Palynological Analysis of Materials from the Draper and White Sites

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Introduction

A total of 14 sub-surface samples from two Huronian prehistoric sites, White and Draper, were submitted for palynological analysis (Table 1). These samples had been collected independently by archaeologists working at the two sites. In addition, four surface samples consisting of the upper 2" of the soil, were taken at the Draper location. Of these, all four surface and seven of the subsurface samples were analyzed for pollen content.

There were no priorities, but there was a request for certain data. It was asked whether the local palaeoecology could be inferred from the pollen assemblages found in archaeological horizons, and whether any distinct advantages of the site locations for human occupation could be deduced from these assemblages. Evidence of agricultural activity (i.e., the presence of maize pollen) was sought, particularly from the White site.

The surface samples were analyzed as a means of comparison with midden material. Such samples are useful in determining the representation of local species, in terms of under- or over-representation, and the degree to which the pollen assemblage reflects the present vegetation.

Methods and Materials

To varying amounts of the sample material chosen for analysis (see Table 1), two exotic *Lycopodium* pills were added, each pill containing 12,500±500 distinctive and unmistakeable grains. These are generally added to determine rates of pollen influx per unit area, using a ratio of exotic to fossil grains. However, it was suspected that the preservation of the pollen would be poor and that therefore no accurate picture of the volume of the pollen influx could be determined. Thus the *Lycopodium* was introduced largely as a means of gauging the effect of processing on the fossil pollen, and of examining an equivalent amount of each sample (i.e., by counting the number of fossil grains per 100 exotic grains).

To this material 100 mL of 10% KOH were added and the samples were heated and "swirled", to dissolve extraneous material and any remaining cytoplasm. They were then sieved, using a series of mesh sizes. Initially, a series of 150, 90 and 30 micron mesh sieves were used, with all materials greater than 30 microns and less than 90 microns in size being retained for further preparation. Later, a series of 150, 120 and 30 microns was used to reduce the possibility of loss of the larger grains. Some of the smaller grains (those smaller than 30 microns) were unavoidably lost in this process, but it was necessary to remove as much of the matrix as possible and thus concentrate the preserved pollen.

The sieved samples were washed into centrifuge tubes using distilled water, centrifuged and decanted. Hydrofluoric acid was added to remove silicates from the samples, which were then heated in a boiling water bath, centrifuged and decanted. Preparatory slides indicated the presence of some potassium silicate precipitate, but the particles were sufficiently dispersed and the grains sufficiently identifiable as to preclude the necessity of adding silver nitrate.

This preparation was followed by acetolysis, as described by Faegri and Iverson (1964: 71), to remove cellulose and the like from the samples. A drop of saffranine dye was added to stain the material, which was finally washed into a vial with Tertiary butyl alcohol. Two drops of silicon oil (the mounting medium) were added and slides made.

Four of the fossil samples were prepared using zinc chloride floatation to separate the organic from the inorganic fraction. After heating in 10% KOH, the materials were washed into 50 mL centrifuge tubes with distilled water, then centrifuged with alcohol to remove all traces of the water, and decanted. The samples were then acidified with 10% HCl, to prevent the precipitation of $Zn(OH)_2$.

A zinc chloride solution of specific gravity of about 1.96, as suggested by Kummel and Raup (1965), was added and the material was centrifuged for about half an hour. The floating portion was carefully decanted into another centrifuge tube and centrifuged with alcohol to remove the heavy liquid. ZnCl was used because it is stable, easy to

TABLE I.

Sample #	Square	Site	level	amount used	analysis
1.	42–44N 5– 7E	White	18 21 cm	4.68cc = 6.57 g	floatation
2.	22–24N 38–40E	Draper	A horizon under midden, 15 cm	4.68cc = 6.49 g	floatation
3.	42–44N E42–44	Draper	39–42 cm	1.8 cc = 2.73 g	floatation
4.	22–24N E38–40	Draper	58 cm	1.8 cc = 2.6975 g	floatation
5.		Draper	surface	11.0 cc = 15.05 g	KOH, HF, acetolysis
6.		Draper	surface	11.0 cc = 21.153 g	KOH, HF, acetolysis
7.		Draper	surface	11.0 cc = 17.578 g	KOH, HF, acetolysis
8.		Draper	surface	11.0 cc = 15.97 g	KOH, HF, acetolysis
9.	22–24N E38–40	Draper	29 cm	2.7 cc	KOH, HF, acetolysis
10.	32–34N 40–42E	Draper	A, of paleosol	2.7 cc	KOH, HF, acetolysis
11.	41–44N 5 –7E	White	9–15 cm	2.7 cc	KOH, HF, acetolysis

prepare, relatively inexpensive and it does not oxidize organic matter. This latter characteristic means that in addition to the pollen, some charcoal will also be recovered from the samples, though the process was successful in isolating the lightest organic fraction. Sieving, to remove large and very fine fragments of organic material, was followed by acetolysis, staining and the addition of the mounting medium.

