AN INVESTIGATION OF PALEO-INDIAN LIFEWAYS AT THE THEDFORD II SITE IN SOUTHWESTERN ONTARIO

BY

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ABSTRACT

This thesis studies selected aspects of Paleo-Indian culture and lifeways at the Thedford II site in southwestern Ontario. These aspects are: 1) lithic-related intra-site activities, 2) the intensity of the occupation, 3) the season(s) of occupation. These topics are discussed by analysing the intra-site spatial distribution, association and patterning of lithic materials; comparative archaeology with other Paleo-Indian sites in northeastern North America; and ethnographic data concerning the Nunamiut and Chipewyan.

The determination of tool function by a study of working edge angles and edge shapes is the first step in the analysis. This study produces artifact categories which are subjected to a nearest neighbour analysis, the index of segregation test and the "presence-absence test". The former is used to study the distribution of artifact categories and the latter two determine the spatial association between two or more categories. This distribution and association was generally found to be random. Three artifact clusters which are assumed to indicate activity areas are then formed from artifact groups.

The clusters are compared with each other and with those from other sites regarding inferred activities. From these comparisons, the intra-site spatial analysis and ethnographic data, it is suggested that Thedford II was a base camp where a variety of activities occurred. These activities may have included the working of wood, bone, meat and hide; tool manufacture and maintenance; and the manufacture of clothing, shelter and household items.

The intensity of the occupation was determined by calculating the tool and debris densities for the entire site and the clusters. Similar calculations are made for other Paleo-Indian sites and compared with Thedford II and ethnographic data. It is speculated that the site was occupied once by a small group, perhaps a family of 4 to 7 individuals for a month or less.

The occupation was perhaps during cold-weather, likely winter. This inference is based on the intensity of the occupation, the types of intra-site activities inferred, the degree of lithic raw material conservation and comparison with ethnographic data.

The main importance of this thesis is the application of a statistical approach to study Paleo-Indian intra-site activities, camp formation and organization and the intensity and season of occupation. The employment of more than one statistical test in combination with a tool function analysis is unique to Paleo-Indian studies in northeastern North America and it is hoped that this will stimulate similar research at other sites. This thesis also adds to the current body of Paleo-Indian knowledge, where few sites have been extensively analysed.

ACKNOWLEDGEMENTS

This thesis is the culmination of several years of research and its completion would not have been possible without the assistance of certain individuals.

I am very grateful to Chris Ellis and Brian Deller who allowed me to excavate at the Thedford II site. They also provided me with access to the artifacts and invaluable site data.

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Finally, my deepest and warmest appreciation goes to my wife, Susan, whose encouragement and understanding enabled me to complete this thesis. She spent many long hours performing the monumental task of transforming my sloppy handwriting and cryptic notes into presentable text for the several preliminary drafts and this final thesis copy.

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CHAPTER I
INTRODUCTION

The aim of this thesis is to study selected aspects of Paleo-Indian culture and lifeways as revealed by the Thedford II site lithic remains (Fig. 1). These aspects are 1) lithic-related intra-site activities, 2) the intensity of the occupation which refers to the number of site inhabitants and their length and frequency of occupation, 3) the season(s) of occupation. These topics are addressed by using intra-site archaeology, comparative archaeology with other Paleo-Indian sites and ethnographic data.

The study of Paleo-Indians is important to archaeological research because knowledge is obtained concerning a cultural group which existed during the late Pleistocene and early Holocene. This is a little known period of great environmental and cultural change especially in northeastern North America. The sites usually contain few artifacts and little or no floral and faunal remains in comparison with sites of the succeeding Archaic culture. Within southwestern and soutcentral Ontario, an area covering over 50,000 km^2, approximately five Paleo-Indian sites have been published (Deller, 1976; Roosa, 1977a, 1977b; Storck, 1979, 1982; Roosa and Deller, 1982). Thus less is known about the Paleo-Indian culture than later cultures. This fact and the paucity of sites makes it necessary to investigate early sites more intensively. This thesis provides valuable information especially concerning Paleo-Indian lifeways, tool function and intra-site activities in the Great Lakes region.

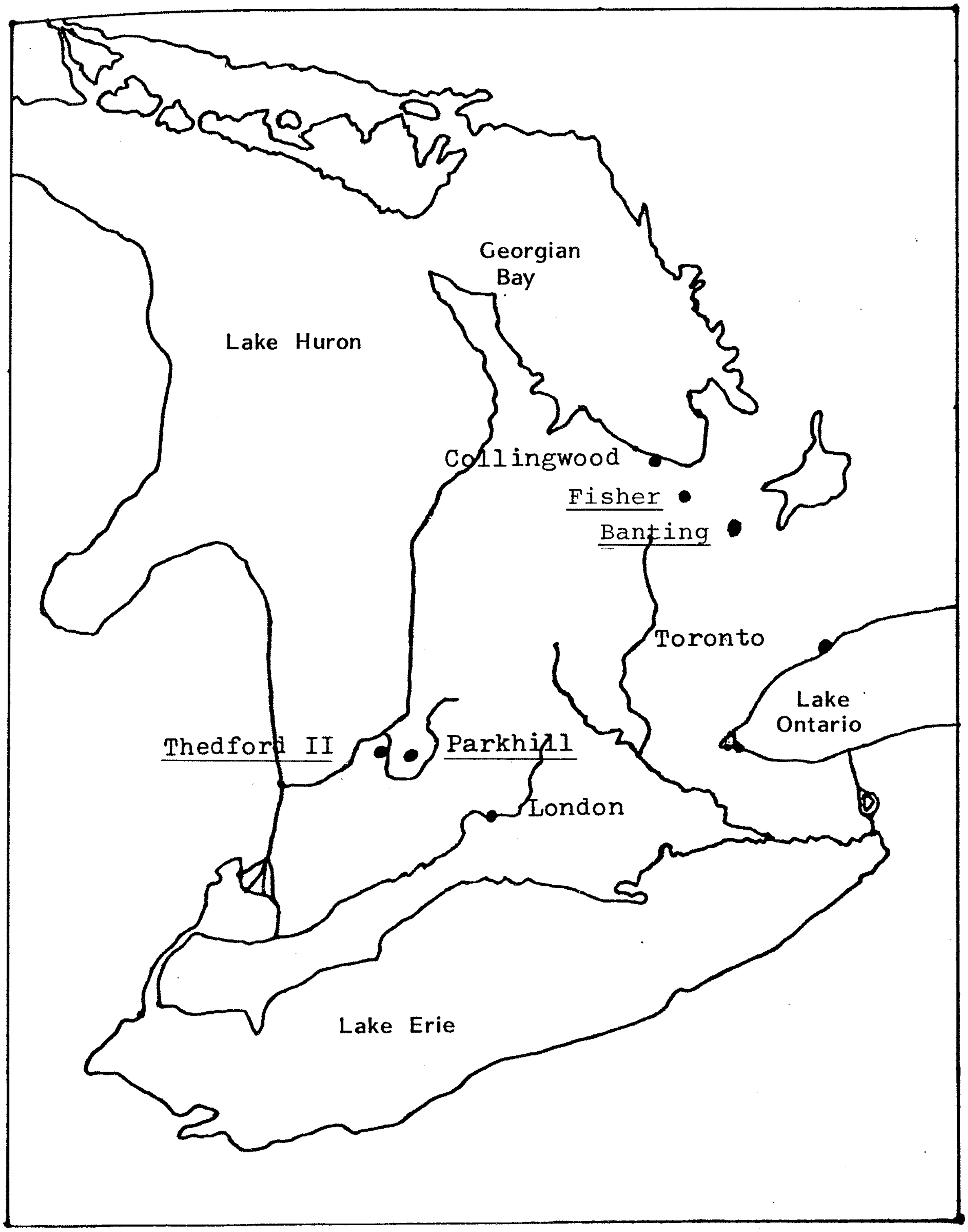


Figure 1: Location of the Thedford II site in southern Ontario
(Paleo-Indian sites are underlined)

The determination of intra-site activities was pursued by analysing the spatial distribution, association and patterning of lithic materials. This was done largely through statistical procedures. No other known Paleo-Indian site studies in the Great Lakes region except the Barnes site (Voss, 1977) in Michigan have employed a statistical approach to analyse the spatial distribution of artifacts. The shortcomings of Voss' work are discussed in Chapter 3. Paleo-Indian researchers (e.g. MacDonald 1968; Storck, 1979; Gramly, 1982) often merely present artifact distribution maps without analysing them in order to support inferences regarding intra-site activities. This thesis will hopefully stimulate similar research as more sites are investigated.

The first procedure in the analysis was to determine tool function. This was accomplished by studying working edge angles and edge shapes following Wilmsen (1970) and Keeley (1980). The artifact categories produced from the tool function analysis allows one to: 1) study the type of distribution of each category 2) discover which categories are associated and then to 3) group the categories to form artifact clusters which can then be studied.

The distribution of artifact types and/or associations of types has been attempted by using various techniques. Some authors have relied merely on inspecting artifact plots of occupation floors and discussing the possible spatial relationships between the artifacts. Another method involves counting the number of artifact types in a certain size of units into which the occupation floor has been divided and then employing contiguity ratios and the variance mean ratio to determine spatial association (Dacey, 1973). Whallon (1973) has demonstrated the application of dimensional analysis of variance which defines the unit sizes coinciding with the degree of artifact patterning.

This thesis employed a nearest neighbour analysis to study the dispersion of artifact categories. It was first adopted by Clark and Evans (1954) and used by Whallon (1974) in archaeology. The two methods used here for determining the spatial association between two or more artifact categories are the index of segregation and the "presence-absence test". Both tests measure the tendency for artifact types to be segregated or aggregated. The former was developed in plant ecology (Pielou 1969) and has since been employed by archaeologists (Peebles, 1971; Price, 1978). The method also depends upon the measurement of the distances between points, dealing with the distribution of a single artifact type and then comparing it to that of another type. The latter has been used in archaeology by Dacey (1973). and depends upon whether or not an artifact type is located within each quadrat into which the site has been divided.

In the next step, artifact groups were defined by constructing an ordered matrix composed of the index of segregation values for the artifact types. This led to the formation of artifact clusters which may indicate activity areas on the site. These clusters were formed by joining together those points whose nearest-neighbours were less than a calculated "cut-off" distance (Whallon, 1974). The clusters were then compared with each other regarding contents, size and location, and in relation to clusters on other northeastern Paleo-Indian sites.

The data generated by the spatial analysis was used to discuss the lithic-related activities at the site. Calculating the tool and debitage densities for the entire site and the clusters provided additional data for comparison with densities at other Paleo-Indian sites. This allowed statements to be made regarding the extent and importance of activities at Thedford II.

The location and appearance of artifacts can be influenced by site formation processes such as cultivation, caching and trampling (Schiffer, 1976). This problem can be partially dealt with by fitting together those artifacts which were broken and noting how far apart the fragments are from each other. A detailed analysis of this sort has been done by Cahen et al. (1979). If the fragments of the same artifact are close to one another then it is possible to assume that the artifacts have remained generally where they were deposited and that the location and composition of the associated cluster is thus accurate. Site formation processes are discussed in detail in Chapter 3.

The second means of discussing the lithic-related activities as well as the intensity and season(s) of the occupation was by comparisons with other Paleo-Indian sites in northeastern North

America. The Parkhill site (Fig. 1) is the only other Paleo-Indian site in southwestern Ontario to be extensively excavated and reported on (Roosa, 1977a, 1977b; Ellis, 1979; Deller, 1980b; Roosa and Deller, 1982). Other sites in southern Ontario include Banting (Storck, 1979) and Fisher (Storck, 1982). Thedford II and these sites are believed to have been occupied by groups possessing the same culture (Deller, 1980b; Roosa and Deller, 1982; Storck, 1982). Other sites which can be compared to Thedford II include Barnes (Wright and Roosa, 1966; Voss, 1977), Vail (Gramly, 1982) and Debert (MacDonald, 1968).

The third means by which all of the topic areas were addressed is ethnographic data. Northern caribou hunters such as the Nunamiut (Gubser 1965; Binford, 1978a) and the Chipewyan (Smith, 1970, 1975; Burch, 1972; Vanstone, 1974; Sharp, 1977; Iromoto, 1981) live in a forest-tundra environment similar to that proposed for the Paleo-Indian occupation of southern Ontario. These groups can be compared to the Paleo-Indians regarding subsistence activities, and how their sites differ from the latter in terms of group size, occupation length and location.

The second topic area, the intensity of the occupation, was investigated by using the overall and individual tool and debitage densities for the entire site and its clusters. These densities were then compared with those from the Parkhill, Banting, Barnes and Vail sites and with statements researchers have made concerning the group size, occupation length and frequency of occupation at these sites. Data from the Thedford II spatial analysis is also used where applicable to help strengthen inferences.

The third topic area, the season of site occupation, was difficult to determine because some activities are not restricted to any particular season. What was determined is whether Thedford II was inhabited during a warm or cold time of the year. Some intra-site tasks are performed more often in the fall such as hide working so the information gained from the spatial analysis aided in this topic area discussion. Comparisons were made with other Paleo-Indian sites and with ethnographic data. Among recent hunters the intensity of occupation and the activities performed vary according to season. The information regarding the other two topic areas was also used to help ascertain the season of occupation.

The Thedford II site was surface collected in the 1970's and its location was noted by Deller (1979, 1980a). Surface collection by Deller delimited three discrete areas of Paleo-Indian material. These areas are referred to as Grids A, B, and C (Figure 2). Grids A and B are located at the southern portion of the site and are separated by about 20 metres. The dimensions of Grid A are about 35 metres south to north by 60 metres east to west. Three Paleo-Indian lithic artifact concentrations were located through excavation within this grid. Grid B comprises an area of 20 square metres and remains unexcavated. Grid C is located about 90 metres north of Grid B along the north edge of the site. Its size is only approximately 10 by 10 metres and is also unexcavated. Only a few artifacts

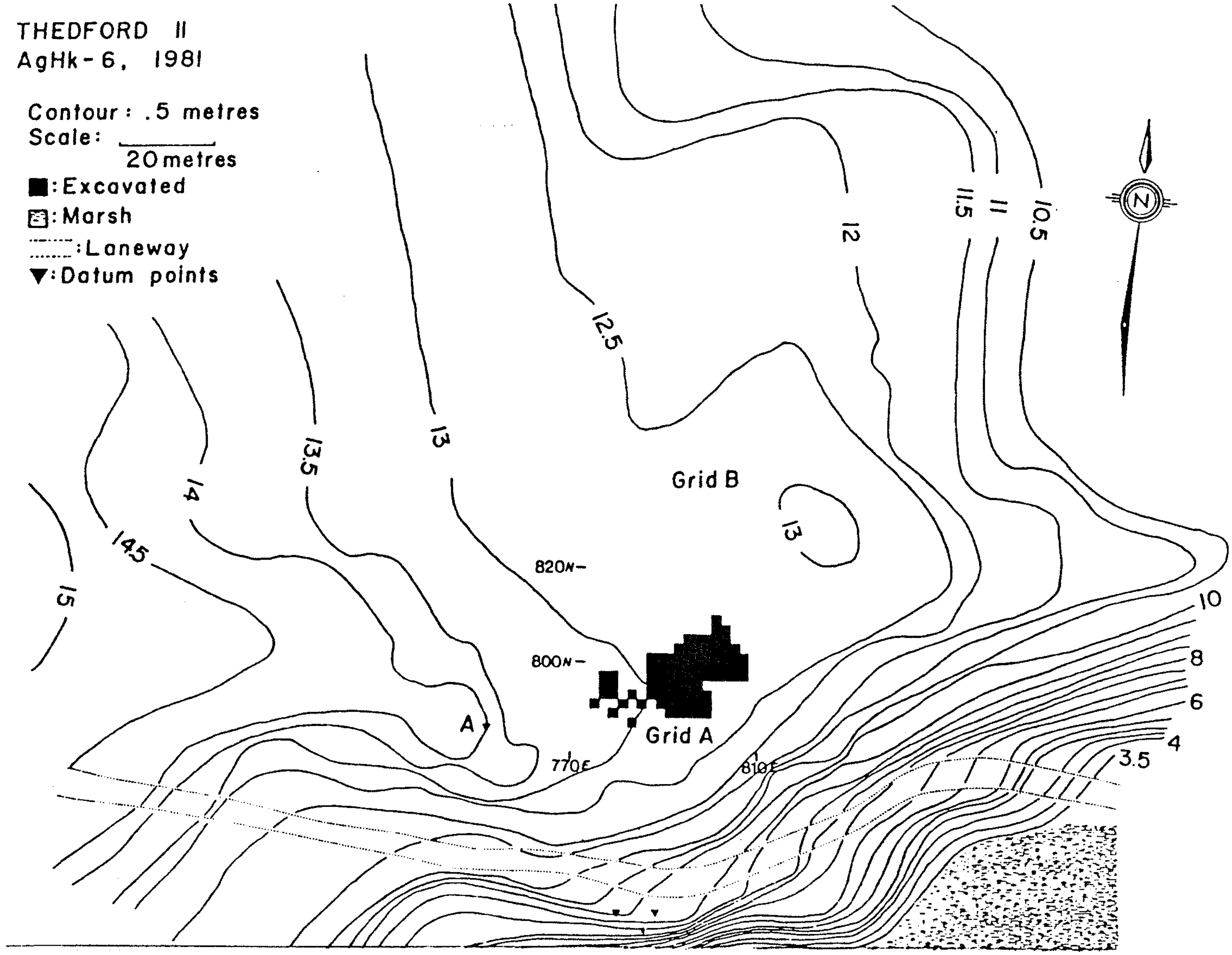


Figure 2: Contour map of the Thedford II site and surrounding area

have been found within this grid, all by surface collection.

Thedford II was excavated in 1981 and a report was produced in 1982 by Deller and Ellis describing the excavation methods, the artifacts recovered and the cultural features. Chapter 4 deals with much of this information. Unfortunately, no floral or faunal remains from the Paleo-Indian occupation were recovered. Only lithic remains are present making it difficult to infer subsistence activities. Although the site was also occupied more recently, perhaps during the Early or Middle Woodland periods (Deller and Ellis, 1982), the artifacts from each occupation are clearly distinguishable by their form and material type.

CHAPTER 2

SITE AND ENVIRONMENTAL SETTING

SITE SETTING AND PHYSIOGRAPHY

The Thedford II site is located on Lot 20, Concession 1, Bosanquet Township, Lambton County, Ontario. It is on a terrace at about 198 m above sea level overlooking a ravine on the south which has a low swampy area (Fig. 2). "The north end of the site is bordered by a shallow depression which runs and deepens to the east and joins the ravine mentioned above. This ravine continues to the northeast and eventually opens up on the Ausable River plain about 1 km northeast of the site" (Deller and Ellis, 1982:6).

The Ausable River is the major drainage source in the site area (Fig. 3). Many small tributaries feed into it after flowing along the eastern edge of the Wyoming moraine. The river follows this edge until it reaches Arkona where it strikes bedrock and is forced northward through the moraine (Cooper, 1979:8). The river then flows through the Thedford Marsh where sand deposition has caused it to turn sharply to the southwest and empty into Lake Huron at Port Franks.

The site is located on St. Joseph till which is the surface till of the Wyoming moraine. This till, part of the Huron slope, is attributed to the Port Huron stadial and is composed primarily of silt and clay (Cooper, 1979). The Huron slope is the area between the Algonquin shoreline and the Wyoming moraine. Chapman

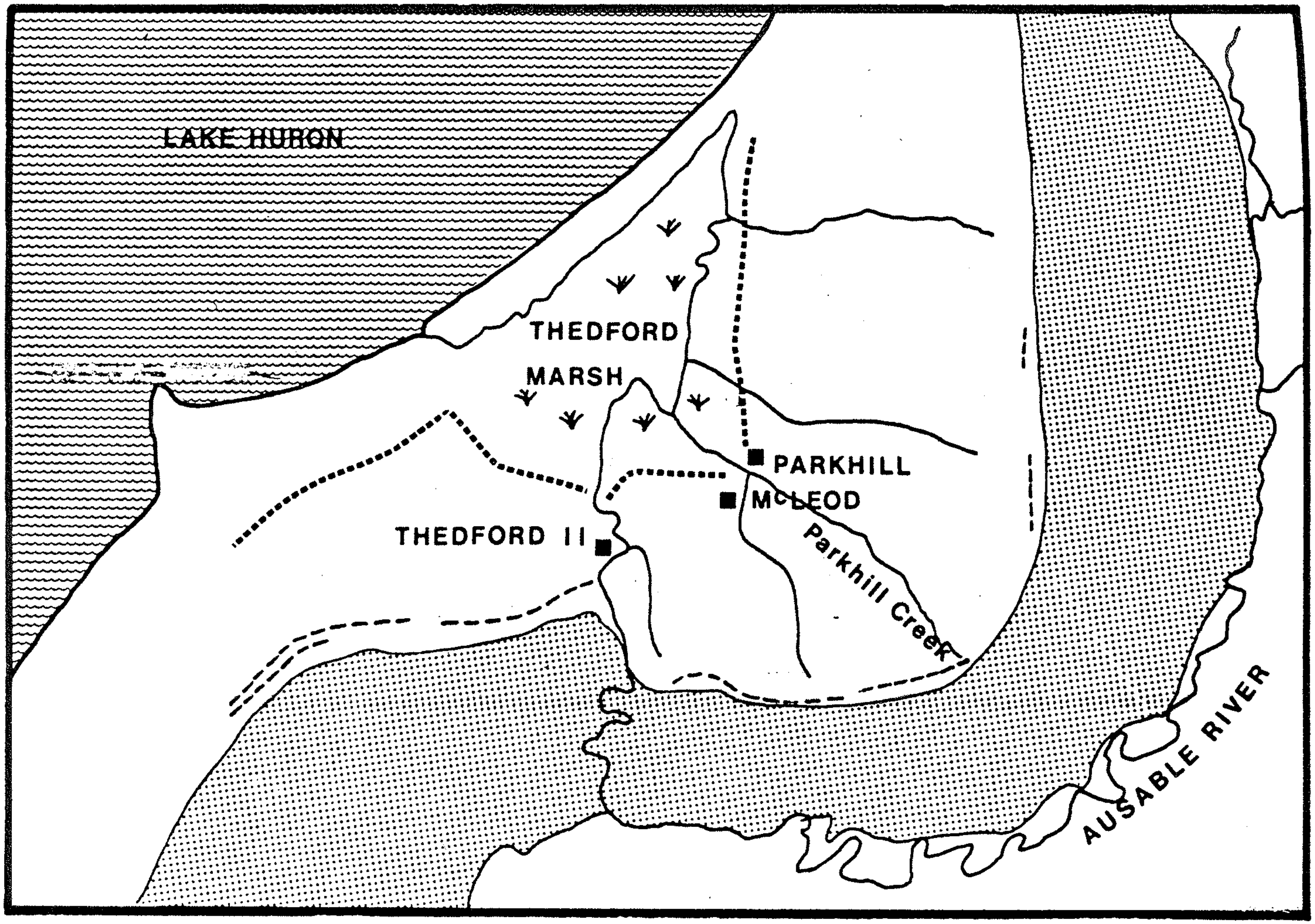


Figure 3: The Thedford II site in relation to other Paleo-Indian sites and to physiographic features

10 km

N

....	Algonquin/Nipissing Shoreline		
-----	Warren Shoreline	(stippled)	Wyoming Moraine

and Putnam (1973:263) describe it as "essentially a clay plain modified by a narrow strip of sand running parallel to the Warren Beach". The shallow sand has been formed into parallel beach ridges and depressions with swampy areas in the depressions.

The Wyoming moraine is a conspicuous physiographic feature located 2 km south of the site (Fig. 3). It is part of the Port Huron morainic system that was built across the central and eastern Great lakes region during the Port Huron stadial about 13,000 B.P. (Dreimanis, 1977).

After the Port Huron ice retreated northward, glacial lake waters covered the Thedford II area. Water levels descended until the Lake Algonquin level 11,500 to 10,600 B.P. When the ice margin retreated further north Lake Algonquin drained into the Champlain Sea to the east (Karrow, et al, 1975). The lake gradually rose again until about 5,500 B.P. when the Nipissing shoreline was reached (Cooper, 1979:34).

Unlike other Paleo-Indian sites in southern Ontario there is no direct association with glacial lake strandlines. The Nipissing-Algonquin shoreline is about 3 km north of Thedford II (Fig. 3). The strandlines are at the same elevation (184 m) in the area accounting for why they are discussed together. Karrow (1980:27) however states that "the Nipissing transgression extensively removed and destroyed the older Algonquin features". The Ausable River has eroded evidence of the Nipissing shoreline northeast of the site. These factors make it difficult to determine exactly where the Lake Algonquin beach was and thus the distance from the site to the shoreline. The closest that the

Algonquin beach could have been to the site is from 1.3 to 1 km.

The other major strandline in the area, the pro-glacial Lake Warren shoreline is located along the Wyoming moraine's north edge about 1.2 km south of the site. Lake Warren existed between 12,500 and 12,000 B.P. (Cooper,1979:39). At this time it would have covered the site (Fig. 3).

An important feature, 2.8 km north of the site, is the Thedford embayment or marsh. Archaeological sites are found along or near its margins, especially the eastern edge. The marsh is located in the area bounded by the Algonquin-Nipissing shoreline between Grand Bend and Thedford. It was protected by baymouth bars during the existence of Lakes Algonquin and Nipissing (Cooper, 1979:32-33). In post-Nipissing times the embayment was separated from the Algonquin-Nipissing sediments by a series of sand dunes, forming a right-angled triangle. Presently the embayment is protected from Lake Huron by sand dunes, and flooding has turned it into a marsh, part of which is drained and under cultivation.

VEGETATION

Two major vegetation zones are located in southern Ontario according to McAndrews (1981:321): a deciduous forest in the extreme south and a mixed forest north of it. The former zone is dominated by southern hardwoods such as elm (Ulmus) maple (Acer) and ash (Fraxinus) which also extend north through the mixed forest zone into the southern part of the boreal forest zone. Other hardwoods such as oak (Quercus) beech (Fagus), and hickory (Carya) are also found in the deciduous and mixed forest zones. The mixed forest is characterized by high amounts of maple (Acer), hemlock (Tsuga), arborvitae (Thuja) and white pine (Pinus strobus). The Thedford II site is located close to the border of these two regions and thus has species of both zones.

When the Port Huron ice retreated, large areas of southern Ontario were open for plant colonization. The initial vegetation has been termed a forest-tundra (McAndrews, 1972, 1981; Kapp, 1977). McAndrews (1981) has studied a pollen profile from Pond Mills Pond near London, Ontario, about 60 km east of Thedford II. There the forest-tundra zone formed the earliest level, being represented primarily by black spruce (Picea mariana). The existence of non-arboreal pollen such as sage, Artemisia and the sedge (Cyperaceae) and grass (Gramineae) families help to characterize this zone as a forest-tundra (McAndrews, 1981:239). The next zone (zone 2) lasted from about 10,500 to 8,000 B.P. and is divided into subzones 2a and 2b. Subzone 2a shows jack pine (Pinus banksiana) replacing the black spruce (Picea), while small peaks of fir (Abies) and birch (Betula) suggest the presence of a boreal forest; the non-arboreal pollen decreases from the previous zone (McAndrews 1981:239). This subzone spans from about 10,500 to 10,000 or 9,750 B.P. when zone 2b commences. This zone indicates that a mixed forest existed with pine (Pinus) declining being replaced by oak (Quercus), along with elm (Ulmus) and maple (Acer) (McAndrews, 1981:329).

Other pollen analyses taken from Eighteen Mile River, Cookstown Bog and near Kincardine along the Lake Huron and Georgian Bay shores also show spruce forests dominating until about 10,600 to 10,500 B.P. This is followed by a pine-dominated forest until approximately 10,000 B.P. (Anderson, 1971; Karrow et al. 1975). Sites above the Algonquin shoreline may have been good areas for pine (*Pinus*), birch (*Betula*) and ash (*Fraxinus*), as well as *Artemisia* and upland grasses and sedges.

The transition from spruce (*Picea*) to pine (*Pinus*) dominated forests at about 10,500 B.P. has been inferred from pollen diagrams at various sites in northeastern United States (cf. Ogden, 1967). These consistent dates from varied locations indicate that a major climatic change occurred in northeastern North American regions. Terasmae (1974:17)inferred a 6°C increase in the mean annual temperature to 2°C at the Pleistocene-Holocene boundary.

Lake Algonquin drained at this time, resulting in wide land areas becoming available for terrestrial vegetation development (Dreimanis, 1977:83). Some Lake Algonquin lakebed shoreline areas are associated with swampy conditions which may have offerred better plant and animal resources for humans than in the surrounding forests. Similar habitats have been suggested for other areas of northeastern North America (cf. Eisenberg, 1978; Funk, 1977; Loring, 1980). Deller (1980b:34-35) has termed these areas as micro-environments and notes that during prehistoric times the "low, flat, poorly-drained areas of lakebed flanking the relict shorelines offered a richer and more attractive environment consisting of lush sedges, grasses, lichens, horsetails etc. They can be thought of as rich glade-areas within a more sterile environment". Thedford marsh was one of these low, swampy areas.

Other favourable environments may have been abandoned shorelines in the interior as well as existing beaches. These sites provided lichen-rich habitats for game. Frozen embayments and protected areas of Lake Algonquin could have provided safety and food for animals during the winter. Areas recently freed of ice or glacial lakes may have supported large herbivore populations such as caribou, deer and mammoth. The vegetation present during the Paleo-Indian occupation of the Thedford II site has not been determined to date. Pollen samples were taken from two Paleo-Indian cultural features but have not yet been analysed.

FAUNA

Few faunal associations exist with Paleo-Indian cultures in northeastern North America. The faunal samples are often too fragmentary to identify the species. One bone fragment identified as barren ground caribou has been found in association with human activity at the Holcombe site in eastern Michigan (Fitting, 1966), but Griffin, (1977:10) suggests that the site may not be related to a fluted point culture. Other caribou remains are present from Bull Brook, Dutchess Quarry Cave in New York and the Whipple site in New Hampshire (Gramly, 1982).

Cleland (1960:20) suggests mastodon, moose, bear, caribou, beaver, muskrat, wolverine, snowshoe hare and porcupine lived in the Great Lakes area from about 11,000 to 9,000 B.P. It is felt that barren ground caribou was the main source of game for the Paleo-Indians in southern Ontario (cf. Deller, 1973, 1976, 1979, 1980b; Roosa, 1977a, 1977b; Storck, 1979, 1982). Spiess (1979:40-41) further notes that caribou stay in the spruce forest from late fall through the winter feeding on lichen, willow and sedges (Carex) and move onto the tundra in late April where they remain, eating sedge and grass, until the fall migration southward begins. Deller (1979:12) also notes that in the sub-arctic today caribou are often attracted to poorly drained glade areas within larger coniferous environments. This environment would appear to be similar to that suggested above during the proposed Paleo-Indian occupation of southern Ontario. In particular, the forest-tundra and low swampy areas may have been favourable for caribou.

