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Ridge Pine 3: A Late Archaic site in the southern Lake Huron Basin

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Abstract

The Ridge Pine 3 site is about 1.3 km inland from Lake Huron on the eastern edge of the Grand Bend community in the Ausable Valley. The site was originally dated to the Late Archaic Small Point complex (ca. 4100 cal BP [3800 RCYBP] to 3200 cal BP [3000 RCYBP]), but a reassessment of the projectile point typology and radiocarbon dating have led to a different conclusion. The primary occupation of Ridge Pine 3 occurred during the Late Archaic Narrow Point complex (ca. 5000 cal BP [4500 RCYBP] to 4100 cal BP [3800 RCYBP]), but there is evidence of multiple occupations throughout the Archaic. The site provides insight into the poorly understood Late Archaic Narrow Point complex in Ontario. To understand the functions of the site and the seasons of occupation, an in-depth analysis of the assemblage, totalling 19978 artifacts, was conducted. Most of the assemblage contains lithic tools and chipped stone debris (debitage). The debitage makes up 96.16% of the assemblage, most of which is Kettle Point and Onondaga chert. Lithic analysis also focused on understanding flintknapping skill levels and the possibility of craft learning. A reconstruction of the paleoenvironment was completed to understand what resources were available to people at Ridge Pine 3 and what environmental constraints they may have faced in that location.

Keywords

Late Archaic, Narrow Point, Lake Huron, Lithic Analysis, Site Functions, Flintknapping Skill Levels, Craft Learning, Paleoenvironment Reconstruction, Environmental Constraints, Kettle Point chert, Onondaga chert

Summary for Lay Audience

The Ridge Pine 3 site is an archaeological site near the Lake Huron shoreline in Grand Bend that dates to the Late Archaic Narrow Point complex (ca. 5000 cal BP [4500 RCYBP] to 4100 cal BP [3800 RCYBP]). This is a poorly understood time in Ontario's precontact history, and the site can provide valuable information to add to our current understandings. The purpose of this study was to analyze the artifact collection from the Ridge Pine 3 site which mostly contains lithics or stone tools and debitage, the material removed during the manufacture of stone tools. This analysis shed light on the date of the site, whether occupations outside of the Narrow Point complex occurred, what activities were conducted there, and potential times of the year the site was occupied. As well, lithic analysis focused on trying to understand the skill levels of the flintknappers or people creating the tools at the site and whether that skill was being taught at Ridge Pine 3. A reconstruction of the surrounding environment at the time of occupation was also conducted in order to understand the landscape as it was back then before historical land alterations took place and modern lake levels were reached. This analysis provided insight into what resources were available in the area, what challenges people may have faced, and possibilities for when the site was occupied during the year.

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Chapter 1: Introduction

Ontario archaeology in the 21st century is mainly conducted in the private sector of cultural resource management (CRM). This industry identifies and excavates sites prior to development. Due to the competitive and fast-paced nature of CRM, the archaeological collections often receive only a basic analysis. This thesis focuses on an archaeological site in southwestern Ontario that was excavated in a CRM context to provide a more detailed analysis of the collection. The main focus for the thesis is the analysis of a lithic-dominant assemblage from a Late Archaic site. The Archaic, which spans from ca. 11500 cal BP (calibrated years before present) (10000 RCYBP [radiocarbon years before present]) to 2900 cal BP (2800 RCYBP), makes up a large part of the archaeological record and is still poorly understood (Ellis et al. 2009:4; Muller 1989:3). An in-depth analysis of an Archaic site will contribute to our current understandings of the period. Dates in the thesis were calibrated using the OxCal 4.4 program (2019) with the IntCal 20 calibration curve (Bronk Ramsey 2009). When calibrating date ranges for temporal periods reported in radiocarbon years an error factor of 100 years was assumed.