The slides so prepared were scanned at 25X magnification, using high powers in the case of a difficult identification. Grains were keyed out using the *Key to the Quarternary Pollen and Spores of the Great Lakes Region* (McAndrews, Berti & Norris, 1973). Relative frequencies were produced for each sample; pollen concentrations per unit sediment reflective of influx were worked out for the surface samples only. Interpretation of the results was attempted.

Results

The surface samples (sample numbers 5 through 8) were taken along a transect at the Draper site, running from the top of a hill just west of Duffin Creek, through the stream valley to the opposite bank. In general, the area lies within the deciduous hardwood – evergreen mixed forest region, though there has been much clearage of the land for agriculture. Portions of the river valley in the vicinity of the Draper site have undergone a secondary succession, and now support a young maple-beech forest interspersed with some hemlock, basswood and associated species. The areas surrounding the ravine have been greatly disturbed and support a number of introduced tree and ruderal species.

There were major differences in both soil material and in vegetation cover along the transect. The differences in soil type (i.e., alluvium in the bottomland, loams above the valley) presumably influenced the preservation and thus the quantity of pollen recovered, as well as the nature of the cover.

Although the four surface sites were fairly close together – the whole transect covering perhaps 300' – significant differences in vegetation cover were observed, and these differences were reflected in the composition of the pollen assemblages. Sample #5, taken from a disturbed hilltop supporting an open vegetation cover, contained a high percentage of non-arboreal pollen, largely grasses, sedges and composites. In sample #6, a thick cover of ferns in the ground layer was reflected in the high relative frequency of Polypodiaceae spores. Both samples 6 and 7, taken from heavily forested areas, indicate their origin by their high arboreal pollen counts. Sample #8, from an area forested largely with cedar and supporting little ground cover, nonetheless contained a large proportion of non-arboreal pollen, probably due to the poor preservation of the weak cedar pollen and the influx of herbaceous pollen

TABLE 2.

Sample #	exotic Lycopodium	Total fossil pollen	Fossil concentration (#/g sediment)	AP #	AP %	NAP #	NAP %	unknown (% of total)	indeterminable (%)
1.	167.5	35 5	807	16.5	46.5	13	36.6	5.6	11.3
2	197 5	25.5	497	14.5	56.8	6	23.5	–	21.6
3.	226	1	41	1	100	–		–	–
4.	202	2	92	–		–		–	100
5.	92	491	8868	334.5	68.1	132.5	26.9	1.1	3.8
6.	98	150	1809	108	72	38	25.4	–	2.7
7.	112	131.5	1670	101.5	77.2	23	17.4	2.3	3.0
8.	110	68.5	975	40	58.4	22	32.1	5.8	3.7
9.	149.5	12	–	6.5	54.1	3	25	–	20.8
10.	172.5	17.5	–	7.5	42.9	7	40	–	17.1
11.	297	27.5	–	22.5	81.8	3	10.9	–	7.3

types from nearby disturbed areas.

In general, the pollen of herbaceous species tends to diffuse only a few metres (Anderson 1970: 41), and thus the assemblages will reflect local variations in this flora. Also reflected are certain regional trends, such as a general over-representation of pine, as a result of long distance transport of the grains.

Concentrations per unit sediment in the surface samples were much higher than those in the fossil samples (consisting of 2 samples from the White site and 5 from the Draper site). Preservation was on the whole poor in these latter (see Tables 2–3), and two of the samples – numbers 3 and 4, both from the Draper site – were sterile. The good recovery of exotic *Lycopodium* indicated that this was not a result of the method of processing, but of the general absence of fossil pollen from the soil, and the small amounts of material processed. The data suggests that preservation decreased with depth, which is in keeping with the findings of authors such as Vehik (1971).

Relative frequencies were derived and diagrammed for all samples from which pollen was recovered. The samples are isolated by site, and placed in order of increasing depth.