Another important food source for Paleo-Indians in southern Ontario may have been the moose. They are presently found in environments which are also occupied by caribou. Irimoto (1981:40) states that moose are hunted by the Chipewayn during the summer in meadow areas, and in the fall. Other subarctic tribes such as the Cree, Micmac, Slave and Beaver also hunt moose frequently, while relying to a somewhat lesser extent on other game such as elk, muskox and caribou. Fish is also one main resource for these groups, especially during the summer and fall. If all or some of these animals and those listed by Cleland (1966) were available to the Paleo-Indians, then it is very likely that they would have exploited them. Caribou may have been one of the more important food resources, but there is no reason to believe that Paleo-Indians did not hunt whatever game was present.

The mastodon was present at the time of the Paleo-Indian occupation in southwestern Ontario, but it was probably not hunted often, if at all. The distribution of known mastodon remains in the region appears to be concentrated on the Warren lakebed flanking the northern Lake Erie shore. The known Paleo-Indian sites, in contrast, are all north of this area (Deller, 1980b:30). Dreimanis (1977:83) states the following regarding the mastodon extinction:

> "The dramatic change in temperature and/or precipitation around 10,000 years ago resulted in the rapid expansion of pine and the corresponding decrease in spruce. This change in vegetation coincided also with the beginning of a rapid decline in radiocarbon-dated mastodon sites. The association of decrease in mastodons and their subsequent extinction with the climatic and vegetation changes, together with evidence that mastodons obtained their food from spruce forests or woodland, led me to propose environmental and climatic causes for extinction of mastodon in the Great Lakes region".

If the mastodon were associated with the Warren lakebed, then they would have had to have been present after 12,500 B.P., when Lake Warren drained. There is also evidence that mammoth was present in the area as late as 10,660 B.P. (McAndrews, 1983: personal communication). A new genus of deer was recently discovered from late Pleistocene deposits near Toronto. It is estimated to have been the size of caribou and has been dated at about 11,300 B.P. (Churcher and Peterson, 1982).

CHAPTER 3

RESEARCH PLAN AND METHODOLOGY

INTRODUCTION

The methodology employed follows from the problem areas stated in Chapter 1: the lithic-related activities, the intensity of the occupation and the season of occupation. In order to achieve these aims, all available data must be utilized such as intra-site archaeology, comparative archaeology with other Paleo-Indian sites and ethnography.

The first topic area is investigated by an analysis of the lithic material spatial patterning which includes artifact distribution and association. This emphasizes the delineation of activity areas and tool kits. Activity areas occur where specific or related tasks took place at the site such as tool manufacturing or food processing. Tool kits are groups of associated artifacts which were used in identical or similar tasks.

The identification of tool kits and their locations at Thedford II may aid in relating the site to others within the Paleo-Indian settlment system of southern Ontario, such as Parkhill, Fisher and Banting. Initial attempts at defining tool kits and tool distributions at other sites has consisted of the visual inspection of artifact distribution maps (eg. MacDonald, 1968; Wheat, 1972). This type of study was not always sufficient as artifacts may be too numerous to easily group into tool kits or to define activity areas. Also the artifact patterning may not be easily observable. The more recent use of statistical methods has provided archaeologists with easier, more objective ways of analysing the spatial distribution and association within and between sites. The methods used by archaeologists have included contingency tables, contiguity tests and the variance-mean ratio (Dacey, 1973); dimensional analysis of variance (Whallon, 1973); and nearest neighbour analysis (Whallon, 1974). The latter method is applicable where the exact provenience of items is known. As mentioned previously all tools and tool fragments recovered through excavation at Thedford II have been plotted exactly, along with certain debitage categories such as scraper retouch flakes and channel flakes. The data is thus suited for a nearest neighbour analysis to define the degree of artifact type dispersion. The method was originally used in the study of plant population distribution by Clark and Evans (1954). It has also been used by archaeologists to describe site distributions (eg. Plog, 1974; Washburn, 1974; Earle, 1976).

LITHIC RELATED ACTIVITIES

The investigation of artifact spatial distribution may involve three basic steps as outlined by Price (1978:3): "1) the definition of the nature of the distribution of a single artifact category, whether random, regular or clustered; 2) the investigation of association between two or more artifact categories, i.e. the definition of artifact groups; and 3) the description of the location, contents, and size of artifact clusters on the occupation floor" (emphasis in original). These steps will be followed in this analysis but first it is necessary to determine the types of tools present at the site. Deller and Ellis (1982) have performed this task and a summary of their work in this respect appears in the following chapter.

The method of nearest neighbour analysis will be employed to explore the first step. It entails measuring the linear distance between tools, within a specific type, which are closest to each other. Scraper retouch flakes and channel flakes will also be included. The fragments of conjoined artifacts are treated individually. Before calculating the nearest neighbour ratio it is important to deal with the "boundary effect". A difficulty with nearest-neighbour analyses has been in including points (artifacts) in the calculations which were close to the edge of the excavation. This affected the degree of spatial aggregation or segregation. Whallon (1974) suggested solving this problem by measuring only those points which were closer to one another than to the edge. This served to eliminate those points which may have nearest neighbours outside of the study area. McNutt (1981) has devised a series of formulae in order to reduce the number of points measured within the study area, but they are only applicable where regularly shaped areas such as squares, rectangles, circles, or triangles are present. Unfortunately the area of Thedford II is irregularly shaped so that none of these formulae can be implemented. Thus Whallon's method will be followed here.

Another weakness of nearest neighbour analysis is associated with the size of the area used in the calculation. Ideally the limits of the excavation should correspond to the limits of the site. Where this is not the case, i.e. the excavation is larger or smaller than the site, the value of the nearest neighbour ratio R will change. A larger excavation area for example will lower the value of R, and artifact types which seem to be randomly distributed will statistically indicate clustering. A solution, which Price (1978:9) offers, is to use a specific unit of sampling size such as an area defined by a contour of a certain number of artifacts per square meter. He does not however use this solution in his analysis as its applicability is limited to sites with similar densities. He instead uses the total area excavated, a practice which is followed here also. The areas used here, i.e. A-centre and A-northeast, probably represent the full extent of the site in these areas.

The nearest neighbour ratio is computed in the following manner. The density "p" of the number of items "N" in the sampling area "A" is given as $p=\frac{N-1}{A}$. The observed average nearest neighbour distance of the sample population is stated as as $\bar{r}o=\frac{\Sigma r}{N}$ where "r" represents the nearest neighbour distances.

The expected average nearest neighbour distance is found by $\bar{r}e = \frac{1}{2\sqrt{p}} = 0.5\sqrt{\frac{A}{N-1}}$. The ratio of the observed to the expected nearest neighbour distance, the nearest neighbour ratio, $R=\frac{\bar{r}o}{\bar{r}e}$ is a measure of the degree of randomness of the distribution. If this ratio is equal to 1 then a random pattern is present. If the points cluster in one spot then R is equal to 0, while it equals 2.149 when a uniform arrangement of points is present.

The level of significance can be found by using the chi-square statistic $\chi^2 = 2\lambda\Sigma r^2$. This is based on the Poisson distribution which is determined by $\lambda = \pi p$ where the square units of area are converted into circles with "λ" representing the average number of items found in a circle of radius 1 in the site. Chi-square in this calculation has 2N degrees of freedom. The 5% significance level is tested using the random matching table in Pinder and Witherick (1972:287).

The index of segregation Sp will be used to investigate the association between artifact categories. It was first used by Pielou (1969) in ecological studies and in archaeology by Peebles (1971), Hodder and Orton (1976), and Price (1978). This index serves to measure the tendency for two tool types to be aggregated or segregated in space. It is useful in conjunction with the nearest neighbour ratio as it measures the association between items of two different types, while the nearest neighbour deals with the distribution of a single tool type (Price, 1978:4). The method is not influenced by the "boundary effect". To determine Sp a contingency table is formed which appears as:

		Base Point		
	Type	A	B	
Nearest Neighbour	A	a	b	a+b=e
	B	c	d	c+d=f
		a+c=g	b+d=h	N

Sp is calculated as $1-\frac{(c+b)N}{ef+fg}$. A value of -1 indicates aggregation that isolated pairs of types A and B are present, composed of one A and one B; while a value of 0 means that there is a randomness of the two types. If the index equals 1 then a complete segregation of A and B occurs (Hodder and Orton, 1976:204-205). The chi-square statistic can be used to test for the significance of Sp.

Price (1978:14) notes that this index requires explanation as a value of -1 indicates complete aggregation of two types meaning that they were always found in pairs. However, since the rate of discard varies for different artifact types it is unlikely that complete pairing will occur. Based on this, Price states that relationships which statistically appear to be aggregated or mixed, represent a spatial association between types and that low negative or low positive values of Sp may reveal information on this association. Price unfortunately does not indicate how this information can be interpreted.

Another method to be employed in testing for the spatial association of artifact types involves the presence or absence of two types within a particular unit of area. This method was also developed by plant ecologists and its application in archaeology is detailed by Dacey (1973) and Hodder and Orton (1976). It involves dividing the site into quadrats and then noting the presence or absence of each type within each quadrat. The size of quadrat to be used in the present analysis will be the unit of excavation, the 2 x 2m square. A contingency table is then made, similar to that for the index of segregation which takes the following form:

		Type A +	Type A −	
Type B	+	a	b	e
	−	c	d	f
		g	h	N

From this table the expected number in each cell can be calculated if each type were independent of the other. The chi-square test is then used to test the significance of the difference between the observed and the expected values in the cells. The test appears as $x^2 = \frac{[(ad-bc)-N/2]^2 N}{efgh}$ (see Hodder and Orton 1976:202; Dacey, 1973:326). This test examines if the null hypothesis of independence between two distributions should be accepted or rejected.

The V coefficient is another test which can be performed from the contingency table which indicates the degree of association. This is also a measure of segregation but, unlike the index of segregation it deals with the presence/absence data of two types and not with neareast neighbour distances. Hodder and Orton (1976:202-204) discuss the use of the V coefficient to measure the degree of association. It appears as $V = \frac{ad-bc}{(efgh)^{\frac{1}{2}}}$. A value of −1 indicates that the types are segreated while 0 means no association is present, and complete aggregation occurs when V equals +1. A problem with this test is that it is affected by the amount of area in which neither type occurs, i.e., the "d" value of the contingency table, but this value must be included in order to determine the degree of independence of the distributions (Hodder and Orton, 1976:204). The size of the quadrat also affects the value of V, so the same tables are used as those for testing for the association of artifact types.

As discussed earlier in this chapter the investigation of association between two or more artifact categories is conducted in order to define artifact groups or tool kits. To achieve this the values obtained for the index of segregation will be ordered in a matrix where every tool class is paired with every other tool class, and those tool pairs not segregated, as shown by the tests of significance, will become more easily visible. Groups of artifacts will hopefully be present in this matrix (see Price, 1978:15). From these groups, artifact clusters can be defined on the site plan through the use of the nearest neighbour distances.

One problem is that the data tends to be positively or negatively skewed due to the presence of isolated tools. Whallon (1974) has suggested a solution to this problem which is used in this thesis and involves the calculation of a "cut-off" distance. This distance is found by calculating the standard deviation of the nearest neighbour distances and using a point 1.65 standard deviations above the mean nearest neighbour distance. This removes the 5% of the distances which comprise the tail end of the distribution. Points within this cut-off distance are joined together to form clusters.

The interpretation of the artifact groups and clusters is more difficult than their identification. The trouble stems from the uncertainty in the determination of tool function. Some of the tools such as scrapers may have had more than one use, i.e., scraping and/or cutting, and may have been utilized to work a variety of materials such as hide, bone and/or wood. The absence of wood and bone tools and floral and faunal remains makes the interpretation of function difficult. A tool function analysis employing the methods of Wilmsen (1970) and Keeley (1980) is presented in Chapter 5.

The information generated by the spatial analysis will enable comparisons to be made with other Paleo-Indian sites in northeastern North America in terms of intra-site activities and the location, density and composition of single artifact categories, artifact groups and clusters. These sites include Parkhill (Roosa, 1977a, 1977b; Deller 1980b); Debert (MacDonald, 1968); Barnes (Wright and Roosa, 1966; Voss, 1977); Banting (Storck, 1979); Fisher (Storck, 1982); and Vail (Gramly, 1982). Unfortunately, Barnes was the only one of these sites subjected to a spatial analysis, i.e., analysis of variance (see Voss, 1977). Nevertheless, the data provided through the visual inspection of artifact plots for the other sites will be useful regarding Paleo-Indian activities, activity areas and tool association. Ethnographic data also provides a means of comparing which intra-site activities could have been performed.

INTENSITY AND SEASON OF OCCUPATION

The second topic area, the intensity of the occupation, defined as the length and frequency of the occupation and the group size, involves primarily the densities of artifacts within the entire site and the clusters. These densities depend on the types of activities which occurred at the site. For example, tool manufacture produces more debris than does tool maintenance. Such densities may thus vary considerably depending on the activities making the interpretation of intensity difficult. Comparisons can be made with the Parkhill, Banting, Barnes, Vail and Debert sites. No density standards are present enabling only relative comparisons to be used in this thesis. The relationship between clusters can provide general information concerning the intensity of the occupation.

The individual aspects of intensity are difficult to determine and statements made here must be considered with caution. The number of people and their length of occupation at Thedford II are based on interpretations of the Paleo-Indian sites referred to above and on ethnographic analogy. The frequency of the occupation, e.g. single vs. multiple occupations, is more speculative because discussion largely involves only the refit analysis and ethnographic data. Inferences formed concerning the intensity of the occupation are made with reasonable confidence based on the reliability of the ethnographic record and the frequent consistency of the archaeological data.

The third topic area, the season of occupation is difficult to determine because there are only lithic remains from Thedford II and at all of the sites used for comparison. Certain activities such as hide working might be more prevalent during the colder seasons because the hides are of higher quality. A working edge angle analysis can suggest which tasks the tools were used for. The degree of tool exhaustion may also be related to the season of occupation. If the group has recently been to a lithic source and has an abundant supply, there is less need to resharpen tools. Instead, new tools will be made rather than old ones resharpened. However, the tools will be more completely exhausted as the length of time spent away from the lithic source increases. This is reflected in the tool size and in the size and number of waste flakes. Comparisons can be made with other Paleo-Indian sites regarding tool exhaustion and the inferred season of occupation. The season of occupation is indicated ethnographically by the type, size and location of camps and by the number of people residing at them. The discussion of the second topic area is also of use here.

SITE FORMATION PROCESSES

A discussion of these topic areas must also involve a consideration of site formation processes. Schiffer (1976) divides these processes into cultural and noncultural categories. The former involves artifacts left by the occupying group of which there are three types: primary refuse where artifacts were discarded where made or used, secondary refuse such as worn-out broken materials discarded away from their place of use and de facto refuse which consists of usable items abandoned and lost within an activity area when the group left the site. Unfortunately, these definitions are difficult to operationalize. Secondary refuse is usually found in areas of high artifact density and diversity (Schiffer, 1976:31). When long distances are travelled the heaviest objects, the least important objects and the most easily replaced light objects will be de facto refuse (Schiffer, 1976:33). In analyses concerning horizontal artifact patterns on occupation floors and limited activity sites, archaeologists have assumed that they were dealing only with primary refuse (Wilmsen, 1970; Whallon, 1973; Goodyear, 1974; Schiffer, 1976). However, ethnographic data suggests that artifact patterns were formed by other processes such as secondary refuse, as will be discussed later.

Once deposited, the location of cultural items may change due to trampling, caching and being cleared from an area. Other cultural formation processes involve artifact removal from a site by surface collection and uncontrolled excavation.

N-transforms are principles which account for noncultural formation processes (Schiffer, 1976:15). These processes result in post-depositional changes in site and artifact morphology. Some noncultural formation processes include: faunalturbation which is disturbance by animals such as rodents and earthworms (Golley et al., 1975; Wood and Johnson, 1978), floralturbation where treefalls and roots disturb the location of artifacts (Wood and Johnson, 1978), frost heaving (Johnson and Hansen, 1974; Wood and Johnson, 1978), wind and water erosion (Gifford, 1978) and cultivation (Roper, 1976).

The Thedford II site may consist of primary, secondary and de facto refuse assuming that Schiffer (1976) is correct in the identification of these site formation processes. Secondary refuse is probably represented by artifacts such as projectile points and preforms broken during manufacture. Schiffer (1976:31) hypothesizes that the greater the intensity of occupation and the larger the group, the larger the ratio of secondary to primary refuse produced. Artifacts, without fresh breaks may represent primary or de facto refuse because these artifacts were likely left at their place of use through discard and/or abandonment. Plowing at Thedford II has affected artifact location, the extent of which is discussed in Chapter 6 concerning the refit analysis. This type of analysis has been conducted most noticeably at the Paleolithic site of Meer, Belgium by Cahen et al (1979). At Thedford II some tool breaks were caused when the tools were struck by the plow or other farm machinery in recent years. These breaks are evidenced by a "fresh " looking broken edge. Some of the fragments were fitted together in the field and the rest in the lab. Some tools were probably broken during use as the broken edges do not appear "fresh" and are more rounded than those edges produced through recent breakage.

Roosa (1977b) notes at the Parkhill site that artifacts from the plowzone are clustered with subsoil artifacts and features. For example, a point base with red ochre on one face from the plowzone was about one metre from a subsoil hearth. He concludes that the plow appears to have blurred or slightly enlarged clusters (Roosa, 1977b). Similar cultivation methods were employed at both sites. A few rodent burrows exist at Thedford II and may have resulted in some artifact movement, but most are located in low artifact density areas. There is no evidence of erosion, and frost heaving is not believed to have affected artifact movement due to the sandy nature of the soil.

Binford (1978b) describes five cultural formation processes, termed disposal modes, of which two need to be discussed here. "Dropping" occurs when items fall from the hand where activity is taking place and "tossing" involves moving items away from where they were used (Binford, 1978b:345). These two disposal modes are equivalent to Schiffer's (1976) primary and secondary refuse, respectively. Binford (1978b) notes that artifacts may be in disposal areas and not in activity areas. This makes it difficult to distinguish these latter areas.

Artifacts can be curated which involves transporting them elsewhere for future use (Binford, 1973). Important and seldom used tools can be cached at the site to be used later. These form de facto refuse. Curation is more likely to occur when short distances such as a few kilometers are travelled. Lithic artifacts curated at the Thedford II site may have included projectile points, which take long to manufacture and are an important part of the tool kit. Unifacial tools are easier to manufacture and were likely not curated. There is no evidence of caching at the site.

ETHNOGRAPHIC ANALOGY

Employing ethnographic analogy is important in archaeological studies especially where cultural remains are scarce. Caution concerning its use must be observed because human behavior has undergone many changes through time. The limitations of ethnographic analogy have been discussed by researchers such as Binford (1968, 1972); Freeman (1968); Heider (1967) and Wobst (1974). Binford (1972) notes that ethnographic behavior may differ from that which was present archaeologically, while other factors such as the environment may have been similar. Different types of behavior may produce the same archaeological result. Heider (1967) shows that an artifact can have different uses, even within the same geographical area. Ethnographic observations can be used to formulate postulates which can be tested regarding archaeological remains and the behavior which produced them (Freeman, 1968). Characteristics of Paleolithic societies based upon living hunters and gatherers include: 1) Movement within a seasonal round, 2) the maintenance of a minimum band network with an average of 25 individuals per band, 3) low population densities (Wobst, 1974). The first characteristic relates to the season of occupation and to the resources exploited by the Thedford II inhabitants. The second and third are associated with the intensity of the occupation which in turn is linked to site activities. These characteristics will be further discussed in Chapter 7 where ethnographic data are used.

CHAPTER 4

METHODS OF SITE EXCAVATION, DATA COLLECTION, TOOL PRODUCTION AND DESCRIPTION OF ARTIFACTS AND FEATURES

SITE EXCAVATION AND DATA COLLECTION METHODS

The entire site has been cultivated with corn, beans, barley, wheat and other grains being the main items grown. It was planted in winter wheat when it was excavated. The west half of the site has been under cultivation for a large but unknown number of years, (perhaps more than 100 years). There is evidence that a fence ran north-south through the site until it was taken down about 20 years ago at which time the land began to be cultivated. This fence served to separate the cultivated land from the brush which grew in the eastern portion of the site. This eastern part was thus less disturbed by cultivation than was the rest of the site.

All excavation was conducted within this grid and 336 m^2 were excavated (Fig. 4). A horizontal grid system of two by two metre squares was placed over the site. The north-south and east-west baselines were laid out with a transit and the squares were triangulated in. Each square was assigned a north and an east co-ordinate at its southwest corner. Each square was then divided into four one metre subsquares which were numbered, beginning with the southwest subsquare, counter-clockwise. This provided greater control when excavating the square than would be the case if it were excavated as a whole.

The first squares were excavated in a checkerboard pattern.

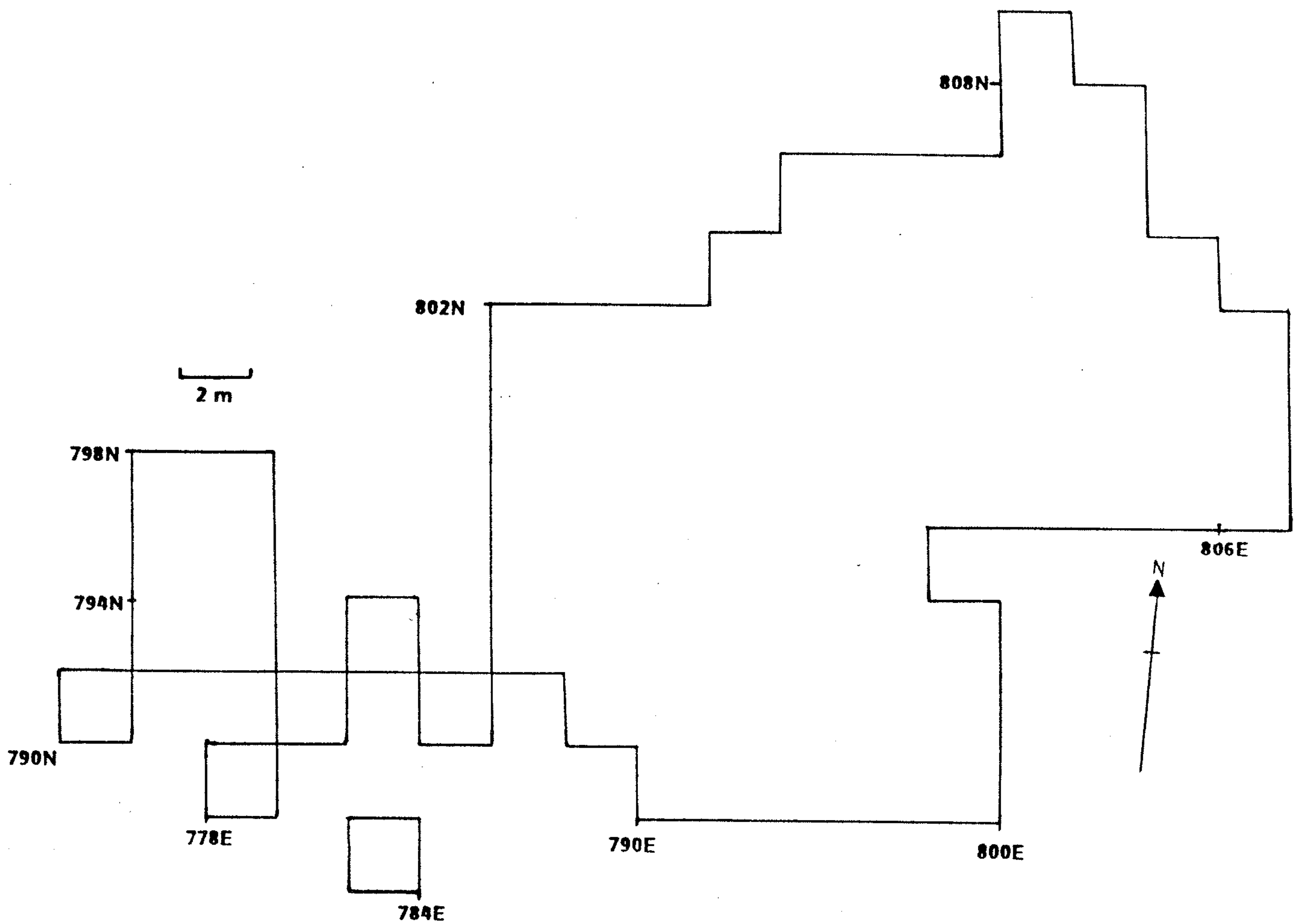


Figure 4: Plan of Thedford II excavations

This pattern was continued until it was decided to excavate the intervening squares in order to completely excavate as much of the area as possible to provide data suitable for intra-site spatial analyses. Unfortunately, time did not permit the total excavation of Grid A, although artifact concentration limits were fairly well defined in all but the western part of the grid.

The squares were excavated by first removing the plowzone of each subsquare with shovels and screening it separately. Subsquares 1, 2, and 4 were screened through 1/4 inch hardware cloth while subsquare 3 was screened through 1/8 inch hardware cloth. One shovelful of dirt was screened at a time in order that any tools within the shovelful could be located. All tools, scraper retouch flakes and channel flakes were plotted to the centre of the removed shovelful. Other artifacts such as lithic debitage were placed in bags according to subsquare. Corner baulks were left in each square and 10 cm wide baulks were left between squares of the checkerboard pattern. These baulks helped to prevent the walls of adjoining squares from collapsing, as well as to hold backdirt and to act as guides for subsoil excavation. The baulks were removed and screened according to subsquare after the unit was excavated if there was indication of dense occupation in the area.

The plowzone was not entirely removed by shovel so as not to excavate too deep and inadvertently destroy possible subsoil cultural features. Instead the plowzone-subsoil interface was cleaned with trowels so that these features would be visible. Plan drawings were made at the interface in each square of cultural features, roots and root stains, rodent burrows, clay pockets, sand pockets and any other soil discolourations. All visible cultural and non-cultural features, e.g. root stains, were excavated with trowels with plan and profile drawings and photographs being made. Soil samples were taken from all cultural features for flotation. Charcoal samples for C14 dating were also taken from features where possible.

The subsoil was excavated in 5 cm contoured arbitrary levels by "shovel-shining". If artifacts or features were discovered, then trowelling was used. The subsoil was screened through the same mesh sizes as those used for the plowzone. Debitage was bagged by arbitrary level and subsquare. Subsoil materials located _in situ_ were plotted on maps. All _in situ_ tools were located within a three-dimensional framework. Horizontal measurements were made to the artifact from the southwestern and the southeastern pins of the square. Vertical co-ordinates were taken with reference to a central vertical datum point and a depth below interface measured from one of the above corners of the square. All squares were excavated to at least a depth of 15 cm in the subsoil in non-clay areas if no artifacts were found. If artifacts were discovered then the square was dug until a sterile 5 cm level was reached.

Information was recorded on various standardized forms including artifact forms on which was written data concerning specific artifacts; feature forms with information on cultural features such as size, shape and the contents; and square summary forms which contained information about each subsquare, for example, the plowzone thickness, the maximum depth the subsquare was excavated to, the depth below the datum and the materials found at each level. Each excavator also kept field notes concerning the squares dug, the features located, artifacts found and other data.

RAW MATERIAL DESCRIPTION

Approximately 90% of the tools at Thedford II are made of Collingwood chert. There is no evidence of it having been used by cultures other than the Paleo-Indians, making it diagnostic. The source is from the Fossil Hill formation in the Collingwood area, about 175-200 km northeast of the Thedford II site (Deller and Ellis, 1982:14). Collingwood chert is found in beds which range up to 30 cm thick (Storck and Von Bitter, 1981:31). It is also usually banded with the bands parallel to the bed. Deller and Ellis (1982) show how this banding, in combination with other aspects of artifacts, helps to "place each tool into its original position in the bed matrix" (Deller and Ellis, 1982:16). The colour of Collingwood chert ranges from a white/light grey to beige to a pale brown.

The other identifiable raw material used at Thedford II is Bayport chert. It is found in the Saginaw Bay area of Michigan, about 125-150 km northwest of the site. It occurs in nodules in a dolomitic to sandy limestone (Deller and Ellis, 1982:16). It is distinguished by concentric banding, the presence of small quartz crystal grains and its fossiliferousness. The colour of Thedford II artifacts of this material range from a light grey to grey

(Deller and Ellis, 1982:17).

TOOL PRODUCTION

The manufacture steps and product groups of Collins (1975) are used in the tool production and artifact descriptions (Table 1). The absence of cores and debris from tool blank production indicates that the lithic raw material was at least in tool blank form (Deller and Ellis, 1982:B-23). There are thus no products assignable to Group I or II of Collins' (1975) sequence. All of the unifacial tools were probably made by primary trimming (Group III) and are the products of use (Group V). Some of these tools have also been refurbished, especially the triangular and fluted end scrapers. They form product Group VI along with scraper retouch flakes. Deller and Ellis suggest (1982:B-22) that these waste flakes may also be a product of manufacture (Group IV).

Bifacial tools may have been brought to the site as bifacial preforms instead of as unmodified tool blanks. This is based on the relatively few thinning stage preforms (Group I) and biface thinning flakes (Group III). The biface thinning flakes which were recovered are probably isolated removals from individual preforms to prepare them for retouching and fluting (Deller and Ellis, 1982:B-25). Group IV products include an unfluted preform, 6 fluted preforms and 8 fluted biface fragments some of which may have broken during use. The debitage associated with this secondary trimming stage are channel flakes and bifacial retouch flakes. Only one finished fluted point was found at the site. It was probably used (Group V) and was produced through the above

Table 1 Lithic Manufacturing Sequence at Thedford II

TYPE	MANUFACTURE STEP	PRODUCT GROUP	N	%
TOOLS				
Fluted point	Use	V	1	0.7
Fluted preforms	Secondary trimming	IV	6	4.4
Fluted bifaces	Use and/or secondary trimming	IV, V	8	5.9
Unfluted points	Primary and/or secondary trimming	III, IV	2	1.5
Concave base biface	Use?	V	2	1.5
Alternately bevelled biface	Modified	VI	3	2.2
Backed biface	Use	V	1	0.7
Other biface	Use	V	2	1.5
Piece esquillée	Use	V	1	0.7
Gravers	Use	V	17	12.6
Offset bit end scrapers	Use	V	5	3.7
Triangular end scrapers	Refurbished	VI	3	2.2
Fluted end scrapers	Refurbished	VI	2	1.5
End and convex side scrapers	Use; Refurbished?	V, VI	2	1.5
Bit end scrapers	Use	V	7	5.2
Other end scrapers	Use; Refurbished	V, VI	4	3.0
End and side scrapers	Use	V	4	3.0
Backed and snapped side scrapers	Use	V	6	4.4
Concave side scrapers	Use	V	3	2.2
Single convex side scrapers	Use	V	3	2.2
Double convex side scrapers	Use	V	3	2.2
Other side scrapers	Use	V	3	2.2
Other scrapers	Use	V	5	3.7
Beaked scrapers	Use	V	5	3.7
Flake knives	Use	V	5	3.7
Other unifacial tools	Use	V	5	3.7
Unifacial tool fragments	-	-	27	20.0
TOTAL			135	99.8
DEBITAGE				
Channel flakes	Secondary trimming	IV	24	3.5
Biface thinning flakes	Primary and secondary trimming	III, IV	31	4.6
Bifacial retouch flakes	Secondary trimming refurbishing	IV, VI	178	26.1
Scraper retouch flakes	Refurbishing	VI	111	16.3
Flat flakes	-	-	286	41.9
Other debitage	-	-	52	7.6
TOTAL			682	100.0

stages of primary and secondary trimming. Other evidence of secondary trimming occurs on 3 alternately beveled bifaces, a backed biface, a pièce esquillée and a complete tool with retouch. All of these tools were used (Group V) except for two of the alternately beveled bifaces which had been reworked into scrapers (Group VI).