Another focus for the project is paleoenvironmental reconstruction. The surrounding environment and broader landscape will be researched through multiple lines of evidence to understand what resources were available to past peoples during site occupation. Southwestern Ontario has a wide range of resources that are widely distributed, so understanding what resources were available and where will help to explain why the site location was chosen and potential functions of the site based on available resources.

1.1 Ridge Pine 3

The Ridge Pine 3 site (AhHk-137) is located about 1.3 km inland from Lake Huron on the eastern edge of the Grand Bend community within a roughly 2.42-hectare property (see Figure 1). The site was subjected to Stages 1 through 4 archaeological assessments during the 2009 and 2010 field seasons under the professional archaeological license of Arthur Figura. Timmins Martelle Heritage Consultants Inc. (TMHC) conducted the archaeological assessments, and it was almost completely excavated in advance of development which has still not started (TMHC 2012:5-8).

The Stage 4 excavation consisted of one-metre unit excavations across areas of high artifact concentrations discovered during the Stage 3 assessment (TMHC 2012:36). Excavations continued until units produced less than 10 precontact artifacts. All units were excavated via shovel and trowel to the subsoil level where the presence of subsurface cultural features was checked before excavation continued for another 5 cm below the plough zone. If artifacts were found in the subsoil, excavation continued until less than five artifacts were present in a 5 cm level. The soil from each unit was screened through ¼" hardware cloth and artifacts were bagged and tagged per one-metre provenience unit. A total of 152 units were excavated during the Stage 4 investigation. Topsoil depths ranged from 10 to 20 cm, generally consisting of a dark brown clay loam, and subsoil excavations had a maximum depth of 40 cm (TMHC 2012:35-37).

The size of the Ridge Pine 3 site is approximately 20 m east-west by 17 m north-south (TMHC 2012:37). Based on the widely fluctuating artifact densities across the site, Ridge Pine 3 appears to be less disturbed than two other sites found on the property. Ploughing would have caused artifact distributions to become more homogenous across the site, but Ridge Pine 3 shows discrete concentrations of areas of high artifact density (Figure 4). The property where Ridge Pine 3 is located is wooded with mainly secondary growth as there are few large trees in the area which indicates that the land was cleared in the past (TMHC 2012:5). Ridge Pine 3 is in the northeast corner of the property and is the furthest site from a cleared strip along the western border (TMHC 2012:5-7). The area is generally level with a few small knolls, and slopes downwards to the north and west where a creek known as the Simmons/Pergel Drain is located (TMHC 2012:5).

The assemblage contains a large number of lithic tools and chipped stone debris, totalling 19978 artifacts. Chipping detritus, or debitage, makes up 96.16% of the assemblage, most of which is Kettle Point and Onondaga chert. The primary deposits for Kettle Point chert are located about 20 km south of Ridge Pine 3 on the modern Lake

Huron shoreline (Cooper 1979:11-12; Ellis et al. 2014a:21). The relationship between the location of the Kettle Point chert and lake levels in the Huron basin will be explored in Chapter 4. The primary Onondaga chert outcrop is about 150 km from Ridge Pine 3, along the northern Lake Erie shore (Spence & Fox 1986:21). However, TMHC (2012) notes that some of the Onondaga chert is of low quality and may be from secondary sources, such as river gravels and till, that are possibly located closer to Ridge Pine 3.

The initial assessment of Ridge Pine 3 concluded that occupation mainly occurred during the Small Point complex, providing a date of ca. 3800 cal BP (3500 RCYBP) to 2900 cal BP (2800 RCYBP) (TMHC 2012; Ellis et al. 2009:818; Bronk Ramsey 2009). This conclusion was based on the presence of six projectile points of which four were typed as Innes points. My investigation challenges this conclusion and argues that the primary occupation occurred in the older Late Archaic Narrow Point complex dated to ca. 5000 cal BP (4500 RCYBP) to 4100 cal BP (3800 RCYBP) based on point typology and radiocarbon dating. It should be noted here that there was significant ambiguity in dealing with the Ridge Pine 3 assemblage. Different interpretations and conclusions are still possible for the site, particularly in the projectile point types assigned and the potential occupations of the site. More research into the Late Archaic in Ontario and the excavation of future sites may change the interpretations described in this thesis.

