lid of the Burial 270 coffin and the 8.0 percent of the type in the stomach of the same individual also represent funerary plants. These individuals were probably buried during the June to September, when these plants are in bloom (Fernald 1970:1095).

Four of the six individuals—Burials 45, 115, 270, and 392--with relatively high honewort-type pollen counts were buried in the south section of the excavated portion of the burial ground (Figure 7). The honewort-type content of the grave fill and coffin lid samples from the these four burials averaged three percent, including the Burial 270 coffin lid sample that has been attributed to a floral tribute. This is similar to the average combined grave fill and coffin lid samples percentage (3.65 %) for all of the burials in the area (3.2 percent without the Burial 270 coffin lid sample), and somewhat higher than the figures for the North Area (1.84%), the Southeast Area (1.88 %) and the fence line (1.45 percent). This could indicate that the relatively high honewort-type counts from the stomach samples of these four individuals came from plants growing in the area. These area figures are small, as are the differences between them. The type was also not prominent in the stomachs or on the coffin lids of another eight burials analyzed from the same area.

The temporal position of these four burials within the African Burial Ground sequence varied from Middle to Late Middle to Late (Figure 8). It is possible, but does not appear probable, that the high honewort-type counts in these four burials can be attributed to the flora in the area or to a traditional burial practice among a social group who customarily buried in this area.

Sex and age may have been a factor in determining who received a floral tribute at burial. One of the Burials, No. 45, in which honewort was a prominent pollen type, was that of a child of unknown sex whose age at death was somewhere between two and one half years and four and one half years. A second individual, Burial 115, was a woman who died between the ages of 25 and 35. The sex of four–Burials 151, 210, 270, and 392—of the five remaining individuals could be determined. All four were males (Figure 6). Age for three of the five remaining individuals could be estimated at 35 to 45 for Burials 151 and 210 and at 42.5 to 52.5 for Burial 392. The median of the estimated age at death range for each individual fell into the 40 to 49 year bracket (Figure 5). While these numbers are small, they do suggest a preference for supplying flowers for the graves of adult men.

Honewort-type appears to be less well represented on the Burial Ground chronological pollen diagram (Figure 8) from the Early and Late Group burials than from the Middle and Late-Middle Groups. Only one out of 22 counts from the Early and Late Groups exceeded five percent of the sum, while four out of 16 counts from the Middle and Late Middle Groups exceeded that sum. The averages of the combined grave fill and coffin lid percentages from the four burials —Early (2.25 %), Middle (3.38 %), Late Middle (4.1 %), and Late (1.65%) to which Phase II burials were assigned also appear to support this inference. These percentages are small but might reflect changes in funerary customs or the amount of honewort or close relatives available for picking in the cemetery. The early period data came from only two burials. The lower average for this period is attributable to the small amount (average 0.5 %) from the Burial 221 and may not be significant.

Thorow-Wax-type. Two other morphological varieties of carrot family were noted in the Burial 45 stomach sample during the Phase I analysis. One of these resembled the pollen produced by thorow wax (*Bupleurum americanum*), and the other looked like that of Queen Anne's lace (*Daucus carota*). Thorow wax-type contributed nine percent to this count, 67 percent perfectly preserved, but was not seen in any of the other seven exploratory samples. Thorow wax-type pollen was also noted in only three of the 62 Phase II samples (Table 2) and its representation did not exceed one percent.

Four species of thorow wax grow in the United States. Native thorow wax (*B. americanum*) is confined to the western Great Plains, Idaho, Oregon, and Alaska. Hare's ear (*B. roundifolium*), a plant introduced from Eurasia, does grow in the immediate New York City area, and two other introduced species, narrowleaf thorow wax (*B. ofontites*) and lanceleaf thorow wax (*B. lancifolium*), are reported from nearby states (USDA BULA3 2004). The thorow wax-type pollen in the Burial 45 sample could be from hare's ear, but some other member of the carrot family producing similar pollen could also be the source. The author has not been able to locate any references to the human exploitation of these plants. Hare's ear and other members of the same genus are attractive plants (USDA BULA3 2004), and it appears probable that the thorow-wax-type pollen came from plants in a floral funerary tribute. Its inclusion in the Burial 45 flora tribute does not appear to be part of a pattern, and it also appears that the thorow wax or relative included in the floral tribute was not gathered in the African Burial Ground.

<u>Queen Anne's Lace-type</u>. The seven percent Queen Anne's lace-type from the Burial 45 sample was only two percent higher than the representation of this type on the lid of Burial 112 and contained a somewhat smaller proportion of well-preserved pollen than the lid sample. Small quantities, one to three percent, of the type, including a few well-preserved pollen grains, were noted in four of the other Phase I exploratory samples. The type appeared in only three of the 62 Phase II samples and reached one percent in only

one of these three samples. The Queen Anne's lace-type pollen in the Burial 45 stomach sample may have been derived from the floral tribute indicated by the thorow wax -type and honewort-type pollen in the Burial 45 stomach sample, but it was not regularly employed in funerary rites at the African Burial Ground.

Buckwheat. The second potential economic pollen type among the African Burial Ground spectra, buckwheat, was represented in 11 of the 62 Phase II samples containing sufficient pollen to warrant analysis. The highest counts of this type were the one percent in the stomach of Burial 135 and two percent in the stomach of Burial 270. This pollen could be derived from *Fagopyrum esculentu,* the cultivated variety of buckwheat. These sums are not, however, sufficiently large to confidently interpret, and it is equally likely that the buckwheat pollen among the African Burial Ground spectra came from one or more of six species naturalized from Europe and Asia (Britton and Brown 1970:Vol. I: 671).

Cotton. The third potential ethnobotanical indicator among the African Burial Ground counts was a single pollen grain of cotton found in the Burial 25 grave fill sample. These plants are not native to the area. Given its location in grave fill, it probably did not arrive on clothing, and may be derived from industrial waste blown into the cemetery.

Eurasian cereal-type. Seventy five grains of Eurasian cereal-type pollen were found scattered through the spectra in quantities of one to seven grains. These might be ethnobotanical in origin. Rye (*Secale*) is wind-pollinated, or anemophilous. It produces large quantities of pollen and disperses it widely. In Europe it is regarded as one of the most reliable indicators of cultivation (Behre 1983:227). The other three Eurasian cereals--wheat (*Triticum*), barley (*Hordeum*), and oats (*Avena*) are autogamous (self-pollinating) and little pollen escapes until the grain is threshed (Vuorela 1973:10). These types are rare, or completely absent in Old World peat profiles, even when cultivation went on quite close by (Behre 1983:227). In modern samples they are more likely to be found dispersed with chaff along transportation routes within farms than in fields (Vuorela 1973:12). Significant quantities of pollen from these taxa have, however, been found in previously cultivated soils where agricultural waste and manure have been applied as fertilizer (the "plaggen" soils of European terminology), in threshing spoil, and in historic barn deposits (Behre 1983; Kelso 1994b; Kelso and Miller 1996). Large quantities of Eurasian cereal-type pollen have been found in all kinds of wheat flour; bleached, unbleached, wheat, and white (Williams-Dean 1978:151), and it survives baking in bread and pastries. The Eurasian cereal-type pollen in the African Burial Ground samples might reflect agriculture on the property before it became a cemetery. Where Eurasian cereal-type has been previously noted in North American historical-era agriculture-related sites, however, it has been accompanied by relatively high percentages of ragweed-type pollen (Kelso 1994; Kelso and Miller 1994). That is not the case here.

The size of most of the African Burial Ground Eurasian Cereal-type pollen grains also suggests that they do not have an agricultural origin. Eurasian cereal-type pollen is distinguished from the pollen of other grasses by its large size (ca. 40 to 59 microns diameter) and a pore annulus of at least 8 microns diameter (Faegri and Iversen

1964:196). One of these pollen grains was 49 microns in diameter and might be that of rye. The rest--44 microns at the greatest diameter--measured toward the lower end of the of the Eurasian cereal portion of the grass pollen size scale, where Eurasian cereal pollen sizes overlap with those of some native grasses; such as *Andropogon*, *Agropyron, Echinochloa*, *Elymus* (Mc Andrews, Berti, and Norris 1973:26). It appears most probable that non-domesticated grasses producing large pollen grains are the source of the Eurasian cereal-type pollen in the African Burial Ground spectra.

SUMMARY AND CONCLUSIONS

Pollen analysis was undertaken on 80 grave fill, coffin lid, and stomach area samples from the graves of 31 persons interred in the African Burial Ground in order to recover data providing information about (1) the diet or medicines of the deceased, (2) plants that might have been part of the burial customs of Africans during the colonial period, (3) the season the interments took place and (4) the landscape of the African Burial Ground. Adequate pollen to analyze was recovered from 62 of the 80 samples, including at least one sample from 28 of the 31 graves. Multiple samples with an adequate quantity for analysis were recovered from 24 of the 31 graves. Twenty three of the 74 pollen types identified were contributed by trees and the taller woody shrubs, while 48 came from herbs and shorter shrubs (non-arboreal pollen types). Aquatic plants contributed four of the non-arboreal pollen types. Only four of the 23 tree pollen types—chestnut, cedar family, pine, and oak—and only six of the 48 non-arboreal pollen types—ragweed-type, honewort-type, goosefoot-type, chicory-type, pea-family, aster-type (*Aster*-type), and grass family–were represented among the samples with sufficient consistency to be analyzed with confidence.

There are two constraints to defining ethnobotanical data and the season of interment for the individuals buried in the African Burial Ground. One problem is that the differences between the stomach samples and the grave fill and coffin lid samples may reflect distinctive vegetation assemblages in separate locations—Burial Ground and living or body preparation sites—rather than consumption of the parent plants or seasonal over-representation in the stomach samples. The second problem is that most of the pollen in the comparative samples—grave fill and coffin lids—is probably not contemporaneous with the stomach samples. The pollen in each of the comparative samples is a random segment of the rapidly changing vegetation record of the proto-historic and colonial periods that had percolated down into the soil over the previous 200 years and during the period between the day that the grave was filled and time that the Burial Ground was built over. Ethnobotanical data and season of interment were defined by comparing percentages of given pollen type in stomach samples with the average stomach sample percentage for that type.

Much of the landscape interpretation of the African Burial Ground data is based on comparison of the spectra with a contemporaneous segment of a profile from the Old Merchant's House, Manhattan, to the north on 4th Street. The pollen data registering the African Burial Ground landscape suggest that the flora was dominated by grass with some insect-pollinated herbs, such as relatives of goosefoot, chicory, asters; members of the pea sub-family; and, probably, some ragweed. Land clearance and tree removal on Manhattan and in the surrounding region are registered among the average total tree pollen percentage, but it does not appear that there were trees actually within the Burial Ground during the period from which we have data. The sedge pollen data suggest that the ground within the cemetery was moist, but not marshy, and does not register any changes in soil moisture across space or through time. One trend that is evident among the data recording landscape is a small increase in weedy taxa—aster relatives, goosefoot relatives, and chicory relatives—from Late Group burials. There is no similar increase in ragweed-type, suggesting that the increases in the other weedy types were not caused by cultivation or continuous soil disturbance. Non-cultivated plants related to asters, goosefoot, and chicory are most commonly found on formerly, but not actively, disturbed ground, and the larger quantities of these pollen types probably came from plants that colonized the landfill that was dumped in the area during the late 18th century (Chapter 3:5). Plants producing honewort-type appear to have decreased in numbers on the Burial Ground during the Late Period. Pollen evidence from seven stomach samples and one coffin lid sample suggests that these plants were used in funerary flower arrangements. The changes in the amount of this pollen type could reflect alterations in funerary customs or the quantities of the parent plants in the cemetery.

Pollen counts that may reflect the human use of plants (ethnobotanical data) were noted among the honewort-type, grass-family, pea family-type, goosefoot-type, chicory-type, thorow wax-type, and Queen Anne's lace-type spectra. The 16 percent goosefoot-type in the Burial 115 stomach, stomach compared to the one percent on the coffin lid, appears to record an incident of the consumption of goosefoot or amaranth seed or leaves in some form shortly before death. This may also be indicated by the 11.9 percent pea-family pollen in the Burial 192 stomach sample and the 12.6 percent of the same type in the Burial 392 stomach sample; as well as the 43.4 percent, the 58.9 percent, 52.2 percent, and 60.2 percent, respectively, grass pollen in the stomachs of Burials 155, 207, 366, and 6. The pea sub family pollen is insect-transported and very likely of ethnobotanical origin. It could be from flowers placed in the coffins. The pollen of non-domesticated grasses, on the other had is wind-transported. The high counts of this type could reflect the consumption of gathered seed but could also be the products of seasonal over-representation at the place where the bodies were prepared for burial. No patterns definitely indicating the habitual consumption of particular plants were evident among the pollen spectra.

Some herb pollen data from the African Burial Ground almost certainly indicate human use of the parent plants for non-dietary purposes. Chicory-type percentages from Burial 194 were high in both the stomach sample (20.3%) and the coffin lid sample (15.7%) compared to the grave fill sample (8%) and probably record flowers used in the funeral ceremony. Honewort percentages also appear to be significantly higher in stomach samples than the grave fill samples in Burials 45, 115, 151, 210, and 392 and in the stomach and coffin lid samples of Burial 270. It is unlikely that these counts reflect consumption of the parent plants. They are more reasonably attributed to floral tributes placed in and on the coffins. The Burial 45 bouquet appears to have also contained thorow wax and may have included Queen Anne’s lace as well. Four of the six individuals to receive flora tributes—Burials 151, 210, 270, and 392–were males, and the median ages at death of three of the seven individuals–Burials 151, 210, and 392—fell in the 40 to 49 years bracket. While these numbers are small, they do suggest a preference for supplying flowers for the graves of adult men. The honewort component of the bouquets could have been gathered in the Burial Ground itself, and the decline in the pollen of this type in Late Group burials could reflect alterations in funerary customs or the quantities of the parent plants in the cemetery.