Comparisons of the amount of biface versus scraper alteration can be made with the Parkhill site. At Thedford II the ratio of bifacial to scraper debris is 2.1 to 1. Collins (1975:32) notes that biface alteration produces considerably more flakes than uniface alteration. This accounts for the low tool to debris ratios at Thedford II where there are more than twice as many scrapers as bifaces. If more biface flakes were found in relation to scraper retouch flakes then the ratios should increase.

ARTIFACT DESCRIPTION

The following descriptions are based largely upon Deller and Ellis (1982). Additional data including dimensional attributes, artifact and working edge shape, working edge angle and provenience are presented in Appendix A. Paleo-Indian lithic tools and fragments number 157 prior to refitting and 135 after refitting (Tables 1, 2). Of these, 41 were recovered during previous surface collecting and thus their exact location is unknown.

Table 2 Tool Types at Thedford II

(Includes Surface Collection)

TYPES	N	%
Fluted Points and Preforms	7	5.2
Bifaces	19	14.1
End Scrapers	23	17.0
Side Scrapers	18	13.4
Other Scrapers	14	10.4
Gravers	17	12.6
Other Unifacial Tools	10	7.4
Unifacial Tool Fragments	27	20.0
TOTAL	135	100.0

BIFACIAL TOOLS

Unfluted Preforms

Two bifaces (Fig. 5a, b) were probably intended to be point preforms. They are from surface collection. One is in a primary trimming stage as evidenced by broad thinning flake scars and is 58.1 mm long by 30.4 mm wide by 10.9 mm thick. The other has a finer retouch, is at the secondary trimming stage and may have been discarded due to a large potlid scar on one face (Deller and Ellis; 1982:32). It is 67.7 mm long by 30.1 mm wide by 10.0 mm thick.

Fluted Bifaces

Eight fluted biface fragments are present which may be from either complete points or preforms. There are three tips (Fig. 6h, i), one mid-section (Fig. 6g) and four lateral edge fragments. A channel flake portion fits on one of the tips (Fig. 6i). These were found about two metres apart in the plowzone, suggesting that the tool broke during manufacture (Deller and Ellis, 1982:32).

Fluted Preforms

Six fluted preforms were found at the site. Two have unfinished bases (Fig. 6b, c) and were probably discarded due to tip fractures caused by secondary trimming. One of these measures 40.1 mm long by 22.1 mm wide by 5.1 mm thick. Two others broke during fluting (Fig. 6d, e). A channel flake portion fits one of these (Fig. 6e). Another preform broke after it had been fluted from the tip instead of the base (Fig. 7f).

Figure 5 **Bifaces, Thedford II Site**

a-b) Preforms (c.n. 36, 35)

c-d) Concave-base bifaces (c.n. 37, 320)

e) Biface (c.n. 84/113)

f) "Backed" biface (c.n. 43)

g-i) Alternately beveled biface fragments (c.n. 30, 33, 29)

Note: c.n. = catalogue number

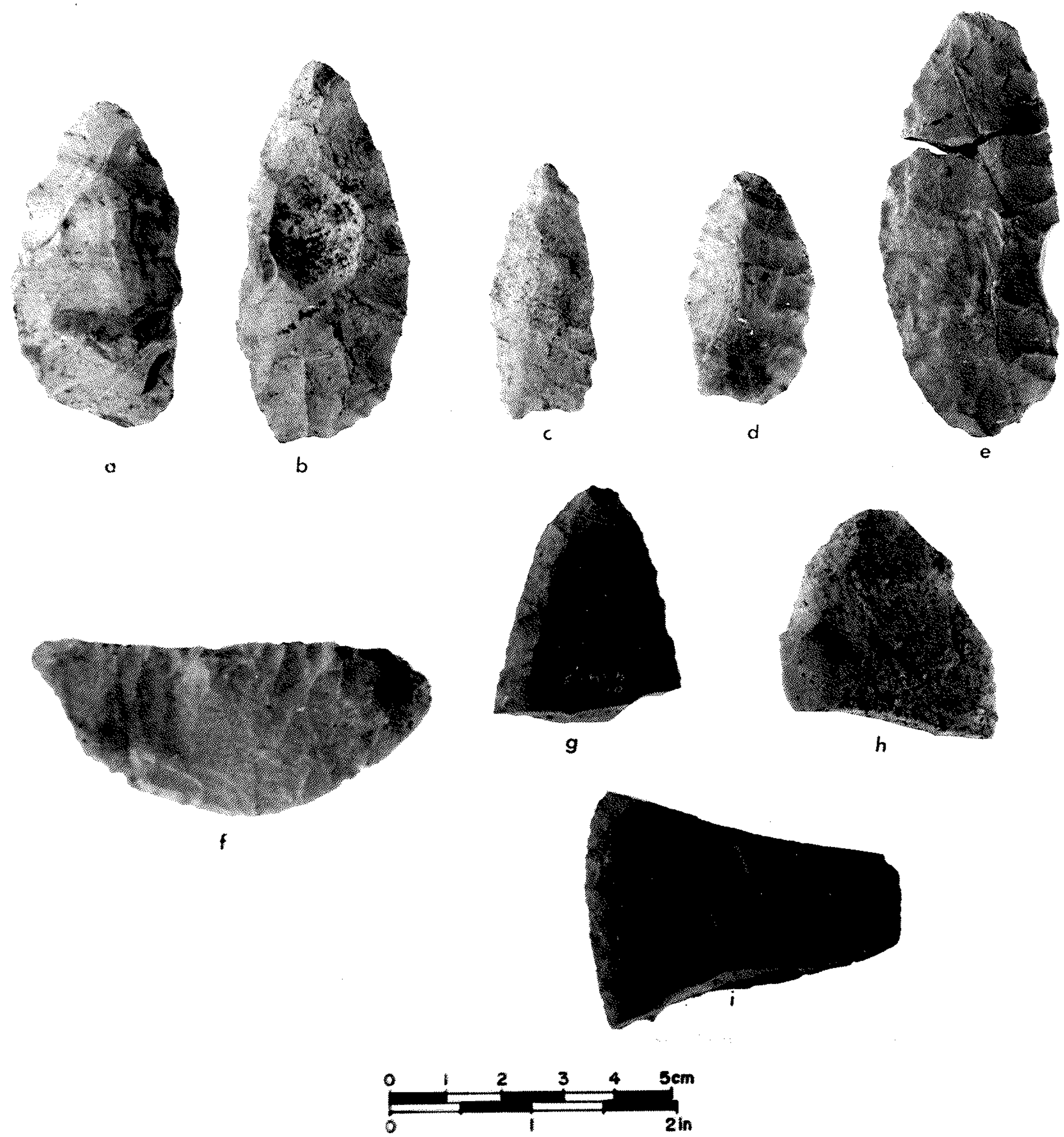
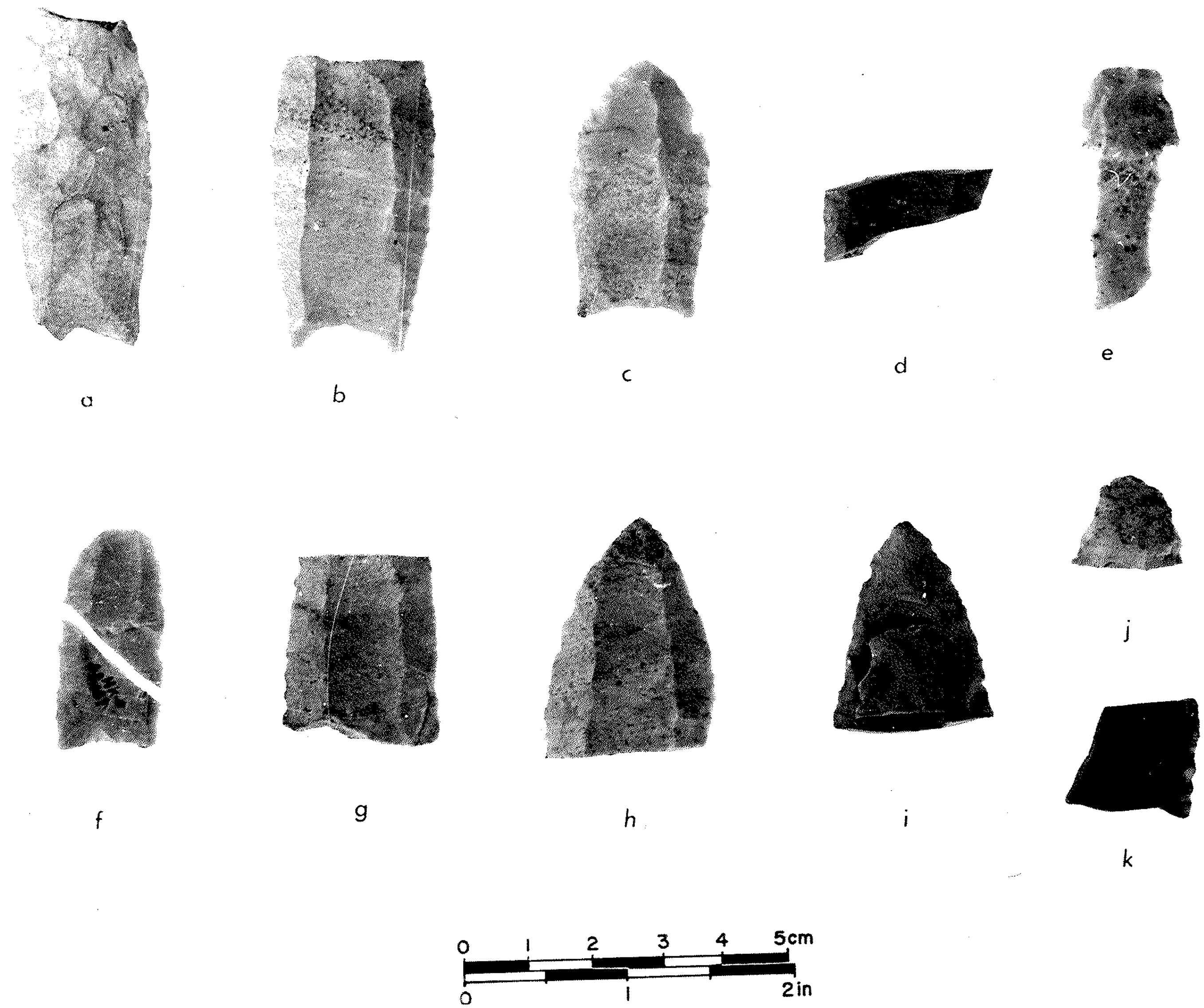

a
b
c
d
e
f
g
h
i
0 1 2 3 4 5cm
0 1 2in

Figure 6: Fluted Artifacts from Thedford II

a) Fluted point

b to f, j) Fluted preforms (c, c.n. 94; d, c.n. 358; e, c.n. 351/356/371; f, c.n. 80/189; j, c.n. 359)

g to i, k) Fluted Bifaces (g, c.n. 79; h, c.n. 191; i, c.n. 313; k, c.n. 157)


a
b
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k
0 1 2 3 4 5cm
0 1 2in

For this reason it may have been made by an inexperienced knapper (Deller and Ellis, 1982:31). It is 32.1 mm long by 16.7 mm wide by 3.6 mm thick. The final preform is a tip with part of a flute visible (Fig. 6j).

Fluted Point

One finished fluted point from a previous surface collection is about 53.5 mm long by 22 mm wide by 7 mm thick (Fig. 6a). It is made of an unidentified white material and is not well fluted. It has an impacted, broken tip and a broken ear, commonly caused by use.

The above point and preforms are most similar to those from the Barnes site in Michigan and from the Parkhill site, termed the Barnes type (Roosa, 1965; 1977a). "In common with this type, the Thedford II artifacts exhibit expanding lateral edges with maximum width on the blade element, fairly pronounced ears, no curvature in longitudinal section, a marked biconvex transverse section (prior to fluting) and a narrow basal width" (Deller and Ellis, 1982:32).

Concave Based Bifaces

Two concave-based, eared bifaces were found. One (Fig. 5c) is a surface find and resembles a tool from the Debert site (MacDonald, 1968:82, Fig. 21a, b). It measures 44.4 mm long by 19.0 mm wide by 5.7 mm thick. The other biface has the characteristics of a Hi-Lo Point (Fig. 5d). It is 40.7 mm long by 23.6 mm wide by 8.0 mm thick.

Alternately Beveled Bifaces

Three large biface fragments with unifacially retouched alternately beveled lateral edges were recovered previously from the surface of the site. One is an end fragment with an intentional break (Fig. 5h). It is 41.6 mm long by 38.7 mm wide by 9.5 mm thick. The end has been unifacially retouched into an end scraper. Another fragment is a mid-section 55 mm wide and 8 mm thick (Fig. 5i). It has deliberately made breaks at both ends perhaps made to recycle the tool. These have been retouched with one edge resembling an end scraper and the other a beaked scraper (Deller and Ellis, 1982:36). The remaining fragment is a tip end with a recent plow break and is 41.6 mm long by 33.0 mm wide by 8.65 mm thick (Fig. 6g).

"Backed" Biface

One biface, recovered from the surface, has a thin bifacially worked lateral edge (Fig. 5f). The opposite edge has a wide, flat "back" used as a striking platform. Another edge is slightly beveled wih retouch suggesting it was used as a scraper. The tool is 71.5 mm long by 31.5 mm wide by 7 mm thick.

Other Bifaces

Three other bifaces were found at the site. These include a small fragment, a complete tool with well-executed retouch measuring 75.4 mm long by 32.3 mm wide by 8.6 mm thick (Fig 5e) and a pièce esquillée measuring 14 mm long by 5 mm thick. The latter two artifacts were probably used as tools. The first item is too fragmentary to determine its manufacture step.

UNIFACIAL TOOLS

End Scrapers

Offset Bit End Scrapers

Five end scrapers were made on expanding flakes and have a thin retouched distal end (Fig. 7d, e; 8e). This retouch appears to have reduced the tool length very little. All were probably hafted and two possess retouch along one lateral edge which stresses the expanding nature of the flake (Deller and Ellis, 1982:40). The tools range from 40.5 to 64 mm long by 29 to 44 mm wide by 7.5 to 12.5 mm thick.

Triangular End Scrapers

Three end scrapers also made on expanding flakes have a thick beveled end with a well-executed continuous retouch (Fig. 7b, c). One of these was collected from the surface (Fig. 7c) and another is incomplete. They were probably hafted. They average 34 mm long by 30.4 mm wide by 7 mm thick. The retouch and thick ends suggest that they were extensively refurbished.

Fluted End Scrapers

Two end scrapers were recovered which have steeply retouched distal ends (Fig. 7m, n). The dorsal surfaces have a depression and a ridge making them appear almost fluted. These tools are almost the same size as the triangular end scrapers being on the

Figure 7: End Scrapers, Thedford II Site

(a, c.n. 20; b, c.n. 90; c, c.n. 25;
d, c.n. 65; e, c.n. 23; f, c.n. 22;
g, c.n. 217; h, c.n. 140; i, c.n. 330;
j, c.n. 256; k, c.n. 26; l, c.n. 241;
m, c.n. 207/245; n, c.n. 232)

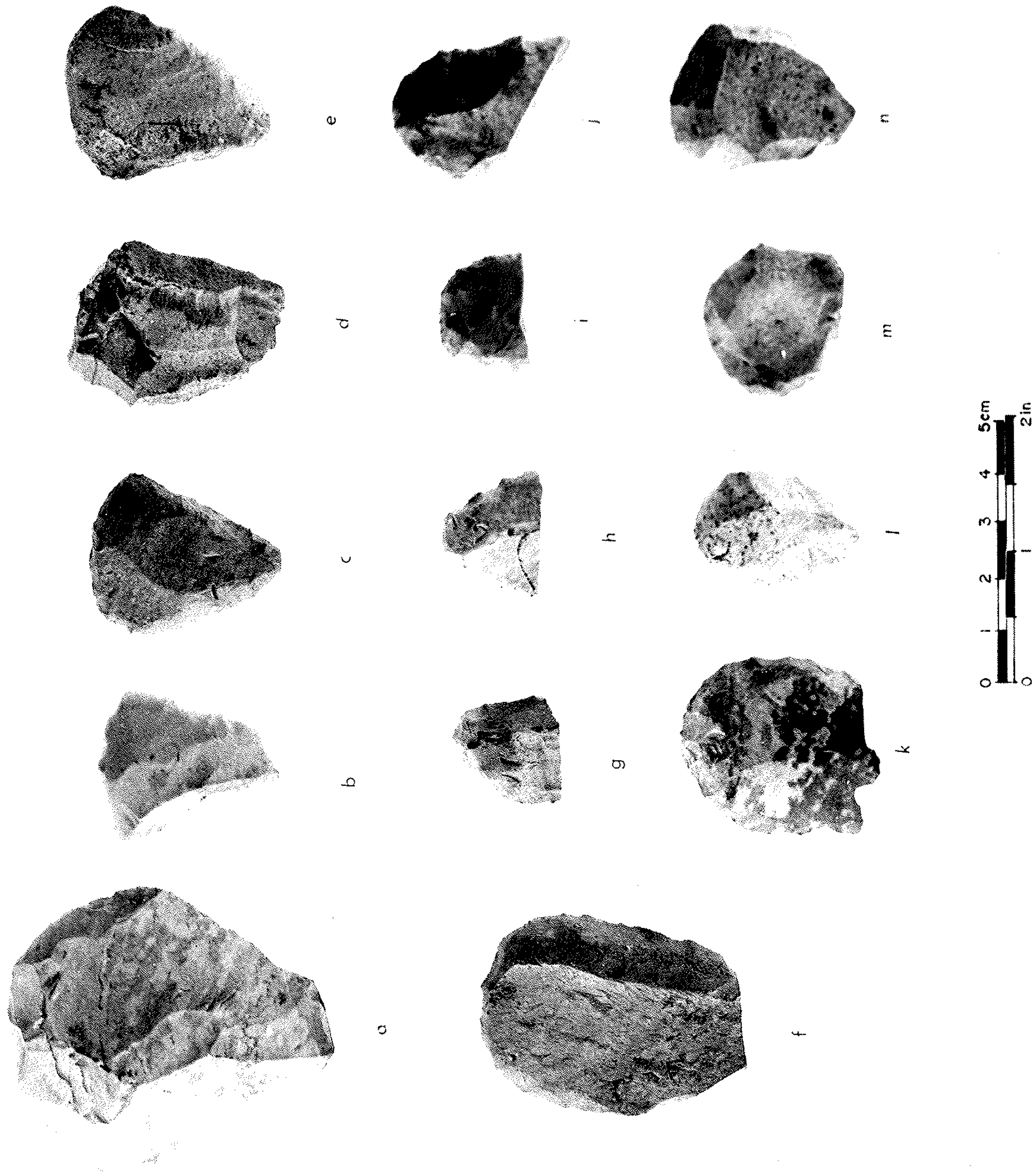
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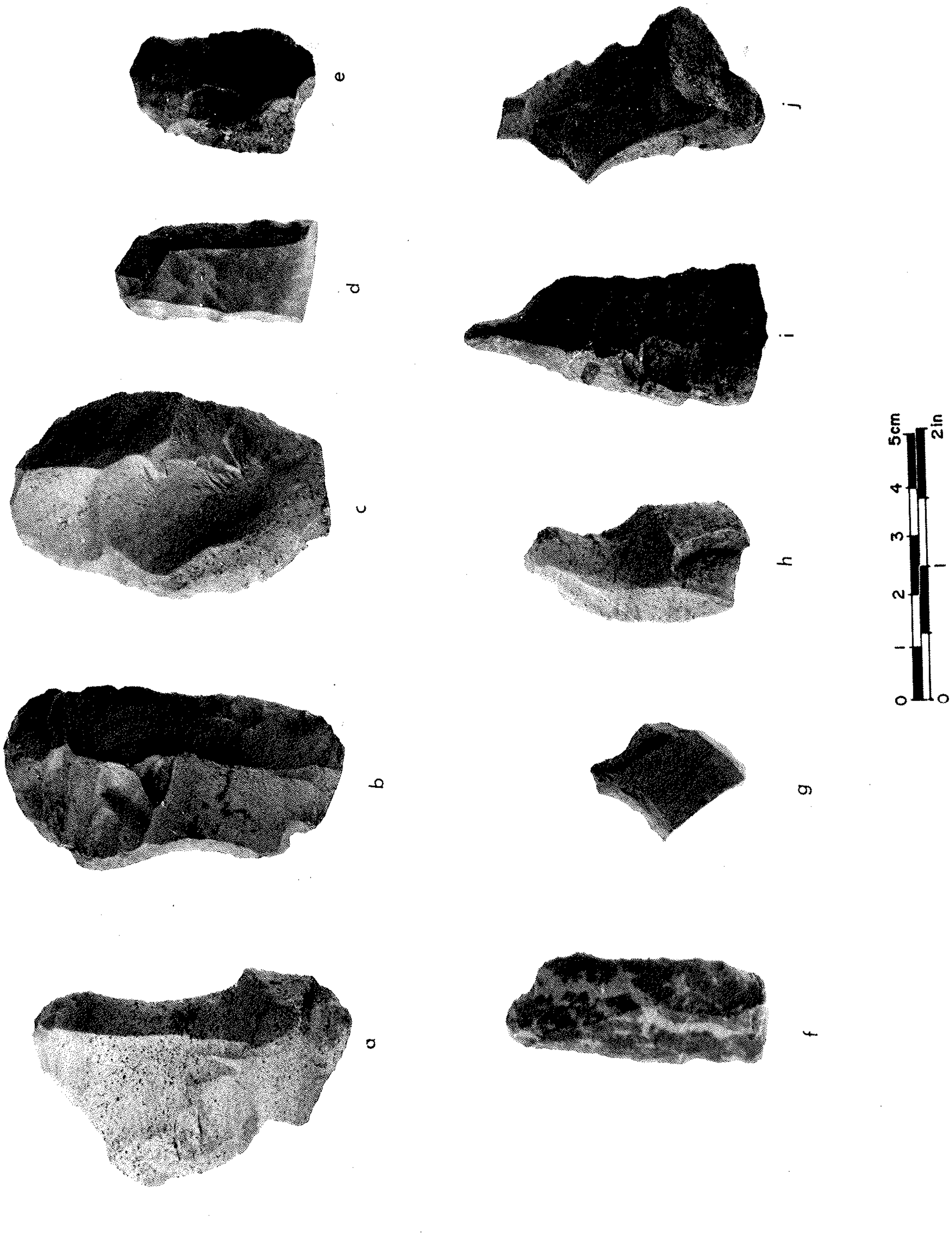
Figure 8: Scrapers, Thedford II Site

a-b) Combination end and side scrapers (c.n. 126, 19)

c) End scraper (c.n. 324)

d-e) Combination and and side scraper (c.n. 175, 195/134)

f-j) "Beaked" scrapers (c.n. 326, 45, 44, 240, 279)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average 1 mm shorter, 2 mm less in width and .7mm thicker. They were probably hafted and resharpened.

End and Convex Side Scrapers

These two tools appear to be longer versions of the fluted end scrapers (Fig. 7f, 8c). They have a very convex, steep, well-retouched bit end as well as a depression and ridge on the dorsal surface. One tool may have been hafted. Their average dimensions are 56.2 mm long by 38.6 mm wide by 10.2 mm thick.

Other End Scrapers

Four other end scrapers were recovered. One tool is steeply retouched on its distal end and was probably resharpended on the inverse distal end face (Fig. 7l). It is 31.4 mm long by 23.2 mm wide by 8.6 mm thick. A second tool has contracting lateral edges and a thin distal end. A third tool is a biface thinning flake with a small amount of distal retouch and is 45 mm long by 32.5 mm wide and 5.5 mm thick. A final end scraper is very large, measuring 65 mm by 56.5 mm by 17 mm (Fig. 7a). This tool and the previous one were found on the surface.

Bit End Fragments

Seven bit end fragments were recovered, two of which have recent breaks. The other five may have broken through use. Only one possible end scraper proximal end was found at the site suggesting that they may have been resharpened or reworked.

End and Side Scrapers

There are four end and side scrapers from the site. Two have straight retouched lateral edges and a bit end at the proximal flake end (Fig. 8d, e). They were probably unhafted and average 36.6 mm long by 22 mm wide by 7 mm thick. The remaining tools in this category each have a concave lateral edge (Fig. 8a, b). One is a double end scraper and the other a singl end scraper. These are large tools averaging about 62.3 mm long by 37.7 mm wide by 9 mm thick. These tools were probably not resharpened.

SIDE SCRAPERS

Backed and Snapped Scrapers

There are six tools in this category (Fig. 9a-c). They are wedge-shaped in transverse cross-section, with unifacial retouch along the thin edge of the wedge. One or both ends have been snapped with retouch usually at the corner. Two of these tools are made from the same flake which had been snapped in half. One piece was retouched on the dorsal surface and the other on the ventral surface. These tools range from 31.5 to 36 mm long by 21.5 to 27.5 mm wide by 8 to 12 mm thick (Deller and Ellis, 1982:46).

Single Convex Side Scrapers

Three single convex side scrapers were found at the site (Fig. 10b, c). All were exposed to heat and are thus fragmentary. They range from 38 to 60 mm long by 28 to 49 mm wide by 4.5 to 10 mm thick. There is no evidence of resharpening.

Figure 9: Scrapers, Thedford II Site

a-c) Backed and snapped side scrapers (c.n. 46, 236, 306)

d) Single concave side scraper (c.n. 170/176)

e) End scraper (c.n. 158)

f) Concave/convex side scraper (c.n. 196)

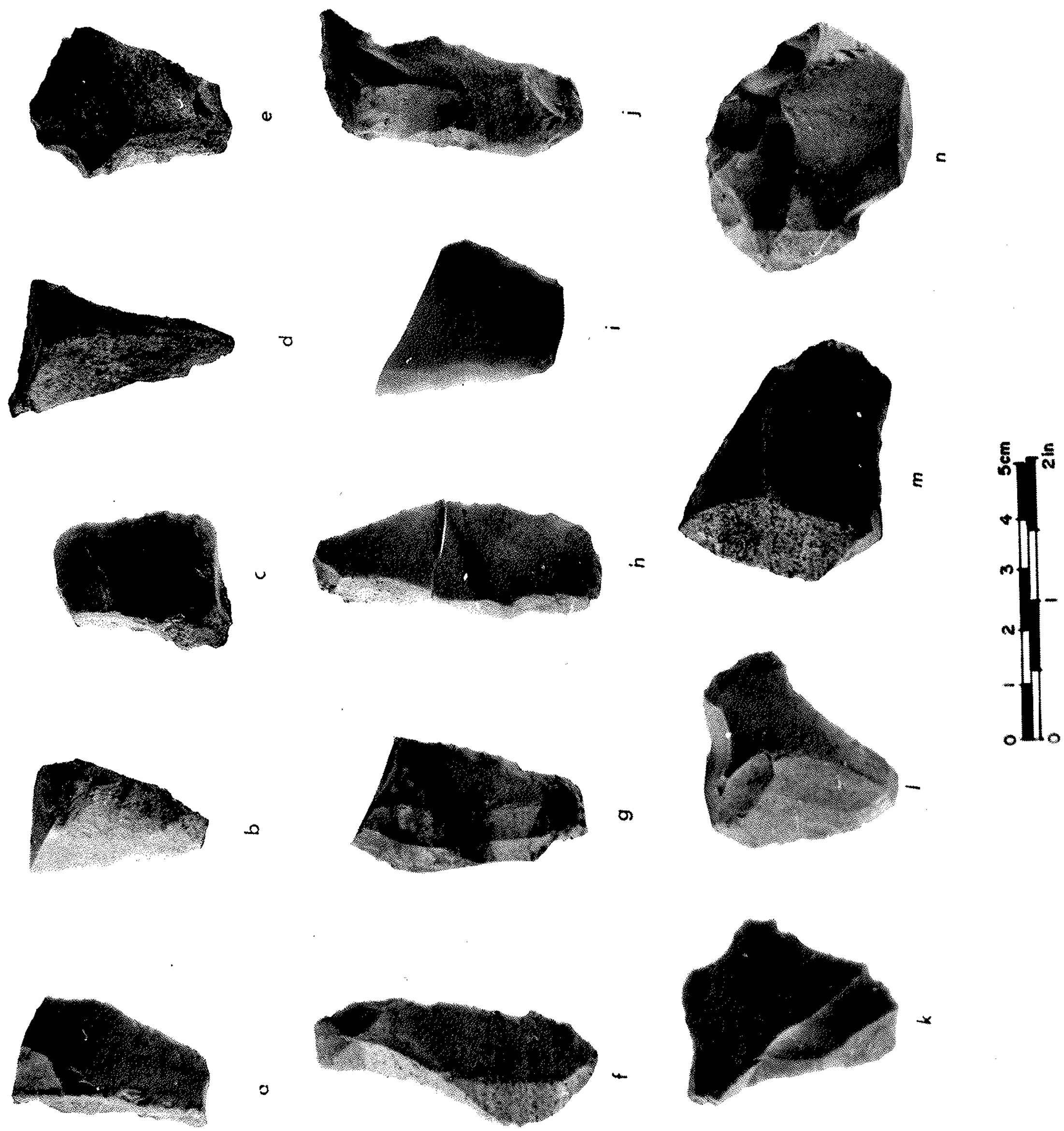
g-i) Double convex side scrapers (c.n. 275, 76/96; 254)

j) Single straight side scraper (c.n. 367)

k-l) "Bulbous" concave side scrapers (c.n. 242,329)

m) Canted scraper (c.n. 31)

n) Transverse scraper (c.n. 177)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Double Convex Side Scrapers

Three scrapers have two convex lateral edges (Fig. 9g, i). Two possess bend breaks at the distal end, one resulting from plow damage. The other tool is complete and is 48 mm long by 24.3 mm wide by 7.4 mm thick.

Concave Side Scrapers

Three single concave side scrapers were recovered (Fig. 9 k, l). They average 39 mm long by 32 mm wide by 8.6 mm thick.

Other Scrapers

Eight scrapers were found which do not fit into any of the above categories. They are briefly described below:

1) A double side scraper with retouch on alternate faces which is 52.8 mm long by 19.9 mm wide by 6.3 mm thick (Fig. 9h).

2) A double concave-convex side scraper, measuring 52.1 mm long by 24.7 mm wide by 4.6 mm thick.

3) A convex transverse scraper, 37.2 mm long by 45.8 mm wide by 13.9 mm thick (Fig. 9n).

4) A canted scraper found on the surface, 36.4 mm long by 44.7 mm wide by 10.1 mm thick (Fig. 9m).

5) A side scraper/snapped tool with two concave edges on the same lateral edge. The snapped opposite edge has been used. It is 56.6 mm long by 20.0 mm wide by 8.0 mm thick.