The site is also situated near the former Thedford Embayment, a large lagoon-like bay that existed during the Lake Algonquin (ca. 13200 cal BP [11300 RCYBP] to 12500 cal BP [10500 RCYBP]) and the Nipissing (ca. 5700 cal BP [5000 RCYBP]) high water stages in the Lake Huron basin (Belyea 2019:7; Cooper 1979: 6-7; Ellis et al. 2009:25; Karrow & Warner 1990:15; Prest 1970:730). With the older date for Ridge Pine 3, it overlaps with the high-water stage of the Nipissing Phase and the rapidly falling lake levels that signalled its end between 4500 cal BP (4050 RCYBP) and 3400 cal BP (3200 RCYBP) (Baedke & Thompson 2000:423). The embayment was likely transitioning into a marsh environment at the time of the site occupation with falling lake levels, possibly pointing to a lacustrine orientation for the site.

In terms of research potential for Ridge Pine 3, this thesis will provide more insight into the Late Archaic in southwestern Ontario and the poorly understood Archaic as a whole. It will add to existing data and knowledge about Late Archaic settlement and subsistence strategies. Ridge Pine 3 can provide insight into varying ecological settings for Archaic sites in Ontario, the idea of a diffuse resource model for the Archaic, and the transitional nature of the Archaic period. The in-depth lithic analysis will help to achieve a better understanding of Narrow Point lithic technology and will include an examination of flintknapping expertise/skill levels which may provide insight into craft learning.

1.2 Research Questions

The three main research questions I am looking into at the Ridge Pine 3 site include:

(1) What is the time period of the Ridge Pine 3 site and are there any indications of multiple occupations at the site? This question will confirm or reject the suggestion that the site dates to the Small Point complex as concluded by the TMHC investigations (2012) and if other time periods or complexes are represented. A typological analysis of the projectile points and other potentially diagnostic tools will be conducted. Four of the six have been typed as most similar to the Innes type which is diagnostic of the Small Point complex so these identifications will be confirmed or altered, and I will also attempt to type the two untyped points. The lithic toolkit of the Narrow Point complex is described in depth in Chapter 2, the period I have concluded to be the primary occupation of the site, which will allow for comparisons with the Ridge Pine 3 assemblage. Accelerated mass spectrometry (AMS) radiocarbon dating of carbon samples from features will also provide evidence for the occupation period(s) at Ridge Pine 3. It is important to understand if the site has been reoccupied over time by different groups or is restricted to a Narrow Point complex occupation.

(2) What were the functions of the Ridge Pine 3 site and what role might it have played in the settlement-subsistence system of the site occupants? Multiple lines of evidence will be looked at to provide a more robust interpretation in answer to this question. Paleoenvironmental reconstruction will determine what resources would have been available in the area throughout the year to get an idea of the opportunities and

constraints of the site’s location in terms of resources. Within this reconstruction, paleoethnobotanical analysis may provide indicators of seasonality and subsistence. Intrasite spatial analysis of tools, debitage, and features can help identify potential activity areas at the site. Lithic analysis of formal tools will give insight into the activities being performed and subsistence indicators. Debitage analysis and stage(s) of reduction as well as biface analysis for reduction stages will show what flintknapping activities were being conducted at Ridge Pine 3. Finally, comparison with settlement-subsistence models in the region and other Late Archaic sites in the area will help to establish where Ridge Pine 3 fits within current systems and determine potential functions.

