THE MIDDLE ARCHAIC OCCUPATION OF THE NIAGARA PENINSULA: EVIDENCE FROM THE BELL SITE (AgGt-33)

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Excavation and analysis of the *Bell* site (AgGt-33), *located near Fonthill, Ontario, has provided* new insights into the settlement *and subsistence patterns of the poorly* documen*ted Middle* Archaic *occupants* of the *Niagara Peninsula.*

In the summer of 1984 Archaeological *Services Inc.* carried out an archaeological resource assessment on a parcel of land to be developed on Lot 163, Fonthill, Township of Thorold (now Town of Pelham) in the Regional Municipality of Niagara. This survey resulted in the discovery of two sizeable lithic scatters overlooking a tributary of Twelve Mile Creek (Figures 1 and 2).

Subsequent investigations suggested that one of these two scatters, the Bell site (AgGt-33), which was located near the southwestern boundary of the property, could be dated to the Middle Archaic period. While the majority of the site lay beyond the area of the pro-posed development, it was apparent that valuable data would be lost should construction proceed prior to salvage mitigation. These excavations were carried out in 1985.

The following is a summary of the subsequent analysis of the settlement, subsistence, and artifactual remains recovered during the 1985 salvage excavation of that part of the Bell site to be impacted by the development (Williamson et al. 1985). The economic behaviour of the site inhabitants is briefly examined by employing an ecological approach to reconstruct the prehistoric environment surrounding the site, in order to help define the economic function of the site and its place within the annual subsistence schedule. The environmental reconstruction includes examinations of the geomorphological origin of the Fonthill Kame delta and associated sand plain, the regional soil characteristics, the inferred vegetational cover, and the available floral and faunal resources.

Site data are then compared with current archaeological reconstructions of Archaic lifeways in the general region and are evaluated for their importance in understanding Middle Archaic cultural development in other parts of southern Ontario. This study has yielded important data concerning the settlement-subsistence systems of hunter-gatherer populations who inhabited the Niagara area several thousand years ago.

GENERAL ENVIRONMENTAL SETTING

A detailed reconstruction of the prehistoric environment surrounding the Bell site has been completed (Williamson et al. 1985). This reconstruction took into consideration the geomorphological and fluvial evolution of the Niagara Peninsula, as well as soil development and the associated vegetational cover. The latter two characteristics are of consider-able importance in any effort to reconstruct prehistoric settlement-subsistence adaptations from the archaeological record.

The soils within a five-kilometre radius of the site are those derived from deltaic processes and are predominantly well-drained sandy loams to loams (Chapman and Putnam 1973:257-258). These are soils on which oak either tends to dominate or has a significant presence (Maycock 1963; Kenyon and Payne 1981; Williamson 1985:89-100). They are,

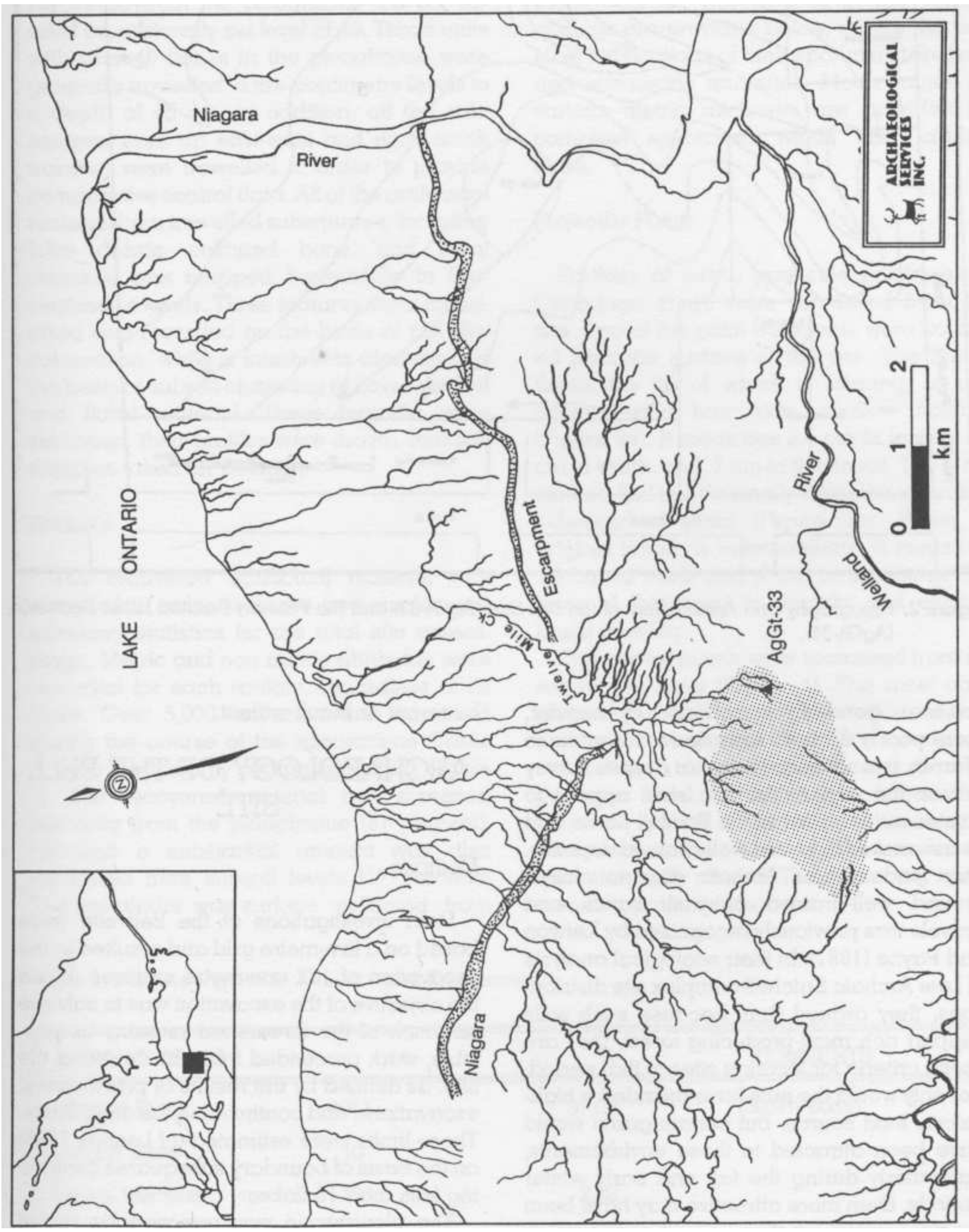

Figure 1.General Location of the Bell Site (AgGt-33), Fonthill, Ontario. Regional fluviology is reconstructed from various early maps. Stippling indicates the extent of the Fonthill Kame sands.

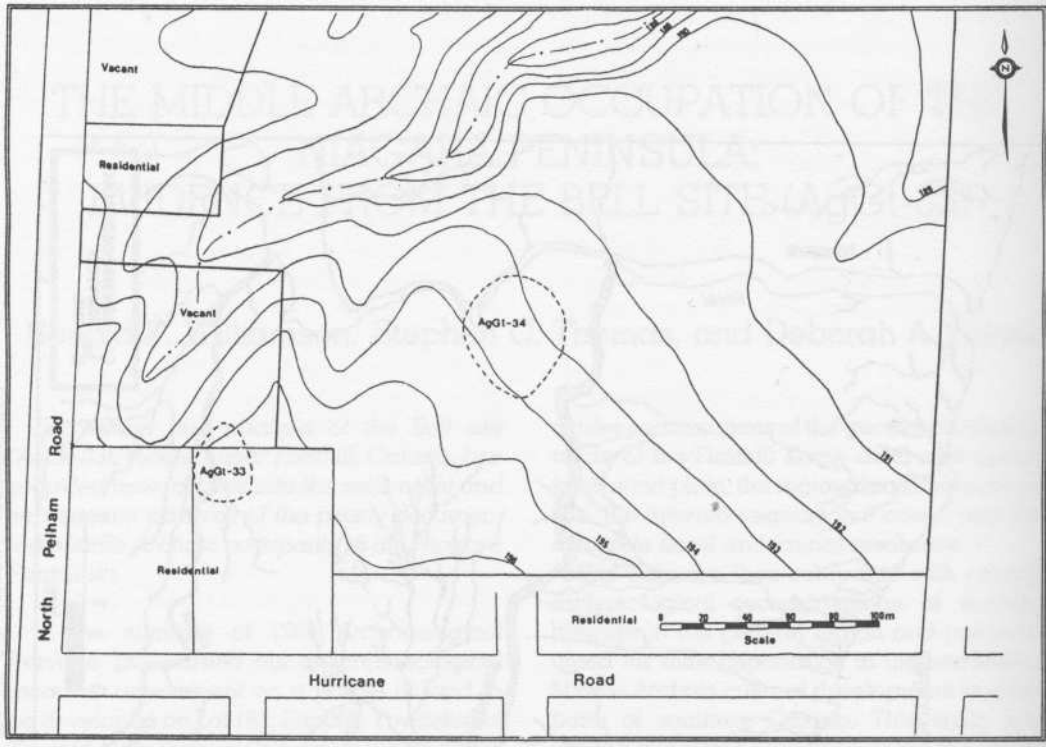

Figure 2. Topography and Areal Extent of the Bell Site (AgGt-33) and the Possibly Related Lithic Scatter(s) (AgGt-34).

however, generally surrounded by heavier, more poorly drained soils derived from Lake Warren. It is not surprising that despite survey across the region, Archaic sites appear to cluster with respect to the Fonthill Kame and its associated light and well-drained deposits. This tendency for Archaic sites to cluster around well-drained outwash sands and gravels was previously recognized by Kenyon and Payne (1981). In their ecological analysis of Late Archaic Satchell complex site distributions, they argued that, because such soils support rich mast-producing forest, they are useful criteria for locating sites of that period. Not only would the nuts have provided a high-caloric food source, but certain game would have been attracted to these environments, particularly during the fall and early winter periods. Even more attractive may have been the river systems cutting through areas of oak forest, especially where the river bottoms widened and supported marsh communities and other fruit-bearing hardwoods, such as butternut or black walnut.