The pollen counts providing ethnobotanical data may also record the season of interment of the individual involved. The grass counts of the Burials 155, 207, 366, and 6 stomach samples, if derived from consumed seed rather than more grass at the mortuary preparation location, suggest June, July, or August interments, and the pea sub-family percentages from the stomachs of Burials192 and 392 suggest May to August interments. The goosefoot-type pollen in the Burial 115 stomach is probably derived from food that would have been harvested during late Summer or early Fall. These resources could, of course, have been consumed from stored resources at some other time.

Season of interment determinations based on floral tributes rather than dietary elements may be less biased by the question of storage. The high honewort frequencies of the Burials 45, 115, 151, 210, and 392 stomach samples, as well as the Burial 270 coffin lid and stomach samples imply a June to September interments for those individuals. The chicory-type pollen in and on the Burial 194 coffin appears to also indicate summer burial (May and September). Although probably derived from the background pollen rain rather than food or floral tributes, the relatively high percentages of ragweed-type pollen in the stomachs of Burials 147, 192, and 415 suggest that those individuals died during the Fall, before the first heavy frost. The data were not adequate to suggest season of death for any other individuals.

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Table 1. African Burial Ground Phase I Raw Sums.

Burial	Sample	Oak	Chestnut	Pine	Hemlock	Cedar Family	Hickory	Birch	Hazel	Alder	Red Maple-type	Sugar Maple-type	Poplar	Elm	Tulip Tree	Buckthorn Family	Sweet Gum	Total Tree Pollen	Ragweed-type	Aster-type	Chicory-type	Wormwood-type	Goosefoot-type	Grass Family	Eurasian Cereal-type	Honewort-type	Thorow Wax-type	Queen Anne's Lace-type	Nightshade-type	Ground Cherry-type
45	Coffin Lid	18	11	5	1	3	3	1	0	1	0	0	2	0	1	0	0	42	9	4	4	1	1	17	2	0	0	2	1	1
45	Stomach	8	3	7	1	1	1	2	0	0	1	1	0	0	0	0	0	24	2	1	1	0	2	12	0	21	9	7	3	0
112	Coffin Lid	34	3	11	4	2	2	0	1	0	0	1	2	1	0	0	0	60	4	0	3	2	1	15	2	0	0	5	0	0
112	Stomach	19	4	6	3	5	5	0	0	0	0	0	0	0	0	1	0	37	8	2	4	1	2	27	0	2	0	1	0	1
115	Coffin Lid	14	1	5	1	2	2	0	0	0	0	0	0	1	0	1	0	24	7	1	5	1	1	1	0	2	0	0	0	1
115	Stomach	11	2	11	7	3	3	0	0	2	0	1	0	0	0	0	0	37	5	4	3	3	16	16	2	11	0	0	0	0
119	Coffin Lid	8	2	13	1	5	5	3	2	0	0	0	1	0	0	1	0	35	5	6	0	1	1	29	0	2	0	3	3	0
119	Stomach	21	4	5	0	3	3	1	1	1	0	0	0	0	0	0	1	36	7	3	2	1	1	38	0	2	0	3	0	1

Burial	Sample	Narrow Leaf Plantain-type	Broad Leaf Plantain-type	Pulse Family	Smartweed-type	Sheep-Sorrel-type	Pink Family	Barberry-type	Elderberry-type	Heath Family	Meadow-Rue	Marsh Rose-type	Sedge Family	Broad Leaf Cattail-type	Joint Fir	Not Identified	Too Degraded to Identify	Concentration per Gram
45	Coffin Lid	0	1	0	1	0	0	0	0	0	1	0	2	0	1	9	56	318
45	Stomach	1	2	5	0	0	1	1	1	1	0	0	2	0	0	4	47	371
112	Coffin Lid	0	0	0	0	0	1	1	0	0	0	0	0	0	0	6	61	547
112	Stomach	0	0	6	0	0	0	0	0	0	0	0	2	1	0	5	52	583
115	Coffin Lid	0	0	1	0	0	0	0	0	0	0	0	4	0	0	1	38	168
115	Stomach	0	0	0	0	0	0	0	0	0	0	0	2	0	0	3	24	279
119	Coffin Lid	0	2	1	0	0	0	0	0	0	0	1	2	0	0	6	39	543
119	Stomach	0	0	0	0	1	0	0	0	0	0	0	2	0	0	3	25	252

Table 2. African Burial Ground Pollen Types

ARBOREAL POLLEN TYPES	NON-ARBOREAL POLLEN TYPES
Acer saccharinum – Sugar Maple	*Ambrosia* – Ragweed-type
Acer rubrum – Red Maple	*Cryptotaenia* – Thorowax-type
Alnus – Alder	*Daucus-carota* – Queen Anne's Lace-type
Betula - Birch	*Artemisia* – Wormwood-type
Ostrya -Carpinus – Blue Beech-type	*Berberis* – Barberry
Carya – Hickory	Chenopodiaceae/*Amaranthis* – Goosefoot-type
Castanea – Chestnut	Convolvulaceae – Morning Glory Family
Corylus – Hazel	*Croton* – Croton-type
Curessaceae – Cedar Family	*Ephedra* – Joint Fir
Fraxinus - Ash	Ericaceae – Heath Family
Juglans – Walnut	*Gallium* – Bedstraw-type
Liquidambar – Sweet Gum	Geraniaceae – Geranium Family
Liriodendron – Tulip Tree	Lamiaceae – Mint Family
Morus – Mulberry	Liguliflorae – Chicory Sub-Family
Populus – Poplar/Cottonwood	Lamiaceae – Mint Family
Pinus – Pine	Malvaceae – Mallow Family
Quercus – Oak	Nyctagniaceae - Four O'clock Family
Rhamnaceae – Buckthorn Family	*Onethera* – Evening Primrose-type
Rhus – Sumac	Paplionaceae – Pea Sub-Family
Salix – Willow	*Pedicularis* - Lousewort
Sambucus – Elderberry-type	*Plantago lanceolate* – Narrow Leaf Plantain
Tilia – Basswood	*Plantago major* – Broad Leaf Plantain
Tsuga – Hemlock	Poaceae – Grass Family
Ulmus - Elm	*Polygala* – Milkwort -type
	Polygonaceae – Buckwheat Family
	Polygonum – Knotweed-type

Table 2 (continued). African Burial Ground Pollen Types

	Portulacaceae – Purslane Family
	Ranunculaceae – Buttercup Family
	Rosaceae – Rose Family
	Rosa palustrus-type – Marsh Rose-type
	Rumex – Sorrel
	Solanaceae – Nightshade Family
	Solanum – Nightshade-type
	Thalictrum- Meadow-Rue
	Trifolium – Red Clover
	Tubliflorae – Aster-type
	Uriticaceae – Nettle Family
	Cerealia – Eurasian Cereal-type
	Cryptotaenia-type – Honewort-type
	Gossypium – Cotton
	Fagopyrum – Buckwheat
	Cyperaceae – Sedge Family
	Potamogeton – Pondweed
	Sparagnum/Typha angustifolia – Narrow Leaf Cattail-type
	Typha latifolia – Broad Leaf Cattail

Table 3. African Burial Ground Phase II Raw Tree Pollen Sums

Burial Number	Description	*Acer saccharum*	*Acer rubrum*	*Alnus*	*Betula*	*Carpinus*	*Carya*	*Castenea*	*Corylus*	Cupressaceae	*Fraxinus*	*Juglans*	*Liquidambar*	*Liriodendron*	*Morus*	*Populus*	Pinaceae	*Quercus*	Rhamnaceae	*Rhus*	*Salix*	*Sambucus*	*Tilia*	*Tsuga*	*Ulmus*	**Total Arboreal Pollen**
6	Stomach									1			2				11	3						3		**20**
10	Coffin Lid			1	1			11		3							16	6						1		**38**
10	Stomach							2	1	1							28	3			1			4		**40**
18	Stomach				3	1		6		3							24	5						5		**47**
25	Grave Fill				2			2		3							43	3						10		**63**
25	Coffin Lid	1					2	3		3						1	13	12						5	1	**40**
25	Stomach	1				1		2		3							27	7						8		**48**
39	Coffin Lid			1		1		12		1	1						12	5	1					2		**35**
135	Grave Fill	1			2	1		10		5							17	11								**46**
135	Stomach			2	4	2		6		11							27	7			2			2		**61**
147	Coffin Lid	1		1	1			13		5						3	7	8	1							**38**
147	Stomach			2				12		7			1	1			7	11						1	1	**41**
151	Grave Fill			1				5		4							20	11			2			3		**45**
151	Coffin Lid			1	2			6		**4**							20	15			2			3		**52**
151	Stomach							14	2	5							22	17						2		**62**
155	Grave Fill	1		2	3	3	1	4	2	10			1			1	7	12			2			2	1	**49**
155	Stomach			2			1	5	3	8							2	18				1		3		**41**
191	Above Bone			1	2	3	1	12		4							4	13			1			2		**43**
191	Stomach	1				1	1	9	2	4			1			1	6	6								**31**
192	Grave Fill			1				7		3							14	7			2			1		**34**
192	Coffin Lid		1					4		1							13	1								**19**
192	Stomach	1						6		3						3	13	4			1					**30**

Table 3 (continued). African Burial Ground Phase II Raw Tree Pollen Sums

Burial Number	Description	*Acer saccharum*	*Acer rubrum*	*Alnus*	*Betula*	*Carpinus*	*Carya*	*Castenea*	*Corylus*	Cupressaceae	*Fraxinus*	*Juglans*	*Liquidambar*	*Liriodendron*	*Morus*	*Populus*	Pinaceae	*Quercus*	Rhamnaceae	*Rhus*	*Salix*	*Sambucus*	*Tilia*	*Tsuga*	*Ulmus*	**Total Arboreal Pollen**
194	Grave Fill						2	4		4							11	12	1						1	**35**
194	Coffin Lid						6		2	4							5	11	1							**29**
194	Stomach		1				11			2		1					4	5					1			**24**
207	Grave Fill						3	8		1							6	2								**20**
207	Coffin Lid						3	10		2							8	14							1	**38**
207	Stomach					2	2	6		2							6	3						6		**27**
210	Grave Fill			1	15			15	2	8				1		2	19	7				1		3		**73**
210	Stomach	1			2		2	13	1	6							14	8	2			2		2		**52**
221	Grave Fill						1	8		1						1	4	8	1					1		**25**
221	Coffin Lid	1		2	1		1	7		4			1			2	8	10								**34**
241	Grave Fill	1					1	1		1							29	8			1			2		**43**
241	Coffin Lid				2			19					2				6	10	2							**41**
243	Grave Fill						4			2							5	5	1					3		**20**
243	Stomach		2				4	9		1							3	7	1						1	**26**
259	Grave Fill			2		2	7	6	1			1					9	2						2		**30**
259	Coffin Lid		1	1			3	6		5							16	4			2					**36**
259	Stomach		1	2				3		3							8	5			2			1		**22**
266	Grave Fill					2	2	4		4						2	17	15						1		**47**
266	Coffin Lid				7	1	2	6		4						1	20	10			1			6		**58**
266	Stomach	1				1		4	1	2							10	8			2					**28**
270	Coffin Lid	2		2	7		1		1								12	9						6		**36**
270	Stomach				2	1		1	2		2		1				27	10						1		**47**
341	Grave Fill			2	1			7		3						1	27	7			1			1	1	**49**
341	Stomach				6			5	1	2							30	15							1	**60**

Table 3 (continued). African Burial Ground Phase II Raw Tree Pollen Sums

Burial Number	Description	*Acer saccharum*	*Acer rubrum*	*Alnus*	*Betula*	*Carpinus*	*Carya*	*Castenea*	*Corylus*	Cupressaceae	*Fraxinus*	*Juglans*	*Liquidambar*	*Liriodendron*	*Morus*	*Populus*	Pinaceae	*Quercus*	Rhamnaceae	*Rhus*	*Salix*	*Sambucus*	*Tilia*	*Tsuga*	*Ulmus*	**Total Arboreal Pollen**
351	Grave Fill				4		3										23	14			1					**45**
351	Coffin Lid				1		1	2		3							21	14								**42**
352	Grave Fill				1		2	6		2						1	14	8	2					5		**41**
352	Coffin Lid			2			2	2	2	2						1	18	12				1		4	1	**45**
352	Stomach							3		2							6	10		1				1		**23**
366	Coffin Lid			2		1		5		1							12	3	1		1			1		**25**
366	Stomach							7		3							13	1			1			1		**26**
379	Grave Fill			1				17		2			1				2	5						1		**28**
379	Coffin Lid		1					13	2	3							4	10					1			**33**
379	Stomach	2		1	1	2	2	9		1							11	13						1	3	**43**
384	Stomach						3	3		1							12	6								**25**
392	Grave Fill								2	7			1		1		17	8	1						2	**39**
392	Stomach							5	1	3							20	5		2				1		**37**
415	Grave Fill			1		1	2	9	2	1							22	9			1	1		1		**49**
415	Coffin Lid					1	1	7	1	2							23	12			2			1		**50**
415	Stomach			1				4									4									**8**

Table 4a. African Burial Ground Phase II Raw Herb Pollen Sums, *Ambrosia to Polygala*.

Burial Number	Description	*Ambrosia type*	Apiaceae *Bupleurem*	Apiaceae *Daucus*	*Artemisia*	*Berberis*	ChenoAm	Convolvulaceae	*Croton*	*Ephedra*	*Ericaceae*	*Gallium*	Geraniaceae	Lamiaceae	Liguliflorae	Liliaceae	Malvaceae	Nyctaginaceae	cf. *Onethera*	Paplionaceae	*Pedicularis*	*Plantago lanceolata*	*Plantago major*	Poaceae	Polygala
6	Stomach	18					5								1					15			2	122	1
10	Coffin Lid	26	1	1			2				2				15					13				83	
10	Stomach	20					5								7		3			8		1		95	
18	Stomach	44			1		8								12		2			16				45	
25	Grave Fill	15					3								15		3			9				87	
25	Coffin Lid	16					6								8		2		1	17				113	
25	Stomach	13		1			4						1		8		3			10				117	
39	Coffin Lid	47		1	1		7								5					17				77	
135	Grave Fill	26					3								24					11				87	
135	Stomach	29					15								5					4				58	
147	Coffin Lid	26			3		9					1			13		2			8				79	
147	Stomach	46					11								17					3				64	
151	Grave Fill	21					11								12					11				90	
151	Coffin Lid	13					8								13		1			15				91	
151	Stomach	9					2													6	1			87	
155	Grave Fill	44			1		12		1						6					3				61	
155	Stomach	12					8								9					13				90	
191	Above Bone	30					4								16					7				93	
191	Stomach	29	2				6								5	1				10		2		89	
192	Grave Fill	25					11								27					9				78	1
192	Coffin Lid	32					10								28		1			12		1		82	
192	Stomach	48					6			1					12	1				24				64	
194	Grave Fill	35					14								16					16				61	

Table 4a (continued). African Burial Ground Phase II Raw Herb Pollen Sums, *Ambrosia to Polygala*.