(3) How did the occupants of Ridge Pine 3 use the local environment and broader landscape to meet subsistence needs and was it constraining in any way? Again, the paleoenvironmental reconstruction will play a role here in understanding available resources and the opportunities and constraints of the site’s location. This reconstruction will include paleoethnobotanical analysis, nineteenth century survey records, lake levels, paleoclimate and paleoenvironment research, soil cores, and geology regarding primary and secondary chert sources in the area. Macroscopic lithic analysis for raw material types and frequencies will also be conducted. This will help in understanding raw material procurement strategies, such as primary vs. secondary deposits.

Chapter 2 provides background context to set up the rest of the thesis. Chapter 3 details the theoretical frameworks and methodologies used. Chapter 4 reconstructs the environment at the time of primary site occupation. Chapter 5 goes through the results from the lithic analyses, intrasite spatial analysis, and radiocarbon analysis. Chapter 6 brings everything together to answer the three research questions. Chapter 7 provides conclusions for the Ridge Pine 3 site. All figures and tables are provided in Appendix A in the order they would appear in the text.

Chapter 2: Background

This chapter covers a wide range of topics to provide background for the rest of the thesis. Topics include the geological history of the Great Lakes region, an overview of the Archaic period, and a more in-depth look into the Late Archaic. Specifically, this section includes an overview of the complexes within the Late Archaic before focusing on the Narrow Point complex and our current understandings regarding toolkits, settlement and subsistence, climate, and environment.

2.1 Geological Setting

Southern Ontario, and the Great Lakes region in general, has been shaped and formed by ice sheets and the subsequent fluctuating water levels that came from the formation of various lakes created by ice sheet meltwater. The last ice sheet to completely cover the Great Lakes watershed was the Laurentide Ice Sheet which occurred during the Wisconsin glaciation. It began its retreat northward after about 21300 cal BP (18000 RCYBP) with a series of readvancements interrupting the retreat at about 18800 cal BP (15500 RCYBP), 15400 cal BP (13000 RCYBP), 13600 cal BP (11800 RCYBP), and 11500 cal BP (10000 RCYBP) (Larson & Schaetzl 2001:525-527; Lewis & Anderson 2020:453; Lewis et al. 2005:188). The pro-glacial and post-glacial lakes that formed after this retreat were not very stable due to isostatic rebound resulting in fluctuating lake levels and a continuously changing landscape which would have affected ancient cultures, especially in the last 8000 years (Karrow & Warner 1990:13; Larson & Schaetzl 2001:529, 534). This section will briefly discuss the lakes that formed in southern Ontario due to the retreating Laurentide Ice Sheet with a focus on the lakes that had a direct impact on the Lake Huron basin where Ridge Pine 3 is situated.

Around 19200 cal BP (16000 RCYBP), the first proglacial lakes formed and existed for less than 1000 years before the readvancement of the ice sheet about 18800 cal BP (15500 RCYBP) (Larson & Schaetzl 2001:529; Lewis et al. 2005:188). About 15400 cal BP (13000 RCYBP), the readvancement of the ice sheet was directed to the Port Huron moraine and resulted in the formation of Lake Saginaw in the Huron basin and Lake Whittlesey in the Erie basin (Larson & Schaetzl 2001:531). As the ice sheet began its retreat northward, these two lakes expanded and then combined to the level of Lake Warren which was ultimately drained when a new outlet near Buffalo was exposed, leading to the development of Lake Grassmere and later Lake Lundy situated in the Huron and Erie basins (Larson & Schaetzl 2001:531). There is also believed to be a Lake Wayne in the Huron and Erie basins which was a low-level lake that did not last very long before the level of Lake Warren fell to that of Lake Grassmere (Larson & Schaetzl 2001:531). Soon after 14700 cal BP (12500 RCYBP), the Erie basin water levels fell and allowed for drainage of Early Lake Erie into the Ontario basin where Lake Iroquois was expanding (Larson & Schaetzl 2001:531; Lewis & Anderson 2020:453). Around 13800 cal BP (12000 RCYBP) Early Lake Algonquin was developing in the Huron basin when its water levels soon dropped (Larson & Schaetzl 2001:531). This resulted in the Kirkfield low-water phase around 13300 cal BP (11400 RCYBP) for the Huron and Georgian Bay basins, as the Fenelon Falls outlet was exposed by the retreat of the ice sheet (Karrow & Warner 1990:15; Larson & Schaetzl 2001:531; Lewis et al. 2005:192).