ARCHAEOLOGY OF THE BELL SITE

Methods

Field investigations at the Bell site were based on a five-metre grid and resulted in the excavation of 132 one-metre squares. Since the objective of the excavation was to salvage as much of the threatened remains as possible, work proceeded from the centre of the site, as defined by the results of previous test excavations, and continued to the outer limits. These limits were estimated (cf Lennox 1986) on the basis of boundary subsquares containing less than 15 flakes.

The ploughzone was removed by shovel and screened through standard six-millimetre (1/4") mesh. While attempts were made to utilize three-millimetre (1/8") mesh, it became necessary to water screen and the technique was abandoned as too time consuming. Once the ploughzone was removed from the squares, the first five centimetres of subsoil were screened, provided the number of flakes recovered from the ploughzone did not exceed an arbitrarily set level of 40. Those units with over 40 flakes in the ploughzone were generally trowelled in five-centimetre levels to a depth of 15 cm. In addition, all the subsquares from an east-west and north-south transect were trowelled in order to provide comparative control data. All of the artifactual material from trowelled subsquares, including lithic debris, calcined bone, and floral remains, was mapped horizontally in five-centimetre levels. Three features were recognized and recorded on the basis of soil discolouration, while a fourth was identified on the basis of subsoil clustering of flakes, faunal and floral material. These features were sectioned, their profiles were drawn, and soil samples taken for flotation.

Artifacts

The recovered artifactual material was analyzed in order to derive frequencies and summary statistics for the total site assemblage. Metric and non-metric attributes were recorded for each artifact, regardless of its class. Over 5,000 artifacts were recovered during the course of the excavations (Table 1), with the majority comprising lithics (Table 2). The recovered material was screened primarily from the ploughzone (81 percent), although a substantial amount was also recovered from subsoil levels (17 percent). The remainder was surface collected from the south half of the site, beyond the threatened area. Materials exhibiting potlid fractures, grainy surfaces, or obvious surface discolouration were characterized as "thermally altered". Descriptions of the various artifacts are provided below, as are the possible implications of their spatial distributions and non-metric attributes. Mean values for various metric attributes are provided for complete specimens within each artifact class.

Projectile Points

Portions of seven projectile points, all of Onondaga chert, were recovered from the site. Two of the point fragments were collected from the surface of the site. The first of these, the tip of which is missing, is side notched and has wide, shallow notches (Figure 3d). It measures 3.5 cm in length, 1.8 cm in width, and .7 cm in thickness. The other surface find is a thermally altered and broken side-notched point (Figure 3e). While its original length is indeterminate, it measures 1.9 cm in width and .6 cm in thickness. The base of this point is straight and exhibits basal thinning.

Five partial points were recovered from the excavation units (Figure 4). The most complete of these (Figure 3c) is a side-notched point with an expanded base. It measures 2.7 cm in length, 1.5 cm in width, and .5 cm in thickness. The basal fragments of three other projectile points (Figure 3a,b,f) were also recovered. All are side notched and have been thermally altered. The remaining specimen is a point tip fragment.

Table 1. Bell Site (AgGt-33), Artifact Class Frequencies.

ARTIFACT CLASS	n	%	COMMENTS
Chipped Stone	4911	97.02	(39.9% burnt)
Ground Stone	10	.20	
Faunal Elements	131	2.59	
Floral Remains	9	.17	(exuding floats)
Red Ochre	1	.01	
TOTAL	5062	99.99	

Table 2. Bell Site (AgGt-33), Lithic Artifact Types and Frequencies.

ARTIFACT TYPE	n	%
Projectile Points	7	.14
Bifaces	73	**1.48**
Unifaces	3	.06
Knives	2	.04
End Scrapers	19	.39
Lateral Scrapers	7	.14
Crescent Scrapers	6	.12
Combination Scrapers	**5**	.10
Scraper/Gravers	8	.16
Amorphous Flake Scrapers	15	.30
Utilized Flakes	77	1.56
Gravers	2	.04
Burins	1	.02
Primary Flakes	75	1.52
Primary Flake Fragments	15	.30
Secondary Rakes	1173	23.84
Secondary Flake Fragments	2891	58.75
Shatter	174	.54
Heat Shatter	347	7.05
Cores	12	.24
Cobble Fragments	1	.02
Abraders	1	.02
Abrader/Anvilstones	1	.02
Abrader/Hammerstones	1	.02
Harrnerstones	1	.02
Hammer/Anvilstones	1	.02
Fire-cracked Rock	2	.04
TOTAL	**4921**	**99.95**

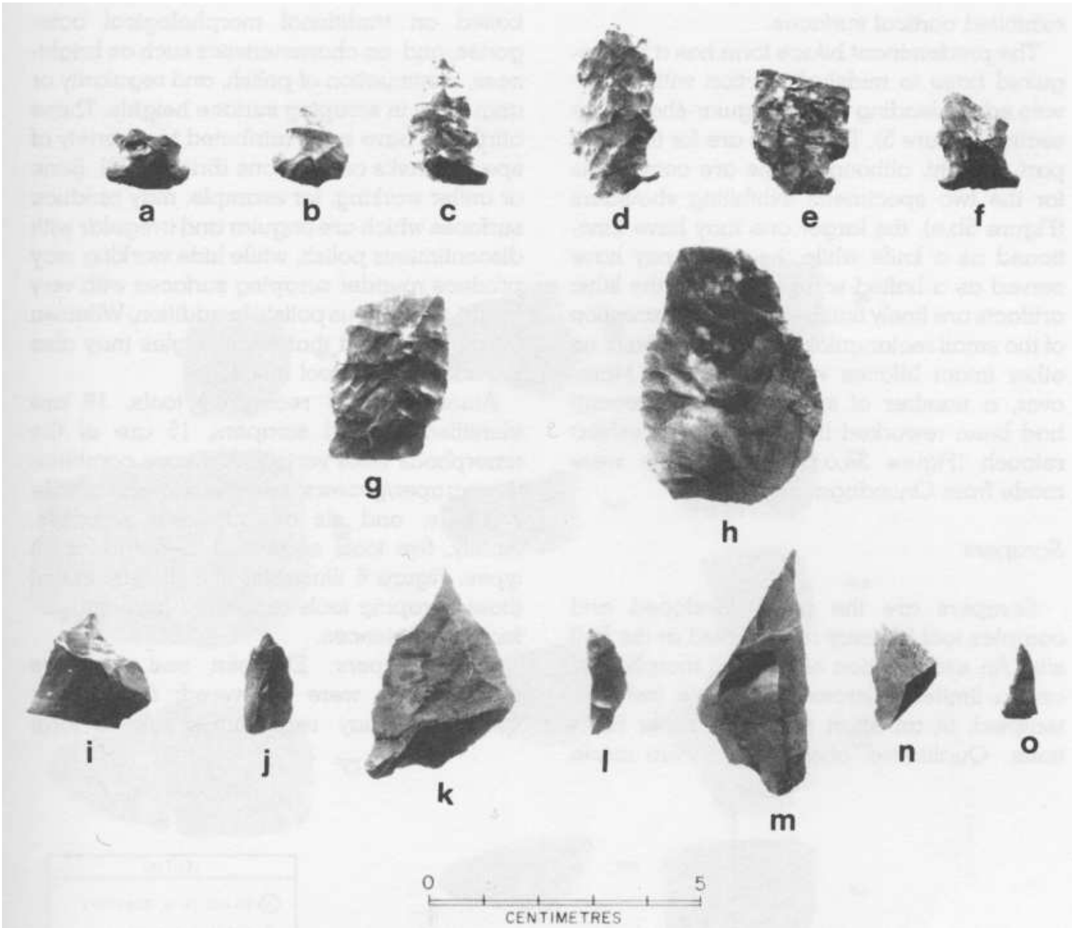

Figure 3. Projectile Points (a-f), Knives (g-h) and Gravers (i-o) from the Bell Site (AgGt-33).

Because of the lack of complete specimens, and the fact that most have been thermally altered, the points from the site cannot easily be assigned to established type categories. While all are side notched, the notch widths and basal widths vary considerably. Nevertheless, there is some uniformity in overall basal configuration, which appears to be consistent with the Brewerton side-notched form (Ritchie 1971). The complete projectile point is bi-convex in cross-section, with a trianguloid blade characterized by excurvate/straight edges and a straight but expanded base. While these are characteristic attributes for the Brewerton side-notched form, this specimen falls below the generally accepted size range for such points. The Middle Archaic Brewerton phase has been dated to circa 5,000 - 4,500 B.P. for south-ern Ontario and contiguous parts of the Northeast (Ellis et al.1990:86).

Bifaces

Seventy-three bifaces were recovered, 25 percent of which were surface finds from south of the excavated area. Three bifaces were recovered from subsoil contexts, while the remainder were from the ploughzone (Figure 4). For those specimens where lengths, widths, and thicknesses could be recorded, their means are 3.08, 2.57, and .81 cm, respectively. Eighteen percent of the bifaces were thermally altered and 19 percent exhibited cortical surfaces.