6) A tool with continuous retouch along the distal and one lateral edge (Fig. 10a). A spur is located at the proximal end

Figure 10 Scrapers and Flake Knives, Thedford II Site

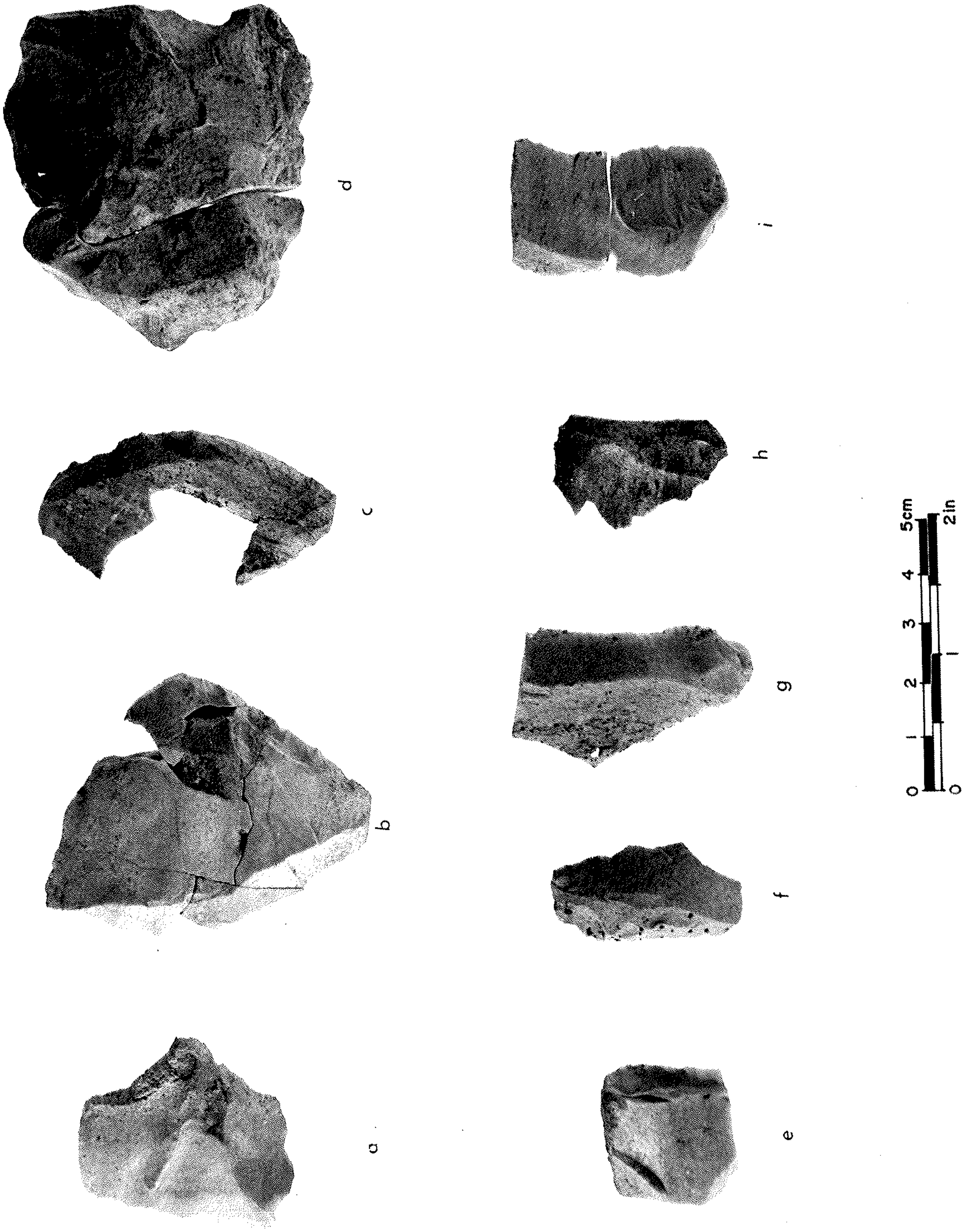
a) Side scraper with graver (c.n. 286)

b-c) Single convex side scrapers (c.n. 68/107/172/222/297/333; 199/75/424)

d) Scraper on blocky fragment (c.n. 27/28)

e) Backed and snapped scraper (c.n. 34)

f-i) Thin flake knives (c.n. 322, 239, 187/396, 57/133)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juncture. It is 39.7 mm long by 36.5 mm wide by 10.8 mm thick.

7) A very large, thick tool on a tabular piece of chert (Fig. 10d). One edge and part of another are steeply beveled. This tool measures 61 mm long by 57 mm wide by 15 mm thick.

Beaked Scrapers

Five tools were found which have thick, narrow, steeply retouched rounded or squared-off projections, formed around a pronounced ridge for strength (Fig. 8f-j). These are similar to the stone awls at the Debert site (MacDonald, 1968:98). They range from 37 to 56 mm long by 21 to 35 mm wide by 5 to 9 mm thick (Deller and Ellis, 1982:39).

Gravers

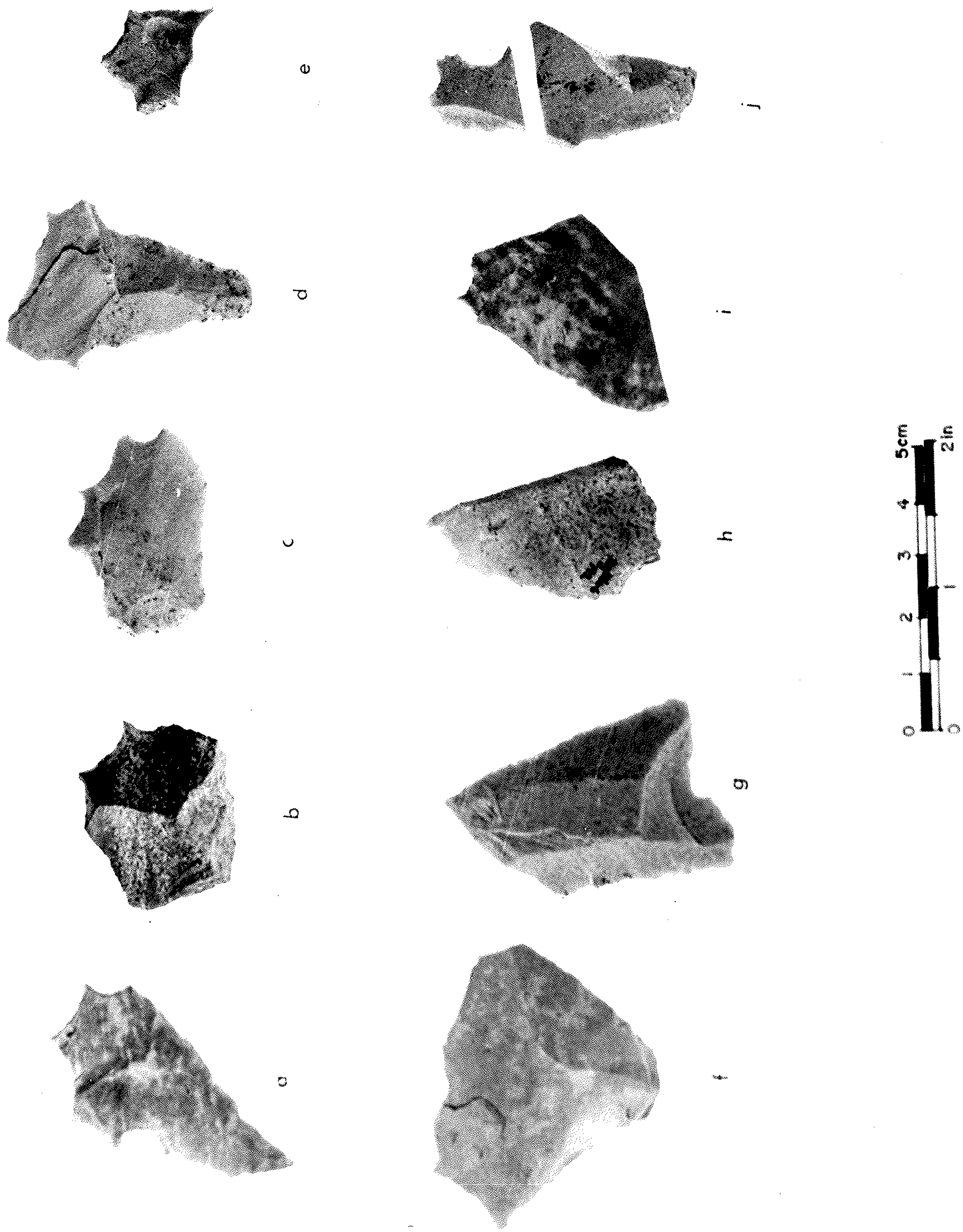
Seventeen gravers were recovered, possessing 1 to 9 spurs which are chipped into shape (Fig. 11). The tools are thin in the spur area (2 to 3.5 mm) and the spurs are sometimes placed around ridges or at abrupt edges for strength. The gravers range in size from 16.1 to 48.6 mm long by 16 to 50 mm wide by 2.5 to 8.4 mm thick.

Flake Knives

Five thin flakes with a short, fine retouch along one lateral edge were found (Fig. 10f-i). They range from 34 to 46.5 mm long by 14 to 27.5 mm wide by 3 to 6 mm thick (Deller and Ellis, 1982:49).

Figure 11: Gravers, Thedford II Site

(a, c.n. 194; b, c.n. 117; c, c.n. 283;
d, c.n. 150; e, c.n. 182; f, c.n. 77;
g, c.n. 149; h, c.n. 192; i, c.n. 81;
j, c.n. 179/124)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Other Unifacial Tools

Other tools include a denticulate, two used flakes and a "perforator". The latter tool has a short, narrow, thick projection on the distal end. A lateral edge is continuously retouched. It is 34.0 mm long by 24.3 mm wide by 9.0 mm thick. There are also 27 other unifacial tool fragments.

DEBITAGE

Paleo-Indian lithic debris totals 682 pieces, of which only 12 were recovered through surface collection. All but a few are made of Collingwood chert. The debris types are similar to those from the Parkhill site (Ellis, 1979:35-68). A detailed attribute analysis of the Thedford II debris appears in Deller and Ellis (1982:Appendix B). Table 1 lists the debris by type and according to manufacturing sequence and product groups of Collins (1975).

Biface Thinning Flakes

Biface thinning flakes number 31 and are large, broad, expanding flakes with an average weight of .74 grams. Most are probably the result of thinning point preforms and not refining outline shape (Deller and Ellis, 1982:B-9). Two thinning flakes appear to have been removed after the tool edge was retouched to finish its outline shape. These flakes are the result of secondary trimming. The others are associated with primary trimming.

Channel Flakes

Twenty-four channel flakes were recovered, none are complete. They were produced during the fluting of points and are long, thin, flat and usually parallel-sided, indicating a later removal in the manufacturing sequence. They range from 8 to 35 mm long and .09 to .91 gms in weight (Deller and Ellis, 1982:B-13).

Bifacial Retouch Flakes

Bifacial retouch flakes number 178 of which 77 are complete. These flakes are narrower, thinner and lighter than the other biface flake debris ranging from 4 mm to 20.5 mm long by 2 mm to 14 mm wide with an average weight of .14 gms. These flakes are similar in shape to the retouch scars on points and preforms indicating that they are a result of the finishing stages of point manufacture (Deller and Ellis, 1982:B-15). They thus are the result of secondary trimming.

Scraper Retouch Flakes

Scraper retouch flakes number 111 and have been described in other analyses (Frison, 1968; Schafer, 1970; Witthoft, 1952). These are small, thick, generally curved flakes removed from the working edge of the tool in order to resharpen it. They range from 4 mm to 16.5 mm in length by 3 mm to 15 mm in width and have an average weight of .15 gms (Deller and Ellis, 1982:Table B-2).

Flat Flakes

These flakes are the most common at the site with 286 found.

They are the distal and medial fragments of the other types except channel flakes which are identifiable even if fragmented. As a result they cannot be assigned to a product group.

Other Debris

There are 20 angular fragments which were probably exposed to heat and 14 similar fragments not exposed to heat. Eleven pop-out flakes were found which leave "potlid" scars on the artifact surface when removed due to heat. It is unknown if this debris results from Paleo-Indian activity. Non-heat fragments may occur due to plow breakage while heat fracturing may be the product of activities by later groups. There are seven additional flakes which do not fit into any of the other types. Five of these could be from flakes previously described or from added sources.

Debris Summary

The flaking debris indicates that the entire tool production sequence did not occur at the site. Individual items of debris are small with only 11 pieces weighing more than 1 gram each and the average weight per item is .21 gms. There are also no cores or large unmodified flakes suitable for use as tool blanks. The debris is easily assignable to the reduction of general tool categories such as scraper and biface. This occurs because the tools are nearing their completed shape in the final manufacturing stages and the knapper is more careful in flake removal making the debris fairly diagnostic. This enables most of the debris to be placed confidently within Collins' (1975) product groups IV and VI which includes channel flakes, biface thinning flakes and bifacial retouch flakes, while a few flakes form product group III. The debris to tool ratio is a low 8.1 to 1 excluding tool fragments, Bayport chert tools and surface collected tools (Deller and Ellis, 1982:B-20). Tool weight exceeds debris weight by a high 5.4 to 1. These ratios considered with the numbers and types of debris indicate that tool maintenance and the finishing stages of tool manufacture occurred at the site.

CULTURAL FEATURES

Three Paleo-Indian features were identified at the site (Fig. 12). Feature 3 had a long, linear, oblong shape in plan and a shallow basin in profile. It was about 250 cm long, 64 cm wide and extended 20 cm into the subsoil (Fig. 13). The feature was disturbed by root and rodent activity, but contained only Collingwood lithic material in the undisturbed areas. This material includes one graver, one tool fragment, 7 bifacial retouch flakes and 6 flat flakes. Large quantities of tools and debitage were found in the squares surrounding this feature and in the plowzone above it.

The only other feature with a discernible outline was Feature 8, located about 8 m to the north of Feature 3 (Fig. 14). It had a slightly irregular outline and was about 180 cm long, 134 cm at its maximum width and had a maximum depth of 42 cm (Fig. 15). This feature was disturbed by root stains, a few small extant roots and a rodent burrow, mostly in its southeastern

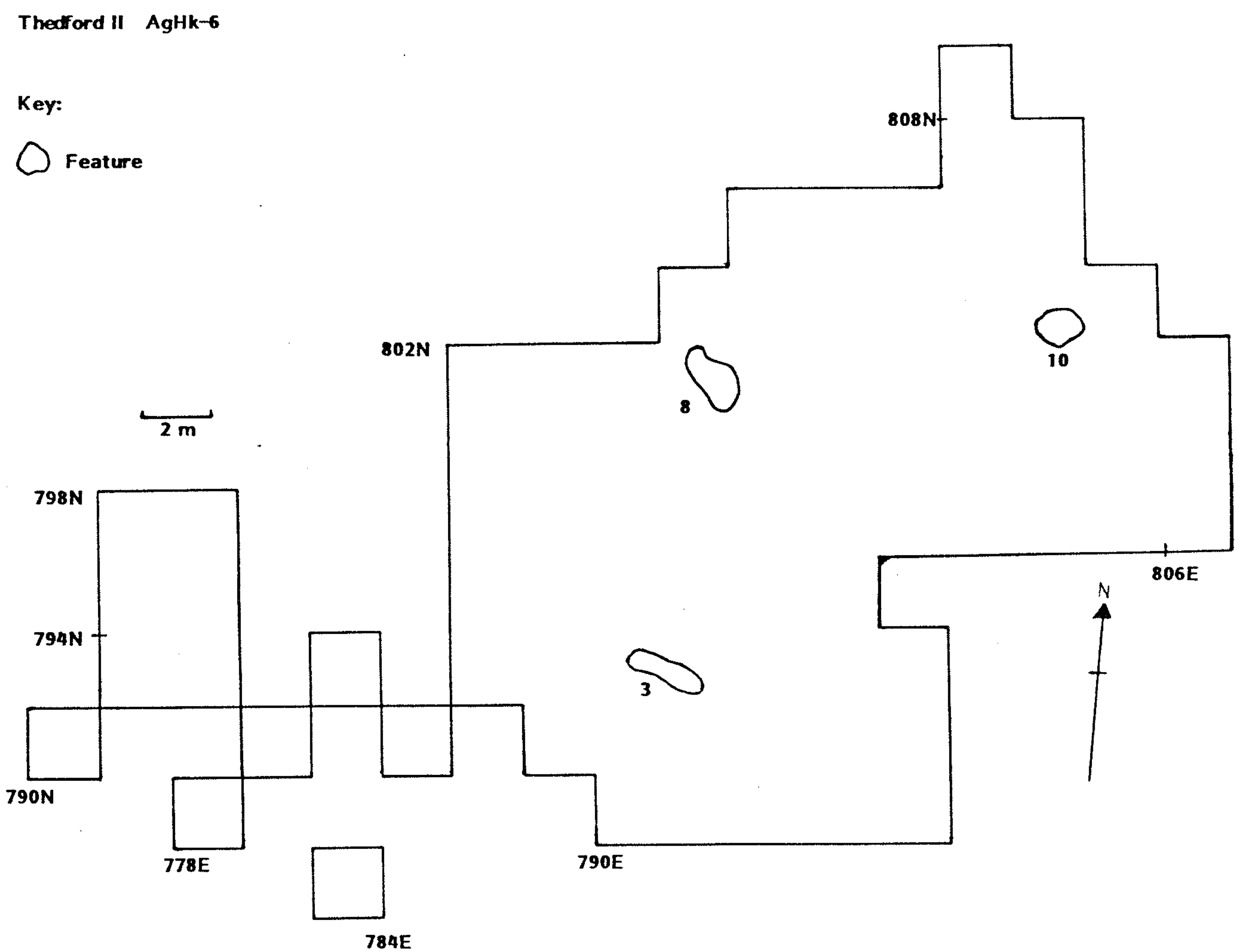


Figure 12: Location of cultural features

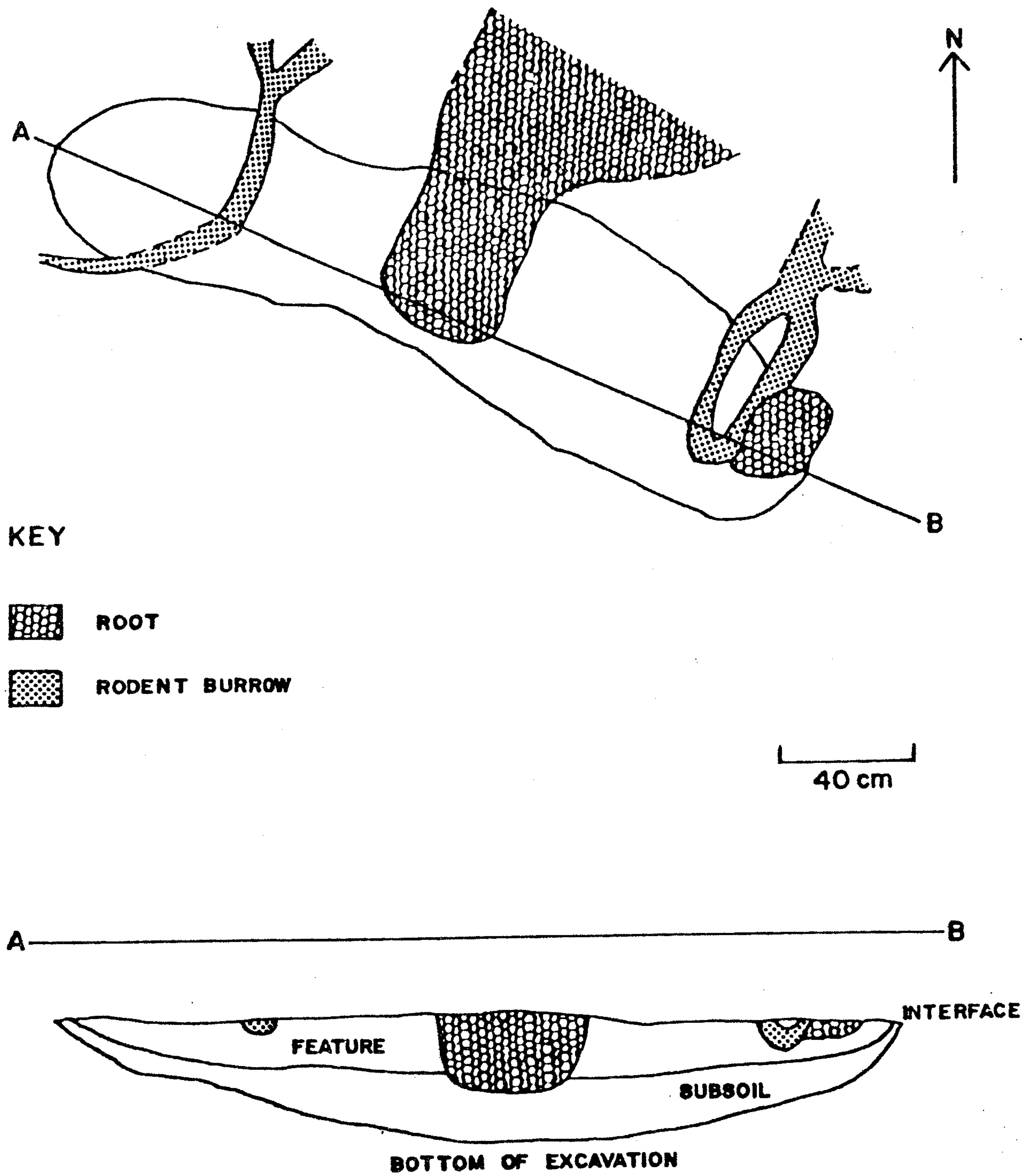


Figure 13: Plan and profile views of Feature #3

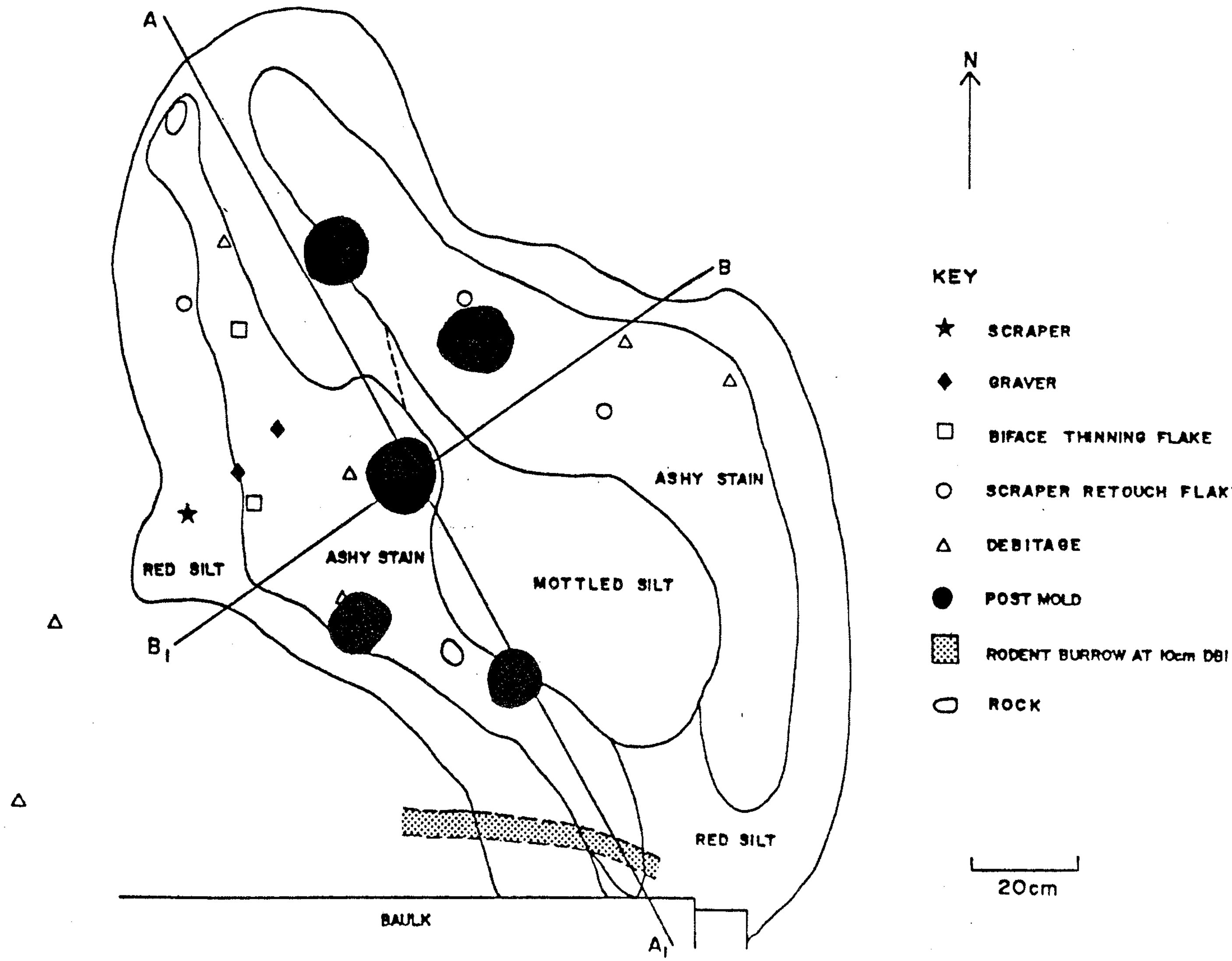


Figure 14: Plan view of Feature 8

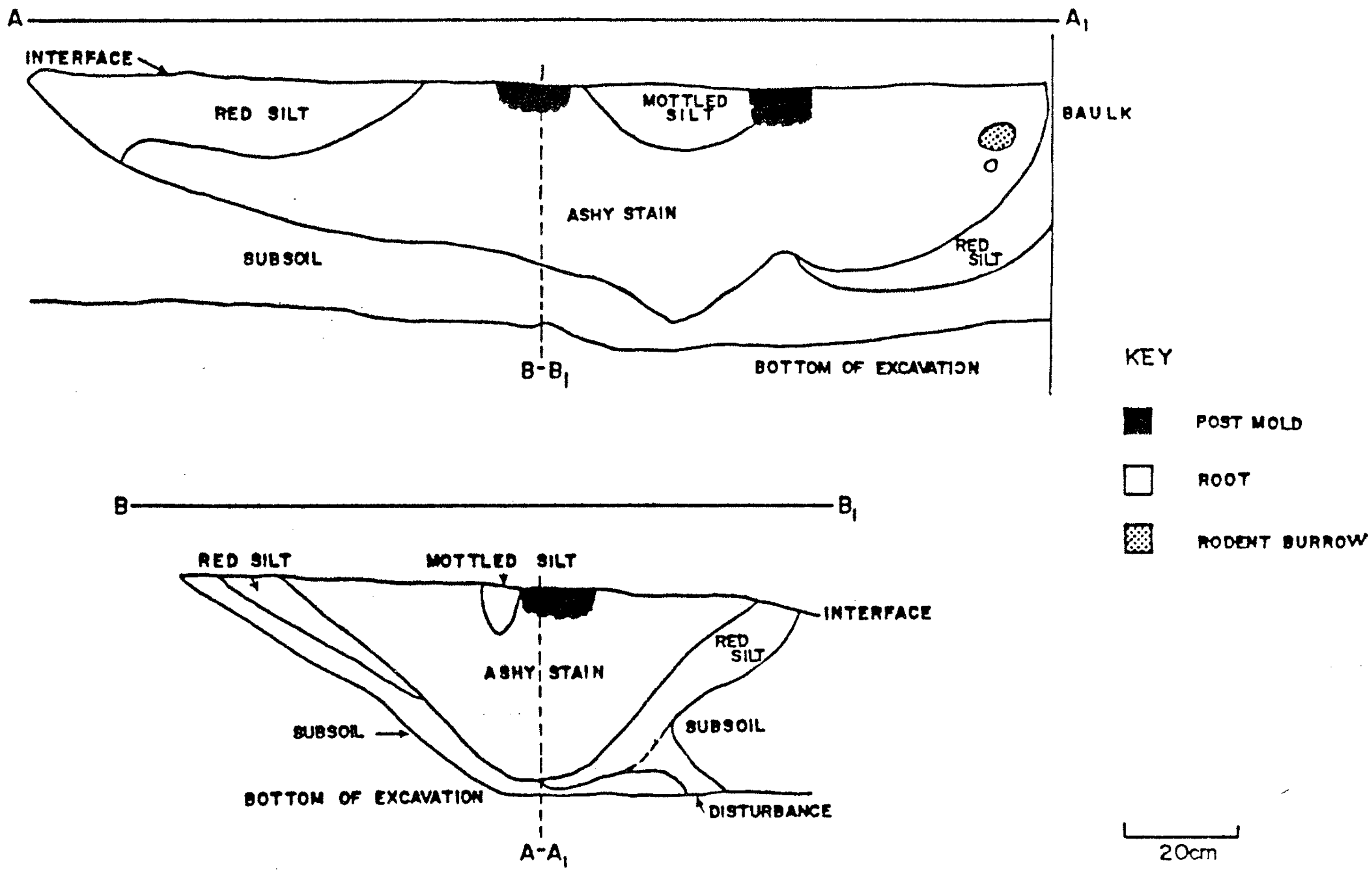


Figure 15: Profile views of Feature 8

part. The northwestern part of the feature was well defined and relatively undisturbed, containing most of the Paleo-Indian artifacts. The artifacts include two multiple gravers, one side scraper with a graver, four heat-fractured tool fragments, 17 scraper retouch flakes, 10 flat flakes, three biface thinning flakes and two other flakes. The flaking debris was densely concentrated within the feature as opposed to the lesser, more scattered amounts in the surrounding squares. Charcoal flecks were present from an ashy layer in the central part of the feature. Charcoal samples for C-14 dating were taken from the northwestern part of the feature and flotation samples were gathered as well.

Feature 10 was located east of the above two features and was identified by a concentration of Paleo-Indian tools and debris. These items were found to a depth of 29 cm in the subsoil, but no distinguishable outline to the feature could be seen. The artifacts include a beaked scraper, a concave side scraper, a backed and snapped scraper, a flake knife, three flat flakes, 6 bifacial retouch flakes, 1 scraper retouch flake and two other flakes. A similar tool concentration was encountered in A-west about 26 m southwest of Feature 10. It contained a beaked scraper, a concave side scraper, a flake knife and an end scraper. This similarity of tool types may suggest that a feature similar to Feature 10 was present which has subsequently been disturbed by roots. The features will be further discussed in Chapter 6.

CHAPTER 5

TOOL FUNCTION

Activity area interpretation at Thedford II depends greatly on artifact function. Tool function is difficult to determine for many lithic assemblages. The function of artifact categories at the site will be generally discussed, following the approach used by Wilmsen (1970) and partly by Keeley (1980). Wilmsen used Paleo-Indian sites located in the United States in his study while Keeley looked at Lower Paleolithic sites in Britain. Wilmsen determined tool function primarily by measuring working edge angles and concluding that certain ranges of angles would have been suitable for performing specific tasks. Keeley also measured edge angles, but in addition studied edge shape, edge damage, and polish and striation on the use areas. A working edge angle and edge shape analysis is conducted in this thesis. Since the majority of the tools within the areas at Thedford II are scrapers, they are the focus of study.

Wilmsen discovered that the edge angles in his sample clustered around three ranges, 26° to 35°, 46° to 55° and 66° to 75°. The first appeared on the lateral edges of tools which suggests a cutting function of soft materials such as meat and skin (Wilmsen, 1970:70). The second range was the most numerous, being located on lateral and distal edges. Many functions are suggested involving uses on hard and soft materials, including skinning and hide-scraping, sinew and plant fiber shredding, and heavy wood, bone and/or horn cutting. The final category appeared most frequently on distally retouched tools and suggests use on hard materials such as heavy wood and bone working and heavy plant shredding. Edge angles from 56° to 65° are thought by Wilmsen to indicate that the tools served the same functions as the steeper-edged tools. The more acute angles on end scrapers in this range, i.e., 56° may be associated with hide preparation (Wilmsen, 1970).