Burial Number	Description	*Ambrosia type*	Apiaceae *Bupleurem*	Apiaceae *Daucus*	*Artemisia*	*Berberis*	ChenoAm	Convolvulaceae	*Croton*	*Ephedra*	*Ericaceae*	*Gallium*	Geraniaceae	Lamiaceae	Liguliflorae	Liliaceae	Malvaceae	Nyctaginaceae	cf. *Onethera*	Paplionaceae	*Pedicularis*	*Plantago lanceolata*	*Plantago major*	Poaceae	Polygala
194	Coffin Lid	40					5								32					5				78	
194	Stomach	35					6								41		2			10				66	
207	Grave Fill	30					10								20					25				86	
207	Coffin Lid	21	2				4			1					14					28				76	
207	Stomach	19					6							1	4					16				123	
210	Grave Fill	50					10								5					8				52	
210	Stomach	55					8								5					10				45	
221	Grave Fill	37					1	1							24					27				61	
221	Coffin Lid	22					5								19		1			17			1	80	
241	Grave Fill	32					6								18					10				78	
241	Coffin Lid	22		2			10								14					14				87	
243	Grave Fill	46					18				1				17					8				82	
243	Stomach	27					13								19					17				72	1
259	Grave Fill	21					6				1				8					14				106	
259	Coffin Lid	24					3								13					14			1	87	1
259	Stomach	32		1			10								8				2	7				113	
266	Grave Fill	9					3								12					7				109	
266	Coffin Lid	19					13								8				1	14				80	
266	Stomach	14					6								15					10				111	
270	Coffin Lid	14		2			6					1			4					16				98	
270	Stomach	12					4								3					12				91	
341	Grave Fill	35					7								10					8				66	
341	Stomach	42					9								7	1				5				60	
351	Grave Fill	26																		4		1		103	

Table 4a (continued). African Burial Ground Phase II Raw Herb Pollen Sums, *Ambrosia to Polygala*.

Burial Number	Description	*Ambrosia type*	Apiaceae *Bupleurem*	Apiaceae *Daucus*	*Artemisia*	*Berberis*	ChenoAm	Convolvulaceae	*Croton*	*Ephedra*	*Ericaceae*	*Gallium*	Geraniaceae	Lamiaceae	Liguliflorae	Liliaceae	Malvaceae	Nyctaginaceae	cf. *Onethera*	Paplionaceae	*Pedicularis*	*Plantago lanceolata*	*Plantago major*	Poaceae	Polygala
351	Coffin Lid	15					2								7					8				102	
352	Grave Fill	29					6								5					9				110	
352	Coffin Lid	17					2								6					10				99	
352	Stomach	41					2								2		1	1		10				104	
366	Coffin Lid	58					9								20		2			9				63	
366	Stomach	33					2								4					10				105	
379	Grave Fill	38					10							1	6					20				87	
379	Coffin Lid	27					8						2	1	8		1			18				89	
379	Stomach	32				1	11								11				1	10				70	
384	Stomach	42					15								2		3			17				81	
392	Grave Fill	42					8								6	1				12				65	
392	Stomach	48					6								4	1				26				41	
415	Grave Fill	18					5							1	5					26				75	
415	Coffin Lid	22		1			7								1					24				80	
415	Stomach	55		1			10								20					21				77	

Table 4b. African Burial Ground Phase II Raw Herb Pollen Sums, Polygonaceae to *Typha latifolia*.

Burial Number	Description	Polygonaceae	*Polygonum*	Portulaceae	Ranunculaceae	Rosaceae	Rosa Palustrus-type	*Rumex*	*Solanaceae*	*cf. Solanum*	*Thalictrum*	*Trifolium*	*Tubliflorae*	Urticaceae	*Cerealia*	Apiaceae *Cryptotaenia type*	*Gossypium*	*Fagopyrum*	*Cyperaceae*	*Potamogeton*	*Sparagnum/Typha angustifolia*	*Typha latifolia*
6	Stomach												6		1	11			1			
10	Coffin Lid								1				5	1		10						
10	Stomach												3			14			5			
18	Stomach		2					1	1				5	2	2	14			1			
25	Grave Fill								3				5			4	1	1	2			
25	Coffin Lid									2			3			6			3			
25	Stomach															8						
39	Coffin Lid							1	4							5						
135	Grave Fill		2										4		2	3			1			
135	Stomach												6	4		11		2	5			
147	Coffin Lid	3											9			4		1	1			1
147	Stomach												9	5		1			3			
151	Grave Fill												8			6						
151	Coffin Lid												2			5						
151	Stomach							1					3	2		26						
155	Grave Fill					1							3	2	4	8			3			1
155	Stomach	1	1										14	3	4	3			4			
191	Above Bone								1				2	1	4	4		1				

Table 4b (continued). African Burial Ground Phase II Raw Herb Pollen Sums, Polygonaceae to *Typha Latifolia*.

Burial Number	Description	Polygonaceae	*Polygonum*	Portulaceae	Ranunculaceae	Rosaceae	Rosa Palustrus-type	*Rumex*	*Solanaceae*	*cf. Solanum*	*Thalictrum*	*Trifolium*	*Tubliflorae*	Urticaceae	*Cerealia*	Apiaceae *Cryptotaenia type*	*Gossypium*	*Fagopyrum*	*Cyperaceae*	*Potamogeton*	*Sparagnum/Typha angustifolia*	*Typha latifolia*
191	Stomach						1		1				4	1	4	13						1
192	Grave Fill												8	3		1			2		2	
192	Coffin Lid								1				7	2	1	5			4		1	
192	Stomach								1				1	4	2	5			1	1		
194	Grave Fill		1						3				15			2		1	2			
194	Coffin Lid								2				10						1			
194	Stomach												15									
207	Grave Fill								2				12	3	1				1			
207	Coffin Lid								4				6	2	1							
207	Stomach					2							4	2	1			1				
210	Grave Fill			1				1					2	2		3			2			
210	Stomach												3			20			1		1	
221	Grave Fill							2	3				13		2				5			
221	Coffin Lid				1			2	3				6		1	2			4			
241	Grave Fill								1				4			5			2			
241	Coffin Lid								2						2	11						
243	Grave Fill		1			2			2					2		1						
243	Stomach		1						1				8	1	3	1			2	2	3	
259	Grave Fill								2				8						2		1	1
259	Coffin Lid												4	2	2	9		1	2		2	
259	Stomach												2		4	6						

Table 4b (continued). African Burial Ground Phase II Raw Herb Pollen Sums, Polygonaceae to *Typha Latifolia*.

Burial Number	Description	Polygonaceae	*Polygonum*	Portulaceae	Ranunculaceae	Rosaceae	Rosa Palustrus-type	*Rumex*	*Solanaceae*	*cf. Solanum*	*Thalictrum*	*Trifolium*	*Tubliflorae*	Urticaceae	*Cerealia*	Apiaceae *Cryptotaenia type*	*Gossypium*	*Fagopyrum*	*Cyperaceae*	*Potamogeton*	*Sparagnum/Typha angustifolia*	*Typha latifolia*
266	Grave Fill												3		1	1					2	
266	Coffin Lid								2				6		6	7						
266	Stomach											2	5			8		1	1		1	
270	Coffin Lid								2				3		1	14			2			
270	Stomach								1				5		3	16		4				2
341	Grave Fill					1		2					5	3	1	6			1			
341	Stomach												7			7		1	2			
351	Grave Fill												1	2		13			1		1	
351	Coffin Lid												2	1		18			1			
352	Grave Fill						1	2					1		2	5			1			
352	Coffin Lid						2						3	2	3	11			1			
352	Stomach						1				1		3		4	10						
366	Coffin Lid												7	2		4			2			
366	Stomach											1		1	2	16			1			
379	Grave Fill												9									
379	Coffin Lid					2			1				6	2					2			
379	Stomach												7			10		1	3			
384	Stomach												3		2	1			4			

Table 4b (continued). African Burial Ground Phase II Raw Herb Pollen Sums, Polygonaceae to *Typha Latifolia*

Burial Number	Description	Polygonaceae	*Polygonum*	Portulaceae	Ranunculaceae	Rosaceae	Rosa Palustrus-type	*Rumex*	*Solanaceae*	*cf. Solanum*	*Thalictrum*	*Trifolium*	*Tubliflorae*	Urticaceae	*Cerealia*	Apiaceae *Cryptotaenia type*	*Gossypium*	*Fagopyrum*	*Cyperaceae*	*Potamogeton*	*Sparagnum/Typha angustifolia*	*Typha latifolia*
392	Grave Fill		1					1	1				6	2	1	7			4		2	
392	Stomach		4								1		5	1	5	23			1			
415	Grave Fill								7				3		2	7					2	1
415	Coffin Lid								4				5			3					1	
415	Stomach											1	5			4						

Table 5. African Burial Ground Phase II Matrix Formation Process Indicators.

Burial Number	Description	Unknown	**Total Pollen**	Indeterminate	**Pollen Concentration per gram**
6	Stomach		**203**	12	4314.1
10	Coffin Lid	2	**200**		3706.7
10	Stomach	3	**204**	25	2606.8
18	Stomach		**203**	18	496.0
25	Grave Fill		**211**	13	2349.0
25	Coffin Lid		**217**	69	7463.0
25	Stomach		**213**	36	2425.9
39	Coffin Lid	1	**201**	10	3601.1
135	Grave Fill	1	**210**	35	563.0
135	Stomach	2	**202**	62	1035.4
147	Coffin Lid	4	**202**	25	801.2
147	Stomach	3	**203**	39	1615.4
151	Grave Fill	1	**205**	11	4551.3
151	Coffin Lid		**200**	23	3380.0
151	Stomach	2	**201**	28	5213.0
155	Grave Fill	1	**200**	49	1735.3
155	Stomach		**203**	55	2821.4
191	Above Bone	3	**209**	12	1130.6
191	Stomach		**200**	39	2496.5
192	Grave Fill	2	**203**	29	4581.3
192	Coffin Lid	1	**207**	31	2720.7
192	Stomach	1	**202**	17	4676.7

Table 5(continued). African Burial Ground Phase II Matrix Formation Process Indicators.

Burial Number	Description	Unknown	**Total Pollen**	Indeterminate	**Pollen Concentration per gram**
194	Grave Fill		**201**	17	2620.2
194	Coffin Lid	2	**204**	15	3157.3
194	Stomach	3	**204**	15	3272.4
207	Grave Fill	5	**215**	4	4426.0
207	Coffin Lid	3	**200**	27	2010.0
207	Stomach	4	**209**	14	6684.3
210	Grave Fill		**209**	83	813.0
210	Stomach		**200**	50	943.7
221	Grave Fill	1	**202**	16	3824.8
221	Coffin Lid	5	**203**	41	4688.2
241	Grave Fill	1	**200**	15	1711.3
241	Coffin Lid	1	**206**	18	940.0
243	Grave Fill	3	**203**	3	3985.0
243	Stomach	8	**205**	15	3769.2
259	Grave Fill	4	**204**	31	3883.9
259	Coffin Lid	2	**203**	23	6895.2
259	Stomach	2	**209**	17	8773.2
266	Grave Fill	6	**200**	35	1883.4
266	Coffin Lid	3	**217**	16	5263.1
266	Stomach	1	**203**	17	10201.6
270	Coffin Lid	1	**200**	7	5569.2

Table 5(continued). African Burial Ground Phase II Matrix Formation Process Indicators.

Burial Number	Description	Unknown	**Total Pollen**	Indeterminate	**Pollen Concentration per gram**
270	Stomach		**200**	30	5764.6
341	Grave Fill	6	**200**	35	1410.5
341	Stomach	3	**204**	19	565.2
351	Grave Fill	3	**200**	26	3503.6
351	Coffin Lid	2	**200**	25	1952.3
352	Grave Fill	2	**214**	21	5995.8
352	Coffin Lid		**201**	23	17666.4
352	Stomach		**203**	17	30004.7
366	Coffin Lid	1	**202**	23	1355.9
366	Stomach		**201**	13	2741.3
379	Grave Fill	1	**200**	19	1329.9
379	Coffin Lid	2	**202**	37	1547.7
379	Stomach	3	**203**	48	3427.9
384	Stomach	7	**202**	28	3660.6
392	Grave Fill	2	**200**	36	2345.0
392	Stomach	4	**206**	38	2325.5
415	Grave Fill	1	**202**	23	6408.6
415	Coffin Lid	2	**200**	30	3708.0
415	Stomach		**202**	15	2266.5

G.3. Macro-Plant Analysis (Leslie E. Raymer)

APPENDIX G.3.

MACRO-PLANT ANALYSIS

(The following text is excerpted and adapted from a draft preliminary report authored by Leslie E. Raymer, New South Associates, March 2004. The draft report was provided by New South Associates in partial fulfillment of a sub-contract to Howard University. Data tables prepared by Raymer follow.)

Methods:

Soil samples were collected from several hundred graves located within the African Burial Ground in Manhattan during archaeological investigations that were conducted at the location of the proposed 290 Broadway Federal Office Building site between 1991 and 1992. Samples were taken from coffin lids, coffin fill, grave shaft fill, and the stomach and pelvic regions of most of the excavated interments. All bulk soil samples from these proveniences were subsequently floated in Shell Mound Archaeological Project-type (hereinafter SMAP) flotation devices by Mr. William Sandy and New South Associates, Inc. staff members in order to retrieve macroplant remains for archaeobotanical analysis.