The predominant biface form has a rectanguloid base to midshaft section with excurvate edges leading to a triangular-shaped tip section (Figure 5). The bases are for the most part straight, although some are convex. As for the two specimens exhibiting shoulders (Figure 5b,e), the larger one may have functioned as a knife while the other may have served as a hafted scraper. Few of the lithic artifacts are finely finished. With the exception of the small rectanguloid type (Figure 5a,f), no other intact bifaces were recovered. More-over, a number of specimens (10 percent) had been reworked into scrapers or exhibit retouch (Figure 5n,o,p). All but one were made from Onondaga chert.

Scrapers

Scrapers are the most developed and complex tool industry represented at the Bell site. An examination of general morphology and a limited microwear analysis were attempted, in an effort to infer scraper functions. Qualitative observations were made based on traditional morphological categories, and on characteristics such as brightness, continuation of polish, and regularity or angularity in scraping surface heights. These attributes have been attributed to a variety of specific tasks or functions (Brink 1978). Bone or antler working, for example, may produce surfaces which are angular and irregular with discontinuous polish, while hide working may produce rounder scraping surfaces with very bright, continuous polish. In addition, Wilmsen (1968) has noted that edge angles may also provide clues to tool function.

Among the 59 recovered tools, 18 are identified as end scrapers, 15 are of the amorphous flake variety, eight are combination scraper/gravers, seven are lateral or side scrapers, and six are crescent scrapers. Finally, five tools combined elements of all types. Figure 6 illustrates the distribution of those scraping tools recovered from subsurface proveniences.

End Scrapers. Eighteen end scrapers (Figure 7a-k) were recovered; three other specimens may represent a related form

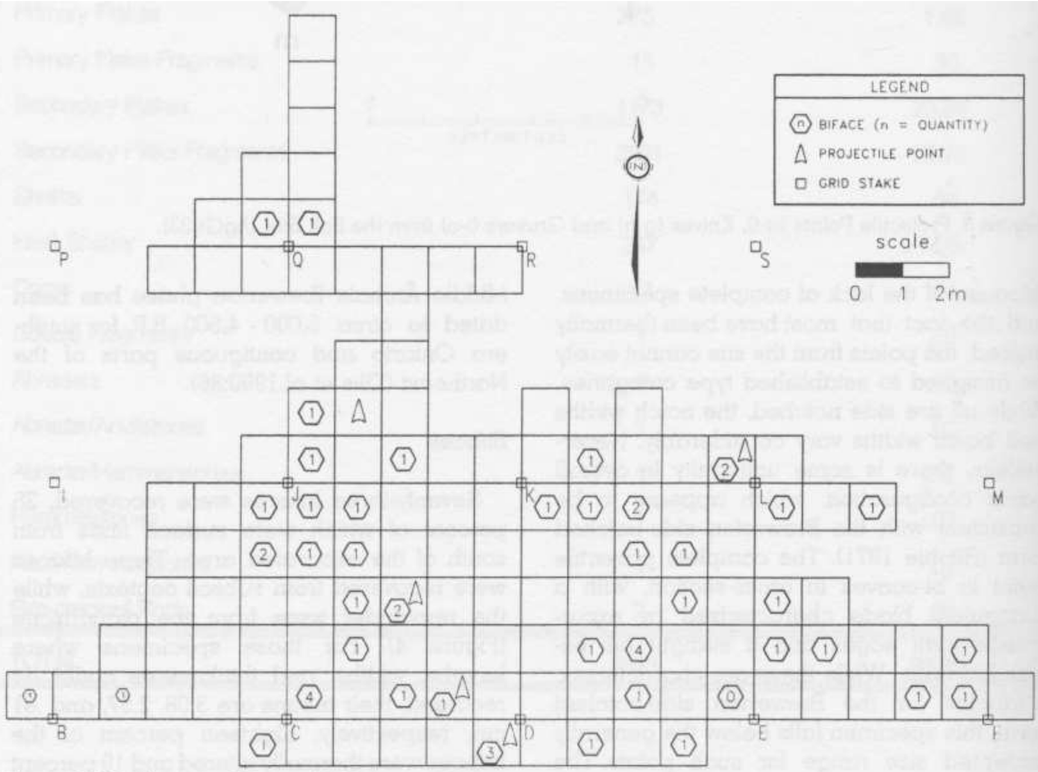

Figure 4. Distribution of Projectile Points and Bifaces from Excavated Units.

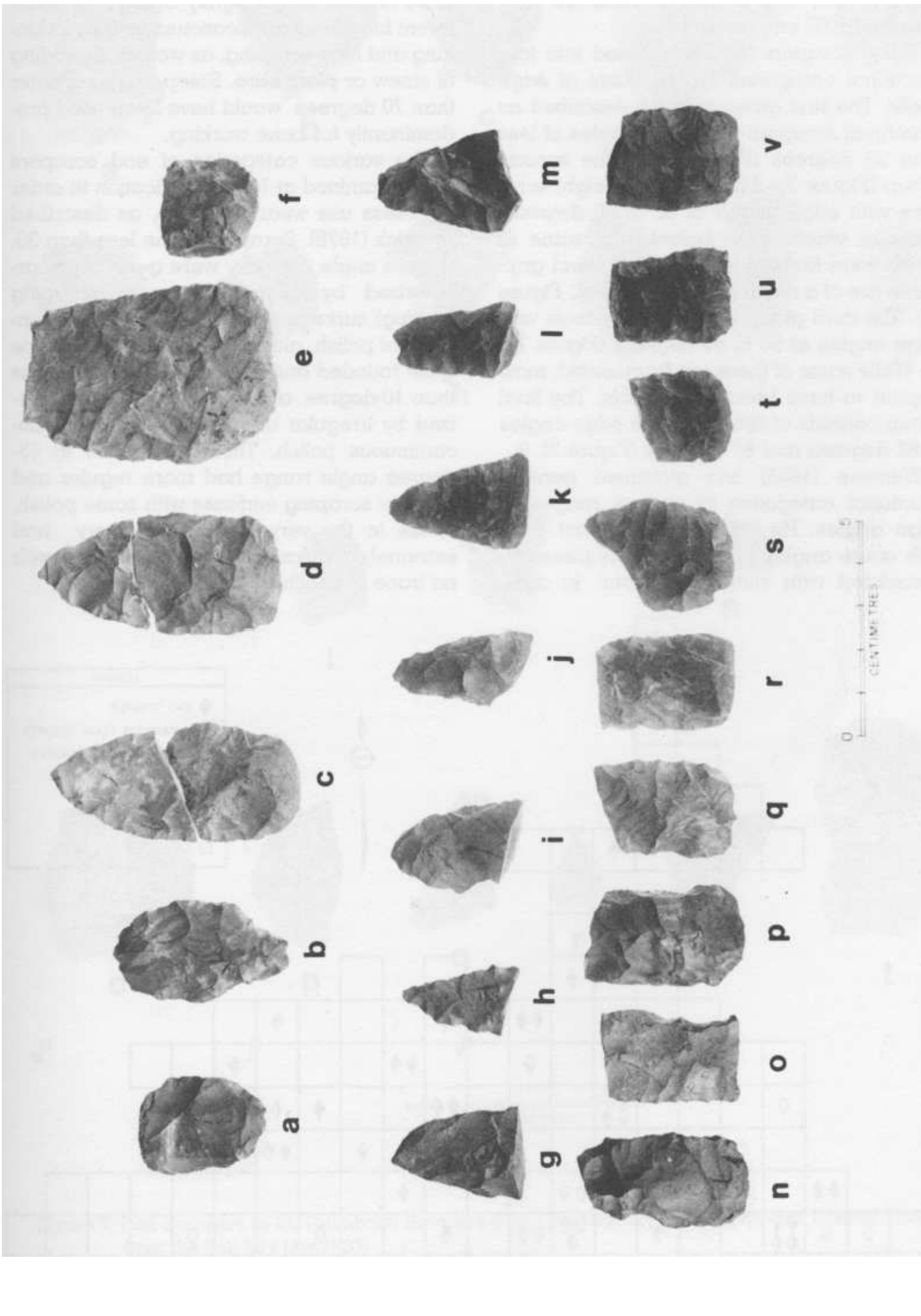

Figure 5. Bifaces from the Bell Site (AgGt-33).

(Figure 71-n). Together, they total almost forty percent of the scraping tool industry. Lengths vary from 2.4 cm to 3.9 cm, and edge angles from approximately 30 degrees to 85 degrees. Mean length, width, and thickness are 2.86, 2.21, and 0.69 cm, respectively.

These scrapers may be classed into four functional categories on the basis of edge angle. The first group may be described as thumbnail scrapers with edge angles of less than 30 degrees (Figure 71-n). The second group (Figure 7a-d,h) consists of eight scrapers with edge angles of 30 to 40 degrees, some of which were hafted, and some of which were faceted to facilitate a hand grip. Three are of a much smaller size (e.g., Figure 7k). The third group includes eight tools with edge angles of 55 to 65 degrees (Figure 7e, g). While some of these are fragmented, most appear to have been hafted tools. The final group consists of two tools with edge angles of 82 degrees and 85 degrees (Figure 7f, j).

Wilmsen (1968) has attributed general functional categories to various ranges of edge angles. He has suggested that tools with acute angles less than 40 degrees are associated with cutting functions. In addition to those described above, two other tools (Figure 3g, 1) are categorized as knives on the basis of their edge angles and forms.

Wilmsen also argues that angles in the 45 to 55-degree range signify a number of different functional applications, including skinning and hide scraping, as well as shredding of sinew or plant fibre. Steep angles greater than 70 degrees would have been used predominantly for bone working.