Conclusions

Considering the limited nature of the data, it is difficult to make a meaningful interpretation of the fossil assemblages. Preservation was poor, probably due to the nature of the substrates. Alluvium and calcareous materials tend to have low pollen contents; thus the need to process large amounts of soil and effect concentration of the palynomorphs to the greatest extent possible, was stressed in this study. However, even with good concentration problems of identification remain, since the fossil pollen was not only dispersed but often ghosted, crushed and broken as well.

Some contamination of the samples was possible, both in the field and in the laboratory. However, assuming that the assemblages are indeed fossilized and not the products of contamination, then certain conclusions can be drawn. It can be suggested that the vegetation at the Draper site was in the past at least similar to that of the present. Sample #2, from the A_1 horizon of a paleosol, contains somewhat less pine and more hemlock and basswood than present assemblages, and might possibly represent an undisturbed forest situation, predating the settlement although the non-arboreal pollen of this same sample seems to indicate some disturbance (see Fig. 2). These interpretations of the arboreal and nonarboreal pollen counts do not necessarily conflict, since the NAP tends to reflect quite local conditions and may indicate a natural clearing. Identification of the actual species found would improve the accuracy of the interpretation, but identifications even to the genus level were often impossible.

In other Draper site samples, the high occurrence of pine

TABLE 3.

AP

Sample #	#	Pinus (Pine) %	#	Abies (Fir) %	#	Picea (Spruce) %	#	Tsuga (Hemlock) %	#	Cupress (Cedar) %	#	Acer (Maple) %	#	Ulmus (Elm) %	#	Quercus (Oak) %	#	Fagus (Beech) %	#	Tilia (Basswood) %	#	Populus (Aspen) %	#	Betula (Birch) %	#	Fraxinus nigra (Ash) %	#	Alnus (Alder) %	#	Ostrya/Carpinus Ironwood %
1.	12½	75.8					2	12.1																					2	12.1
2.	6½	44.8					2	13.8											5	34.5									1	6.9
3.	1	100																												
4.																														
5.	263½	78.8	7½	2.2	11½	3.4	7	2.1	6	1.8	12	3.6	2	0.6	4	1.2	5	1.5	5	1.5	6	1.8	3	0.9	1	0.3	1	0.3		
6.	93	86.1	½	0.5	3	2.8	7½	6.9			2	1.8	1	0.9	1	0.9														
7	74	72.9	2½	2.5	9	8.2	11	10.8	2	1.9			1	1.0			2	1.9												
8.	27½	68.8					6½	16.2	3	7.5	1	2.5							2	5.0										
9.	6½	100																												
10.	7½	100																												
11.	20½	91.2	1	4.4															1	4.4										

NAP

TABLE 3 (Continued)

	#	Gramineae (grass family) %	#	Cyperaceae (sedge family) %	#	Tubuliflorae %	#	Liguliflorae %	#	Ambrosia (Ragweed) %	#	Chenopodiaceae (goosefoot family) %	#	Polypodiaceae (fern family) %	#	Ericaceae (Heath family) %	#	Caryophyllaceae (Pink family) %	#	Typha latifolia (cattail) %	#	Epilobium latifolium (Willow herb) %	#	Cornus canadensis (Dogwood) %
1.	2	15.4	3	23.1	3	23.1					1	7.7	3	23.1										
2.	2	33.3	1	16.7							3	50.0												
3.																								
4.																								
5.	20½	15.5	28	21.1	6½	4.9	46	34.7	14½	10.2	1	0.75	11	8.4	4	3.0	1	0.75						
6.	1	2.7	7	18.4	1	2.7	2	5.3					21	57.9					4	10.5	1	2.7		
7.	2	8.7	10	43.5			2	8.7	1	4.4			4	17.4	4	17.4								
8.	5	22.7	7			1.8	2	9.1					3	13.6					4	18.1			1	4.5
9.	1	33.3	1	33.3	1	33.3																		
10.	1	14.3									2	28.6			4	57.1								
11.	1	33.3					2	66.7																