Fifty-three soil samples from 22 inhumations were analyzed in 1998 by New South Associates staff members and subconsultants as part of a Phase I feasibility study of the research potential of macroplant, palynological, and parasitological studies at the African Burial Ground site (Raymer et al. 1998). It was hoped that preservation of macroplant remains, pollen, and parasites would be adequate enough to aid in answering such questions as the burial practices of the enslaved African-Americans using the Burial Ground in the seventeenth and eighteenth centuries, the inclusion of burial offerings by African population of New York, the evolution of the landscape within the burial ground, the degree of parasitism in the burial population, and the preservation of ingested food remains at the time of death. This preliminary analysis demonstrated that macroplant and pollen preservation was adequate enough to warrant analysis of additional soil samples. The parasite study yielded no results and consequently further parasitological studies were not conducted.

Phase II archaeobotanical analysis of 190 flotation light fractions and 34 heavy fractions from 100 inhumations was conducted by New South Associates in 2003. The pollen analysis is being conducted by Dr. Gerald Kelso and Arizona State University under a separate contract. This report represents a management summary and preliminary analysis of macroplant remains recovered from 224 samples submitted to New South Associates for archaeobotanical analysis in 2003.

One hundred and ninety 0.33 to 2.0 liter flotation samples were floated by Mr. William Sandy and New South Associates staff members. The samples were subjected to machine-assisted water separation in two Shell Mound Archaeological Project (SMAP) type flotation machines (Pearsall 1989; Watson 1976). The heavy fraction insert of the system utilized by New South Associates was screened with 0.8 mm mesh. The heavy fraction insert of the Sandy machine is not known. In the laboratory, each flotation light fraction was weighed, and then passed through nested geologic sieves (4.0 mm, 2.0 mm, 1.0 mm, 0.71 mm, 0.5 mm). Each size-graded light fraction was fully sorted under low magnification (8-40x). All of the material that was greater than 2.0 mm was pulled from the sample matrices and was quantified by material type, weight, and count. Material that was smaller than 2.0 mm was sorted, but only charred and uncharred seeds were removed. Thirty-four flotation heavy fractions were sorted in order to verify the flotation separation, which seems to have been excellent.

Two comparison ratios (species ubiquity, species density) were utilized to study the macroplant remains. In ubiquity analysis, the occurrence of each plant type is expressed as a percentage of the total number of proveniences in which a particular taxon is present. This measure ascribes equal weight to the physical presence of a given taxon, regardless of the abundance of that plant type in a particular sample. Therefore, a sample that contains one seed of a given taxon is equivalent to a sample containing several hundred of the same seed. This offers a way to assess the relative importance of various plant species and gives an indication of how common each plant type is at the site. Ubiquity analysis is utilized in the analysis of plant food remains to assess the relative importance and meaning of the seed assemblage.

The analytical procedure of Species Density was used to quantify the macroplant remains associated with each site area and burial component (lid versus grave shaft versus coffin content samples). Species Density measures the count or weight of a plant taxon per liter of processed soil. This measure allows a comparison of the relative densities of different plant taxa and is useful for standardizing raw count/weight data. In this preliminary study, density measures were used to calculate the count density of all seeds and each category of macroplant remains found in each area of the burial ground and from each sampled area of each burial.

Table G.3.1 presents raw counts of all seeds and counts and weights of wood charcoal recovered from the light fractions; Table G.3.2 presents data from the heavy fractions; Table G.3.3 lists the identified wood charcoal assemblage; and Table G.3.4 lists the common and Latin names, economic uses, and season of availability for the species identified.

Overall recovery:

Light fractions

Macroplant remains associated with the 190 flotation light fractions (124.44 liters of flotation) consisted of 5,739 uncharred seeds from 24 plant taxa, 3.31 grams of greater than 2.0 mm wood charcoal (297 fragments), and 8 pine needle fragments. The recovery of wood charcoal was miniscule; the overall wood charcoal weight density was a mere 0.027 grams per liter of floated soil. The count density of seeds was a modest 45.1 seeds per liter of floated soil. This count density is much lower than that which is typically encountered in urban historic site settings in the northern United States. This difference is likely a consequence of the unique setting of this site (Colonial era African-American cemetery) relative to other urban sites (domestic settings with deep shaft features such as wells and privies). However, the lower counts may also be an artifact of poor seed preservation. This possibility cannot be ruled out, given the evidence for possible poor preservation that was found in the cultural features associated with younger deposits overlying the burial ground (see Raymer and Bonhage-Freund 2000).

The macroplant assemblage from the African Burial Ground samples, while modest in numbers, is quite diverse. Twenty-four categories of seeds were identified, including nine economically important plants (4 fruits, 1 vegetable, 1 nut, 2 condiments, 1 ornamental), 8 naturally occurring edible and/or medicinal herbs (including Jimsonweed), and 7 non-economic weeds/weedy grasses (see Table 1). Undeniably archaeological, uncharred specimens of the majority of these taxa are often preserved in eighteenth and nineteenth-century contexts, particularly in deep shaft features such as privies and wells (Wheaton et al. 1990; Cummings 1993; Raymer and O'Steen 1993, 1994; Cummings and Puseman 1994; O'Steen et al. 1995a, 1995b; O'Steen and Raymer 1995; Raymer 1993, 1995, 1996, 1997, 1998, 1999, 2000; 2002, 2003a; Raymer et al 1997).

The species diversity of the burials macroplant assemblage, like its overall numbers, is similar to that of the non-burial cultural features at the 290 Broadway site (21 taxa were identified) reported by Raymer and Bonhage-Freund in 2000.

Ninety-eight percent (N=5,621) of the Burial Ground macroplant assemblage originated from a single weedy taxon, jimsonweed. Jimsonweed is a naturalized weed. The seeds were found in 83 percent of the analyzed flotation samples. Jimsonweed was also highly abundant and ubiquitous within the nineteenth-century cultural features that overlay the Burial Ground.

The entire seed assemblage is analyzed in this study. Often, only carbonized seeds are interpreted as being unquestionably associated with archaeological deposits. Uncharred seeds are frequently excluded from macroplant analyses because they are interpreted as modern intrusions into archaeological deposits (Lopinot and Brussell 1982; Miller 1989; Minnis 1981). Several studies have assessed problems associated with the long term preservation of uncharred seeds in open-air sites in mesic environments (Miksicek 1987; Miller 1989). Uncharred seeds are rarely preserved for many years in open-air, moist soils and are poorly preserved in open-air, dry soils (Miksicek 1987). However, when suitable environmental conditions exist, fresh seeds will last for long periods of time (Miller 1989: 50).

Because the African Burial Ground site (Broadway Block) was occupied in the recent past, the likelihood of recovering uncharred seeds from the archaeological deposits is greatly increased. Extensive studies of macroplant assemblages from nineteenth-century archaeological sites conducted by the author and others have shown that even the most fragile seeds are frequently preserved in both features and midden deposits, particularly when the sites are rapidly and deeply buried (Cummings 1993; Cummings and Puseman 1994, O'Steen et al 1995a, 1995b; O'Steen and Raymer 1995; Raymer 1993, 1995, 1996, 1997, 1998, 1999; Raymer et al 1997; Raymer and O'Steen 1993, 1994; Wheaton et al 1990). With this in mind, the origins and antiquity of each plant taxon are carefully assessed.

The entire African Burial Ground seed assemblage from graves is uncharred. This was likewise the case with the overlying cultural features that were analyzed in 2000 (Raymer and Bonhage-Freund 2000). Burial component features with seeds included grave shafts, coffin lids, and coffin contents. Both the burial surfaces and early post-cemetery cultural features at the Burial Ground site were deeply buried by later building episodes. These sealed contexts provide optimal conditions for the long term preservation of uncarbonized seeds. The thick layer of overlying fill reduces the possibility of the insertion of modern seeds into these features after they were abandoned. Keepax

(1977) and Bocek (1986), in separate studies of agents of postdepositional bioturbation, have shown that the majority of modern seeds are found in the upper 50 centimeters of a given soil column. The Burial Ground graves were covered by far more than 50 centimeters of fill. The evidence suggests that the entire uncharred seed assemblage dates to the time of the site's occupation and use. Further evidence lies with the seeds themselves. Most of the seeds are obviously old, and many are mineralized, which greatly increases the durability of uncharred macroplant remains in more shallow feature contexts.

A brief examination of the distribution of seeds and wood charcoal from each of the general site areas indicates that there are considerably fewer seeds found in burials from the Southeast area relative to the North and South areas. Wood charcoal densities (when smoothed out by density measures) are uniformly small and similar between the three areas. The recovery of seeds was as follows from each of the site areas:

> North area (27 burials, 54 light fractions-30 liters of float): 1.68 grams of wood charcoal; 2,244 seeds; 74.8 seeds/L of floated fill.
>
> South area (44 burials, 77 light fractions-44.12 liters of float): 0.52 grams of wood charcoal; 2,322 seeds; 52.6 seeds/L.
>
> Southeast area (13 burials, 24 light fractions-23.49 liters of float): 0.70 grams of wood charcoal; 254 seeds; 10.8 seeds/L.
>
> Fence line (15 burials, 35 light fractions-30 liters of float): 0.41 grams of wood charcoal; 801 seeds; 26.7 seeds/L.

Heavy fractions

Analysis of 34 flotation heavy fractions indicates that flotation separation of the soil samples was excellent. Macroplant remains found in the heavy fractions consisted of 0.31 grams of wood charcoal (39 fragments) and 189 jimsonweed seeds.

Wood charcoal

Sixty-eight flotation light fractions contained wood charcoal. No more that 26 fragments of wood were found in any individual context. Most samples yielded far less than 10 fragments. Wood charcoal identifications were only possible on 59 wood fragments from 19 light fractions. Wood found in other samples was either too small or fragmentary to classify. The identified wood charcoal assemblage was placed into eight analytical categories (hardwood, hickory, red oak, white oak, pine, hophornbeam, walnut, elm). Sixteen fragments could only be identified to the general category of indeterminate hardwood. The remaining 43 fragments were at least identifiable to the genus level. The identified wood charcoal consisted of 12 hickory, 9 red oak, 1 white oak, 10 pine, 1 hophornbeam, 1 walnut, and 1 elm.

Assemblage composition:

This section presents a discussion of the seeds and other plant parts recovered from the African Burial Ground. The specifically identified seed taxa are broken into seven broad categories based on their presumed economic importance. These are condiments, fruits, vegetables, nut-bearing shade trees, ornamental herbs, edible/medicinal herbaceous plants, and herbaceous weeds/grasses. The first four categories represent definite economically important food and ornamental plants. Evidence will be presented that the edible herbaceous plants also represent utilized plant remains as well. The herbaceous weeds and grasses probably represent naturally deposited yard weeds. The uses and natural environments of each plant taxa are presented in this section.

<u>Condiments</u>

Four hundred and eighty-six seeds from two condiments (mustard, parsley) were found in five burial contexts. These remains were exclusively associated with coffin lid and control contexts. The heavy weighting toward coffin lid samples offers tantalizing evidence that these seeds may represent burial offerings placed on the caskets.

Mustard

Approximately 100 species of mustard (*Brassica* sp.) are found in the northern temperate parts of the Eastern Hemisphere (Bailey 1949). The mustards, many of which were introduced from Europe and Asia, are annual herbaceous plants that are common noxious weeds of old fields, roadsides, and other waste places. Bailey (1949) discusses 18 domesticated species of *Brassica,* including cabbage, cauliflower, broccoli, cresses, radishes, and brussel sprouts. The young leaves of mustard plants are consumed as a salad green and cooked as a potherb. The seeds are used as a seasoning for meats and salads and in the production of table mustard (Gillespie 1959; Hall 1976).
Mustards were widely used folk remedies and commonly prescribed by nineteenth-century physicians. Indeed, mustard was so popular among physicians that it is mentioned in virtually every medical text published in the nineteenth century (Crellin and Philpott 1989). The most common use for mustard seeds was in the application of heat-producing poultices for the topical treatment of respiratory ailments, lumbago, rheumatism, and strains (Angier 1978; Crellin and Philpott 1989). The seeds were taken internally as a cough medicine, emetic, and laxative (Angier 1978; Krochmal and Krochmal 1973).

Parsley

Parsley is a biennial herb that was commonly grown in eighteenth and nineteenth-century herb gardens. This garden herb only rarely escapes from cultivation. Favretti and Favretti (1990) and Leighton (1987) list this plant as a garden vegetable and culinary herb that was popular in America in the latter half of eighteenth century and throughout the nineteenth century. The leaves were added to as a flavoring in both raw salads and cooked vegetables, and were used as a garnish for meat dishes. Parsley has a long history of medicinal use. Crellin and Philpott (1989) state that this herb was a popular herbal medicine in the 1700s in both Europe and the Americas. Among other uses, parsley was believed to increase the flow of breast milk and act as an effective diuretic.

Fruits

Four varieties of economically important fruits, apple, blackberry/raspberry, blueberry, elderberry were retrieved from the light fractions. Blackberry seeds (N=34) were recovered from 16 proveniences including 6 stomach samples, 3 lid samples, 4 graveshaft, and 3 unknown contexts. This diversity suggests that either (a) some seeds represent stomach contents and others were inserted into the grave fill from overlying cultural deposits or (b) that all seeds represent non-burial related seed rain that was incidentally inserted into the graves. This seems unlikely, given the depth of the grave shafts. A single apple seed originated from one grave shaft sample. Blueberry seeds were found in two burial samples collected from the sacral area of two inhumations. These seeds may represent undigested foodstuffs. Finally, elderberry seeds were found in 2 stomach, 2 control, and 1 lid contexts.