The various categories of end scrapers were examined at 10x magnification in order to assess use wear attributes, as described by Brink (1978). Scrapers in the less than 30-degree angle category were generally characterized by angular, irregular scraping (cutting) surfaces with discontinuous to non-existent polish, although one appeared to be quite rounded and regular. Those in the less than 40-degree angle class were characterized by irregular angular surfaces with discontinuous polish. Those in the 55 to 65-degree angle range had more regular and rounder scraping surfaces with some polish. Those in the very steep category had extremely angular and irregular surfaces with no trace of polish.

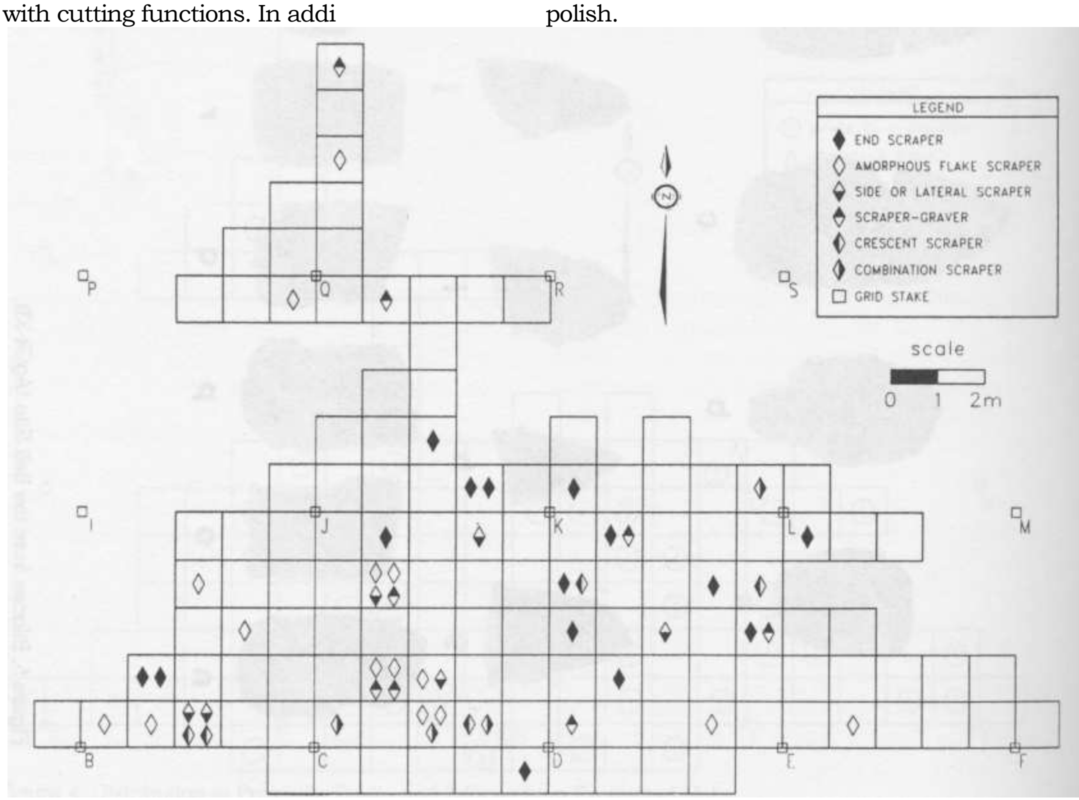

Figure 6. Distribution of Scraping Tools from Excavated Units.

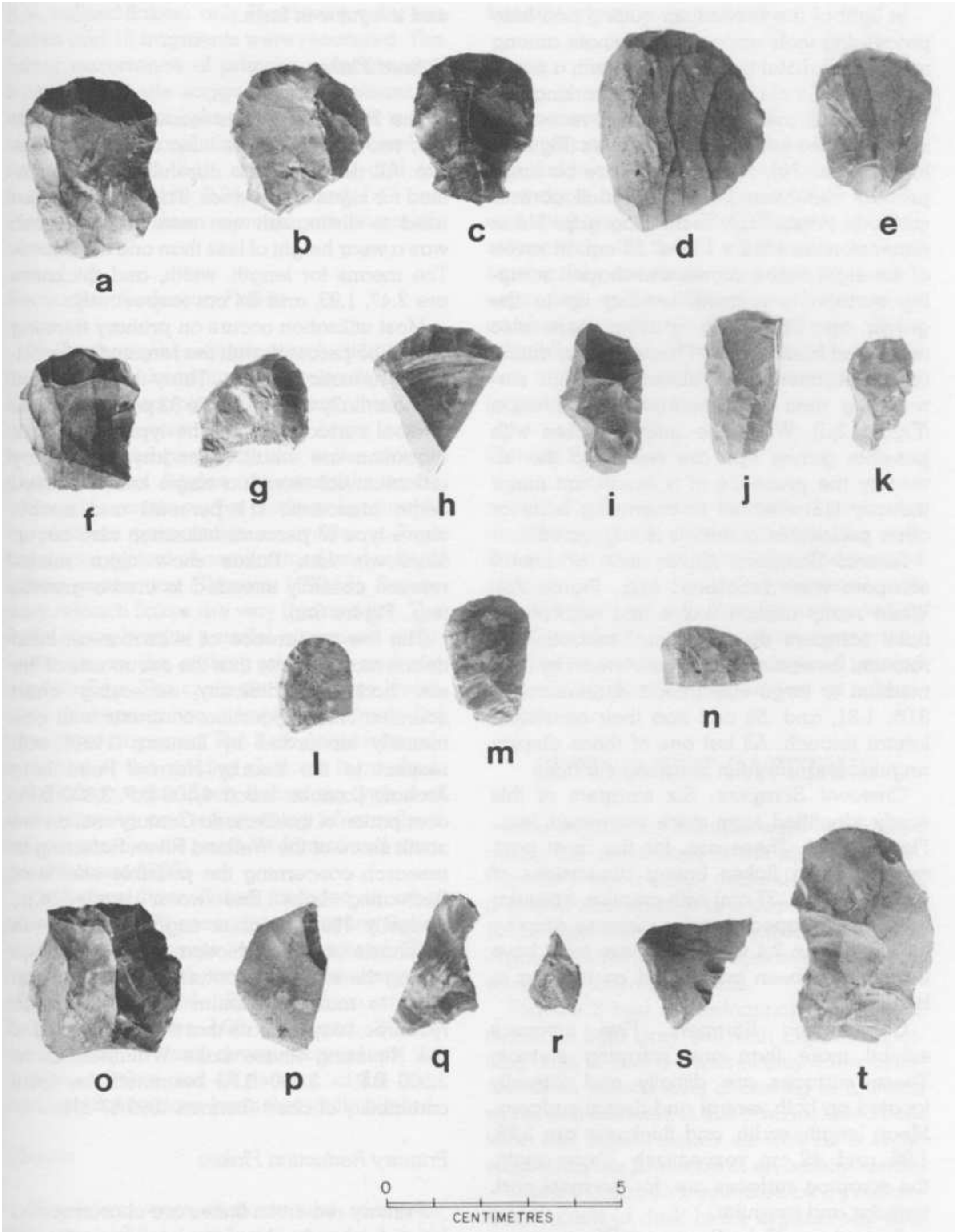

Figure 7. End Scrapers (a-k), Thumbnail Scrapers (1-n), Crescent Scrapers (p, q), and Utilized flakes (r-t) from the Bell Site (AgGt-33).

In light of the preceding, cutting and hide processing tools appear to dominate among recognized distal type scrapers, with a minor presence of tools used for bone working.

Scraper/Gravers. Eight of the recovered scrapers also functioned as gravers (Figure 3 k,l,n; Figure 7p). Five of these are on large primary reduction flakes with dull cortical surfaces presumably facilitating grip. Mean dimensions are 2.8 x 1.96 x .53 cm. In seven of the eight cases, a crescent-shaped scraping surface is present, leading up to the graver tip. Two other gravers were also recovered from the site. These are very diminutive specimens, but obvious retouch surrounding their tips confirms their function (Figure 3j,l). When the utilized flakes with possible graver tips are added to the inventory the presence of a significant minor industry (13) devoted to engraving bone or other perishable materials is suggested.

Lateral Scrapers. Seven side or lateral scrapers were recovered (e.g., Figure 7o). While many utilized flakes and amorphous flake scrapers display lateral utilization or retouch, these tools are characterized by their medium to large size (mean dimensions of 3.05, 1.81, and .56 cm) and their consistent lateral retouch. All but one of these display angular and irregular scraping surfaces.

Crescent *Scrapers.* Six scrapers of this easily identified form were recovered (e.g., Figure 7p,q). These are, for the most part, medium-sized flakes (mean dimensions of 1.87, 1.85, and .37 cm) with angular, irregular crescentic-shaped scraping surfaces, ranging in length from 2.4 to .8 cm. These tools have traditionally been interpreted as relating to bone working.

Combination Scrapers. Five scrapers exhibit more than one scraping surface. These surfaces are distally and laterally located on both ventral and dorsal surfaces. Mean length, width, and thickness are 2.28, 1.98, and .42 cm, respectively. Once again, the scraping surfaces are, for the most part, angular and irregular.

Amorphous *Flake Scrapers.* Fifteen amorphous flakes also exhibit scraping surfaces. Their mean length, width, and thickness are 2.49, 2.01, and .53 cm, respectively. For the most part, scraping surfaces are laterally located on dorsal surfaces, and are angular and irregular in form.

Utilized Flakes

The 77 utilized flakes recovered represent only two percent of the lithic debris from the site. All debitage was carefully hand-examined for signs of use wear. The main criterion used to distinguish use wear from retouch was a wear height of less than one millimetre. The means for length, width, and thickness are 2.47, 1.93, and .54 cm respectively.

