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Buried Dreams: Refitting and Ritual at the Mount Albert Site, Southern Ontario

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Abstract

Few intact Middle Archaic sites have been investigated in Southwestern Ontario and attention has focused on large, multicomponent sites, which are difficult to interpret. This thesis focuses on recent work that has been conducted on an undisturbed, single-component Brewerton site in Mount Albert south of Lake Simcoe, where the lithic assemblage presents an unprecedented view of lifeways in the Middle Archaic (ca. 5000-4500 B.P.). Notable is the presence of high numbers of fragmented formal flaked stone tools - moreso than is consistent with solely tool production activities. The thesis evaluates the possibility that the artifacts were intentionally destroyed as part of previously undocumented ceremonial practices in the region. Refitting of the pieces and experimental breakage of reproduction bifaces each offer insights into strategies for the purposeful breakage of stone artifacts.

Key Words

Middle Archaic, Laurentian, Brewerton, ritual breakage, ceremonial practices, refitting, lithic analysis, experimental archaeology, bannerstones.

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Chapter 1: Introduction

This thesis provides a detailed analysis of a collection of lithics from a small, intact site (BaGt-40) in Mount Albert, southcentral Ontario, excavated as a Cultural Resource Management (CRM) project (Fig. 1). The site has yielded two, diagnostic, stone projectile points that relate it to the poorly known Brewerton Phase of the Laurentian Middle Archaic in the area (ca. 4500-5000 years ago) (see Ellis et al. 1990; Ellis et al. 2009; Funk 1988; Ritchie 1969). The preliminary report on the CRM work at the site (Archaeological Services Incorporated 2014) suggested it witnessed activities involving the deliberate mechanical destruction of stone hunting and hide-processing tools. These analyses suggested that activities of a social and ceremonial import occurred that have never before been reported in Laurentian contexts.

Documenting and evaluating these ritual activities is the central focus of this thesis. However, the Mt. Albert site is significant from other perspectives. First Brewerton, and more generally Laurentian, sites that have been excavated invariably tend to be large and multi-component so it is difficult to sort out the non-diagnostic Laurentian material from that of other components. Second, regardless of whether or not a large site is multi-component, it is difficult to understand the site formation processes of these large, long used and reused sites and examine, for example, the spatial organization of activities. Small, intact, single component sites have inherent advantages in documenting and interpreting the sociocultural practices of past peoples (Moseley and Mackey 1972; Shiner 1970). My research will emphasize these advantages of studying small sites and draw away from the often “bigger is better” mentality that is embedded within the CRM industry. Finally, and aside from the suggestion that artifacts from the site were deliberately broken, examination of the lithic collection suggests patterns of activity that are unprecedented in any other Brewerton contexts and that need to be thoroughly documented. For example, three fragments of winged bannerstones, enigmatic groundstone artifacts often interpreted as spearthrower weights (Kinsella 2013; Sassaman 1998, 2010), were recovered on site. Bannerstones are centrally-drilled groundstone slate artifacts. Such items are unique to the Archaic of Eastern North America. Aside from very few examples, such as at the Welke Tonkonoh site (Chris Ellis: personal communication, 2015), the Adder Orchard site (Fisher 1990), and from sporadic CRM contexts, these items are some of the only excavated bannerstones from an Ontario site and their spatial associations at Mt. Albert offer new insights into their social contexts of production and use.

1.1 Brewerton in Ontario

The Laurentian Archaic occupation of Ontario occurs throughout the latter half of the Middle Archaic period, roughly 5,500-4,500 RCYBP with the Brewerton Phase occupying roughly the second half of this time span (Ellis et al. 2009; Funk 1988; Ritchie 1969). Ritchie (1969) defined the Laurentian as encompassing sites where there was a combination of large, broad-bladed, flaked, stone points and a wide range of groundstone artifacts, including slate points, bayonets, winged bannerstones and so on. The most complete association of such cultural items occurs in eastern Ontario and bordering areas in Quebec, New York, and New England. Mt. Albert actually occurs at the western edge of that distribution. Outside of the Laurentian Archaic "heartland" (Woodley and Ramsden 1998:144), such as in southwestern Ontario (Ellis at al. 2009), comparable broad-bladed flaked stone points occur (see Tuck 1977) but the associated groundstone tools are rare or lacking, leading to debates about whether these sites should be considered Laurentian (e.g. Ellis et al. 1990:92).

1.2 Mt. Albert Site

The Mt. Albert site was fully excavated as part of a stage 4 CRM project (Archaeological Services Incorporated 2014). In total, 76 one-metre square ploughzone units were block excavated, which yielded 743 artifacts (Fig. 6.1). Beneath the ploughzone one "invisible" cultural feature (e.g., with no outline visible to the naked eye), roughly 5 m long, was identified on the basis of artifact concentrations. This sub-ploughzone material was piece-plotted. From the feature, 2,162 artifacts were recovered. Organic preservation is overall poor and, with the exception of 9 highly fragmentary pieces of unidentifiable calcined bone, all of the recovered artifacts are stone. Thermal alteration occurs sporadically through the assemblage on 898 artifacts (31.59% of all artifacts).

Flaked lithics made on Ontario sourced cherts comprise the majority of recovered artifacts, at 2,843 objects. The formal chert tools recovered include 172 biface fragments (6.05%), 5 bifaces (0.17%), 3 scrapers (0.1%), 2 unifaces (0.07%), 2 drills (0.7%), and 2 projectile points (0.7%; ibid.). One complete Brewerton corner notched projectile point was recovered and a second example with tip damage was found 30 m south of the site during the earlier stage 2 survey. The majority of bifaces and identifiable biface fragments (60%) are in the early to middle stages of manufacture, while relatively few (40%) exhibit increasing refinement indicated by pressure flaking and a generally thin cross-section (Archaeological Services Incorporated 2014:2). The vast majority of the assemblage consists of small, angular fragments, at 2,368 pieces (83.29%). The remaining debitage is made up of only 213 flake fragments (7.49%), 6 primary reduction flakes (0.21%), 14 primary thinning flakes (0.49%), 21 secondary knapping flakes (0.74%), 32 secondary retouch flakes (1.13%), and 1 core and 3 core fragments (0.14%).

Other stone tools include a single hammer/anvil stone with significant pitting along its ventral and dorsal surfaces, and the aforementioned 3 fragments of groundstone winged bannerstones. All three bannerstone fragments are green banded slate and have split down their centrally drilled midshafts; two do not physically conjoin but appear to be part of the same bannerstone.

1.3 Analytical Perspectives

Overall, my analyses of the Mt. Albert lithics will emphasize certain perspectives and focus on certain kinds of information. The significance of this site cannot be understated, as intentional breakage has seldom been documented in the archaeological record of Ontario (but see Ellis 2009; Taché 2011). Combining the data from site BaGt-40 with other Laurentian Archaic sites presents the potential for synchronic studies, which can then be used to test the veracity of ethnographically derived hypotheses concerning hunter-gatherer lifeways. For example, the Mt. Albert data will help to evaluate the ways in which ritual sites differ from other Laurentian sites with evidence of economic and subsistence activities.

In addition, I believe previous researchers have often neglected the importance of debitage frequencies to interpretation. Given the preponderance of stone tools and especially debitage over organic remains at Mt. Albert, and considering that spatial patterning is intact within the sub-surface feature, these two aspects will constitute the focus of my analyses.

1.4 Thesis Organization

In the following chapter I provide background data on a) the Laurentian Archaic and b) bannerstones, in order to contextualize the Mt. Albert analyses. The following chapters then present the Mt. Albert site analyses that seek to expand knowledge about the Laurentian Archaic. Specific analyses will first focus on site activity delineation.

In Chapters 3 and 4 I evaluate the idea that the Mt. Albert site witnessed the deliberate destruction of stone artifacts by documenting the artifacts present and the kinds of fractures present in the assemblage. In Chapter 4, the bannerstone data from BaGt-40 will also be examined to contribute to the ongoing search for insights into their function(s) and roles in Brewerton society. Notably, Ritchie (1951) has argued for the prominent social role of these items in the Laurentian Archaic of New York. Considered with their functional usage as atlatl weights, it seems the occupants of Mt. Albert were engaged in behaviours that are absent from coeval sites in Southwestern Ontario. Significantly, the fragmented bannerstones present at Mt. Albert have split along their central, drilled ridge. This commonality suggests that the bannerstones were broken as part of the ritual "killing" of other tools. Whereas other artifacts were violently smashed onsite, bannerstones seem to have been snapped with care to preserve their winged form, which necessarily amplifies the significance of their destruction. Thus, I will emphasize both utilitarian and ceremonial roles that bannerstones may have been embodied with at Mt. Albert.

In subsequent chapters I focus on presenting evidence that supports the idea that many of these items recovered were purposefully broken and emphasis is placed on determining the exact ways this breakage was carried out. Chapter 5 focuses on comparing the Mt. Albert data on different lithic type frequencies with data from other intact Laurentian Archaic sites within the surrounding Great Lakes region (cf., Ellis et al. 2009; Funk 1988). Specifically, I focus on the relative percentages of formal tool types to debitage frequencies in an attempt to show how inter-site comparability contributes to inferences about the mechanics of artifact production and destruction. Notably, the abnormally high frequencies of fragmented bifaces (n = 172; Archaeological Services Incorporated 2014) at Mt. Albert suggest that that they were intentionally destroyed: as will be shown, it seems unlikely, and is undeniably suspicious, that such a large quantity of otherwise complete tools could have been broken in manufacture given that there is an extreme paucity of knapped flakes of any kind.

The subsequent chapter examines the spatial organization of different stages of tool deconstruction to reveal the *chaîne opératoires* (Dobres 1999), or sequence of behaviour, involved in the process of smashing artifacts that contributes to structuring the socially meaningful actions of individuals. At Mt. Albert lithic manipulation took place in a pattern of behaviour that has been argued is consistent with the ceremonial "killing" of formal tools (Archaeological Services Incorporated 2014). The distinct feature encountered, which consisted of four discrete concentrations, was piece-plotted and provides a clear picture of significant patterning among artifacts. Specifically I will examine the spatial contexts of fragmented tool types, including their distribution, raw material, and presence of thermal alteration in order to test the reality of hypothesized patterns. As part of this analysis, fragmented parts were refitted into their original bifaces, thereby correlating separated parts with their point of original destruction and identifying the process of destruction. Consequently, this thesis promotes, as has been long recognized (e.g. Hofman and Enloe 1992), the value of refitting analyses in archaeology.

In the final chapter, the results of refitting broken stone artifacts will be discussed to examine the nature of ritual activities. Experimental breakage and refitting of reproduction bifaces offers insights into the exact procedures used in mechanically breaking the stone artifacts at Mt. Albert. Specifically, similarities in fragmentation patterns are used to show that artifacts were broken intentionally, rather than in production. This analysis follows the analytical lead of researchers such as Deller and Ellis (2001; Ellis and Deller 2002) who have shown the utility of refitting studies to demonstrate patterns consistent with deliberate breakage.

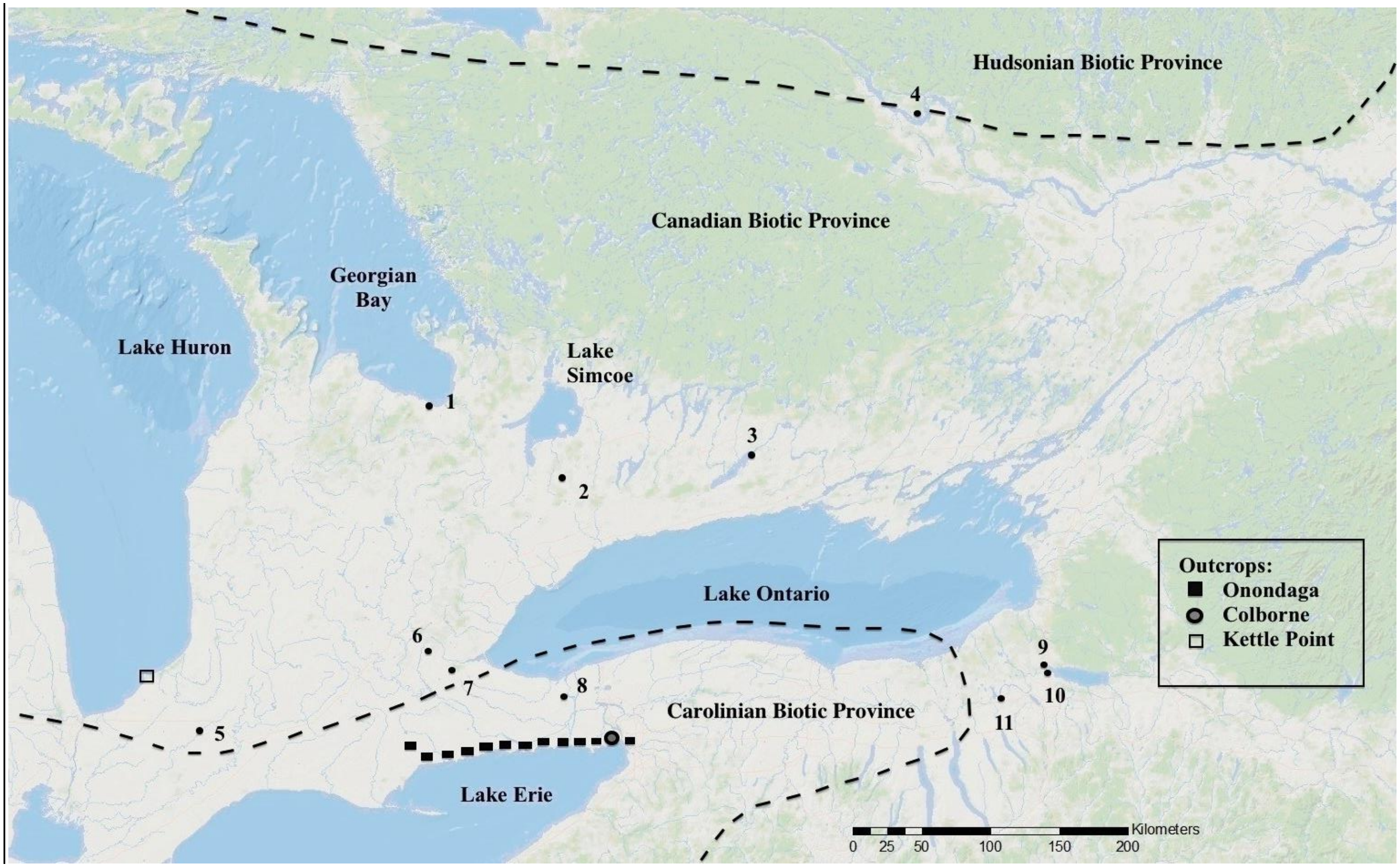

Figure 1.1: Locations of some Middle Archaic and Paleoindian sites mentioned in the text and chert outcrops in Southern Ontario. Sites: 1) Rentner; 2) Mt. Albert; 3) East Sugar Island; 4) Morrison's Island, Allumettes Island; 5) Caradoc. Crowfield: 6) Peiganovitch: 7) Little Shaver: 8) Bell: 9) Oberlander No. 1: 10) Robinson: 11) O'Neil.

Chapter 2: Background and Context

2.1 The Laurentian Archaic

The Laurentian Archaic reflects an enigmatic and culturally rich series of occupations on a scale that is unprecedented in all earlier periods of human occupation in the Northeast. Ritchie first described the phenomenon as a series of

> regional and probably temporal manifestations of a widespread northeastern culture characterized by ground slates of several types; a variety of chipped projectile points, mainly broad of blade; gouges; plummets; and certain forms of the bannerstone as its most distinctive traits… For this culture we have proposed the name Laurentian Aspect, since we believe that the lower St. Lawrence region lies close to its geographical center of distribution, as suggested by the range in the northeast of its characteristic traits (Ritchie 1940:96).

It is perhaps most appropriate to consider the Laurentian tradition as an amalgamation of regional material culture traits that converge within, and are adapted to, the Canadian Biotic Province to produce a series of temporally and regionally identifiable phases (see Tuck 1977). Based on their work at the Morrison's-6 and Allumettes-1 Island sites in the Ottawa valley, Chapdelaine and Clermont (2006:206) have suggested that the massive prevalence of materials and cultural influences sourced from far beyond the known occurrence of Laurentian sites indicates this "archaeological construct is an interaction sphere". Given the relatively broad occurrence of these phenomena multiple syntheses have been produced with the effect of developing a strong working knowledge of Laurentian lifeways (Funk 1988; Tuck 1977).

It is important to define the ways in which researchers have previously discussed the Laurentian concept. Tuck (1977) has suggested that archaeologists have interchangeably referred to two Laurentians. The first Laurentian concept holds true to the idea put forth by Ritchie (1940; 1980), which posits an extensive Archaic continuum, rich in groundstone tool forms, with a hunting-fishing-gathering lifestyle broadly adapted to the hardwood Lake-Forest zone (Canadian Biotic Province) surrounding the St. Lawrence River. This "Lake-Forest" ecological region is the transitional zone between the more southern deciduous dominated forests of the Carolinian Biotic Province and northern coniferous forests of the Canadian Shield/Hudsonian Biotic Province (Mason 1981; Ritchie 1940; 1980; Fig. 1.1). The specific ecological affiliation of Laurentian has subsequently come under attack by investigators who note that the flaked stone projectile point forms of Richie's (1940) conception occur far beyond the borders of the Canadian Biotic Province, earlier than the initially proposed time period, and without associated diagnostic ground slate tools (Dragoo 1959; George 1971). Thus, the second Laurentian breaks free of its association with the Lake-Forest zone, and is instead founded on common cultural relationships as indicated by the presence of projectile points and other material traits (Tuck 1977:33). Tuck (ibid.) has sought to remedy this divergence by proposing that the first, ecologically contingent "Laurentian" is actually a late component of a "formative Laurentian" tradition from which other phases subsequently evolved and moved beyond the Lake-Forest region.

Regardless, within this thesis Laurentian is conceived of in Ritchie's (1940, 1980) terms and in Ontario, Quebec and New York dates to the latter half of the four thousand year long Middle Archaic period or from ca. 5,500 to 4,500 B.P. Broad-scale regional differences in material traits led Ritchie (1940, 1965, 1980) to identify the presence of distinctive phases within the Laurentian Archaic period. By far the most well known are the Vergennes and Brewerton phases, and Vosburg represents the third major manifestation of Laurentian traits. The Duck Bay phase likely represents a fourth component of Laurentian culture (Pfeiffer 1984). These phases are briefly outlined below.

2.1a Vergennes

While there are no hard boundaries between the material cultures of neighbouring phases, different regions are home to unique aspects. The Vergennes phase is the earliest recognized phase of Laurentian in the St. Lawrence lowlands and is largely restricted to eastern Ontario, New York, Vermont, and western Quebec (ca. 5,500-5,000 B.P.; Ellis et al. 1990; Funk 1988: Fig. 6). To a greater degree than other phases, Vergennes materials are predominantly found within the Lake-Forest region surrounding the St. Lawrence and Ottawa River systems. Flaked stone tools are characterized by distinct broad bladed, side-notched Otter Creek style projectile points (Ritchie 1971b:40-41; 1979: Plate 6) and groundstone tools are very common. At some sites, such as Alumettes Island on the Ottawa River, native copper artifacts, the source of which is in the Lake Superior region, are common and along with the frequent presence of Onondaga chert from near Lake Erie, suggest active widespread trade networks (Chapdelaine and Clermont 2006; Childs 1994; Griffin 1961).

It has been suggested that Vergennes represents the progenitor culture from which later Laurentian phases, namely Brewerton, Vosburg, and Duck Bay, were derived (Ritchie 1980; Tuck 1977:32). Indeed, there is evidence for related populations returning to the same areas for centuries, as exemplified by the close proximity of the Vergennes Allumettes Island site and the Brewerton Morrison's Island site in the Ottawa River (Chapdelaine and Clermont 2006). Even within Allumettes Island, the presence of a few broad-bladed Brewerton points alongside Otter Creek points alludes to the return of Brewerton groups to locations utilized by their Vergennes ancestors (Wright 1972b:76).

Other Vergennes sites cluster around Rice Lake and Balsam Lake in Ontario, and the highest density of Ontario Laurentian sites, including Brewerton, in general occurs along the Trent Waterway, with more than 60 documented in the area (Ritchie 1949; Ramsden 1998). This watershed region indicates localized exploitation of riverine resources, with emphasis on migrating species and multiple intense occupations situated alongside rapids. Some sites in the Trent Waterway with significant Vergennes stations are the Mcintyre site (Johnston 1984) and the Poison Ivy Site on East Sugar Island (Kenyon 1973).

2.1b Brewerton

By far the most geographically expansive Laurentian manifestation is the Brewerton phase, which has been dated to ca. 5,000-4,500 B.P., although there are suggestions that it occurs even earlier in some areas (Ellis et al. 1990:86). Brewerton sites permeate New York State, northern Pennsylvania, southwestern and eastern Ontario, and western Quebec (Funk 1988: Figure 6). They exist along the St. Lawrence lowlands, well within the Lake-Forest region; however, some Brewerton components have been identified on sites across northern areas of the Carolinian Biotic Province due to the presence of Brewerton points (see Ritchie 1971a). This proliferation implies that Brewerton culture was not entirely reliant on the transitional Lake-Forest zone to maintain broad-spanning cultural ties with Laurentian communities across the Northeast.

Chipped stone toolkits contain large proportions of diagnostic broad-bladed Brewerton projectile points (see above), as well as drills, scrapers, finely flaked knives, and high numbers of crude bifaces that were utilized as blanks/preforms and choppers (Mason 1981:172; Ritchie 1940; 1944; 1980). Overall ground slate tools, such as ulus, lances, and points, are comparatively rare at Brewerton sites, although ground slate bannerstones are significant traits across the Brewerton range (Ritchie 1940). Again, use of Onondaga chert for flaked stone tools and native copper artifacts are common at some sites such as those in the Ottawa River area like Morrison's Island (Chapdelaine and Clermont 2006; Kennedy 1967). Fishing was a major activity, and bone and antler barbed harpoons and gorges are regular occurrences, but fishhooks are conspicuously absent. Groundstone woodworking tools also proliferate in Brewerton contexts, and are represented by heavy celts, adzes, and gouges (Ellis et al. 1990; Mason 1981).

On the basis of relative quantities of artifacts used for the exploitation of food resources, Ritchie (1980:92) perceived hunting to constitute the majority of subsistence activities for Brewerton groups. At multiple sites in New York roughly 90 percent of the flaked stone tools are projectile points. At the Robinson site 60 percent of all artifacts are projectile points, which make up over 80 percent of flaked lithics, while the Oberlander site's artifacts consist of 39 percent projectile points, which constitute 71 percent of the flaked-stone objects (ibid.). These sites depict an obvious bias towards hunting activities, but this interpretation belies the proximity of the majority of sites in Ontario to watercourses (Ramsden 1998), many of which were undoubtedly situated to exploit riverine prey. For example, the Morrison's Island site contains large numbers of eel remains and organic fishing equipment (Clermont and Chapdelaine 1998; Kennedy 1966). Likely there was a generalized hunting-gathering-fishing lifestyle implemented by Brewerton groups. Considered alone, or in clusters, individual sites are unrepresentative of the whole set of subsistence activities practiced by Brewerton communities, especially if different tasks were completed around the landscape (cf. Lovis et al. 2005).

The Robinson and Oberlander sites are located on opposite sides of the Oneida River in New York and are the Brewerton "type sites" (Ritchie 1940). Bifacially flaked preforms are significant inclusions that number 80 at Robinson and 26 at Oberlander (Ritchie 1980:35, 72). These are thick ovate bifaces with rough flaking that largely represent rejected preforms for projectile points, and many still retain the flat, unflaked margins of the natural chert surface from when they were quarried. These quarry blanks were quarried as raw chert spalls and brought to Robinson and Oberlander, where they were expediently flaked in order to trim the edges or perhaps brought for further reduction after roughing out at the quarry. This manufacturing strategy is a common one used by Brewerton groups to produce knapped artifacts, and similar patterns are present at the O'Neil site in New York (see below). At Mt. Albert multiple fragmentary quarry blanks are present, although it is unlikely they were manufactured on site given the paucity of flaking debris relative to its New York counterparts (see Chapter 5).

Groundstone implements at Robinson and Oberlander are restricted to heavy woodworking tools such as gouges, adzes and celts, and the only ground slate artifacts are winged bannerstones (Ritchie 1980:36). Ground slate lances, bayonets, and ulus are conspicuously absent from both sites (Wright 1972b).

The multicomponent, stratified O'Neil Site in New York yielded a Brewerton occupation in its bottom stratum dated to ca. 4,500-4,000 B.P. (Ritchie 1973). The occupation was relatively ephemeral and may represent a temporary camping or hunting site, which is characteristic of the majority of Brewerton occupations in the Northeast. This site exhibits some similarities with the Mt. Albert and Robinson and Oberlander sites in terms of its artifact makeup, particularly the prevalence of early stage, thick bifaces. A Brewerton eared point was recovered in association with a cache of 37 quarry blanks or early stage preform roughouts of Onondaga chert (Ritchie 1973:93).

Multiple Middle Archaic sites within the western half of southern Ontario occur along the Lake Huron shoreline in Bruce County and along Georgian Bay in Grey County. While there are demonstrable stylistic connections to the Ontario Laurentian sequence at the Rentner site, which contains Brewerton side and corner notched projectile points and ground slate points (Lennox 2000), many of the most westerly iterations seem to exist independently of the major cultural influences that characterize eastern sites. To date copper is absent from all sites in this area and cultural affiliation is limited to projectile point morphology.

Sites with Brewerton flaked stone point styles occur frequently in southern Ontario north of Lakes Ontario and Erie. Located near the westernmost shore of Lake

Ontario, the Peiganovitch site offers insights into relatively small, ephemeral Brewerton occupations. Only 62 flaked artifacts have been excavated with 638 pieces of associated debitage, which suggests tools were made *in situ* (Woodley 2006:48). The most prevalent tools are utilized flakes, with 32 identified. This dominance suggests that utilized flakes fulfilled the majority of activities on site, which likely include butchery and hide working. Contrasted with the high frequencies of projectile points on many Brewerton sites, it is evident that the occupation here was far less intense than semi-permanent village sites, and may reflect the movement of task groups around the landscape (Lovis et al. 2005).

2.1c Vosburg and Duck Bay

The third major Laurentian phase is referred to as Vosburg, which has been dated between 5,200 and 4,500 B.P. (Funk 1988:15). It is restricted to northeastern North America and the majority of sites have been found within the Hudson Valley, which runs in a line from western Vermont southward through western Massachusetts and Connecticut, and extends into southeastern New York (Funk 1988: Figure 6). Vosburg projectile points are typically broad and triangular, with straight edges and low-placed corner notches (Justice 1987:116-118).

The fourth proposed Laurentian phase, Duck Bay, dates to ca. 4,700 B.P. (McBride and Dewar 1981; Pfeiffer 1984). To date this complex is restricted to Connecticut and is based on a small number of excavated sites. Nevertheless, associations of stone tools suggest localized implementation of various Laurentian point styles, which include Brewerton eared and Vosburg points in addition to the Beekman triangular style, an un-notched, seemingly generalized Middle Archaic point found in New England (Ritchie 1971b).

2.2: The Distribution and Significance of Bannerstones in the Laurentian Archaic and Eastern North America

This section seeks to explore the origins and significance of bannerstones to the Archaic of the Eastern Woodlands in order to contextualize their implementation in Laurentian Archaic culture. This aspect is significant because the bannerstones present at

Mt. Albert may be some of the first examples that are purposely broken in the entire Laurentian tradition. Bannerstones exist as a category of artifacts unique to the Archaic period of Eastern North America and, as I will argue, hold both functional and symbolic roles for the people who used them. Bannerstones were primarily used as weights for attachment onto atlatls, however given the variable contexts in which they are found it seems likely that they had different functions.

The term “bannerstone” reflects the continuing ambiguity surrounding their symbolic usage, especially considering that they have been found in various contexts such as in burials and caches with exaggerated forms and in middens with domestic refuse (Sassaman 2010). As additions to the atlatl-dart weapon system, Webb (1957) has found bannerstones lying *in situ* with atlatl handles and hooks in Tennessee burials and comparable examples dating back as far as 8,000 years ago are now reported from New England (Cross 1999). It is on the basis of early publications (Baer 1921; 1922) and such contextual burial data that bannerstones are now broadly accepted as atlatl weights, used to improve some aspect of launching a dart from a spear thrower.

Within Ontario and around the eastern Great Lakes by far the most common material used for bannerstone production is green banded slate. That they are manufactured on this material, instead of the many other rocks that would be suitable to make these tools, suggests aesthetic concerns were involved in the production of bannerstones beyond a simple desire for hunting implements. The most common style is that having symmetrical wings spreading laterally from a centrally drilled hole, with variations including “bipennate, butterfly, lunate, knobbed, crescent, double crescentic, reel, oval, battle-axe, and geniculate forms” (Baer 1921:449).

2.2a Geographic Range

The earliest consistent appearance of bannerstones occurs after 8500 B.P. in the Shell Mound Archaic of the Midwest and Midsouth during the Middle Archaic stemmed horizon, and in the Neville horizon (ca. 9000–8000 B.P.) of the Atlantic Slope (Sassaman 2010:107). At the Early Archaic Nettling site (ca. 9800-8900 B.P.) in southwestern Ontario there are six polished, drilled stone tubes, as well as seven preforms, that likely reflect the earliest documented bannerstones in the eastern woodlands (Ellis et al.

2009:797-798). One of the stylistically early crescentic forms comes from Annasnappet Pond in Massachusetts *in situ* with an atlatl mortuary offering dated to 8600-8000 B.P. (Cross 1999).

Ritchie (1951:131) suggested that less elaborate forms of bannerstones first appeared in the Laurentian of New York. The bannerstones in New York appear as trapezoidal, ovate, spheroidal, crescentic and winged forms. Initially Ritchie (1937:182-183) argued that winged and notched bannerstones were part of a northward migration from Ohio into the New York region. However, Sassaman (2010) has since refined this hypothesis to identify distinct regions of bannerstone development in which it is possible to identify separate centers of stylistic expression and change (see below).

As one of the groundstone artifact types integral to the Laurentian Archaic sphere of influence, Wright (1984:292) argued that bannerstones entered the Laurentian region from the Southeastern United States. There has been much speculation regarding the origins of bannerstones, but it is likely that their proliferation across eastern North America was largely due to social factors and hunting practices that were communicated and embodied within and between group boundaries on a macro-regional scale. Given the Laurentian propensity for engaging in long-distance networks of trade and interaction, it makes sense that artifacts as conspicuous as bannerstones might have been adopted as valued cultural icons.

Although “simple forms of the bannerstone” (Ritchie 1965:79) are diagnostic of the Laurentian tradition based on their presence at the Brewerton type-sites (Robinson and Oberlander), their appearance on sites across the full Laurentian territory has been sporadic. Seven bannerstones, including rectangular, oval, and trapezoidal forms of green banded slate were excavated at the Robinson site (Ritchie 1940:38). At the adjacent Oberlander No. 1 site one fragmented wing of a rectangular bannerstone was found with parallel incisions traversing its base (Ritchie 1940:74). A single winged bannerstone, found with a Brewerton component next to the Genesee River, near Smoky Hollow, supports the attribution of bannerstones to the Brewerton phase in northern New York.

Bannerstones are less well known from the Vergennes phase. While there are many ground slate tools from the KI site in Vermont, only one wing fragment of a bannerstone was identified (Ritchie 1968). The Otter Creek No. 2 site has yielded a single bannerstone preform, although no completed objects were found (Ritchie 1979: Plate 6). Vergennes bannerstones are also known from the Bridge site in Vermont and a bipennate bannerstone was recovered from the Barren Island site in southeastern New York (Funk 1988:33). Other than the Barren Island site, which has a Vosburg component, bannerstones are missing from other Vosburg sites. Duck Bay phase sites in Connecticut have yielded rectangular and trapezoidal bannerstones. At the Bliss cemetery site bannerstones were interpreted as being ritually killed and incorporated as grave goods in cremation burials and there are at least five bannerstones that have been heavily fractured by thermal trauma (Funk 1988:31). Two wing fragments of rectangular bannerstones that have split down the centrally drilled perforation were also found at the Ames Rockshelter (Lavin 2013).

The relative paucity of bannerstones throughout the Laurentian Archaic precludes definitive statements about stylistic expression, although there is slight variation to be seen between and within sites. Notably, the Robinson site contains the greatest variety of different styles. It is the only Laurentian site where an ovate bannerstone has been found, and thus, hints at connections, if not cultural and stylistic origins, with the Southern Ovate bannerstones that proliferate in the Southeast prior to 4000 B.P. (Sassaman 1998:102). The remaining rectangular and trapezoidal bannerstones are alternately akin to styles present on other Brewerton and Vergennes sites.

One center of production is in the Savannah River valley of Georgia and South Carolina, from where bannerstones were traded to northeast Florida to be deposited in burial mounds. As Sassaman and Randall (2007) note, early production (5500-5200 B.P.) within the Savannah River valley was implemented within mortuary contexts, and later bannerstone styles (5,200–4,200 B.P.) were manipulated as indicators of group identity and were situated within exchange networks to maintain inter-group alliances. Especially in the Shell Mound Archaic of west central Kentucky, bannerstones and atlatl components are incorporated as grave goods in mound burials (Kinsella 2013:26). Significantly, the more “elaborate and hypertrophic bannerstones” are believed to have occurred around the peripheries of their centers of origin, which attests to the fact that bannerstones were used conspicuously to construct separate and bounded group identities (Sassaman 2010:112).

In the Illinois River Valley bannerstones occur only in mortuary contexts and are excluded from household refuse, which alludes to the existence of a "regionally distinct mortuary program" that involved the interment of the deceased with hunting implements (Sassaman 1996:62). This pattern notably differs from sites to the Southeast where fragmentary bannerstones are found predominantly in household middens (ibid.). Further, considerable effort seems to have been devoted to selecting raw materials with aesthetic properties such as banding, and the entire process of production, including polishing, attests to their value as objects of artistry. This evidence suggests that cultural meanings of bannerstones were locally variable and that they could be used with varying degrees of functionality or ceremonialism at the same time.

Drawing on Malinowski's (1922) ideas, Sassaman (1996:63) contends that "hypertrophic" artifacts are valued in instances where the worker has spent an "inordinate amount of labour producing an object that is too good, too big, or too charged with ornamentation to be used functionally." Hypertrophic bannerstones are those whose form and worked features are highly elaborate in excess of what is needed for a purely functional object. Efforts have clearly been made to accentuate the natural qualities of the raw material and the shape has been purposely structured to evoke "agentive properties" embodied by the artifact's form (Kidder 2011:111).

2.2b Symbolic Roles

In the absence of writing and other institutions of memory, Sassaman (2010:97) contends that the distribution of commonly recognized artifacts such as bannerstones served to connect social groups that were spatially and temporally distanced. Material culture can be consciously used to assert identity within a larger cultural framework. Significantly, the symbolic qualities attributed to producing bannerstones occur within a context of specialized production and it follows that this significance was accumulated as part of the collective knowledge, skill, personhood and communal belonging (Dobres 2010:109) that became embodied within the technical processes, and thereby the materiality of bannerstones, seen at manufacturing sites.

As bannerstones were increasingly used to make statements about group identity (cf. Sassaman and Randall 2007) it is likely that these cultural markers were intended to establish distinct relationships unique to certain groups. While the bannerstones from Mt. Albert are not overly elaborate when compared with some hypertrophic styles that appear in the Late Archaic, it is evident that a great degree of care was afforded to polishing and accentuating the natural banding within the slate.

Experiments in bannerstone manufacture may offer insights into the ways they were perceived by their makers. Production involved hand drilling one bannerstone with a cane drill and chert dust as an abrasive, and the total time required to perforate 28 mm of bannerstone was 10 hours (Kinsella 2013:33). The drilled section of one bannerstone fragment from the Bliss cemetery (Funk 1988:Fig. 23 - #8) is roughly 8 cm deep, or between 6 and 9 cm deep on ones at the Robinson site (Ritchie 1940: Plate 16 - #25-28). These totals effectively double or triple the time Kinsella (2013) spent on drilling in his experiment. Combined with quarrying the raw material, grinding and pecking a rough preform outline, and heavily polishing the surface, these activities elevate bannerstone production to a multi-day process. The labour and time-intensive nature of bannerstone manufacture suggests that they were embodied with prestige and were incorporated in socially significant activities.

2.2c Function

Crafted between 8,500 and 3,000 years ago by Archaic hunter-gatherer-fishers living in the eastern woodlands of North America, potential functions for bannerstones include net-mesh spacers, components of darts to increase the force of their impact, and attachments to atlatls (Kinsella 2013:25). Undeniably, their most likely usage was as atlatl weights.

While it is tenuous to identify which point attributes were consistently used with a given weapon system, attempts have been made to correlate the width, length, thickness, and weight of projectile points with the size of projectile shafts (Hughes 1998:346). Using Australian analogs Hughes (1998:370) notes that “Small, lightweight darts increased velocity and distance [travelled], while large, heavy darts imparted greater impact energy.” Because projectile points adhere to their shafts in terms of size and weight, they also directly influence the size and weight necessitated by their propulsive device. It follows that the most efficient method to increase spearthrower weight would be to add a bannerstone to the atlatl. From this perspective bannerstones can be seen as indicative of large projectiles even though there are multiple changes in point size throughout the Archaic. Therefore, relatively thick dart shafts attached to broad-bladed Brewerton points would likely benefit from the extra throwing capacity of a bannerstone-atlatl combination.

Former theories of bannerstones as atlatl or dart weights include attachment to the end of a flexible atlatl to create a compounding pendulum effect similar to a baseball bat hitting a baseball. However, Sassaman (1996:60) maintains that a spearthrower's mass should be as small as possible to limit the energy that is lost in bending the spearthrower – thus, should an atlatl weight be positioned on the atlatl's distal end it probably contributes little to purported mechanical advantage.