Apple

The common apple, *Malus pumila,* a member of the rose family, is a common domesticate throughout Europe, Asia, and North America (Root 1980). Bailey (1949) states that approximately 25 species grow wild in the northern temperate zone of both hemispheres. The common apple was introduced to the New World by the first European colonists. The Pilgrims apparently planted apples shortly after their arrival in Massachusetts. The governor of the Plymouth Colony purchased 200 acres of land from another colonist in 1649 that contained a three year old apple orchard made up of 500 trees. By 1741, apples were being exported from New England to the West Indies (Root 1980). Since its introduction, this small domesticate, which seldom exceeds 20 feet in height, has escaped cultivation and become widely naturalized in the eastern United States (Bailey 1949; Britton and Brown 1970; Radford et al. 1968). Apples have long been prized as a health preservative; the fresh fruits, apple cider, apple vinegar, and bark have been used as home cures for ailments such as diarrhea, constipation, upset stomach, bilious ailments, fever, and scurvy. Apple bark was apparently in regular use in the eighteenth century (Crellin and Philpott 1989). Rafinesque (1828-1830) stated in his early nineteenth-century medical treatise that the bark had medicinal properties similar to cherry bark. The pharmaceutical company Parke-Davis marketed an extract of apple bark in the 1890s as a tonic and a medicine for the reduction of fevers. In addition to the fresh fruit and bark of this popular domesticate, apple cider and apple vinegar enjoyed minor medical reputations in the nineteenth century. Apple cider was regarded as a treatment for "putrid fever" and vinegar was sometimes sprinkled in sickrooms as an air purifier (Crellin and Philpott 1989:61).

Blackberry/Raspberry

Shrubs of the genus *Rubus,* (refers to all *Rubus* sp., including blackberries, dewberries, raspberries, etc.) were apparently a prized fruit in nineteenth-century American households, as blackberry/raspberry seeds are virtually ubiquitous in nineteenth-century archaeobotanical assemblages in the United States. Blackberry/raspberries, which are distributed throughout the eastern United States, commonly form thickets along fence rows and roadsides, within old fields, and other disturbed habitats. The succulent berries are available for harvest from the late spring through midsummer (Bailey 1949; Radford et al 1968). The berries are eaten fresh, prepared as a fresh fruit beverage, and made into jellies, jams, pies, and wine (Fernald and Kinsey 1958; Gillespie 1959; Hall 1976; Medve and Medve 1990; Peterson 1977).

Rubus fruits were highly regarded as a virtual medicinal panacea throughout the nineteenth century, both by professional medical practitioners and in folk medicine. Griffith, in his influential Medical Botany (1847), extolled the value of blackberry root as an astringent medicine (diarrhea treatment). Teas made from dried blackberry/raspberry root bark were used to control diarrhea, as a blood purifier, and as a spring tonic. Dried blackberry roots were sold commercially in the nineteenth century. Finally, decoctions of the roots were gargled for sore throats and to cure mouth ulcers. Berry juice, which was used as a diarrhea cure and to control upset stomachs, was stored in the form of blackberry brandy and a thick syrup. (Angier 1978; Coon 1963; Crellin and Philpott 1989; Krochmal and Krochmal 1973).

Blueberry

Blueberries, *Vaccinium* sp., were apparently a prized fruit in nineteenth-century American households, as blueberry seeds are common constituents of nineteenth-century archaeobotanical assemblages in the eastern United States. Approximately 150 species are found in the United States, several of which are cultivated for their edible fruit and as ornamentals (Bailey 1949). Blueberries favor acidic soils, and flourish in a wide variety of habitats including both dry and moist woodlands, swamps, and dry, rocky settings at high altitudes. These shrubs and small trees often form dense thickets in the wild, in both upland and lowland settings (Bailey 1949; Britton and Brown 1970).

Bailey (1949) discusses nine species that are cultivated in the United States. The blueberry, along with huckleberry, is a member of the heath family (Ericaceae). In the wild, blueberry fruits are available for harvest in June and July (Britton and Brown 1970). Blueberries were eaten fresh, preserved by drying and as jams and jellies, and used as ingredients in a variety of prepared dishes. Blueberries were stewed, added to fruit pies, made into muffins and tarts, and mixed with other fruits in summer puddings (Angier 1974; Gillespie 1959; Hall 1976; Peterson 1977). Root (1980) reports that wild blueberries are consumed as often as domesticated varieties in the United States.

Blueberries were chiefly valued as a folk medicine in nineteenth-century America, however, their medicinal value was also mentioned in such influential medical treatises as Griffith (1847) and Rafinesque (1828-30). Blueberries were used in the nineteenth century as an astringent and diuretic medicine (Crellin and Philpott 1989; Krochmal and Krochmal 1973). Griffith (1847) stated that the fruit, leaves, and root bark were useful in the treatment of mouth sores, diarrhea, and other bowel complaints. Rafinesque (1828-30) discussed this taxon as a diarrhea cure. The berries were once rendered into a syrup-like beverage that was consumed for chronic dysentery. The leaves and root bark were made into a tea that was administered as a treatment for sore throats and diarrhea (Angier 1978; Krochmal and Krochmal 1973).

Elderberry

Like blackberry/raspberry, elderberry seeds are found in most archaeobotanical assemblages in the East. About 20 species of elderberries (*Sambucus* sp.) occur in the temperate and subtropical regions of both hemispheres. Five species are commonly cultivated (Bailey 1949). Elderberries grow in moist soils bordering field edges or swamps. This deciduous shrub or small tree, which grows from 5 to 30 feet tall, flowers in the spring and fruits in October. Elderberry trees are found throughout North America and Europe in moist woods, roadside ditches, thickets, stream banks, and marsh edges (Angier 1974; Coon 1963; Radford et al 1968).

Elderberries were principally grown in the nineteenth century for food, medicine, and ornamentation. Both native and imported varieties were planted as garden and yard ornamentals in the late eighteenth and nineteenth centuries (Favretti and Favretti 1990; Leighton 1987). Crellin and Philpott (1989) report that elderberry bushes were planted around American homes so that the plant would be readily available for the production of medicine. Both imported European *elder (Sambucus nigra*) and native elderberry (*S. canadensis*) were employed in nineteenth-century domestic medicine in America. Elderberry was used to treat skin conditions, as a purgative, and as a diuretic (Crellin and Philpott 1989). Its popularity apparently declined in the latter half of the nineteenth century (Griffith 1847). The dried inner bark was commonly prescribed as a purgative in the past. Ointments made from the crushed leaves were applied to bruises and sprains and thickened fruit juice was administered internally for coughs and colds. The dried flowers, which were once listed in the United States Pharmacopoeia, were used as a topical treatment for sunburn, to relieve itching, and to remove freckles (Coon 1963). Elderberry has been used in folk remedies as a cureall for "abrasions, asthma, bronchitis, bruises, burns, cancer, chafing, cold, dropsy, epilepsy, fever, gout, headache, neuralgia, psoriasis, rheumatism, skin ailments, sores, sore throat, swelling, syphilis, and toothache" (Duke 1992:423).

The primary edible portions of the elderberry are its fruits and flowers. The fruits were eaten fresh, made into wine and tea, processed for jellies and jams, added to pancake and muffin batter, and used as pie filling. The flower clusters were added to pancake, waffle, and muffin batter, made into tea, battered and fried as fritters, made into tea, and made into sweet-smelling wine (Fernald and Kinsey 1958; Gillespie 1959; Hall 1976; Medve and Medve 1990; Peterson 1977). Green blossoms were pickled and served in place of capers (Bryan and Castle 1974; Hedrick 1972). Elderberries may have been planted on the lots, since these weedy shrubs are easily propagated in crowded urban settings. The fruits were probably also available for purchase in city markets.

Vegetables

A single maize cupule was recovered from a coffin-lid sample taken from Burial 415 (SAL) in the Southeastern site area. This is the only domesticated grain recovered from this analysis. This cob element may have originated from a burial offering placed on the coffin.

Nutmast

Acorn shell was recovered from a coffin lid soil sample from Burial 397. Did this macroplant remain originate from a burial offering? Or is it simply the remains of a rodent buried nut? Oaks (*Quercus* sp.) are one of the most economically important hardwood species found in North America. Approximately 70 taxa are found in the United States, fifty-eight of which are trees. Britton and Brown (1970) discuss 25 species that are commonly found in the northeastern United States. Oaks grow in virtually every ecological niche in the eastern woodlands, from dry upland ridges to rich alluvial bottomlands (Britton and Brown 1970; Radford et al 1968). Oaks are used for fuel, building materials, food, medicine, shade and ornamentation, tannin, and cork. Oak acorns provide a rich and reliable food source for both humans and wildlife. The nuts are ground for flour, which made excellent muffins and pancakes. Acorns can be roasted and used as a coffee substitute. Acorns from white oaks are more palatable than red oaks, due to the higher levels of tannic acid found in the red oak acorns. Red oak acorns are more bitter, and must be soaked several times in boiling water prior to their consumption (Angier 1974; Gillespie 1959; Peterson 1977). Oaks were deliberately planted around dwellings in the nineteenth century as shade trees and for their acorns (Favretti and Favretti 1990; Leighton 1987).

Oaks have a long history of medicinal use in America, both as a home remedy and by professional medical doctors. Oak bark tea was consumed as a treatment for sore throat and diarrhea. Concoctions of oak bark and leaves were also used as external astringent and antiseptic medications, for the treatment of burns, skin sores, and ulcers (Crellin and Philpott 1989; Krochmal and Krochmal 1973). Acorns were only used medicinally when bark and leaves were unavailable. Griffith, in his influential *Medical Botany* (1847), provided detailed descriptions on the medical value and uses of oaks. White oak *(Quercus alba)* and black oak *(Quercus velutina)* were considered the most valuable species for medical uses in nineteenth-century America (Crellin and Philpott 1989).

Ornamentals

A single ornamental, geranium, is represented in the graveshaft fill sample of Burial 210. This seed may have originated from an ornamental plant growing in the cemetery. Britton and Brown (1970) record 10 species of geraniums in the Northeastern United States and Canada. These plants, most of which are naturalized from Europe and Asia, are common field weeds throughout the Northeast. Geraniums fruit from May to September. Geraniums were grown by Euro-Americans as garden ornamentals from the seventeenth through the nineteenth century in the eastern United States (Leighton 1986, 1987; Favretti and Favretti 1990). This plant is not recorded as edible. Geranium, particularly the native variety, Geranium maculatum, have a widespread reputation as an astringent medicine. The rhizomes (alum root) were dried and used in the treatment of dysentery, diarrhea, sore throats, and mouth ulcers (Cox 1985). Geranium roots were used medicinally from the Colonial Period throughout the nineteenth-century by both lay people and medical professionals (Crellin and Philpott 1989).

Naturally Occurring Edible Herbaceous Plants and Non-Economic Weeds/Grasses

Edible Herbaceous Plants

Fifty-two seeds are derived from seven naturally occurring edible herbaceous plants. These taxa are commonly recovered from contexts that indicate they often represent food remains. These taxa, like the previously discussed definite economically important plants, derive from a variety of sample contexts that make definitive interpretation as either food remains or incidentally included natural seed rain difficult. It is possible that these seeds derive from both cultural and non-cultural sources. For instance, goosefoot was found in eight proveniences, including 3 lid, 3 grave fill, and 2 stomach samples. Hopefully fine scale analysis will aid in determining which is the more likely explanation.

Bedstraw

Bedstraw is an annual or perennial herb that is native to edge zones and woods in the East (Radford et al 1968). Bedstraw is found both in dry, wooded areas and in saturated areas such as swamps and wetland meadows. Bedstraw fruits ripen between May and August. This plant derives its name from its apparent use a bedding material, although it has been documented as being used for medicinal purposes as well (Cox 1985). The young shoots of this herb are eaten both as a salad green and cooked as a potherb. The fruits have been used as a coffee substitute (Medve and Medve 1990). This taxa sustains a minor reputation as a medicinal herb; it has been used as a diuretic, to increase urine flow, as an appetite stimulant, to reduce fevers, and to cure vitamin C deficiencies.

Carpetweed

Carpetweed, *Mollugo verticillata*, is an annual herbaceous weed that was introduced to the United States from the American tropics. This noxious weed, which is commonly found in sandy soils in old fields, gardens, and yards, is now virtually ubiquitous throughout North America (Britton and Brown 1970; Cox 1985). Carpetweed greens may be cooked and eaten as a potherb or added to salads as a fresh green (Cox 1985). This plant has become popular in recent decades as a nutritional supplement (Crellin and Philpott 1989).

Carpetweed was never very popular as a domestic medicine in the United States. It was apparently completely ignored by professional medical practitioners in the nineteenth century (Crellin and Philpott 1989). According to Cox (1985), carpetweed has a minor reputation as a treatment for diarrhea and mouth and throat sores. Crellin and Philpott (1989) also attribute diuretic properties to this plant. No definite research has proven or disproved this plant's purported use as a diuretic and cholesterol lowering agent (Crellin and Philpott 1989).

Goosefoot

Goosefoot (*Chenopodium album*), also known as lambsquarters, has long been valued as a nutritious wild plant food. This annual herbaceous plant, which grows in disturbed habitats, is a common weed growing around human habitations throughout the continental United States (Britton and Brown 1970; Radford et al 1968). A single plant can produce up to 100,000 seeds. Young goosefoot leaves are cooked as a spinach-like potherb, eaten raw in salads, or added to soups, and the seeds can be ground for flour or consumed as a cereal (Cox 1985; Fernald and Kinsey 1958; Hall 1976; Gillespie 1959; Hedrick 1972; Medve and Medve 1990; Peterson 1977). Goosefoot greens and seeds have been used historically as a gathered dietary supplement. Euroamerican pioneers reportedly added goosefoot flour to breads, cookies, muffins, and pancakes (Duke 1992). Goosefoot seeds were mixed with wheat to extend the crop in times of famine in Europe (Krochmal and Krochmal 1973). Several species of *Chenopodium* were cultivated in the nineteenth century as medicinal herbs and garden ornamentals (Favretti and Favretti 1990; Leighton 1987). Lambsquarters (*Chenopodium album*) was not recorded in the literature reviewed for this report as a medicinal herb (Angier 1978; Coon 1963; Cox 1985; Crellin and Philpott 1989; Duke 1992; Foster and Duke 1990; Grieve 1931; Krochmal and Krochmal 1973; Massey 1942; Millspaugh 1884).