Most utilization occurs on primary thinning flakes (65 percent), with the remainder on primary reduction flakes. Thirty-three percent are thermally altered, while 32 percent exhibit cortical surfaces. While the typical forms of utilization are small secondary or primary reduction flakes with a single lateral utilized edge, crescentic (11 percent) and spokeshave-type (7 percent) utilization also occur. Moreover, four flakes show clear micro-retouch possibly intended to create gravers (e.g., Figure 3m).

The low occurrence of utilization on lithic debris may indicate that the occupants of the site had little difficulty accessing chert sources. This suggestion contrasts with one recently forwarded by Lennox (1990) with respect to the nearby Narrow Point Late Archaic Lamoka (circa 4,500 B.P.-3,800 B.P.) occupation of the Canada Century site, on the south shore of the Welland River. Referring to research concerning the possible effects of fluctuating Lake Erie water levels (e.g., Pengelly 1991), Lennox suggested that an emphasis on the reduction of bipolar cores during the tool manufacturing process, in an effort to make maximum use of a scarce resource, may indicate that the high waters of the Nipissing Phase Lake Wainfleet *(circa* 5,500 B.P. - 3,900 B.P.) restricted the local availability of chert (Lennox 1990:47-51).

Primary Reduction *Flakes*

Primary reduction flakes are characterized by a thick, chunky dorsal surface. Dorsal flake scars are deep and random, and exhibit a large Beta Angle. Such flakes may be produced during initial core reduction (Thomas 1992:21). Excluding those primary reduction flakes included in other categories (i.e., utilized flakes), only 75 primary reduction flakes and 15 fragments were recovered. The minor occurrence of primary reduction activities at the site suggests that preforms or bifaces were brought to the site. The mean length, width, and thickness for complete flakes are 2.64, 2.13, and .57 cm, and for fragmentary flakes 2.31, 2.36, and 1.47 cm, respectively. Fifteen percent are thermally altered.

Secondary Reduction Flakes

The category of secondary reduction flakes includes both knapping and retouch flakes. Secondary knapping flakes are thin and regular in cross-section. Dorsal scars tend to be aligned and perpendicular to the striking platform. Beta Angles are generally acute, although sometimes the platform is rounded by platform preparation or crushing. Such flakes are typical of semi-refined and refined biface production (Thomas 1992:23). Secondary retouch flakes are very thin and flat. The flake scars have a parallel alignment, perpendicular to the striking platform, and are very shallow. The cross-section is very lenticular, or approaches a broad, extremely flat triangle or trapezoid. The Beta Angle is usually acute, or the striking platform is crushed, rounded or worn. Such flakes are typical of final shaping or resharpening of a refined biface, a projectile point, or formal end scraper (Thomas 1992).

Excluding those flakes included in other categories, 1,173 secondary reduction flakes and 2,891 fragments were recovered. The mean length, width, and thickness for complete flakes are 1.54, 1.27, and .26 cm, and for fragmentary flakes 1.06, 1.04, and .22 cm, respectively. Twenty-seven percent of the complete flakes and 43 percent of the fragmentary flakes have been thermally altered.

Shatter

Specimens were characterized as shatter when typical flake attributes appeared to be missing. Most are rectanguloid in form. Their mean length, width, and thickness are 1.81, 1.23, and .49 cm. The mean length, width, and thickness of heat shatter are 1.7, 1.23, and .51 cm. Ninety-five percent of all shatter was found in ploughzone contexts.

Cores

Ten cores were recovered from ploughzone contexts and two from subsoil contexts. Only one had been thermally altered and all are of Onondaga chert. Their mean length, width, and thickness are 4.63, 2.86, and 1.65 cm, respectively. Of the 12 specimens, two are bipolar, four are single ridge, four are heavily expended, one is utilized along its heavily crushed margins, and one appears to be bifacially worked. The latter artifact may, in fact, represent a basal fragment from a very large biface.

Ground Stone Tools

Ten small abraders, hammerstones, and anvilstones were recovered from the site. Seven abraders, formed from fine-grained sandstones, are irregularly-shaped with multiple surfaces smoothed through grinding use. Two other specimens show clear pitting and use as anvils, while pecking and faceted surfaces on another suggest use as a hammerstone.

SETTLEMENT PATTERNS

Four subsurface features were recognized during the excavation of the site (Figure 8). Feature 1 was a small, ovate-shaped pit with a simple basin profile to a depth of 10 cm. It had a light-coloured fill of subsoil with some organic soil mottling and contained only three secondary flake fragments.

Feature 2 had a predominant surface fill matrix of light grey soil with charcoal mottling. This fill had a depth of only a few centimetres. A subsoil level clustering of artifacts within and adjacent to this area included both lithic and faunal debris as well as a knife, suggesting the presence of an activity centre.

Feature 3 was characterized by a predominant matrix of dark black organic soil with charcoal and subsoil mottling. Fire-cracked rock and lenses of fired soil and sand mottled with fully carbonized charcoal were evident in the first 10-15 cm of fill. Numerous thermally altered, secondary reduction flakes, carbonized butternut fragments, faunal remains,

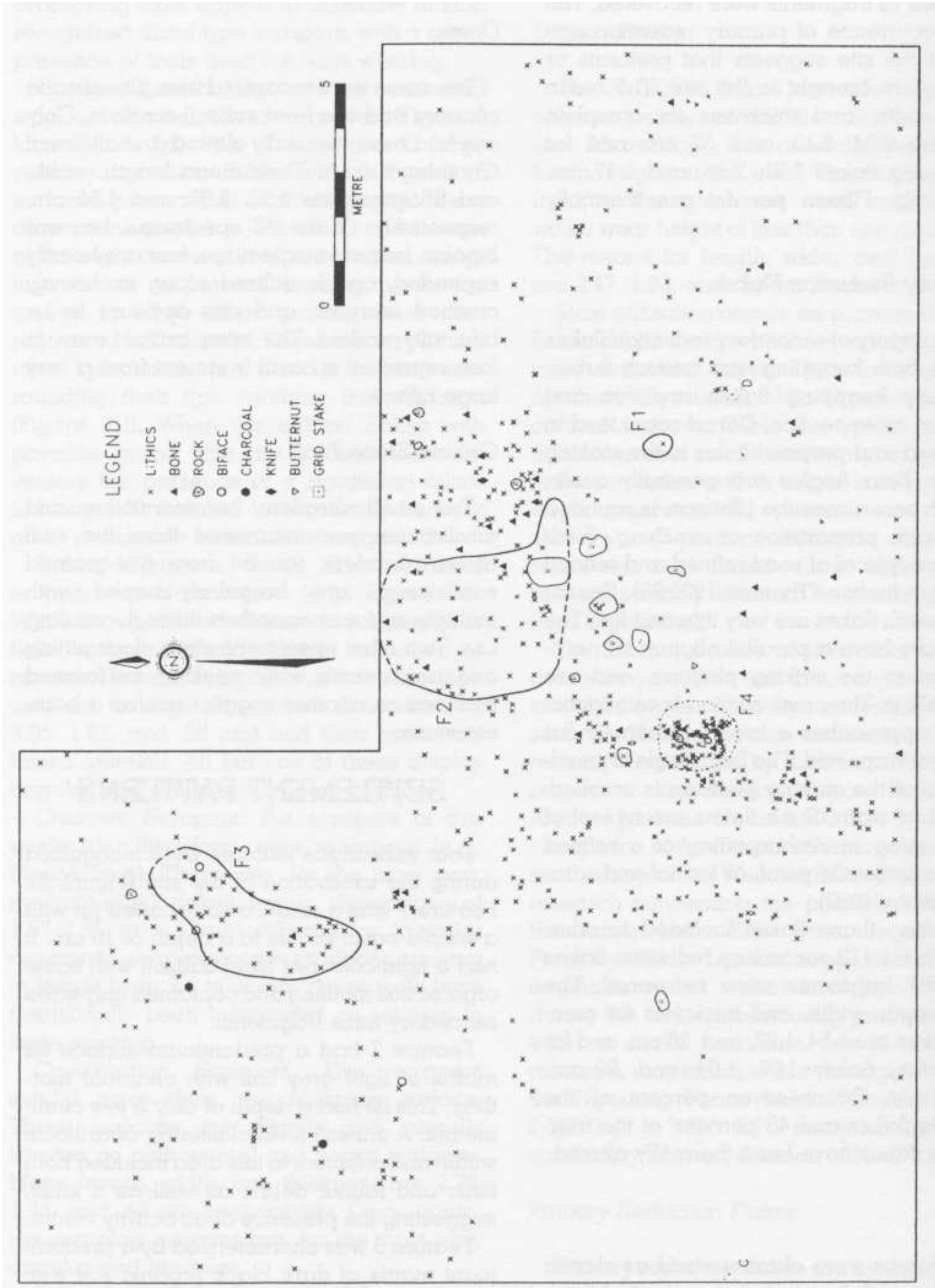

Figure 8. Subsurface Settlement Patterns and Artifact Finds.

and several biface fragments were also recovered.

Feature 4 was not recognized on the basis of soil discolouration, but on the basis of artifact clustering in the subsoil. The location appears to correlate with high densities of floral and faunal remains, scraping tools, and other artifact types.

None of these features, or artifact clusters representing activity areas, can be related to the presence of house structures. While house walls have been interpreted elsewhere on the basis of debitage density transects in ploughzone levels (Lennox 1986, 1990), the densities recorded at Bell for ploughzone levels (Figure 9) appear to reflect rather small, multiple areas of high densities rather than a larger focal pattern. On the other hand, those units at the southern base line of the excavations appear to represent the centre of most activity on the north section of the site. Future examination of units immediately south of the excavated area may result in a more complete picture, and perhaps even the delineation of house walls.

