Northeast Historical Archaeology

Volume 24 Article 7

1995

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Gerald K. Kelso

Dick Ping Hsu

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Kelso, Gerald K. and Hsu, Dick Ping (1995) "Battlefield Palynology: Reinterpretation of British Earthworks, Saratoga National Historical Park, Stillwater, New York," *Northeast Historical Archaeology*: Vol. 24 24, Article 7.
https://doi.org/10.22191/neha/vol24/iss1/7 Available at: http://orb.binghamton.edu/neha/vol24/iss1/7

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Cover Page Footnote

The authors wish to thank Myra Harrison, Manager of the National Park Service North Atlantic Cultural Resources Center for encouraging scientific landscape research in the National Park Service, Nora Mitchell of the NPS North Atlantic Regional Office for inital project funding, and Paul Okey of Saratoga National Historial Park for providing the Wilkinson map. Stephen Strach, NPS Historian, and John Luzander, former NPS Historian, provided valuable refernces and insights into recent and former land use at the park. Mary Troy of the CRC generously copyedited the manuscript. Laborartory facilities were provided by the Department of Archaeology, Boston University. Laboratory equipment was provided by the National Science Foundation under Grant No. BNS-7924470 to Boston University.

This article is available in Northeast Historical Archaeology: http://orb.binghamton.edu/neha/vol24/iss1/7

Battlefield Palynology: Reinterpretation of British Earthworks, Saratoga National Historical Park, Stillwater, New York

Gerald K. Kelso and Dick Ping Hsu

Pollen analysis was done on a core through a linear mound formerly identified as a 1777 British earthwork at Saratoga National Historical Park. Documents indicate that the British earthwork was built in a forest in a sparsely settled region. Pollen data record a 71-year reforestation sequence under the mound, indicating that it cannot be a Revolutionary War earthwork.

Il a été fait analyse du pollen d'une carotte provenant d'un remblai linéaire précédemment identifié comme un ouvrage de terre britannique de 1777 au parc historique national de Saratoga. D'après les documents, l'ouvrage fut construit dans une forêt située dans une région peu colonisée. Les données relatives au pollen relèvent un reboisement de 71 ans sous le remblai, ce qui indique qu'il ne peut s'agir d'un ouvrage de terre de la guerre révolutionnaire.

Introduction

In 1777 a British army under the command of Lt. General John Burgoyne invaded the fledgling United States along the Lake Champlain corridor. This campaign culminated in a month of maneuvering and battles near the village of Stillwater, New York. Saratoga National Historical Park (FIG. 1) is dedicated to those events of 19 September to 8 October 1777. Several detailed military maps of the area (FIG. 1) were drawn in 1780 by Lt. W. C. Wilkinson, Burgoyne's engineer (Wilkinson 1780). With the aid of these maps, Snow (1977, 1981) was able to identify, excavate, and describe several important elements of the field fortifications on the British side of the battlefield (FIG. 2).

Among the remains mapped by Snow was a ditch and low mound in the area of the main British camps on Wilkinson's 1780 maps (FIG. 1). A trench through the mound disclosed a horizontal log running transversely across the original ground surface under the mound. This appeared to be the remains of a gun emplacement, and buttons bearing the number of the British 21st Regiment were recovered from an artifact collector, who claimed to have found them with a metal detector just north of this mound. Snow (1977: 24; 1981: 20) interpreted the ditch and mound arrangement as the possible remnants of field fortifications in front of the British camps.

The question of the origins of the mound and ditch recently has been reopened. A number of similar ditch and mound arrangements have been observed in the area. Many of these run at right angles to Snow's ditch and mound and do not conform to the logical line for British fortifications in this area. Recent trenching through the mound described by Snow (1977: 24) produced no evidence of the expected log core or gun position shoring (Starbuck et al. 1986). The only evidence of human occupation noted during the 1985 excavations in the camp area was one lead ball found on the surface and a burned-appearing area at ca. 40 cm depth (Starbuck et al. 1986).