Maygrass

Maygrass grains were recovered from the grave fill and stomach area soil samples collected from a single North area burial (Burial 210). Maygrasses (also known as canarygrass, *Phalaris* sp.) are cool season annual or perennial grasses that favor moist habitats. Three species of maygrass grow in the northeastern United States and Canada. Two varieties are naturalized (*P. arundinacea, P. canariensis*) while the third, *Phalaris caroliniana,* is native (Britton and Brown 1970). The native variety was widely cultivated by Prehistoric Period Native Americans in the eastern United States for its nutritious starchy grains, which were ground into flour. Fernald and Kinsey (1958) record historic use of this plant for food in the United States. Maygrass grains were recovered by the author from midden contexts associated with African American nineteenth-century slave cabins at the Hermitage Site in Tennessee (Raymer 1997).

Pokeweed

Pokeweed, *Phytolacca americana*, is an indigenous North American herbaceous weed that grows along the entire eastern seaboard, from Quebec to Florida. Pokeweed favors rich, low ground in open wooded areas, pastures and fields, and disturbed areas. The crimson berries, whose juice has been used as a food and wine coloring, paint pigment, dye, and ink substitute, are available for harvest from May until first frost (Cox 1985; Radford et al 1968).

Young pokeweed shoots and leaves are harvested and consumed as a potherb. The young stalks can be cooked and eaten like asparagus or pickled and stored for later consumption.

The leaves are cooked as a spinach-like potherb (Cox 1985; Gillespie 1959; Hall 1976). The young leaves are canned and stored for future use in the Appalachians (Krochmal and Krochmal 1973). The shoots of this herb have been, and still are, cultivated in the United States. Cox (1985) found gardeners cultivating pokeweed in southern Missouri and Gillespie (1959) stated that this plant was still sold commercially in West Virginia in the 1950s. Pokeweed was imported into Europe, where it is still cultivated as a garden vegetable (Angier 1974; Cox 1985; Hall 1976). Pokeweed was widely used as a folk remedy during the eighteenth and nineteenth centuries in the United States (Cox 1985; Crellin and Philpott 1989; Krochmal and Krochmal 1973; Massey 1942). Indeed, this plant was in such high regard among both laymen and professional medical practitioners that it became known as a virtual cure-all during the nineteenth century. The principal medicinal value attributed to this plant was as a cure for rheumatism. In eighteenth and nineteenth-century America, pokeweed roots and berries were widely prescribed as treatments for rheumatism, skin conditions, syphilis, and as a laxative (Crellin and Philpott 1989). A 1912 survey of physicians referenced in Crellin and Philpott's (1989) monograph on herbal medicine found that pokeweed was still a popular botanical remedy in the early twentieth century. Early settlers used pokeberry juice to treat skin conditions; dried leaves were used to make poultices that were applied as a topical treatment for sore eyes, wounds, and ulcers (Coon 1963; Krochmal and Krochmal 1973). The roots were once gathered by pharmaceutical companies for commercial sale as an emetic (Angier 1978).

Purslane

Purslane, *Portulaca oleracea,* is an annual herbaceous weed that was introduced to the United States from southern Europe. This plant, which fruits from May to October, is a widely distributed weed that grows in lawns, cultivated fields, along roadsides, and within virtually every disturbed habitat throughout the United States (Cox 1985; Radford et al 1968). Purslane seeds are virtually ubiquitous in historical archaeological contexts in the eastern United States.

Like goosefoot and pigweed, both the greens and seeds of purslane are edible. The young shoots and leaves, which can be gathered throughout the summer and regenerate rapidly after picking, are added to raw salads, cooked as a green vegetable, and added to soups and stews as a thickener. The stems can be preserved by pickling. The seeds can be ground for flour, which is mixed with wheat flour in order to add flavor to baked goods (Cox 1985; Gillespie 1959; Hall 1976). In the past, purslane was cultivated in Yemen and Brazil; consumed as a potherb in Burma; added to soups and pickled in Italy and France; and consumed as a salad green in England (Hedrick 1972). Indeed, the French have developed an upright variety that is cultivated as a potherb (Bailey 1949).

Purslane has a minor reputation as a medicinal herb in the United States, particularly in the seventeenth and eighteenth centuries. Favretti and Favretti (1990) list this plant as a culinary and medicinal herb that was grown in American gardens from 1600 until 1776. It is not mentioned as an American garden plant in the nineteenth century (Favretti and Favretti 1990; Leighton 1987). Purslane was used in the sixteenth century to relieve indigestion and as an appetite stimulant. Astringent properties were also attributed to it, making it a useful remedy for hemorrhoids, heavy menstruation, and bloody fluxes. The Puritans reputedly consumed purslane in the seventeenth century as a scurvy preventative (Crellin and Philpott 1989).

The evidence suggests that purslane was not highly valued by nineteenth-century Euroamericans, either as a potherb or an herbal medicine. According to Hedrick (1972), and Crellin and Philpott (1989), this herb was more popular in Europe than it was in America. Cobbett, in his *American Gardener,* which was published in 1846, disdained purslane as a noxious weed that was eaten as a famine food by Frenchmen and pigs when nothing else was available (Hedrick 1972). Crellin and Philpott (1989) found little evidence that purslane was a popular medicine in nineteenth-century America, however, it was accepted as a treatment for diarrhea and as a preventative for scurvy. Parke-Davis, a pharmaceutical firm, sold a liquid form in the 1890s which the company touted as a diuretic and refrigerant (Crellin and Philpott 1989).

Smartweed

The smartweeds, *Polygonum* sp., which are available for harvest in the summer, are common herbaceous weeds of disturbed habitats throughout the United States and Canada (Britton and Brown 1970; Radford et al 1968). Britton and Brown, in their *Illustrated Flora of the Northern United States and Canada* (1970), discuss 14 species of *Polygonum.* Smartweeds are common throughout the eastern United States in alluvial settings and disturbed areas (Britton and Brown 1970; Radford et al 1968).

The seeds and greens of these herbaceous plants have long been utilized as a gathered dietary supplement in the United States, with the roots, seeds, and bulbs all being used for food. The smartweeds are most highly prized for their seeds, which are ground into flour for baking or parched and eaten as a cereal. The leaves and shoots are eaten fresh in salads and cooked as a potherb. The rootstalks of some species are valued as a potato substitute (Angier 1974; Gillespie 1959). Gillespie (1959) states that some varieties of smartweed were also used as a pepper substitute. The smartweeds, particularly *Polygonum hydropiper* and *Polygonum aviculare,* have a reputation in folk medicine as an astringent, a diuretic, and a tonic. The smartweeds were best known in nineteenth-century America for their supposed diuretic and astringent qualities (Crellin and Philpott 1989). Smartweed was apparently not a very popular herbal medicine among nineteenth-century medical professionals, since it was generally only briefly mentioned in medical treatises, and Griffith (1847) stated that this taxon was rarely prescribed as a medicinal remedy.

Medicinal Herbaceous Plant - Jimsonweed

Jimsonweed, *Datura stramonium,* is a widely naturalized endemic weed that grows abundantly on garbage heaps (Millspaugh 1884). This taxa, which is extremely poisonous, was planted in nineteenth-century gardens as an ornamental flower and is recorded as a narcotic, medicinal herb (Crellin and Philpott 1989; Leighton 1987). Bonde (nd) records the use of this taxa for its narcotic qualities since medieval times in northern Europe and North Africa, in China and India, and in the

East Indies. She records use of this taxa for its narcotic qualities in the New World by Peruvian Indians, the Aztecs, tribes in the southwestern United States and northern Mexico, and by Historic Period Algonquin Indians in Virginia. The Algonquins used this powerful hallucinogen as part of their rites of passage for their young men when they passed into adulthood.

Jimsonweed is recorded as a medicinal herb that although extremely poisonous, was used as an antispasmodic, topical treatment for skin conditions, antiasthmatic, and sedative (Crellin and Philpott 1989; Krochmal and Krochmal 1973). All parts of the plant are to some degree toxic, especially the seeds. The most common use of this herbaceous weed was as a treatment for the spasmodic coughing associated with asthma. The plant was burned and the smoke was inhaled by the asthma sufferer. The plant juices, flowers, leaves, and roots were also made into salves and poultices that were variously used as topical treatments for sores, boils, pimples, swellings, and skin ulcers (Crellin and Philpott 1989; Krochmal and Krochmal 1973). Crellin and Philpott (1989) reiterate the value of this plant as an inhalant for asthma patients and state that jimsonweed cigarettes are available today in some parts of the world.

<u>Non-economic Weeds and Grasses</u>

Fifteen seeds from seven weedy herbs and grasses with minimal economic potential were recovered from the flotation light fractions. These taxa were only found in one to three samples each (13 total). Only three of the thirteen samples is associated with coffin interior contexts. The other 10 derived from lid, control, and grave fill contexts.

Composite Family

A single unknown composite family taxa was recovered from one burial context (Burial 214, coffin fill). This weedy annual likely represents a non-economic weed that was growing in the project locality. Since it is too deteriorated to specifically identify, it is not possible to determine if it is a weed or utilized variety of this highly diverse plant family.

Nightshade

Nightshade (*Solanum* sp.) is a highly poisonous weed that is a common invader of disturbed areas (Britton and Brown 1970; Radford et al. 1968). Britton and Brown (1970) discuss nine species that grow wild in the northern United States and Canada. Nightshade is inedible, and this taxon is not planted as a garden ornamental. Indeed, this plant is widely regarded as a noxious weed. Nightshade has a minor reputation as a medicinal remedy. Authors of nineteenth-century medical texts discuss this genus as a treatment for diarrhea and rheumatism (Crellin and Philpott 1990). Millspaugh (1884) recommends nightshade as a resolvent to treat dropsy, gastritis, nervous afflictions, and syphilis. Nightshade was listed in the United States Pharmacopoeia in 1880.

Sedge Family

Two sedge family taxa were recovered. These include bulrush (*Scirpus* sp.), and sedge (*Carex* sp.). Both of these taxa are regarded as noxious weeds in the United States. Neither of these weedy species are recorded as medicinal herbs, and only two sedge family species -- great bulrush (*Scirpus validus or S. acutus*) and chufa (*Cyperus esculentus*) -- are recorded as edible (Angier 1978; Coon 1963; Cox 1985; Crellin and Philpott 1989; Duke 1992; Foster and Duke 1990; Grieve 1931; Krochmal and Krochmal 1973; Massey 1942; Millspaugh 1884). Hence, it is likely that these seeds represent naturally occurring weeds rather than remnants of economic plants.

Thirty-one genera of bulrush are recorded by Britton and Brown (1970) as growing in the Northeast. These annual and perennial herbaceous plants frequent wet habitats such as ditches and marshes. Britton and Brown (1970) list more than 242 sedges (*Carex* sp.) in their *Illustrated Flora of the Northern United States and Canada.* Both sedge family genera fruit throughout the summer and early fall and grow in disturbed habitats and ditches. Most members of the sedge family are regarded as endemic weeds with no economic value.

Two sedge family taxa, bulrush (*Scirpus validus or S. acutus*) and chufa (*Cyperus esculentus*) are recorded as food plants. The tubers of chufa (*Cyperus esculentus*), which are cultivated in many parts of the world and have a long history of use as food, can be eaten raw, boiled as a vegetable, or dried and ground into flour. The dried tubers have also been ground and used as a coffee substitute (Hall 1976; Peterson 1977). Great bulrush (*Scirpus validus or S. acutus*), which grows in marshy locations throughout the United States, produces edible pollen, shoots, seeds, and rootstocks. The rootstock, which was highly regarded by Native Americans as source of starch and sugar, can be ground for flour or used as a potato substitute. The seeds and pollen can be used for flour and the shoots can be cooked as a potherb (Hall 1976; Medve and Medve 1990; Peterson 1977). Bulrush roots can also be chewed to help alleviate thirst.

Grasses

At least three grass taxa were recognized, including crabgrass, goosegrass, and an unknown grass. Goosegrass is a native of Asia that is widely naturalized in the United States. It is an endemic weed of yards, fields, and waste places. Crabgrass is a common annual weed of sandy soils that is frequently found in lawns, gardens, and old fields. Both crabgrass and goosegrass are common constituents of urban nineteenth-century archeobotanical assemblages. These grass taxa likely represent yardweeds that grew naturally on the lots.

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Table G.3.1. Light Fraction Wood Charcoal and Identified Seed Assemblage

Burial	Catalog Number		General site area	Sample location				Medicinal Herb	Fruit				Vegetable	Nut	Condi-ment		Orna-mental	Edible Herb							Weed		Weed-Grass			Weed		
					Volume	Wood Char Ct	Wood Char Wt	Jimsonweed	Apple	Blackberry	Blueberry	Elderberry	Maize Cupule	Acorn Shell	Mustard	Parsley	Geranium	Bedstraw	Carpetweed	Goosefoot	Maygrass	Purslane	Pokeweed	Smartweed	Bullrush	Composite	Crabgrass	Goosegrass	Grass Family	Nightshade	Sedge	Pine needles
6	219	SBL	S	Stomach	0.50	4	0.02	13										1	4													
6	219	SCL	S	Grave fill storage	0.62	1	0.02	2												1												
7	218	SAL	S	Soil above lower extremity	0.50			17		1																						
7	218	SBL	S	Abdominal area beneath lid	0.50			2																								
9	233	SAL	S	Above coffin lid	0.50																											
9	233	SBL	S	Stomach	0.50			9																								
10	234	SAL	S	Above coffin lid	0.50	2	0.02	187														11						1				
10	234	SCL	S	Stomach	0.50			83																								
15	286	SAL	S	Inside coffin	0.50			7																								
16	326	SAL	S	Grave fill	0.50			20																								
16	326	SBL	S	Midsection of skeleton	0.50	11	0.06	19																								
18	310	SAL	S	Top of coffin	0.50																											
18	310	SBL	S	Stomach	0.50																											
23	383	SBL	S	Inside Pelvis	0.50					3																						
23	383	SCL	S	Control	0.50					3																						
25	358	SAL	S	Aove coffin lid	0.50			117																								
25	358	SBL	S	Stomach	0.50																											
35	458	SAL	S	Above lid	0.50			9	1	2																			1			
35	458	SBL	S	Stomach	0.50			8																								
37	46	SAL	S	Coffin interior	0.50																											
64	803	SAL	S	Stomach	0.50			2																								
65	806	SAL	S	Within coffin	0.50			3																								
67	810	SAL	S	Above coffin	0.50			23																								
67	810	SBL	S	Stomach	0.50	1	0.02	36																								
67	810	SCL	S	Control	0.50	2	0.02	84							1																	
69	808	SAL	S	above coffin	0.50			10																								
69	808	SBL	S	Stomach	0.50			4																								
101	843	SCL	S	Lid	0.50	9	0.11	96		1																			1			
128	873	SAL	S	Stomach	0.50																											
128	873	SBL	S	Lid	0.50			1																								
135	880	SAL	N	Lid	0.33																											
135	880	SBL	N	Stomach	0.50			1																								
135	880	SCL	N	Control	0.50	2	0.01	20																								
142	887	SAL	S	Above lid	0.50			2																								
142	887	SBL	S	Above lid	0.50			2		1																						
142	887	SCL	S	Pelvis	0.50	1	0.01																									
145	890	SAL	S	Coffin lid	0.50			87																								