Keeley carried Wilmsen's work a step further and used tool edge shape to aid in determining tool function by experimentation. He classified edges as straight, convex or concave. Keeley found five ranges of edge angles; less than 35°, 35° - 49°, 50° - 64°, 65° - 79° and 80° - 95° (Keeley, 1980:110). Like Wilmsen, he believes the smaller angled tools were used for meat and hide cutting as well as butchery and some hide scraping. These tools almost all possess convex edges. Some of them may also have been used on harder substances such as wood whittling and wood sawing if they have concave or denticulate edges. The 50° to 64° and 65° to 79° ranges appear on tools used for a variety of purposes such as wood whittling, wood chopping, wood scraping and hide scraping. Tools with the steepest edges were possibly employed primarily for wood scraping as well as wood planing and wood chopping. There is no significant preference to edge shape other than that already noted for meat and hide cutting tools, except that wood scrapers do not have convex edges and hide scrapers lack concave edges. It is interesting to note the absence of any tools which Keeley feels may have been utilized to work bone or antler.

The only other tool type found in all of the clusters is the graver or borer. Their function, as discussed earlier, is difficult to dertermine. Most archaeologists agree that these tools were likely used for incising bone and possibly wood (cf. Deller, 1980; MacDonald, 1968; Storck, 1979; Wilmsen, 1970). Piercing or perforating wood and bone is another suggested function (Goodyear, 1974; Price, 1978).

The working edge angles, working edge shapes and the most likely material many of the tools were used on is presented in Appendix A. The latter data is summarized in Table 3. Fig. 16 is a histogram of working edge angles for unifacial tools and Fig. 17 is a histogram of working edge angles for the clusters.

BIFACES

The concave-based biface which is similar to a tool from the Debert site may have been used as a knife, possibly on soft material. The three alternately beveled bifaces were probably used as end scrapers on hard or soft materials. The backed biface has a working edge angle of less than 45° making it suitable for scraping soft material. The pièce esquillée was more than likely used as a wedge for splitting wood. This function is described by MacDonald (1968) and Gramly (1982).

END SCRAPERS

The five offset bit end scrapers have working edge angles ranging from 50° to 70° with an average of 58°. The steeper edges were probably used to work hard items and the edges in the 50° range for softer items such as hides.

Table 3 Type of Material Worked According to Tool Category at Thedford II

TOOL TYPE	MATERIAL WORKED SOFT (<46°)	HARD (>55°)	SOFT AND HARD (46°-55°)
End Scraper	2	11	4
Side Scraper	7	6	9
End and Side Scraper	1	12	4
Beaked Scraper	1	4	-
Other Scrapers	3	7	-
Other Unifacial Tools	6	3	-
TOTAL	20	43	17

Figure 16 Histogram of working edge angles for unifacial tools at Thedford II

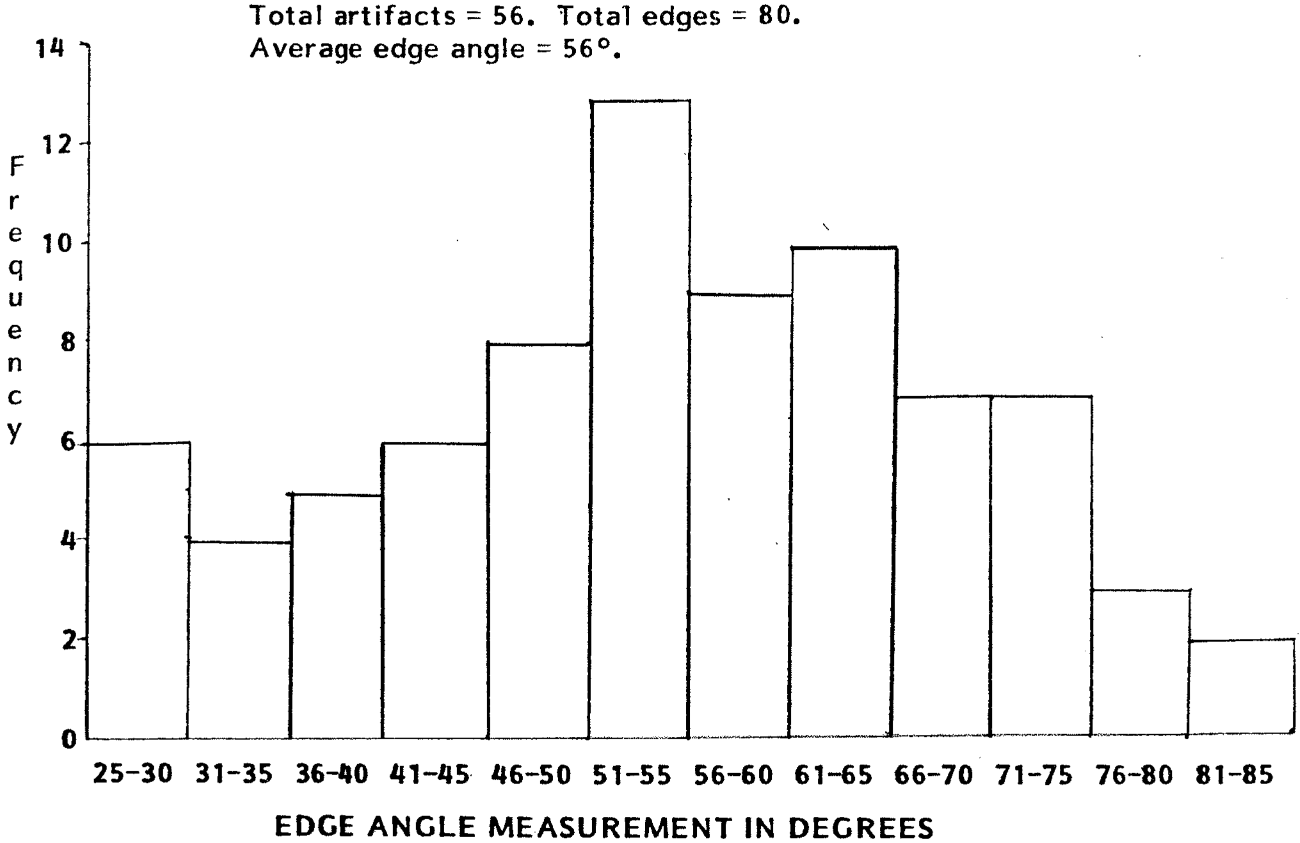
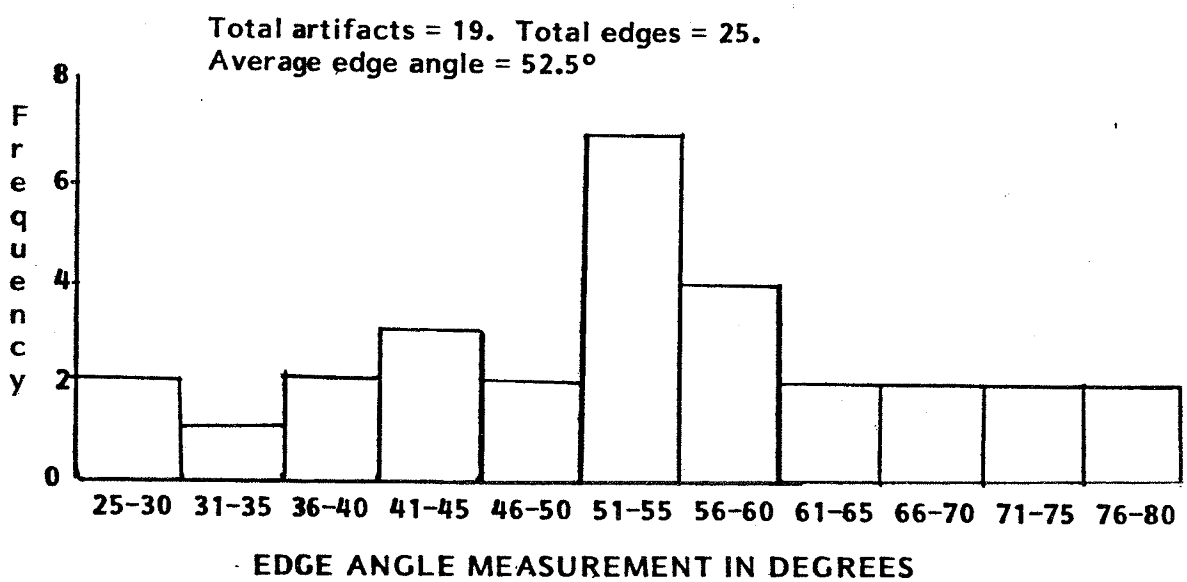


Figure 17 Histogram of working edge angles for Clusters A, B and C



Two triangular end scrapers have distal edge angles of 75° while the other has an edge angle of 60° . This indicates that they were used on hard materials. The fluted end scrapers have edge angles of 55° and 60° which means that they could have functioned on hard materials. The two end and convex side scrapers have a small steeply retouched (70° - 75°) portion on their distal ends with less steep edges (55° - 60°) on either side. These areas were probably used to work hard materials. Of the four "other" end scrapers, three have working edge angles from 65° to 70°indicating tasks associated with hard materials. The remaining scraper in the category has an edge angle of only 35° and was undoubtedly utilized on soft materials, perhaps in hide working.

Many of the end scrapers from Thedford II appear to have been suitable for working hard materials such as wood and bone (Table 3). A few could have been used on hard or soft substances, while there is only one edge with an angle less than 45° which would indicate a use on soft materials. It has been suggested that end scrapers from other fluted point sites in the northeast were used for wood and bone working (cf. Deller, 1980b; Eisenberg, 1978; Kraft, 1977). Other archaeologists (e.g. MacDonald, 1968) believe that end scrapers were used almost exclusively to work hide and skin. MacDonald (1968:111) states that a microscopic use wear analysis was conducted on the lithic tools from Debert, but does not provide consistent or clear evidence of its results. It is felt that he may have dismissed too readily functions associated with the working of hard substances.

END AND SIDE SCRAPERS

The two smaller end and side scrapers have straight lateral edges and convex bit ends. One has lateral edge angles of 50° placing it in Wilmsen's (1970) multi-purpose category and a bit end edge angle of 65° indicating a use on hard materials. The other scraper has one lateral edge angle of 50° and one of 80°. This steep edge would have been useful for working hard substances and the shallower edge once again on hard or soft materials. The end has an edge angle of 65°, also suitable for hard materials. Of the remaining two end and side scrapers one has a concave lateral edge of 60° suggesting a function of wood working and edge angles from 65° to 80° on convex ends indicating they were used to work hard substances. The other scraper has a concave lateral edge of 67.5° which was also probably used to work wood. The opposite lateral edge angle measures 65° in one area and 35° closer to the bit end. This variation indicates functions concerning hard materials and soft materials, possibly hides. The distal end edge angle ranges from 65° to 70° making it suitable for working hard materials. The end and side scrapers almost all possessed steep edge angles indicating they were used to work hard materials (Table 3). Only one working edge angle was below 45°, occurring on a small portion of the edge. Three edges were within the range for working hard or soft materials.

SIDE SCRAPERS

Two of the backed and snapped side scrapers each have a concave lateral edge with an angle of 75° indicating that they were probably used to work wood. Two other scrapers in this category have working edge angles of 50° to 55° placing them in Wilmsen's (1970) multi-purpose category, while another scraper has an edge angle of only 25° making it suitable for working soft materials. The convex side scrapers have convex working edge shapes. The largest of these scrapers has a working edge angle of 45° which suggests a use on soft materials. Another scraper in this category has an edge angle of 55° making it suitable for working hard or soft materials and the third scraper possesses an edge angle ranging from 35° to 50° with an average of 42.5° suggesting that it was used on soft substances and perhaps hard substances.

The three double convex side scrapers have similar working edge angles ranging from 50° to 55° for the most part placing them in the multi-purpose range. Two edges have angles of 40° and 45° indicating a use on soft materials. The single concave side scrapers or spokeshaves were probably used to work wood, e.g. shaft thinning, and have edge angles of 45° , 55° and 60° . The alternately retouched side scraper has an average working edge angle of 52.5° indicating a use on hard or soft materials. An edge angle of 45° occurs along the concave edge and an angle of 30° is on the convex edge of the double concave-convex scraper. The former angle suggests a function of a spokeshave and the latter angle hide or meat working. The transverse scraper has convex working edges measuring 60° making it useful to work hard substances.

The canted scraper has a lateral working edge angle of 65° indicating a use on hard materials and a distal retouched edge with an angle of 45° which may have been utilized. The side scraper/snapped tool has two areas along the same lateral concave edge which suggests that it was used to work wood. The spurred side and end scraper has convex working edges with angles of 40° . This class of scraper is common at other fluted point sites such as Debert, Vail, Fisher and Bull Brook. Edge angle sizes suggest a function on soft materials, while the spur was possibly used on wood or bone. The large, steeply-beveled tool possessed edge angles of 65° and 70° making it suitable for working hard materials. The completely retouched tool has working edge angles of 60° to 70° and 85° indicating a use on hard substances. The presence of graver spurs helps to confirm this use.

The side scrapers and the "miscellaneous" scrapers were used for a variety of purposes based on their working edge angles and edge shapes. Thirteen edges were probably used on hard materials, 10 edges on soft materials and another 9 edges for hard or soft substances (Table 3). Wilmsen (1970:70) suggests that for tools in the multi-functional range, those with retouch on both lateral edges were probably used for sinew and plant fiber shredding. This may apply at Thedford II to the double convex side scrapers and the alternately retouched side scraper which have edge angles from 50° to 55°.

BEAKED SCRAPERS

The beaked scrapers may have functioned to cut grooves in wood and bone (Storck, 1979; Deller, 1980 b). This use is inferred for the Thedford II specimens because most have projection edge angles of 55° to 85° . One of these tools however has an angle of only 30°indicating that it may have been used to perforate hides as MacDonald (1968:98) has stated.

GRAVERS

Seventeen gravers were found at the site. This tool is the most diagnostic of Paleo-Indian artifact types. The function of this tool type is believed to have been for incising grooves or slots in bone or wood (cf. MacDonald, 1968; Eisenberg, 1978; Storck, 1979; Deller, 1980 b; Gramly, 1982).

OTHER UNIFACIAL TOOLS

The flake knives are similar to those from the Debert site (MacDonald, 1968:102). Their function is suggested by MacDonald to have been in aiding animal butchering and to cut hide. These uses are supported by the flake knives at Thedford II which have working edge angles from 30° to 40° . The denticulate, as its name suggests was probably used to cut wood. It has an edge angle of 50° . The retouched flakes each have a lateral edge angle of 30° making them useful probably for cutting soft materials. One of these flakes also exhibits a concave retouched area on part of a lateral edge with an angle of 45° indicating a function of wood working. The perforator may have been used to pierce hide as

(MacDonald, 1968:114) indicates. It has working edge angles of 60° however, so it was also perhaps used on hard materials.

In summary, many of the tools were probably used on hard materials, especially the end scrapers and the end and side scrapers (Table 3). However, many of these scrapers were resharpened and previous to this may have been used for hide working as their angles would have been more acute, perhaps in the 50° to 55° range. The side scrapers exhibit greater edge angle variation, indicating that some soft materials were worked. Some of these steeper edged tools were also perhaps resharpened increasing the number of edges which possibly had been used on soft materials. Of the remaining unifacial tools, the beaked scrapers, gravers and the denticulate were probably used to work hard materials. The flake knives, retouched flakes and the perforator were likely used for cutting meat and hides.

CHAPTER 6

RESULTS OF THE ARTIFACT SPATIAL ANALYSIS

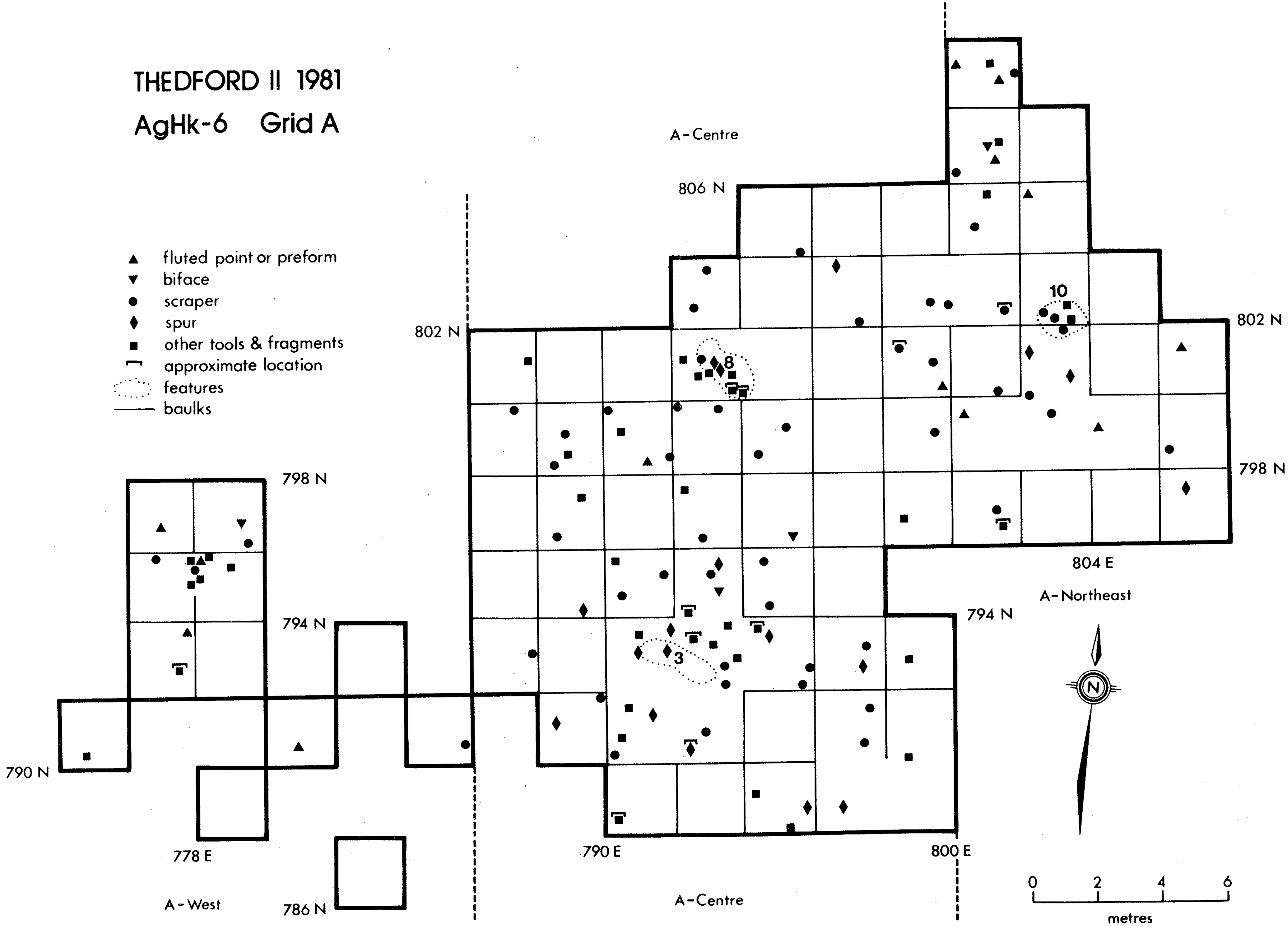
Generally speaking, most of the tools were found within a few metres of the features, especially Features 3 and 8, although 18 tools and fragments were found in A-west, the smallest of the three areas. Visual inspection of the Thedford II main excavation indicates three artifact distribution areas, A-centre, A-northeast and A-west (Fig. 18). A-centre includes Features 3 and 8, while Feature 10 is contained within A-northeast. About 70% of the gravers were found in the southern part of A-centre, with two others in Feature 8 and only three in A-northeast. However, 75% of the bifaces and preforms appear in A-northeast, including a cluster of five in the extreme northern portion. The scrapers appear to be scattered throughout the site.

Most of the lithic debris is located in A-west and in and around the features (Fig. 19). This especially includes the scraper retouch flakes and the bifacial retouch flakes (Fig. 20, 21). The channel flakes were found mostly in A-west and in the region north of Feature 3 (Fig. 22). It is difficult to determine the exact nature of artifact distributions or associations based on the visual inspection of the site excavation plan.

The nearest neighbour analysis provides an objective way of evaluating the appearance of the artifact distributions. Statistics were calculated for the nearest neighbour distances including the use of chi-square statistics to test the randomness of the distributions (Table 4). The complete excavation area was

Figure 18: 1981 excavations at Thedford II showing artifacts and features.

The spatial analysis included only A-centre and A-northeast. Within these areas, artifacts closer to the edge of the excavation than to their nearest neighbour were excluded.


THEDFORD II 1981
AgHk-6 Grid A
fluted point or preform
biface
scraper
spur
other tools & fragments
approximate location
features
baulks
A-Centre
806 N
802 N
798 N
794 N
790 N
786 N
778 E
790 E
800 E
804 E
A-West
A-Centre
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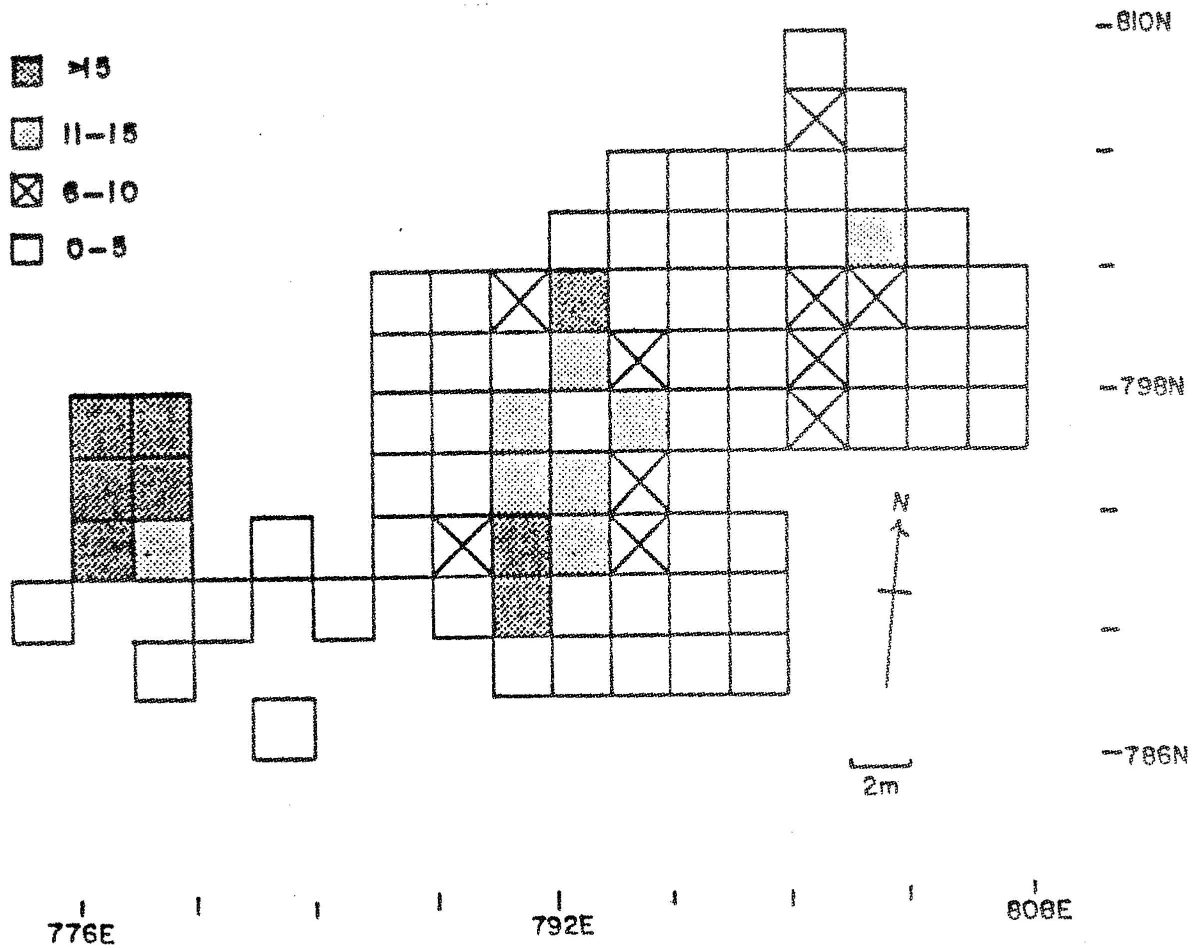

Figure 19: Distribution of Paleo-Indian waste flakes

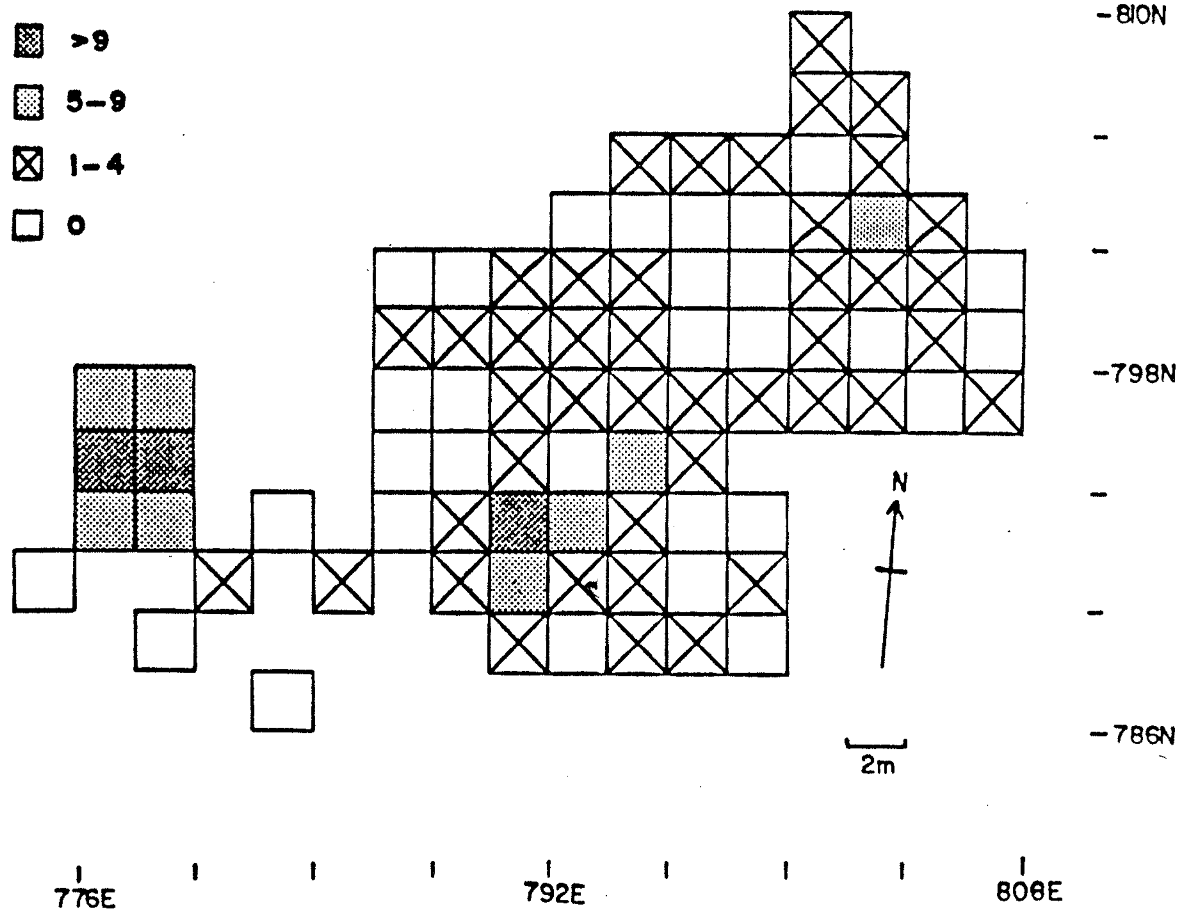

Figure 20: Distribution of bifacial retouch flakes

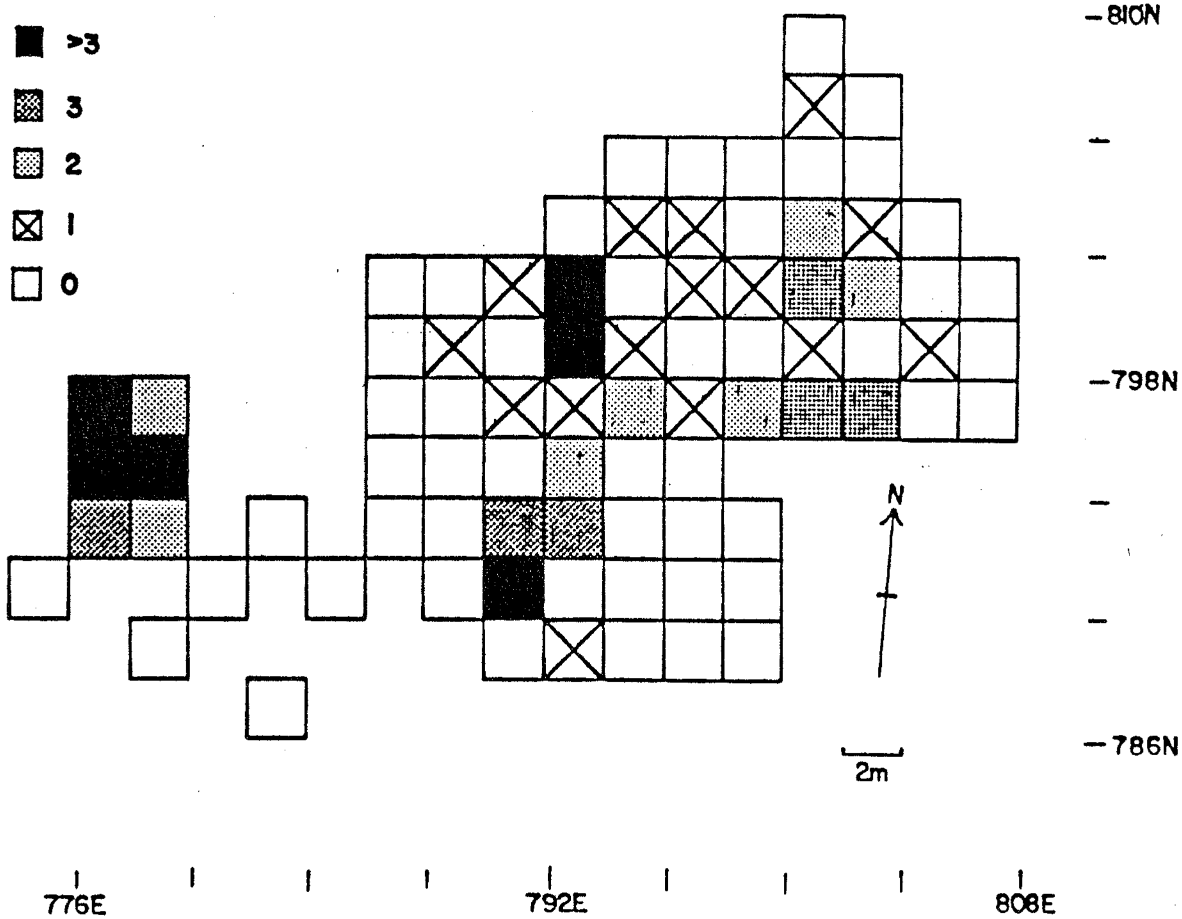

Figure 21: Distribution of scraper retouch flakes

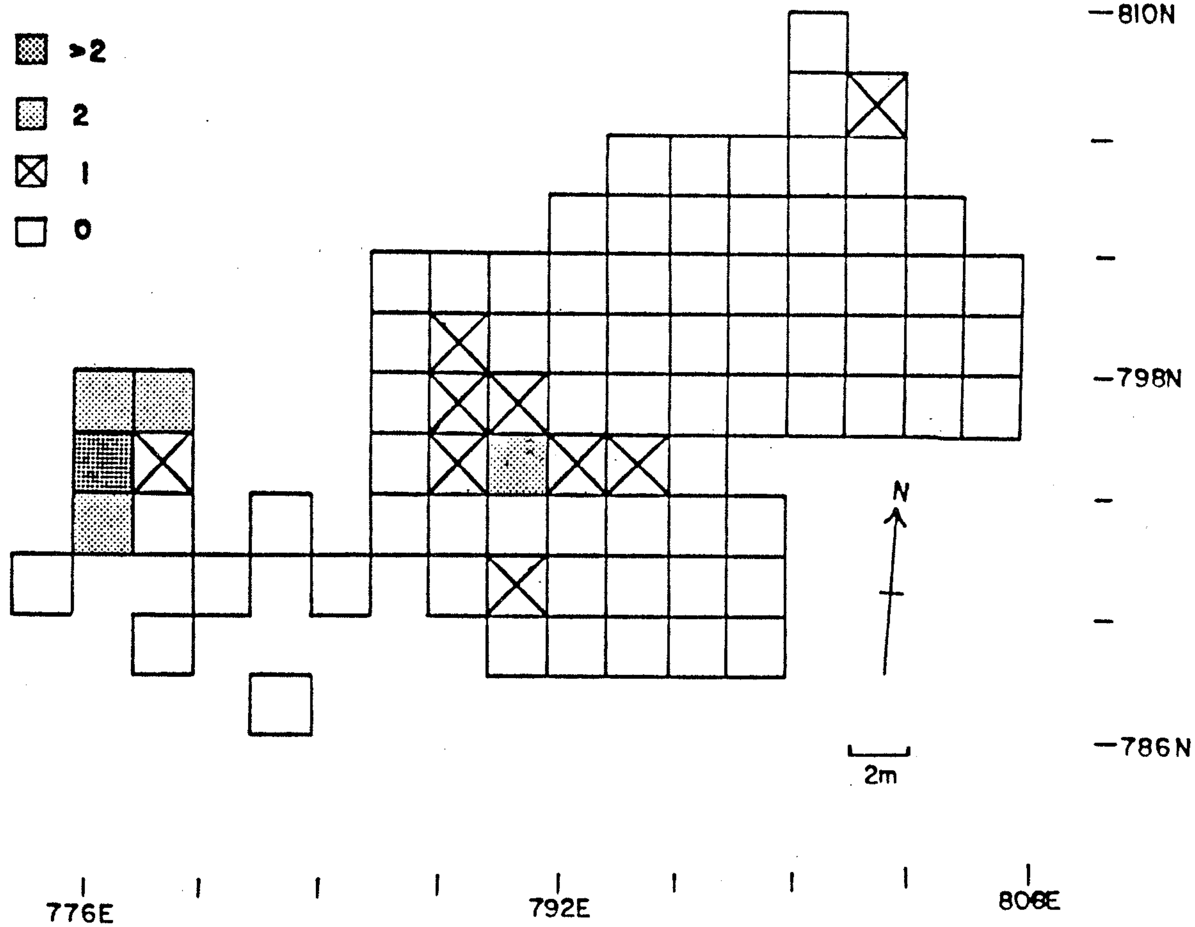

Figure 22: Distribution of channel flakes

Table 4 Nearest Neighbour Analysis of the Thedford II Site
(Distances are in metres)