The area in question, now called the "British Woods," is currently an open woodland dominated by oaks with a thin understory largely composed of ferns, hazel (*Corylus*) sprouts a foot high or less, and scattered members of the heath family. Some of the large oaks on the plot developed from sprouts on stumps a meter in diameter (Russell 1993: 40). Documents indicate that the area was heavily wooded at the time of the battle (Gordon 1987: 21–24). Local tradition holds

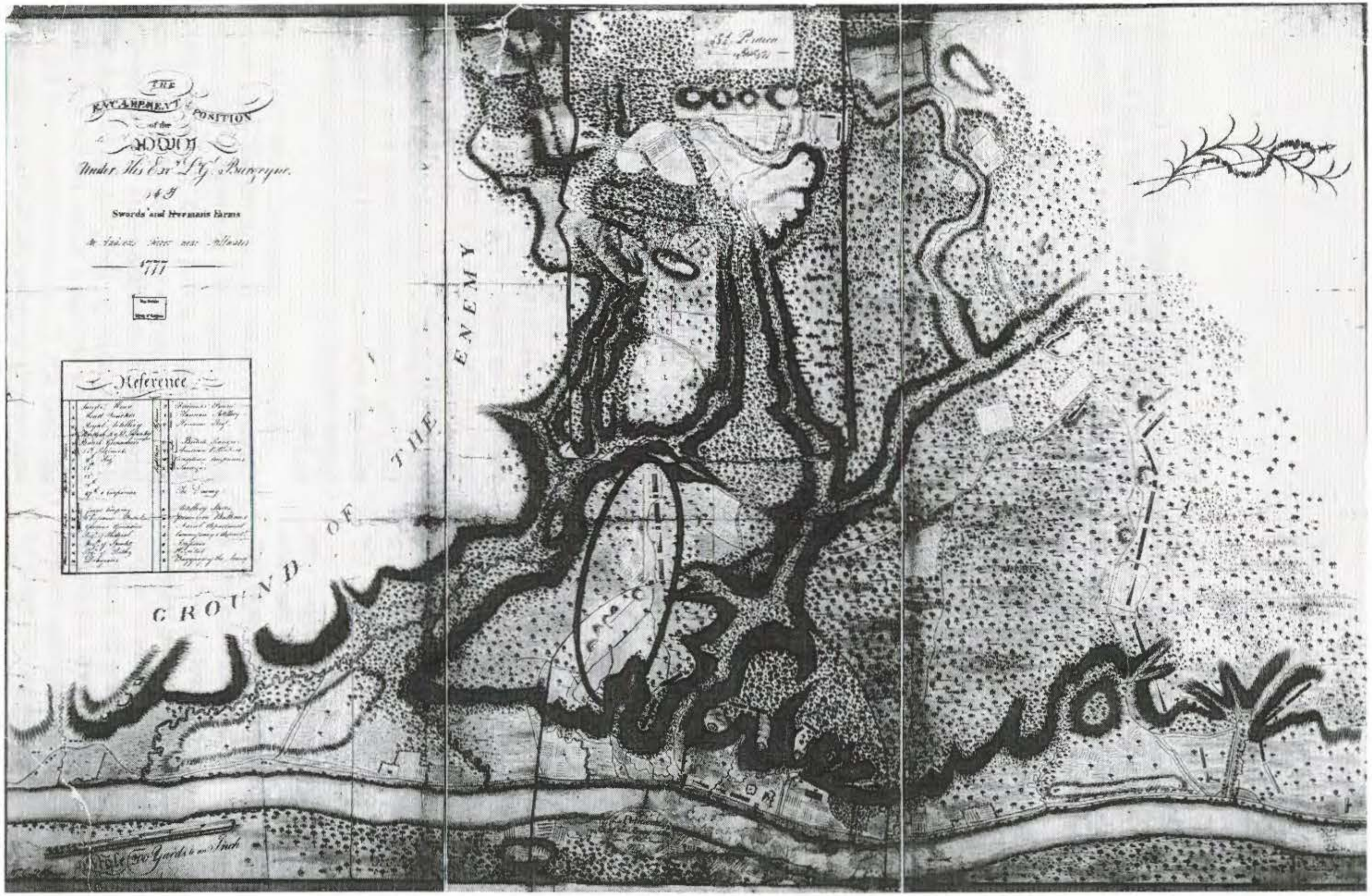

Figure 1. The 1780 Lt. W. C. Wilkinson manuscript map of the Saratoga Battlefield, from photographic copy on file at Saratoga National Historical Park. The earthwork area under investigation is circled.