G.3.1. - 1

Table G.3.1. Light Fraction Wood Charcoal and Identified Seed Assemblage

Burial	Catalog Number		General site area	Sample location				Medicinal Herb	Fruit				Vegetable	Nut	Condi-ment		Orna-mental	Edible Herb							Weed		Weed-Grass			Weed		
					Volume	Wood Char Ct	Wood Char Wt	Jimsonweed	Apple	Blackberry	Blueberry	Elderberry	Maize Cupule	Acorn Shell	Mustard	Parsley	Geranium	Bedstraw	Carpetweed	Goosefoot	Maygrass	Purslane	Pokeweed	Smartweed	Bullrush	Composite	Crabgrass	Goosegrass	Grass Family	Nightshade	Sedge	Pine needles
145	890	SBL	S	Control sample coffin fill	0.50	4	0.04	83																							1	
145	890	SCL	S	Control sample coffin fill	0.50	2	0.01	15															1									
146	891	SAL	S	Lid	0.50			239																						1		
146	891	SBL	S	Coffin fill	0.50			364																								
147	892	SAL	N	Above coffin fill	0.50			6												2												
147	892	SBL	N	Stomach	0.50			2																								
148	893	SAL	S	Lid	0.50	2	0.02	4																								
148	893	SBL	S	Burial pit fill control sample	0.50	3	0.02.	11																								
151	896	SAL	N	Lid	0.50	1	0.01	24																								
151	896	SBL	N	Stomach	0.50			8																								
155	900	SAL	S	Lid	0.50			1																								
155	900	SBL	S	Stomach	0.50																											
157	902	SAL	N	Lid	0.50	26	0.37	1												1												
159	905	SAL	N	Lid	0.50			3																								
159	905	SBL	N	Stormach	0.50			1																								
164	916	SAL	N	Lid	0.50			6																	1							
164	916	SBL	N	Stomach	0.50			1																								
165	919	SAL	N	Belly soil	0.50			2																								
176	942	SAL	S	Coffin lid	0.50			2																								
176	942	SBL	S	Struc. A Stomach	0.50			9																								
180	960	SAL	N	Struc. B Lid	0.50	2	0.02	14																								
180	960	SBL	N	Struc. B Stomach	0.50			5																								
180	960	SCL	N	Control	0.50	6	0.06	67				1								2												
181	967	SAL	N	Stomach	0.50			13		1																						
181	967	SBL	N		0.50	18	0.18	75																								
181	967	SCL	N	Grave fill	0.50	1	0.01	20																								
183	971	SCL	N	Coffin interior	0.50			35		1																						
186	987	SAL	N	Stomach	0.50			2																								
186	987	SBL	N	Coiffin lid	0.50	5	0.04	37																								
190	1017	SAL	N	Above coffin lid	0.50			6																								
190	1017	SBL	N	Stomach	0.50																											
191	1081	SAL	N	Pelvic	0.50			4																								
191	1081	SBL	N	Coffin lid Struc. C	0.50	2	0.01	8																								
191	1081	SCL	N	Control fill	0.50			2																								
192	1088	SAL	fence	Lid Sample	0.50			9																								
192	1088	SBL	fence	Stomach soil	0.50			8																								
194	1109	SAL	N	Above lid	0.50			3																								

G.3.1. - 2

Table G.3.1. Light Fraction Wood Charcoal and Identified Seed Assemblage

								Medicinal Herb	Fruit				Vegetable	Nut	Condi-ment		Orna-mental	Edible Herb							Weed		Weed-Grass			Weed		
Burial	Catalog Number		General site area	Sample location	Volume	Wood Char Ct	Wood Char Wt	Jimsonweed	Apple	Blackberry	Blueberry	Elderberry	Maize Cupule	Acorn Shell	Mustard	Parsley	Geranium	Bedstraw	Carpetweed	Goosefoot	Maygrass	Purslane	Pokeweed	Smartweed	Bullrush	Composite	Crabgrass	Goosegrass	Grass Family	Nightshade	Sedge	Pine needles
194	1109	SBL	N	Stomach	0.50	5	0.4																									
197	1152	SAL	fence	Lid	0.50			58																					1			
197	1152	SBL	fence	Stomach	0.50			6																								
202	1171	SAL	S	Stomach	0.50						2																					
202	1171	SBL	S	Burial pit fill control sample	0.50			2																								
207	1181	SAL	S	Above coffin lid	0.50	5	0.03	1																								
207	1181	SBL	S	Stomach	0.50																											
209	1184	SAL	N	Lid	0.50			4																								
209	1184	SBL	N	Stomach	0.50																											
210	1185	SAL	N	Burial pit fill	0.50	4	0.03	1141		2							1			4	2											
210	1185	SCL	N	Gut	0.50	15	0.09	113													1											
212	1189	SAL	fence	Coffin	0.50			4																								
212	1189	SBL	fence	Stomach	0.50			1																								
214	1191	SAL	S	Lid	0.50			68																	1							
214	1191	SBL	S	Head area	0.50			219																		2						
221	1206	SAL	S	Lid	0.50			4																								
221	1206	SBL	S	Stomach	0.50																											
221	1206	SCL	S	Control sample	0.50			17																								
226	1212	SAL	S	Lid	0.50																											
230	1216	SAL	N	Lid	0.50	3	0.02	23		2																						
230	1216	SBL	N	Stomach	0.50			8		1																						
235	1221	SAL	S	Coffin lid	0.50			16																								
235	1221	SBL	S	Above coffin lid	0.50			86																								
238	1224	SBL	S	Coffin lid	1.00			18																								
238	1224	SCL	S	Stomach	0.50			23																								
241	1228	SAL	N	Lid	0.50			42																								
241	1228	SBL	N	Stomach	0.50			10																								
242	1229	SAL	N	Coffin lid	0.50			19												1												
242	1229	SBL	N	Stomach	0.50	2	0.03	24																								
243	1230	SAL	N	Stomach sample	0.50	6	0.05	71		1																					1	
243	1230	SBL	N	Control sample coffin fill	0.50	7	0.03	142												2												
250	1239	SAL	S	Lid sample	0.50			3																								
253	1242	SAL	S	Lid Sample	0.50			12							4					1										2		
254	1243	SAL	S	Lid	0.50																											
254	1243	SBL	S	Controal	0.50	1	0.01																									
259	1249	SAL	N	Lid	0.50	3	0.07	4								1																1
259	1249	SBL	N	Pelvis sample	0.50			5				1																				

G.3.1. - 3

Table G.3.1. Light Fraction Wood Charcoal and Identified Seed Assemblage

Burial	Catalog Number		General site area	Sample location				Medicinal Herb	Fruit				Vegetable	Nut	Condi-ment		Orna-mental	Edible Herb							Weed		Weed-Grass			Weed		
					Volume	Wood Char Ct	Wood Char Wt	Jimsonweed	Apple	Blackberry	Blueberry	Elderberry	Maize Cupule	Acorn Shell	Mustard	Parsley	Geranium	Bedstraw	Carpetweed	Goosefoot	Maygrass	Purslane	Pokeweed	Smartweed	Bullrush	Composite	Crabgrass	Goosegrass	Grass Family	Nightshade	Sedge	Pine needles
262	1256	SAL	N	Stomach	0.50	3	0.03	66			1	1																				
262	1256	SBL	N	Control	0.50	2	0.02	15																	1							6
266	1262	SAL	N	Coffin lid	0.50	2	0.02	36																								
266	1262	SBL	N	Stomach	0.50			5																								
270	1266	SAL	S	Lid sample 1	1.00			2																								
270	1266	SCL	S	Lid sample 2	0.50			2																								
276	1273	SAL	N	Stomach	0.50	2	0.02	32																								
276	1273	SBL	N	Control, screened	0.50	8	0.08	52																								
282	1301	SAL	S	Stomach	0.50			1																								
289	1321	SBL	S	Control	0.50			9		1																						
289	1321	SAL	S	Coffin lid	0.50			1																								
290	1324	SBL	S	Stomach	0.50																											
304	1460	SAL	fence	Above coffin lid	0.50			1																								
304	1460	SBL	fence	Stomach	0.50																											
305	1469	SAL	N	Coffin lid	0.50			2																								
305	1469	SBL	N	Control	0.50	2	0.02	12																								
306	1474	SAL	fence	Lid	0.50	2	0.01	9														3		1								
306	1474	SBL	fence	Stomach	0.50			2																								
310	1486	SAL	fence	Soil above lid	0.50			1																								
310	1468	SBL	fence	Stomach	0.50																						1					
316	1521	SBL	S	Stomach	0.50			1																								
323	1565	SAL	N	Stomach	0.50			21																								
326	1584	SBL	S	Stomach	0.50	1	0.01	31																								
328	1589	SAL	fence	Coffin lid	0.50	3	0.01	5																								
328	1589	SBL	fence	Stomach	0.50																											
329	1603	SAL	fence	Stomach	0.50	5	0.06	53		2																						
329	1603	SBL	fence	Control	0.50	1	0.01	24																								
333	1613	SAL	SE	Lid	0.50	5	0.04	1																								
335	1616	SAL	SE	Lid	1.50	1	0.02	12																								
335	1616	SBL	SE	Stomach	0.50			2																								
337	1628	SAL	N	Lid	0.50	3	0.03	27												2												
337	1628	SBL	N	Stomach	0.50	2	0.03	4																								
338	1630	SBL	S	Stomach	0.50	2	0.02	8																								
340	1651	SAL	SE	Lid	0.50																											
340	1651	SBL	SE	Lid	0.50			1																								
340	1651	SCL	SE	Stomach	0.50			5																								
340	1651		SE	Control-Burial pit	0.50	2	0.02	2																								

G.3.1. - 4

Table G.3.1. Light Fraction Wood Charcoal and Identified Seed Assemblage

Burial	Catalog Number		General site area	Sample location				Medicinal Herb	Fruit				Vegetable	Nut	Condi-ment		Orna-mental	Edible Herb							Weed		Weed-Grass			Weed		
					Volume	Wood Char Ct	Wood Char Wt	Jimsonweed	Apple	Blackberry	Blueberry	Elderberry	Maize Cupule	Acorn Shell	Mustard	Parsley	Geranium	Bedstraw	Carpetweed	Goosefoot	Maygrass	Purslane	Pokeweed	Smartweed	Bullrush	Composite	Crabgrass	Goosegrass	Grass Family	Nightshade	Sedge	Pine needles
341	1652	SAL	SE	Lid	0.50			3																								
342	1660	SAL	fence	Lid sample # 2	0.50			30		2																						
343	1663	SBL	fence	Stomach	0.50																											
351	1716	SAL	fence	lid sample	2.50	3	0.04	15						1/.01																		
351	1716	SCL	fence	Control	2.50	1	0.02	4																								
351	1716		fence	Stomach sample	1.00	2	0.02	1																								
352	1719	SAL	fence	Coffin lid sample	2.00	4	0.06	52																								
352	1719	SCL	fence	Control sample, screened	0.50			75																								
353	1723	SAL	fence	Coffin lid	1.00			46																								
353	1723	SBL	fence	Stomach	0.50	2	0.02	12																								
353	1723	SCL	fence	Control	0.50			18																								
357	1758	SBL	SE	Stomach	2.00	23	0.41	28																								
357	1758	SCL	SE	Control screened	2.00	17	0.06	50																								
366	1830	SAL	SE	Under sill, coffin lid	0.50			26																								
366	1830	SBL	SE	Stomach	0.33			14																								
373	1878	SAL	fence	Lid sample	2.00			13																								
373	1878	SBL	fence	Stomach	0.50																	1										
373	1878	SCL	fence	Control, screened	2.00	6	0.06	174		10																						
376	1895	SAL	S	Lid	2.00	4	0.03	30																								
376	1895	SCL	S	Stomach	0.50			97																								
377	1901	SAL	fence		0.50																											
377	1901		fence	Lid sample # 2 Struc. G	1.50																											
377	1901		fence	Lid sample #1 Struc. G	1.50																											
379	1906	SAL	fence	lid sample	0.50	2	0.03	27				3																				
379	1906	SBL	fence	Stomach	0.50			12																								
379	1906	SCL	fence	Screened control	1.50	7	0.07	141				6																				
384	1955	SAL	SE	Above lid	2.00	3	0.03																									
384	1955	SBL	SE	Stomach	0.33																											
389	2023	SAL	SE	Lid sample	2.00	4	0.04	21																								
393	2051	SBL	SE	Control screened	2.00			33										1														
397	2060	SAL	SE	Coffin lid	0.50	1	0.01	2						1																		1
397	2060	SBL	SE	Stomach	0.50			3																								
404	2069	SBL	S	Control	0.50	3	0.03	4																								
405	2071	SAL	SE	Coffin lid	2.00			16																								
405	2071	SCL	SE	Control	0.50																											
415	2097	SAL	SE	Coffin lid sample	1.00	4	0.03	16					1			1																
415	2097	SBL	SE	Stomach	0.33	1	0.01	7																								