FIG. 1

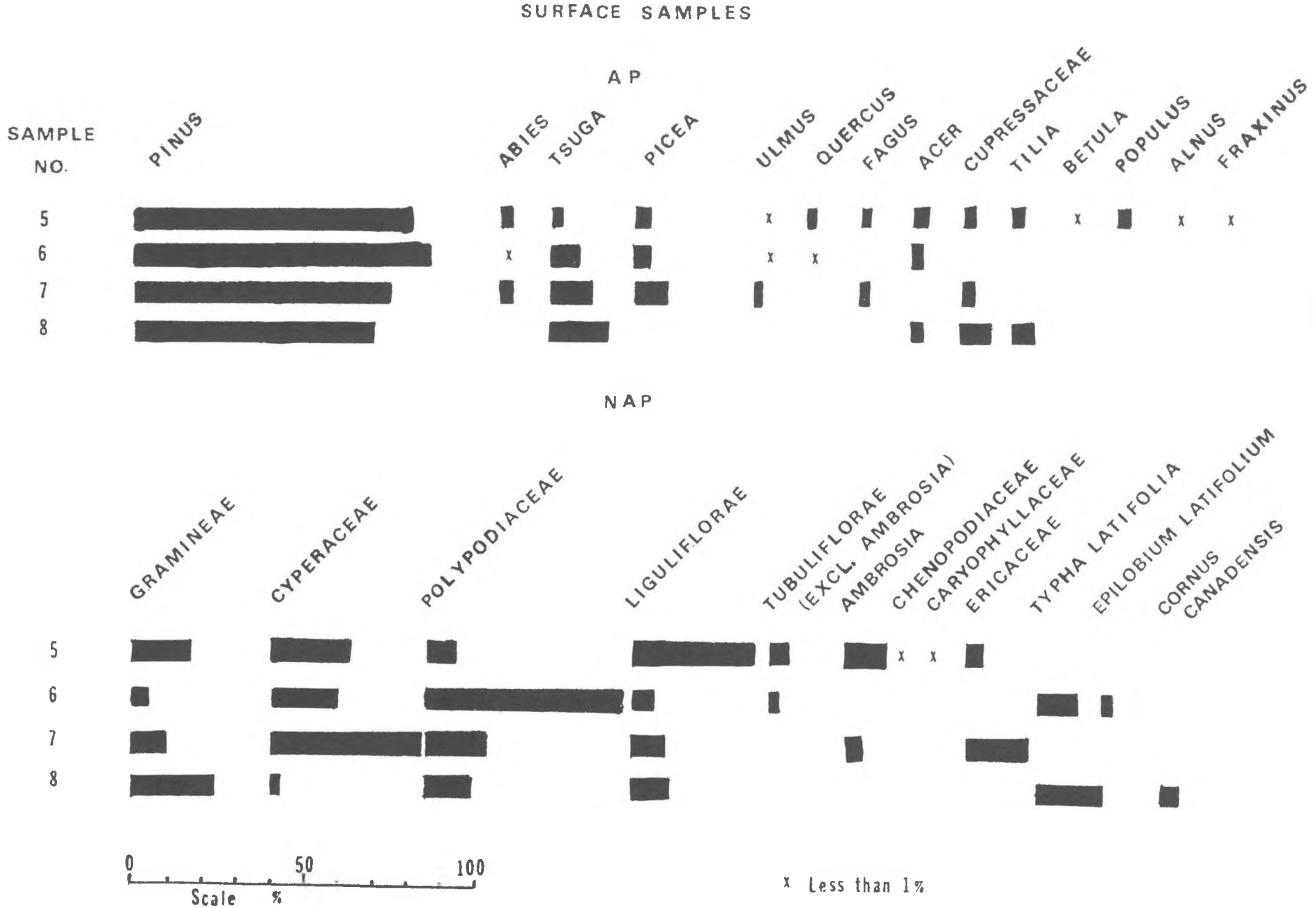
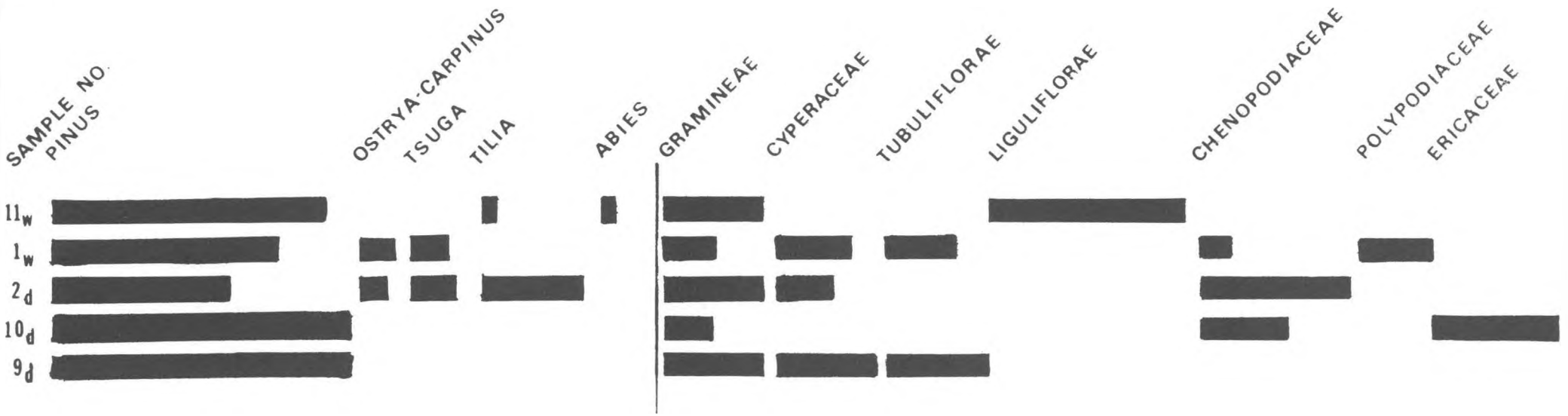