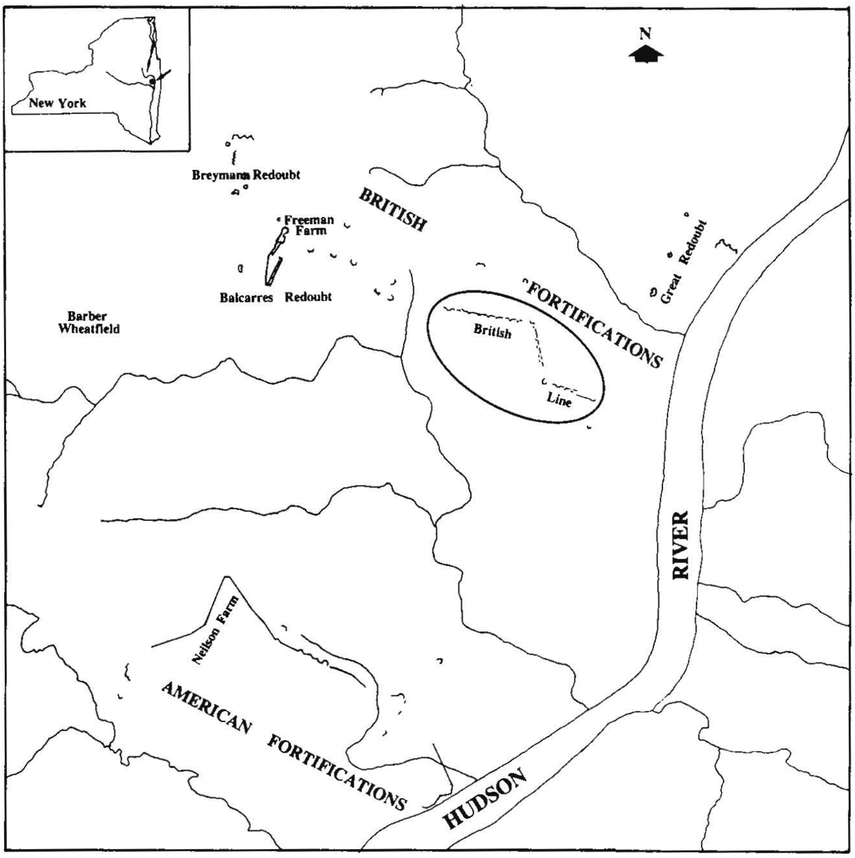

Figure 2. Location and layout of the Saratoga Battlefield, redrawn from Snow 1977. The investigated mound and ditch is located in the left (west) half of the circled line of earthworks.

that this plot has never been completely cut over, but the property passed through a number of hands before the State of New York took it over for a park in 1927. Documents and physical traces indicate mixed farming, grazing, and sand mining within the area of the present park (Russell 1993). Some of these may have led to post-battle modifications in the "British Woods."