In the meantime, however, the nature of subsurface features and the overall density and distribution of various artifactual remains attest to an intensive, if not long-term, occupation. The spatial distribution noted at the Bell site has also yielded important data for designing and implementing research programs at similar sites in the future. Figures 9 and 10 provide frequencies for recovered artifacts from ploughzone and subsoil proveniences. While the highest ploughzone densities clearly correlate with significant subsoil artifact densities and indices of feature activity, mid-range ploughzone densities (30 - 60 flakes) may not (e.g., P21-Q2; K6,11; D2,7,12, 17,21). This suggests that some activity areas may be reflected only in ploughzone densities. Moreover, these areas may be located beyond the limits of the site as delineated by numerous adjacent units consistently producing less than 15 flakes (e.g., P21; Q1,2).

Another attribute which may or may not correlate with subsoil activity is the percentage of thermally altered material within ploughzone levels (Figure 11). In all those cases where subsoil activity areas were detected, percentages of thermally altered material from those (or immediately adjacent) squares were significantly above 50 percent, whereas the mean for the site is less than 40 percent. As might be expected, the same is true for subsoil percentages (Figure 12). Although fired soil was not detected outside of Feature 3, these percentages, along with the recovery of fire-cracked rock, carbonized flora and calcined fauna, suggest these concentrations may also have been hearths. Unfortunately, the distribution of subsoil flakes does not suggest anything more specific, beyond the delineation of the four features and a few other less dense, but still discrete clusters of flakes, north and south of Feature 4.

SUBSISTENCE PATTERNS

Flora

Plant remains recovered from two of the features and a number of trowelled subsoil contexts were analyzed by Dr. Stephen Monckton. Samples consisted of 21.56 g of light fraction from a subsoil feature (Feature 3 at 6-10 cm) and a series of wood charcoal fragments. The following descriptions and identifications were provided by Monckton.

Following Crawford (1982), the light fraction of Feature 3 was passed through a series of nine geological sieves with aperture sizes of 4.00, 2.80, 2.36, 2.00, 1.40, 1.00, .710, .425, and .212 mm. The resulting 10 particle size fractions were sorted individually. Material larger than 2.36 mm was separated completely into wood charcoal, mineral, uncarbonized organic, and unidentified plant remains. The weight proportions of these components were used to calculate their contribution to the sample as a whole. Since the light fraction was collected using a .596-mm mesh, the collection of particle size categories smaller than this was considered to be fortuitous. Percentage calculations for the total sample, therefore, do not include the contents of the .212-mm mesh. All mesh contents, however, were sorted and examined for seeds.

Analysis of the light fraction from Feature 3 revealed 10 carbonized raspberry *(Rubus* sp.) seeds, a knotweed (Polygonum sp.) seed, a fragment of white pine (Pinus *strobus)* needle, and two unidentified cone or bud structures. Members of *Rubus* are known to have been

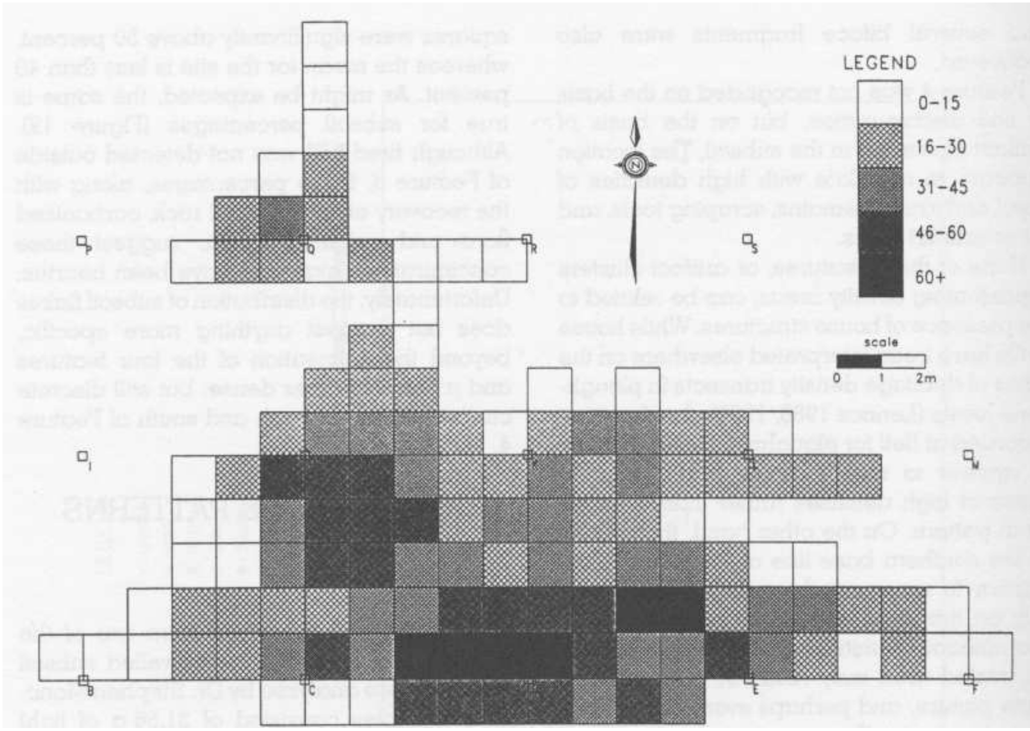

Figure 9. Artifact Density per One-Metre-Square Ploughzone Level.

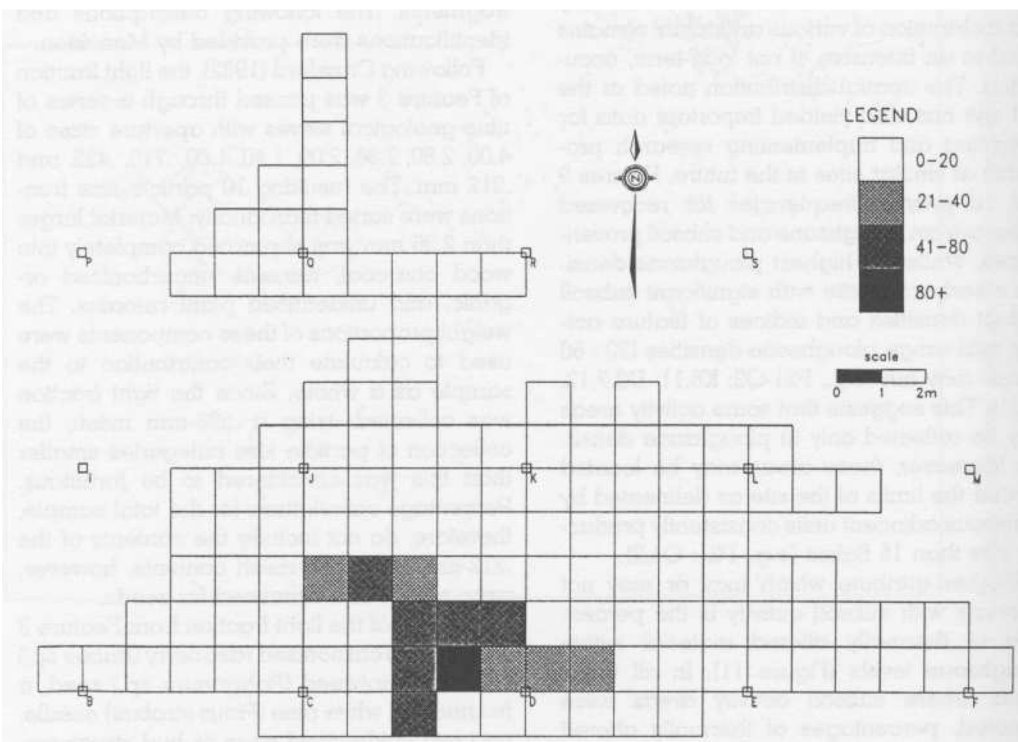

Figure 10. Artifact Density per One-Metre-Square Subsoil Level.

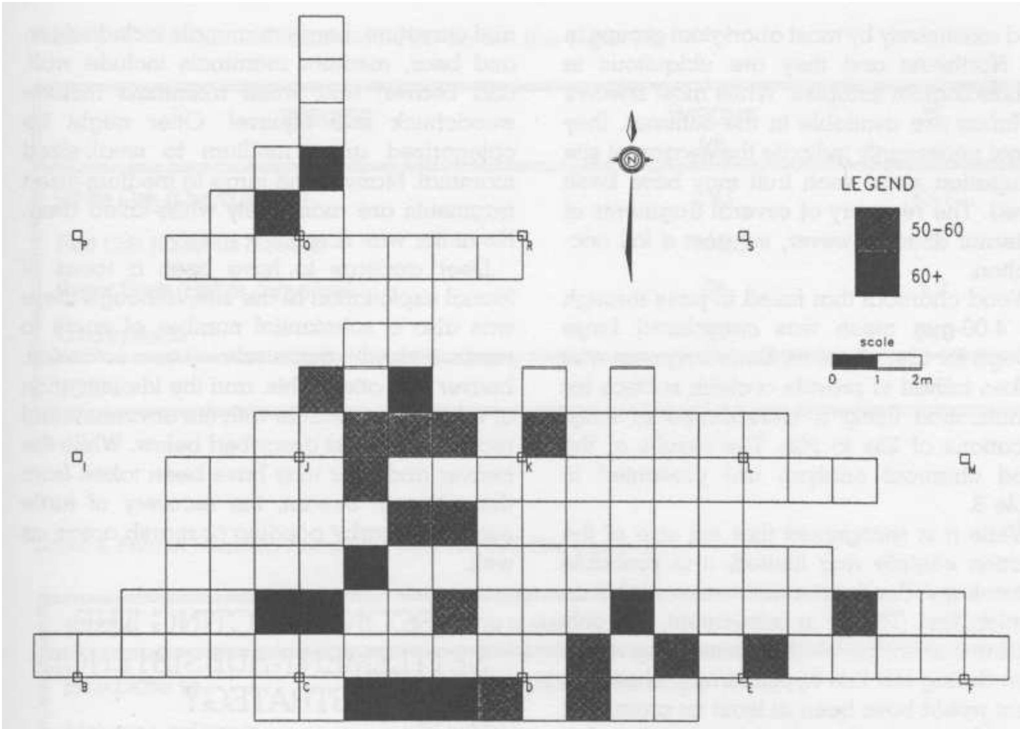

Figure 11. Thermally Altered Artifact Density per One-Metre-Square Ploughzone Level.