There is evidence that bannerstones utilized as atlatl weights did not add to the force of the dart, but rather they were used to secure balance on the hand of the atlatl-dart combination (Peets 1960). While hunting white-tailed deer, waiting in ambush with an atlatl and projectile in pre-launch position is physically stressful and a bannerstone attached to the atlatl would serve as a counterbalance to offer relief. Given the prominence of deer bone at Kentucky Green River Archaic sites, where bannerstones are common (Kinsella 2013), it is probable that the most likely function for bannerstones is as a counterbalance, enabling an atlatl hunter in pre-launch position to remain immobile for several minutes prior to throwing the dart at a deer.

Pre-launch position entails maintaining the total weapon system, including atlatl and loaded projectile, held above the shoulder, yet not resting on the shoulder, ready to be deployed as forcefully as possible in an instant (Kinsella 2013). Accordingly, the bannerstone increases the amount of time that a hunter can comfortably remain motionless in pre-launch position before muscle strain detracts from throwing accuracy and power. Here, instead of relying on the momentum of a heavy bannerstone to whip a projectile with full force, similar to the weighted momentum of a trebuchet, the hunter becomes the primary driving force behind the dart.

The development of bannerstones likely facilitated the successful stalking of white-tailed deer (Kinsella 2013). Accordingly, the pre-launch position was adapted to deer behaviour, since deer are easily startled and look at a hunter to test for movement.

Potentially, a simple rock tied to the shaft of an atlatl was not used due to the possibility that if it came loose, a stone slapping against a wooden atlatl would startle the deer and cause it to escape. By measuring muscle strain involved in the pre-launch position with an electromyography machine using atlatls, both with and without bannerstones, it was discovered that a human deltoid experiences 62 percent less stress, and forearm flexors experience 72 percent less stress, when the bannerstone was used as a counterweight (Kinsella 2013:50). The ability to regularly lessen fatigue during hunts, and therefore increase the number of kills, would have made the adoption of bannerstone technology attractive for Laurentian hunter-gatherers.

2.2d Conclusions

It is evident that bannerstones exist within overlapping spheres of semantic content related to their utility as both functional and symbolic objects. That they were culturally bounded is shown by their inclusion within regionally distinct styles. Patterns of discard may also be seen to adhere to spatial boundaries, with artifact placement in burial and midden contexts contingent upon proximity to regional centers of cultural influence. Significantly, bannerstones were likely used to enforce and reify group identity through the strategic maintenance of inter-group stylistic differences. Significantly, bannerstones come to embody the personhood and intentionality of individuals within different social groups. It is these attributes that make them attractive inclusions in Laurentian contexts. The addition of distinct objects of cultural identity and function borrowed from southern groups makes sense in the context of large-scale networks of exchange from the West and East. Given their regional variability within socio-cultural contexts it follows that similar diversity would have been maintained in functional attributes. In all likelihood bannerstone-atlatl technology was employed strategically and could have been used for multiple tasks by the same people. It was the unique confluence of environmental and faunal factors within the Archaic that led to the adoption of the bannerstone and its subsequent spread across eastern North America.

Chapter 3: Description of Mt. Albert Artifacts

3.1 Siliceous Artifacts

3.1a Raw Material

The vast majority of the Mt. Albert assemblage consists of flaked chert artifacts. This chapter is concerned with describing these bifacially and unifacially flaked preforms and tools, as well as the groundstone items, found at Mt. Albert. Chapter five discusses in detail the potential flaking debris recovered and its significance.

One of the most commonly used toolstones in the southern Great Lakes is Onondaga chert (Fig. 1.1), and this material preference by precontact peoples is reflected at Mt. Albert, where 2,046 artifacts (71.9% of the assemblage) are Onondaga. The remaining artifacts consist of 796 artifacts of Bois Blanc formation chert (28% of the assemblage), one piece of Selkirk chert, and one fragmentary projectile point of Kettle Point chert (Fig. 3.1b). Onondaga, Bois Blanc, and Selkirk all outcrop along or near the northeastern shore of Lake Erie roughly 200 km south of Mt. Albert, and Kettle Point sources are found adjacent to the southern shore of Lake Huron (Fig. 1.1; Ellis and Deller 2002:2).

Onondaga chert occurs in primary outcrop locations beginning west of the Grand River, along the north shore of Lake Erie in the Niagara Peninsula, and eastward into New York State (Eley and von Bitter 1989; Fox 2009; Parkins 1977). It can also be found in secondary deposits in adjacent areas along Lake Erie and has been glacially transported as far west as Pelee Island (Fox 2009:362). It was likely favoured by precontact groups due to its availability in thick beds and reliability of knapping, although coarse areas of low silica content are common (Long 2004:20). The quality of cherts from Mt. Albert varies greatly, and these low-silica, light-brown inclusions similar to limestone abound in the Mt. Albert collection (see Fig. 3.4A, B; Fig. 3.6D-3.6F). Onondaga has a distinctive mottled dark or light grey to bluish grey colour, and often contains a characteristic “camouflage” pattern (compare Figs. 3.6A and 3.7D). The dominance of Onondaga in the assemblage suggests it was directly procured rather than received as a product of exchange.

Bois Blanc cherts occur in the sedimentary formation of that name in southcentral Ontario (Parker 1986). Based on visual identifications, it is probable that artifacts made of this material are, more specifically, the chert variety referred to as “Colborne chert” (Fox 2009:361). This chert outcrops in Ontario along the northeastern shore of Lake Erie, near Port Colborne. Outcrops are near to the more easterly Onondaga sources, so it is possible that the occupants of Mt. Albert procured both materials from the same area. It forms in flattened, “nodular,” discontinuous beds within limestone formations (Parker 1986:5). The colour typically ranges in hues of light grey, and includes white, blue-grey, and pink (compare Fig. 3.3D with Fig. 3.3A-C, E-H). The overall quality of Colborne chert artifacts is variable as well, and many exhibit hollow and limestone inclusions in the raw material (Fig. 3.3A, B). These flaws likely contribute to some of the large amounts of amorphous shatter present at the site.

Kettle Point chert primarily outcrops in 2 to 75 mm thick beds at the tip of Cape Ipperwash that are currently submerged up to 2 m by Lake Huron (Fox 2009; Janusas 1984:5). Secondary sources are also present in glacial till, stream, and beach deposits in that vicinity. Kettle Point exhibits a wide range of colours that include banded shades of grey, mauve, light blue, brown, and beige (Janusas 1984:32-33). This chert often contains mineral impurities, such as hematite, that cause distinctive rust-coloured staining on artifacts (Fig. 3.1B; Janusas 1984:3).

The relatively close proximity of most stone resources along the Lake Erie shoreline, combined with the fact all artifact forms including debris occur on the materials from that area, suggests direct raw material exploitation by the people who occupied Mt. Albert, rather than indirectly via long distance trade in exotic materials as is suggested at some Laurentian sites where not only are the materials from exceedingly long distances but they are restricted to certain tool categories such as points (e.g. Chapdelaine and Clermont 2006; Funk 1988; Ritchie 1980). The distance between Kettle Point and Onondaga/Colborne outcrops and the Mt. Albert site is low enough to suggest that the sole Kettle Point projectile point was processed by the Mt. Albert occupants but it could have been introduced via exchange. Certainly, it is within the ranges that most Archaic groups travelled in southwestern Ontario (Janusas 1984:59) and the point’s presence may simply reflect curation from a prior quarrying trip.

Significantly, the nature of raw material procurement for hunter-gatherer groups is fluid and embedded within schedules of subsistence around the landscape. As Binford

(1979:259) notes, ethnographically documented hunter-gatherer task groups rarely travel long distances for the sole purpose of gathering raw materials. Therefore, it is likely that the different tool stones present at Mt. Albert, except perhaps the single item on Kettle Point, were gradually accumulated over time and transported as part of an individual's or band's toolkit. Indeed, a broad variety of artifact types are represented such that they might fulfill all the lithic subsistence necessities of an Archaic band.

3.1b Bifacial Artifacts

Bifacial artifacts at Mt. Albert exhibit a scale of refinement that ranges from early stage bifacial blanks to fully refined, completed tools. This range of refinement seems to reflect an overall Brewerton lithic reduction strategy that involves the transportation of large numbers of early stage, barely flaked bifacial preforms/blanks designated for eventual transformation into knife blades and projectile points. As noted earlier, similarly high frequencies of early stage bifaces are present at the O'Neil site Brewerton component in New York, notably as part of a cache of 37 items (see Chapter 2; Ritchie 1973: Plate 42), but they also occur at the Robinson (n = 80) and Oberlander (n = 26), New York, type-sites in non-cache situations (Ritchie 1940).

Measurements were taken of all bifaces that were sufficiently intact to reasonably make inferences about the length or width of objects prior to their fragmentation. For example, while the biface tips in Fig. 3.2 only represent partial sections of completed preforms and tools, their surfaces are complete enough to convey approximately how wide they were as whole artifacts.

The width/thickness ratios of bifaces allow for inferences concerning the scale of manufacturing refinement of items in the assemblage. Width/thickness ratio is a useful indicator to identify the stage of reduction a biface is in because it reflects overall amounts of bifacial thinning that have been applied to individual artifacts. By comparing width/thickness ratios of separate biface categories it is evident that there is a noticeable range of bifacial refinement in the Mt. Albert artifacts. Typically the more refined artifacts such as projectile points and knife blades have a width/thickness ratio above 4 (see Tables 3.1 and 3.2), while lower ratios indicate less bifacial refinement and therefore earlier stages in the knapping process (Table 3.4). Typically as bifaces are thinned they decrease in width, and accordingly it is easier to produce broad, thin projectile points on preforms with higher width/thickness ratios (Whittaker 1994). Similar patterns are present at the Paleoindian Caradoc site, where thin knives, bifaces, and preforms exhibit width/thickness ratios above 4 (Ellis and Deller 2002:Table 2.14).

Figure 3.1: Broad-bladed, corner-notched Brewerton projectile points; A, Onondaga chert; B, Kettle Point chert.

Table 3.1: Projectile point metric variables; all measurements in mm.

Projectile Point	Length	Width	Thickness	Width/Thickness Ratio	Basal Width	Depth of Notches
Fig. 3.1a	40.1	31.3	7.7	4.06	15.7	6.1; 7.7
Fig. 3.1b	28.3	29.1	6.9	4.22	20.6	3.6; 7.4

3.1ba Refined Bifaces. In addition to higher width to thickness ratios, refined bifacial artifacts typically exhibit some pressure flaking, a developed cutting edge and a pointed tip end, all of which imply that they were used as tools. Refined artifacts in this collection are the projectile points in Fig. 3.1, the projectile tip in Fig. 3.2B, and the knife blade in Fig. 3.2E. The sole intact bifacial tool in the assemblage, the Onondaga projectile point (Fig. 3.1A), has well defined barbs and is more extensively retouched along one edge, which suggests it has been subjected to repeated instances of resharpening. The tip has snapped off, likely the result of impact damage (Dockall 1997), and the end has not been subsequently retouched into a pointed apex. Blade edges are excurvate, although one area of resharpening near the tip has resulted in a slightly concave margin. This retouched section probably reflects efforts to sharpen and reshape the damaged tip into a point. All of the edges are rounded, which indicates potential “bag wear” (Archaeological Services Incorporated 2014), dulling from cutting activities, or possibly that acidic soils removed sharp extremities. The latter scenario is tenable given a large percentage of the projectile point is made up of low silica content chert (Long 2004) that is vulnerable to wear from acidic soils, and this process could be responsible for weakly defined flake scars across the point’s surface. On the reverse side one broad basal thinning flake terminated in a step fracture and a subsequent bending fracture snapped off the obverse side of one basal ear, resulting in the base’s lopsided appearance.

The Kettle Point projectile point missing its tip is broad-bladed and well-flaked such that it retains a sharp cutting edge (Fig. 3.1B). It has narrower corner notches and a more defined base than its Onondaga counterpart.

Projectile points characteristic of the Brewerton cluster are broad-bladed and often excurvate, although flat and incurvate edges occur (Ritchie 1944: Plate 110). Hafting styles include corner and side-notched, as well as eared-notched and eared-triangle forms (Justice 1987:115-122, Figure 23-24). Brewerton point styles are the most pervasive types found on Laurentian sites, and have been recovered from sites as far away as New England (Lavin 2013). There is no doubt that the broad bladed, corner notched projectile points from Mt. Albert have a Brewerton affiliation.

The Onondaga projectile point tip in Fig. 3.2B was likely much wider closer to the basal end, and likely would have a higher width/thickness ratio than is currently represented. It is the most finely flaked item in the entire assemblage – even more than the other projectile points recovered.

The Onondaga “blade”/refined biface (Fig. 3.2E) exhibits some pressure flaking and efforts have clearly been made to obtain a lanceolate profile and maintain sharp cutting edges. It is relatively thin and well made, with a width/thickness ratio close to 4. Bifacial thinning flakes were removed from nearly the entire surface, although in the centre of both faces the biface still exhibits the ventral and dorsal surfaces of the large primary flake on which it was made. Pressure flakes were sporadically removed from its edges to regularize the general lanceolate outline and sharpen the edge.

Table 3.2: Metric variables of pointed preforms; all measurements in mm; Fig. 3.2A measurements include both fragments from Fig. 3.6A.

Refined & Semi-Refined Bifaces	Length	Width	Thickness	Width/Thickness Ratio
Fig. 3.2A, Fig. 3.6A	74.9	37.5	9.2	4.07
Fig. 3.2B	12.1	16.5	4	4.12
Fig. 3.2C	22.3	32.4	9.9	3.27
Fig. 3.2D	50	36.7	17.9	2.06
Fig. 3.2E	72.9	31.8	7.9	4.02
Fig. 3.2F	36.8	52.1	13.9	3.75
Fig. 3.2G	29.6	40.1	9.6	4.18
Fig. 3.2H	31.8	42.2	9.3	4.54
Fig. 3.2I	34.9	53.5	13.5	3.96

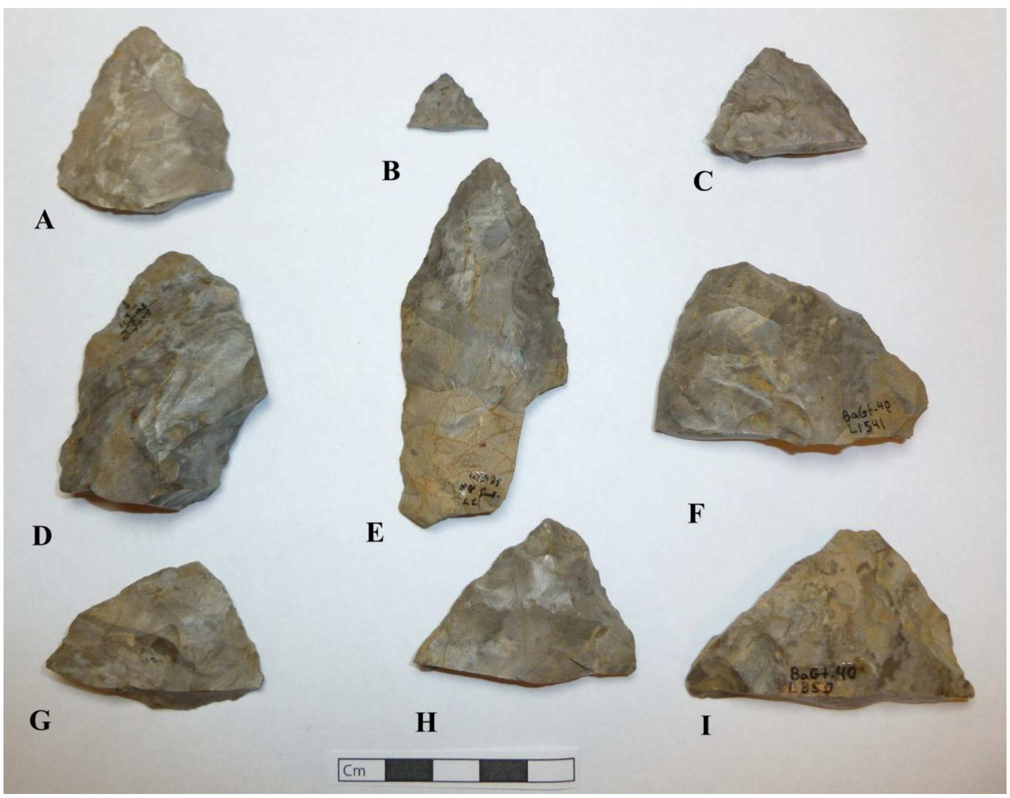

Figure 3.2: Refined and semi-refined bifacial blade and preform tips. A, E, probable knives; B, projectile point tip; C, D, F-I, preform tips.

3.1bb Semi-Refined Bifaces. Semi-refined bifaces are those from which bifacial thinning flakes have been meticulously removed from both surfaces to the point where these preforms are almost thin enough so that pressure flaking might begin. They differ from the refined forms in that they do not yet exhibit the final stages of pressure flaking or evidence of use as tools. Yet, like the refined forms, and as shown on Fig. 3.2, all of these biface fragments have more pointed tip ends, which suggests they were already being shaped into predetermined tools like the knife blade or projectile points described above (Fig. 3.2A, C, D, F-I). With the exception of the robust biface fragment (Fig. 3.2D), which has a width/thickness ratio of 2.06, the remaining preforms are relatively thin and well formed, with width/thickness ratios that range from 3.27-4.54, with a mean of 3.96 (Table 3.2).

The biface "blade" that is in two fragments (Figs. 3.2A and 3.6A) is the most extensively knapped item in the semi-refined category, and exhibits bifacial thinning flake scars entirely covering both surfaces. It exhibits an overall lanceolate profile and relatively little knapping work would need to be done to refine this preform into a point or knife.

By far the thickest semi-refined biface (Fig. 3.2D) exhibits characteristics of both refined and earlier stage "cruder" bifaces. While biface thinning flakes were removed from much of its surface and attention has been paid to maintaining a pointed shape, along its right edge is an unflaked, flat surface characteristic of the striking platform of a large primary flake. Although preliminary shaping and thinning was applied to this biface, it is evident that a significant amount of reduction would be required before it could be turned into a refined tool.

The remaining semi-refined bifaces/preforms are overall very wide and their bases likely would have been more ovoid in shape than the lanceolate preform in Fig. 3.2A. Although some are quite thick (Fig. 3.2F, I; Table 3.2) their wide blades maintain high width/thickness ratios and subsequent bifacial thinning into projectile points would keep intact the broad blades necessary to manufacture Brewerton style points. The reported maximum lengths and widths of all these points fall within the size range for early stage bifaces (Table 3.4), and they appear to represent more refined forms of the roughly knapped quarry blanks or ovate bifaces. On the majority (Fig. 3.2C, D, F-I) flaking appears opportunistic, with select flakes removed to maximize thinning and rough out the general pointed shape. With the exception of the lanceolate preform, all of the semi-refined tips (Fig. 3.2C, D, F-I) exhibit some areas where no biface thinning flakes were removed. Made on thick spalls that were procured from the primary quarry source, these seemingly unknapped areas are the ventral surfaces of large primary flakes removed from Onondaga cores to serve as tool blanks.

Table 3.3: Metric attributes of ovoid Colborne preforms; all measurements in mm.

Colborne Bifaces	Length	Width	Thickness	Width/Thickness Ratio
Fig. 3.3A	47	51.6	20.3	2.51
Fig. 3.3B	63.6	52.5	16.4	3.2
Fig. 3.3C	68.4	50.3	14.7	3.42
Fig. 3.3D	66	43.9	15	2.93
Fig. 3.3E	73.5	60.4	15.9	3.8
Fig. 3.3F	62	39.3	17.4	2.26
Fig. 3.3G	66.1	58.9	15.6	3.78
Fig. 3.3H	-	53.1	13.3	3.99

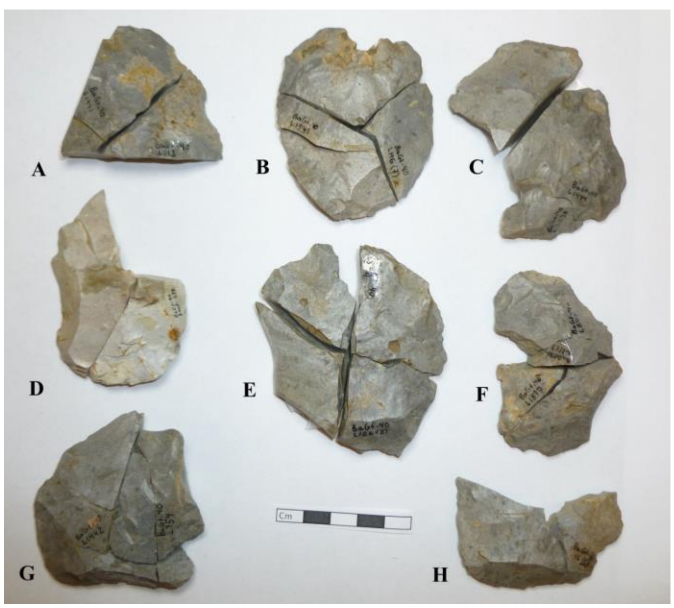

Figure 3.3: Refitted ovoid Colborne bifacial blanks.

3.1bc Early Stage, Unrefined Bifaces ("Roughouts"). These bifaces are those that are thick and exhibit rough, haphazard percussion flaking. They all have flaking on both faces but they lack any attempts to produce a recognizable tip end and often they have surfaces or margin segments that lack secondary thinning flake or retouch flake removals. No effort has been made to rough out a more refined form other than minimal attempts to create vague ovoid outlines. Presumably such minimal reduction was to make an item lighter to carry to locations of tool use and to test material pieces for flaws. Many of these items have cortex or flat quarry block surfaces along their edges, which suggests they were separated from the initial raw material piece/nucleus relatively recently in the sequence of knapping stages. These original surfaces are smooth and unbattered by glacial movement, which indicates that they were procured directly from outcrops rather than secondary (e.g. glacial) sources. A few were made on large, early stage flakes struck from a quarry block/core and one face is almost a completely unknapped flake surface that exhibits a bulb of percussion and the smooth ventral flake surface (Fig. 3.7E, 3.7F). These are very comparable to the “quarry blanks” found in the cache at the O’Neil site, New York (Ritchie 1973). This widespread evidence for expediently knapped blanks likely represents a classic Brewerton manufacturing stage in which materials are transported away from toolstone sources. Flat surfaces along one or more bifacial edges, or quarry block/nucleus edges, occur on 11 complete and fragmentary biface blanks (Fig. 3.5). These are produced when spalls are removed sequentially from a core and again suggest that chert was quarried from beds or nodules, rather than refined out of rounded cobbles that can be found in glacial till or streams.

All of the Colborne artifacts in the assemblage are early stage, ovate bifacial forms (Fig. 3.3). Altogether there are 19 discrete Colborne bifaces and biface fragments. The remaining Colborne material consists of varying sizes of angular and blocky fragments. All bifaces show signs of some bifacial thinning, although, unlike some of the Onondaga artifacts described above, none have been further refined beyond rough preforms. The quality of this material is highly variable. Some artifacts (Fig. 3.3D, E, G) are flawless in that they have no internal impurities that inhibit flakes from travelling or cause striking platforms to crumble. Others (ie. Fig. 3.3A, B) are riddled with internal limestone-filled cavities that had to be avoided while knapping. The majority of this chert is light grey with mottled dark grey inclusions, although one biface (Fig. 3.3D) is cream coloured. Two fragments of the same material display a pink hue that may be the result of thermal alteration.

Colborne bifaces exhibit a range in width/thickness ratios (Table 3.3). Ratios range from 2.26-3.99, with a mean of 3.24. Notably, this width/thickness ratio is lower than that for the semi-refined biface category, yet higher than the Onondaga early stage bifaces (see below), which shows that overall Colborne blanks are better made and/or in more refined states than the Onondaga blanks. Indeed, some (Fig. 3.3B, C, E, G, H) are relatively well-flaked blanks where biface thinning flakes occupy the entire surface. In fact, compared with Onondaga ovate bifaces (Fig. 3.4) these Colborne blanks are far more reduced and greater effort has been spent to create thin, symmetrical blanks. In addition to the complete, more refined blanks, 6 biface fragments show similar signs of care afforded to biface thinning. The thickest blanks (Fig. 3.3A, D, F) have far fewer flake scars across their surfaces, so they reflect an earlier stage of refinement. Additionally, two bifaces (Fig. 3.3A, E; Fig. 3.5B, C) have unflaked flat edges consistent with quarry surfaces that occur on large primary flakes.

Table 3.4: Metric attributes of whole, fragmentary, and refitted Onondaga bifacial preforms and blanks; all measurements in mm.

Bifacial Type	Length	Width	Thickness	Width/Thickness Ratio
Ovate Fig. 3.4A	62.3	41.3	12.6	3.28
Ovate Fig. 3.4B	59.6	42.5	15.4	2.76
Ovate Fig. 3.4C	50	44.5	13.6	3.27
Early stage Ovate Fig. 3.4D	53.9	41.4	13.4	3.09
Early stage Ovate Fig. 3.4E	54.8	42.2	18.7	2.26
Quarry Blank Fig. 3.4F	57.5	46.6	18.2	2.56
Ovate Fig. 3.6B	69.4	51.3	16.7	3.07
Ovate Fig. 3.6C	-	50.9	17.6	2.89
Ovate Fig. 3.6D	-	53	9.9	5.35
Ovate Fig. 3.6E	63.8	51.1	12.7	4.02
Ovate Fig. 3.6F	61.9	47.3	15.9	2.97
Early stage Ovate Fig. 3.7A	52.7	44.9	16.6	2.71
Quarry Blank Fig. 3.7B	-	57.6	18.7	3.08
Early stage Fig. 3.7C	-	57.7	16.6	3.48
Early stage Fig. 3.7D	53.8	40.5	15.1	2.68
Early stage Fig. 3.7F	59.4	-	18.3	-
Quarry Blank Fig. 3.8A	80.6	48.7	20.9	2.33

Bifacial Type	Length	Width	Thickness	Width/Thickness Ratio
Early stage Fig. 3.8B	82.6	55.6	22.4	2.48
Quarry Blank Fig. 3.8C	71.3	48.8	15.6	3.13
Early stage Fig. 3.8D	-	55.8	19.9	2.80
Early stage Fig. 3.8E	74.5	52.4	17.9	2.93
Early stage Fig. 3.8F	78	51.1	13.7	3.73
Early stage Fig. 3.9A	-	51.5	16.5	3.12
Quarry Blank Fig. 3.9B	-	58.6	17	3.45

Figure 3.4: Early stage Onondaga ovate bifacial blanks.

Early stage Onondaga bifaces vary greatly in their degree of reduction and quality of knapping. Seven blanks that display the most bifacial reduction are invariably oval or circular in profile (Figs. 3.4A-C; 3.6B-3.6F). Width/thickness ratios for these blanks range from 2.76-5.35, with a mean of 3.45 (Table 3.4). Biface thinning flakes completely or almost cover the entirety of these surfaces and attention was clearly paid to produce roughly symmetrical outlines. The least symmetrical biface (Fig. 3.4C) has multiple voids along its margins that are the result of impacts after it was completed, and it was likely similarly symmetrical to the others made on thick primary flakes or spalls (Figs. 3.6B; 3.6C; 3.6F). The biface in Fig. 3.6C has been relatively well-flaked across both its surfaces, although the flat striking platform used to remove its large flake blank from a core remains intact. Further, remnants of the smooth, rounded ventral surface of the primary flake it was made on occupy central surface areas.

The material on these items contains the highest proportion of high silica content chert, whereas the others (Figs. 3.4A, B; 3.6D; 3.6E) contain high percentages of poorly flaking limestone inclusions that may have confounded the paths of flake removals. Two (Figs. 3.6D; 3.6E) appear to be made on already thin primary flakes that sporadic percussion flakes were removed to rough out an ovate shape and to initially create bifacial edges. One (Fig. 3.6D) has shallow, broad flake scars from well-placed billet strikes.

The roughest bifaces are those that exhibit mostly unflaked primary flake surfaces and, while they have some marginal biface flakes removed, little-to-no thinning has been applied (Figs. 3.4D-F; 3.7A-3.9B). Accordingly, these artifacts have some of the lowest width/thickness ratios in the entire assemblage. Width/thickness ratios on these bifaces range from 2.26-3.73, with a mean of 2.75 (Table 3.4). Notably, these ratios are much lower than the other more reduced and refined bifaces (see above). Low rates of refinement are also indicated by the presence of limestone cortex that is still extant on two bifaces in this category (Figs. 3.7B and 3.7C). Both have relatively large scars from earlier stages of percussion flaking that were likely used to rough out spalls and isolate striking platforms. They are both quite thin, with width/thickness ratios of 3.08 and 3.48 respectively (Table 3.4). However, given the presence of original ventral flaking surfaces, this thinness is more a product of the thinness of the flake blanks on which they were made rather than the effort expended on bifacial thinning.

The biface blank with the largest mass (Fig. 3.8B) is roughly flaked over most of its surfaces. It is quite thick, with a width/thickness ratio of 2.48 (Table 3.4) and it is likely that what little flaking was done was for the purpose of reducing its mass for transportation. The pronounced bulb of percussion left in one intact flake scar suggests that the blank was roughed out using hard hammer percussion. This inference is consistent with knapping sequences that involve hard hammer percussion in the earlier stages of reduction, and soft hammer percussion with wood or antler billets during later refinement of bifaces (Dibble and Pelcin 1995). Use of the latter percussors is suggested by the long, well-defined flake scars on smaller, more refined bifaces.

Some bifaces (Figs. 3.4D-F; 3.7A, D-F; 3.8E-F) would be almost indistinguishable from thick primary flakes were it not for the removal from the edges of few and sporadic secondary knapping flakes that travel shorter distances and are narrower than biface thinning flakes. These blanks have not yet been refined to any degree and were likely carried to eventually replace equipment that would inevitably wear out (Binford 1979:261). One (Fig. 3.7E) still exhibits a pronounced bulb of percussion and a broad, flat striking platform. Only minor bifacial knapping flakes were removed from its distal edge. Others (Figs. 3.4E, F; 3.7A; 3.7D; 3.8E-F), are missing striking platforms and bulbs of percussion, however their ventral surfaces retain the concentric ripples indicative of conchoidal fractures from their removal from cores. Their dorsal surfaces show the remnants of older, large flake removals that were likely used to prepare striking platforms for spall removal. These unrefined objects lack identifiable bifacial thinning or retouch.

Quarry blanks carry distinct flat edges that interrupt bifacial edges (Fig. 3.5; see above). Onondaga bifacial objects that carry these edges are relatively thick and are typically robust (Figs. 3.4D, F; 3.8A; 3.8C; 3.9B; Table 3.4). Three are on primary flake blanks with little reduction (Figs. 3.4D, F; 3.9B), while the other two (Figs. 3.8A; 3.8C) have good flake coverage across both their faces, which indicates preliminary steps were being taken to refine these into preforms.

Some significant colour change has occurred to individual Onondaga biface fragments and is likely the result of heating from the same forces that caused multiple heat fractures sporadically throughout the collection (see chapter 4). Three bifaces (Figs. 3.6C; 3.8D; 3.9D) show distinct colour changes between refitted fragments. Burned fragments display a dark blue-grey hue, which is a sharp contrast from the mottled brown and grey fragments they were separated from and which characterize the majority of Onondaga artifacts. Further, while signs of burning occur on other bifaces in the form of potlid fractures (ie. Figs. 3.7D and 3.8F), colour change is absent from most other artifacts.

3.1bd Other Bifaces. Two Onondaga rod-like bifaces or “drill” fragments were found on site (Fig. 3.10). It is possible that they were once part of the same object, although that interpreation is unlikely based on their different colours and sizes. Certainly, the intact fracture surfaces on both pieces do not fit together. At its thickest point on the base, 11.6mm, the expanding base drill is almost twice as thick as both projectile points. While a common Archaic drill production method involved the recycling of projectile points that have been narrowed by repeated instances of retouching, it is clear that the drill with the intact base (Fig. 3.10A) was made from a much thicker preform. While the reverse side exhibits pressure flaking along the entire drill face, on the obverse steep pressure flaking only occurs along the shaft, and because of its thickness (8.34mm), a developed ridge travels along the length of the drill shaft. The entire obverse drill base reflects larger percussion scars from earlier stages of flintknapping and is left untouched by pressure flakes. This evidence suggests that, like semi-refined bifaces, this drill was made directly on a relatively early stage biface rather than by recycling worn out tools.

Figure 3.5: Early Stage Bifaces; arrows indicate locations of retained, flat, original quarry block surfaces; A, D, Onondaga; B, C, Colborne.

The fragmentary drill bit (Fig. 3.10B) is well flaked bifacially and a polished region at the tip suggests it was used for drilling purposes. Similarly to the shaft of the base, the reverse side of the bit is pressure flaked across a flat surface, while the obverse was pressure flaked at a steep angle to produce a central ridge running down its centre.

One bifacial end scraper appears to have been adapted from a relatively early stage Onondaga biface (Fig. 3.11). Along one edge approximately 40 per cent of its length has cortex intact. Long, linear percussion flakes run bifacially across the entire length of this object, and have produced a flat surface on the reverse side and a convex surface on the obverse. Along the convex working edge a continuous series of steep retouch flakes no longer than 3mm in length have been unifacially removed. This occurs along the rounded edge and continues unilaterally until the pressure flakes end 8mm away from the cortex. The rounded edge holds some polish that may be use wear from scraping hides.

This scraper has a similar size and shape, and appears to be percussion flaked similarly to one other biface (Fig. 3.7C) in the collection. They also are made on the same dark chocolate coloured Onondaga chert and maintain remnants of the same thin cortex. Thus, it is probable that they were part of the same chert nodule and that they were removed as a series of primary flakes from a core.

3.1c Unifacial Artifacts

End scrapers are defined here after Ellis and Deller (2002:42) as artifacts that have distinctive unifacial "scraper retouch," or continuous, marginal flaking that extends approximately 3mm onto the scraper face, to form a convex beveled edge at the distal end of a flake. The sole intact end scraper (Fig. 3.12B) is well flaked, with retouch at a relatively narrow angle (44°) compared with its counterparts. The two other end scrapers have snapped along their bodies so that only the scraper "bit" is intact. Both are roughly the same width as the other end scrapers and both have steeply retouched bits (Fig. 3.12A, 50°; 3.12C, 57°). One (Fig. 3.12A) exhibits multiple pot lids and its dark colour may be a product of thermal alteration.

Side scrapers are retouched unifacially with short, steep sequential/continuous flakes removed along one or both elongated side edges of a blank to form a continuously beveled margin(s). One (Fig. 3.13A) was produced on a broad, thin flake that may have been a large bifacial thinning flake. It is unilaterally retouched for 41mm along its edge, and is otherwise unknapped along its opposite edge. The second side scraper (Fig. 3.13B) is convex along its dorsal surface and has been distinctly retouched along at least one edge, although potential pressure flakes are minor and poorly formed along the opposite edge. It is possible that retouch is continuous and occurs around the proximal, rounded edge, as might characterize the “bit” of an end scraper, although the flaked proximal end has not been refitted. The final side scraper (Fig. 3.13C) is little more than a large, primary, flake blank with minor retouch and possible hide polish along the edge of its ventral surface. It retains a wide striking platform and a prominent bulb of percussion on its ventral surface. This flake is within the size range for some of the semi-refined bifaces on site, and might easily have been reduced into an ovate biface.

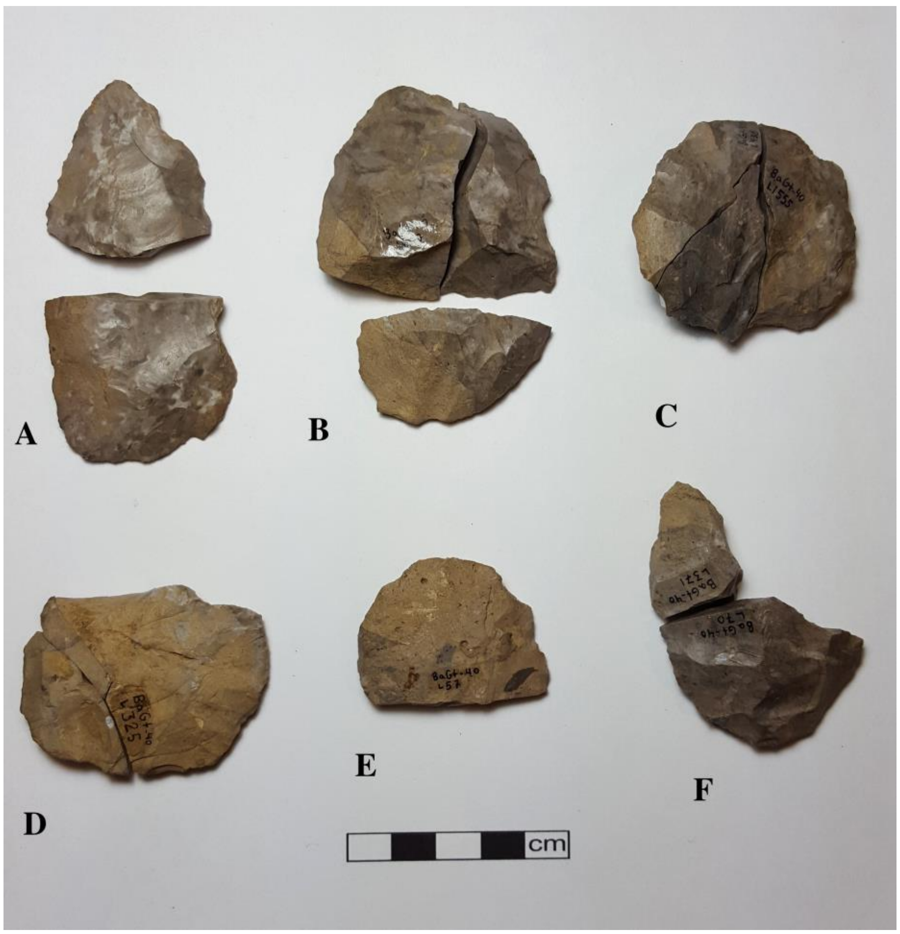

Figure 3.6: Onondaga bifaces. A, refined Onondaga lanceolate biface; B, Onondaga ovate/ovoid biface; C, Onondaga ovate/ovoid biface; D, Onondaga ovate/ovoid biface; E, Onondaga ovate/ovoid biface end; F, Onondaga ovate/ovoid biface.