A layer of fine sand found under the "British woods" is ideal for molds for brass casting. At least three sand-mining companies operated in the area, and one of these, the Petteros Brothers, acquired the farm incorporating the "British Woods" in 1917 (Russell 1993: 21, fig. 8). The sand deposits were shallow and thin and were customarily mined in trenches about 3 ft (0.91 m) wide (Hartnagel and Broughton 1951: 97). These trenches could pass between trees without destroying the woodland. The U.S. Army held extensive maneuvers in the park during the late 1930s, and it is possible that entrenchments and tank traps, standard elements of the tactics of the day, were employed. Pollen analysis can provide evidence of the formation processes responsible for the development of archaeological deposits (Kelso 1993). This article reports a palynological investigation of the earthwork mound described and mapped by Snow (1977, 1981).

Theoretical Considerations

Pollen deposited on unsheltered ground surfaces is moved downward by percolating

Figure 3. Coring the British Woods mound, April 1990. Photograph looking west with the ditch on the south side of the mound.

rainwater (Dimbleby 1985: 5) and is progressively destroyed by oxygen in the groundwater and by aerobic fungi (Tschudy 1969; Goldstein 1960). Percolated pollen sequences 200–375 years long have been recovered from soils, and these records can be more or less permanently preserved by rapid, deep burial under earthworks (van Zeist 1967: 45; Schoenwetter 1962: 376; Dimbleby 1985: 54–62). In a natural soil profile most of the pollen is concentrated in the upper 4 cm (Dimbleby 1985: 5), and very high pollen concentrations immediately under these mounds contrast sharply with the less polliniferous overlying fill. This marks the original ground surface. Below this buried surface, pollen concentrations normally decline with depth, and the percentage of pollen that is visibly degraded increases in a natural percolation-created sequence frozen in time by the protection of the overlying mound. A sequence such as this should be preserved under the British mound and may provide the means of evaluating its postulated origin.

Wilkinson's 1780 map (FIG. 1) shows the area of the British line to have been wooded, except for plowland along the river, a small cleared area in front of the line, and two cultivated fields to the north and west of the line. In a wooded area almost all of the pollen falling on the ground originates within 30 m of the sampling point (Anderson 1973: 112). The pollen spectrum falling on the ground during the brief British occupation would have been dominated by oak, possibly with some pollen from pitch pines (*Pinis rigida*) on sandy places in the area (Russell 1993: 8) and there would be some weed pollen blown in from the nearby fields. If the ditch and mound are British in origin, then the surface trapped under the mound should be dominated by oak, and the pre-mound spectrum leached into the profile below should record a primordial forest. If the pollen sequence under the mound reflects anything but a primordial forest, the mound and ditch cannot be a 1777 British construction.

Methods

Snow's (1977, 1981) original mound excavations were identified by the plastic that he had laid down in his test trench before backfilling. A pollen core was collected from this mound in April 1990 (FIG. 3). The core was sampled in contiguous 2-cm segments (i.e., no interval between them), with 1-cm intervals where layers were thin. Mehringer's (1967) mechanical/chemical pollen extraction method was employed, but was modified by eliminating the HNO_3 step and reducing the NAOH strength to 1% to minimize oxidization of the already somewhat degraded and fragile pollen characteristic of the deeper portion of temperate zone soil profiles. Sediment residues were rinsed on a 150-micron mesh screen and examined for organic or cultural remains. Pollen residues were mounted in glycerol for viewing. The pollen was identified at 400 power, with problematical pollen grains examined under oil immersion at 1000 power. Previous studies have indicated that gross vegetation and pollen record formation patterns are discernable in economical 100 grain counts (Kelso 1989). One hundred grains per sample counts were used in this study.