SURFACE SAMPLES
AP
SAMPLE NO.
PINUS
ABIES
TSUGA
PICEA
ULMUS
QUERCUS
FAGUS
ACER
CUPRESSACEAE
TILIA
BETULA
POPULUS
ALNUS
FRAXINUS
5
6
7
8
NAP
GRAMINEAE
CYPERACEAE
POLYPODIACEAE
LIGULIFLORAE
TUBULIFLORAE (EXCL. AMBROSIA)
AMBROSIA
CHENOPODIACEAE
CARYOPHYLLACEAE
ERICACEAE
TYPHA LATIFOLIA
EPILOBIUM LATIFOLIUM
CORNUS CANADENSIS
0
50
100
Scale %
x Less than 1%

FIG. 2

SUBSURFACE SAMPLES
FROM THE DRAPER AND WHITE SITES



w White site
d Draper site
in order of increasing depth

pollen (though over-represented, undoubtedly) and the composition of the herbaceous flora are suggestive of disturbed habitats.

In the two samples from the White site, preservation was somewhat better. The deeper sample (sample #1, at a depth of 18–21 cm) yielded an assemblage seemingly representative of a relatively undisturbed habitat, though perhaps near an area of disturbance. The percentage of pine resembles closely that in the surface samples from the forested areas at Draper, and the presence of fern spores suggests a vegetation similar to that on the valley wall at the Draper site (Fig. 1). The upper sample, with its higher percent of pine and the presence of Liguliflorae (generally a rare pollen type) strongly suggests disturbance. A more careful sampling of the White site midden at finer intervals might indicate more precisely a pattern of clearage and abandonment although drawing conclusions from the impoverished and undated assemblages found is not wholly valid.

The generally poor recovery from the archaeological deposits could be traceable to the calcareous nature of the subtrates, which are neutral to alkaline in reaction, perhaps increased by leaching of charred bone fragments in the midden samples (though pH values for the middens were unfortunately not determined). Biotic activity destructive to fossil exines occurs more readily in slightly alkaline soils than in acid soils. Preservation was better in the paleosols, the buried soils (samples 10 and 2), perhaps due to the alteration of conditions of oxidation and the like following the rapid deposition of overlying materials.

Thus the conclusions that can be drawn are fairly limited – the species found in the past appear to be the same as though found at present, although European settlement has led to the widespread removal of forests and introduction of some ruderal species. There is some evidence of disturbance related to the Huronian occupation, particularly in the upper sample from the White site. The Draper material is less useful, with the exception of the paleosol material, which suggests a less disturbed habitat containing perhaps more *Tilia* (basswood) and *Tsuga* (hemlock) than are found at present.

No direct palynological evidence of agriculture was found. The few grass pollen grains recovered were generally less than 45 microns in size, indicating that they represent wild grasses. Two grains greater than 45 microns were found (in samples 2 and 5), but neither of these was recognizable as a cultivated species. The absence of *Zea mays* pollen is meaningless — not only because of the absence of maize pollen in surface samples though maize is grown in the area, but because there is other firm evidence of Huronian agriculture at the Draper site. The only possible agriculturally significant find was an echinate tricholpate grain in sample #9, which was tentatively identified as *Helianthus* (sunflower).

Other techniques, such as seed analysis, were more effective in reconstructing the ecology and cultivation of this site at the time of habitation. The very poor preservation of the pollen, both quantitatively and qualitatively, results in small sample sizes and reduces the validity of interpretation, especially when possibilities of contamination and errors in identification are considered. Thus, while pollen analysis has proved useful in some archaeological applications, in this case it would seem that such analysis has little to add to the understanding of the Draper and White sites.

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