3.1d Other Flaked Stone Artifacts

The Mt. Albert collection contains three other flaked stone items of note: a core (Fig. 3.14) and two large unmodified primary flakes (Fig. 3.15; 3.16). The Onondaga core has had a sequence of long, narrow flakes removed from its dorsal surface. Such narrow flakes may have been used as expediently knapped microblades that could have served as disposable cutting flakes removed, used, and discarded based on necessity. The core was burned at some point after flakes were removed from its dorsal surface, evidenced by the presence of 6 potlids across both ventral and dorsal surfaces.

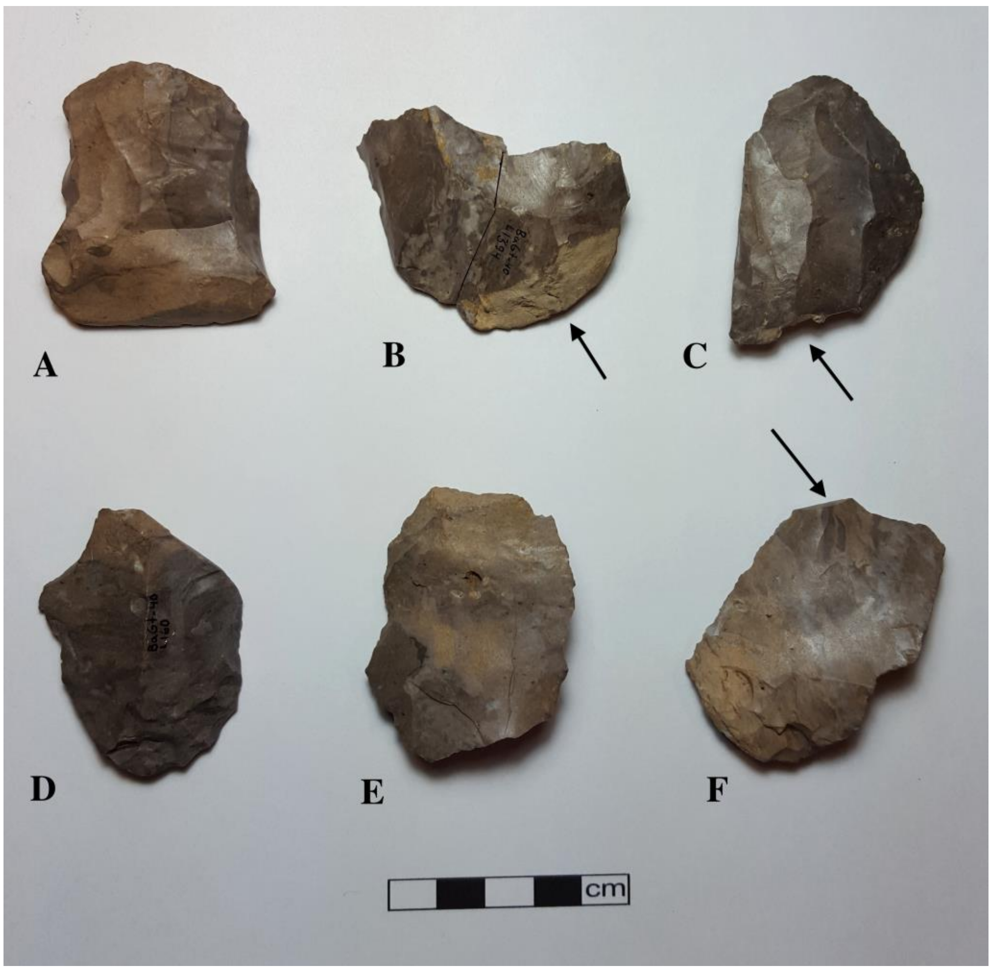

Figure 3.7: Rough Onondaga bifaces. A, early stage Onondaga ovate/ovoid biface; B, early stage Onondaga biface/quarry blank, arrow points to cortex; C, early stage Onondaga biface, arrow points to cortex; D, very early stage Onondaga biface; E, very early stage Onondaga biface; F, very early stage Onondaga biface, arrow points to striking platform and bulb of percussion.

Figure 3.8: Rough Onondaga bifaces. A, very early stage Onondaga biface “quarry blank;” B, early stage Onondaga bifacial blank; C, early Stage Onondaga biface; D, very early stage Onondaga biface; E, very early stage Onondaga biface; F, very early stage Onondaga biface.

Two large primary reduction flakes show no signs of flaking after removal from cores. Both items could represent the earliest stage of biface manufacture, or essentially be flake blanks that eventually would be turned into bifaces. However, they might also be blanks for unifacial tools such as the side or end scrapers described above. The ovate flake (Fig. 3.15) is very early stage and both surfaces are unflaked. The reverse side contains a hollow pocket of limestone, and the flake may have simply been removed to trim cortex off a core. One fragment was burnt, which resulted in a darker colouration. The second primary flake (Fig. 3.16) is elongated and quite thick. Relative to its length and thickness it is quite narrow, and its discard without further modification may have been a result of its slim profile, which would make thinning while maintaining width difficult.

Figure 3.9: Rough Onondaga bifaces. A, very early stage Onondaga biface; B, very early stage Onondaga biface fragment; C, very early stage Onondaga biface fragment; D, very early stage Onondaga biface fragment.

Figure 3.10: Onondaga drill fragments.

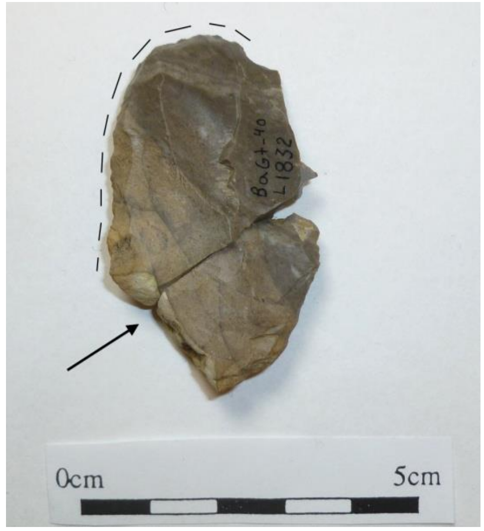

Figure 3.11: Bifacial end scraper; arrow points to cortex; broken line delineates the scraper edge.

Figure 3.12: Dorsal surfaces of Onondaga end scrapers.

Figure 3.13: Dorsal surfaces of Onondaga side scrapers.

<u>3.2 Non-Siliceous/Groundstone Artifacts</u>

Three wing fragments of un-notched, winged bannerstones made on green banded slate were the only ground slate items found on site. Each segment represents roughly one lateral half of a bannerstone. All have split down the length of their centrally drilled midshaft and there is a strong likelihood that two (Fig. 3.17B, C) were part of the same object based on their similar height and thickness (Table 3.5). Wings are excurvate above the wingtips and they were ground to a flat edge at right angles to the dorsal and ventral surfaces along the bottom margin shown in the photo (Fig. 3.17). All surfaces have been ground and are highly polished. The thinner wing fragments (Fig. 3.17B, C) were ground to emphasize and contrast the raised central ridge overtop of the drilled midshaft, whereas

Figure 3.14: Dorsal surface of unifacial Onondaga core.

Figure 3.15: Onondaga primary flake.

Figure 3.16: Onondaga primary flake dorsal surface.

Figure 3.17: Banded slate bannerstone fragments; flat surface edges face downward.

Table 3.5: Metric attributes of bannerstones; all measurements in mm.

	Internal Shaft Diameter	External Shaft Thickness	Height of Shaft	Thickness of Ridges	Thickness of Wingtip	Maximum Wing Thickness	Distance from Wingtip to Centre	Weight
A	12.7	24.3	35.2	6.7; 5.6	6.1	20.2	29.2	23.7g
B	9.1	N/A	37.8	3.5; 4.7	1.7	9.8	26.2	14.1g
C	9.3	17.2	37.2	5.3; -	1.7	12.1	32.7	19g

on the other fragment (Fig. 3.17A) there is no thickness contrast (e.g., no ridge) between the drilled area and the preserved wing.

Given the slight weight and mass of the bannerstone fragments it is tempting to suggest that they were minor attributes to the hunter’s toolkit, especially considering their larger sizes in later Archaic horizons across the Eastern Woodlands. However, given that a hunting strategy incorporated into an overall resource exploitation structure of logistic mobility (cf. Lovis et al. 2005; Binford 1979) would necessitate a highly portable toolkit, the form and function of these particular bannerstones were likely perfectly suited to the subsistence needs of this Brewerton group.

One large sandstone hammerstone was recovered at Mt. Albert (Table 3.6). It has large clusters of pitting on both of its flat ventral and dorsal surfaces, which suggests it was utilized extensively (Figs. 3.17 and 3.18). This pitting is inconsistent with the patterns that would be expected for accumulated wear resultant from knapping activities.

Had the hammerstone been used for flintknapping or spalling chert nodules, impact marks would occur on the rounded and narrower distal and proximal ends to maximize striking accuracy. It is, however, conceivably large enough to remove from Onondaga nodules the large primary flakes that rough bifaces were made on (ie. Fig. 3.7E). Further, the hammerstone is much too large to have been used for hard hammer percussion on the Mt. Albert artifact assemblage, since the mass of percussors necessarily correlates with the size of artifacts during flake removal (Dibble and Pelcin 1995). Rather, there occurred an indiscriminant and prolonged series of impacts with smaller, hard objects, so it was likely utilized as either a hammerstone or an anvil.

Figure 3.18: Hammerstone surface.

Figure 3.19: Opposite hammerstone surface.

Table 3.6: Metric attributes of hammerstone; all measurements in mm.

	Length	Width	Thickness	Weight
Hammerstone	95.4	77.4	51.1	552g

Chapter 4: Artifact Breakage Patterns

4.1 Degree of Fragmentation

A primary goal of this thesis is to determine the sources of artifact breakage using, among other things, refitting analyses. As mentioned earlier, the majority of the Mt. Albert lithics (83.3 percent) consists of highly fragmentary stone debris. Most (73.5 percent; Fig. 4.1) of these pieces are either too small or too badly burned/pot lidded to incorporate into the refitting study, which requires all pieces to be labeled.

Of the total flaked stone tool assemblage 769 fragments were large enough and sufficiently intact to individually label and thus, track their specific provenance. It is the labeled pieces that were the subject of sustained refitting attempts. Out of these, 147 chert pieces were refit together in addition to the two bannerstone fragments that are likely part of the same object.

The initial goal of the refitting analysis was to determine whether artifacts were primarily damaged by heat fracturing or mechanically. There are some wavy to more circular breaks that are characteristic of heating, but most of the heating evidence consists of small, circular potlid or popout fractures that have caused minimal to moderate damage to individual fragments (see below). This heat damage raises questions about the sequence of events that contributed to artifact fractures.

Although this study focuses primarily on diagnostic tool or biface fragments retaining one or more segments of surfaces altered by secondary thinning or retouch flaking, it is also useful to consider the frequencies and types of smaller angular to sliver-like fragments without such flaked surfaces. The high amounts of this angular debris at Mt. Albert are largely incidental to mechanically breaking bifaces rather than burning them and in many analyses would be classified as “shatter” produced as a by-product of tool manufacture. During the early stages of flintknapping, angular to blocky fragments are typically produced that lack, unlike most flaking debris, clear dorsal and ventral surfaces and striking platforms (e.g., Binford and Quimby 1963).

However, as discussed in the next chapter (see chapter 5), much evidence indicates it is unlikely that flintknapping manufacture was a significant activity at Mt. Albert. Rather, aside from the lack of cores (n=1) and recognizable flakes expected if the angular debris was simply from manufacturing activities, as will be discussed later in this chapter, experiments in the deliberate breakage of items also render this interpretation unlikely. By applying hammer blows directly to artifact surfaces I show that this activity can produce very similar debris pieces in significant quantities. These by-products of deliberate breakage, herein called “angular pieces” to distinguish them from shatter *per se*, form between the broken interfaces of major artifact pieces including biface fragments. When artifacts are deliberately fragmented they produce high amounts of angular debris due to crushing at the point of impact, and small flake removals occur along the surfaces of breaks. These small fragments form the amorphous and jagged debris that constitutes the majority of the assemblage (Fig. 4.1A, B, D-F, H-L). Also, when artifacts are repeatedly struck, the early stage fragments that form radially fractured wedges and snaps become increasingly pulverized and lose the diagnostic surface flake scar remnants of bifacial and other implements, so they can be confused with shatter. These pieces of debris (Fig. 4.1C, G, M) tend to be blockier than the other more flake-like angular debris and are actually fractured segments of chert artifacts rather than residual material and micro-flakes.

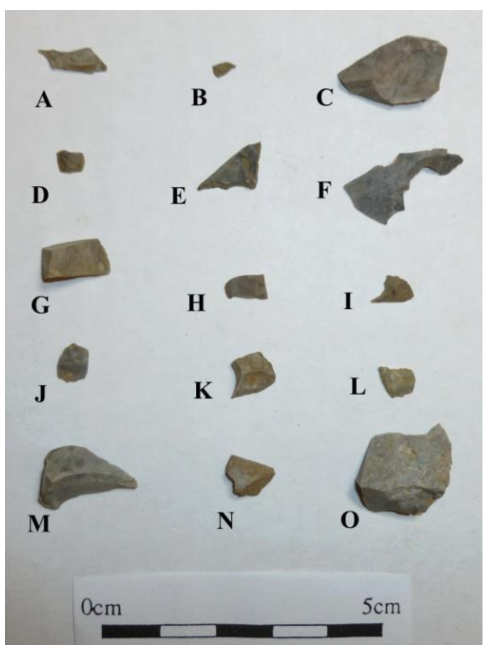

Figure 4.1: Sample of debris from Mt. Albert; A, E, F, amorphous jagged debris; B, D, H-L, N, highly fragmentary debris; C, G, M, blocky debris; O, pot-lidded segment produced by heat fracture.

<u>4.2 Sources of Breakage</u>

It is conceivable that a small number of the artifacts at Mt. Albert could have been broken accidentally or while in use. The breaks on the projectile points, for example, could be "use induced." Trampling could be a factor in the destruction of thinner artifacts such as projectile points, utilized flakes, drills, and bannerstones, which are weakest along their drilled midshaft. However, Weitzel et al. (2014) carried out experiments that indicate artifacts over 7 mm thick are very unlikely to be fragmented by trampling damage. Thus, since the majority of the fractured biface blanks and preforms at Mt. Albert exceed this thickness, and significantly so (see last chapter), the fragmentation has to be accounted for by means other than trampling and the large amount of angular debris also cannot be accounted for in this manner. Additionally, it is probable that artifacts were deposited in subsoil features such as pits (see chapter 6), so it is not likely that they were exposed to people's movements around the site.

Similarly to trampling, damage resultant from ploughing activities is rare at Mt. Albert. As indicated by "nick snaps" and other distinctive breaks, which predominantly initiate along the edges of artifacts and not their surfaces (see Mallouf 1982), the refitted artifacts show no instances of major plough damage. The Kettle Point projectile point recovered from the site surface (Fig. 3.1B) exhibits one recent break that could be the result of ploughing activities. This break is the only potential evidence of plough damage at the site. One basal ear has been removed and the fracture surface exhibits an unworn surface indicating it is a recent break, in contrast to the broken tip, which is weathered similarly to other fracture surfaces in the collection. Cultivation seems a likely cause of the ear break.

Additionally, if we momentarily discount the evidence for deliberate breakage of worked artifacts, it is conceivable that the finished tools could have been broken during accumulated periods of hard use. The broken tip of one point (Fig. 3.1B) has a distinctive rounded lip indicative of a bending, or snap, fracture that could be a use break, although there is no indication of an impact fracture. Certainly the surface of this break is worn similarly to the face of the other projectile point, so it was likely broken prior to deposition. Regardless, breakage in use cannot account for the many shattered blanks and preforms (e.g. unfinished tools), whose very nature precludes their use in conventional hunting or domestic activities where trauma could consistently occur.

Some of the more finely worked artifacts like the refined blades, the projectile points, and the scrapers, are quite thin and would naturally be prone to snapping compared with thicker preforms and blanks. Yet, in spite of this vulnerability, the thin Onondaga projectile point (Fig. 3.1A) is actually the sole intact specimen in the assemblage.

The primary indicator of intentional breakage in the Mt. Albert assemblage is the frequent presence of impact scarring. On twenty-six artifact fragments the locations of points of impact are focused and distinct. Impact points are indicated by small dorsal surface concavities that exhibit concentrated crushing in one area or hollow regions. These are often directly above bulbar swelling ("bulbs of force") and associated eraillure scars on the adjacent broken surfaces (Bergman et al. 1987). Where the adjacent fracture surface can be refit, there is a depression representing the "negative" of the bulbar swelling on that adjacent piece and that is also often accompanied by crushing at the fracture/artifact surface juncture. Most impacts are on the surfaces of artifacts well removed from the artifact edges. If fractures were produced by errors in the knapping process, it follows that impact scars that produce fracturing would originate along the worked edges where platforms are struck to remove flakes. In the event of a missed strike, it is conceivable that a hammer impact could occur slightly away from the worked edge, resulting in a snap/split (similar to Fig. 4.2C), but these would be overall very rare and associated with small edge "bites" where a small semi-lunar section of the tool edge is detached. Such semi-lunar breaks are quite common at Mt. Albert (see below) and are very large as they are struck more deeply back from the edge, which is not something expected in flintknapping activities. Moreover, the general lack of regular biface thinning flakes at the site, discussed in the next chapter, also indicates these breaks are not a result of manufacturing errors. As the impacts are applied to the surfaces of artifacts rather than their edges, the fractures themselves are produced by "bending" of the object well in from the edge.

Such bending forces almost always leave a lip at the juncture of one face of the object and a depression or negative lip groove on the matching other side of the fracture (see Appendix B, Fig. B15). These lips are not distinctive solely of purposeful breakage. For example, breakage due to end shock looks similar to bend breaks because of the presence of slight lipping along fracture edges. End shock, also referred to as remote fractures, occurs when a percussion strike intended to remove a flake instead bends the artifact and causes it to snap in half on the opposite end from the platform where it was struck (Crabtree 1972; Ellis and Deller 2002:69). However, lips are characteristic of mechanical breakage in general and their presence indicates that a fracture was not caused by heating (Deller and Ellis 2011:20).

Overall, while it is true that knapping activities can result in low frequencies of broken artifacts, the repeated series of impacts away from worked edges in an assemblage alludes to a trend that is not accidental. Certainly the common focused points of impact are not what one sees from other forms of breakage, such as a result of agricultural equipment or by trampling. In many instances where impact scars are present at Mt. Albert they occur approximately in the centre of artifact surfaces. Those impacts that do not occur in the centre tend to produce characteristic "edge bite" fractures that are created by superimposed artifacts, which interrupt direct hammer blows (see experiments section below).

4.3 Descriptions of Fractures

In this section the different fracture types that characterize the Mt. Albert collection will be discussed. Notably, and not surprisingly, there is some inter-site uniformity as similar breakage patterns also occur at the Late Paleoindian Caradoc site where purposeful mechanical breakage of an assemblage was demonstrated (Deller and Ellis 2001; Ellis and Deller 2002). At Caradoc three major mechanical breakage types are present, defined as snap, radial, and "complete cone" fractures (Fig. 4.2). The first two of these types are well represented in the Mt. Albert collection (Table 4.3), although complete cone fractures are absent. Instead of cone breaks, however, there are visually similar "edge bite" fractures that produce concave, or "lunar shaped," breaks in artifacts. Additionally, the majority of the Mt. Albert lithics are in a far more fragmentary state than those found at Caradoc. The following refitting study seeks to identify causal variables that created differences between the two assemblages.

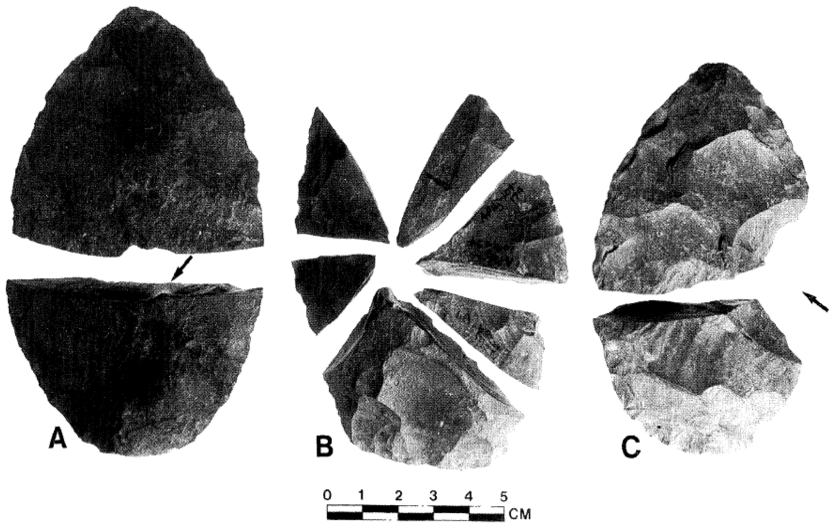

Figure 4.2: Fracture types on deliberately broken bifaces at the Caradoc site; A, snap break; B, radial break; C, complete cone fracture; illustration courtesy of Chris Ellis (from Deller and Ellis 2002). Arrow on A shows location of circular impact point and adjacent bulb of force on one half of the break surface.

As noted, a portion of the Mt. Albert artifacts has been burned, which warrants a discussion of the role fire played in fragmenting objects. Here (Table 4.3) heat fractures are only counted when they are responsible for separating artifact fragments larger than the small, circular pot lids that cause only superficial damage to artifacts. Pot lids are thermally produced fragments of chert that literally "pop out" of artifacts that rapidly expand due to exposure to high temperatures within fires (Purdy 1975). Whereas pot lids are small and saucer shaped, typically no larger than 4 mm in diameter, larger, heat-induced, "crenated" fragments can break off large portions of artifacts. These fractures are characterized by curved or wavy fracture outlines in plan view (Fig. 3.8E). Overall, the damage done by thermal trauma is slight in relation to mechanical breakage.

Across the site 898 artifacts (31.6% of the total assemblage) show signs of thermal alteration (Archaeological Services Incorporated 2014), although after excluding small potlids only six instances occurred where heat damage caused the separation of larger diagnostic artifact fragments (Table 4.3). Diagnostic fragments are here considered to be bifacial or unifacial edges, tips, bases, and ventral and dorsal surfaces without which a given artifact is partially incomplete. This definition is based on artifacts that have been refitted along heat-fractured surfaces (Figs. 3.8C; 3.13B) and artifacts with fragments missing from heat-damaged breaks (Figs. 3.9D; 3.12A, C).

It is clear that the thermal damage that permeates the Mt. Albert assemblage is predominantly superficial and did not contribute to the majority of fragmentation that characterizes the flaked stone artifacts. The presence of many of the pot lids on mechanical fracture surfaces implies that artifacts were burned after they were already broken. Further, the discolouration that characterizes individual pieces of refitted artifacts with definitive heat damage could only have happened after the fragments were already separated since other fragments of the same artifacts are unburned and not discoloured. Thus, artifacts were mechanically broken with force prior to one or more sequences of burning. It is probable the burning was caused by land clearing activities such as burning stumps or by post-occupational brush or forest fires and as such it only affected some fragments of artifacts.

Turning to the mechanical fracture types, snap breaks develop relatively even breaks transversely across the bodies of artifacts. Prominent lips typically occur at the point of separation at one juncture of the break and an artifact face. For the purposes of this study, snap breaks are defined as when an artifact has been split into two fragments. This results in minimal shatter compared with the radial fractures described below, and identified lips are usually more prominent on such snaps. While it is more difficult to identify additionally induced fractures (e.g. multiple blows) on artifacts with known radial breaks, as those items have fractured along multiple paths, snap breaks are easily recognizable due to their singular breakage and usually obvious impact scars. Therefore, it is possible to identify artifacts that have been snapped multiple times or exhibit a combination of snap breaks and edge bite fractures even though snap breaks can be initiated by edge bites similar to the cone fractures at the Caradoc site (Ellis and Deller 2002:73).

A second type of fracture is the radial break where several cracks/fractures radiate out from the point of impact and produce multiple fragments (e.g. Fig. 4.2B). Radial fractures propagate from the point of impact, breaking off multiple fragments with acute outline angles diagonally across the artifact. Forces that cause radial fractures tend to leave distinctive points of impact characterized by hollow or crushed voids, from which compression fractures travel through artifacts and terminate in three or more blocky wedge-shaped pieces (Jennings 2011:3645). Often, directly beneath these impact marks are bulbs of percussion, eraillure scars, and associated lipping along fracture surfaces. By their nature, radial fractures produce multiple wedge-shaped lines of breakage within an artifact due to the character of Hertzian fracture mechanics, which initiates concentric rings of force that produce radiating cracks (ibid.). Objects with multiple snap breaks are therefore distinguishable from radial fractures largely because of the central orientation of radial fracture initiations.

Overall, identifiable snap breaks occur more frequently than radial fractures in the refitted artifacts from Mt. Albert (Table 4.3). This difference is largely due to the high degree of fragmentation caused by a single radial fracture, which complicates refitting efforts, and the fact that some artifacts were struck multiple times and exhibit two or more snap breaks (see below). Considered in terms of raw numbers of fragments, pieces that exhibit apparent radial-like breaks (e.g. more triangular to pie-shaped pieces) greatly outnumber those that show signs of snap breaks (Table 4.4).

When pressure is applied to the centre of artifacts two types of forces occur: bending and compression. The first is largely responsible for the snap breaks described above, while the latter typically results in radial fractures. When there is little opposing force via a resisting surface underlying a given artifact, impacts result in “bending” fractures that split objects transversely (Cotterell and Kamminga 1987: Figure 15). Snap fractures can also initiate from bulbs of force/percussion formation at the point of impact with a hammer, which propagates lateral force through artifacts (Jennings 2011). Curiously, even on snap breaks that were produced by percussion, bulbs of percussion can be absent, which makes differentiation between fracture types difficult (Deller and Ellis 2001). Ellis and Deller (2002:70) alternately propose that snaps lacking identifiable impact points may have been produced by hand pressure or from knapping error, although the latter scenario is unlikely given the relative absence of knapping activities at Mt. Albert (see chapter 5). In contrast to bends, when underlying force resulting from good support of artifacts is applied to the surface opposite to the point of impact, compression fractures tend to radiate outwards along two or more lines of force, resulting in the radial fractures.

Semi-lunar shaped “edge bites” are variations of snap breaks that produce concave fracture surfaces on artifacts. The “edge bite flakes” produced by these snaps are similar to biface thinning flakes, except they have a pronounced lip that is broader than those on biface thinning flakes. These edge bite flakes initiate further in on the biface surface from the edge than biface thinning flakes, which are struck and initiate on or near to the edge (Fig. 4.3B, E). Biface thinning flakes are typically thin, long and flat with a short striking platform and multiple, older flake scars along their dorsal surfaces (Whittaker 1994:186-187). As the name implies, biface thinning flakes reflect efforts made to thin the cross-sections of bifaces and remove undesirable portions of the exterior of a core, such as cortex. These flakes often exhibit a small ventral lip connected to the striking platform, which is a residual portion of the biface edge.

Edge bite flakes can be produced in two ways. The first, which happens during normal flintknapping activities, occurs when a striking platform is made too strong so that the initiating fracture develops away from the platform and removes a flake at a steep angle (Whittaker 1994:190). The second is manufactured by direct impacts to the surface of artifacts away from the worked edges, whereby a snap break occurs that develops the “lunar” shaped outline of an edge bite. Missed hammer blows can produce this pattern during attempted flake removals, and direct impacts that were directed away from the centre of artifacts can similarly remove distinctive “bites” from bifacial edges (see breakage experiments below). Additionally, edge bites can initiate prior to lateral breaks that sometimes terminate in snap fractures across artifacts (Bonnichsen 1977).

Edge bite flakes are typically thick and blocky. Adjacent to the dorsal striking platform is a right-angled, concave fracture surface approximately as thick as the artifact from which it was removed, which transitions into an elongated thinner flake termination. The shape of the thin flake segment on edge bites caused by flintknapping is often contracting in plan, and results in a feathered, pointed end. In contrast, the flake remnant segment on edge bites caused by direct blows is often marginal, as the force of impact fails to travel laterally across the surface of the artifact. Because bipolar percussion produced lunar-shaped edge bite snaps in the Mt. Albert collection, underlying anvils often crushed any distal thin flake remnants that were removed along with the edge bite snap fragment. Additionally, expanded thin flake segments that remain attached to the edge bite "platform" segments are relatively short compared with similar flakes produced during flintknapping activities. The high amount of force required to fracture such thick biface fragments, compared with thinner biface edges, means that flake remnants at Mt. Albert are little more than slightly elongated lips.

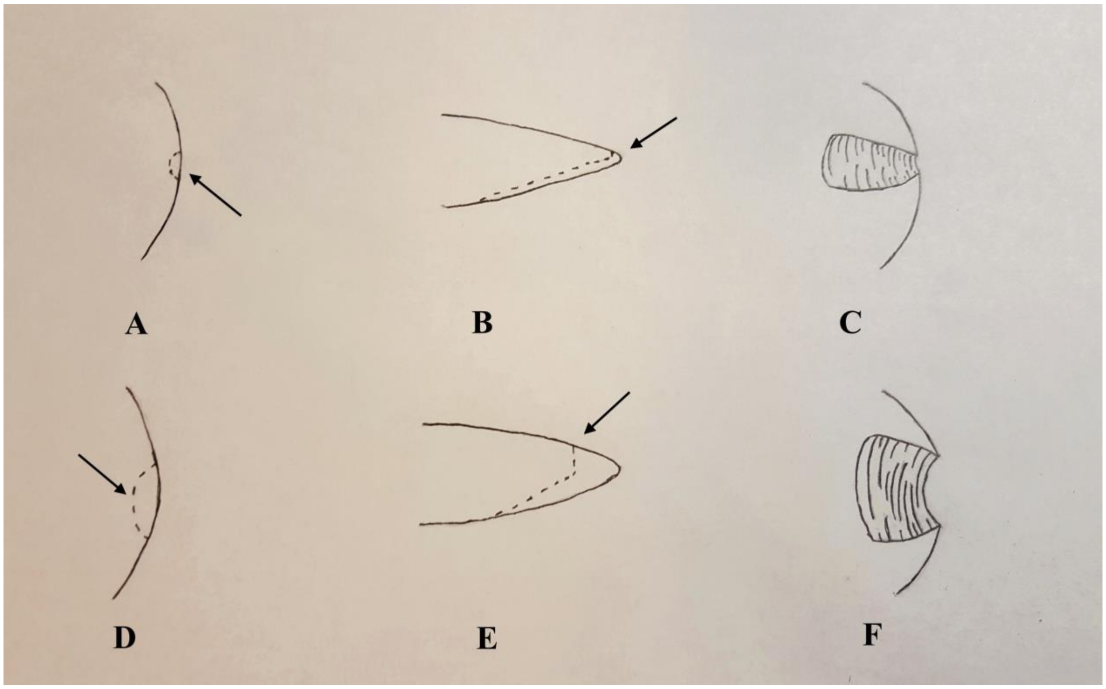

Figure 4.3: Biface thinning flake (A-C) compared with edge-bite flake (D-F); A, D, dorsal surface of bifaces, arrows show location of hammer strikes along bifacial edges; B, E, cross-section view of bifaces with flake terminations, arrows show location of hammer blows on striking platforms; C, F, ventral surface of bifaces with flake scars.

Normal flintknapping activities produce a relatively low amount of edge bite error flakes. As an example, at the Late Archaic Davidson site (Ellis et. al 2015; Kenyon 1980) data collected by the author revealed 372 chert biface thinning flakes but only 18 edge bite flakes that resulted from knapping errors. In contrast, at Mt. Albert there are 21 biface thinning flakes compared with 22 edge bite snap fractures. Therefore, as an objective measure of flintknapping activities, it stands that a low percentage of error flakes are produced only after a large number of various other flake types accumulate. Given the very low amounts of flintknapping that occurred at Mt. Albert (see Chapter 5), it is clear that the numerous edge bites were not caused by errors in the knapping process.

The fragments at Mt. Albert are similar to edge bite error flakes caused during flintknapping activities, although the striking platform, or the distance between the location where the artifact was impacted and the worked edge, is on average much thicker in the Mt. Albert collection than in the Davidson assemblage. This difference in size is present because, on average, artifacts were struck much farther from the worked edge at Mt. Albert (19.6 mm; Table 4.1) than the bifaces that were struck at the Davidson site (9.6 mm), where edge bites have relatively shallow/short platforms (Table 4.2). Differential fracture mechanics are primarily responsible for this dissimilarity, as the Davidson examples are the product of recurring flintknapping sessions, while it is clear, as stressed several times herein, that negligible amounts of knapping occurred at Mt. Albert (see chapter 5).

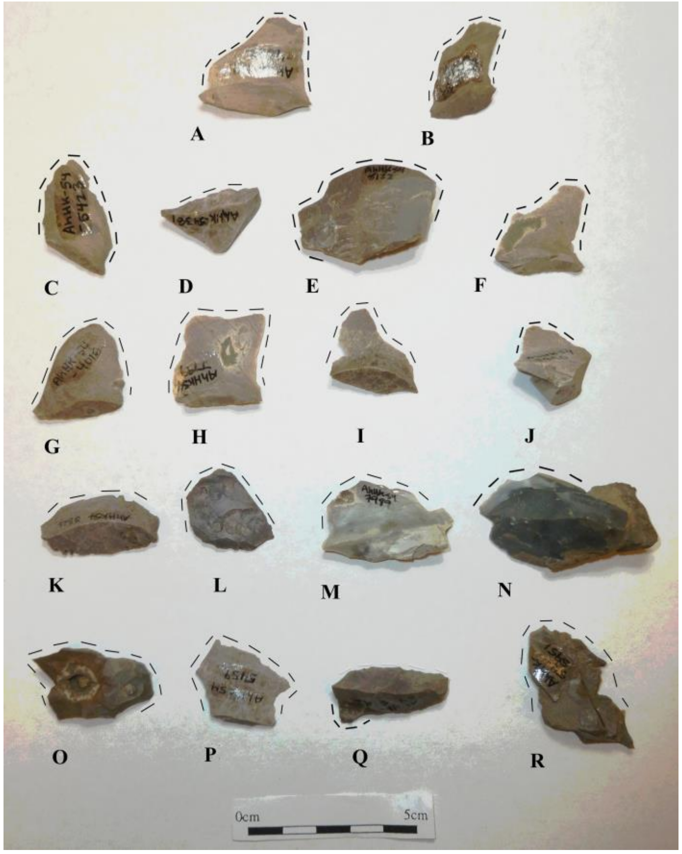

Figure 4.4: ”Edge bite” flakes from the Davidson site; broken lines show length of flake remnants.

Table 4.1: Platform measurements on “edge bite” flakes from the Davidson site (Fig. 4.4); all measurements in mm.

Edge Bite	Platform Length	Platform Width
A	32	8.7
B	19.9	7.9
C	18.5	5.1
D	28.7	7.6
E	41.3	14.5
F	26.4	8.1
G	26.3	7.7
H	23.1	5.8
I	27	8.7
J	26.8	13.3
K	34.5	13.3
L	21.2	4.9
M	35.9	9.5
N	46.6	20
O	30	8.2
P	19.3	5.6
Q	33.9	13.2
R	29.1	12.2
Average	28.9	9.6

Edge bites at Mt. Albert are indicative of direct impacts to the surfaces of artifacts, and are often situated to one side of an artifact rather than in the centre. At Mt. Albert edge bite snaps also occur that do not leave intact edge bite fragments. Rather, the force from the impact terminates in multiple step fractures, or heavy crushing, instead of leaving a smooth distal fracture surface. These impacts cause the struck biface edge to shatter into multiple small pieces. This result suggests that something impeded the energy of the blows that produced fractures. It is possible that this feature is partially a function of variable raw material quality, given that Colborne artifacts only exhibit lunar shaped edge bites that mostly resulted in feather terminations.

On Onondaga artifacts, seven edge bite fractures with evident crushing occur. As will be discussed in greater detail below, breakage experiments show that impacts that result in shattered edge bite pieces are likely the result of interrupted hammer strikes, which can be caused by overlying objects. Instead of directly striking the dorsal surface of artifacts with edge bites, superimposed objects absorb energy from the intended strike,

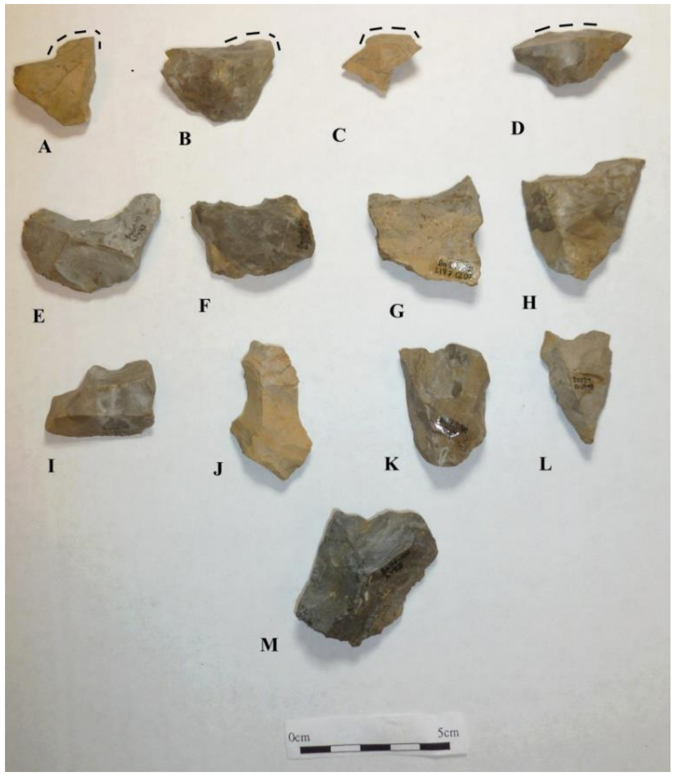

Figure 4.5: Edge bite snap fragments from the Mt. Albert site; A-D, edge bite snap fragments; E-M, artifacts with lunar shaped edge bite snap fragments removed; broken lines show length of thin flake remnants.

and the underlying artifacts are struck by the follow-through of the swing. The follow-through swing carries less force than uninterrupted hammer blows, which contributes to halted impacts and the development of multiple step fractures in close proximity to each other (Fig. 4.7). That these impacts are lighter than direct strikes is alluded to by the presence of artifacts with edge bite fractures that did not additionally transversely snap/split the objective piece as well as cause the edge bite removal (Fig. 4.6). Further, impacts that caused lunar shaped snap fractures but not lateral snaps occur near to the external margins of artifacts, rather than in the centre of artifact surfaces. This evidence suggests that overlying artifacts deflected hammer strikes from impacting a central area on the bottom artifact.