Benninghoff's (1962) exotic pollen addition method was employed to compute pollen concentrations per gram of sample. Concentrations were not calculated for individual taxa because these are misleading where pollen percolation and degradation dominate the record formation process. All pollen grains too degraded to be identified were tabulated to provide further control over corrosion factors. Unidentifiable pollen grains were not incorporated in any sum from which the frequencies of other types were computed, but the data for

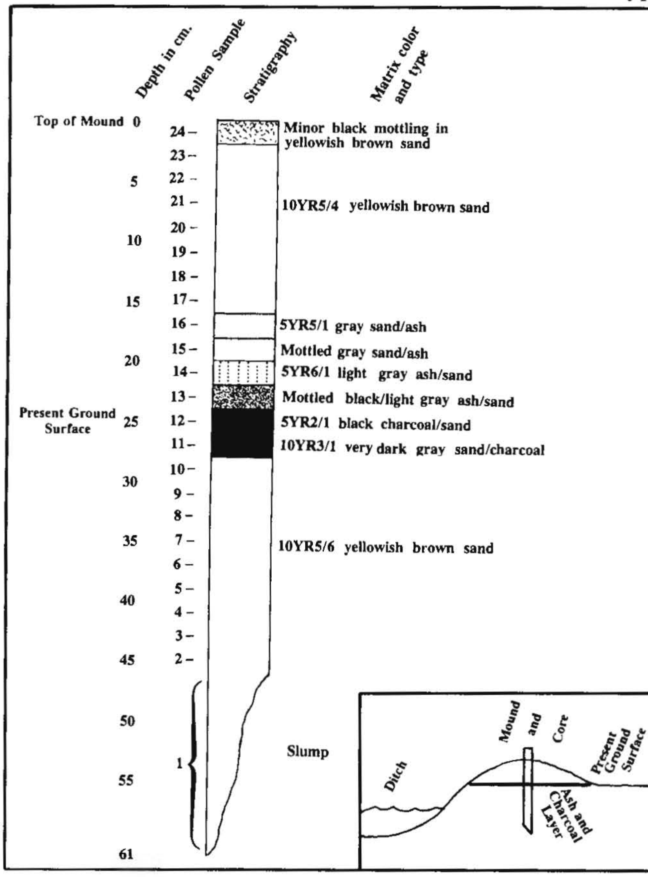

Figure 4. Stratigraphy of the core through the British Woods mound from Saratoga National Historical Park.

this pollen group, as a percentage of total pollen, are presented for each profile. Corroded oak pollen grains, a prominent type that retains its identity while readily degrading (van Zeist 1967: 49), were also tabulated. 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.

Results

Stratigraphy

Sixty-one centimeters of sediment were recovered from a 76-cm core driven through the mound (FIG. 4), indicating a sediment compression rate of 19.7%. The bottom 15 cm of the core was slump, and the actual compression was probably slightly higher. These bottom 15 cm were analyzed as a single sample. From 46 cm depth below mound surface (sample 2) up to 23 cm depth (sample 12) there is a progressive darkening of the matrix from brownish yellow (ca. sample 4) through yellowish brown (ca. sample 8) and dark gray (sample 11) to black (sample 12). The gradual nature of this shift was even more apparent when the samples were lined up in beakers of 5% HCL at the start of pollen extraction. The sequence appears to record a buried soil.

The darkest (10YR0/1) zone in the embankment core was 2 cm thick. Three centimeters (23–20 cm below mound surface) of a light gray, almost white (5YR6/1), sand overlay the apparent buried humus horizon at sample 12. The lowest centimeter of this light gray layer was mottled with black from the humus and was sampled separately (sample 13). The light gray zone (sample 14) faded into gray sand (5YR5/1) above 20 cm below mound surface. The authors observed this same sediment color sequence at approximately present ground surface in Starbuck's 1986 cut through the linear mound, but it was not found in a core taken 30 m south of the mound or in two cores taken 30 m north of the mound.

When the sediment residue from pollen extraction was screened, charcoal was found in the apparent humus zone, in the white zone, and in the gray zone. The largest pieces were recovered from the apparent humus zone (sample 12), but the largest quantities came from the mottled (sample 13) and white (sample 14) zones just above the apparent humus (TAB. 1). The quantities of charcoal declined above the gray zone and disappeared from the record in sample 17 at the bottom of the overlying yellowish brown sand. The black layer of sample 12 appeared to be almost pure charcoal in a second core taken to check stratigraphy. This deposit was so finely divided that very little was recovered when it was washed through a 150-micron screen

Table 1. Percentages by sample weight of the charcoal caught on a 150 micron mesh screen during pollen extraction of the mound core, Saratoga National Historical Park. Depths are below present mound surface.