TYPE	N	LOCATION	SIZE (m^2)	$\bar{r}o$	$\bar{r}e$	R	CHI-SQUARE	COMMENT
Gravers	12	Main excavation	288	1.10	2.56	0.43	6.10	Clustered
End scrapers	10	Main excavation	288	1.80	2.83	0.64	9.15	Clustered
Side scrapers	26	Main excavation	288	1.16	1.70	0.68	27.12	Clustered
Preforms and Bifaces	9	Main excavation	288	1.98	3.00	0.66	8.57	Clustered
End scrapers	8	Features 3 and 8	72	1.59	1.60	0.99	19.95	Random
Side scrapers	13	Features 3 and 8	72	1.06	1.22	0.87	18.95	Random
Side scrapers	9	Feature 10 small area	36	0.85	1.06	0.80	12.45	Random
Side scrapers	9	Feature 10 large area	100	0.85	1.77	0.48	4.48	Clustered

Key: $\bar{r}o$ = observed nearest neighbour distance

$\bar{r}e$ = expected nearest neighbour distance

R = nearest neighbour ratio

Comment is based on "The range of random matching" table in Pinder and Witherick (1972:287) not used in the analysis as A-west contains too few tools. An amount of less than five tools per category is considered too small to make statistical testing meaningful. The section chosen consists of those units east of the 786E grid line which includes A-centre and A-northeast (Fig. 18). Within this area further subdivisions were made in order to provide comparative statistics with the larger segment.

The subdivisions were determined by studying the excavation plan and noting where most of the artifacts were found. Three sectors were selected. One, including Features 3 and 8 is bounded by the units 790N/790E, 800N/790E, 800N/794E and 790N/794E. The other two contain Feature 10; the smaller is defined by the units 798N/798E, 802N/798E, 802N/802E and 798N/804E; while the larger is bounded by those units east of the 798E grid line and north of the 796N grid line (Fig. 18). Only side scrapers were used in the calculations for these latter two areas as less than five of any other tool type occurs, while side scrapers and end scrapers were used from the Features 3 and 8 area. Within the large excavation block, nearest neighbour statistics were calculated for side scrapers, end scrapers, gravers and preforms including bifaces.

It should be noted that some of the items were eliminated from the calculations as they were closer to the edge of the areas than to another artifact. From the largest region this involves six of the thirty-two side scrapers, six of the sixteen end scrapers, five of the seventeen gravers and three of the twelve preforms which were found.

The R values in Table 4 are not close to 0.0 indicating the absence of any highly clustered artifact types. Five types show clustered distributions ranging from 0.43 to 0.68 (Table 4). The chi-square values are also interpreted as showing clustered distributions. These are all of the categories in the main excavation and the side scrapers in the large Feature 10 area. End scrapers and side scrapers in the Feature 3 and 8 area and side scrapers in the small Feature 10 area have R values close to 1.0 suggesting a random distribution. This suggestion is confirmed by the chi-square statistic. The Feature 10 areas contain the same artifacts with the difference being the change in the size of the area. Using a larger area increases the value of $\bar{r}e$ which in turn decreases the value of R, indicating a tendency towards clustering. This tendency is also indicated by the chi-square statistic (Table 4). The index of segregation was used to measure the inclination of two artifact types to be spatially associated. This index is complementary to the nearest neighbour analysis. Types which are randomly distributed according to the latter could be aggregated, segregated or mixed with another type based on the segregation analysis. The results of this analysis are presented in Table 5. The region sizes remained the same as for the nearest neighbour analysis except that the smaller area used in the Feature 10 part was deleted. This was done because the number and variety of artifacts was too small, i.e. only side scrapers were greater than five in number, to warrant any calculations.

The artifact types used in the analysis were side scrapers,

Table 5 Index of Segregation Test of the Thedford II Site

LOCATION	ARTIFACT PAIRINGS	N	SP	CHI-SQUARE	SIGNIFICANCE	SPATIAL RELATIONSHIP
Main excavation	End scrapers/side scrapers	42	.38	4.87	.05>p>.025	Segregation
Main excavation	End scrapers/gravers	34	.16	.41	.75>p>.50	Random
Main excavation	End scapers/preforms	29	.31	1.76	.25>p>.10	Random
Main excavation	Side scrapers/gravers	51	.17	.87	.50>p>.25	Random
Main excavation	Side scrapers/preforms	46	.29	2.47	.25>p>.1	Random
Main excavation	All scrapers/gravers	68	.21	3.21	.10>p>.05	Segregation
Main excavation	All scrapers/preforms	59	.41	7.34	.01>p>.005	Segregation
Main excavation	Gravers/preforms	31	.53	6.71	.01>p>.005	Segregation
Main excavation	Preforms/channel flakes	19	.57	4.54	.05>p>.025	Segregation
Feature 3 and 8 area	End scrapers/side scrapers	16	-.19	.68	.05>p>.25	Random
Feature 3 and 8 area	End scrapers/gravers	15	.08	.01	.90>p>.80	Random
Feature 3 and 8 area	Side scrapers/gravers	25	.16	.21	.75>p>.50	Random
Feature 3 and 8 area	All scrapers/gravers	29	.23	.81	.50>p>.250	Random
Feature 10 area	End scrapers/side scrapers	15	.57	2.39	.25>p>.10	Random
Feature 10 area	Side scrapers/gravers	14	-.28	.52	.50>p>.25	Random
Feature 10 area	Side scrapers/preforms	19	.35	1.13	.50>p>.25	Random
Feature 10 area	All scrapers/gravers	18	-.16	.85	.50>p>.25	Random
Feature 10 area	All scrapers/preforms	22	.52	4.03	.05>p>.025	Segregation
Feature 10 area	All scrapers/scraper retouch flakes	45	.29	3.25	.10>p>.05	Segregation

Note: Value of +1 = Segregation
Value of 0 = Random
Value of -1 = Aggregation

end scrapers, gravers and preforms and bifaces. The latter category was not included in the Feature 3 and 8 area as only three artifacts from it were found there. End scrapers were only paired with side scrapers in the Feature 10 area since not enough of them were present to allow pairings with gravers or preforms. Four end scrapers and three gravers were found in this area while there were eleven side scrapers and eight preforms. Two additional artifact type pairings were tested; channel flakes with preforms within the large excavation block, and scraper retouch flakes with scrapers in the Feature 10 area. Although there were many scraper retouch flakes located throughout the site, they were not all used in the calculations as the provenience was not exact for many of them in Features 3 and 8 where most occured. No other classes of debitage were included in the analysis as the locations of individual artifacts are known only by sub-square or square. The distribution of the debitage can be seen in Figures 19 to 22.

Table 5 indicates that 12 of the artifact pairs are randomly distributed while the other 7 are segregated. None of the pairs are aggregated. Most of the values of Sp are close to 0.0, with only two of them being negative. Four of the values are greater than .5 which indicates a tendency towards segregation. In examining the pairings of the same artifact types between the three areas those combinations that are common to all three generally have the same spatial relationships. Side scrapers/gravers and all scrapers/gravers are randomly mixed, while end scrapers/side scrapers are segregated over the large excavation block and are randomly mixed in the other two smaller areas. Looking at some of the other pairings, those concerning preforms and all scrapers show a tendency to be segregated, while preform/end scraper and preform/side scraper combinations reveal that they are randomly mixed. This could perhaps be attributed to the lesser numbers of end and side scrapers being more scattered over the area chosen than when scrapers are dealt with collectively.

An ordered matrix of the index of segregation values was constructed to ascertain if there was any association between three or four types of tools (Table 6). The values were calculated for the large excavation area only as not all possible artifact combinations were present in the other two areas. Unfortunately, associations were not present beyond artifact pairs because side scrapers/end scrapers and gravers/preforms were segregated, preventing a grouping such as side scrapers/end scrapers/gravers from occurring. Pairs which were spatially mixed included end scrapers/gravers, end scrapers/preforms, side scrapers/gravers and side scrapers/preforms.

The presence/absence test of spatial association is similar to the index of segregation with the exception that the former depends upon the numbers of artifacts within cells, or in this case 2 x 2m excavation units. The areas chosen were the same as those used in the calculation of the index of segregation (Table 7). Most pairings tested were the same as those for the index of segregation with the deletion of all scrapers/gravers and side scrapers/gravers from the Feature 10 region due to the small

Table 6 Ordered Matrix of the Index of Segregation Test (Values indicating randomness are underlined)

	End Scrapers	Gravers	Side Scrapers	Preforms
End Scrapers	0.00000			
Gravers	<u>.16197</u>	0.00000		
Side Scrapers	.37685	<u>.17321</u>	0.00000	
Preforms	<u>.30622</u>	.53030	<u>.28554</u>	0.00000

Table 7 Presence/Absence Test of the Thedford II Site

LOCATION	ARTIFACT PAIRINGS	No. of cells (2 x 2 m)	V COEFFICIENT	CHI-SQUARE	SIGNIFICANCE	SPATIAL RELATIONSHIP
Main excavation	End scrapers/side scrapers	72	.07	.08	.90>p>.75	Random*
Main excavation	End scrapers/gravers	72	.02	.03	.90>p>.75	Random
Main excavation	End scrapers/preforms	72	-.10	.15	.75>p>.50	Random
Main excavation	Side scrapers/gravers	72	.08	.16	.75>p>.50	Random
Main excavation	Side scrapers/preforms	72	-.05	.62	.50>p>.25	Random*
Main excavation	All scrapers/gravers	72	.17	1.27	.25>p>.10	Random*
Main excavation	All scrapers/preforms	72	-.06	.02	.90>p>.75	Random
Main excavation	All scrapers/scraper retouch flakes	72	.19	1.95	.25>p>.10	Random*
Main excavation	Gravers/preforms	72	-.10	.15	.75>p>.50	Random*
Main excavation	Preforms/channel flakes	72	.03	.07	.90>p>.75	Random
Feature 3 and 8 area	End scrapers/side scrapers	18	.44	1.70	.25>p>.10	Random
Feature 3 and 8 area	End scrapers/gravers	18	-.18	.03	.90>p>.75	Random
Feature 3 and 8 area	Side scrapers/gravers	18	.25	.28	.75>p>.50	Random
Feature 3 and 8 area	All scrapers/gravers	18	.25	.28	.75>p>.50	Random
Feature 3 and 8 area	All scrapers/scraper retouch flakes	18	.08	.03	.90>p>.75	Random
Feature 10 area	End scrapers/side scrapers	25	-.30	-.83	.50>p>.25	Random
Feature 10 area	Side scrapers/preforms	25	-.28	.90	.50>p>.25	Random
Feature 10 area	All scrapers/preforms	25	-.24	.59	.50>p>.25	Random*
Feature 10 area	All scrapers/scraper retouch flakes	25	.20	.35	.75>p>.50	Random*

Note: -1 = Segregation
0 = Random
+1 = Aggregation
* = Pairs which were segregated in Table 5

number of gravers. Five pairings were added: scrapers with scraper retouch flakes for both the large excavation area and for the Feature 3 and 8 segment, and preforms with bifacial retouch flakes for all three areas. These were included since the provenience of scraper retouch flakes and bifacial retouch flakes was known by 2 x 2m square (Fig.20, 21) and the presence/absence test required only this information, not their exact location as does the index of segregation.

All of the pairings in the presence/absence test show that the types are randomly distributed, i.e. independent and that they lack spatial association (Table 7). In all but 7 cases out of 19 the results agree with the index of segregation. Most of these involve all scrapers or preforms in combination with another artifact type.In the results of the Features 3 and 8 area, both tests show similar degrees of randomness or non-association. Such is not the case for the Feature 10 area where all scrapers/preforms are segregated in the index of segregation test but not in the presence/absence test.

The scraper/scraper retouch flake association in the presence/absence test indicates a more random distribution as the area becomes smaller. This may be due to the fact that as the areas become smaller the proportion of squares having scraper retouch flakes becomes larger. The preforms/bifacial retouch flakes pairings reveal the opposite relationship as do the scraper/scraper retouch flakes associations regarding the sizes of the areas. This is perhaps due to the smallpreform sample size. This in turn decreases the chi-square value which results in an increase in the degree of randomness of the artifact pairings.

The implications of the spatial analysis are that the nearest neighbour analysis indicated a tendency for tools of the same type to be used at the same place. This tendency was shown by the presence of five clustered distributions. The index of segregation and the presence/absence test suggest that pairs of tool types were not consistently found together. This is evidence that different activities may have occurred in different areas of the site.

The artifact groups, i.e. pairings established by the ordered matrix (Table 6) are transformed into clusters. Nearest neighbour distances are measured for all of the items within each pairing. The standard deviation of these distances is calculated and the "cut-off" distance is found according to Whallon's (1974:23) method. Artifacts closer together than this distance are joined together on the excavation plan. This produces clusters A, B and C as shown in Figure 23. Only those clusters with three or more artifacts are drawn on the plan. The pairings used to produce these clusters are: end scrapers/gravers, end scrapers/preforms and bifaces, side scrapers/gravers, side scrapers/preforms and bifaces, and end scrapers/side scrapers.

REFIT ANALYSIS

The refit analysis produced 21 artifact joins with most fragments occuring in the plowzone (Fig. 24). These artifacts include eight side scrapers, two end scrapers, two gravers, two fluted preforms, one biface, one denticulate and five

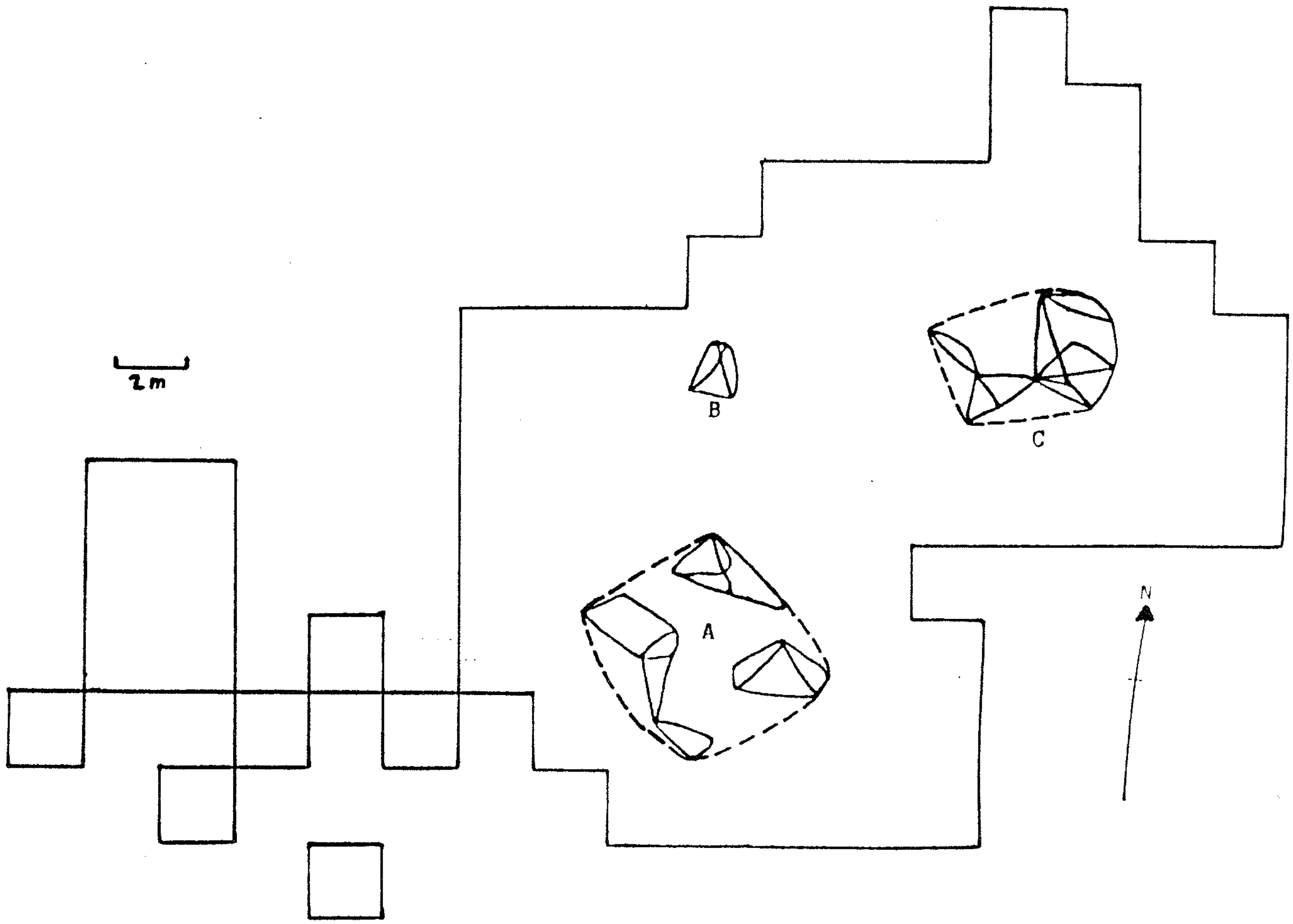

Figure 23: Location of artifact clusters
Solid lines connect spatially associated artifacts
Dotted lines enclose general cluster area

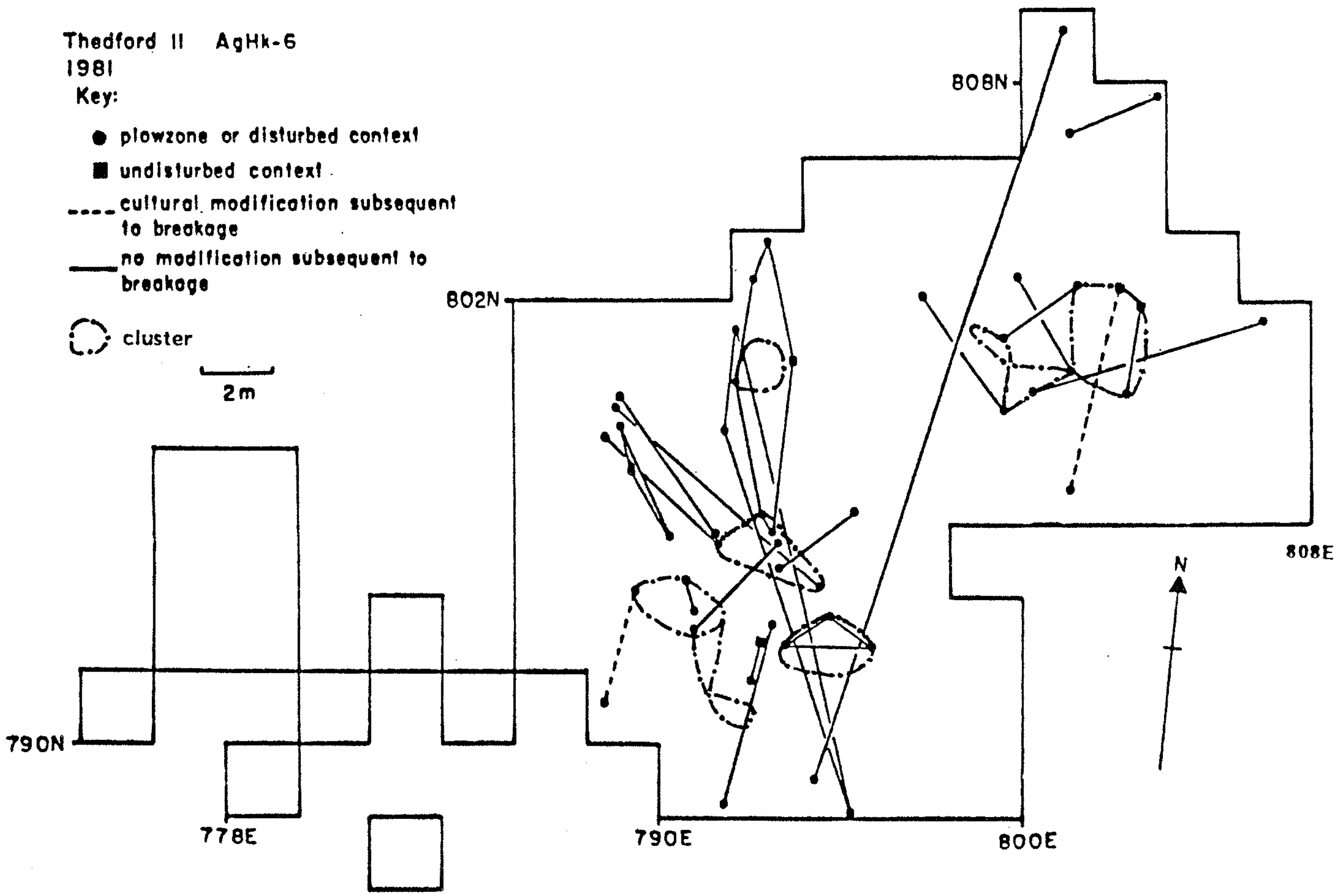

Figure 24: Distribution of artifact fragment matches in relation to artifact clusters
For cluster boundaries see Figure 23

unidentifiable tools. Thirteen refits involved at least one tool from a cluster, including six with tools from the same cluster. One fit was between three side scraper fragments within the eastern mini-cluster of Cluster A while three other refits concerned side scraper fragments within Cluster C. Another refit occurred between graver fragments in the western and northern mini-clusters which are spatially close to one another, and the two fragments themselves were separated by only 3.2 m. The distances between the fragments in the other four refits varied from 2.4 metres to 3.5 metres. Another refit concerned the large convex side scraper discussed in earlier chapters. Two of the seven fragments were from Cluster B and the remainder occurred outside of these areas.

Only six refits involved artifacts from the subsoil. In these instances one of the fragments of each fit was from the subsoil and the other was from the plowzone. Four of these six conjoined artifacts are from Cluster C. Three are side scrapers and one is an end scraper. The fragments of each refit were separated by an average linear distance of 3.4 metres and three were at a depth in the subsoil of 0 to 5 cm while the other was 10 to 15 cm deep. The other two subsoil refits involve artifacts from A-centre. One of the artifact fragments, a graver from Cluster A, is 5 to 10 cm deep and the fragment from the other refit, an unidentified tool located to the southwest of cluster B, is 23 cm below the bottom of the plowzone. This latter fragment was found within a cultural feature (#7) of the group which was at the site after the Paleo-Indian occupation. The artifact may have been swept into this feature along with the numerous flakes of chipping debris produced by this later culture. The two fragments which join the artifact are separated by approximately 13.3 m.

The other refits from the site involve artifacts located primarily within A-centre. One join exists between an unidentifiable tool fragment in the extreme south of A-centre and another approximately 21.3 m to the northeast in A-northeast. This is the furthest linear separation of conjoined artifacts at the site. With the exception of this refit the remaining conjoined artifacts are from either A-centre or A-northeast. These areas are separated by at least 5 m. As discussed earlier, a fence recently ran through the site between the cultivated land of A-centre and the brush of A-northeast. This fence, constructed in historic times, was removed about 20 years ago.

Cultivation has caused the movement of all but two fragments within the plowzone whose edges exhibit fresh breaks. One of these artifacts is from A-centre and the other was found in A-northeast. Both of them possess one piece which came from the subsoil. These may represent the only artifacts which were not moved by cultivation, but became separated through use or discard.

The refit analysis indicates a relatonship between Clusters A and B, but not with Cluster C. Plowing appears to have moved artifacts primarily in a north-south direction while few artifacts were moved east-west. This also indicates that broken artifacts were not transported by the Paleo-Indians between Cluster C and the other clusters. Noncultural formation processes were probably responsible for enlarging the clusters through slightly moving artifacts as noted at the Parkhill site (Roosa, 1977b).

CLUSTER DESCRIPTION AND INTERPRETATION

Three clusters, each associated with a feature, were produced through the statistical analysis (Fig. 23). Other concentrations of artifacts are also referred to below. For the purposes of this analysis it is assumed that artifacts within clusters represent primary refuse. Based on the debitage distribution, artifacts outside of the clusters such as projectile points were probably manufactured within some of the clusters and perhaps outside of them. Each cluster is described below according to its size, shape, location, artifact content and the inferred tool use and activities which may have occurred there. The clusters are then compared regarding tool manufacture, use and maintenance.

Cluster A, circular in shape and covering about 23 m^2, is the largest cluster (Fig. 23). It is located in the southern part of A-centre and is composed of three mini-clusters which are arranged around Feature 3, a hearth. A graver and one tool fragment were the only tools recovered from this feature. This mini-cluster also contains three complete gravers and one fragment, a fluted end scraper, a side scraper and a fragment of the denticulate. A second mini-cluster, 3.3 m^2 in size, is 3 m east of the first. This contained a graver, a convex side scraper, the double concave-convex side scraper and a side scraper fragment. The third mini-cluster is about 3 m northwest of this one, covering approximately 2.5 m^2. It contained fragments of two convex side scrapers, a "backed and snapped" scraper fragment, a fragment of a graver part of which was in the first mini-cluster and a biface fragment (Table 8). In the region between the mini-clusters a flake knife fragment and two unidentifiable tool fragments were found.

The lithic debris from the cluster numbers 118, including 11 scraper retouch flakes and five channel flake fragments. The density of tools in the cluster is $.83/m^2$ and of debitage is $5.13/m^2$. These densities are higher than for the entire site which is $.40/m^2$ for tools and $1.90/m^2$ for lithic debris. This suggests that more manufacturing occurred at Cluster A. The high number of gravers, primarily in the western mini-cluster and the presence of 3 others to the south of the cluster indicates that bone and/or wood incising and splitting was an important task. The working of soft materials, especially in the eastern mini-cluster, such as hide scraping and meat cutting is evidenced by four side scraper edges and the flake knife. The working of harder substances, such as in the northern mini-cluster, is noted by the end scraper, the denticulate, a concave scraper edge, and possibly two of the convex scraper edges as well as the gravers.

The evidence of fluted point manufacturing in Cluster A lies with the five channel flakes found there along with three others near the cluster. The presence of biface thinning flakes and bifacial retouch flakes in and around Cluster A also indicates that bifaces were worked, perhaps in the early stages of point manufacture. However, since no fluted points or preforms and only one biface were recovered from the cluster or nearby, it is

Table 8 Tool Types According to Cluster at Thedford II (Includes conjoined tools)

CLUSTER	SIZE m^2	BIFACES	GRAVERS	SIDE SCRAPERS	END SCRAPERS	END AND SIDE SCRAPER COMBINATIONS	OTHER UNIFACIAL TOOLS AND TOOL FRAGMENTS	TOTAL	DENSITIES/m^2 TOOLS	DENSITIES/m^2 DEBRIS
A	23.0	1	6	7	1	-	2	17	0.7	5.1
B	2.75	-	2	1	1	2	5	11	4.0	13.8
C	9.0	2	2	6	2	-	2	14	1.6	2.7
Total	34.75	3	10	14	4	2	9	42	1.2	6.2
ENTIRE SITE	336.0	26	17	18	23	4	47	135	0.4	2.0

assumed that they were used elsewhere. The manufacture of other tools such as scrapers and gravers is difficult to determine because no tool blanks were found. No scraper retouch flakes were in Feature 3, but 11 were recovered in Cluster A showing that some scraper maintenance and/or manufacture occurred. No scraper retouch flakes were to the east or southeast of the cluster where there were a few scrapers. Perhaps the scrapers were retouched within the cluster and then used in this other area. These tools and others located wihin a few metres of the clusters could have been "tossed" from the clusters after their use was complete.