Considered with the presence of bipolar impact damage to other artifacts (Fig. 3.8A; 3.8B), it is valid to argue that artifacts with incomplete edge bite fractures were in contact with other artifacts situated above. This possibility suggests that these artifacts with lunar shaped edge bite fractures were used as anvils to break overlying objects. At the very least it is clear that multiple artifacts were broken together, rather than individually broken and subsequently piled together as fragments.

Table 4.2: Platform measurements on edge bites from Mt. Albert (Fig. 4.5); A-E, edge bite snap fragments; Fig. 4.9, biface fragments with edge bite snap fragments removed; all measurements in mm.

Edge Bite Snap	Platform Length	Platform Width
A	27.9	22
B	39.7	22.8
C	28.5	15.6
D	40	15.7
E	37	22.1
F	37.9	
G	33.3	
H	27.2	
I	22.6; 26.5	
J	33.9; 24.3	
K	16.4	
L	22.2	
M	29.6	
Fig. 4.6A	34	
Fig. 4.6B	25.3	
Fig. 4.9A	46.6	
Fig. 4.9B	20.2; 26.2	
Average	29.9	19.6

4.4 Early-Stage Bifacial Fracture Patterns

There is some commonality in the way early stage, thick bifaces fragmented. It would be very difficult to snap the biface in Fig. 3.8B given the fact that it is the thickest chert artifact in the collection (Table 3.4). It was snapped in three roughly even pieces, similarly to the relatively thick biface in Fig. 3.8A. It necessitates a high degree of mechanical force to snap such thick objects and it is likely that their robustness contributed to their fragmentation into large snapped pieces, rather than radially fracturing or simply deteriorating into blocky shatter like the majority of artifacts.

Unique to thick bifaces is the presence of pyramidal midsections that have three perpendicular fracture surfaces from which their bifacial edges have been entirely

Figure 4.6: Arrows show locations of concave snap breaks; A, biface with both radial and edge bite remnants; B, biface with two edge bite remnants is otherwise intact.

Figure 4.7: Closeup view of crushing, or "rebound flakes" produced by contact with underlying artifacts while struck; close-up view of right side of Fig. 4.6B; arrow shows location of bipolar impact.

Table 4.3: Discrete fracture types present on artifacts depicted in chapter 3.

Artifact	Number of Pieces	Radial	Snap	Edge Bite	Heat
Projectile Point Fig. 3.1b	1		1		
Projectile Point Tip Fig. 3.2B	1		1		
Bifacial End Scraper Fig. 3.11	2	1			
Drill Base Fig. 3.10A	1		1		
Drill Tip Fig. 3.10B	1	1			
Refined Preform Fig. 3.2A	2		1		
Refined Preform Fig. 3.2E	1				1
Semi-Refined Biface Fig. 3.2C	1		1		
Semi-Refined Biface Fig. 3.2D	1	1			
Semi-Refined Biface Fig. 3.2F	1		1		
Semi-Refined Biface Fig. 3.2G	1		1		
Semi-Refined Biface Fig. 3.2H	1		1		
Semi-Refined Biface Fig. 3.2I	1		1		
Colborne Fig. 3.3A	2	1			
Colborne Fig. 3.3B	4	1			
Colborne Fig. 3.3C	3			1	

Artifact	Number of Pieces	Radial	Snap	Edge Bite	Heat
Colborne Fig. 3.3D	2	1			
Colborne Fig. 3.3E	5	1			
Colborne Fig. 3.3F	4	1			
Colborne Fig. 3.3G	6	1			
Colborne Fig. 3.3H	2	1			
Ovate Fig. 3.4C	1			2	
Ovate Fig. 3.6B	3	1			
Ovate Fig. 3.6C	3			2	
Ovate Fig. 3.6D	3	1	1		
Ovate Fig. 3.6E	1		1		
Ovate Fig. 3.6F	2	1			
Early stage Ovate Fig. 3.7A	1		2		
Quarry Blank Fig. 3.7B	2	1			
Early stage Fig. 3.7C	1		1		
Early stage Fig. 3.7D	1		1		
Early stage Fig. 3.7F	1		1		
Quarry Blank Fig. 3.8A	3		1	1	
Early stage Fig. 3.8B	3		1	1	
Quarry Blank Fig. 3.8C	4	1			1
Early stage Fig. 3.8D	2		2		
Early stage Fig. 3.8E	3	1		1	
Early stage Fig. 3.8F	3	1			
Early stage Fig. 3.9A	1	1			
Quarry Blank Fig. 3.9B	2	1			
Biface Fragment Fig. 3.9C	5	1			
Biface Fragment Fig. 3.9D	2		1		2
End Scraper Fig. 3.12A	1		1		1
End Scraper Fig. 3.12B	1		1		
End Scraper Fig. 3.12C	1		1		1
Side Scraper Fig. 3.13A	2		2		
Side Scraper Fig. 3.13B	3		2		1
Side Scraper Fig. 3.13C	2			1	
Core Fig. 3.14	1		2		
Primary Flake Fig. 3.15	3			1	
Primary Flake Fig. 3.16	2		1		
Total:	106	20	31	10	6

removed (Fig. 4.8). It is very likely that bipolar forces contributed to this even breakage pattern. In Fig. 3.8A one snap fragment was removed from the lateral margin, and instead of snapping the artifact in half (see Fig. 4.2C), the artifact snapped transversely along two

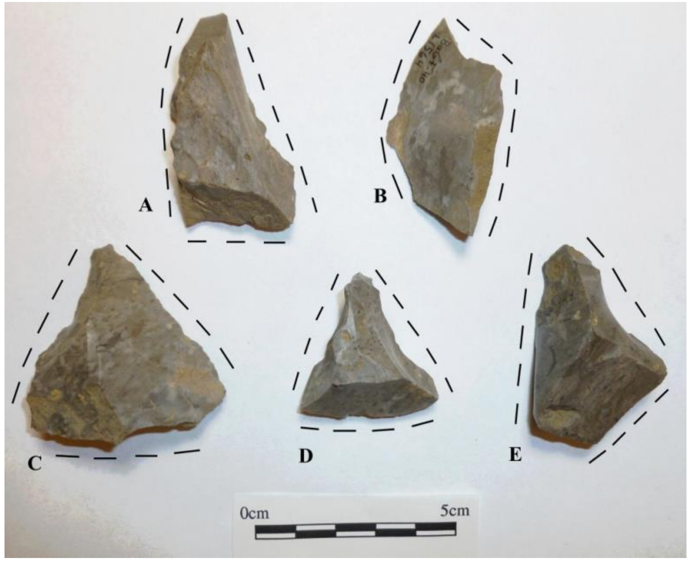

Figure 4.8: Pyramidal midsections of thick bifaces; B, midsection from Fig. 3.8A; C, midsection from Fig. 3.8B; broken lines denote discrete fracture surfaces, note the presence of three fracture surfaces on each midsection.

fracture lines, producing three blocky fragments. The proximal fragment was likely a direct result of the first snap fracture because of the close proximity of the second, proximal snap to the initial impact scar. On the reverse side in the centre of the biface surface are two well-defined impact scars that initiated the splitting of the distal fragment, so it is likely that without bipolar forces, the biface would not have split a second time.

The thicker biface in Fig. 3.8B was, similarly to the other thick biface (Fig. 3.8A), initially struck along its lateral margin, although the edge bite fracture terminated in a deep step fracture that caused the remaining proximal section of the lateral edge to break off. The first proximal snap fracture runs transversely across the biface from the middle of the impact scar. Pitting and impact scars along the reverse side of the distal snap suggest that underlying objects were responsible for this second bend break.

Although refitted fragments carrying obvious impact scars are missing from three of these pyramidal fragments (Fig. 4.8A, D, E), the identical breakage of the other two thick bifaces suggests that similar processes contributed to the production of these pyramidal midsections. Though they are roughly wedge-shaped in plan it is unlikely that they were radially fractured. Radial fractures most often produce pieces with two fracture surfaces meeting at acute angles (Fig. 4.2A), rather than three. These pieces with three intersecting fracture surfaces were broken by two or three impacts so that all of their bifacial edges snapped off. The remaining fragments are therefore only the “midsections” of bifaces that have had their margins removed. Thus, it is likely that these artifacts were struck multiple times to initiate three perpendicular fractures laterally through bifaces.

4.5 Refined and Semi-Refined Biface Breakage Patterns

In Fig. 3.2 all of the refined and semi-refined bifaces exhibit snap breaks, with the exception of two (Fig. 3.2D, E). The propensity for these artifacts to snap is likely a function of their thin cross-sections, as they are thin enough that a blow directed to their central regions can easily fracture them, whereas more robust artifacts are more easily snapped along their thinner edges. Only two of the preforms with snap breaks (Fig. 3.2C, G) show signs of slight crushing due to impacts, while all other artifacts have bulbs of percussion on fracture surfaces that reveal where they were struck. Invariably, these indicators of breakage occur in the centre of artifacts, away from worked edges. One preform (Fig. 3.2A; 3.6A) displays pronounced lipping along its fractured surface, which suggests that the artifact was bent with greater force than the other snapped artifacts given their minor lipping. Greater tensile stress on this artifact may be a result of differential underlying surfaces between objects, or it is possible that it was snapped by hand given its thinness and lack of distinct impact scar and bulb of percussion (Ellis and Deller 2002:70).

Both the Kettle Point projectile point (Fig. 3.1B) and the Onondaga point tip (Fig. 3.2B) exhibit flat snap breaks without identifiable lipping or impact scars. Fracture surfaces on both artifacts show similar weathering to their flaked surfaces, so it is clear that they are both old breaks, rather than recent snaps due to ploughing activities. Both are quite thin (6.9 mm and 4 mm thick, respectively; Table 3.1; 3.2), so it is possible that they were simply broken by hand pressure or by light blows that snapped artifacts without leaving impact scars or bulbs of percussion. Alternately, it is possible that both were broken during use as cutting implements or projectiles, especially since the former came from 30 m away from the main concentration of debris, and may have resulted from different site activities than those suggested by the feature assemblage.

The commonality in snapping semi-refined bifaces suggests that these artifacts may have been subjected to different patterns of breakage than other less refined artifact types in the Mt. Albert collection. Particularly, the preponderance of snap breaks implies that fracturing these objects was not complicated by contact with other artifacts. Additionally, care seems to have been taken to leave pointed tips intact, whereas the worked features of other knapped artifacts have been virtually obliterated by heavy impacts and radial fractures. This difference raises the possibility that refined and semi-refined bifaces were broken individually, possibly to ensure the preservation of valued aesthetic traits.

The most complete refined blade (Fig. 3.2E) appears to have been damaged by thermal shock. The breakage pattern has resulted in a wavy, curved fracture that is reminiscent of heat-damaged artifacts at the Crowfield site (Deller and Ellis 2011) rather than the wedge-shaped radial fractures that characterize much of the Mt. Albert assemblage. Three "pot lids," saucer shaped fragments that pop out of the surface of chert objects when they are rapidly heated, are present on both faces of the blade. There is no surficial impact scarring present that indicates the biface was struck, so it is likely that its thin profile was primarily damaged by rapid heating.

The profile of one other preform (Fig. 3.2D) is similarly shaped, although its thicker size likely contributed to the complete termination of fractures through the material. One area of crushing on the reverse side reveals the central location of a single impact, which separated the artifact into at least three additional wedge-shaped fragments. This object was extensively burned and contains at least 24 pot lid scars, three of which occur on fracture surfaces. These three pot lids indicate that the artifact was burned after being mechanically broken.

4.6 Ovate Biface Breakage Patterns

Most of the refitted Colborne ovate bifaces exhibit comparable radial breakage patterns (Fig. 3.3). All show a central orientation of fracture lines and four in particular (Fig. 3.3B, D, E, G) have evident impact scars at the centre of fracture lines. All of these artifacts were only struck once and minimally fragmented into multiple wedge-shaped pieces without large quantities of extraneous shatter. Two breaks followed along four fracture lines to produce cross-like breakage surfaces (Fig. 3.3B, E), two followed along three breakage surfaces to produce Y-shaped fracture lines (Fig. 3.3D, F), and one produced at least four fracture lines resembling the pie-shaped wedges from the Caradoc site (Fig. 3.3H; Fig. 4.2B). One biface segment (Fig. 3.3A) has a distal flat fracture surface along with a pronounced bulb of percussion that split the artifact transversely. This large fracture is essentially a snap break that subsequently fractured diagonally to produce the two refitted fragments depicted.

Only one refitted Colborne biface (Fig. 3.3C; 4.6A) has an edge bite fracture. The destructive impact removed an intact, crescent-shaped edge bite from one margin, and the remaining biface fragment snapped transversely exactly in the middle of the point of impact. The impact scar is slightly off-centre, which is probably the reason the artifact broke into lunar shaped snap fragments rather than breaking radially. Because the impact produced an intact edge bite, it is probable that the biface was struck directly on its dorsal surface without interference from superimposed objects.

There is no evidence of bipolar reduction on any of the Colborne artifacts and fragments are generally more intact than their Onondaga counterparts. This absence lends credence to the suggestion that certain artifacts were differentially smashed. Given the smaller number of Colborne artifacts compared with Onondaga artifacts, it is possible that Colborne objects were broken together, but fewer were present to complicate the breakage of individual tools. It may even be that a different individual fractured these Colborne items versus the Onondaga ones. These scenarios would require the separation of chert types at the times they were destroyed, which is not possible to determine given the intermixing of artifact fragments (see chapter 6).

Onondaga ovate bifaces are more variable in breakage content than Colborne artifacts. Apart from the incomplete edge bite fractures already discussed, only one additional Onondaga ovate biface shows signs of concave snap fractures (Fig. 4.9B). This biface has two discrete edge bites. The first, deeper fracture (Fig. 4.9B, right side) produced a shallow concavity that terminated by snapping the biface in half at the point of impact. The larger fragment was subsequently struck again, adjacent to the initial break. This second blow produced more crushing along the fracture surface and caused the remaining fragment to snap adjacent to the point of impact. The middle fragment was later burned, while the other two fragments are undamaged by thermal trauma.

Radial fractures in the Onondaga bifaces are more common than edge bites. Ten refitted Onondaga ovate and early-stage bifaces were subjected to radial fracturing (Table 4.3). Of these, four (Fig. 3.6B; 3.6F; 3.7B; 3.9B) were only struck one time and produced multiple wedge-shaped fragments similar to the classic radial fractures at Caradoc (Fig. 4.2B). Two refitted bifaces (Fig. 3.8C; 3.9C) have fragmented along numerous irregular fracture paths in addition to radial fracture initiations, and it is likely that bipolar forces contributed to their maximal fragmentation. As will be shown in the breakage experiments below, breakage of artifacts on top of other stone objects produces the multiple small, angular, and blocky fragments that form the pieces of these two bifaces (Fig. 3.8C; 3.9C).

Figure 4.9: Edge bite fractures on ovate bifaces; arrows point to negative bulbs of force; A, biface from Fig. 3.3C; B, biface from Fig. 3.6C.

Two radially fractured bifaces (Fig. 4.10) are identical in the way they were broken. They both have a rounded bifacial end, from which more than two overlapping, smaller fragments were radially broken off, leaving pronounced lipping along the fracture terminations of the remaining bifacial bases. Although there are no visible impact scars present, they were struck in their centre of mass, near the pointed apex where the two fracture surfaces converge. The initial impacts caused at least three fracture paths to travel through each biface, and after radial fracture paths were initiated it is likely that energy from the broad hammerstone contributed to snapping fragments along the radial fracture lines, which produced prominent lipping.

Some artifacts were struck multiple times and exhibit multiple fracture types. One biface (Fig. 3.6D) has one radial fracture, which removed the proximal half of the biface, and one additional snap fracture along its distal margin, which removed the two refitted pieces from the larger fragment. The snap fracture exhibits a point of impact, which broke off two fragments due to the artifact's thinness (9.9 mm; Table 3.4). The L-shaped fracture pattern developed as a result of the low tensile strength of the thin artifact, as two snap fractures were produced by a single impact.

Figure 4.10: Radially fractured biface fragments; A, base from Fig. 3.8F; B, biface fragment from Fig. 3.9A; broken lines indicate overlapping fracture paths.

Another biface with one edge bite also exhibits an adjacent radial break (Fig. 3.8E; 4.3A). Because the initial edge bite fracture failed to snap the biface, instead leaving a crescent shaped void, the biface was struck again at the opposite end to ensure its fragmentation into multiple pieces.

Altogether there are eight refitted Onondaga ovate and early stage bifaces with snap fractures (Table 4.3). Where points of impact (indicated by surficial depressions) occur they are almost invariably in the centre of artifacts, away from worked edges (Fig. 4.11). Four artifacts have at least two snap breaks resultant from separate hammer blows. One (Fig. 3.7A) was struck close to both of its lateral margins, which snapped only the edges from the artifact. Three others exhibit impact scars and bulbs of force that reveal they were snapped transversely twice (Fig. 3.8D; 4.8A, B). The presence of centrally placed impact scars on their surfaces suggests that they were purposely struck multiple times, possibly because the resulting fragments were considered to be too complete after the first snap.

Three other biface fragments exhibit artifacts that were split in half. One relatively thin ovate biface was transversely snapped with what was likely a light impact to prevent its fragments from overtly shattering (Fig. 3.6E). Another is an early stage biface that still retains a large bulb of percussion and broad striking platform of the original flake blank (Fig. 3.7F). It was struck in its centre and the artifact snapped neatly in half. The last biface of note appears to be snapped lengthwise, although it was also badly burned, so it is difficult to identify other causes of mechanical breakage (Fig. 3.9D). Notably, discolouration indicative of charring occurs on only one fragment, which indicates that burning occurred post-snap.

Figure 4.11: Snap fractured bifaces; arrows point to impact scars.

4.7 Other Artifact Breakage Patterns

Two Onondaga drill fragments, as noted earlier, may have been part of the same artifact prior to fracturing given that both a base and tip are present to the exclusion of any other identifiable drill segments (Fig. 3.10). The fracture surface on the base exhibits a deep lip, which may be the product of a snap break induced by pressure, although impacts can produce similarly massive bending of artifacts. The tip is unilaterally fragmented, which may suggest that the complete drill was struck at some point on its shaft. It is also possible that the fragments were broken while in use, as it is probable that vigorous drilling would produce enough pressure to snap the relatively delicate drill "bit."

Scrapers have distinctive breakage patterns that primarily result from their delicate profiles, which are easily broken. The sole bifacial scraper was struck close to its edge and fractured into radial segments (Fig. 3.11). Because the impact was so close to the edge, one fracture path removed one entire worked edge (not recovered), while the other split the scraper in half transversely.

Two end scraper fragments are relatively uniform in their breakage (Fig. 3.12A, C). These end bits have multiple pot lids across their dorsal surfaces and on fracture surfaces, so it is difficult to identify whether their primary source of breakage was mechanical or by heat damage. The ventral surface of one scraper bit (Fig. 3.12C) carries long hinge fractures that may be the result of a heavy blow to its dorsal surface, which removed flakes from the opposing face. In this context it is probable that the body of this scraper was shattered under heavy force. The more intact end scraper is apparently undamaged by mechanical force and is unburned, so the striking platform along its distal edge is present from when it was removed from a core as a primary flake (Fig. 3.12B; 3.12B).

Side scrapers exhibit relatively light damage in comparison with end scrapers. The thinnest scraper exhibits a clear snap break and could have easily been snapped by hand or by being stepped on since it falls beneath the 7mm thickness threshold for trampling damage (Fig. 3.13A; Weitzel et al 2014). Breakage due to trampling is unlikely because it was snapped neatly into two halves and does not exhibit the extraneous shatter and radial fractures that irregular points of impact during trampling causes. This artifact is the best candidate in the collection for a snap break resultant from hand pressure given a lack of impact scarring and pronounced lipping that indicates the scraper's tensile capacity was exceeded. Similar forces to those that broke the majority of bifacially flaked artifacts would have heavily fragmented the scraper's relatively fragile form, so it is possible that this object was snapped with care to preserve the shape of its pieces.

One thicker side scraper exhibits two snap fractures (Fig. 3.13B). One fracture was initiated by a heavy blow that left a distinct impact scar, while the other break occurs at a right angle and no Hertzian cone is present, although there is one eraillure scar, which suggests that a bending force initiated the second fracture. The final side scraper was broken by a single edge bite fracture that snapped the object transversely (Fig. 3.13C). It was struck on its ventral surface near the edge. Because this artifact is a unifacially retouched primary flake, and considering the location of the fracture beside the edge, it is possible that it was broken accidentally while attempting to remove flakes from a platform.

A single core has two snap breaks, but exhibits no impact scars or signs of Hertzian force, which implies that it was snapped by the application of heavy pressure rather than impacts (Fig. 3.14). It is also possible that the core was struck on both of its proximal and distal ends, which caused downward force to snap the core away from the point of impact. Additionally, it is possible that pressures involved with detaching flakes from the core contributed to snapping this object.

Two primary flakes were mechanically broken through percussion. One broad flake was struck in its centre and exhibits radially fractured wedge-shaped fragments (Fig. 3.15). The second was struck with significant force that snapped the thick flake and expelled the intermediate fragment between fracture surfaces (Fig. 3.16).

Table 4.4: Fragments with identifiable fracture types, excluding those in Table 4.3.

	Radial Fragments	Snap Fragments	Edge Bite Fragments
Colborne	103	11	7
Onondaga	139	47	12

In Table 4.4 all remaining artifact fragments were counted that are mostly not refitted, with the exception of seven objects that contain two refitted pieces, one object that contains three, and one that contains four refitted pieces. All fragments were counted that have at least one flaked surface that represents the ventral or dorsal face of an artifact. Artifacts were categorized as being fragments of radial breaks when they exhibit multiple breakage surfaces such that their profiles are roughly wedge-shaped or resemble the blocky fragments from the centre of radially broken artifacts. Snap breaks were identified based on the presence of one breakage surface that cuts across objects transversely such that breakage would have divided artifacts into two pieces. Edge bite fractures are defined as complete edge bite fragments and objects with concave fracture surfaces, from which complete and incomplete edge bites were separated.

It is possible to account for the far higher proportion of radially broken fragments by the fact that radial breaks produce far more pieces due to multiple fracture lines. Snap breaks alternately produce larger, more intact fragments that leave central areas relatively undamaged. Edge bite fragments are difficult to identify in highly fragmentary pieces because of the general paucity of intact edge bite flakes in the collection, and due to the fact that artifacts that additionally snap from lunar shaped edge bite snap fractures can often be misidentified as radial fractures due to the presence of multiple fracture surfaces.

4.8 Experimental Breakage

This section will discuss the experimental breakage of bifaces in order to gain insight into the nature of artifact destruction at Mt. Albert. Similarities in fracture content between the experimentally broken biface assemblage and the Mt. Albert artifacts are used to examine specific strategies for purposeful breakage. This approach offers the potential to compare artifact fragmentation activities at other sites within the Northeast.

This experimental breakage builds off the work of Ellis and Deller (2002), but seeks to identify causal variables for differential breakage patterns between the Caradoc and Mt. Albert toolkits. Significant is the fact that both sites consist of what was likely an individual or group’s toolkit. Conspicuously absent from these sites are the elaborate and hypertrophic artifacts frequently found with caches and burials throughout the Eastern Woodlands of North America.

These experiments hold significance not only for understanding how the Mt. Albert assemblage was intentionally destroyed, but also for delineating the limits of refitting efforts. Given the amount of miniscule shatter that is produced with each hammer blow, refitting will be a more successful endeavour only to the extent that the interfaces between larger biface segments remain unmolested by excessive crushing.

The importance of experimentally breaking artifacts while in contact with one another has been explored by Jennings (2011) and Weitzel et al. (2014), who recognize that artifacts are rarely broken as singular objects isolated from toolkits. Although artifacts at the Caradoc site were seemingly fractured individually (Ellis and Deller 2002), large numbers of artifacts broken in close proximity to one another can confound interpretations by producing large numbers of intermingled fragments.

The inordinately high frequencies of angular fragments recovered from Mt. Albert raise questions about their origins. Of particular importance is the method of shattering stone tools, as understanding of this will garner unprecedented insights into cultural conceptions of stone tools for Laurentian Archaic people.

Breakage experiments were conducted on reproduction Onondaga bifaces produced by expert flintknapper Dan Long. Eight replica bifaces were experimentally broken to gain insights into the specific behaviours that contributed to fracturing stone tools. The replicas are similar to the Mt. Albert refined and semi-refined artifacts in terms of size and shape, and ovate bifaces in terms of overall width/thickness ratios (Table 4.5).

Table 4.5: Metric attributes of experimentally broken bifaces; all measurements in mm.

Reproduction	Length	Width	Max Thickness	Thickness at Impact	Width/Thickness Ratio
Anvil	80.4	70.4	15.2	9.6	4.63
Biface on Anvil	82.9	55.9	15.5	13.4	3.61
Multiple Impacts	81.3	70	16.7	14.2; 13.3	4.19
Radial	88.8	58.2	15.1	15.1	3.85
Green	96.8	56	13.9	11.8	4.03
Yellow	89.4	57.7	13.8	13.4	4.18
Red	87.7	68.9	16.1	6.7	4.28
Blue	80.8	67.4	19.3	17.2	3.49

The hammerstone that was used to fragment all of the experimental bifaces is a similar size and weight to the hammerstone recovered from Mt. Albert (Table 3.6; 4.6). It has accumulated characteristic pitting in one roughly circular cluster on its ventral surface due to its use as a percussor (Fig. 4.12). Outliers beyond the central cluster of pitting were caused by impacts that struck multiple fragments simultaneously. Striking an artifact and an anvil in the same hammer swing contributes to this distinct patterning, as the follow-through swing often makes contact with the anvil at the edge of the hammerstone. This shows the high degree of damage that a hammerstone with a broad striking surface can impart on single and multiple artifacts.

Table 4.6: Metric attributes of experimental hammerstone; all lengths in mm.

	Length	Width	Thickness	Weight
Hammerstone	105.8	80.6	48.9	689g

A variety of strategies were taken to fracture bifaces in order to understand and reproduce the patterns present at Mt. Albert. One biface was delivered a single sharp blow to its central face in order to reproduce the distinctive radial fractures that have been identified by Deller and Ellis (2002; Ellis 2009; Fig. 4.13). At the point of impact on this radially fractured biface six smaller pieces of angular debris without flaked dorsal or ventral surfaces were removed from the interfaces between larger flaked sections (see Appendix B, Fig. B15). These are called here "intervening fragments". The removal of

Figure 4.12: Hammerstone used to experimentally break bifaces.

these intervening fragments creates a visible void between two broken surfaces that potentially limits the amount of refit pieces that can be rejoined. Significantly, the maximum number of possible refits is limited by the smallest sizes of shatter that are produced.

Figure 4.13: Radially fractured biface with associated angular fragments.

Some artifacts in the Mt. Albert collection exhibit multiple fractures from separate hammer blows. To replicate the process of repeatedly impacting artifacts and measure the attributes of accumulated damage, one ovate biface was struck multiple times (Fig. 4.14). The ovate biface was subjected to multiple blows (n = 7) on a flat ground surface and maintains a general radial fragmentation pattern in spite of large amounts of shatter (n = 51) originating from its center. It was embedded into the ground to a maximum depth of 3.8 cm, so it is apparent that at least some of the impact shock was absorbed by the ground surface. This experiment suggests that good physical support provided beneath an artifact assists in preserving the integrity of its original shape and contains the spread of radial fracture patterns. Accordingly, this “protection” occurs independent of degree of force or number of blows.

The damage done to this biface relative to the preform dealt a single blow (Fig. 4.13) is minimal. Only 51 pieces of shatter were produced by seven impacts to the surface, which is 8.5 times more shatter than the single radial fracture. Significantly, roughly the same number of small, shattered pieces was produced by each strike. This result suggests that there is a linear correlation between the amount of shatter produced and the number of hammer strikes incurred. It is likely that this is a function of the support provided by an uninterrupted ground surface unimpeded by other artifacts, as underlying hard objects produce additional bipolar fractures (cf. Ellis and Deller 2002).

Considering the massive amounts of angular debris at Mt. Albert, artifacts were certainly struck multiple times in efforts to smash them. This process is a significant factor contributing to refitting success because the likelihood of matching two fragments declines greatly the more fragmentary individual pieces are (Laughlin and Kelly 2010) and as the smaller intervening fragments are detached.

Figure 4.14: Radially fractured biface subjected to seven hammer blows, with associated shatter.

In order to replicate the close physical contact of artifacts lying in superposition, one biface was struck while lying on top of another. The biface that was used as an anvil-stone remained relatively intact after the blow to the blank resting on top of it (Fig. 4.15). Along its dorsal surface are sporadic pitting marks from contact with the overlying biface. A single incomplete edge bite fracture was identified along its lateral margin and resulted in significant crushing of the edge and some step fractures along the fracture surface.

The impact from the hammer blow struck the overlying biface near the centre of its dorsal face. The follow-through from the hammer swing, deflected by the top biface, delivered a glancing blow to the biface used as an anvil near its worked edge. This event caused the hammerstone to impact at a steep angle, which produced a shallow, semi-lunar shaped concavity in the edge of the anvil biface. The removal of the edge resulted in 46 small pieces of angular debris rather than a single intact piece (Fig. 4.15). This effect is likely caused by the edge of the anvil absorbing the majority of energy from the impact. The artifact did not additionally snap transversely as a result of the bulb of force/edge bite (see Ellis and Deller 2002), so force that would otherwise travel through the body of the artifact instead terminated by shattering the removed fragment. This holds significance for refitting efforts, as artifacts with edge bite and convex snap fractures that have not additionally snapped transversely produce large amounts of small sized debris that are unlikely to be refitted.

The biface superimposed over top of the biface anvil was struck once on its dorsal surface. The sole impact produced significantly higher volumes of angular debris (n = 34) than single blows to any of the other bifaces broken on the ground surface (Fig. 4.16). This lends credence to the suggestion that blanks and preforms at Mt. Albert were broken *en masse* while in contact with each other. Their close proximity contributed, at least in part, to their thorough and uneven fragmentation.

Although this biface exhibits the technical traits of a snap break along its distal fragment, namely a transverse fracture with associated lipping and bulb of force, the overall breakage pattern follows a radial path. If this biface were simply hit on a ground surface it is unlikely that the same amount of fragmentation would have occurred. That is, it likely would have snapped in half transversely without the four wedge shaped fragments in addition to the snapped base.

This biface exhibits a second fracture initiation on its ventral surface directly beneath the original impact scar. The area immediately adjacent to the bipolar forces has shattered into broad, thin pieces and the more intact proximal bifacial fragments have broken along irregular fracture lines.

Simple radial breaks leave relatively little shatter relative to bipolar fractures, which tend to produce larger quantities of blockier shatter. This difference is attributed to differential support beneath a given artifact. Radial fractures result from relatively even support of the biface as might be characterized by an uninterrupted ground surface. Additionally, Deller and Ellis (2001) have shown that careful blows to single artifacts on a flat anvil surface can replicate wedge-shaped radial fractures. Bipolar force produced by the underlying flat, hard anvil contributes to neatly

Figure 4.15: Biface underlying another artifact, with associated shatter; arrow shows point of impact and negative bulb of force.

fracturing artifacts into identifiable segments that leave most flaked surfaces intact. Conversely, when placed upon an uneven anvil surface with multiple and sporadic points of impact, such as the surface of a bifacial blank, bipolar fractures contribute to maximal shatter. This result is evident in the experimentally broken biface on top of an anvil (Fig. 4.16), where a single blow completely obliterated the artifact's middle section and produced almost as much shatter as seven strikes to a radially fractured biface.

Figure 4.16: Dorsal surface of biface broken on top of anvil, with associated shatter.

4.9 Bannerstones

The uniformity in bannerstone breakage at Mt. Albert warrants a discussion of the mechanics that led to their fragmentation. Functionally, their drilled forms are the primary factors that allowed for even splitting along their latitudinal axes. The thin, and therefore weakened, midshaft would have served as an appropriate guide for fractures to follow along a linear path from top to bottom, neatly dividing the artifacts into two winged halves. None of the winged pieces exhibit shattering to any degree that comes close to shattered blanks and preforms, which is at least partially due to the inability for slate to fracture conchoidally. Slate is a relatively soft material compared with chert, and it fragments uniquely. Due to this physical property, at the Adena Pig Point site banded slate gorgets were purposely snapped by pressure and shattered by striking their surfaces with hammers (Melton and Luckenbach 2013:23).

If bannerstone breakage is the result of impacts, it is clear that care was taken to limit the amount force exerted in order to preserve their winged features. Consider the nature of fractures on the two bannerstone fragments which apparently fit together (Fig. 3.17B, C), where the drilled arches of the remaining midshaft extend unevenly over the drilled cavity on one fragment (Fig. 3.17C) and are nearly absent from the other (Fig. 3.17B). Based on this uneven fracture pattern, it is probable that the midshaft was placed against a hard flat surface or an angle and force was leveraged onto both wings, effectively splitting the bannerstone in half. This downward force would produce breakage resulting in the missing/fragmentary drilled arch on the ventral side in contact with an anvil, while leaving the top arch relatively intact. The fact that the midshaft disconnected from the wing at the junction between wing and midshaft suggests that this point is the weakest one on the bannerstone, rather than at the apex of the drilled arches.

The bannerstone for which there is no connecting fragment (Fig. 3.17A) has been split relatively evenly down both midshaft surfaces and would have produced two halves of near identical size and shape. Compared with the other split bannerstone fragments, this increase in evenness might be accounted for by a more robust form. This fragment is significantly thicker than the other fragments, both at the wing (20.2 mm) and at the midshaft (24.3 mm; Table 3.5). Further, based on surface shape, the thicker fragment displays almost no contrast between drilled ridge and wing, sloping evenly upwards from the wingtip to the apex of both ridges. In comparison, the thinner fragments exhibit a marked contrast between the wing surfaces and raised ridges, diagnostic of more elaborate bannerstone forms which emphasize worked features. This juncture would present the point of least resistance for any significant amount of force applied.

One small fragment of slate along the split central ridge has broken off from the larger bannerstone wing (Fig. 3.17A). At the refit point of contact between both fragments there is significant discolouration indicative of charring and both surfaces exhibit uneven breakage similar to pot lids in chert. This darkened and uneven surface continues down the broken ridge. The fact that it does not occur along the opposite ridge reflects the uneven burning that afflicts chert artifacts throughout the site. More likely than being the primary cause of breakage, it seems that thermal trauma caused pot lids along a broken edge that was already weakened by the splitting process. Certainly, the even break directly down the fragment's center suggests controlled fragmentation uncharacteristic of the potlid and crenation fractures that burning inflicts on chert artifacts (Purdy 1975).

To the author's knowledge no experiments have been conducted to thermally or mechanically fracture banded slate objects. Artifacts recovered from the Bliss cemetery (Funk 1988: Figure 23) reveal the extent to which slate bannerstones fragment when exposed to the high heat of cremation fires. The high temperatures heavily degraded the slate so that remaining pieces are highly fragmentary and nearly unrecognizable. Jagged and curved edges characteristic of crenation fractures (Purdy 1975) suggest that artifacts were rapidly subjected to extreme temperatures. In fact, on three of the bannerstone fragments (Funk 1988: Figure 23, No. 1, 3, 5) the majority of the object has crumbled or shattered away, leaving only massively charred margins. One fully refit bannerstone that was mechanically broken (Funk 1988: Figure 23, No. 6) was evenly split into four sections. One quarter is significantly darker than the others and was clearly charred after it had been separated from the remaining pieces. Lavin (2013:104) has suggested that these artifacts were ritually killed in addition to being burned.

Although one bannerstone fragment at Mt. Albert exhibits minor charring along its snapped midshaft (Fig. 3.17A), it is evident that the ground slate bannerstones were not exposed to the extreme heat of a cremation fire like the ones present at the Bliss site.

Instead, they were mechanically snapped, which only could have happened either by accident in use as atlatl weights, or intentionally as part of the mass of destroyed chert artifacts.

The refit bannerstone from Bliss (Funk 1988: Figure 23, No. 6) holds more in common with the thermally altered biface fragments from Mt. Albert than with the Mt. Albert bannerstones. On a significant number of the bifaces that have been refitted individual fragments exhibit pot lid fractures (Purdy 1975) and colour changes characteristic of heat damage. Thus, it is clear that fragments were burned after they were mechanically broken by hammer stone impacts.

Chapter 5: Inter-site Comparisons

5.1 Introduction

In this chapter I provide a comparative analysis of the overall flaking debris and artifact assemblage from the Mt. Albert site to several other related sites (e.g. Laurentian Archaic affiliation) to evaluate the proposition that the Mt. Albert site assemblage is unusual and unlike patterns found on "normal" occupation sites. To reach this end I will review common analytical approaches to flake debitage/debris analysis that aim to correlate lithic attributes with specific behaviours. The issue of comparability of assemblages is important, as I hope to identify cultural differences between the Mt. Albert assemblage and those of coeval regional sites. Of particular significance is the relative paucity of published information surrounding Brewerton component sites in Ontario (Ellis et al. 2009:794). While there have been numerous (> 60) sites reported that have yielded materials diagnostic of the Laurentian Archaic, the majority of these sites are invariably multi-component, with Brewerton materials interspersed with earlier and later cultural sequences (Ellis et al. 1990). In addition, the earliest excavations of Brewerton sites, including the Oberlander #1 and Robinson type-sites from upper New York, were conducted during an academic climate that emphasized cultural historicism (Ritchie 1940). The result of this view is that discussions of excavated materials were focused largely on more diagnostic and formed artifacts, with debitage being largely ignored. The proclivity to quantify and describe artifacts such as debitage on sites became common only in later times when differences in site activities became a major focus. Naturally, the earlier research focus does not lend itself well to comparisons and much of the relevant data are not available for the sites reported in that time frame.