Sample	*Depth below surface*	*% charcoal by weight*	*color*
19	10/12 cm	0.000	
18	12/14 cm	0.000	10YR5/4 yellowish brown
17	14/16 cm	0.065	
16	16/18 cm	0.410	5YR5/1 gray
15	18/20 cm	0.200	mottled gray
14	20/22 cm	0.920	5YR6/1 light gray
13	22/23 cm	2.140	mottled black/gray
12	23/25 cm	0.610	5YR2/1 black
11	25/27 cm	0.000	10YR3/1 very dark gray
10	27/29 cm	0.000	10YR5/6 yellowish brown

(TABLE 1). The light gray zone between 23 cm and 16 cm depth appears to be ash, and the black layer at 23/25 cm appears to be burned humus.

The light gray zone was succeeded by yellowish brown sand (5YR5/4) above 14 cm depth. This yellowish brown sand is the episodic fill deposit of the overlying mound. It is responsible for the preservation of the buried soil profile in sample 12 (23/25 cm below mound surface) and deeper. There was a very minor black/brown mottling at the surface (0–0.5 cm) of this yellowish sand, but no humus zone was evident. This suggests that the embankment deposit is too recent to have developed a humus zone or, more probably, has lost its humus zone to erosion.

The data indicate that there had been a fire in the area and that the mound was thrown up soon enough after the fire to preserve the ash and charcoal. A wildfire may be indicated, but the possibility exists that the area was burned to clear it of brush for sand mining (Russell 1993: 23).

Palynology

No pollen was recovered from sample 1 (46–61 cm) at the bottom of the Saratoga mound core (FIG. 5), and only ca. 95 pollen grains/gram were found in sample 2 (45/46 cm). The core may be considered to have reached the bottom of the recoverable pollen record under the embankment. Three pollen zones are evident in this core. These are:

3) Sample 23 (3 cm bms*) to sample 24 (1 cm bms)
2) Sample 15 (19 cm bms) to sample 22 (5 cm bms)
1) Sample 3 (43 cm bms) to sample 14 (21 cm bms)

Pollen zone 1 occupies the bottom half of the core. In this core segment, pollen concentrations rise steadily toward the top of the zone, and both "too degraded to recognize" and "% corroded oak" indicate that pollen preservation got steadily worse toward the bottom of the core. This pattern records the normal soil pollen percolation processes described above. Most of the pollen in a normal soil profile is to be found in the upper 4 cm (Dimbleby 1985: 5) and pollen preservation is normally best near the surface (Kelso 1993: 71, fig. 1). These criteria can be used to recognize buried surfaces (Dimbleby 1985: 45–68). Pollen preservation was poor in most of the mound core but was excellent in samples 12 to 14 (25–20 cm). Pollen concentrations were also very high in these samples (FIG. 5, lower right). The high pollen concentrations and well-preserved pollen in this sample 12–14 zone registers a buried surface, coinciding in elevation with both the heaviest charcoal concentrations in the core and the present ground surface north of the mound. Pollen zone 1 records a buried soil.

Only one vegetation trend is registered in pollen zone 1 (bottom half of core). This trend is the decline of oak pollen percentages and increase in pine pollen frequencies from the bottom to the top of the zone. The majority of the pine pollen grains that could be examined had gemmae ("belly warts") on their ventral surfaces and are attributable to white pine (*Pinus strobus*). White pines are prominent in secondary succession sequences in the Northeast (Braun 1950: 429), and the pollen sequences that percolated down from the surface at samples 12–14 record an advanced stage of reforestation preceding the oaks that currently occupy the site. The average pollen percolation rate for the Northeastern United States is 1 cm in 4.2 years (Kelso 1994: 487). When this rate is applied to the mound core, the record from the ash layer of sample 14 down to the oldest surviving pollen is ca. 97 years long. It also indicates that reforestation had been underway for approximately 71 years when the mound was constructed.