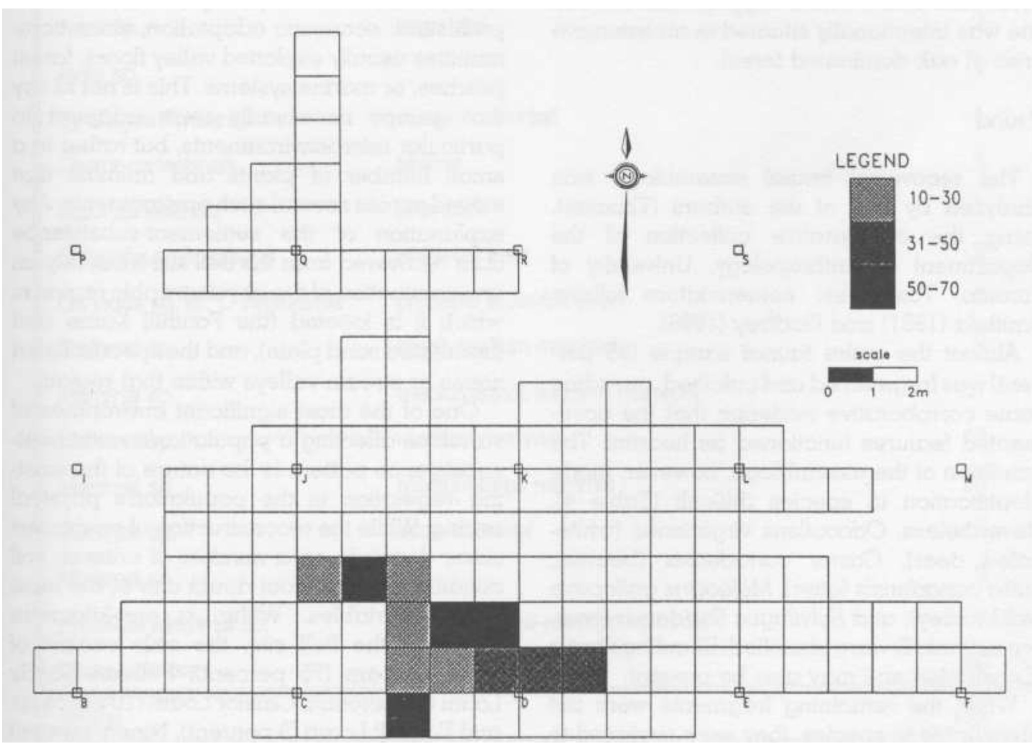

Figure 12. Thermally Altered Artifact Density per One-Metre-Square Subsoil Level.

used extensively by most aboriginal groups in the Northeast and they are ubiquitous in archaeological samples. While most species of *Rubus* are available in the summer, they do not necessarily indicate the season of site occupation since such fruit may have been stored. The recovery of several fragments of butternut does, however, suggest a fall occupation.

Wood charcoal that failed to pass through the 4.00-mm mesh was considered large enough for identification. Each fragment was broken in half to provide a clean surface for identification using a stereoscope at magnifications of 25x to 50x. The results of the wood charcoal analysis are presented in Table 3.

While it is recognized that the size of the flotation sample was limited, it is probable that oak was the dominant taxon available as burning fuel. This is in agreement, not only with our current knowledge concerning vegetation during the late hypsithermal when oak forest would have been at least as prominent in southwestern Ontario as it is today, but also with the environmental reconstruction presented below which suggests that the Bell site was intentionally situated in an extensive area of oak dominated forest.

Fauna

The recovered faunal assemblage was analyzed by one of the authors (Thomas), using the comparative collection of the Department of Anthropology, University of Toronto. Taxonomic nomenclature follows Banfield (1981) and Godfrey (1986).

Almost the entire faunal sample (96 percent) was fragmented and calcined, providing some corroborative evidence that the documented features functioned as hearths. The condition of the assemblage, however, made identification to species difficult (Table 4). Nevertheless, Odocoileus virginianus (white-tailed deer), Castor *canadensis* (beaver), *Lutra* canadensis (otter), *Meleagris gallopavo* (wild turkey), and *Sylvilagus* floridanus (east-ern cottontail) were identified. Blandings turtle *(Emydoidea* sp.) may also be present.

While the remaining fragments were not identifiable to species, they were assigned to size ranges on the basis of cortex thickness and curvature. Large mammals include deer, and bear, medium mammals include wolf, and beaver, and small mammals include woodchuck and squirrel. Otter might be categorized as a medium to small-sized mammal. Many of the large to medium-sized fragments are most likely white-tailed deer. No antler was noted.

Deer appears to have been a focus of faunal exploitation at the site, although there was also a substantial number of small to medium-sized mammals (i.e., cottontail, beaver and otter). This, and the identification of wild turkey concurs with the environmental reconstruction as described below. While the beaver and otter may have been taken from the adjacent stream, the recovery of turtle suggests nearby ponding or marsh areas as well.

RECONSTRUCTING THE SETTLEMENT-SUBSISTENCE STRATEGY

The microenvironment is the most effective level at which to attempt any reconstruction of prehistoric economic adaptation, since communities usually exploited valley floors, forest patches, or marine systems. This is not to say that groups necessarily were adapted to particular microenvironments, but rather to a small number of plants and animals that extend across several such environments. Any explanation of the settlement-subsistence data recovered from the Bell site must rely on an examination of the physiographic region in which it is located (the Fonthill Kame and associated sand plain), and the specific forest zones or stream valleys within that region.

One of the most significant environmental variables affecting a population's settlement-subsistence pattern is the nature of the existing vegetation in the population's physical setting. While the reconstruction of past forest cover depends on a number of criteria, soil conditions are without doubt one of the most critical variables. Within a one-kilometre radius of the Bell site, the soils consist of Pelham Loam (75 percent), Pelham Sandy Loam (10 percent), Caistor Loam (10 percent), and Fonthill Loam (5 percent). Ninety percent of these loams and sandy loams are well

Table 3. Wood Charcoal Recovered from the Bell Site (AgGt-33).

SPECIES	WEIGHT	%
White Oak *(Quercus alba)*	2.63	83.7
Red Oak *(Quercus borealis)*	.03	.9
Paper Birch *(Betula papyrifera)*	**.04**	1.3
Unidentifiable	**.44**	**14.0**
TOTAL	**3.14**	**99.9**

Table 4. Faunal Remains Recovered from the Bell Site (AgGt-33).

TAXON	COMMON NAME	NISP
Emydoidea sp.	large turtle (probably Blandings)	1
Meleagris gallopavo	wild turkey	1
Aves sp.	medium-large bird	1
Aves sp.	large bird	2
Aves sp.		1
Sylvilagus floridanus	eastern cottontail	1
Castor canadensis	beaver	1
Lutra canadensis	river otter	1
Odocoileus *virginianus*	white-tail deer	2
Cervidae sp. cf. *0 virginianus*	probable white-tail deer	3
Mammal sp.	small-medium mammal	9
Mammal sp.	medium/small-medium mammal	31
Mammal sp.	medium mammal	18
Mammal sp.	medium-large mammal	25
Mammal sp.	large mammal	7
Mammal sp.		9
Probable Mammal sp.	probable small-medium mammal	9
Class unknown	probable mammal	19
TOTAL		**133**

drained. Within a five-kilometre radius of the site, the soils include Caistor Loam (20 percent), Pelham Loam (18 percent), Pelham Sandy Loam (14 percent), and Fonthill Loam (12 percent), as well as Haldimand Clay (15 percent), Oneida Clay Loam (13 percent), Berrien Sandy Loam (6 percent), Welland Clay (1 percent), and Ontario Loam (1 per-cent). Seventy-three percent of these soils exhibit good drainage, 21 percent poor drain-age, and 6 percent mixed drainage qualities.

The well-drained loams and sandy loams which predominate in the vicinity of the Bell site provide optimum conditions for supporting stands of mature oak (Quercus sp.). These oaks, and various other secondary species — such as chestnut *(Castanea dentata),* hickory *(Carya sp.),* black walnut *(Juglans* nigra), and butternut *(Juglans* cinerea) — would have formed rich mast-producing forests. The nuts of these trees would have provided a high-caloric food source, and certain game species, particularly white-tailed deer (Odocoileus virginianus), raccoons (Procyon *lotor),* and black bear (Ursus amen-cams) would have been attracted to these environments in the fall and early winter periods. Additional plant species, including (but not limited) to fruit-producing shrubs and trees, would also have flourished within this forest environment.