Whatever the problems with the reported data, I intend to compare the Mt. Albert material with datasets that are presented as raw counts of different lithic artifact categories that have been recovered from intact Laurentian sites in the Great Lakes region. I will present data on Brewerton assemblages from six Middle Archaic sites in addition to the lithic analysis that was conducted on the Mt. Albert site for this comparative study. The sites for which data are available, albeit incomplete in some cases, are the Peiganovitch (Woodley 2006), Rentner (Lennox 2000), Bell (Williamson et al. 1994), Little Shaver (Timmins 1996), Morrison's Island-6 (Clermont and Chapdelaine 1998), and Allumettes Island-1 (Clermont et al. 2003) sites. All of these sites are located in Ontario with the exception of Allumettes Island and Morrison's Island which are located in Quebec, albeit in islands in the Ottawa River opposite Pembroke, Ontario (Kennedy 1966). The Allumettes Island site represents the sole Vergennes phase collection in this dataset, although to the extent that Laurentian material culture represents a shared set of lifeways/activities this site provides a tenable device for examining inter-site comparisons. Specifically, I will focus on the frequencies of formal tool typologies relative to debitage frequencies in an attempt to show how inter-site comparability contributes to inferences about the mechanics of artifact production, use, and discard.

Lithic reduction and retouch occur at the onset of manufacture, during use, and during repair and modification of tools, which can offer insight into associated social patterns. For example, as Wilson and Andrefsky (2008) note, the extent of repair and reshaping of a tool offers insight into how long it was curated and transported, with higher levels of curation suggesting frequent mobility. Here, I will utilize a typological approach to debitage classification rather than an attribute approach. A typological analysis assigns debitage into groups based on multiple shared characteristics and allows one to discern more specific behavioural activities, such as the way a bifacial thinning flake implies the act of thinning a biface rather than some other tool form (Andrefsky 2005:114).

5.2 Methods

For the site comparisons here I rely on a simple typology or a limited number of debitage categories. Detailed comparisons are impossible because the different investigators responsible for the comparative data employed very different typologies. For example, some investigators such as Woodley (2006) recognize the first flakes off initial raw material pieces that have completely unflaked "cortical" dorsal surfaces, or flake types specifically derived from biface reduction, whereas others do not. Nonetheless, all the investigators recognized debris one can classify as "shatter" as compared to all other debris. That other debris may be classified variably into many different categories depending upon the investigator, but as a whole one can lump together such material as simply flakes or as they are referred to here "knapped flakes". Shatter refers to "cubical and irregularly shaped chunks that frequently lack any well-defined bulbs of percussion or systematic alignment of cleavage scars on various faces" (Binford and Quimby 1963:278). This definition implies that pieces of shatter exhibit no identifiable dorsal or ventral surfaces and thus, cannot be flakes. In the following I initially consider all of the shatter and flakes to be debitage (Table 5.1). They are assumed to be the waste byproducts of manufacture to begin with in the analyses even though, as shown in the experiments section of Chapter 4, much of the shatter at Mt. Albert need not be from manufacture. I also counted all stone tools present, including cores, hammerstones, and utilized flakes, but excluding groundstone and abraders, in relation to the debitage count in order to produce a baseline of artifact production at each site, against which it becomes possible to compare the nature of tool production. Juxtaposed with debitage count is the total count of formal stone artifacts, including tools and bifacial preforms that have been produced by, and usually contributed to, the totality of knapping at each site. I formulated percentages out of the total lithics present by combining total tool counts with the total debitage count in order to derive inferences about relative tool/debitage frequencies from the total.

At the Morrison's Island and Alumettes Island sites much of the flaking debris is made up of quartz, as it is about the only flakeable material available locally near those sites. The molecular makeup of the quartz material produces inordinately high amounts of debitage, notably shatter, compared with well-flaking siliceous materials like chert, chalcedony, and even fine-grained quartzite (cf. Tallavaara et al. 2010). Thus, at both these sites, to adequately compare to the chert assemblage at Mt. Albert it is necessary to ignore the massive quantities of quartz materials. For instance, at Allumettes Island 98.38% of the total debitage on site is quartz and there are 20,535 pieces of quartz debitage present compared to only 65 quartz tools and bifacial fragments (Clermont et al. 2003:206). At Morrison's Island, 95.2% of total debitage is quartz with 14,566 pieces compared to 165 flaked implements (Clermont and Chapdelaine 1998:83). The flaked quartz artifacts represent only 0.25% and 1.1% of all quartz items present, respectively, at those sites. These percentages are far below the normative range for tool making at other Laurentian sites where cherts instead predominate (Table 5.1).

5.3 Site Comparisons

Regarding total artifact percentages, there is very little variation between the tool kits at each site with the exception of Morrison's Island (Table 5.1). Excepting Morrison's Island the artifact frequencies are low relative to the debitage and range from 3% to 9 % of the whole, with a 6% mean, or 9.2% including Morrison's. These totals are in keeping with what one would expect at a location where tools were actually produced (Wilson and Andrefsky 2008), notably for Peiganovitch, Rentner, Bell, and Little Shaver. It is possible to account for the high proportion of chert tools relative to debitage at Morrison's Island, and to a lesser extent Allumettes Island, by high rates of curation and transportation of completed, or nearly completed, chert tools to the sites. This inference is in keeping with the prevalence of Fossil Hill, Kettle Point and especially Onondaga cherts that outcrop between 400-600 km to the southwest of these sites (Clermont et al. 2003:198). Especially if considered within the context of other traded materials at those sites, such as the native copper from the north shore of Lake Superior 1000 km to the west, it is logical that the exotic chert materials were subjected to similar patterns of exchange and curation. The significant quantity of copper artifacts at both Morrison's Island (n = 513) and Allumettes Island (n = 2,110), including moderate amounts of copper wastage resultant from producing tools from copper sheets or nuggets (Chapdelaine and Clermont 2006:210), suggests that this material was variably transported as completed artifacts and/or in a raw or semi-refined state. This line of reasoning may be feasibly extended to flaked stone artifacts, transported or traded in a completed or partially refined state to minimize weight in transit and expose flaws in a given piece of material that may prohibit later finishing when away from a source. Therefore, as comparative devices, the Peiganovitch, Rentner, Bell, and Little Shaver sites will be used to elucidate a baseline for tool producing sites, while Morrison's Island and Allumettes Island will serve to examine the nature of Laurentian practices in cases where curation is likely.

Isolated from the larger mass of debitage, "shatter," or angular debris (see chapter 4), provides a raw glimpse into the presence or absence of knapping activities at Mt. Albert. Shatter as a simple flint-knapping product typically results from the *very earliest* stages of knapping when high amounts of force are applied that exploit naturally occurring impurities in chert (Binford and Quimby 1963, 1972; Lennox 2000:32). It is more characteristic of sites at/near lithic sources where the initial reduction of blocks and cobbles occurs and where pieces with impurities that lead to shatter are more likely to be produced. It follows that there is a limited amount of shatter that may be produced at sites

Table 5.1: Comparison of flaked stone artifacts and debitage at Middle Archaic sites; *only chert artifacts are included in totals.

Site Name	Author	Total tools	Debitage count	Tool % of Total	Debitage % of Total
Peiganovitch	(Woodley 2006)	61	638	8.73	91.27
Rentner	(Lennox 2000)	137	3537	3.73	96.27
Bell	(Williamson et al. 1994)	218	4675	4.45	95.54
Little Shaver	(Timmins 1996)	58	1644	3.41	96.59
Mt. Albert	(ASI 2014)	184	2658	6.47	93.53
Morrison's Island-6*	(Clermont and Chapdelaine 1998)	614	1544	28.45	71.55
Allumettes Island-1*	(Clermont et al. 2003)	435	4242	9.3	90.7

away from quarries where only late stage core reduction or where the maximum necessary primary flaking required to sufficiently prepare a biface for sequential reduction may be found. This restricted occurrence is clearly seen in the six control sites at which "normal" knapping activities are known to have occurred and notably even occurs in limited quantities at sites that actually have yielded several exhausted chert cores such as Rentner (n=25; Lennox 2000: Table 2) and Bell (n=12; Williamson et al. 1994), as well as bifaces. Here shatter ranges from 2-9 percent of the total assemblage, with a mean of 4.88 percent (Table 5.2). This range is an acceptable one based on the extent that these sites reflect later stages of core reduction and biface production resultant from whole cobbles or spalls of chert, or even early stage preforms that require percussion flaking. Conversely, the incredibly high percentage of shatter-like objects (83.32%) at Mt. Albert (Table 5.2), which forms the vast majority of lithic material at a site far removed from the lithic sources used, must be accounted for by processes other than tool production. It is conceivable that the mass of angular debris is the product of a much larger toolkit that was knapped on site and finished tools were subsequently taken away. However, the relative paucity of knapped flakes (Table 5.3 and see below) and the presence of only a single, much reduced, core (Fig. 3.14) suggests that this is not the case. If the relatively low percentages of shatter are the inadvertent normal products of necessary knapping techniques at sites removed from lithic sources, it is without a doubt that such a high degree of shatter-like angular debris at Mt. Albert is unusual. In other words, these angular fragments are the deliberately smashed remains of a once functional toolkit, as opposed to the by-product of efforts to produce one. As will be discussed in greater detail below, this angular debris attests to the purposeful destruction of tools and preforms that were manufactured elsewhere and then subsequently brought to Mt. Albert, where they were ultimately broken.

Table 5.2: Comparison of flaked stone artifacts and shatter at Middle Archaic sites; biface counts include complete and fragmentary bifaces.

Site Name	**Total Tools**	**Tool % of Total**	**Shatter Count**	**Shatter % of Total**	**Total Bifaces**	**Bifaces % of Total**
Peiganovitch	61	8.73	67	9.59	11	1.57
Rentner	137	3.73	166	4.52	50	1.36
Bell	218	4.45	174	3.56	73	1.49
Little Shaver	58	3.41	45	2.64	7	0.41
Mt. Albert	184	6.47	2368	83.32	177	6.23
Morrison’s Island-6	614	28.45	117	5.42	93	4.31
Allumettes Island-1	435	9.3	168	3.59	221	4.73

Moving on to comparisons of the other debris, as noted above, I combined all counts of other flakes (e.g. everything except shatter) within each site (Table 5.3) in order to derive a collective ratio for the total amount of knapping activities that involved core reduction and the production of bifacial forms including preforms and finished tools.

I stress that only the later stages of core reduction seem to be present at each site given the general rarity of shatter described above. Also, at some sites, where the actual counts of biface reduction flakes are reported, such as Peiganovitch (Woodley 2006: Table 2), the high percentage of biface thinning flakes recovered from the Brewerton component (42% of the 638 pieces of debris) strongly suggests an emphasis on bifacial reduction. Moreover, at the Bell site, where the biface debris is not typed, the analysts still suggest that biface reduction was the main activity (Williamson et al. 1994:74). In contrast to both of these sites, very few biface thinning flakes (n = 21) are present at Mt. Albert (0.74% of the lithic assemblage; Archaeological Services Incorporated 2014:5), so it is clear that the majority of bifacial implements were transported to the site rather than manufactured/altered *in situ*.

In order to compare the occurrence of knapped objects on Middle Archaic sites, I added together all of the flaked stone objects from each site including both refined points and knives, as well as cores, crude bifaces, and biface fragments (Table 5.3). Across the Rentner, Bell, and Little Shaver sites there is a rough correlation in the frequencies that flaked artifacts occur in relation to each respective site's total assemblage (Table 5.3). At these sites flaked items range from 1.11-1.93% of the total lithic assemblage, with a mean of 1.57%. In contrast, both Peiganovitch and Mt. Albert contain relatively high percentages of bifaces (4% and 6.3% respectively). Peiganovitch is certainly an outlier, with its bifaces constituting 4% of the site's Brewerton assemblage and it is also different from Rentner, Bell and Little Shaver, as well as Mt. Albert in having a higher percentage of points. Combined with the fact that the Brewerton occupation at Peiganovitch has the smallest total lithic assemblage (699 artifacts), and that it has a high percentage of reported biface flaking debris (269/638 or 42%; Woodley 2006: Table 2) it is probable that another factor is accounting for this difference. Namely, it may be a more specialized occupation versus sites such as Rentner, Bell and Little Shaver, such as a hunting camp where point production and use was more important. Certainly, it differs from Mt. Albert where, despite a large percentage of bifaces, points are rare.

At Morrison's and Allumettes Islands it has been established that many chert bifacial implements were brought on site, although this does not account for the proportionally high presence of flakes (Table 5.3). It is possible that many of the bifacial implements, made on distant Onondaga chert from southern Ontario, Cheshire quartzite from eastern Vermont (Chapdelaine and Clermont 2006), and other foreign cherts, were made at these sites, transported or traded as blanks or preforms and completed upon arrival, thus accounting for the flaking debris. This interpretation would be in keeping with the idea that these sites represent workshops at or near occupation sites based on significant refuse from both copper and stone working (ibid.). Further, the high percentage of bifaces at both sites appears to be a function of availability of other materials and tool types given the abundance of copper and bone artifacts. Indeed, chipped stone points dominate in the lithic toolkits, which Ritchie (1940, 1980) notes is the tendency on Brewerton sites, although this trend may in actuality apply only to large workshop or seasonal aggregation sites like the Oberlander-1 and Robinson type-sites that are reminiscent of the Morrison's and Allumettes Island sites. High projectile point frequencies (Table 5.3) suggest that alternate materials fulfilled technical requirements for uses other than weapon tips, such as copper knives and fishing gear and bone or beaver-tooth scrapers substituted for stone hide-working tools (Chapdelaine and Clermont 2006). Unfortunately due to poor organic preservation it is not possible to test if this was the case at Mt. Albert or the "lithic production" sites. However, the absence of native copper artifacts and abundance of multiple flaked stone tool types suggests it was not the case at Mt. Albert.

High percentages of flaking debris occur at all sites excluding Mt. Albert. The percentage of knapping flakes at the other sites ranges from 29-84% (Table 5.3), but always encompasses a large proportion of the total lithic assemblage (mean of 50.96%). The greater variation in the percentages of flakes than in (in)complete bifacial tools can be accounted for by uneven quantities of shatter and flake fragments at each site, which may be the product of variables as simple as quality of raw material, the relative completeness of cores and bifaces when they were knapped, and individual knapping skill. Regardless, since knapped flakes are very rare at Mt. Albert (2.57% of the assemblage), it is evident that substantively less productive activities took place at Mt. Albert.

All of the percentage categories for Mt. Albert contrast when compared with the other “normative” Middle Archaic sites. Knapped objects at Mt. Albert constitute 6.33% of the total artifacts present, a significant departure from the remaining production sites where the mean is 2.18% even when Peiganovitch is included. Frequencies of knapped artifacts at Mt. Albert are more in keeping with those found at Morrison’s and Allumettes Island where it is known that artifacts were exchanged and extensively curated, with a mean of 12.3% (Table 5.3). Of course, the potential for widely differing levels of curation is present depending on the number of occupants at a site and the amount of material exchange they engaged with.

Table 5.3: Artifact makeup of Middle Archaic sites; “total” comprises all artifacts in the assemblage, including knapped artifacts, flakes, and shatter.

Site Name	Knapped Implements	Knapped % of Total	Projectile Points	Projectile Points % of Total	Knapping Flakes	Flakes % of Total
Peiganovitch	28	4	10	1.43	495	70.82
Rentner	71	1.93	17	0.46	1282	34.89
Bell	82	1.68	7	0.14	4151	84.84
Little Shaver	19	1.11	9	0.53	728	42.77
Mt. Albert	180	6.33	2	0.07	73	2.57
Morrison’s Island-6	368	17.05	277	12.84	621	28.78
Allumettes Island-1	353	7.55	127	2.72	2043	43.68

In terms of sheer quantity Mt. Albert has far more bifaces and fragments than much larger sites; almost 100 more than occur at the Bell site, which is roughly twice the size of Mt. Albert in terms of total artifacts (4911 chipped stone artifacts; Williamson et al 1994:67; Table 5.2). Additionally, the proportion of bifaces and fragments at Mt. Albert (6.23%) is the largest of any other site where knapping was done *in situ* (mean = 1.21%) and the percentage is even larger than sites where many artifacts were deposited after being made elsewhere (mean = 4.52%).

At Mt. Albert projectile points occur to a far lesser extent than any other site, and one was found some distance away and so may not even relate to the events at Mt. Albert, which suggests that the hunting demands of a whole group are not represented. One of the two points has been the subject of prolonged curation based on extensive rounding of its lateral margins characteristic of "bag-wear" (Archaeological Services Incorporated 2014). That the number of projectile points diverges so greatly from the great quantity and materials of curated points at Morrison's and Allumettes removes Mt. Albert from engagement in widespread exchange systems, rendering it different from any other known sites in the region. The inclusion of these points may be part of an effort to leave a well-rounded tool kit complete with all the bifacial blanks, scrapers, drills, and points an individual could conceivably need.

Of equal importance is the percentage of knapped flakes compared to the large number of bifaces and other knapped artifacts. Indeed, as queried in the Mt. Albert site report, "One of the first questions to arise concerns the ratio of …[debris]…to the number of bifaces and biface fragments. One would conclude that there should be a greater quantity of flaking debitage given the number of complete or fragmentary bifaces recovered" (Archaeological Services Incorporated 2014:5). As shown on Table 5.2, this low number is inconsistent with the general pattern of bifacial reduction found to be the average throughout the Middle Archaic Laurentian occupation in Ontario. Specifically, while the general pattern is one of utility, consistent with a concerted manufacturing strategy, Mt. Albert diverges. There are few flakes associated with actual manufacture at Mt. Albert, but many bifaces and biface fragments. This result alludes to the transportation to the site of pre-fabricated tools, and the author asserts that the deposition of multiple fully functional tools, with relatively little significant *in situ* modification without debris, renders the site something other than the assumed occupation sites at Peiganovitch, Rentner, Bell, and Little Shaver and the "workshop sites" at Morrison's Island and Allumettes Island. Particularly, because 172 of the bifacial tools at the site were in various stages of fragmentation in addition to, as shown above, gratuitously high amounts of shatter-like debris (see also Archaeological Services Incorporated 2014:5), it is possible to infer that they were intentionally destroyed. It seems unlikely, and is undeniably suspicious, that such a large quantity of otherwise complete tools could have been broken in manufacture considering the absence of flaking debris and in particular, a small amount of debris from making bifaces. I shall conclude with the suggestion that the site served some function that involved very little flintknapping and the mass breakage of artifacts; to evaluate that answer one needs to explore the larger site context of the remaining artifacts.

Chapter 6: Spatial Analyses

6.1 Overall Distributions

As mentioned earlier, 76 one-metre square units were block excavated above a single cultural feature approximately five metres long. Four distinct artifact clusters within the subsoil feature were piece plotted using a Total Station (Fig. 6.2). While the spatial contexts of site use are disturbed within the ploughzone, the subsoil artifacts present an excellent opportunity to examine the fine-grained nature of the activities associated with the Middle Archaic use of the feature. However, I note that the ploughzone artifact frequencies correspond to the highest densities of piece plotted artifact concentrations in the underlying feature, suggesting that even the ploughzone artifact displacement was minimal (Fig. 6.1). Regardless, visually, individual and density plots suggest the material concentrates in four clusters, which will be referred to here as the Northwest, Northeast, Central, and Southern Clusters (Fig. 6.2A). I note, as discussed later in this chapter, that the refitted fragments of the same artifact can be found within two or more of these clusters, suggesting they are all temporally/functionally related at some level.

It is possible that the irregular topography, defined by the maximum depth and unique clustering of artifact groups, indicates the artifact concentrations were situated in already existing natural phenomena (e.g., tree throw depressions) that were utilized by the occupants at Mt. Albert to deposit the artifacts, or the distribution may have been effected by post-depositional processes (Archaeological Services Incorporated 2014). It is also possible that the site's occupants dug several depressions to collect refuse or cache artifact fragments. While the clustering of artifacts is in four places in the feature, the Northwest and Southern clusters contain the densest accumulations (Table 6.1). Therefore, the Northwest and Southern deposits may indicate locations where artifacts were primarily destroyed, while the Northeast and Central groupings contain fragments that were displaced by the force of breakage. This accumulation of ricocheting fragments outside of the most populous clusters is tenable given the deposition of near identical quantities of shatter-like angular fragments in the Northeast (n = 238) and Central (n = 232; Table 6.1) clusters. Conversely, the clustering is relatively dense even in these smaller groupings, and one would not expect material dispersed during breakage to accumulate in certain specific locations, so it is probable that at least some fragments were broken in the other clusters considering the significant number of items present (Fig. 6.5).

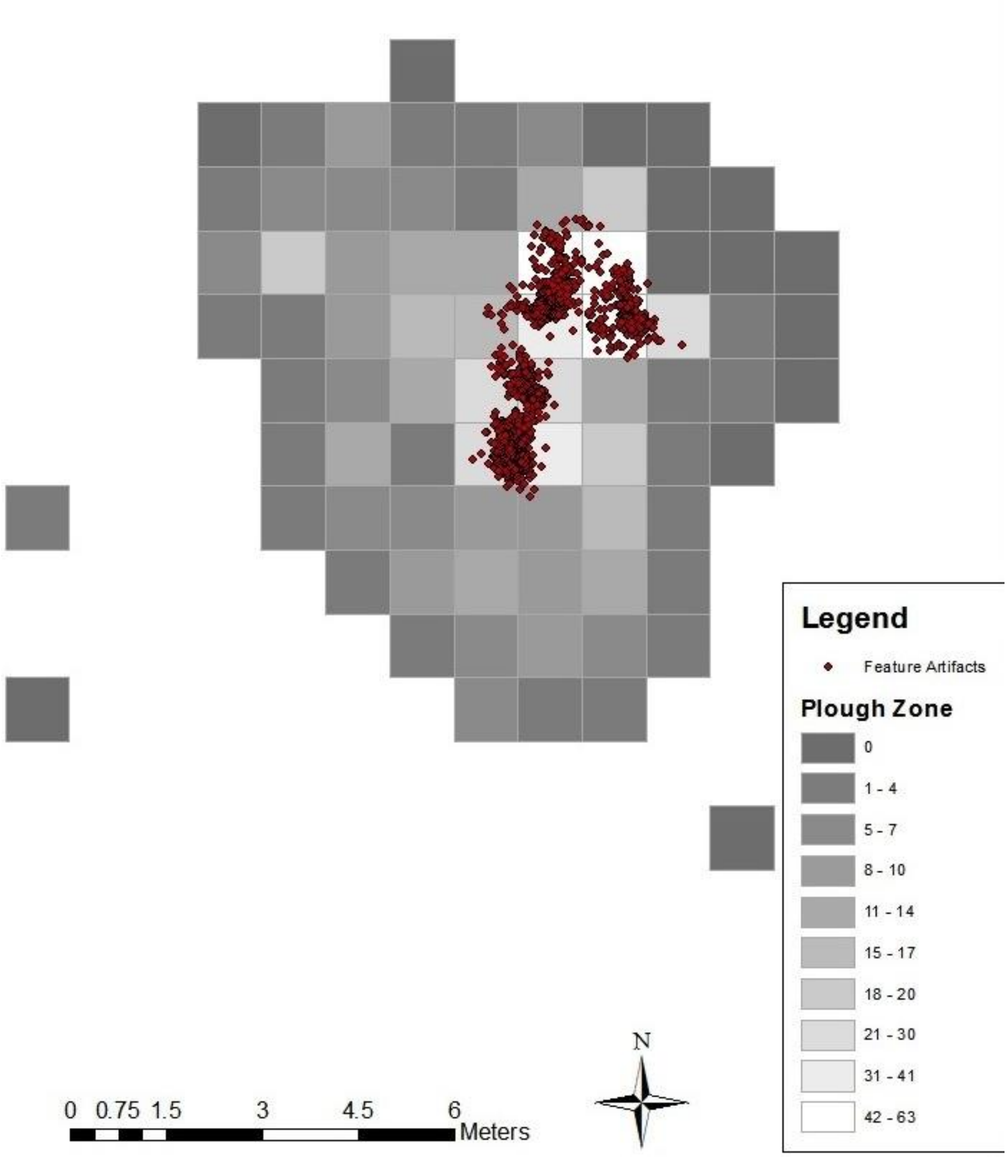

Figure 6.1: Mt. Albert ploughzone and feature artifact distributions.

It is also possible that the artifact clusters within the feature reflect multiple discrete areas where stone tools were struck. The clusters per se include the artifact fragments that were fractured in those locations, while the peripheral scattering of objects reflects loosely aggregated fragments characteristic of pieces that dispersed in the

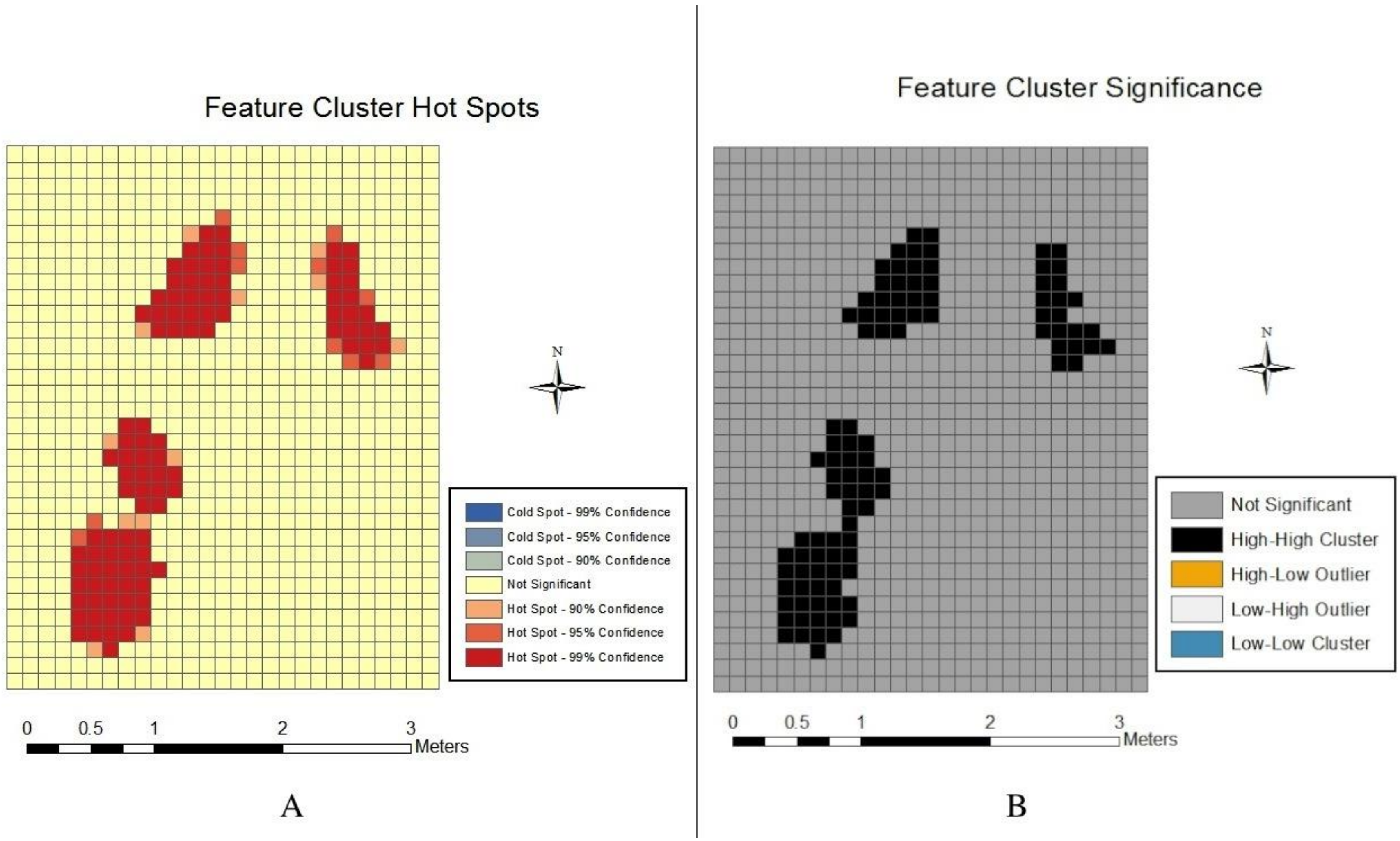

Figure 6.2: Clusters of artifacts within subsoil feature; A, densest accumulations, or "Hot Spots," of artifact clustering; B, apparent feature clusters are all statistically significant; images enlarged from maps in Appendix C, analyses carried out on original maps.

Table 6.1: Frequencies of artifact types within feature clusters; percentages are derived from the total feature artifacts.

	Northwestern Cluster	Northeastern Cluster	Central Cluster	Southern Cluster
Biface	1 (0.05%)	1 (0.05%)	0	1 (0.05%)
Scraper	1 (0.05%)	1 (0.05%)	0	1 (0.05%)
Drill	0	1 (0.05%)	0	0
Bannerstone Fragment	1 (0.05%)	0	1 (0.05%)	0
Projectile Point	0	0	1 (0.05%)	0
Biface Fragment	60 (2.76%)	19 (0.87%)	23 (1.47%)	25 (1.15%)
Flake Fragment	25 (1.15%)	32 (1.47%)	20 (0.19%)	47 (2.16%)
Primary Thinning Flake	1 (0.05%)	2 (0.09%)	2 (0.09%)	2 (0.09%)
Primary Reduction Flake	0	2 (0.09%)	1 (0.05%)	1 (0.05%)
Secondary Knapping Flake	1 (0.05%)	2 (0.09%)	3 (0.14%)	3 (0.14%)
Secondary Retouch Flake	2 (0.09%)	6 (0.28%)	2 (0.09%)	16 (0.74%)
Angular Fragments	426 (19.58%)	238 (10.94%)	232 (10.66%)	957 (43.98%)
Total	518 (23.81%)	320 (14.71%)	285 (13.1%)	1053 (48.4%)

vicinity. This pattern is similar in spatial distance to the horizontally displaced fragments that were produced experimentally (see below), and is representative of the cluster frequencies that would occur with accumulated lithic breakage.

Spatial analyses were conducted using ArcGIS to test the reality of apparent aggregations within the cultural feature, and clustering at the site is highly significant. A fishnet of 12.5 cm cells was used in order to identify areas of lesser statistical significance surrounding hot spots within the feature. While the Central and Southern clusters visually appear to blend together (Fig. 6.1; 6.2B), it is evident the two are discrete groupings with less significant overlap of artifact contents at the peripheries (Fig. 6.2A). Given a z-score of 73.095, there is a less than 1% likelihood that these clustered patterns are the result of random chance. Further, the ubiquity of "High-High" clustering throughout the feature rejects the null hypothesis that there is no spatial clustering of the feature's contents (Fig. 6.2B).

The deposition of artifacts within what appear to be slight concavities in the ground also could be an indicator of fragments being embedded deeply into the ground, similarly to the experimentally broken biface that was struck seven times, and was buried to a depth of 3.8 cm (Fig. 4.14). Yet, it is unlikely that artifacts struck on an uninterrupted ground surface, with or without a sod/organic cover would penetrate the ground to the depth that the deepest artifacts were buried at Mt. Albert - approximately 40 cm below the surface of the subsoil (Archaeological Services Incorporated 2014: Figure 5). It may be tenable that accumulated layers of increasingly fragmentary artifacts pushed each other deeper as the top artifacts were struck but 40 cm deep seems a lot even for that possibility.

Additionally, although there are no patterns to indicate the presence of house features such as hearths or house walls, as has been suggested at other Archaic sites (Lennox 1986), it is possible that artifacts were deposited into concavities similar to the pits that biface caches are often deposited in, which occasionally are recovered from within or nearby to dwellings (Galan 2007). Their dense grouping in isolated areas certainly alludes to their deposition in depressions dug into the ground. Unfortunately, this idea remains speculative.

6.2 Distribution of Artifact Types and Classes

The distribution of chert types across the Mt. Albert feature is wholly intermixed (Fig. 6.3; see Appendix A). Colborne and Onondaga artifacts both fail to cluster apart from the other material type. Instead, both chert types independently correspond to overall densities within the feature. This distribution implies that Onondaga and Colborne artifacts were deposited in equal frequencies across the site.

Significant to spatial analyses of the Mt. Albert assemblage is the distribution of bifaces as they were broken and accumulated across feature clusters. Because Colborne artifact types are limited to biface fragments, it is necessary to limit recovered Onondaga artifacts to bifaces and biface fragments in order to represent the distribution of chert types across the feature (Fig. 6.4).

There does not appear to be any significant correlation of raw material with location at the site. Indeed, it is evident that the Northwestern cluster contains the highest frequency of both Onondaga (n=49) and Colborne (n=11) biface fragments, with fewer pieces in surrounding clusters (Fig. 6.5; Table 1). This distribution suggests that the majority of bifaces were in, and perhaps primarily destroyed at, the Northwestern locus,

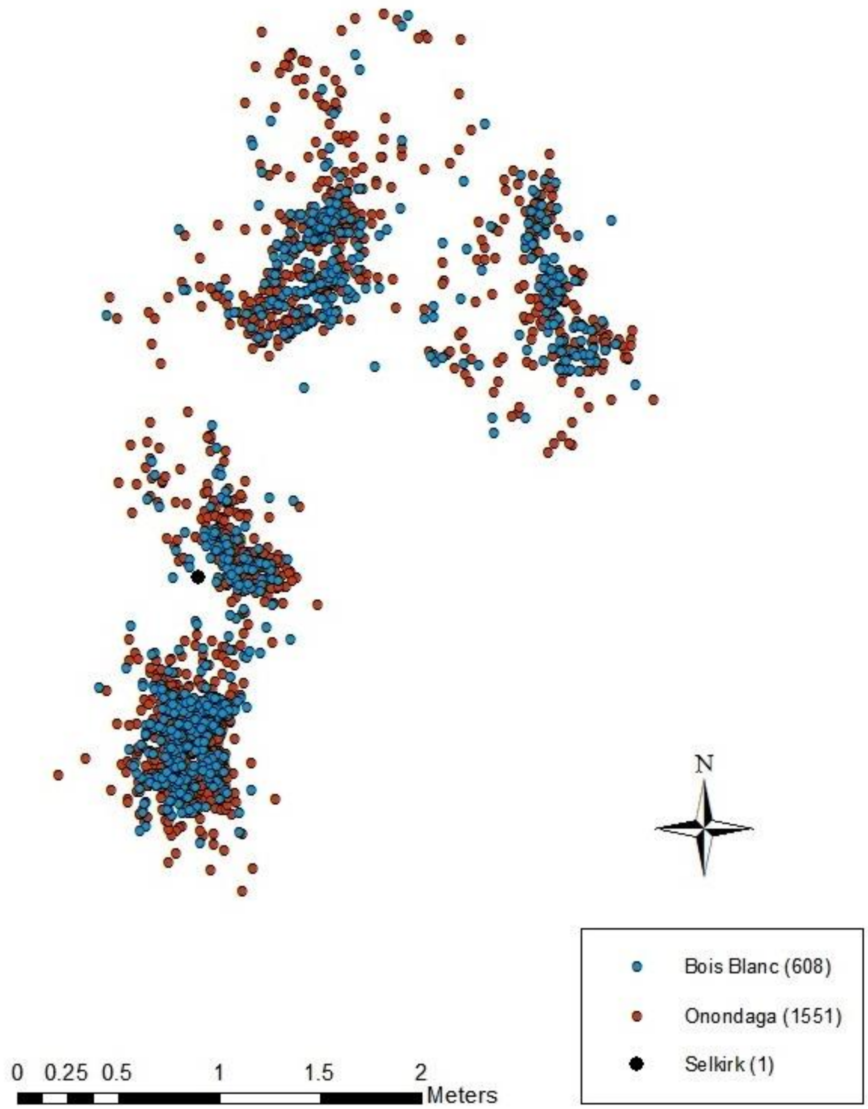

Figure 6.3: Distribution of chert types present in the Mt. Albert feature.

with less dense clusters representing either natural or cultural depressions where fragments accumulated, or areas where fewer bifaces were broken contemporaneously. This assertion rests on the assumption that artifacts were fragmented *in situ* rather than transported and deposited subsequent to breakage.

Although there are two dense accumulations when all of the feature artifacts are considered, biface fragments occur most frequently in the Northwest grouping (Fig. 6.5).

This divergence in localized artifact frequencies may be accounted for by a higher percentage of bifaces struck in the Northwest cluster, although the Southern cluster contains the highest amount of angular fragments (Table 6.1). Additionally, the looser aggregations of biface fragments around the periphery of the more tightly clustered Northwestern area suggests a random patterning in their distribution. This pattern is reminiscent of the way biface fragments ricochet when they are struck on top of other artifacts (see experiments section below).

The presence of the odd, largely intact, biface in each of the Northwestern, Northeastern, and Southern clusters (Fig. 6.4) may allude to preforms that were simply missed in the mass of artifacts. If they were broken while stacked, some artifacts may have missed being fractured. However, the only intact artifact with lateral crushing from being utilized as an anvil occurs in the Northwestern cluster, which may indicate the location where multiple instances of bipolar percussion occurred. Significantly, artifacts used as anvils do not displace like fragments of radially broken bifaces do. Rather, anvils tend to become embedded in the ground from overhead force, so they are the only good potential markers of exactly where artifact breakage occurred.