Pollen zone 2 is incorporated in the gray sand and yellowish brown sand above the buried surface of zone 1. Zone 2 is characterized by lower pine pollen frequencies, higher oak pollen percentages, unpatterned pollen concentrations, and generally worse pollen preservation. Most of these pollen percentages and pollen record formation measures are too irregular to have been formed by any of the normal cultural or natural depositional processes recognized to date, and it is most probable that the pollen in this zone is old pollen dumped on top of zone 1 with the matrix dug from the adjacent ditch.

* bms = below mound surface.

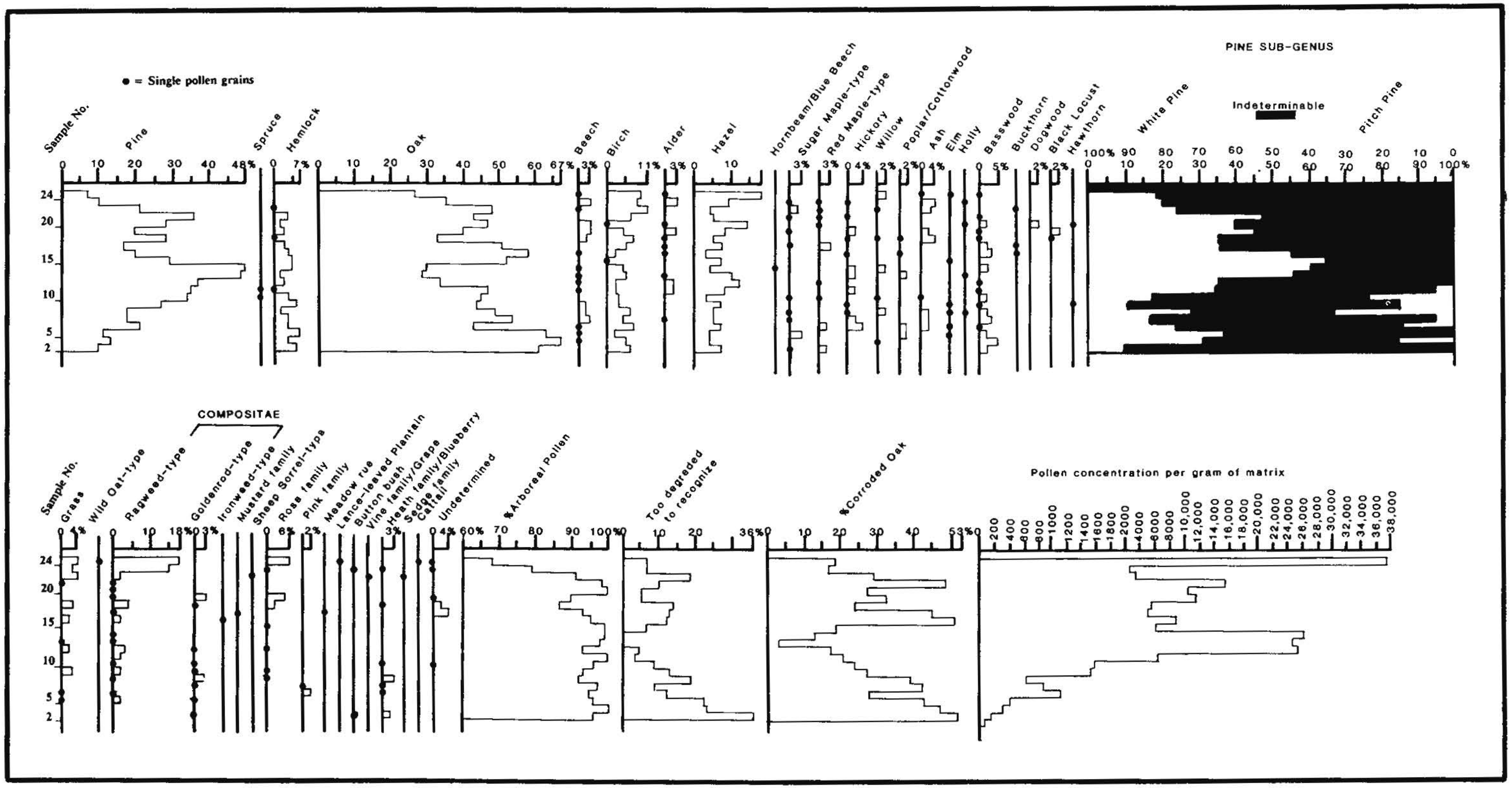

Figure 5. Pollen spectra of the British Woods mound core from Saratoga National Historical Park.

The top two samples (No. 23 and No. 24) of core 2 constitute pollen zone 3. Here oak, pine, total arboreal pollen, "too degraded to recognize," and "corroded oak" percentages drop off while ragweed-type, grass, rose, and hazel pollen frequencies increase. Pollen concentrations are lower except for the uppermost sample. This zone is made up of modern pollen percolated down into the surface of the mound and capped by the previous year's pollen rain. It has not penetrated far into the mound. This could mean that the mound is very recent, but a similar low mound thrown up during the 1600s on Jamestown, Virginia displayed a similar lack of percolated pollen penetration (Kelso 1995). It is probable that the mound shape diverts rainwater and prevents percolation.

Discussion

The documentary record (Gordon 1987: 21–24) indicates that the area of the British lines at Saratoga National Historical Park was mostly wooded at the time of the Burgoyne campaign. The pollen spectrum under the mound that Snow (1977: 24; 1981: 20) tentatively identified as a British earthwork should have reflected oak-dominated primeval forest. This pollen spectrum records, instead, an oak to pine shift reflecting a fairly advanced stage of secondary forest succession. Pollen percolation data, moreover, suggest that this