Cluster B, associated with Feature 8, is approximately circular in shape, about 2.75 m^2 in size and is 7.25 m north of Cluster A (Fig. 23). The tools recovered from it include two multiple gravers, an offset bit end scraper, an end and side scraper, the end and side scraper with graver, two more fragments of the large convex scraper and five heat fractured tool fragments (Table 8). The distal working edge angles range from 40° to 60° and the lateral angles from 30° to 80°. The lithic debris totalled 38 pieces including 17 scraper retouch flakes and three biface thinning flakes. Due to the small size of this cluster compared to Cluster A the density of tools is 4.00/m^2 and 13.82/m^2 for debitage. Two of the scrapers may have been used to work both hard and soft materials and the other two to work only soft substances. The gravers are indicative of wood and bone working. The absence of channel flakes implies that no points were fluted in the cluster, but the presence of a few biface thinning flakes and bifacial retouch flakes suggests that some biface manufacturing occurred. Scraper manufacture and/or maintenance is evidenced by the high number of scraper retouch flakes.

The final cluster C, located in the central part of A-northeast, approximately 9 m east of Cluster B, is about 9 m^2 in size and contains fourteen artifacts (Fig. 23). These include two concave side scrapers probably used as spokeshaves, a backed and snapped scraper, two halves of the alternately retouched side scraper, and a fluted end scraper fragment. All of these tools could have been used on hard or soft materials (Table 8). The working edge angles are the most consistent in this cluster ranging from 50° - 60° on nine edges. Tools which were probably used on bone or wood, besides the spokeshaves, are two gravers, a side scraper/bend break tool, a beaked scraper and the perforator. The offset bit end scraper and flake knife would have been useful for hide scraping and meat cutting respectively. A fluted preform tip and a fluted biface mid-section were also recovered. Twenty-four pieces of lithic debris occur in the cluster including six scraper retouch flakes, with the remainder being bifacial retouch flakes and other waste flakes. The density of tools is 1.56/m^2 while debris is a low 2.67/m^2 . The absence of channel flakes and biface thinning flakes in the cluster suggests that little point manufacturing occurred. The presence of bifacial retouch flakes may indicate some other biface manufacture. There is no evidence that the unifacial tools were manufactured within the cluster, but the scraper retouch flakes indicate that some maintenance occurred.

Two artifact groups, not statistically defined as clusters, also warrant discussion. One group is located in A-west. Although not entirely excavated, this region contained the densest concentration of debitage and tools on the site (Fig. 18-22). The tools include three fluted biface fragments, one biface fragment, one flake knife used for hide and meat cutting, one beaked scraper, a double convex side scraper used for working soft and possibly hard materials, a concave side scraper, an end and convex side scraper which would have been suitable for working hard and perhaps soft items and eight tool fragments. The waste flakes number 276 including 35 scraper retouch flakes, 13 channel flakes and eight biface thinning flakes. The density of tools is $.71/m^2$ which is comparable to that of Cluster A and the debitage density is $11.50/m^2$, second only to Cluster B, but the area is much larger ($24\ m^2$) versus $2.75\ m^2$ for Cluster B. The high debitage density indicates that this area was the major lithic manufacturing region of the site. The manufacture of fluted points and bifaces is evidenced by the channel flakes, biface thinning flakes and bifacial retouch flakes. The high number of scraper retouch flakes shows that a considerable amount of scraper rejuvenation occurred.

The other artifact group, located north of Cluster C, is formed of a concave based biface, four fluted biface fragments including two tips, a biface thinning flake and a channel flake, which fits one of the biface fragments. The fit suggests that one biface was fluted there. Other biface fragments from this area and around Cluster C may represent points broken during manufacture. The number of bifacial retouch flakes within these areas, second only to Cluster A suggests that more points and bifaces may have been retouched than in other site areas.

The statistical analysis aids in the discussion of inferred activities such as tool manufacture and maintenance. All tool types for the main excavation have a tendency to be clustered, although they approach a random distribution. Gravers are the most clustered artifacts because many of them are located in and around Cluster A. The end scrapers and side scrapers are clustered somewhat in the feature areas but are more dispersed than the gravers. The segregated and random spatial relationships between pairs of tools in the main excavation suggests that different tool types were not used together in activities. This could be because many of the scrapers were probably used as multi-purpose tools indicating that one scraper could have been used in place of two or more others. This involves eleven scrapers for certain and possibly seven others where one edge was used to work hard or soft materials and the remaining edge(s) on the tool are in the multi-purpose range (Table 3). This compares with 14 scrapers used on hard materials and 6 used on soft materials. This could also suggest that certain tools were used in specialized tasks and that other tool types were not needed in association with these tools. Gravers may be an example of a specialized tool, probably used to incise bone and wood, which involves no other types of tools such as scrapers.

The preform/channel flake relationship is segregated because most of the channel flakes were found in the Cluster A area while the majority of preforms appeared in the eastern part of the site. As previously discussed, the points represented by the channel flakes were not used at the site and the preforms were probably discarded because they broke during manufacture. The channel flakes associated with these preforms may be located in unexcavated areas of the site. Bifacial debris is scattered beyond Cluster A signifying that fewer points and other bifaces were manufactured than were within the cluster.

In comparing the clusters, it was shown that tool manufacture, maintenance and use took place primarily within clusters, which are associated with features. The evidence for fluted point making lies with the presence of channel flakes which were recovered primarily from Cluster A and the western part of the site. Only a few fluted point or preform fragments were found in these areas indicating that finished points were used elsewhere, presumably in the hunt, and the fragments represent unfinished points which probably broke during manufacture. Bifacial retouch flakes were recovered from all clusters and biface thinning flakes from all except Cluster C. This suggests that some biface working occurred in the clusters, although few bifaces were located, i.e. one in Cluster A and two in Cluster C. Four biface fragments and one tool were located north of Cluster C and two fragments were east of it.

Scraper maintenance and/or manufacture was an important task especially at Cluster B and in the western part of the site where many scraper retouch flakes were found. The distribution of scrapers is more scattered, as indicated by the index of segregation, suggesting that they were retouched near the features and some were used in other areas of the site. The relatively low number of scraper retouch flakes (6) and high number of scrapers (8) at Cluster C compared to Clusters A and B indicates that less scraper refurbishing occurred at Cluster C. This could happen if the scrapers were not extensively used. It was noted earlier that Feature 10 did not have a discernible outline and was identified by the concentration of four scrapers and a flake knife found 29 cm deep in the subsoil. This may indicate that these tools were placed or discarded together.

A variety of activities probably occurred in each cluster. The high number of gravers within Cluster A along with a denticulate, and some of the scrapers indicates that wood and bone working took place. Other scraper edges and the flake knife have lower edge angles suggesting that soft materials were worked. At Cluster B two scrapers were useful to work wood and bone and perhaps hide. Another two scrapers were probably used on soft materials, while the two gravers are indicative of wood and/or bone working. Four scrapers may have been used to work hard or soft materials at Cluster C while a flake knife would have been useful to work soft materials. Seven tools were probably used on hard substances.

Activities would have included the manufacture of tents, clothing and containers of hide, wood and bone tools such as needles and awls, as well as wood drying and storage racks. The use of bone scrapers for hide working is noted ethnographically for the Chipewyan (Irimoto, 1981) and archaeologically for the Paleolithic Period in Europe (cf. Keeley, 1980).

This chapter has reported on artifact distributions, associations and clusters following the methods outlined in Chapter 3. A nearest neighbour analysis revealed that most categories tended to be clustered, with a few being random. Secondly, the association between artifact categories was explored through the use of the index of segregation and the V coefficient. These indicated that most pairings of artifacts were randomly mixed while some others were segregated. Artifact groups, in this case consisting of pairs, were delimited by these association tests.

Finally, artifact clusters were outlined on the excavation plan. It is assumed that these clusters represent major lithic-related activity areas at the site. Different activites occurred in each cluster with fluted point manufacturing at Cluster A but not at Clusters B or C. The manufacture of other bifaces probably took place at all three clusters. Scraper manufacture and/or maintenance occurred primarily at Cluster B. The working of hard materials went on in every cluster, but mostly at Cluster A and to a slightly lesser extent at Cluster C. More soft substances were also worked at Cluster A than at the other clusters. Tools used to work hard or soft materials were found in Clusters B and C, but not at Cluster A. Thus, none of the clusters are similar regarding the lithic-related activities which probably occurred in each. The following chapter will interpret these activity areas in terms of the lithic-related activities, the intensity of the occupation and the season of occupation.

CHAPTER 7

INTERPRETATION AND DISCUSSION

Three topic areas 1) lithic-related intra-site activities, 2) the intensity of occupation and 3) the season of occupation, are discussed in this chapter through the use of intra-site archaeology, comparative archaeological data and ethnographic data. The archaeological sites compared include Parkhill (Roosa, 1977a, 1977b; Deller, 1980b; Roosa and Deller, 1982), Banting (Storck, 1979), Barnes (Wright and Roosa, 1966; Voss, 1977), Vail (Gramly, 1982) and Debert (MacDonald, 1968). The major ethnographic sources used are Binford (1978a) and Irimoto (1981) for the Nunamiut and Chipewyan respectively. This information will be synthesized and Thedford II placed within an overall adaptive strategy and settlement system model for southern Ontario proposed by Deller (1980b).

LITHIC-RELATED INTRA-SITE ACTIVITIES

The inferred activities at Thedford II discussed in Chapter 6 suggested that hard materials such as wood and bone were the most frequently worked. This is evidenced by the relatively steep angles on 54% of the working edges plus the 17 gravers found in Clusters A and C. Soft materials such as hide and flesh were probably worked in all clusters, but especially in B and C. This is indicated by 25% of the working edge angles. The remaining working edges could have been used on hard or soft materials and occur in Clusters B and C as well as around them. Biface manufacture as evidenced by debris such as channel flakes, biface thinning flakes and bifacial retouch flakes occurred mostly at Cluster A and in the western part of the excavation. Scraper maintenance and/or manufacture was especially important within this latter area and at Cluster B. Scraper distribution was scattered, suggesting that they were used away from maintenance or manufacture areas.

The Parkhill site provides the greatest amount of comparative data with Thedford II. It is located 8 km north-east of Thedford II on a plain, crossed by two inactive, shallow valleys. Between these valleys are two very low ridges extending east-west, parallel to the Parkhill Creek which is just south of the site (Deller, 1980b:30). Ten grids which are broad regions of artifact concentration with an average size of 50 m^2 each were identified at Parkhill. Six grids are located at scattered intervals just north of the ridge crests. Five of the ten grids were excavated but the distances between these is unknown to this author.

Grids B, C and part of D were the most extensively excavated grids and their relationship to each other has been frequently discussed (Roosa, 1977a, 1977b; Ellis, 1979; Deller, 1980b; Roosa and Deller, 1982). They are 186 m^2 , 100 m^2 and 37 m^2 in size respectively. Grids B and D are located at opposite ends of the site while Grid C is close to Grid B. These grids are equivalent to those at Thedford II, although only Grid A was excavated there. Clusters and mini-clusters are defined at Parkhill only for Grid B. These are comparable to the clusters at Thedford II.

Unfortunately, the artifact distribution maps are unavailable for Parkhill and, since no spatial analysis was conducted, there are only the numbers and types of tools and debitage within Grids B, C and D for comparative purposes. The artifact densities for these grids and for the site overall are calculated here (Table 9).

The total number of tools recovered from the Parkhill site is 263 including 185 from Grids B, C and D (Roosa and Deller, 1982). A wear analysis on scrapers from the surface of the Parkhill site showed that they were used on hard substances such as wood or bone and rarely on soft materials such as hides (Deller, 1980b). Deller speculated that the excavated scrapers were also used on hard substances. Other suggested activities include incising, shaft preparation, grooving, rearmament and point manufacture. These activities are inferred by the presence of gravers, spokeshaves, beaked scrapers, projectile point bases and channel flakes respectively. They all involve the working of hard materials, i.e. bone, wood or stone.

Grid B contained 85% of the fluted points, preforms and bifaces recovered from the site with a density of $0.5/m^2$, compared with a figure of $0.3/m^2$ over the entire site. In addition, approximately 126 (68%) of the channel flakes and 1,285 (60%) of other bifacial debris with a density of $7.6/m^2$ occurs at this grid. These figures, along with low densities of other tools ($0.08/m^2$) and debris ($0.2/m^2$) suggests that much point manufacturing took place, while few other activities such as the manufacture and maintenance of unifacial tools were performed.

The two artifact clusters and 12 mini-clusters identified at

Table 9: Artifact numbers and densities from Thedford II and other Paleo-Indian sties referred to

Site/Grid/ Cluster	Points and Preforms	Bifaces	Total Bifacial Tools	Scrapers	Gravers	Total Tools	Total Debitage
Thedford II (336 m^2)							
No.	17	9	26	55	17	135	682
Density/m^2	0.05	0.03	0.08	0.2	0.05	0.4	2.0
Cluster A (23 m^2)							
No.	0	1	1	8	6	17	118
Density/m^2		0.04	0.04	0.3	0.3	0.7	5.1
Cluster B (2.75 m^2)							
No.	0	0	0	4	2	11	38
Density/m^2				1.5	0.7	4.0	13.8
Cluster C (9.0 m^2)							
No.	2	0	2	8	2	14	24
Density/m^2	0.2		0.2	0.9	0.2	1.6	2.7
Parkhill (approximate size 500 m^2)							
No.	115	11	126	88	10	263	N/A
Density/m^2	0.2	0.02	0.3	0.2	0.02	0.5	
Grid B (186 m^2)							
No.	82	3	85	6	0	91	2,907
Density/m^2	0.4	0.02	0.5	0.03		0.5	15.6
Grid C (110 m^2)							
No.	19	0	19	13	5	37	1,410
Density/m^2	0.2		0.2	0.1	.05	0.3	12.9
Grid D1 (37 m^2)							
No.	3	0	3	9	0	16	1,441
Density/m^2	0.08		0.08	0.2		0.4	38.7
Feature 9 mini-clusters (10 m^2)							
No.	23	0	23	1	0	28	N/A
Density/m^2	2.3		2.3	0.1		2.8	
Banting A-west (178 m^2)							
No.	2	0	2	16	7	59	N/A
Density/m^2	0.01		0.01	0.09	0.04	0.3	
Barnes (256 m^2)							
No.	28	14	42	13	0	59	2,590
Density/m^2	0.1	0.06	0.2	0.05		0.2	10.1
Area 1 (160 m^2)							
No.	7	3	10	3	0	14	N/A
Density/m^2	0.04	0.02	0.06	0.02		0.09	
Area 2 (52 m^2)							
No.	2	2	4	4	0	9	N/A
Density/m^2	0.04	0.04	0.08	0.08		0.2	
Vail (Area excavated 259 m^2)							
No.	55	21	107	410	N/A	2,026	3,514
Density/m^2	0.2	0.08	0.4	1.6		7.8	13.6
Debert (Area excavated approximately 1,210 m^2)							
No.	110	90	208	1,561	38	3,930	23,636
Density/m^2	0.09	0.07	0.2	1.3	0.03	3.2	19.5

***Note: N/A = not available**

Grid B were the only ones at the site (Roosa, 1977a, 1977b). These were identified by visual inspection of artifact plots and only those for which dimensions are given, so that densities can be calculated, are described here. Three mini-clusters are around Feature 5 and each contained a scraper, a knife and one or more point fragments suggesting that perhaps they form a tool kit used in shaft preparation and point rearmament (Roosa, 1977a). This is the only tool association referred to. Another three mini-clusters were located around Feature 9, a hearth, in an area of 10 m^2. The artifacts include 23 points and fragments, an end scraper and 47 channel flakes. The tool density is 2.8/m^2 and 4.7/m^2 for channel flakes. The amount of other lithic debris is unavailable.

Grid D is considered a base camp because of the varieties of tool types. These varieties include 16 fluted point fragments and preforms, 38 scrapers and 4 other tools (Roosa and Deller, 1982). Of these tools, 3 points with a density of 0.08/m^2, 9 scrapers with a density of 0.2/m^2 and the 4 other tools with a density of 0.1/m^2 came from D1, an area measuring 37.2 m^2. This biface density (.08/m^2) is much lower than at Grid B and that of the other tools is considerably higher. The debris density is a high 38.7/m^2 including 9.9/m^2 for bifacial retouch flakes and 3.8/m^2 for scraper retouch flakes. Two channel flakes from Grid B fit with fluted point blades at Grid D. This is interpreted as indicating that points were brought to Grid D after they were made at Grid B (Ellis, 1979; Deller, 1980b). This shows that different activities predominated at different site areas. The higher density of scrapers and scraper retouch flakes than at Grid B indicates that more maintenance and perhaps manufacture or use of scrapers occurred at Grid D.

Grid C is inferred to be a smaller base camp because it has fewer tools than Grid D, but the same variety. The biface density ($0.2/m^2$)is about twice that of Grid D, while the density of other tools ($0.2/m^2$) is slightly less than half. The bifacial debris is the lowest of the three grids at $4.6/m^2$while that of scraper retouch flakes ($1.4/m^2$) is between Grids B and D1. The activities performed at this grid were probably similar to those of Grids B and D, but on a smaller scale. These include fluted point and other tool manufacture and maintenance.

The Feature 9 mini-clusters described above are collectively similar in size to Cluster C at Thedford II. The tool density ($2.8/m^2$) is greater than at Cluster C ($1.6/m^2$) and the fluted point and biface density is much greater ($2.3/m^2$ compared to $0.2/m^2$). These densities are consistent with those from the other clusters where points, preforms and bifaces are $2.1/m^2$ at Parkhill compared with $0.3/m^2$ for the three Thedford II clusters. This reinforces the suggestion that more point manufacturing occured at Parkhill Grid B than at Thedford II.

The difference in biface density between Thedford II and Grids B, C and D1 at Parkhill has already been noted. Scrapers are twice as dense at Thedford II ($0.2/m^2$ to $0.08/m^2$) and more gravers are found at Thedford II ($0.05/m^2$ to $0.02/m^2$). The greatest disparity in density occurs with lithic debris. The overall debitage density is $2.0/m^2$ at Thedford II compared with

$17.1/m^2$ at Parkhill. Bifacial debris is ten times as dense and scraper retouch flakes are three times as dense at Parkhill. These densities suggest a greater emphasis on fluted point manufacture and scraper refurbishing at Parkhill. Assuming that the points were used for hunting, this suggests that hunting may have been an important activity at the site. The higher number of scrapers and gravers at Thedford II may indicate that more processing, wood working and bone working took place. Scraper use may have been as important at Parkhill however, because scrapers were resharpened more often than at Thedford II.

Another Paleo-Indian site in southern Ontario is the Banting site (Storck, 1979). This site is located in south-central Ontario about 40 km southeast of Georgian Bay. It is near a crest on the end of a drumlin which was formerly an island in a glacial Lake Algonquin embayment. Four site "areas" which are equivalent to grids at Thedford II have been identified (Storck, 1979). These areas range in size from 16 m^2 to 207 m^2 . Artifact clusters were not defined or discussed for any area. Unfortunately only one area, A-west, contains solely Paleo-Indian artifacts. It is 178 m^2 in size. The tool total is 59 and scrapers (16), with a density of $0.09/m^2$, make up 27% of the total and have working edge angles in the wood and bone working range. Gravers comprise 12% and fluted points with a density of $0.01/m^2$ only 3% of the total. Debris is low with a ratio to tools of 5:1, the same as at Thedford II. No debris numbers are given except for bifacial retouch flakes (3) and channel flakes (0). The absence of channel flakes and blanks leads Storck (1979) to infer that lithic manufacturing was unimportant in this area which is termed a small base camp where the manufacture and repair of wood or bone tools and clothing occurred. Tool maintenance is not discussed by Storck (1979). The numbers of tools is more than twice as much and their densities are 25% greater at Thedford II than at this Banting site area. The similar tool:debris ratio may indicate that the same amount of tool manufacture occurred but without having the numbers for all debitage types at Banting A-west it is difficult to discuss this further.

The Barnes site in Michigan (Wright and Roosa, 1966; Voss, 1977) is an example of a fluted point manufacturing hunting camp where few other activities occurred. The site is located in the centre of the lower Michigan peninsula on a very low rise in a fallow field (Voss, 1977). The excavation is 256 m^2 in size and was dug in 2 x 2 m units. Two areas, 160 m^2 and 52 m^2, were identified (Voss, 1977:261) which are approximately equivalent to, in terms of spatial arrangements, A-centre and A-northeast respectively at Thedford II. Of the 59 tools recovered from Barnes, 24 were excavated including 7 point fragments, 3 biface fragments, 3 scrapers and a utilized flake from Area 1; 2 point fragments, 2 biface fragments, 4 scrapers and a utilized flake from Area 2; and a utilized flake from outside of these areas (Voss, 1977;275). The location of the remaining 35 tools is unknown. The number of waste flakes per 2 x 2 m unit is given as a broad range making it difficult to calculate densities. The overall waste density is 10.1/m^2. Individual tool function is not discussed by Voss (1977).

Voss' (1977) analysis showed that point manufacturing occurred in both areas with end scraper production also in Area 2. This is based on bifacial waste flake/channel flake and other waste flake end/scraper associations respectively. In Area 1 the tools and debris were generally segregated indicating that they were used away from where they were manufactured. This situation is reversed in Area 2 suggesting that tools, especially unifaces were used at their place of manufacture. Tool maintenance is not discussed by Voss (1977). The same occurs at Thedford II where most tools are found with debris in the clusters. A waste flake density of $10.1/m^2$, compared with $2.1/m^2$ at Thedford II, supports the inference that tool manufacturing was important at Barnes. The fluted preform density ($0.05/m^2$) at Thedford II is about half that of the points ($0.09/m^2$) at Barnes, while the scraper density at Thedford is four times that of Barnes ($0.2/m^2$ to $0.05/m^2$). This indicates that less point and more scraper use occurred at Thedford II than at Barnes.

Paleo-Indian sites outside of the Great Lakes region include those analysed by Eisenberg (1978). These sites located in the Hudson and Delaware River drainages are Kings Road, Phlenge, Port Mobil, Shawnee-Minisink, Twin Fields and West Athens Hill. Bone and wood working are suggested as important activities at most of these sites from the presence of gravers, spokeshaves and scrapers. It was determined that hide processing was carried out at only two of these sites, Phlenge and West Athens Hill which also had the greatest tool form variety (Eisenberg, 1978:130, 132). Kraft (1977) notes that the scrapers from Phlenge rarely show hide polish, but have heavy wear such as from wood, bone or ivory.

The Vail site in northwest Maine, beside an old river in a forested valley (Gramly, 1982), provides comparative data for Thedford II. The site covers an area of approximately 5,600 m^2 and eight major artifact concentrations termed loci with a total area of about 259 m^2 were investigated. These loci are equivalent to grids at Thedford II and six of them are in an arc, bordering old, shallow stream courses. They vary from 11 m^2 to 85 m^2 in size. The loci are not described individually making it difficult to determine the size, shape and artifact content of activity areas as well as the relationship between these areas and loci. Each locus contained almost every artifact class. The artifacts number 3,856 tools and 5,720 waste flakes including 2,026 tools and 3,514 waste flakes assignable to individual loci (Gramly, 1982; 22, 49). Projectile points from the loci number 55 and bifaces 52, both with densities of $0.2/m^2$. Bifacial debris includes 112 channel flakes with a density of $0.4/m^2$ and 1,945 biface thinning flakes with a density of $7.5/m^2$. This latter density is particularly high indicating a relatively great amount of point and biface manufacture. If Gramly's (1982) assumption of 18 to 36 occupations is used, then only 3 to 6 points were produced per occupation.

A tool use wear analysis was not conducted, but Gramly suggests that the cutters(741), which constitute 30% of the tool total, were used to incise wood and bone. The end scrapers (731) form 30% of the artifact total and Gramly (1982) believes they were used to work wood. Pièces esquillées form the next largest tool category with 22% of the total indicating that much wood and bone splitting occurred. Gramly assumes that the scrapers were used to work wood because bone scrapers which were used for hide working are present from Mesolithic and Paleolithic sites in the Old World. However, this does not constitute sufficient evidence to exclude a hide working function for scrapers from the Vail site. Unfortunately, scraper edge angles are not reported. Tool maintenance is evidenced by 936 scraper retouch flakes, with a density of $3.6/m^2$, recovered from the loci. A low waste flake to tool ratio of 1.7 to 1 suggests that tool maintenance prevailed over manufacture. End scrapers for instance were resharpened into cutters and then pièces esquillées.

The tool type percentages indicate that a greater proportion of scrapers were used at Thedford II than at Vail (41% to 30%). A higher percentage of points, preforms and bifaces were also used at Thedford II than at Vail (32% to 7%). This may imply that more scraping and hunting activities occurred at Thedford II, however the greater amount of tool resharpening at Vail may counter this implication. This would mean that tools could have been reused more frequently at Vail than at Thedford II.

Gramly (1982:64-67) reconstructs the activities which occurred at the site during a single occupation. The first tasks were to repair the tents or make new ones and to gather firewood. Projectile points were refurbished, wood shafts were made with stone scrapers and cutting tools, and families gathered to talk while resharpening and rehafting scrapers. The caribou then arrived and were hunted, butchered and some of the meat cached. Unfortunately, Gramly does not discuss in any detail the possible methods of butchering the caribou or how the hides were worked and what items were manufactured from them, in this "narrative" of the site occupation.

The Debert site is located on a low, sandy ridge of a gently sloping plain in central Nova Scotia. The site was never cultivated but the eastern and northern parts were disturbed by bull-dozing and the southern half was filled up to about 2 m. The central part was largely undisturbed and excavation occurred there (MacDonald, 1968:1). Eleven sections, equivalent to grids at Thedford II were excavated. Eight of these were in a strip in the central site area. Most of the artifacts (92%) and hearth features were from this strip. The sections have an average size of about 110 m^2 with one or two hearths and 600 artifacts. Artifact concentrations appear to be predominately located within and near features but MacDonald (1968) does not discuss them. Each living floor contained a variety of tool types. Of the 3,930 tools in the sections, 1,363 (35%) are end scrapers, 198 (5%) are side scrapers

38 (1%) are gravers and 110 (3%) are projectile points with a density of $0.09/m^2$. The scrapers have a density of $1.3/m^2$.

A use-wear analysis involved the study of polish and striation on the tools. Tool function is not discussed by section but for the entire site. MacDonald believes that the scrapers were used to process plant and animal material for clothing and shelter, while the gravers may have served to manufacture bone needles or incise bone. About one-half of the end scrapers possessed graver spurs. Flake knives comprise almost 10% of the total tool inventory and their use is suggested to be hide cutting, although wood shaving is also proposed. Waste flakes number 23,636 with a density of $19.5/m^2$. These are not listed by category such as biface thinning flakes making it difficult to discuss the amount and type of tool manufacture and maintenance which occurred at Debert.

In summary MacDonald (1968) considers Debert to be a base camp where a variety of activities occurred in each section focusing on hide working and to a lesser extent on bone working. The small amount and density of projectile points and butchering tools indicates that hunting and butchering did not take place at the site.

The inferred activities for Thedford II are similar to those at most of the above discussed sites. Unifacial tools are common at all of the sites, except for Barnes. These were likely used to work hide, wood and bone to manufacture such items as clothing, shelter, wood shafts and bone tools. Barnes is considered a hunting camp where little or no processing occurred. The other sites are deemed base camps where there were a variety of activities. Projectile points and other bifacial tools are fewer in number at many of the sites except Grid B at Parkhill and Barnes. Grid B was a point manufacturing area where the majority of points at the entire site were produced. Bifacial debris was recovered from all of the sites, but frequently not in association with bifaces, indicating that bifaces were worked and used elsewhere. Some tool types were not found at Thedford II such as drills, awls and spurred end scrapers which occur at Debert and Vail. This indicates that some activities such as extensive wood working were not important tasks at Thedford II. Only one pièce esquillée was recovered at Thedford II, but they are common also at Debert and Vail. These tools could have been used for wood and/or bone working (cf. MacDonald, 1968; Gramly, 1982).

Ethnographic Data

Ethnographic data for the Nunamiut and Chipewyan indicates that residential or base camps where a variety of activities occurred were the commonest site type (Binford, 1978a; Irimoto, 1981). Binford (1978a) distinguishes this kind of camp from special-purpose camps. The latter are relatively short term occupations where single subsistence strategies occurred. These include hunting, butchering, gathering firewood and fishing, usually involving a few males or family units. These camps were often reused. Base camps are occupied for a relatively longer period of time and are multiple-activity centres. Some of these are clothing manufacture, hide processing and structure manufacture. The fruits of subsistence strategies which took place at special-purpose camps are consumed and utilized at the base camps. These camps were never reused according to Binford (1978a) but a pattern of almost continuous occupations of camps made near one another every year is produced.

Irimoto (1981) notes the same type of base camps as Binford (1978a) but calls them summer and winter camps. Meat, fish and hides were processed at these camps as well as the manufacture of shelters, clothing and drying racks. The Nunamiut and Chipewyan base camp size was dependent on the availability of food and other resources such as firewood during the winter.

Thedford II is similar to these ethnographic base camps in terms of the possible activities performed such as hide processing, clothing manufacture and shelter construction. These activities were discussed in Chapter 6 according to cluster and the overall site through the spatial distribution and association of artifacts. There is no indication that the site was a special-purpose camp where a single subsistence strategy such as hunting occurred.

INTENSITY OF OCCUPATION

The intensity of the occupation is discussed by comparison with the Parkhill, Banting, Barnes, Vail and Debert sites. The densities referred to above are presented in Table 9 and are also used in this section. By way of comparison, late Paleo-Indian and late Archaic camp sites in the Midwest have tool densities ranging from nearly $0.5/m^2$ at the Sohn site (Reeder, 1981) to $1.6/m^2$ at the Hill site (Shay, 1971). The average tool density for these sites along with the Booth site (Klippel, 1969) and the Itasca site (Shay, 1978) is approximately $1.0/m^2$.

The estimates of the number of individuals per family and group size are derived from ethnographic studies of the Nunamiut and Chipewyan conducted by Binford (1978a) and Irimoto (1981). Archaeological estimates are from Roosa and Deller (1982), who do not state the basis for these estimates. A low debitage density might be expected if little tool manufacture and maintenance occurred. A longer occupation or a larger group size is possible if more debris occurs because a long period of time and/or many people are necessary in order to produce the debris. Consideration must be given to the possibilities that the same site area could have been returned to at a later time. A high artifact density could be present for this area, but this may not represent a single, intense occupation. More than one area may also have been inhabited during the same occupation or at another time. Artifact refitting helps to show the association between site areas.

As discussed earlier the Thedford II refit analysis indicated that clusters A and B denote one occupation while Cluster C could also be related to them. The absence of refits between Cluster C and Clusters A or B might be attributed to the more recent cultivation of the first. This recent cultivation allows less chance of artifact disturbance. Cluster C could also represent a different occupation, but this is unlikely given its small size (9 m^2). The association between Grids B and D at the Parkhill site has been noted above. This is the only mention of artifact refitting at the site and suggests that these grids were occupied at the same time.