Across the whole Mt. Albert site 898 artifacts show signs of heat damage, with the majority, 781 pieces, occurring in the feature. Burning occurs on all artifact types throughout the cultural feature without any preference for formal tools or preforms (Fig. 6.6). Additionally, only a minority of bifaces and biface fragments in the feature were burned, with only 22/130 (17%) exhibiting thermal alteration (Fig. 6.7). Clearly burning is a significant source of damage to many subsoil artifacts. As discussed earlier, it is clear that the artifacts were burned after they were already mechanically broken, and much of the thermal damage to artifacts was superficial and not the primary source of breakage. Yet, the possibility remains open that exposure to fire was used as a secondary source of deliberate breakage in addition to mechanical fractures.

Across the Northeast/Great Lakes area deliberate breakage seems to be largely due to either heating or mechanical processes and not both. Nonetheless, at least one site, the Late Paleoindian DeWulf site in Illinois, yielded artifacts that were mechanically broken before being further damaged by deliberate burning (Loebel and Hill 2012). Hence, it may be that burning was used as a secondary source of breakage at Mt. Albert.

If the artifacts were incorporated into a human controlled fire, undisturbed and burned artifacts would conform to the outlines of the blaze, with the highest proportion of thermally altered artifacts centered in that concentration. However, sporadic burning

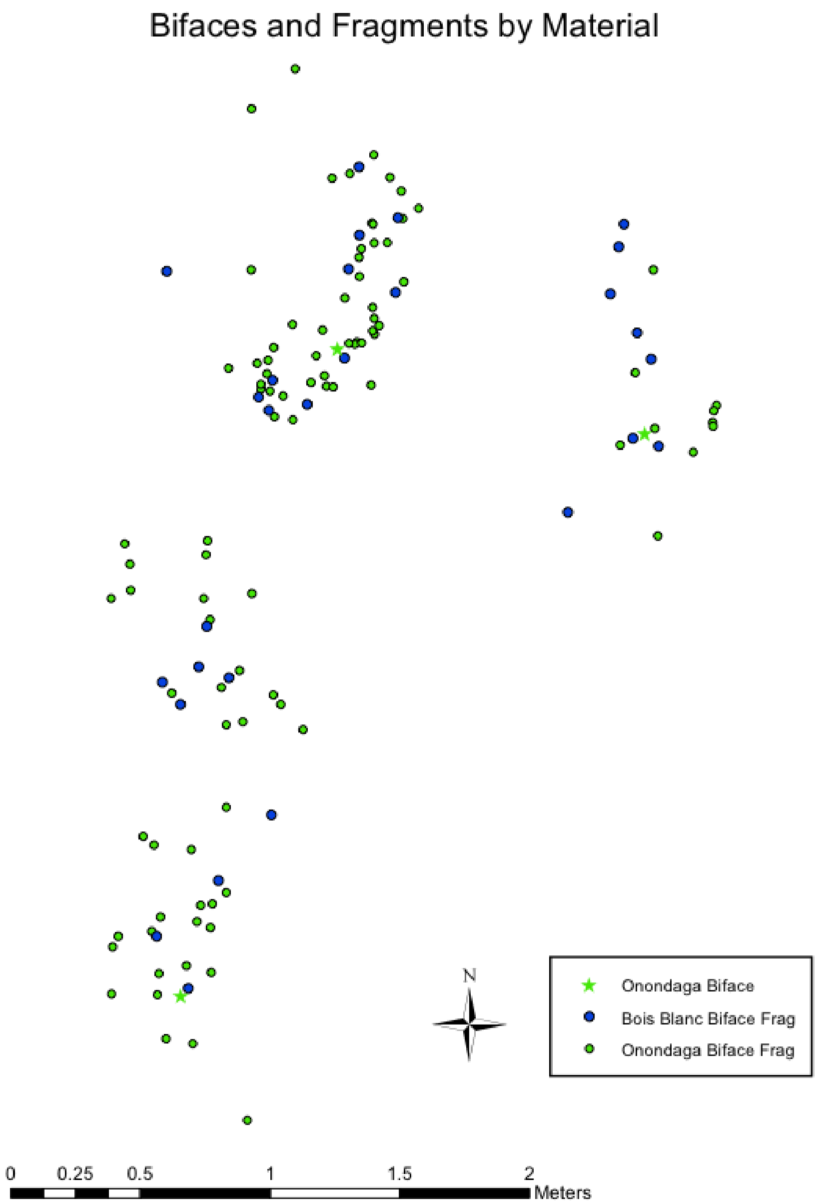

Figure 6.4: Distribution of chert types of bifacial artifacts through feature.

Table 6.2: Distribution of intact bifaces and biface fragments across the subsoil feature clusters.

Material	Northwest	Northeast	Central	South
Colborne	11 (8.8%)	8 (6.4%)	5 (4%)	4 (3.2%)
Onondaga	49 (39.2%)	10 (8%)	17 (13.6%)	21 (16.8%)

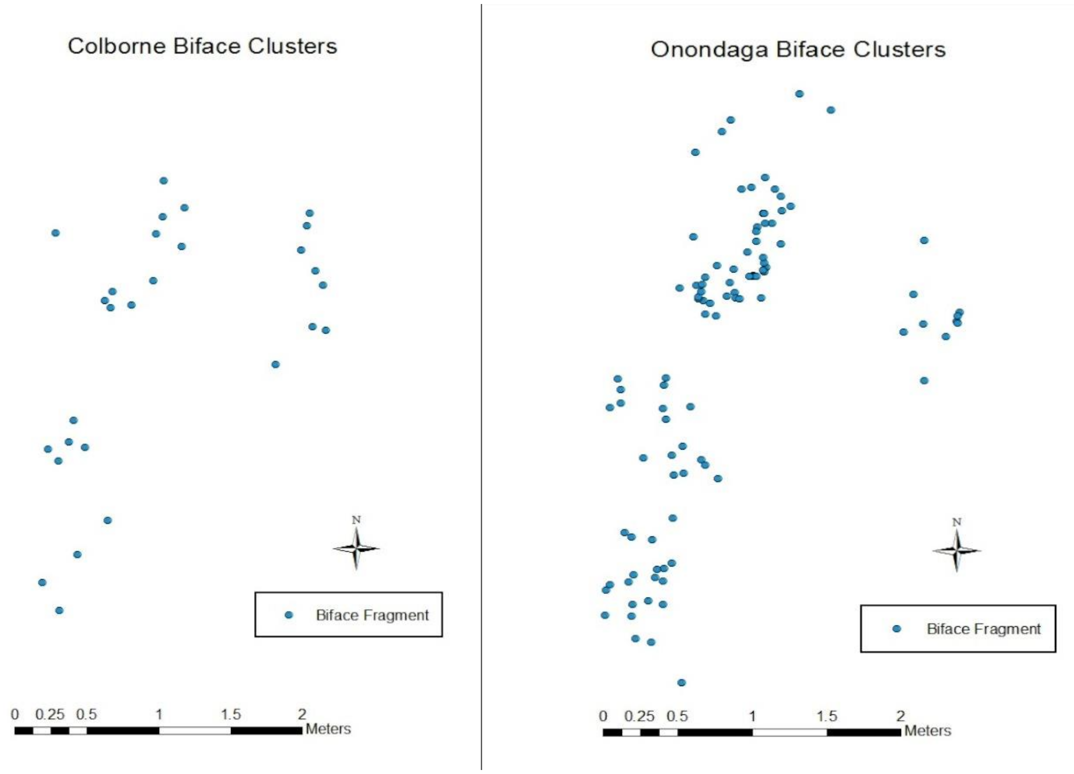

Figure 6.5: Clustering of biface fragments by material.

through the feature area corresponds with the overall lithic densities (Fig. 6.6). If the artifacts were burned *in situ*, then surrounding fires would have heated the whole site, but they only burned hot enough in concentrated areas to damage individual artifacts or fragments thereof rather than the whole assemblage. This spatially random burning indicates that post-depositional factors, such as grass fires or clearing of tree stumps and associated roots during European times, are better sources of the Mt. Albert heat damage.

Among significant artifact classes within the cultural feature, there are relatively few spatial patterns of note. The different artifact forms are mixed up rather than correlating with different areas. The close proximity of the Onondaga projectile point and one bannerstone fragment (Fig. 6.8) might attest to their deposition alongside one another as a completed hunting set including a dart-and-atlatl combination. The other bannerstone fragment recovered from the subsoil feature lies within the Northwestern cluster. The neat breakage lines on bannerstones suggest that the force that snapped these artifacts was not as violent as the majority of chert artifacts, so it is unlikely to have ricocheted like radially fractured bifaces do. Instead, it must have been moved away from the point of breakage due to human intervention.

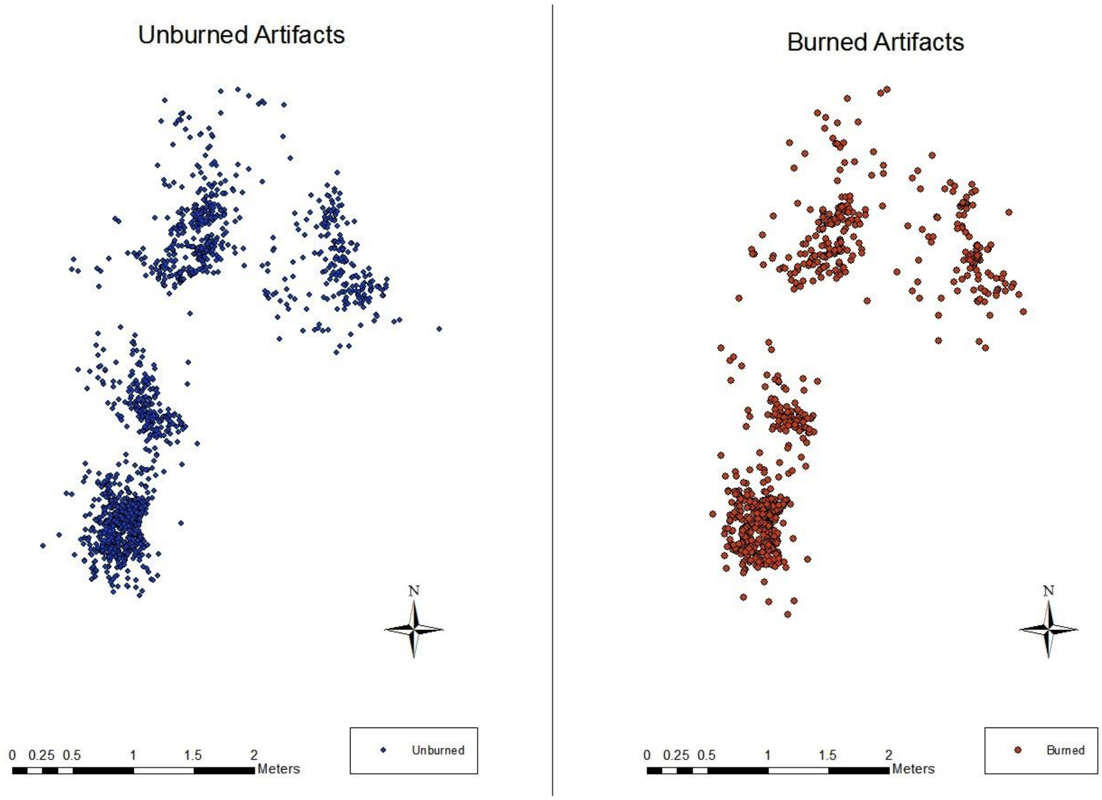

Figure 6.6: Distribution of heat damage throughout feature.

Organic preservation at Mt. Albert is negligible, so it is not possible to say with absolute certainty that the projectile point or the bannerstones were deposited with wood or antler attachments. However, the Onondaga point clearly shows signs of use due to its snapped tip and extensive resharpening of its edges, which indicates that it was attached to a projectile shaft at some point. Further, it is possible that the uniform breakage of bannerstone fragments down their centrally drilled shafts is the result of underlying support from attachment to an atlatl shaft. Although the projectile point is intact, breakage of bannerstones attached to atlatls and the organic shafts of darts might fulfill functional and symbolic roles similar to breaking stone preforms. As a composite implement, a projectile point hafted onto a dart shaft is a completed tool, and fragmenting a single element of this object, for example the wooden shaft, would render the whole unit unusable for its primary function, similar to the act of smashing a biface.

The single hammerstone lies apart from the main artifact densities on site. If it was used to fracture the artifacts as is suggested in Chapter 4, it had to have been separated from the other artifacts after use rather than placed within the mass of broken artifacts. This separate deposition suggests that it was used for the entire fragmentation sequence, and only discarded once its user(s) was finished.

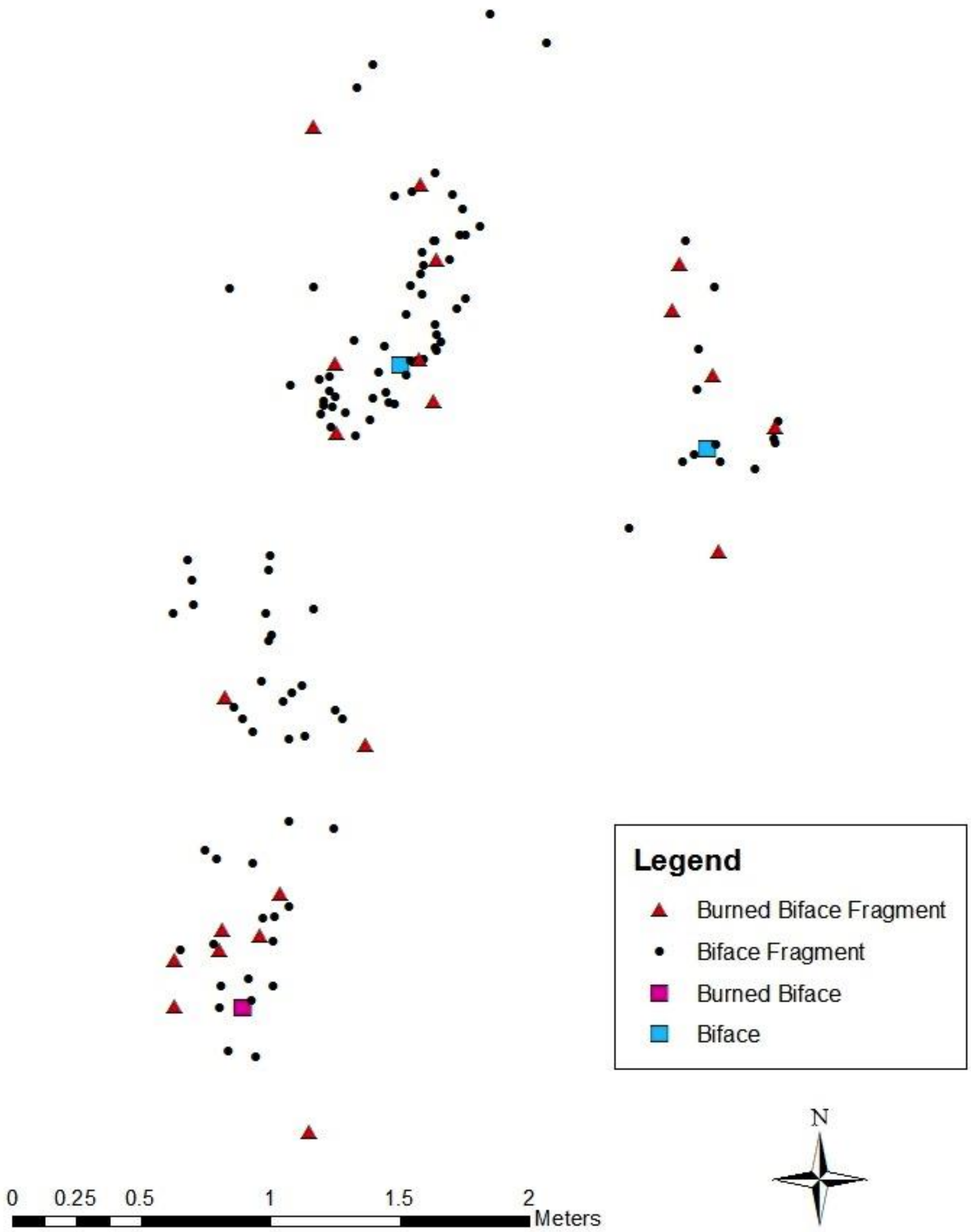

Figure 6.7: Distribution of heat damaged and undamaged bifaces and fragments.

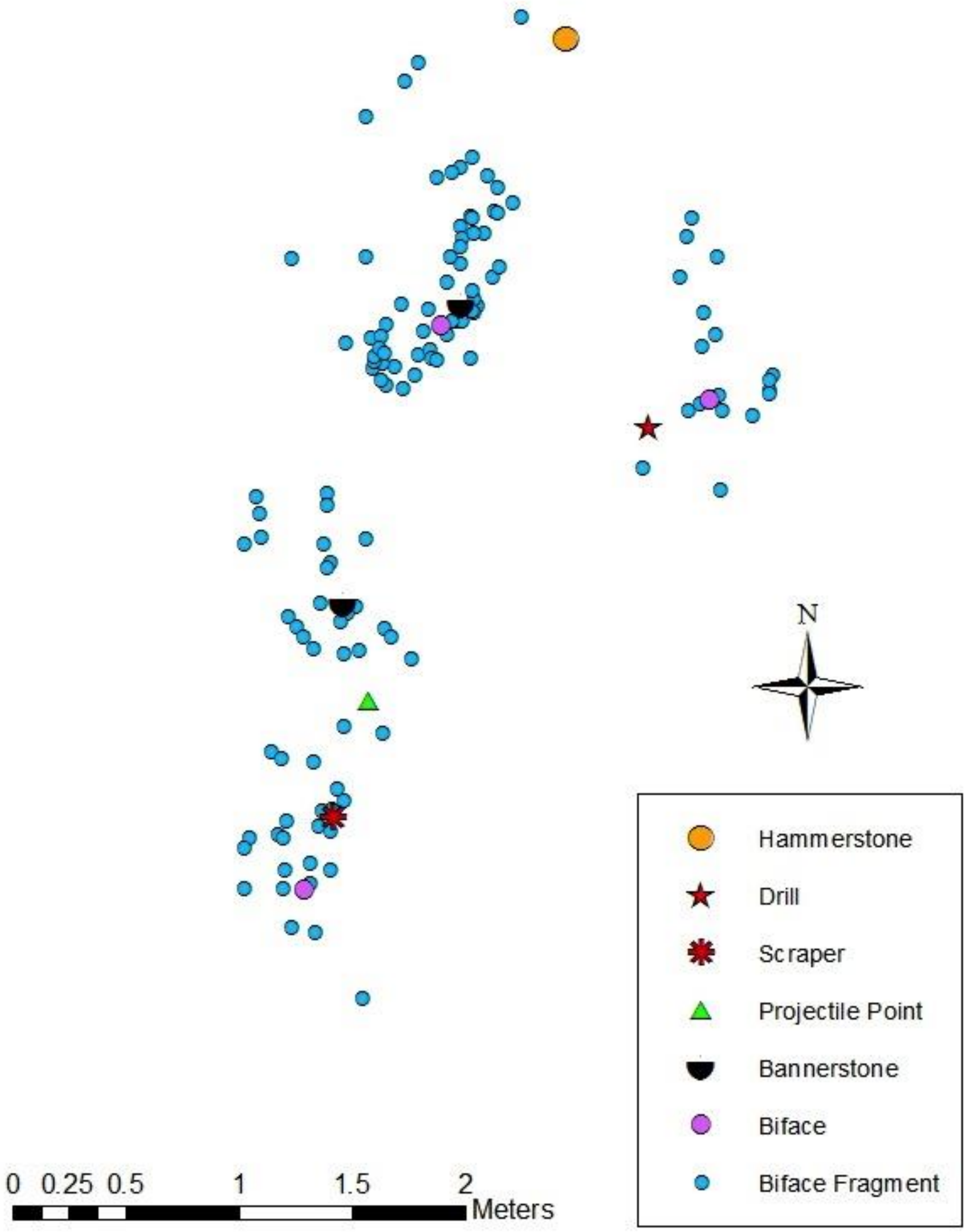

Figure 6.8: Distribution of significant artifact categories.

Based on experiments reported below, the heavy accumulation of angular mechanically produced debris in the Northwestern and Southern loci of the feature suggests that artifacts were predominantly fragmented in these areas (Fig. 6.9) and also, that this distribution is in keeping with the way artifacts are displaced when they are fractured as part of a group. Typically, as shown in the breakage experiments described above, the smaller fragments of angular debris remain close to the point of impact, whereas larger fragments with worked surfaces tend to be more mobile as they are propelled outwards by the energy of the hammer blows.

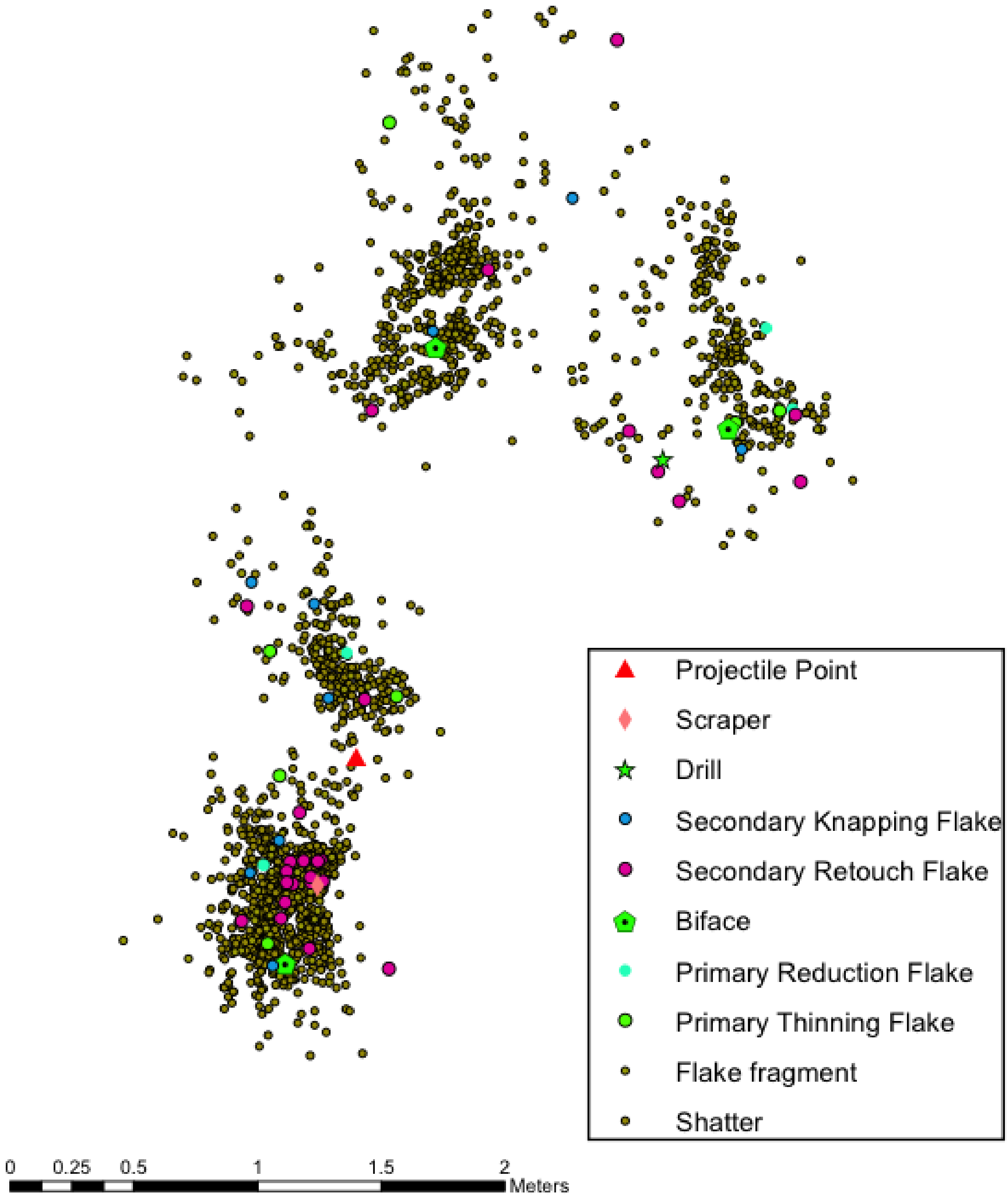

Figure 6.9: Distribution of artifact frequencies.

<u>6.3 Distribution of Refitted Artifacts</u>

Many refitted artifacts were recovered from the ploughzone, so the context of their spatial relationships remains ambiguous. However, all or most of the fragments of eight refitted artifacts were piece-plotted within the cultural feature (see Appendix A, Figs. A1-A8). These refits offer an unprecedented glimpse into the unique nature of artifact breakage activities at a Laurentian Archaic site. Among piece-plotted objects, the spatial patterns of individual fragments of refit tools and blanks show significant separation of the overall pieces in a refit set, with fragments often occurring in two or more of the separate subsoil feature clusters. This result may allude to spatial displacement from their initial point of destruction if they were struck *in situ*, or that fragmented artifacts were gathered from an alternate point of breakage and subsequently deposited into depressions in the ground.

This separation potentially reflects differential treatment of bifaces from other known sites where artifacts were purposely broken. At the Caradoc site artifacts were likely left to lie on the ground surface where they were broken, and although the fragments were from a disturbed context, the majority of artifacts per refitted set were recovered within two metres of each other, which implies that disturbance was minimal (Ellis and Deller 2002:112).

Because artifacts in the undisturbed feature at Mt. Albert are already mixed up, it is clear that plotting the locations of other artifacts within the one metre boundaries of the ploughzone offers little to analyses. Instead, this section focuses on the spatial relationships of artifacts where they hold the potential to offer insights into undisturbed anthropogenic deposition of artifacts.

Two bifaces (Figs. A2 and A4) have refitted pieces that were found in both of the Central and Northeastern aggregation spots in addition to either of the Southern or Northeastern groupings. Only one refitted artifact (Fig. A3) has pieces from both of the Northwestern and Southern clusters. The remaining bifaces (Figs. A1; A5; A6) have fragments from one cluster and one aggregation point. The two side scrapers (Fig. A7; A8) both have fragments recovered from both the ploughzone and the feature. Repeated instances of ploughing mean that artifacts recovered from the ploughzone are necessarily removed from their point of origin. However, the close proximity of the fragments of one side scraper (Fig. A7) overlying the Northeast aggregation, which also contains one fragment from the same item, suggests that horizontal movement of artifacts due to ploughing may be minimal. Unfortunately, most fragments from the majority of refitted artifacts were recovered from the ploughzone, so without an “anchor” artifact in the feature, it is not possible to accurately portray the distances between fragments as the site’s occupants left them.

Overall, all of the refit artifacts show some displacement from their counterparts. In no instances are all the fragments of a single object situated within one artifact cluster. As mentioned earlier, both of the dense Northwest and Southern loci display the most evidence for use as spots to fracture artifacts based on high frequencies of small angular debris. Refitted artifacts reaffirm this hypothesis. The common denominator in all cases where piece-plotted artifacts are present is the situation of at least one fragment in one or both of the Northwest and South groupings. Artifacts never occur in only the Central and/or Northeast clusters. This evidence suggests that artifacts were uniformly struck in a position that caused fragments to travel along a limited number of angles, where pieces accumulated in the relatively looser clusters that form the Central and Northeast clusters. Significantly, if artifacts were struck in both the Northwest and Southern loci, then the paths of ricocheting artifacts converged in the middle and to the east.

6.4 Spatial Displacement of Experimentally Broken Bifaces

Of significance to interpretations is the spatial orientation of experimentally broken artifacts. As was previously discussed, artifacts from Mt. Albert are greatly intermixed. This final breakage experiment was conducted to test the hypothesis that the fragments of multiple bifaces become increasingly mixed up and spatially distanced the more times they are struck while in a group.

Two bifaces were placed perpendicularly atop another two bifaces “Lincoln Log” style in order to imitate the superposition and close contact of artifacts lying in a pile or within a shallow pit. The bifaces were coloured with watercolour paint in order to visualize the distances that individual pieces of broken artifacts travel when struck.

The first hammer blow struck the base of the yellow biface, which radially fractured the distal half of the biface into four wedge shaped fragments, but left the proximal half largely intact (Fig. 6.10). Significantly, this first impact produced two fracture surfaces that join at an acute angle, similar to the unique radial fracture patterns on two bifaces from Mt. Albert (Fig. 4.10). The intact tip of the yellow biface was subsequently struck again, which produced five large wedge shaped fragments. Both fractures contributed to producing 27 pieces of blocky shatter.

Figure 6.10: Radially fractured "yellow" biface with associated shatter; arrow points to location of first impact.

Figure 6.11: Radially fractured "green" biface with additional snap break, with associated shatter; arrow points to location of impact.

One additional hammer strike was incurred on the green biface (Fig. 6.11). This impact produced seven radially fractured pieces. The largest basal fragment simultaneously snapped into two fragments as a result of bending forces originating from the green biface's suspension overtop of two raised anvil surfaces. This biface produced 24 pieces of shatter that predominantly derive from the spot where it was struck.

Two bifaces used as anvils to experimentally fragment the green and yellow preforms each exhibit edge bite fractures with bulbs of force/partial cones largely intact. Impacts occur near the edges of both bifaces and are the results of hammer strikes that were deflected by superimposed artifacts. One edge bite fracture occurred approximately one cm in from the worked edge on the blue biface (Fig. 6.12). The hammer strike shattered the removed fragment on impact, which produced 20 pieces of angular and blocky debris. Notably, the biface did not snap as a result of the edge bite fracture, which likely contributed to the high shatter rate because the edge bite fragment absorbed the remaining energy from the hammer.

In contrast, the second anvil biface, or “red” biface, was struck within half a centimeter from its edge (Fig. 6.13). This produced a complete and intact edge bite fragment that physically resembles a steep flake removal. The edge bite likely remained intact because of a lower area for bending forces to occur across the fragment and less contact with a broad hammerstone to concentrate energy in a smaller area. A broader impact surface rather expands the point of impact and contributes to crushing removed fragments.

Figure 6.12: “Blue” biface with lunar shaped edge bite, with shattered edge bite.

Figure 6.13: “Red” biface with lunar shaped edge bite, with intact edge bite.

When struck on top of anvils that have multiple points of contact with ventral biface surfaces, fragments of bifaces ricochet and travel significant distances. In total ten biface fragments were displaced from their initial impact location (Fig. 6.14). The first impact to the yellow biface failed to displace fragments at all, and they simply lay where they were struck. Once the proximal fragment of the yellow biface was struck, fragments were launched significant distances, with the farthest travelling 55 cm away from the point of impact (Fig. 6.14, far left fragment). The fragments of the biface tip were launched in multiple directions with a roughly radial spread. This evidence suggests that the conchoidal force of impacts that lead to radial fragmentation also forms the impetus for artifacts to expand outwards once they are broken. Five fragments of the tip spread outwards, while one of the originally fragmented pieces was launched away from the pile by leverage caused by hitting the blue anvil.

The single impact to the green biface caused four fragments to travel along radial paths. The farthest fragment travelled 57 cm away from the biface pile (Fig. 6.14, far right fragment). Two fragments were left in close proximity to the anvils, while one piece travelled 23 cm away and lay immediately adjacent to one of the yellow biface fragments, which implies that they were both launched at a similar obtuse angle once they were radially fractured.

Figure 6.14: Spatial orientation of bifaces struck en masse; individually displaced fragments are circled.

Thus, it is evident that significant horizontal displacement of artifact fragments occurs when bifaces are struck while in contact with each other. It implies that fragments grow increasingly intermixed and distanced the more times artifacts and artifact fragments are struck. Without human intervention to gather the remains of artifacts it is clear that a large number purposely broken together would produce a distribution where some individual fragments of artifacts are separated substantially from one another.

Chapter 7: Interpretation

7.1 Introduction

The Mt. Albert site reveals a kind of behaviour never before documented in the 7,000 year long Archaic period of Ontario, let alone the Brewerton Archaic. The "domination of theorizing and the paucity of data" (Emerson and McElrath 2009:23) attributed to Archaic cultures has broadly led to their characterization within progressivist models of cultural evolution and ecologically contingent adaptation to the environment. The distinctive patterns of artifact breakage evident at Mt. Albert offer the opportunity to gain insight into the structural nature of ritual activities for Archaic groups. The materiality of ritual objects is unique in that it provides the potential to shift existing paradigms from restricted dialogues of hunter-gatherer adaptation towards culturally specific knowledge about Archaic perceptions of stone tool use and discard. It is clear that the discard and breakage of artifacts at Mt. Albert took place outside of the set of activities that are broadly considered to be concerned with procurement of food and other subsistence behaviours. This site significantly contributes to constructing the personhood and worldviews of temporally distanced peoples, even if our comprehension of the full meaning of said ritual is slight.

Apparent similarities between the Late Paleoindian Caradoc site (Ellis and Deller 2002) and Mt. Albert offer potential insights into the nature of sacred activities at these two sites. Similarities exist at both sites in the differential breakage and preservation of tool types. For example, despite being separated by 5000+ years in time, both sites yielded a single intact projectile point alongside numerous fractured bifacial preforms, potential tool blanks, and unifaces. This commonality in destruction suggests that fragmentation was a significant activity for both Paleoindian and Archaic hunter-gatherers and signifies social conceptions of objects have potentially remained largely unchanged over a very long period. There are currently no identified sets of purposely broken lithic assemblages between Late Paleoindian and Laurentian times, so it is also possible that the occupants of the two sites independently invented materially comparable practices.

The ability to identify similar patterns from multiple small sites offers the potential to conduct synchronic studies of ritual behaviours (Ellis and Deller 2002:150). It is likely that purposeful breakage is part of a larger structural set of sacred activities involving ritual sacrifice, although the exact nature of these beliefs remains enigmatic. Connecting Mt. Albert with additional small sites has the potential to examine breakage patterns as they shift over time. Additionally, it may become evident whether these activities are associated with human burials and the degree to which they are personalized and attributed to individuals or to groups.

7.2 Artifact Breakage at Mt. Albert

The Mt. Albert lithics maintain some commonality with patterns of purposeful breakage at other sites across the Northeast such as the mechanically fractured artifacts at the Paleoindian Caradoc site (Ellis 2009), radially fragmented Ramah chert bifaces in Quebec (Burke 2006), and shattered and burned artifacts at the Bliss site in Connecticut (Pfeiffer 1984). However, certain elements at Mt. Albert such as the degree of fragmentation and the types of artifacts represented are unique. It is useful to begin with a consideration of the only unbroken tool in the assemblage, a projectile point, as its complete state offers insight into the ways Laurentian Archaic people perceived their tools, their contexts of use, and the ways they ought to be treated.

Some of the more finely worked artifacts, like the knife blade, scrapers, and the projectile points, are quite thin and would naturally be prone to snapping compared with thicker bifaces (Weitzel et al. 2013). Interestingly, of all the finer pieces, including three projectile points, only one Onondaga projectile point is intact (Fig. 3.1A). This may suggest differential veneration of artifact types or simply that it was missed in a mass of shattered artifacts, which acted as protective barriers from the hammerstone. The latter scenario is unlikely given the thorough fragmentation of bifaces - it is implausible that the sole intact projectile point was simply forgotten in a ritual that involved the intentional breakage of artifacts.

Another possibility, suggested earlier, is that the projectile point was part of a composite implement, for example hafted to a dart or spear shaft, but that only the decayed shaft/organic portion was intentionally broken. Snapping a spear shaft or foreshaft would effectively render that object unusable for its intended function, just as pounding a biface into shattered fragments would make its eventual transition into a projectile point impossible, or splitting a bannerstone in half along its drilled midshaft would prevent it from ever being slid onto an atlatl. This act would fulfill the necessary goal of artifact breakage that characterizes the rest of the assemblage. Due to negligible organic preservation, Archaic lithics are often divorced from their conditions of actual use, which necessarily impacts the ways archaeologists view stone tools.

Additionally, the Onondaga projectile point exhibits the only sign of use-wear in the toolkit. The fractured tip (see chapter 3) indicates that it sustained impact damage as a result of its use as a projectile (Dockall 1997), and unilateral resharpening suggests that it was being reshaped for continued use as a weapon tip.

Extensive rounding along its edges alludes to the way the projectile point was treated as a tool. Interpreted as “bag wear” in the initial Mt. Albert report (Archaeological Services Incorporated 2014), it is possible that this artifact was curated for a prolonged period. Curated items take multiple forms for Binford (1979). In the intended sense for the Onondaga Brewerton point recovered, curation is meant to imply that it spent a protracted time in contact with a material, likely animal hide, that has gradually worn down all the sharpened edges. Ethnographic studies of Nunamiut hunters indicate that blade cores and extra tools were often carried to fulfill future necessity for unanticipated tasks that might arise during hunting expeditions (ibid:261). Significantly, these curated tools often exhibit similar dulling of edges as a result of contact with their containers. It is possible that the projectile point was carried to fulfill similar unanticipated roles to replace a lost weapon or expediently re-haft a broken spear or dart tip. In the context of this assumed dormant use life within a pouch, it is possible that, unlike other artifacts, the projectile point was deposited within the pouch, which separated it from artifacts that were mechanically broken. Finished tools like the point are more likely to be impacted by breakage than more robust unfinished forms, so they may have needed more protection in transport.

Alternately, significant rounding along the blade edges and smoothing of flake scars may reflect repeated contact with animal bone and use as a cutting tool (Dockall 1997:324). Therefore, smoothing and polishing of the basal area on the projectile point may reflect “haft wear” rather than “bag wear” (ibid.). Considered with the above suggestions that this tool was extensively utilized while hafted, it is probable that it was interred as a composite tool.

The extensive use life of the projectile point suggests that it was a personal item and efforts were made to maintain it. This reinforces the possibility that the Mt. Albert artifacts were part of an individual or group’s toolkit, with a wide range of artifact types intentionally included.

The relatively broad striking face of the hammerstone possibly contributed to the highly fragmentary nature of artifacts and is partially responsible for their consistent fragmentation into small, angular pieces. However, the large hammerstone is not solely responsible for the high degree of breakage seen at Mt. Albert as it is evident that some artifacts were struck multiple times, and many while in contact with other objects, or as called here “*en masse*” (see chapter 4). The individuals breaking the objects were not satisfied with simply splitting lithics into halves or several larger radial wedges, or with breaking each artifact separately, as was the case in the earlier dating Paleoindian Caradoc assemblage. Some aspect of the beliefs of the artifact breaker(s) warranted that artifacts ought to be massively degraded by multiple hammer strikes.