process had been underway for approximately three quarters of a century before the mound was constructed. The mound probably does not date to the Revolutionary War period. Charcoal concentrations on the surface buried under the mound indicate a fire immediately preceding the creation of the mound. The mound might have been thrown up to smother this fire. The mound and ditch, however, conform to published descriptions of sand mining trenches, and it is more probable that charcoal reflects a brush-clearing fire incidentally preserved by mining spoil.

It is not the intention of the authors to criticize the work of our predecessors at Saratoga Battlefield but rather to urge archaeologists working in historical sites to take advantage of the valuable data that may be garnered by close observation of the soil profiles within sites. We particularly wish to call the attention of researchers to the utility of pollen analysis for the definition of deposit formation processes in archaeological sites.

Acknowledgments

The authors wish to thank Myra Harrison, Manager of the National Park Service North Atlantic Cultural Resources Center for encouraging scientific landscape research in the National Park Service, Nora Mitchell of the NPS North Atlantic Regional Office for initial project funding, and Paul Okey of Saratoga National Historical Park for providing the Wilkinson map. Stephen Strach, NPS Historian, and John Luzader, former NPS Historian, provided valuable references and insights into recent and former land use at the park. Mary Troy of the CRC generously copyedited the manuscript. Laboratory facilities were provided by the Department of Archaeology, Boston University. Laboratory equipment was provided by the National Science Foundation under Grant No. BNS-7924470 to Boston University.

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Gerald K. Kelso
Cultural Ecology Laboratories
172145 W. 15th Place
Golden, CO 80401

Dick P. Hsu
National Park Service
Cultural Resources Center
Boott Cotton Mills Museum
1100 Foot of John Street
Lowell, MA 01852