G.3.1. - 5

Table G.3.1. Light Fraction Wood Charcoal and Identified Seed Assemblage

								Medicinal Herb	Fruit				Vegetable	Nut	Condi-ment		Orna-mental	Edible Herb							Weed		Weed-Grass			Weed		
Burial	Catalog Number		General site area	Sample location	Volume	Wood Char Ct	Wood Char Wt	Jimsonweed	Apple	Blackberry	Blueberry	Elderberry	Maize Cupule	Acorn Shell	Mustard	Parsley	Geranium	Bedstraw	Carpetweed	Goosefoot	Maygrass	Purslane	Pokeweed	Smartweed	Bullrush	Composite	Crabgrass	Goosegrass	Grass Family	Nightshade	Sedge	Pine needles
415	2097	SCL	SE	Control	2.00	4	0.03	3																								
416	2098	SAL	S	Above coffin lid	2.00			27								1																
416	2098	SBL	S	Stomach	0.50	1	0.01	2																								
418	2101	SBL	S	Stomach	2.00	3	0.03	67																								
335/356	1616	SCL	SE	Control	0.50			9																								

Table G.3.2. Heavy Fraction Wood Charcoal and Identified Seeds

Burial	Catalog Number		Sample Location	Count	Weight	Jimsonweed
6	219	SCH	Grave fill	1	0.01	11
9	233	SBH	Stomach			2
10	234	SAH	Above coffin lid	1	0.01	7
25	358	SBH	Stomach			15
135	880	SCH	Control	4	0.01	1
147	892	SAH	Above coffin fill			2
151	896	SAH	Lid			2
181	967	SAH	stomach			4
191	1081	SCH	Control			1
210	1185	SCH		3	0.02	12
214	1191	SBH	Head area			2
221	1206	SCH	Control			1
241	1228	SBH	Stomach			1
243	1230	SBH	Control			2
259	1266	SAH	Lid	9	0.05	
270	1321	SBH	Control	1	0.01	1
329	1603	SAH	Stomach	6	0.08	17
329	1603	SBH	Control	4	0.04	2
335	1616	SAH	Lid			
340	1651	SCH	Stomach			
351	1716	SAH	Lid	4	0.03	2
351	1716	SCH	Control	1	0.01	
352	1719	SAH	Lid			30
352	1719	SCH	Control	1	0.01	18
353	1723	SAH	Lid			
353	1723	SCH	Control			2
373	1878	SAH	Lid			
373	1878	SBH	Stomach			
373	1878	SCH	Control			7
379	1906	SAH	Lid	1	0.01	
379	1906	SBH	Stomach			3
379	1906	SCH	Control			
393	2051	SBH	Control			
426	2112	SAH	Lid	3	0.02	44
				39	0.31	189

Table G.3.3. Identified Wood Charcoal

Burial	Catalog Number		Sample Location	Hardwood	Hickory	Red Oak	White Oak	Pine	Hophornbeam	Walnut	Elm
6	219	SCL	Grave fill storage	1							
10	234	SAL	Above coffin lid		1						
16	326	SBL	Midsection of skeleton			5					
142	887	SCL	Pelvis				1				
157	902	SAL	Lid	1	1			4			
210	1185	SCL	Gut		1	1		1			
259	1249	SAL	Lid							1	
276	1273	SAL	Stomach	1		1					
329	1603	SAL	Stomach	1	3						
329	1603	SBL	Control	1							
340	1651		Control-Burial pit		2						
351	1716	SCL	Control		1						
352	1719	SAL	Coffin lid sample	2							
357	1758	SBL	Stomach	2		1			9		
357	1758	SCL	Control screened	2				4			
373	1878	SCL	Control, screened	1				1			
379	1906	SCL	Screened control	2	1	1					1
384	1955	SAL	Above lid		2						
415	2097	SAL	Coffin lid sample	2							
				16	12	9	1	10	9	1	1

Table G.3.4. Common Names, Latin Nomenclature, Economic Uses, and Seasonality of Assemblage

Major Use	Common Name	Scientific Name	Family	Vegetative Type	Edible	Edible Part	Medicinal	Ornamental	Poison	Weed	Habitat	Season of Availability
Condiment	Mustard	*Brassica sp.*	Cruciferae	Annual/perennial herb	X	Greens, Spice	X			X	Cultigen; disturbed habitats	April-July
Condiment	Parsley	*Petroselinum crispum*	Umbelliferae	Biennial herb	X	Greens	X	X			Cultigen; occasionally escaped	June-July
Fruit	Blackberry/Raspberry	*Rubus sp.*	Rosaceae	Shrub	X	Fruit	X			X	Cultigen, fence rows, thickets	June-July
Fruit	Blueberry	*Vaccinium sp.*	Ericaceae	Shrub	X	Fruit	X	X			Woods, clearings	June-September
Fruit	Common Apple	*Malus pumila*	Rosaceae	Small tree	X	Fruit	X	X			Cultigen; old orchards	July-October
Fruit	Elderberry	*Sambucus canadensis*	Caprifoliaceae	Shrub	X	Fruit	X	X			Moist soil, meadows	July-August
Vegetable	Maize	*Zea mays*	Gramineae	Domesticate	X	Seeds	X				Cultigen	June-October
Nut	Acorn Shell	*Quercus sp.*	Fagaceae	Tree	X	Nutmeat	X	X			Rich woods	September-November
Ornamental	Geranium	*Geranium sp.*	Geraniaceae	Perennial			X	X			Gerianiaceae	April-June
Edible Herb	Bedstraw	*Galium sp.*	Rubiaceae	Annual/perennial herb	X	Greens	X			X	Woods, clearings, roadsides	April-July
Edible Herb	Carpetweed	*Mollugo verticillata*	Aizoaceae	Annual herb	X	Greens	X			X	Waste places, introduced	May-frost
Edible Herb	Goosefoot	*Chenopodium sp.*	Chenopodiaceae	Annual herb	X	Greens, Seed	X			X	Distrurbed soil, waste places	June-frost
Edible Herb	Maygrass	*Phalaris sp.*	Gramineae	Annual herb	X	Seeds	X			X	Fields, favors moist habitats	May-July
Edible Herb	Pokeweed	*Phytolacca americana*	Phytolaccaceae	Perennial herb	X	Greens	X		X	X	Fields, waste places	May-frost
Edible Herb	Purslane	*Portulaca oleracea*	Portulacaceae	Annual herb	X	Greens, Seed	X			X	Waste places, introduced	May-October
Edible Herb	Smartweed	*Polygonum sp.*	Polygonaceae	Annual/perennial herb	X	Greens, Seed	X	X		X	Fields, waste places	June-frost
Medicinal Herb	Jimsonweed	*Datura stramonium*	Solanaceae	Annual herb			X	X	X	X	Waste places, introduced	July-October
Weed	Bulrush	*Scirpus sp.*	Cyperaceae	Annual/perennial herb						X	Ditches, marshes	July-September
Weed	Composite Family		Compositae							X		
Weed-Grass	Crabgrass	*Digitaria sp.*	Gramineae	Grass						X	Waste places; fields; lawns	July-October
Weed-Grass	Goosegrass	*Eleusine indica*	Gramineae	Grass						X	Waste places	June-October
Weed-Grass	Grass Family	Gramineae	Gramineae	Grass						X		
Weed	Nightshade	*Solanum sp.*	Solanaceae	Annual/perennial herb			X			X	Waste places, fields, roadsides	June-October
Weed	Sedge	*Carex sp.*	Cyperaceae	Perennial herb						X	Waste places, dry woods	May-June
Weed	Sedge Family	*Cyperaceae*	Cyperaceae	Perennial herb						X	Waste places	Summer-Fall

G.4. HCI Flotation Summary (William Sandy)

The following is excerpted from "Foley Square Flotation Preliminary Summary Report" by William Sandy of Historic Conservation and Interpretation, Inc (HCI). The report was prepared in September, 1992, after the General Services Administration transferred the project from HCI to John Milner Associates.

Introduction

Between May, 1991 and July, 1992, Historic Conservation and Interpretation, Inc. (hereafter called HCI) conducted archaeological investigations at two sites in lower Manhattan as part of the Foley Square Project. Flotation soil sampling and processing was carried out as part of the excavation procedures at both the Courthouse and Broadway Sites. Flotation sampling was also included in the methods used when the cemetery was discovered on the Broadway block. After July, 1992, flotation processing and analysis was halted. The purpose of this report is to document the flotation sampling, processing and analysis employed to date on the Foley Square Project. In addition, a brief discussion of the preliminary results of the analysis will be presented. Observations regarding future flotation processing and analysis for this project will also be offered.

Flotation Processing Equipment And Methods

Both Foley Square sites used the same flotation equipment and methods, which will be detailed in this section. The flotation soil sampling strategies, and amount of analysis varied, and will be presented in subsequent sections.

Archaeologists have long known that the types and sizes of artifact and ecofacts (animal and plant remains) that they recover from sites are directly related to the recovery techniques they employ (Struever 1968). Flotation uses water and fine screens to recover small seeds, bone fragments, fish scales, beads and other tiny artifacts. The Foley Square Project has utilized a drum flotation device. This flotation system used water flowing under pressure to reduce the flotation soil sample into two components, a "HEAVY FRACTION" and a "LIGHT FRACTION". The heavy fraction is collected in a piece of screening (usually nylon window screening) and can recover small artifacts, like beads and tacks, bone fragments and teeth, and other non floating remains. The light fraction captures floating floral materials, like seeds, some bone, the occasional fish scale and other lighter than water objects. The drum flotation devices used on this project were of the "Delaware Park" type, and were designed and built by the author (R. Thomas 1981, Sandy 1985). Since the first device of this type was built for the Delaware Park Site in 1981, dozens of these devices have been sold to museums and archaeologists throughout the eastern United States, the rest of the country and abroad. The Delaware park drum flotation device is based on a design by Williams (1973) and is somewhat similar to the SMAP-style flotation system (Piersall 1990:32-35). One major difference between these systems and the Delaware Park system is the latter is built primarily of plastic components, and is lighter and more portable. The Delaware Park devices have been built in two sizes, using a 35 gallon or a 55 gallon plastic drum. The Foley Square project utilized one device of each size. Usually, two devices processed samples simultaneously. The actual processing methodology was along the lines described by

Sandy (1985:Appendix I). An attempt was made to dry the flotation soil samples prior to processing, as this has been shown to improve recovery rates and processing time (Sandy 1985). The heavy fraction collectors utilized consisted of nylon window screening (16 by 18 mesh per inch). The light fraction collectors were 80 mesh nylon drawstring bags.

The Broadway Block -- Burials

A total of 428 flotation samples, with a combined volume of 652.7 liters, were processed from burial contexts. A majority of the samples were from two types of contexts: above the coffin lid or from the stomach. Other contexts include inside the coffin, pelvis, and belly.

Of the 428 burial flotation samples, the light fractions of 43 samples have been analyzed and inventoried. Seeds were identified with the aid of identification manuals, other pertinent literature and a comparative collection (Delorit 1970, Martin and Barkley 1961, USDA 1971, McWeeney 1989).

The most common seed in the samples are those of jimson weed, which are present in most samples. Jimson week, also known as Jamestown weed, jimson, jimpson, jimpson weed and apple of Peru (DATURA STRAMONIUM) is an intensely poisonous coarse annual weed with foul smelling white or purple flowers. Purslane seeds are also present in several samples. Other seeds present in small numbers include chenopodium, berry, flatsedge and a few unidentified types. Seeds which could not be readily identified were separated, described, measured and given a temporary designation (e.g. Type 1). This will simplify updating the inventory if and when that type is identified. It is believed that most of the unidentified types are probably insect parts. Non plant remains consist primarily of sclerotia (fungi fruiting bodies) and bone fragments (McWeeney 1989). Human finger bones and insect parts were also found in some light fractions. A total of 274 heavy fractions from burial contexts were examined and inventoried. Heavy fraction samples contained pins and pin fragments, nails, glass beads, tack fragments, jimsonweed seeds, bones and bone fragments, wood fragments, kaolin pipe fragments and fish scales. Some of the bones are human finger bones. Also recovered were some human teeth, including small deciduous (baby) teeth.

A portion of each burial flotation soil sample was set aside for possible chemical analyses.

Water Screening

Because they had or were suspected to contain important small finds, large soil samples were water screened from eight (8) burials (Burial #116, 117, 210, 258, 259, 263, 303 and 310). These samples were sifted using water flowing under pressure and nylon window screening. Three of these samples (from Burials 116, 210 and 263) were sorted and inventoried. The Burial 210 sample produced a variety of material, including ceramics, bones, shell, jimson weed seeds, a black glass bead, smoking pipe fragments, and possible lead shot and jewelry fragment.

Conclusions and Recommendations

A total of 428 flotation samples, with a combined volume of 652.7 liters, were processed from burial contexts. The light fractions of 43 samples have been analyzed and inventoried. The most common seed in the samples are those of jimsonweed, which is present in most samples. Purslane weeds and several other types were also present in several samples. Non plant remains consist primarily of sclerotia (fungi fruiting bodies) and bore fragments (McWeeney 1989). Human finger bones and insect parts were also found in some light fractions. A total of 274 heavy fractions from burial contexts were examined and inventoried. Heavy fraction samples contained pins and pin fragments, nails, glass beads, tack fragments, jimson weed seeds, bones and bone fragments, wood fragments, kaolin pipe fragments and fish scales. Some of the bones are human finger bones. Also recovered were some human teeth, including small deciduous (baby) teeth. In some cases, their teeth might be the only skeletal remains of an infant or child burial.

It is recommended that the floatation consultant be allowed to sort and identify the remaining flotation heavy fractions as soon as possible. In this way, the human remains will be separated, transferred to the physical anthropologists for analysis, and eventually reburied with the other human remains. The flotation light fractions should also be dealt with promptly. If an analysis strategy is developed, it may be that not all burial light fractions will be examined for seeds. However, since some of these samples have been shown to contain human bone, all the light fractions should be examined for bone. In that way, all human remains will be available for study and eventual reburial.

Some flotation soil samples have not been subjected to flotation processing. Those samples should be processed as soon as possible, and the resultant fractions dealt with as described above. If this flotation processing is delayed, all these samples should be fully air dried as soon as possible. This will improve flotation processing and minimize destruction of any organic remains within the soil. In May, 1992, archeologist Michael "Chris" Griffin made a notable discovery during burial excavation. An extremely small black glass bead. An extra fine mesh heavy fraction collector (a bridal veil) has been obtained for use with this burial's flotation sample. The samples from this burial should be separated and tagged accordingly.

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