Before the complexities of seasonal resource exploitation and the reconstruction of settlement-subsistence strategies are discussed, certain general concepts concerning foraging economies and their socio-cultural systems must be outlined. This is best accomplished by examining previous ethnohistorical and archaeological analyses of foraging populations. It has been suggested that hunter-gatherer groups came together in the spring or early summer to form macroband settlements that made use of rich riverine or lakeshore resources. In the fall and winter they separated into microbands consisting of only a few families, in order to exploit forest-based faunal resources, which generally could not support larger concentrations of people (Stothers 1977; Finlayson 1977). As noted below, however, such a settlement-subsistence pattern can no longer be considered to have been the only possible adaptive strategy.

While researchers have attempted to reconstruct settlement-subsistence strategies of regional foraging populations by employing optimal foraging models (Jochim 1976; Reidhead 1980; Keene 1981; Winterhalter and Smith 1981), there are not yet sufficient data in this particular region to reconstruct the complete settlement-subsistence system. We can, however, assume that the Bell inhabitants had a thorough knowledge of their environment and behaved rationally with respect to the exploitation of flora and fauna. The assumptions normally employed by archaeologists to characterize rational decision-making are invariably derived from Zipfs (1949) principle of least effort. The present study likewise assumes that those plant and animal species within a region that are the most cost-effective (in terms of caloric or other value relative to the energy expended in their exploitation) will have played the leading role in the subsistence economy. In so far as they are preserved in the archaeological record, the remains of these resources should be present in high proportions. Unfortunately, the two crucial variables of need and cost are difficult to quantify.

In optimal foraging models, the question of need is usually solved by first estimating the size of the human population under study and then calculating its nutritional and raw material requirements in terms of available wild plant and animal resources. Since quantifying either variable is difficult in the present case, we must be content to assume that those natural resources which were being exploited were done so in a cost-effective manner. It is also reasonable to assume that both basic nutritional needs, and non-food requirements had to be satisfied. Gramly (1977) has noted the importance of animal hides in the manufacture of clothing. Of those animals readily available in the site area, the hides of deer, bear, beaver, and raccoon were the most useful (Keene 1981:145), although the skins of squirrel and muskrat were probably also used. Deer hides were preferred for the production of clothing (Keene 1981:145). Gramly has calculated that Late Iroquoians, living in a climate only slightly colder than that of the study region, needed an average of 3.5 deer hides per person per year to satisfy their clothing needs, exclusive of footwear and other accessories (Gramly 1977:602). When constructing a subsistence schedule, allowance must be made for the acquisition of adequate numbers of deer and other animals at the time of year when their hides were in prime condition. In most cases, this corresponds to those seasons when animal densities and body weights are highest and are therefore most cost-effective to exploit. It is also recognized that cultural variables, such as the desire for dietary variety, would also have played a role in the selection of food resources.

The quantification of cost in subsistence strategies has traditionally been calculated in terms of energy expended or cost-benefit ratios measured in calories (Lee 1968; Rappoport 1968). A notable exception is Reidhead (1976), who relied heavily on ethnographic analogy and experimental data to estimate the hourly labour output required for the exploitation of seasonally-available resources. Jochim's (1976) study provided the foundation for most recent optimal foraging models and efforts at defining cost. Employing ethnographic literature on foragers, he identified two major and recurring decisions that control resource exploitation: (1) the desire to obtain a secure level of food and manufacturing resources, and (2) a need to minimize energy expenditures. To assess the major decisions and cost factors quantitatively, Jochim formulated two main relationships, using as input the average weight of a species, its aggregation size, its density, its mobility, and its non-food yield. His conclusions, not surprisingly, were that the significance of a resource correlates positively with increases in its weight and non-food yield, while its risk as a resource decreases as resource density increases and mobility decreases. Resources were also calculated to be less expensive as aggregation size increases and mobility decreases. One of the most serious problems involved in applying Jochim's or other cost formulas, is estimating values for variables such as mobility, aggregation, or non-food yield. Moreover, Keene (1983) in his critical review of optimal foraging theory, has suggested that it is difficult to assess either the cost involved in maintaining social needs or the degree to which social processes influenced the structure of econo mies. The need to consider such social factors in the application of optimal foraging models has been reiterated by Spence et al. (1984) and Savage (1990).

While we have traced the various problems which characterize any effort to infer a subsistence strategy in a cost-benefit framework, which is the hallmark of optimal foraging models (Keene 1983:139; Martin 1983), this analysis concerns only one component of an annual subsistence schedule. The environmental data suggest that the Bell site was situated in or close to a mast-producing forest and may have functioned as an inland fall and winter hunting camp for a microband consisting of one or two families. The occupation of such a site would have occurred from September to at least December. Important fall activities would have involved the collection of nuts, bush fruits, and tree fruits, as well as the exploitation of deer, raccoon, squirrel, and wild turkey, which were all attracted to the mast-producing forest. Locations along streams, originating within the oak forest zone, would be optimal for the exploitation of such resources, since both humans and fauna require water. There are several other advantages to stream-side locations, including their suitability for black walnuts and butternuts, and their attractiveness to muskrat and beaver.

If these sites were occupied from September to December and functioned primarily as food exploitation and hide processing sites, at least a few house structures would have been necessary. The presence, or absence, of house structures at Bell can only be deter-mined through further excavation to the south of the threatened portion of the site. Such sites should have evidence of the exploitation of resources available within the mast-producing forest zones, and should yield tool assemblages that reflect hunting, hide-working, and nut-processing activities. For the most part, both the artifactual assemblage and subsistence remains recovered from the Bell site excavations conform to these expectations.

SUMMARY AND CONCLUSIONS

Work at the Bell site has resulted in the documentation of one settlement type belonging to a regionally-based, Middle Archaic settlement-subsistence system in the Niagara peninsula. Excavations suggest that it was occupied in the fall to exploit deer and other animals attracted to a mast-producing forest. Moreover, significant scraping and engraving tool industries suggest that the processing of hides and animal bone was one of the major economic activities at the site. Another activity involved the reduction of bifaces, as evidenced by a preponderance of secondary reduction flakes and flake fragments. While the walls of house structures were not delineated, the nature of subsurface features and the overall density and distribution of various artifactual remains attest to an intensive if not long-term occupation. The six temporally-diagnostic artifacts recovered from the site indicate that this occupation dates to the Brewerton phase of the Middle Archaic Period *(circa* 5,000 - 4,500 B.P.).

The Bell site has also yielded important data for designing and implementing re-search programs at similar sites in the future. As discussed earlier, and illustrated in Figures 9 and 10, the relationships between the frequencies of recovered artifacts from ploughzone and subsoil proveniences may be more complex than generally assumed. The highest ploughzone densities clearly correlate with significant subsoil artifact densities and indices of feature activity; however, this correlation is not as apparent in mid-range ploughzone densities. This suggests that some activity areas are only reflected in ploughzone densities.

Another attribute which may or may not correlate with the presence of subsurface features is the percentage of heat-treated material in ploughzone levels (Figure 11). In those areas where concentrated activity was apparent, the frequencies of heat-treated material were significantly higher. Subsoil frequencies of thermally altered material (Figure 12) also share this general correspondence. Although fired soil was not detected outside of Feature 3, these percentages, along with the recovery of fire-cracked rock, carbonized flora and calcined fauna suggest these concentrations may have been hearths.

Analysis of the Bell site also included an attempt to reconstruct the paleoenvironment of the Fonthill Kame to advance an understanding of the nature and habits of flora and fauna available to the site inhabitants. The animal resources apparently exploited in the vicinity of Bell include white-tailed deer, wild turkey, beaver, otter, cottontail and turtle. Significant numbers of deer would have been available to the site inhabitants within a five-kilometre catchment, provided the site was situated in an oak dominated forest zone, and was occupied in the fall. The floral remains, although limited in sample size, support both propositions. The overall size and nature of the site suggests that it functioned as a hunting and processing centre for a small group, probably consisting of one or two families, and was occupied in the fall and perhaps winter. It was neither a base settlement for a larger macroband population, nor a settlement situated to exploit rich riverine re-sources.

While evidence for the Middle Archaic period occupation of the eastern Niagara Peninsula remains relatively scarce, more general Archaic period patterns of site distribution, and regional settlement-subsistence strategies, are better documented. For the most part, regional groups appear to have followed settlement-subsistence systems involving interior fall and winter microband camps located upriver, and larger spring and summer macroband settlements located near river mouths and lakeshores (Ellis et al. 1990). Such inferences are largely based on the work of Ritchie and Funk (1973), who have described the New York Brewerton settlement and subsistence patterns in terms of small inland hunting camps occupied in the late fall and winter by small bands or families, and larger spring macroband settlements at productive fishing spots, where groups may have remained for months.

More recent research has, however, raised questions about the inland/microband/cold season - littoral/macroband/warm season dichotomy in the cyclical movement of groups. Several of these studies suggest that the frequent re-use of many Middle and Late Archaic sites, may indicate that some populations were attracted to particularly rich environments that offered the potential of meeting subsistence needs on a year-round basis (e.g., Woodley 1990; Welsh et al. 1992). Such regionally-based settlement-subsistence systems, in which the need for large scale mobility was obviated by the reliability and diversity of more localized resources, may have significant implications for an under-standing of the evolution of band territoriality during the Middle to Late Archaic, as was originally proposed by Brose (1978).

Further excavation at the Bell site and a well-designed regional survey would likely yield important new data. More research in this and other regions will permit archaeologists to assess the full range of site types present, and to identify settlement-subsistence systems through environmental reconstruction. The Bell site study, while not part of a long-term research project of this type, has successfully salvaged important data from a Middle Archaic site that would otherwise have been lost or destroyed during development.

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