Multiple strikes were incurred by a large hammerstone and the intermixing of artifacts at Mt. Albert was at least partially caused by the natural distances that pieces of artifacts travel when they are struck while in contact with each other. This factor is likely one that contributed to the majority of overall artifact type/lithic material mixing, although the large amount of mixing of fragments of the same artifact into different clusters suggests some intentionality may have been involved. In other words, it is possible that the artifacts, once shattered, were purposely mixed and clustered together in the feature where they were destroyed. Alternately, it is tenable that artifacts were smashed elsewhere and deposited in the feature. Due to the large quantities and miniscule size of some of the angular, shatter-like fragments present one might envision that breakage took place on animal hides, which were subsequently poured into the feature depressions. This procedure would effectively produce the artifact mixing that is apparent within the feature clusters. If so, the large number of such fragments in the Northwest and Southern Clusters may not reflect the locations of breakage. However, such an interpretation would not explain why these clusters have more quantities of smaller debris whereas the others do not.

7.3 Interpreting Intentional Breakage

There is a variety of reasons why past peoples intentionally fragmented artifacts. Purposeful breakage occurs for both utilitarian and symbolic purposes and the act of breakage maintains layers of meaning for the social actors that take part (Hoffman 1999:103). It is difficult to positively identify activities as "ritual" or "sacred" in nature within small, mobile, bands of hunter-gatherers whose primary archaeological remains are flaked stone tools, especially in contrast to economically and socially more complex larger scale societies where the distinction between different activity types are more apparent due to the presence of many different lines of evidence lacking at non hunter-gatherer sites (Ellis and Deller 2002:140; see Renfrew and Bahn 1991). Also, there is often no clear separation between sacred and economic life amongst small bands, and indeed, the two are fluid and often overlap (Sanger 2003; Tanner 1979).

Utilitarian purposes for intentional fracturing include recycling tools into other types to make the most use out of the material, and sharing malleable materials as a strategy for alleviating resource stresses. However, these are clearly not the motivation for the Mt. Albert breakage as discussed here.

In terms of recycling, for example, radially broken and snapped artifacts are relatively common occurrences on Paleoindian sites, albeit encompassing only a small percentage of overall assemblages (see Frison and Bradley 1980; Gramly 1999). Paleoindian artifacts were reportedly fractured to produce thick and often sharp edges. These edges were hardy enough for tasks that flaked edges are too weak/thin to employ (Ellis and Deller 2002:72). The thick, sharp, acute fracture edges of wedge-shaped fragments are excellent tools for engraving tasks involving hard materials such as bone and antler and thick, right-angled snaps serve ideally in wood and bone shaving/scraping and other tasks. As Deller and Ellis (2001; Frison and Bradley 1980) note, wedge-shaped fragments or bend break tools were often produced by breaking flaked artifacts that were already extensively used for other tasks or on fragments of unfinished tools such as preforms that had been broken in manufacture, or essentially by recycling. Thus, it is probable that Paleoindian artifact breakage of this nature is part of a strategy to maximize the usage of scarce raw materials by transforming artifacts that had outlived their usefulness into different tool types.

It is improbable that the artifacts at Mt. Albert were fractured for similar purposes. Firstly, the sheer quantity of artifact fragments at the Mt. Albert site is far greater than the numbers found at Paleoindian sites, and it does not seem likely that a group would need hundreds of broken biface fragments to fulfill its engraving needs. Nor is there any direct evidence the bifaces were preforms that were discarded due to manufacturing errors. Additionally, Laurentian Archaic groups utilized a variety of groundstone woodworking tools, such as gouges and adzes, and pointed chert implements such as drills and scrapers with thick edges (Ritchie 1944: Plate 111), that would be sufficient for engraving hard materials like bone or antler. Further, none of the Mt. Albert artifacts exhibit any additional use-wear along the edges or points of fracture surfaces beyond impact damage from hammer strikes, nor is the author aware of any reported Laurentian assemblage where any items were purposefully broken to use the resulting segments as tools – a direct contrast with the earlier Paleoindian site assemblages where such breakage is repeatedly found. Perhaps most significant, the occupants of Mt. Albert had ready access to local Onondaga and Colborne chert sources along the north shore of Lake Erie, even though they are approximately 200 km away from Mt. Albert. This access means that it is unlikely the site's occupants were forced to resort to recycling tools to mediate chert unavailability as earlier Paleoindian groups did.

The sharing of raw materials represents another practical reason for deliberate breakage. For example, such sharing was likely the primary reason for purposeful breakage of copper artifacts during the Copper Age of Mallorca in Spain (Hoffman 1999). Copper blanks were split apart into even halves using a series of chisel strikes to make longitudinal cuts into their surfaces. The ensuing cracks were subsequently used to pull one copper ingot apart into two even fragments (Hoffman 1999:114). The two halves were recovered from adjacent locations 50 metres apart, which supports the hypothesis that this act was completed to distribute resources between communities during a time when social roles were becoming increasingly hierarchical. The growing control over resources by elites ultimately necessitated the sharing of materials as part of a strategy to mediate scarcity in valued goods.

It is unlikely that bifacially knapped blanks at Mt. Albert were fragmented for similar reasons. The omnipresence of Onondaga chert on Archaic sites across Southern Ontario indicates that this material was plentiful and, moreover, there is no evidence for hierarchical social structures during this time to restrict access to necessary commodities such as chert. On the contrary, large-scale social connections were used to distribute exotic materials across the Laurentian sphere of influence. Additionally, the small fragments of broken artifacts are not useful for making projectile points of a sufficient size and weight to meet the needs of Laurentian point forms, so it is not possible that breakage was done to share raw materials. In fact, as noted earlier, there is no evidence such small biface fragments were even needed to be used as tools after their production.

In addition to recycling or sharing, Chapman (2000:23) has proposed additional explanations for the worldwide prevalence of objects deposited in fragmentary states. Other than the obvious accidental breakage or breakage through normal use, Chapman also mentions: 1) deposition of objects after being deliberately ritually "killed;" and 2) intentionally fracturing of objects so they can be used in relationships of "enchainment" and in which the broken segments are subsequently buried. To the extent that inferences about ritual breakage are tenable as hypotheses, this latter explanation holds particular relevance to interpreting the breakage patterns at Mt. Albert.

It is conceivable that some of the artifacts at Mt. Albert could have been broken accidentally or while in use. Trampling could be a factor in the destruction of thinner artifacts such as projectile points, utilized flakes, drills, and bannerstones, which are weakest along their drilled midshaft, although Weitzel et al. (2014) have demonstrated that artifacts over 7 mm thick are unlikely to be fragmented by trampling damage. As noted earlier (see chapter 3), a high percentage of the Mt. Albert items exceed, and often considerably, this thickness threshold. Thus, the majority of fractured biface blanks and preforms have to be accounted for by means other than trampling, which is consequently unable to produce the high rates of shatter present, nor is it able to produce impact fractures like those at Mt. Albert. Additionally, if we momentarily discount the evidence for deliberate breakage of worked artifacts it is possible that the finished tools could have been broken during accumulated periods of hard use, however this explanation again fails to account for the many shattered blanks and preforms, whose very nature precludes their use in conventional hunting or domestic activities where trauma could consistently occur.

The first hypothesis rests upon the assumption that artifacts designated for destruction can be “killed,” or be stripped of some animistic property. Symbolic reasons for the intentional breakage of objects often involve the “killing” or “sacrificing” of objects in order to produce an intended outcome within, or outside of, the natural world. Collections of artifacts, including bifaces and groundstone tools such as bannerstones or gorgets, have been intentionally broken across the Eastern woodlands (see Melton and Luckenbach 2013; Taché 2011), and ritual killing is a well-documented worldwide phenomenon, although the intended outcomes vary greatly (Chapman 2000; Chapman and Gaydarska 2007; Renfrew 1994; Renfrew and Bahn 1991).

Often ritually “killed” objects are associated with deceased persons and constitute a form of symbolic death for the objects. Reasons for breakage can include the fear of spiritual or physical pollution by objects of ritual power and impurity, feelings of disgust at reuse, and aversion to associate with objects that belong to deceased persons (Grinsell 1960:476-478; 1973). Frequently artifacts were “killed” alongside deceased persons so that the objects might be of utility to spirits within the next world. The objects that are broken and deposited within funerary contexts often consist of elaborate artifacts made specifically for the ritual (Lavin 2013:103). Given that many of the artifacts at Mt. Albert are bifacial blanks and preforms, they were never used prior to their transportation to the site. This characteristic does not necessarily suggest that they were manufactured specifically for inclusion in the destructive activities at Mt. Albert as other Laurentian sites, such as the O’Neil site (Ritchie 1973) and the Robinson and Oberlander sites (Ritchie 1940; 1980:36), have caches of early stage bifaces that were probably intended for use as preforms/blanks for future tools. Instead, the preforms/blanks were likely transported as part of normal Brewerton everyday activities and were available when the breakage ritual was performed.

Although both “offerings” and “sacrifices” are concerned with the presentation of a gift, Insoll (2011:151) distinguishes between the two in that the latter incorporates a destructive element necessary to facilitate the completion of the ritual. By referring to the “killing” of objects it is implied that the object is an entity embodied with a recognizable “soul” that is able to transcend the physical world upon destruction.

Significantly, Chapman (2000:25) suggests that a characteristic common to most killed objects is that all of the fragments are interred together in close proximity to one another. Given the recovery of the majority of artifact fragments at Mt. Albert, which has allowed for 147 lithic fragments to be refitted (see Chapter 4), it is clear that the artifacts were broken *in situ*, or at least, nearby. This evidence reaffirms the hypothesis that the artifacts at Mt. Albert were “killed” to fulfill some form of sacred sacrificial offering.

Chapman’s (2000) second explanation involves the exchange of fragmented objects as signifiers of social connections. “Enchainment” operates as a relationship between separated parts and whole objects. The process of enchainment based on the fragmentation of artifacts involves a social relationship or transaction that the actors involved agree to materialize within an appropriate artifact (Chapman 2000:6). The object is fractured and individual fragments are taken by the actors as tokens of the exchange that took place. The pieces of the object are subsequently carried until the relationship is reunited or the transaction has completed, and the fragments are deposited together to symbolize social reconstitution. Significantly, enchained connections are known to exist between recently deceased persons and their surviving kin (ibid.), and reunification culminates at the completion of burial ceremonies.

There exists the possibility that fragmented artifacts were purposely split and exchanged between individuals or groups to maintain social connections, or “enchained relationships,” over distances (Chapman 2000). If true, this practice would constitute a significant shift in the material basis of inter-group connectivity, from trading the relatively malleable medium of chert cores across the Laurentian sphere of influence to exchanging parts of pre-made objects that can be re-made once the two groups meet again. The latter system of exchange implies an intended future reunion of people and of the socially important materials that signify those relationships. As a physical indicator of a relationship, a bannerstone split in half would only be able to reconnect with its other half and no other bannerstone fragment, thereby signifying the uniqueness of the relationship.

Enchainment could explain the unique nature of destruction among bannerstones at Mt. Albert. By contrast, the bifaces were split into many small, blocky, and angular fragments where the prominent worked features of knapped artifacts are largely obscured due to lines of breakage. While it is conceivable that the multiple fragments of radial fractures could serve as objects of enchainment for relationships that involve more than two individuals, this process is unlikely given that many flaked artifacts were struck multiple times, thereby destroying many of the fragments large enough to become enchained. Additionally, winged bannerstones were often incorporated within significant social structures in the Middle and Late Archaic periods of the Eastern Woodlands (Sassaman 1998, 2010, 2011), so their roles within relationships of enchainment may have been emphasized over more abundant artifacts such as flaked stone blanks. Certainly the large amount of labour invested in completing banded slate implements offers the impression that they were highly regarded, and substances like banded slate were valued for their aesthetic qualities (Jones and Macgregor 2002). Banded slate gorgets were intentionally broken, likely to establish enchained relations, during the Early Woodland period (Melton and Luckenbach 2013). Thus, it is probable that select objects were reserved for the materialization of special relationships, rather than any and all knapped and carved/polished stone objects.

Deliberate breakage of bannerstones and other artifacts may have involved the transportation and emplacement of fragments in multiple contexts. In this context, the two fragments that likely fit together would be perceived as reconstituted parts of a relationship. Whereas it is entirely possible that the missing piece of the remaining bannerstone fragment lies beyond the known site boundaries, it is also tenable that it represents one half of a relationship that was never remade prior to the deposition of fractured materials, and so was removed by kin or an ally.

It is probable that the drilled form of bannerstones allowed for splitting into two evenly sized halves (see Chapter 4). This trait would make them attractive artifacts to fracture for enchained relations. Additionally, these are highly polished artifacts and care was taken to emphasize the natural banding within the slate. Thus, these artifacts embody the technical skills and choices of their makers, so the bannerstones come to embody the personhood of individuals who ultimately trade fragments of themselves when they exchange objects within enchained relationships. In the context of widespread Laurentian exchange networks it makes sense that symbolically charged objects such as bannerstones could be used to maintain social ties with distant communities.

Other symbolic material actions can be seen in the deliberate mixing of materials within the feature. In the context of enchainment, mixing might signify the material permanence of reconstructed relationships. Once bannerstone fragments become embodied with the “dividual” personhood of individuals or groups, mixing would establish metaphorical consanguinity and wholeness by erasing the social boundaries that were constructed at the point of fragmentation.

Beyond ritual or social explanations for intentional breakage, the caching and fragmentation of artifacts may have functions that are more symbolically active in nature. Caching here transcends purely practical motives, such as preparation for future tool necessity; because objects were broken there likely was no intention to recover and utilize them in emergencies based on unforeseen need (see Lovis et al. 2005). Rather, it is possible that breakage and burial of artifacts maintained symbolic roles for Middle Archaic hunter-gatherers that incorporated unseen and mythical elements of the environment. Hunter-gatherers embody a fluid sense of identity that is intrinsically tied to places within the landscape, which is itself constructed with layers of symbolism that are continually shifting (Ellis 2009:347; see also Deller and Ellis 2011; Ferris 2014; Kelly 2003). Given that objects such as stone artifacts are embodied with agency (Wright 1995:116) it is possible that their fragmentation and deposition was part of efforts to imbue the landscape with cultural meaning. Some Paleoindian caches have been interpreted as part of efforts to embed cultural meaning within areas new to human occupation (Ellis 2009:347; Kornfeld et al 1999). Although Laurentian groups were not the first people in Southern Ontario, hunter-gatherers continually re-negotiate their relationship to the world in which they live in a never-ending process of “becoming” that involves the formation and reformation of individual and group identities (Ferris 2014:372-373). Therefore, the nature of Brewerton interaction with the landscape is inherently different from that practiced by the Paleoindian ancestors.

7.4 Ethnographic Accounts of Breakage

Through examination of ethnographic analogs and similar cross-cultural precontact practices it is possible to glean some insight into the potential meanings of ritual breakage, and subsequently the lived experiences of the people involved. The amount of veracity in this endeavour is subject to interpretation, however (see Wylie 1985). Given the incredibly personal and culturally embedded nature of performing rituals, these suggestions ultimately remain speculative when applied to the Middle Archaic ancestors of recorded groups.

Jesuit accounts of life among the Huron-Wendat in the seventeenth century, such as that of Father Gabriel Sagard, provide pertinent insight into the cultural beliefs that surround burial ceremonies (Heidenreich 1975). As part of the Feast of the Dead ceremony the remains of all those ancestors who had died over a period of several years were interred together in a single ossuary. Accompanying the deceased were also interred recently killed dogs and personal belongings (Heidenreich 1978:374; Kapches 2010:2). These grave goods include the personal belongings of individuals as well as gifts of food and tools that were perceived to be of use to the deceased in the afterlife. Many of these artifacts were symbolic in nature, embodied with "deep spiritual meanings" that allow for interactions on a spiritual plane (Lavin 2013:102). Due to the Wendat belief that the souls of the deceased continue to maintain the personalities and roles in the afterlife that they did in life, these souls still have

> …the same need of drinking and eating, of clothing themselves and tilling the ground, which they had while still clothed with their mortal bodies. This is why with the bodies of the dead they bury or enclose bread, oil, tomahawks, kettles, and other utensils in order that the souls of their relatives may not remain poor and needy in the other life for lack of such implements. For they imagine and believe that the souls of these kettles, tomahawks, knives, and everything they dedicate to them… depart to the next life to serve the souls of their dead… (Wrong 1939:172).

Algonkian speaking Beothuk living in New England during the seventeenth century saw the afterworld as a perfect reflection of the natural world minus the "pain, fear, and want" that plague the living (Lavin 2013:103). Similarly to Huron-Wendat burial rituals, everyday artifacts of utility and spiritual objects, such as wooden human and bird effigies, were incorporated into burials (Wiseman 2005:83-93).

Ritual breakage is seen among multiple Iroquoian populations in the disposal of human effigy pipes (Mathews 1980). Notably, many effigy pipes had their faces mutilated or were intentionally broken before being discarded, with their heads and bodies separated prior to burial. This practice indicates a necessary separation of the symbolically and functionally integral parts of certain objects. The intended result is to facilitate the release of the spirit contained within these pipes.

These commonalities in burial rituals between linguistic groups allude to the widespread nature of perceptions of materiality within the afterlife. Among both groups objects are embodied with souls that are able to transcend the limits of their physical properties and join human spirits in the next life. There is a significant distinction between objects intended to accompany individuals into the next world that are interred as whole objects and those that are fragmented prior to final deposition.

Analogies from Huron-Wendat burial rites hold relevance with regard to interpreting the depositional contexts of ritually killed Laurentian Archaic toolkits. Artifacts become mixed up when they are broken and this act is analogous to stirring the osteological remains of deceased ancestors among the Huron-Wendat. Just as ossuary burial emphasizes group consanguinity, the mixture of broken artifacts may evoke similar cultural requirements to combine the physical and social elements of “deceased” or intentionally “killed” tools and preforms. Additionally, artifacts were being broken as a group as well as being mixed together after fragmentation.

This discussion is not meant to imply that evident similarities between Laurentian, Huron-Wendat, and Algonquian rituals entail the idea that these populations and communities are culturally related. Rather, it shows that contact-period First Nations living in the Laurentian Archaic homeland practiced activities that produce similar material remains as the people who occupied the Mt. Albert and Bliss sites. It could be that some continuity of perceptions about sacred worldview was carried through time and across shifting cultural boundaries.

7.5 Laurentian Burial Patterns

Human burials are known from multiple Laurentian Archaic sites with variable interment styles. At the Brewerton type-sites in New York (Robinson and Oberlander-1;

Ritchie 1940), the Wapanucket-6 site in Massachusetts (Robbins 1960), and the Old Lyme site in Connecticut (Pfeiffer 1984) there are in-flesh burials associated with living areas. Articulated skeletal remains also proliferate throughout expansive living areas at both of the Morrison's Island-6 and Allumettes Island-1 sites, and there are several disarticulated bundle burials at the latter (Pfeiffer 1977). The interment of human remains through living floors and refuse areas at these sites indicates that most Laurentian groups did not bury their dead in areas specially allocated apart from habitation spaces as cemeteries (Spence 1986:86), although the burials at the Morrison's and Allumettes Island sites do cluster and may reflect early cemeteries (Pilon and Young 2009).

Highly fragmentary skeletal elements from bundle burials occur at the Otter Creek-2 site in Vermont (Ritchie 1979). Cremation burials have been positively identified at the Clark site in New York (Ritchie 1951) and the Bliss site in Connecticut (Pfeiffer 1984). Altogether it is clear that burial style was relatively unstructured and fluid for Laurentian populations given the mutability of interments between and within different sites.

There is some evidence for burial ceremonialism from the Bliss cemetery site, where bannerstones, bifaces, and ground slate knives were purposely broken and incorporated as offerings with cremation burials (Lavin 2013). Additionally, at Allumettes Island-1 multiple burials were sprinkled with red ochre, which is an element of burials through later periods that was also widely incorporated in sacred rituals (Chapdelaine and Clermont 2006). These examples allude to increasing funerary symbolism around this time and could suggest the existence of a related Middle Archaic funerary cult that is similarly represented at Mt. Albert in the form of material offerings and cremations.

Unfortunately, the absence of osteological material at Mt. Albert, potentially a product of the destructive nature of Ontario's acidic soils, renders the presence of cremations purely speculative. Further, and perhaps most significant, because of the uneven distribution of thermal trauma to artifacts throughout the assemblage, this attests to sporadic sequences of burning that are not characteristic of funeral pyres or even cooking hearths (Thoms 2008; Wandsnider 1997). That being said, the nature of broken tools is identical to patterns identified from culturally similar burials. To the degree that being part of the Laurentian sphere of exchange can be reasonably extended to shared worldview, one possible explanation for the character of artifact sacrifice at Mt. Albert is that it was part of a funerary context, similar to the offerings from the Bliss burial complex. While there are potentially variable reasons to deliberately shatter stone tools, it is evident that the Mt. Albert assemblage was intended as an offering that was possibly a sacred component in human interments.

Although the burning of broken artifacts is apparently random throughout the site, it is conceivable that artifact fragments were intentionally displaced after incorporation into a funeral pyre. This would facilitate an intermixing of cremated human remains and the fragmentary elements of the toolkit, thereby making the separate entities whole and establishing permanent material-human connections that occur post-life, similarly to the process of ossuary burial.

Chapter 8: Summary and Conclusions

The Mt. Albert site was excavated as part of a Stage 4 CRM project to mitigate damage to the site due to residential development. Preliminary analyses suggested that most of the stone tools were heavily fractured on site, an activity that has rarely been identified in the extensive Archaic period of Eastern North America. The studies here have confirmed the hypothesis that these stone tools were deliberately broken as part of efforts to ritually "kill" the artifacts.

It is clear that the artifact patterns at Mt. Albert reflect a unique set of ritual activities never before seen in the 7,000 year long Archaic period in Ontario. In total 2,905 artifacts were recovered and include flaked Onondaga and Colborne tools and bifacial blanks, slate bannerstones, and a single hammerstone. Sustained efforts resulted in the refitting of 147 chert fragments, many of which are thick bifacial artifacts of which several were completely reconstituted. Many refitted artifacts show distinctive impact scars from being struck in the centre of their faces away from knapped edges. Experimental breakage of reproduction bifaces builds on previous studies of artifact fragmentation (Ellis and Deller 2002; Weitzel et al. 2014) by demonstrating how bifaces fracture when they are struck *en masse*. Based on the central position of fracture initiations on artifacts, as well as the large numbers of broken objects, there is no doubt that artifact destruction was intentional.

Although the upper deposits at the site were disturbed by ploughing, one deeper subsurface feature, roughly five square metres in size, was documented that contained 743 artifacts. The distributions of individual pieces of refitted artifacts are mixed together and do not cluster alongside one another in close proximity, as one might expect if artifacts were broken individually and on an uninterrupted ground surface. This evidence suggests that objects were broken as a group and the fragments were left to lie where they landed after being struck or that after breakage on, for example, an animal hide nearby which facilitated their being placed together in the feature. Additionally, some of the subsoil clusters could represent actual locations of breakage and others areas where excess material was dumped. Additionally, it is possible that the pieces were purposefully stirred, possibly to break down the physical boundaries of objects in order to facilitate the transcendence of artifacts' spirits into the next world. Given that artifact densities reveal multiple depressions in the ground, it is possible that artifacts were mixed or even partially broken within pits dug into the ground in order to contain their horizontal displacement.

While there are some similarities present in the ritual killing of toolkits from the Laurentian Archaic Bliss site, as well as at the Paleoindian Caradoc and Crowfield sites (Ellis 2009), Mt. Albert breakage varies in a number of ways. For one thing, heat shattering rather than mechanical breakage played a role in the breakage at Bliss and Crowfield but not at Mt. Albert. Also, whereas careful mechanical breakage of individual tools was dominant at Caradoc and seemingly was sufficient to release the spirits contained within those tools, many Mt. Albert artifacts were massively shattered lying/piled together and the remaining fragments, which ricocheted and dispersed when they were destroyed, were consequently mixed together in a process that may have valued consanguinity, or the dissolution of individual bodies (represented by the artifacts) in death. At the Late Paleoindian Renier site (Mason and Irwin 1960), the Late Paleoindian (Scottsbluff) Pope site (Ritzenthaler 1972), and the Duck Bay phase Bliss cemetery (Pfeiffer 1984) artifacts were emplaced as inclusions in definitive cremation burials. Only a few of the Mt. Albert artifacts were burned after mechanical breakage and seemingly randomly, so it is less likely that they were incorporated into a funeral pyre, but given their ritual breakage context it is possible that they were part of grave goods interred with humans or sacrifices associated with such an event.

Although the presence of human interments is speculative, it is likely that artifact breakage was part of attempts to communicate with supernatural entities in addition to facilitating social connections. The nature of these entities may vary, and can include interaction with the souls of ancestors or deities and animate elements of the landscape.

An interpretation of ritual breakage argues stone tools reflected more than just ways of adapting to the natural world. This topic offers insights into the agency that individuals exert when they make the decision to break artifacts. Within this behaviour there are evident efforts to interact with, and actively impact, seen and unseen agents within and outside the known realm of existence. In these meaningful actions people exercise considerable freedom of choice in determining the most appropriate ways to perform ritual activities in the most appropriate places at the best times. Agency reflexively governs the intended outcomes of deliberate actions by mandating culturally mediated options for future action.

The Mt. Albert site builds on existing, albeit uncommon, knowledge about ancient sacred ritual in Northeastern North America. Although the ritual killing of objects is rare, and can include mechanical breakage or heat shattering, or both, similar patterns are evident thousands of years prior to, and after the occupation of the Mt. Albert site. Spatially, similar rituals also occur thousands of kilometers away, and it is clear that there are local variations on this common practice. These commonalities suggest some uniformity in the social and cultural meanings of artifact sacrifice and allude to common ways of viewing the natural and supernatural worlds. The subjective meanings of sacred activities will doubtlessly remain enigmatic. However, by connecting the data from the Mt. Albert site with future small sites with suggestions of ritual, like the Caradoc site, it will become possible to develop a working model for identifying related sites. The ability to recognize these types of activities may also prove useful for identifying ritual components on other Archaic sites where patterns of broken artifacts are mistakenly attributed to use or manufacture.

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Appendix A: Spatial Distribution of Refitted Artifacts

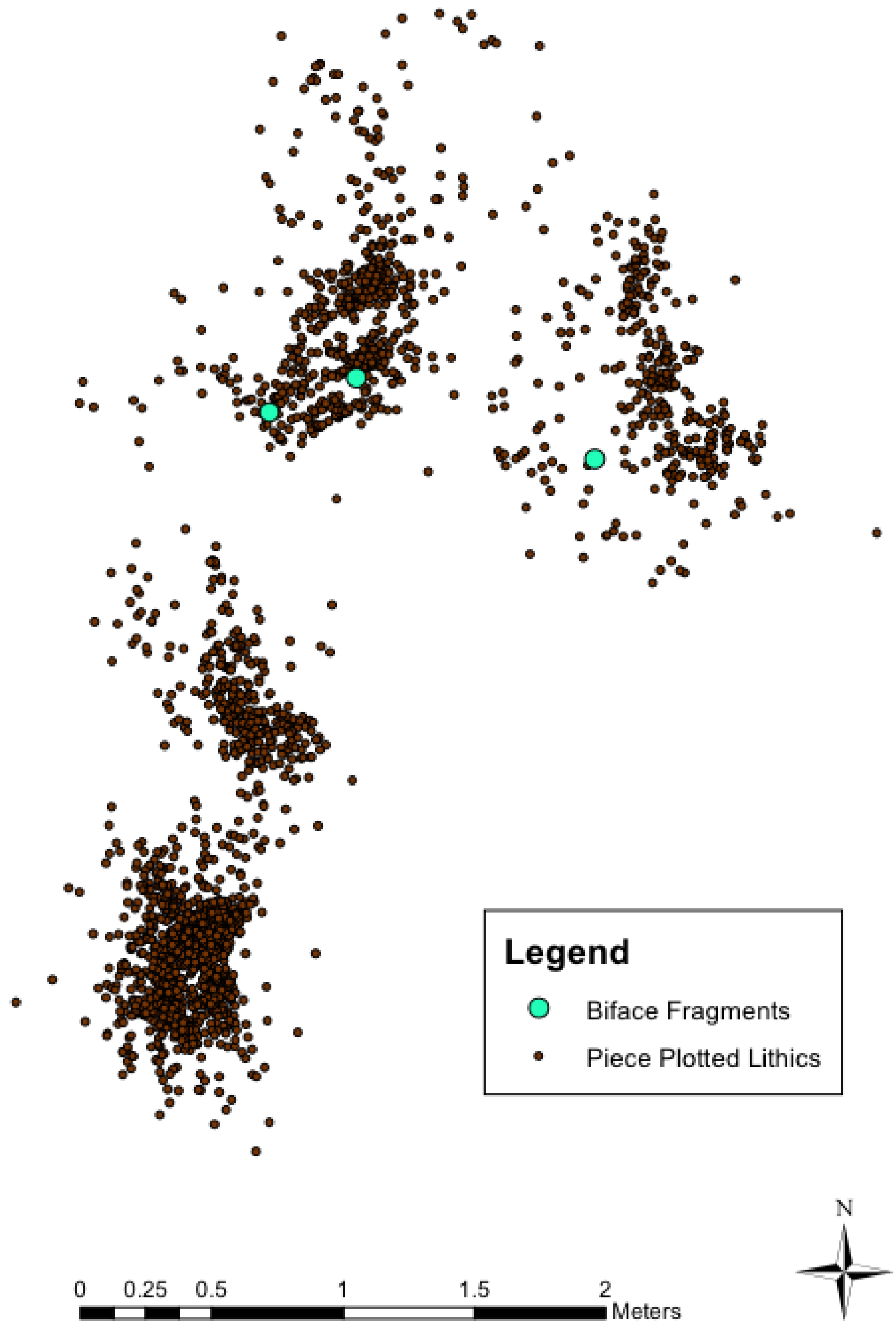

Figure A1: Refitted biface L1865.

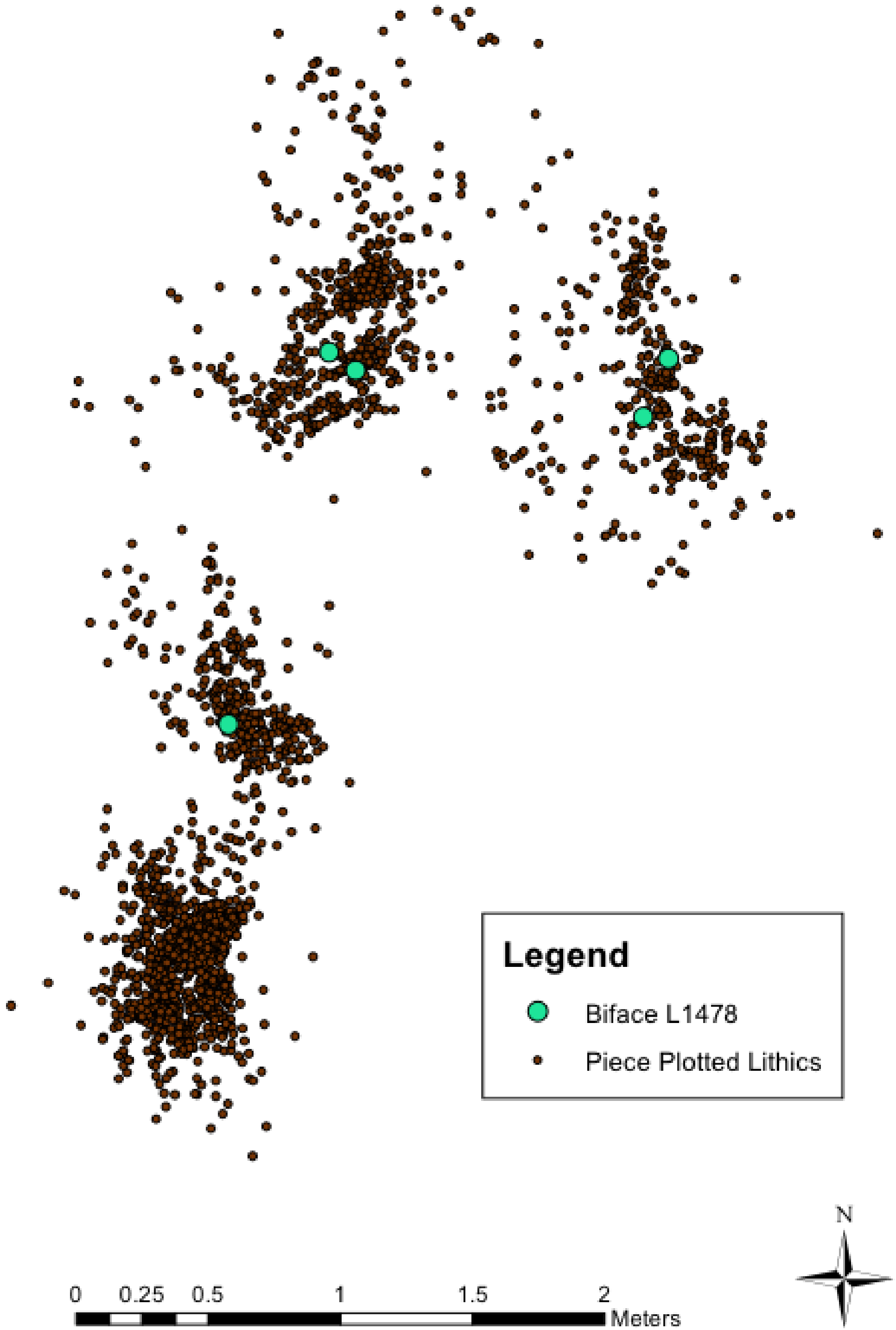

Figure A2: Refitted biface L1478 (Fig. 3.9C).

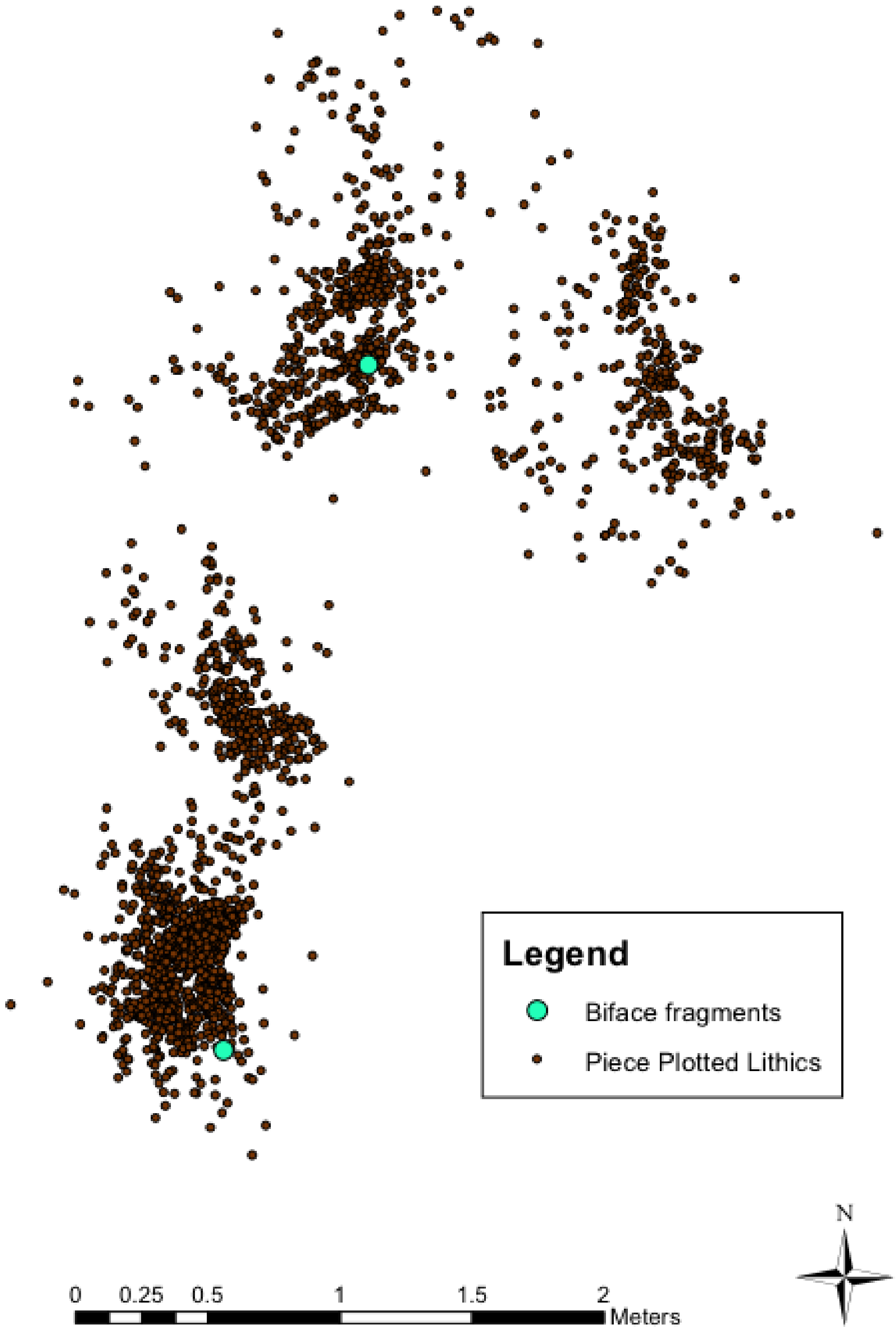

Figure A3: Refitted biface L1591.