It was noted above that the debitage density at Thedford II is much lower than at Grids B, C and D1 of Parkhill (2.0/m^2 to 17.1/m^2). This is mostly due to the greater amount of biface working at Parkhill. The tool densities are almost the same (0.4/m^2 at Thedford II and 0.45/m^2 at Parkhill). Bifaces comprise only 32% of this density at Thedford II and 72% at Parkhill. Although the debris densities may indicate a less intense occupation at Thedford II, the tool densities do not. They show that less point manufacturing occurred at Thedford II, perhaps suggesting that fewer hunters or males were present or that different activities took place there. It has been assumed archaeologically and shown ethnographically that males produced projectile points. Thus, the more males present at a site, the greater the probability that points will be made or repaired.

The number of point manufacturers at Grid B of Parkhill is stated as 15 (Roosa, 1977b; Roosa and Deller, 1982). This is how many different point style groups are identified at Grids B and D and it is assumed by these authors that a different individual produced each style. Perhaps, however, an individual possessed more than one point style. It is believed that there were 3 to 5 people per family meaning that a total of 45 to 75 individuals lived at these grids, assuming that each of the 15 males were from a different family. No indication is given of the occupation length exept that it may increase as the group becomes larger. At Grid C the point style groups number 3 or 4 and differ from those at Grids B and D. This indicates that 12 to 20 people may have lived at this grid. There appears to be no relationship between Grid C and the others suggesting that it was occupied at a different time, perhaps for a shorter interval. Deller (1980b), however, states that since Grids B and D are located at opposite ends of the site this represents a single occupation because all the grids in between follow a similar locational pattern. However, I believe that this pattern could represent successive occupations of different grids each season or year. The consideration of Grids B and C as base camps supports this belief because there would be no reason for two base camps to be occupied simultaneously unless two groups were present. (Deller, 1980b), however, speculates that only one group occupied the site. There is insufficient data to speculate on the occupation intensity of any other grids at Parkhill.

Since there is only one complete fluted point from Thedford II it is unwise to estimate the group size based on point styles. The greater scraper and graver densities at Thedford II could indicate a more intense occupation based on processing instead of point manufacture. These densities are closest to those at Grid C of Parkhill and the overall tool density is similar to that at Grid D1. The much lower debitage density at Thedford II however, suggests less tool manufacture and maintenance in comparison with Grid C or D1 at Parkhill. This indicates perhaps a shorter occupation and/or a smaller group size for Thedford II, perhaps related to a different reason of occupation.

The low artifact number (59) and tool to debris ratio of 5 to 1 at A-west of the Banting site leads Storck (1979) to infer that this area was occupied once, as a temporary general-purpose camp or base camp. A higher ratio may indicate that multiple occupations were necessary in order to produce a larger amount of debitage and tools. Storck (1979) notes that many of the diagnostic artifacts are from an area ca. 10.5 m^2 to 12 m^2 in diameter. Gravers number 7 with a density of 0.04/m^2, scrapers 16 with a 0.09/m^2 density and the overall tool density is 0.3/m^2. These low densities may indicate a less intense or a short occupation by a small group of perhaps less than 10 or 15 individuals. The total tool density is comparable to Thedford II, and the tool variety is also similar. The area however is smaller, 178 m^2, indicating that a larger population could have resided at Thedford II or a group of like size which stayed longer.

The intensity of occupation can also be compared with that of the Barnes site. Voss (1977) surmises that the site was a hunting camp of males because of the high projectile point proportion (47.5%) and its small size (256 m^2). Four point style groups were identified which Voss interprets as meaning that the site inhabitants were from different minimal subsistence units, because each style is distinctive, perhaps indicating varied interaction during the subsistence cycle (Voss, 1977:272). This may also indicate that four males from the same group produced different styles in much the same way as Roosa (1977b) and Roosa and Deller (1982) proposed for the Parkhill site, although there is no ethnographic evidence to suggest that each male produced one point style. The high debitage density ($10.1/m^2$) indicates a somewhat intense occupation which was focused on fluted point manufacture. The tool density, excluding points, is a low $0.1/m^2$ suggesting that few other activities occurred such as processing. The occupation was probably short with enough time for a small group of males to manufacture a few scrapers and the fluted points for hunting. This contrasts with Thedford II where fluted point manufacturing was unimportant and a wider range of activities were performed. Thus, Thedford II was probably occupied by a larger group, who stayed for a longer time than the group at Barnes.

At the Vail site Gramly (1982) discusses the number of loci which were occupied simultaneously based on artifact refitting. Three artifacts from separate loci were conjoined, two were fluted points and one was a drill. The points are from adjacent loci and Gramly (1982) suggests that this represents meat-sharing between separate tents. This may have resulted if a point tip remained in a cut of meat which was then given to a hunter's neighbour (Gramly, 1982:49). The number of occupations per loci ranges from 1 to 12, assuming that during each stay the same number of artifacts were left. Long habitations are considered unlikely because the tools were already near exhaustion, perhaps when the group arrived at the site, and many had evidence of heavy resharpening. Thus, a visit to the lithic source was necessary to replenish the supply, but there is no evidence that this occurred. The same population size and number of dwellings is predicted for each occupation based on a possible consistent food supply. The refits from different loci such as that described above, are interpreted as meaning that each time the site was occupied two dwellings belonging to separate families were constructed. This indicates that 18 site occupations were made, with dwellings constructed 20-35 m apart based on the distance between Loci A and B and Loci D and E (Gramly, 1982:51). A size of 27 m^2 is speculated for each tent and its associated activity area (Gramly, 1982:53).

Assuming that 18 occupations occurred at the site the average tool density per stay is $0.4/m^2$ which is identical with that at Thedford II. The density of projectile points and bifaces is $0.02/m^2$, $0.09/m^2$ for all scrapers and $0.08/m^2$ for cutters which includes gravers. The point density is much lower than the $0.05/m^2$ at Thedford II. The scraper density is twice as much at Thedford II while that of gravers is slightly less than for the cutters at Vail. The debitage density at Vail is a very low $0.8/m^2$ consisting primarily of biface thinning flakes and resharpening flakes. This indicates that tool manufacture was less important than at Thedford II. The amount of possible resharpening which occurred may be less than that implied by Gramly given the low debitage density. Some exhausted tools could have been discarded without being used, indicating an even less intense occupation.

It is hypothesized by Gramly (1982) that the Vail site was occupied from mid-July to September by a group of at least two families to hunt caribou. Using Roosa and Deller's (1982) estimate of 3 to 5 individuals per family, this means that 6 to 10 people were at the Vail site per visit. They would have occupied an area of about 54 m^2 assuming that Gramly's (1982) size estimate per family area is correct. This area is approximately half that of Grid C at Parkhill which is also considered to be a base camp. Thus, using Gramly's data there should only have been 4 families or 12 to 20 individuals at Grid C and not the 15 families or 45 to 75 individuals suggested by Roosa and Deller (1982).

An alternative suggested by this writer is that there are 7 to 8 families or 21 to 40 people represented per Vail site occupation. It seems difficult to imagine this number of people living in such a small area as 54 m^2 or 45 to 75 individuals in an area of 110 m^2 at Grid C of Parkhill. Gramly's estimate of 27 m^2 per family appears to be more reasonable. Using this information for Thedford II, Cluster A may be representative of one family's tent and activity area. Cluster B could be a small region where this family performed tasks and one or two individuals may have lived or perhaps only accomplished certain duties at Cluster C. This then indicates that, like Vail, 4 to 7 people could have lived at Thedford II. Based on a similar tool density, Thedford II was perhaps also occupied for a month.

The tool densities at the Debert site are high in comparison to Thedford II. The total tool density is eight times greater at Debert ($3.2/m^2$ to $.4/m^2$). The scraper density is $1.3/m^2$ at Debert and $0.2/m^2$ at Thedford II. The point density is more comparable ($.09/m^2$ at Debert and $.05/m^2$ at Thedford II). The debitage density is a high $19.5/m^2$. It is difficult to discuss the intensity of occupation at the site because MacDonald does not indicate how many times the site may have been occupied, only that it was occupied successively (MacDonald, 1968:127).

Ethnographic Data

The ethnographic data concerning caribou reliant societies indicates that small groups resided at their sites, especially during the colder seasons of the year. Binford (1978) studied Nunamiut pre-sedentary fall villages which were occupied by single and extended families ranging in size from 5 to 20 persons. One of these sites, occupied by 5 people, covered an area of approximately 300 m^2 including a tent and yard area of 135 m^2 and a dog yard of 81 m^2 (Binford, 1978a:380). This family remained at the site for a little more than a month.

Spiess (1971:221) notes that ethnographic interior caribou hunters spent winters in microband groups ranging from the size of a nuclear family (5-7 persons) to 50 people. Those groups of greater than 20 individuals usually represented two or more microbands which moved apart as game became scarcer. During the fall-winter season the maximum group size is estimated at 20 to 30 persons (Spiess, 1979:248). Each nuclear or extended family lived in a tent which covered approximately 20 to 33 m^2 of floor space. Assuming an average of five persons per tent, the floor area occupied by the maximum group size would have been 80 to 198 m^2. If the average was seven individuals per tent, then an area of 60 to 132 m^2 is expected. The sites would have been larger than these floor areas, allowing for activities performed outside of the tents.

For the Chipewyan, Irimoto (1981) describes primarily their summer and winter camps. The summer residential camps were usually composed of related nuclear families with an average of 6 people per family. The number of families in each camp ranges from 2 to 9, indicating that from 12 to 54 people with an average of 33 resided at these camps. Winter camps were large if the fall hunt was successful. Six to 12 families or units lived at the sites, but there were only an average of 3.5 individuals per family. The group size ranged from 15 to 42. Smaller camps were present if the hunt was poor with only 1 to 4 families or 3.5 to 14 people per camp. If food was in short supply during the late winter then the camps would break up into even smaller units and travel further into the forest for food. Irimoto (1981:76-77) only deals with one of these camps in detail. It covered about 400 m^2 and had 3 domestic units representing an occupation of 12 individuals.

These ethnographic groups appear to have 5 to 7 persons per family, except the Chipewyan who, during the winter, have an average of 3.5 individuals in each family or unit. This indicates that Roosa and Deller's (1982) population estimate could be too small making the figure for the Vail site also too low. If one tent was present at Thedford II, then 5 to 7 people could have occupied the site. If, however, the site was a winter camp made after an unsuccessful hunt, then there may have only been 3-4 individuals. The site areas of 300 m^2 and 400 m^2 given by Binford (1978a) and Irimoto (1981) respectively compare with the 336 m^2 of Thedford II. The group sizes of 5 and 12 stated by Binford (1978a) and Irimoto (1981) respectively for these camps make the amount of 4 to 7 proposed for Thedford II seem plausible. A stay of about a month or less is also reasonable. Binford (1978) observes that these base camps were never re-occupied nor does Irimoto (1981) mention more than one stay.

In summary, the Thedford II occupation appears not to have been intense, with one or two families, representing a population of probably less than 10 residing for a month or less at the site. It was likely never re-occupied.

SEASON OF OCCUPATION

The season of the Thedford II occupation is difficult to determine because there are no floral or faunal remains to provide clues. The intensity of the occupation, the site location, the raw material usage, site comparisons and ethnographic data are the information sources available for this discussion. It was suggested above that the site was not intensely occupied, probably by a small group for a month or less. A year-round occupation is thus ruled out. Unintensely occupied Paleo-Indian base camps archaeologically, and sub-arctic and arctic base camps ethnographically occur during the coldest part of the year, when food is scarcest. It is argued that Thedford II was an unintensely occupied base camp and thus could have been occupied during the cold season.

The Parkhill site is thought to have been occupied in the spring because it is in an ideal location, on the north side of a waterway, to intercept caribou herds as they migrated north (Deller, 1980b:87). The hunting of caribou at water-crossings to take the animals when they are in the water and coming out is noted ethnographically (Burch, 1972; Smith, 1975; Gordon, 1977; Binford, 1978a). It was also suggested by Deller (1980b:90) that Thedford II is in a good location to intercept caribou herds during their fall migration. However, hunting was probably not an important activity at the site, as already discussed, meaning that its location was likely not related to hunting. The distribution of Paleo-Indian sites in southern Ontario suggests a seasonal range (cf. Storck, 1979, 1982; Deller, 1980b; Roosa and Deller, 1982). Sites in this range used predominately Collingwood chert in tool manufacture, and this lithic material has only been found in the northern part of the range. The tools manufactured, especially the fluted points, are very similar technologically and stylistically from sites such as Banting, Fisher, Parkhill and Thedford II. These two factors indicate that sites such as these, within the range, were probably occupied by the same or interacting bands. Sites in the northern part of the range such as Fisher and Banting are believed by these authors to have been occupied during warm-weather seasons. Sites in southwestern Ontario, including Thedford II, were likely occupied during cold-weather seasons. Movements within this range were probably influenced by caribou exploitation. The herds would have been in the northern part of the range during the warm seasons and further south in the cold seasons. Although caribou hunting was probably unimportant at Thedford II, the site could still have been occupied before or after the fall hunt.

The lithic raw material economy varies according to the distance from the source, which is also associated with the season of site occupation. This conservation has been noted at other Paleo-Indian sites (cf. MacDonald, 1968; Deller, 1980b; Gramly, 1982). A higher conservation is evidenced by the presence of artifacts reworked into other tools and by smaller tools in relation to other sites. At Parkhill some of the fluted points and blades were also used as knives or scrapers (Deller, 1980b:57). At Vail, fluted points were reworked into knives, end scrapers and eventually pièces esquillées (Gramly, 1982:28). This wear and reuse is not evident on these artifact types from Thedford II. The Collingwood chert source is thought to have been visited during a warm season so that the supply would have been only slightly diminished at the beginning of the next season when the group(s) travelled southwards. By the end of the cold season however, the chert supply would have been relatively lower and nearly exhausted, resulting in a greater need for conservation. This was probably the case at Parkhill, while

Thedford II is representative of a site earlier in the cold season when the lithic supply was not so exhausted. This is apparent from the lesser artifact reduction and reworking at Thedford II than at Parkhill or Vail.

Ethnographic Data

Ethnographic data presented for the intensity of occupation discussion indicated that the winter group size was the smallest of any season. It was speculated above that a small group was probably at Thedford II, and that the site was perhaps occupied during the winter or at some time between the larger fall and spring base camp occupations. During the fall, the Nunamiut base camps were constructed where there was firewood, sometimes a long distance from the hunting camp because hunting often occurred where there was little firewood. Due to this long distance between camps, animal hides were dried and sometimes scraped at the hunting camp in order to reduce their weight, making transportation easier. The meat was cached for winter consumption. Winter camps were usually located close to firewood and to the fall meat cache. This could account for the greater number of working edges used on hard materials such as for wood and bone-cutting, than soft materials at Thedford II. Much hide working could have already been done at the fall camp(s) and the meat also cached. This would allow more time for wood and bone working at the site. If food became scarce then ice-fishing could have been carried out in the nearby Ausable River and other available game could have been hunted.

In summary, the evidence presented indicates that Thedford II was probably occupied during the winter. This supposition is based on several factors such as the low intensity of occupation, the site location, the lithic raw material conservation, the probable small group size and the considerable amount of hard material working at the site.

DISCUSSION

Deller (1980b) has proposed a model of the southern Ontario Paleo-Indian occupation. Sites in the Georgian Bay area such as Fisher and Banting represent the northern extent of an annual round while the southern limit of the range includes sites in southwestern Ontario such as Thedford II, Parkhill and McLeod. The former sites were occupied during the summer, where Collingwood chert was used to make tools, and caribou were exploited at the northern limit of their range. In the early fall groups moved south to sites such as Thedford II in anticipation of a caribou migration. Deller does not mention any winter sites but speculates that groups moved at the beginning of spring to other sites in southwestern Ontario such as Parkhill where northward migrating caribou herds were hunted. The tools were nearly exhausted and a return to the raw material source was necessary. He states that McLeod may be a satellite camp of Parkhill where a small group directed the migrating caribou toward Parkhill and also hunted some of the herd (Deller, 1980b:90).

Similar seasonal rounds based on caribou exploitation have been proposed involving sites such as Debert (MacDonald, 1968) and Vail (Gramly, 1982). MacDonald (1968:128-129) speculates that Debert is located between mountain slopes and plains to intercept game. He notes that the site is approximately 50 km from the lithic raw material source, but does not state the direction. He surmises that the site was visited on a regular basis for a month or more, probably by a single band since no lithic materials from another source were found (MacDonald, 1968:129). The season of occupation was not determined and other sites within the seasonal cycle were not yet found. This makes it difficult to evaluate the position of Debert within the cycle.

Gramly (1982:75-78) provides a more complete hypothetical seasonal round. Vail is seen as a large hunting camp occupied during the warm season for 4 to 6 weeks where caribou were hunted and processed. The group then moved to the lithic source to manufacture tools and blanks before travelling south to a large, cold season camp for most of the year. Smaller camps could also have existed and were perhaps occupied for a week or two by hunting parties and other task groups which went out from the base camp. These small camps could also represent rest-stops during travel between base camps (Gramly, 1982:77, 78). Vail was probably occupied 18 to 36 times suggesting that it was in a favourable location for some time. Unfortunately, the large cold season hunting camps and the small camps associated with Vail have not been located.

This model is similar to Deller's (1980b) in that both contain a warm season base camp located near a lithic source. The difference is that Gramly suggests that one cold season camp existed, while Deller speculates that there were two, a fall and a spring camp. Movements occured in response to north-south caribou migrations. Unfortunately, not enough sites have been excavated to determine which, if any, model is the most acceptable. It is just as conceivable that a fall and a spring camp could be found associated with the Vail site as it is that Parkhill may be the only cold seson camp associated with the Fisher site.

Deller (1980b) has suggested that Thedford II is a fall base camp, but it has been argued in this chapter that the site was occupied during the winter and less intensely than Parkhill. A winter occupation is not expected if migrating caribou were exploited. Deller (1980b) speculates that migrating caribou were hunted at Parkhill. Ethnographic caribou-reliant camps are the most intensely occupied during the spring and fall when migrating caribou are exploited (Binford, 1978a; Irimoto, 1981).

Hunting was probably not an important activity at Thedford II because of the low projectile point, preform and bifacial debris amounts and densities. The group size was likely smaller than at Parkhill which also indicates that a major activity such as the hunting of a caribou herd probably did not occur. Ethnographic data indicates that the largest groups are present when caribou herds are exploited (Smith, 1975; Gordon, 1977; Binford, 1978a; Irimoto, 1981). Larger, more intensely occupied fall base camps may have existed, but are unknown at the present in southwestern Ontario. The Thedford II data suggests the site represents a small camp or a satellite camp in Gramly's and

Deller's models respectively.

CHAPTER 8

SUMMARY AND CONCLUSIONS

The aim of this thesis was to study selected aspects of Paleo-Indian culture as revealed by the Thedford II lithic assemblage. This aim was met by investigating three topic areas: the lithic-related intra-site activities, the occupation intensity and the season of occupation. These aspects were discussed by employing intra-site archaeology, comparative archaeology with other sites and ethnographic data. The focus was on a spatial analysis of artifact distribution association and patterning.

Tool function was determined prior to the spatial analysis through an examination of working edge angles and edge shapes. It was found that 54% of the edges were likely used to work hard materials such as wood and bone, while 25% were probably used to work soft materials such as hides and 21% may have been used on hard or soft materials. The spatial analysis delineated areas on the site where these activities occurred. Single artifact categories were studied by using the nearest neighbour analysis to measure the degree of dispersion of each tool category member. Then the association between two or more artifact categories was examined by using the index of segregation and the presence/absence test in the hope of defining groups or tool kits. These groups are used to form artifact clusters or activity areas.

The nearest neighbour analysis showed that the tool types were clustered over the entire site and randomly distributed when smaller site areas were selected. The index of segregation revealed pairs of artifact types to be mixed and segregated within the larger area and primarily randomly mixed in the smaller Feature 3 and 8, and Feature 10 areas. Tool kits could not be defined outside of artifact pairs. Three activity areas were produced from these spatially mixed pairings. All of these areas contain a feature and most have gravers in combination with side scrapers and/or end scrapers.

This indicated that lithic-related site activities were centered around the use of these tools. Gravers were the most highly clustered in and around Cluster A suggesting that bone and wood incising was important. The scrapers were more dispersed signifying that they were not used in specific areas of the clusters or the site. Some scrapers were probably multi-purpose tools so that it may have been unnecessary for them to be used with other tools. Different tools such as gravers may have been employed for specific tasks and also could be used without being associated with other tool types.

Projectile point manufacture was unimportant as evidenced by the lack of channel flakes and other bifacial debris. The artifact densities are considerably less than at other Paleo-Indian sites such as Parkhill, Barnes and Vail. More emphasis was on scraper rather than biface maintenance and/or manufacture especially at Cluster B and A-west where the scraper retouch flake numbers and densities were high. Scraper density was greater than at Parkhill and Barnes indicating that more manufacturing of items such as clothing, shelter, bone tools and wood shafts occurred at Thedford II than at these sites. Other lithic-related activites probably included the making of wood and hide containers, wood drying and storage racks, wood and bone needles and awls, and incising wood and bone.

The occupation of Thedford II was likely not intense, as suggested by the low debitage density, by comparisons with other sites and by the ethnographic data. A small group of 4 to 7 individuals representing one family could have lived at the site, probably for one month or less. There is no evidence to indicate that the site was occupied more than once. A cold-weather season of occupation, likely during the winter, is evidenced by several factors including the low intensity of occupation, the probable small group size, the lithic raw material conservation, the abundance of hard material working and comparisons with the ethnographic record.

The most important contribution of this thesis is the study of Paleo-Indian intra-site activities, camp layout and lifeways by employing a statistical approach. This approach has rarely been used in northeastern North America and never for southern Ontario Paleo-Indian research. It involved determining the spatial distribution, association and patterning of artifacts as well as constructing artifact groups and clusters. These clusters or activity areas provided comparative information for other Paleo-Indian sites such as Parkhill, Banting, Barnes, Vail and Debert. This information included speculated tool function, the relationship of debitage to tools, intra-site activities, duration and season of occupation, and the approximate group size. The use of statistical analysis provides an objective means of analysis and makes comparisons easy. However, there are certain limitations of the techniques.

One limitation is that nearest neighbour suffered from the "boundary effect" causing points to be excluded from the analysis. This meant that only those artifacts away from the edges of the excavation were considered. It was speculated that A-centre and A-northeast closely approximate the site extent in these areas. This is because very few tools and little debitage were located near the excavation boundaries. A-west was not completely excavated due to a lack of time, meaning that the site was not totally excavated.

The index of segregation was a useful method for testing the association between two artifact types. Unfortunately, when the matrix was constructed tool kits could not be well defined because only artifact pairs were associated. However, artifact clusters could still be formed from these pairs and activity areas were delineated. This method was of greater value than the presence/absence test because it depended on the exact location of artifacts. The latter requires artifact provenience according to cells or quadrats, providing an imprecise measure of the degree of association between two artifact types. This is supported by the fact that all pairs were randomly distributed in the presence/absence test, while some were segregated by the index of segregation.

The artifact sample size may have affected the index of segregation test. With a greater number of tools, tool kits would perhaps have been defined. This would have made the types of activities which occurred at the site easier to determine. A more detailed debitage analysis could have been made if the exact provenience were known for more categories such as bifacial retouch flakes and biface thinning flakes. Not all scraper retouch flakes and channel falkes were used in the statistical tests for the same reason. These waste flakes are primarily from Features 3 and 8 where soil samples were removed for subsequent laboratory flotation. The number of artifacts recovered from these samples is unknown. The intra-site patterns of artifacts would probably have changed little if more artifacts were present. This situation is evident in Paleo-Indian sites which possess a high number of artifacts such as Debert (MacDonald, 1968), Vail (Gramly, 1982) and Bull Brook (Byers, 1954).

There is a need for more studies such as this one in order to provide additional data concerning Paleo-Indian lifeways, camp structure and intra-site as well as inter-site activities. Further employment of statistical approaches is important so that the results can be compared with this study and further evaluated. Other statistical techniques should be used where applicable and more extensive use-wear analyses conducted to better determine tool function and lithic economy. Comparative densities could be calculated for individual artifact categories at other Paleo-Indian and Archaic sites to determine changes through time with respect to site activities, the intensity of occupation and the season of occupation.

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APPENDIX A

ATTRIBUTES OF TOOLS, THEDFORD II SITE

Key:

LL	=	left lateral
RL	=	right lateral
D	=	distal
inc.	=	incomplete
N.R.	=	not recorded
a	=	convex
b	=	straight
c	=	concave
d	=	convex and concave
e	=	irregular

Attributes of bifacial tools

Figure reference	Catalogue number	Maximum length (mm)	Maximum width (mm)	Maximum thickness (mm)	Maximum weight (gms)	Average working edge angle (°) LL	RL	D	Working edge shape LL	RL	D	Most likely Material Used on Hard	Soft
5a	36	58.1	30.4	10.9	17.8								
5b	35	67.7	30.1	10.0	18.0								
6c	94	40.1	22.1	5.1	4.6								
6f	80/189	32.1	16.7	3.6	2.5								
5c	37	44.4	19.0	5.7	5.2								
5d	320	40.7	23.6	8.0	8.3								
5g	30	41.6 (inc.)	33.0 (inc.)	8.7 (inc.)	11.3 (inc.)	N.R.	N.R.		a	a		X	X
5h	33	41.6 (inc.)	38.7	9.5	14.4 (inc.)			N.R.			a	X	X
5i	29	Inc.	55.2	6.9	19.4 (inc.)	N.R.	N.R.		a	a		X	X
5f	43	71.0	30.9	7.2	17.7	N.R.	N.R.		a	b			X
5e	113/84	75.4	32.3	8.6	23.6	N.R.	N.R.		a	d			
-	309	14.0 (inc.)	inc.	5.0	N.R.							X	

Attributes of end scrapers

Figure Reference	Catalogue number	Cluster	Maximum length (mm)	Maximum width (mm)	Maximum thickness (mm)	Weight (gms)	Average working edge angle (°)		Working edge shape		Most likely Material used on	
							RL	D	RL	D	Hard	Soft
-	21		54.7	44.2	7.0	19.0		60		a	X	
7e	23		41.6	33.2	7.3	9.0		55		a	X	X
7d	65		43.3	32.8	12.1	12.4		64		a	X	X?
9e	158	C	37.5	27.0	10.4	7.9		52.5		a	X	X
-	261	B	62.8	28.5	10.1	15.2		62		a	X	X?
7c	25		37.5	31.1	5.3	7.0		60		a	X	
7b	90		30.2	29.7	8.0	8.3		75		a	X	
-	271		34.7	inc.	8.1	5.5 (inc.)		75		a	X	
7n	232	A	35.1 (inc.)	28.1	10.1	9.3 (inc.)		60		a	X	
7m	207/245	C	26.8	28.9	5.7	5.1		55		a	X	X
7f	22		52.2 (inc.)	37.7	9.2	19.9	65	70	a	a	X	
-	324		60.1	39.5	11.2	26.7	55	75	a	a	X	X?
-	24		43.2	35.4	8.2	9.2		65		a	X	
-	52/71		45.1	32.1	5.8	5.3 (inc.)		35		a		X
-	249		31.4	23.2	8.6	6.8		70		a	X	
7a	20		63.5	56.7	17.3	51.2		68		a	X	
7k	26		inc.	33.8	inc.	16.1 (inc.)		68		a	X	

Attributes of side scrapers

Figure reference	Catalogue number	Cluster	Maximum length (mm)	Maximum width (mm)	Maximum thickness (mm)	Weight (gms)	Average Working edge angle (°)		Working Edge Shape		Most Likely Material used on	
							LL	RL	LL	RL	Hard	Soft
	32		36.0	26.5	8.1	9.1	75		c		X	
9a	46		36.0	21.7	10.5	7.7	50		b		X	X
-	153/235	A	32.4	26.4	7.2	5.5	25		c			X
9b	236	C	31.7	23.0	11.4	8.2	50		b		X	X
9c	306		31.3	26.7	11.3	9.6	75		c		X	
10e	34		25.3	24.4	8.2	6.6	N.R.		b			
-	215		34.1	13.3	4.3	2.4	40		b			X
-	155/220	A	38.0 (inc.)	31.3	7.9	10.8	55		a		X	X
10b	75/199	A	55.3	inc.	5.4	6.2 (inc.)	43		a			X
10c	68/107/172	A, B	59.4	48.7	9.3	26.1	45		a			X
9i	254		inc.	30.0	5.7	4.3 (inc.)	50	55	a	a	X	X
9g	275		inc.	25.1	5.1	6.1 (inc.)	50	45	a	a	X?	X
9j	367		46.6	24.3	7.4	8.6	40	53	a	a	X?	X
9l	329		36.4	35.8	8.6	8.7	45		c		X	
9k	242	C	39.4	35.2	6.2	7.0		55		c	X	
9d	170/176	C	41.5	24.7	11.0	7.1		60		c	X	
9f	196	A	52.1	24.7	4.6	5.2	30	45	a	c	X	X
9h	76/96	C	52.8	19.9	6.3	6.3		53		b	X	X
-	178/206	C	56.6 (inc.)	20.0	8.0	6.6 (inc.)		55		d	X	X?

Attributes of other scrapers

Figure reference	Catalogue number	Cluster	Maximum length (mm)	Maximum width (mm)	Maximum thickness (mm)	Weight (gms)	Average Working edge angle (°)			Working edge shape			Most likely material used on	
							LL	RL	D	LL	RL	D	Hard	Soft
8d	175	B	37.7	19.6	7.3	7.6	80	50	65	b	b	a	X	X
8e	134/195		35.5	24.0	6.6	5.5	50	50	65	b	b	a	X	X
8b	19		64.7	35.0	8.1	18.0	65	65, 35	68	c	b	a	X	X
8a	126		60.1	40.3	10.2	20.3		60	71		c	a	X	
9n	177		37.2	45.8	13.9	21.8		60	60		a	a	X	
9m	31		36.4	44.7	10.1	15.7		65	45		b	a	X	X?
10d	27/28		62.9	57.4	16.2	60.7	70		65	e		e	X	
-	74		35.1	24.6	9.1	7.3	N.R.	65	85	e	d	a	X	
10a	286	B	39.7	36.5	10.8	11.0	40		40	b		b		X
8f	326		49.4	20.6	5.1	6.2			55			a	X	
8h	44		37.7	32.2	6.9	6.3			85			a	X	
8g	45		inc.	21.6	5.3	3.2 (inc.)			80			d	X	
8i	240	C	55.7	27.0	8.8	12.4			75			a	X	
8j	279		49.6	37.4	7.1	7.9			30			d		X

Attributes of other unifacial tools

Figure reference	Catalogue number	Cluster	Maximum length (mm)	Maximum width (mm)	Maximum thickness (mm)	Weight (gms)	Average working edge angle (°)			Working edge shape			Most likely material used on	
							LL	RL	D	LL	RL	D	Hard	Soft
10f	322		35.5	18.0	3.6	2.7	40			a				X
10g	239	C	41.0	25.5	5.2	6.3	35			b				X
10h	187/396		32.7	22.0	1.1	2.3	35			d				X
10i	57/133		40.8	23.7	3.7	4.8	30			b				X
-	99		34.0	24.3	9.0	7.7		60	60		a	a	X	
-	53/247		33.9	49.0	10.7	11.9	30			c				X
-	64		54.4	29.2	7.7	10.7	30			b				X
-	92/394		49.7	35.7	10.4	15.2		50			e		X	