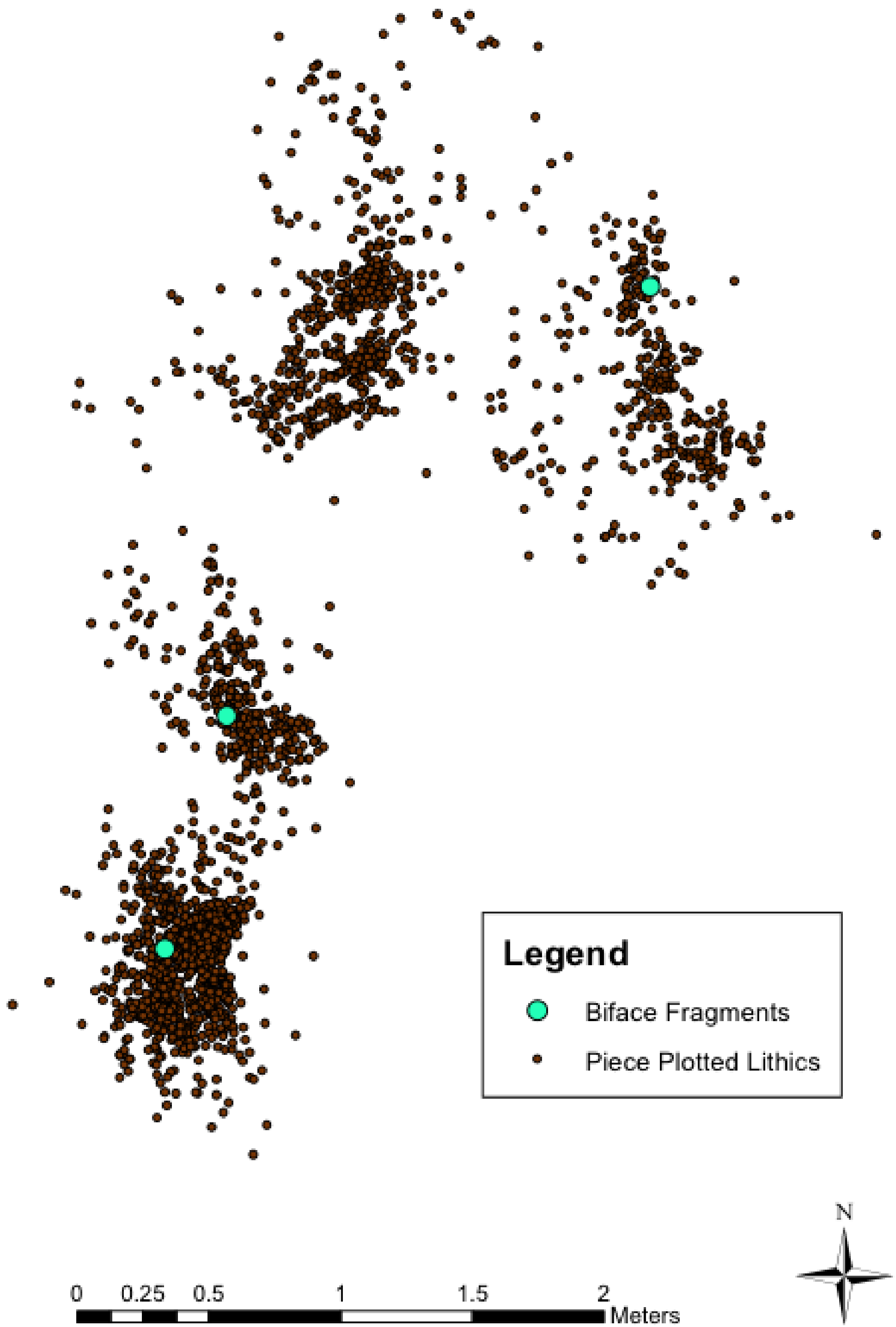

Figure A4: Refitted ovate biface L325 (Fig. 3.6D).

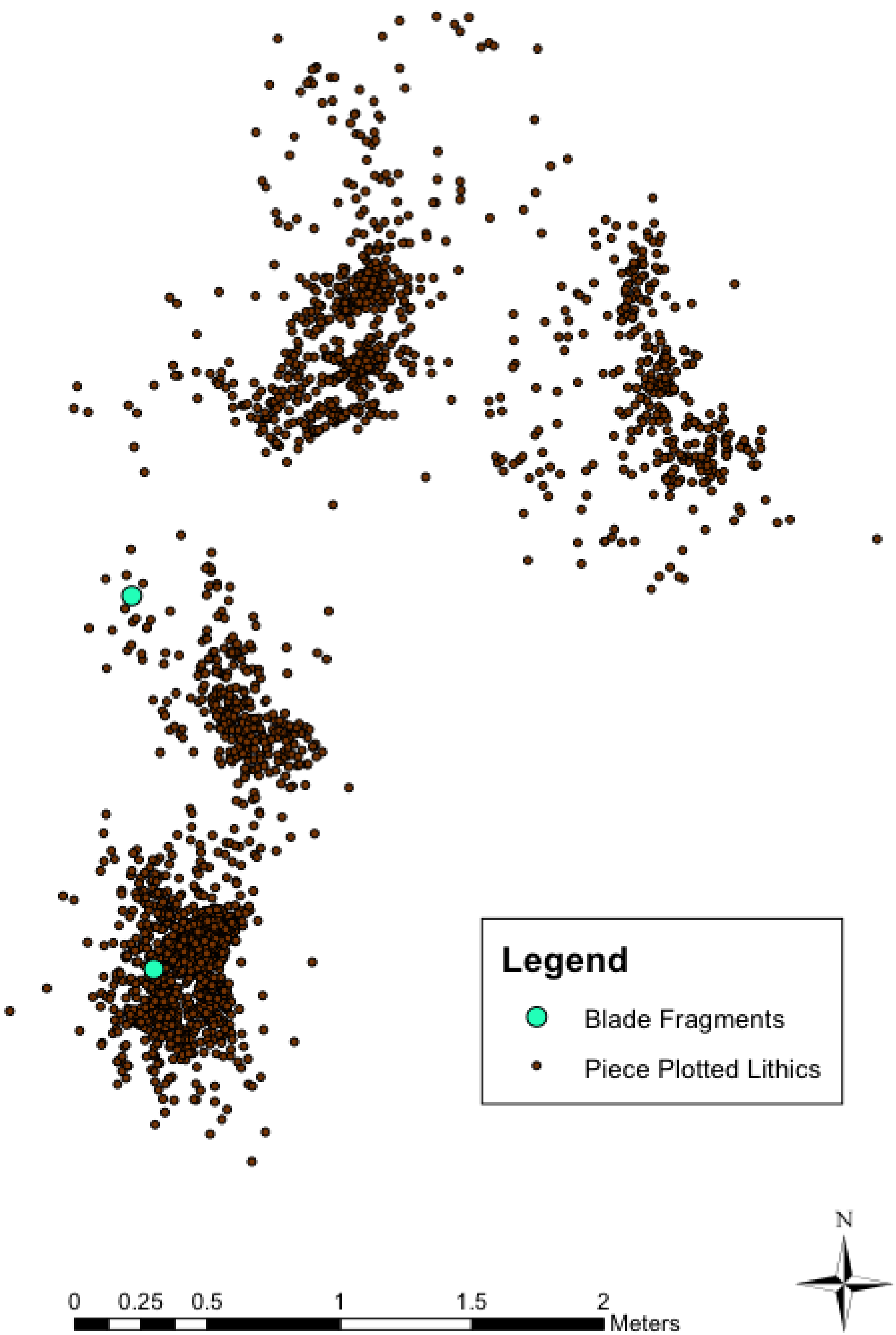

Figure A5: Semi-refined lanceolate blade (Fig. 3.6A).

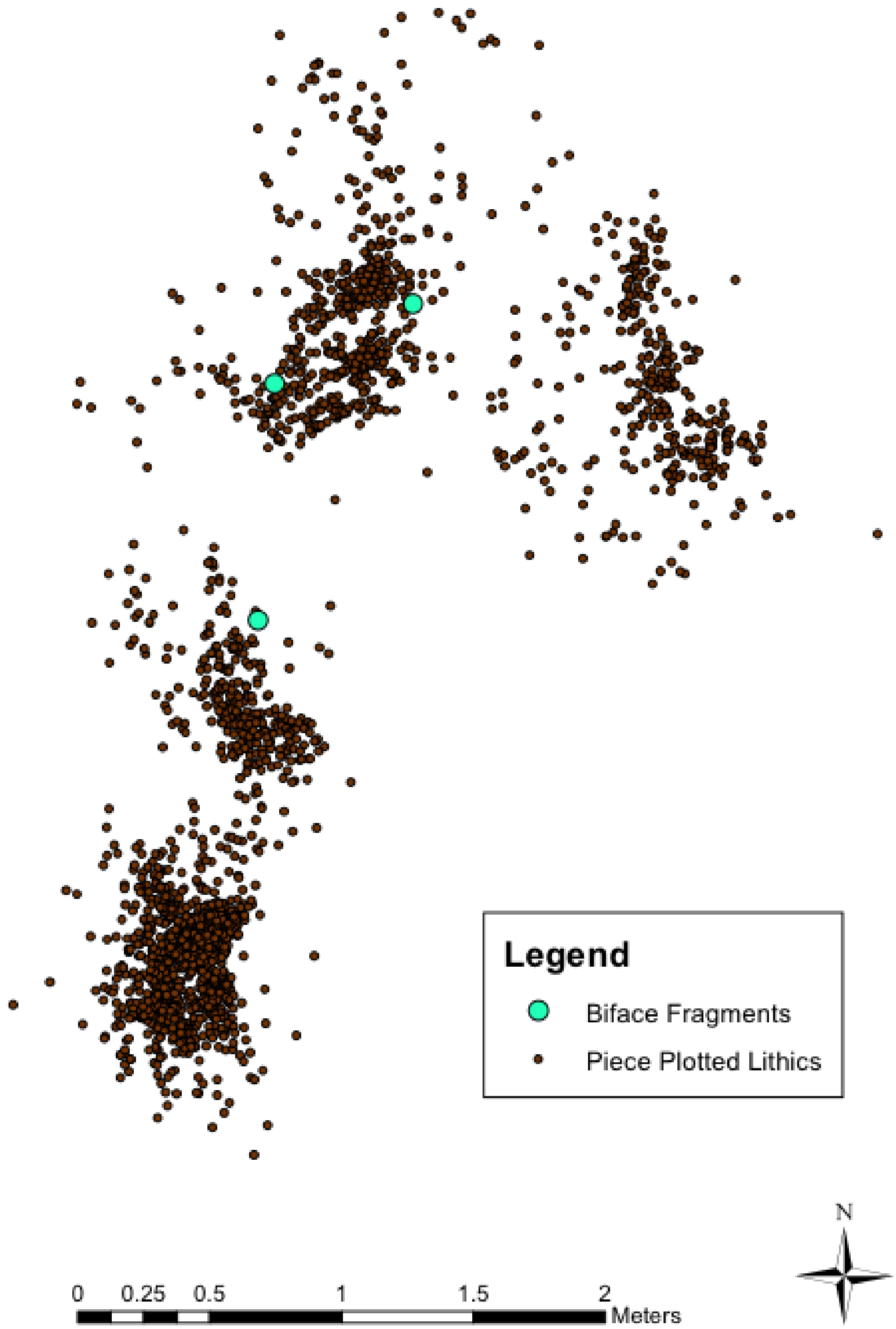

Figure A6: Refitted ovate biface L1669 (Fig. 3.6B).

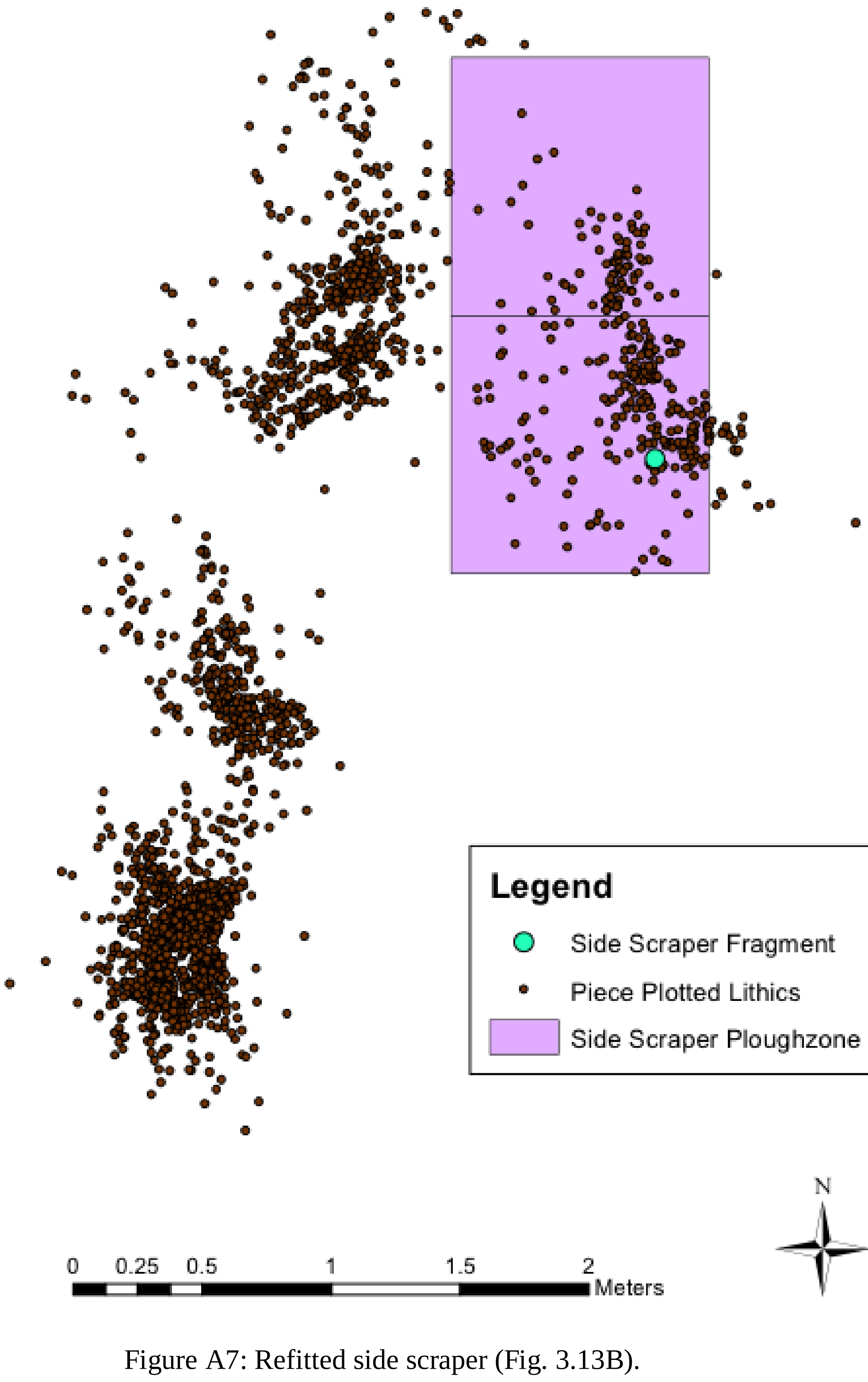

Figure A7: Refitted side scraper (Fig. 3.13B).

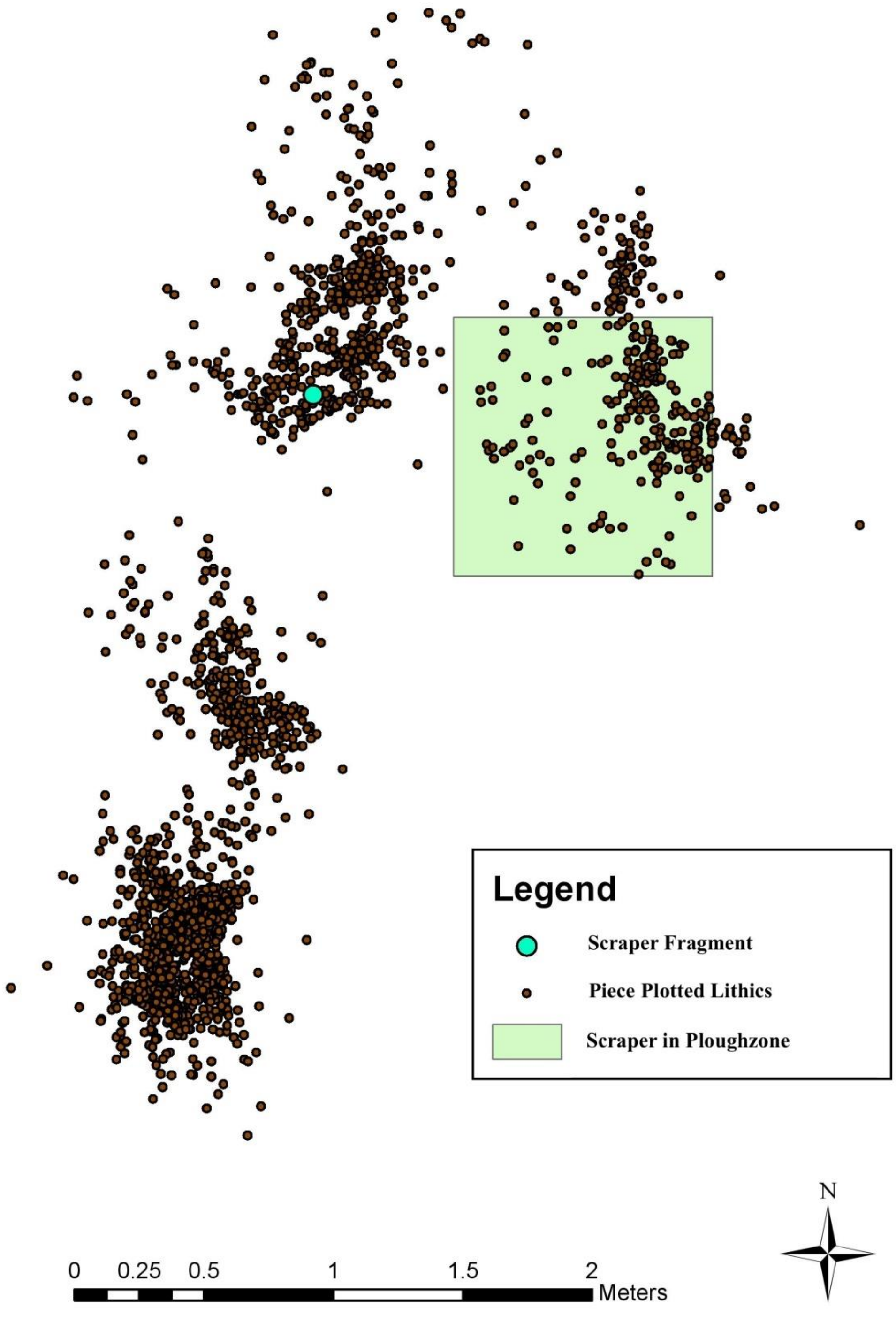

Figure A8: Refitted side scraper (Fig. 3.13C).

Appendix B: Stages of Fragmentation in Experimentally Broken Bifaces

This appendix illustrates the development of fracture patterns on bifaces as they become increasingly fragmentary. The sequence of destruction is a significant attribute of breaking stone tools because differential contexts contribute to highly variable breakage patterns.

Radially Fractured Biface

Figure B1: Radially fractured biface struck once (Fig. 4.13).

Radially Fractured Biface

Figure B2: First hammer strike to biface (Fig. 4.14).

Figure B3: Second hammer strike to biface (Fig. 4.14).

Figure B4: Third hammer strike to biface (Fig. 4.14).

Figure B5: Fourth hammer strike to biface (Fig. 4.14).

Figure B6: Fifth hammer strike to biface (Fig. 4.14).

Figure B7: Sixth hammer strike to biface (Fig. 4.14).

Figure B8: Seventh hammer strike to biface (Fig. 4.14).

Biface Broken on Anvil

Figure B9: Biface struck once on top of anvil (Fig. 4.15 and 4.16).

Bifaces Broken "En Masse"

Figure B10: Bifaces lying "Lincoln Log" style (Fig. 6.18-6.21).

Figure B11: Initial blow to yellow biface (Fig. 6.18).

Figure B12: Second blow to yellow biface (Fig. 6.18).

Figure B13: Final blow to green biface (Fig. 6.19).

Figure B14: Recovered shatter from coloured bifaces (Fig. 6.18-6.21).

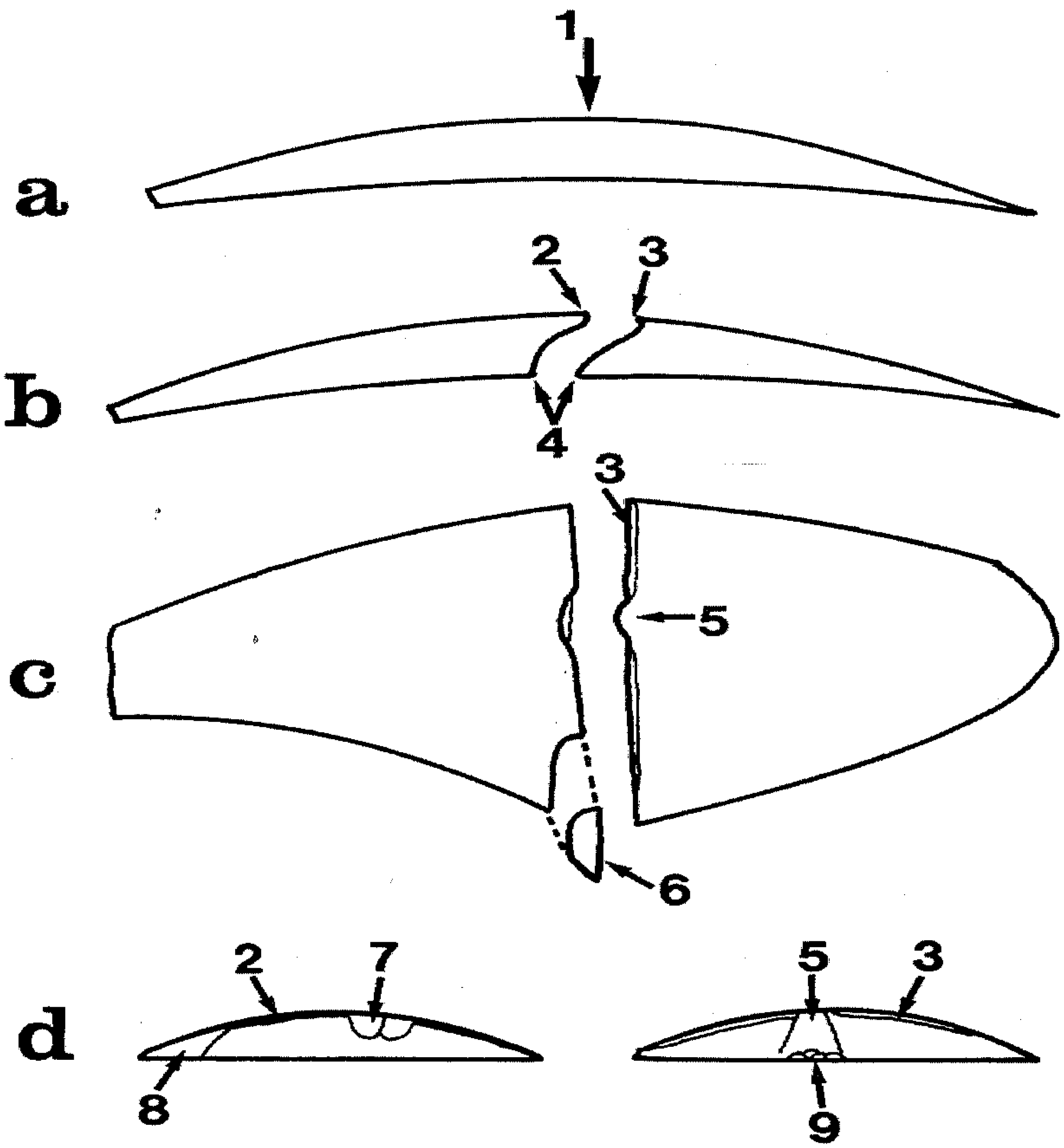

Figure B15: Schematic depictions of the features identified in experimentally and archaeologically broken chert artifact fragments; illustration courtesy of Chris Ellis (from Deller and Ellis 2002). A, longitudinal profile view of unbroken flake; B, longitudinal profile view of broken flake; C, plan view of dorsal surface of broken flake; D, profile views of corresponding transverse fracture surfaces. 1, direction of hammer strike to dorsal surface of flake; 2, lip; 3, negative impression left by lip; 4, point of fracture initiation on ventral surface; 5, cone initiation remnant at location of hammer strike; 6, “rebound” flake detached due to rebound off underlying stone object; 7, small flake removals similar to “angular fragments” detached from opposite cone initiation due to force of the impact; 8, rebound flake scar; 9, crushing opposite point of impact due to contact with underlying stone object.

Appendix C: Density of Feature Clusters

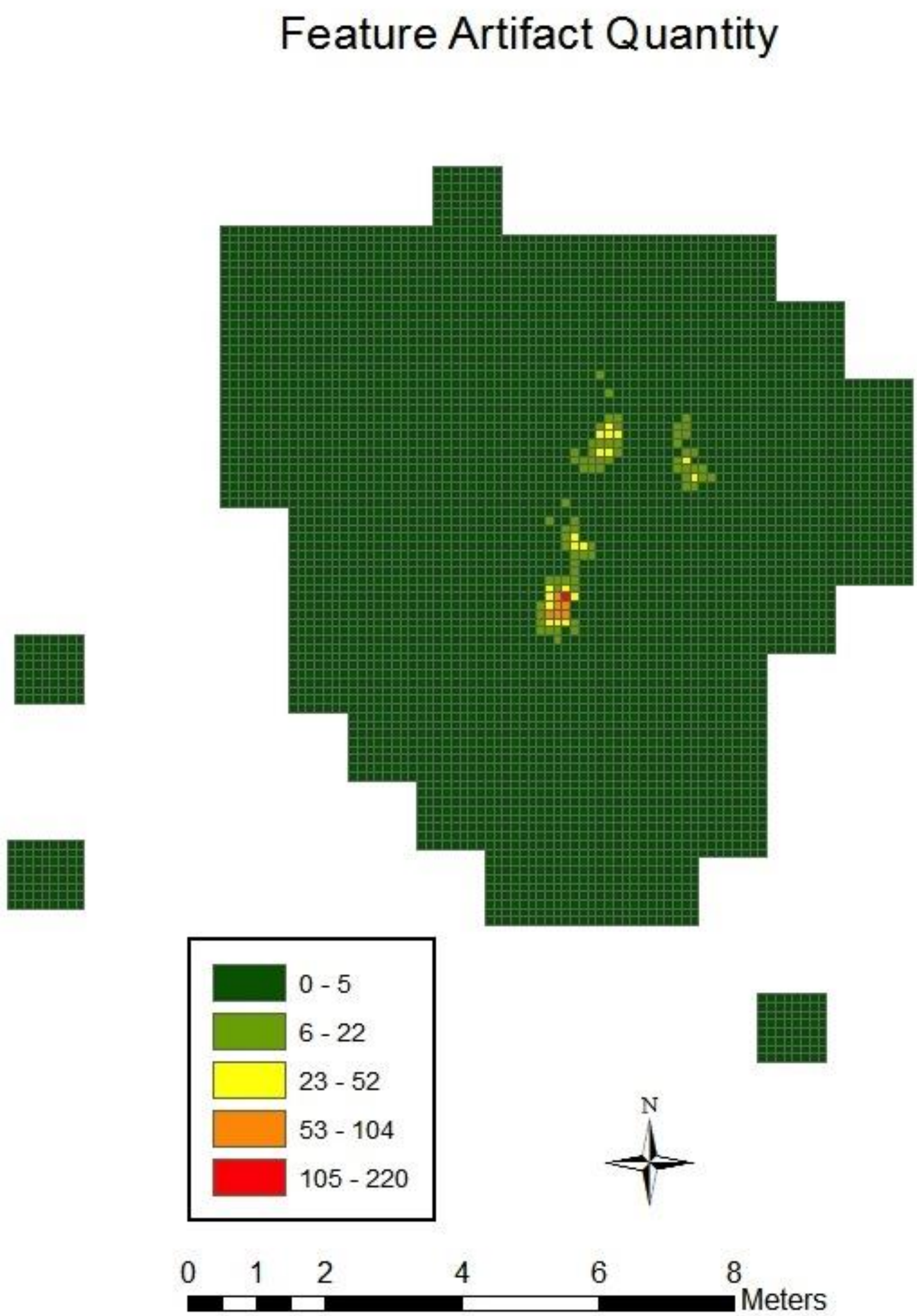

Figure C1: Location and density of feature clusters beneath plough zone.

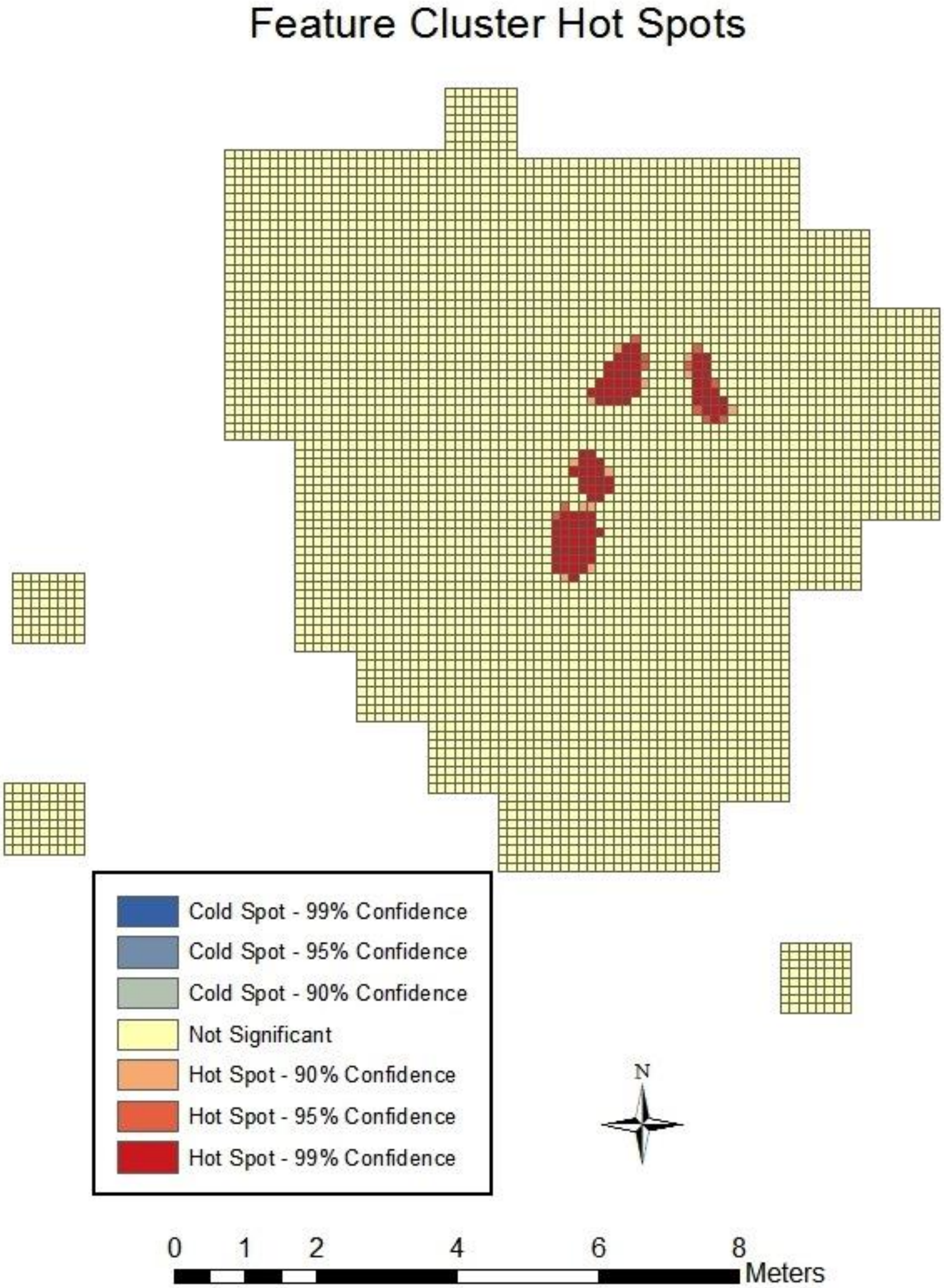

Figure C2: Location and density of feature "Hot Spots" beneath plough zone.

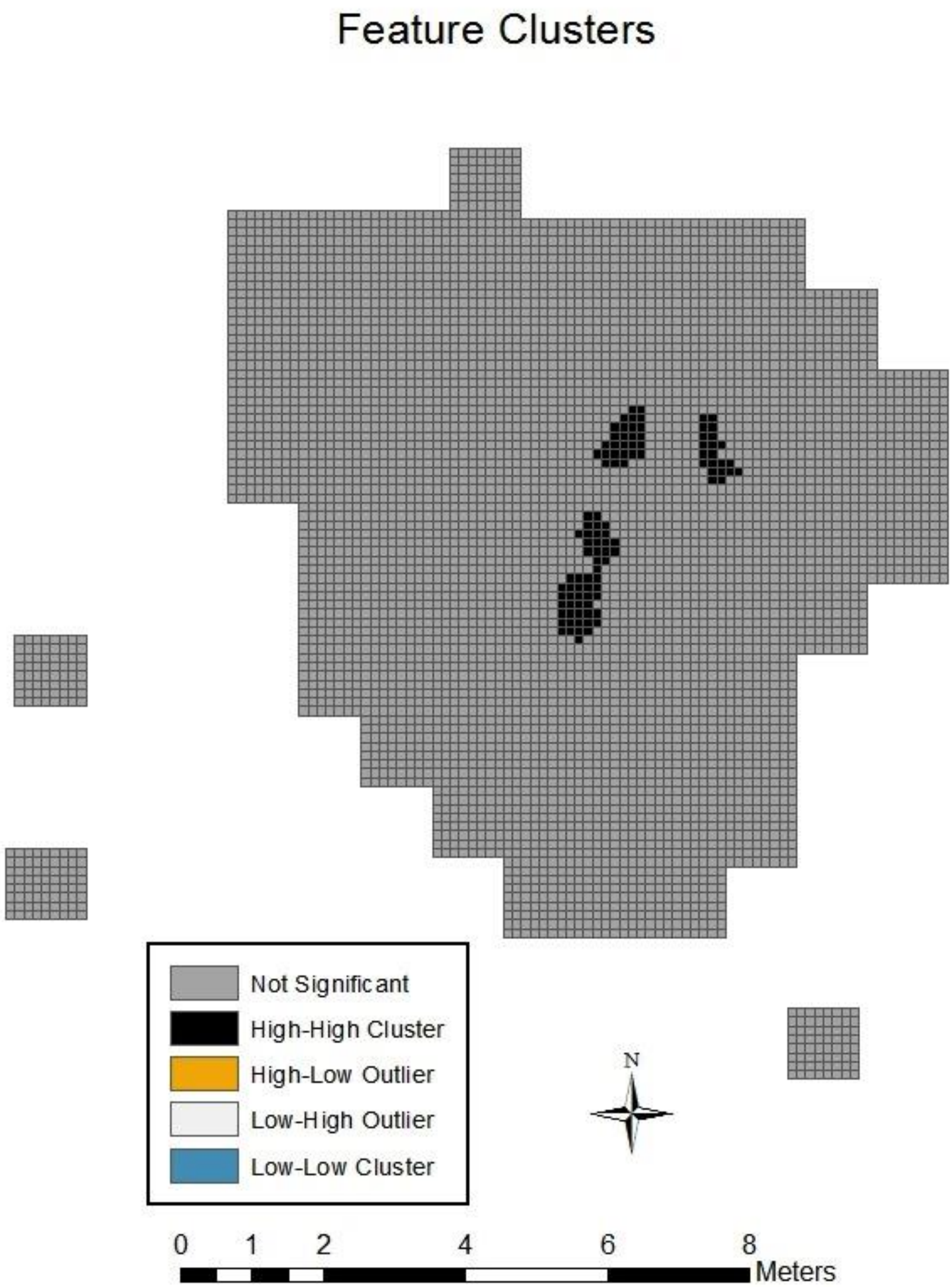

Figure C3: Location and significance of feature clusters beneath plough zone.

Appendix D: Catalogue Numbers of Refitted Artifacts

Lanceolate Biface – L935, L1614

Side Scraper – L210, L164, L931

Uniface – L76, L221

Utilized Flake – L163, L1554

Flake – L68, L517

Ovate Biface – L1555, L438, L159

Ovate biface – L1669, L275, L2176

Ovate Biface – L197, L172, L2397

Ovate Biface – L196, L1545, L363, L32

Ovate Biface – L314, L314, L126, L94, L131

Ovate Biface – L171, L954, L1442, L126, L196, L10

Biface – L70, L371

Biface – L18, L1444, L2230

Biface – L1700, L34

Biface – L170, L1897, L1119, L807

Biface – L167, L74

Biface – L1696, L157, L1564

Biface – L283, L187, L1351, L539

Biface – L227, L405, L1473

Biface – L783, L1147, L325

Biface Fragment – L82, L1683

Biface Fragment – L2169, L1437

Biface Fragment – L1865, L1604, L760

Biface Fragment – L1730, L167

Biface Fragment – L1394, L2387

Biface Fragment – L1686, L741

Biface Fragment – L440, L150

Biface Fragment – L2214, L2213

Biface Fragment – L2259, L1832

Biface Fragment – L1721, L1073

Biface Fragment – L658, L1553

Biface Fragment – L222, L1831

Biface Fragment – L1694, L1894

Biface Fragment – L122, L2375, L200

Biface Fragment – L15, L111, L938, L751

Biface Fragment – L159, L207, L191, L53

Biface Fragment – L1447, L207

Biface Fragment – L1478, L731, L549, L1007, L2047

Biface Fragment – L1806, L118

Biface Fragment – L1891, L206, L2170, L2389

Biface Fragment – L7, L269

Biface Fragment – L217, L206

Biface Fragment – L1441, L113

Biface Fragment – L1988, L206

Biface Fragment – L721, L187

Biface Fragment – L1443, L117, L90

Biface Fragment – L547, L622

Biface Fragment – L206, L124

Biface Fragment – L95, L63

Biface Fragment – L79, L158

Biface Fragment – L72, L2216

Curriculum Vitae

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