After 13600 cal BP (11800 RCYBP), the ice continued to retreat which led to the drainage and termination of Lake Iroquois by 13000 cal BP (ca. 11200 RCYBP) and the beginnings of Early Lake Ontario (Larson & Schaetzl 2001:532; Lewis & Anderson 2020). For the Huron basin specifically, the ice sheet's retreat resulted in Lake Algonquin slowly encroaching southward as the Fenelon Falls outlet was uplifted creating a high-water phase of about 184 m above sea level (asl) for Lake Algonquin from about 13200 cal BP (11300 RCYBP) to 12500 cal BP (10500 RCYBP) (Belyea 2019:7; Cooper 1979:6-7; Eschman & Karrow 1985:90; Karrow & Warner 1990:15; Larson & Schaetzl 2001:532; Lewis et al. 2008:130; Muller 1989:15). The period when glacial Lake Algonquin was present occurred during a cooler climate which is associated with a boreal conifer forest (Lewis et al. 2008:133). As lower outlets continued to be uncovered, Lake Algonquin's water levels dropped quite quickly and formed Lake Hough in the Georgian Bay basin, Lake Stanley in the Huron basin, and Lake Chippewa in the Michigan basin around 11500 cal BP (10000 RCYBP) (Breckenridge & Johnson 2009:398; Larson & Schaetzl 2001:532; Lewis et al. 2005:194). This series of lower lake stages persisted until ca. 8500 cal BP (7700 RCYBP) (Breckenridge & Johnson 2009:398; Lewis et al. 2005:203). For the Huron basin specifically, the Lake Stanley low water level is dated to ca. 8800 cal BP (7900 RCYBP) with a water level of about 50 m below modern levels in northwestern Lake Huron (Breckenridge & Johnson 2009:398; Lewis et al. 2007:444). Figure 2 provides depictions of the major proglacial lakes from 15400 cal BP (13000 RCYBP) to 5700 cal BP (5000 RCYBP) as described above and below.

The ice sheet retreated to the northern Superior basin by 10700 cal BP (9500 RCYBP) and around 10200 cal BP (9000 RCYBP) the northern rim was deglaciated, marking the end of the glacial history for the Great Lakes watershed (Larson & Schaetzl 2001:532; Lewis et al. 2005:532). Isostatic uplift and fluctuating water levels continued to play a role in the formation of postglacial lakes and ultimately the Great Lakes that we see today. A major geological event that occurred was the formation of the Nipissing Great Lakes, due to uplift of the North Bay outlet for Lake Hough which caused water to spill over outlets at Port Huron and Chicago (Larson & Schaetzl 2001:532). The high-water phase, known as the Nipissing Transgression, occurred around 5700 cal BP (5000 RCYBP) and caused the water levels in Lake Huron to rise to about 184.5 m asl which is about 9 m above modern water levels for Lake Huron (Cooper 1979:6-7; Jackson et al. 2000:427; Karrow 1980:1272; Larsen 1985:65; Larson & Schaetzl 2001:532; Lewis et al. 2005:190; Lewis et al. 2008:133; Prest 1970:730; Thompson et al. 2011:568). At ca. 4500 cal BP (4050 RCYBP), these high-water levels in the Nipissing Phase eventually fell to the modern levels of Lake Huron and Lake Michigan at 175.8 m asl (Baedke & Thompson 2000:423; Karrow & Warner 1990:21; Larson & Schaetzl 2001:532).

The Nipissing Transgression is an important event because it brought emerging wetlands, as evidenced by sediment cores analyzed for pollen which contained molluscs, along the shore of Lake Huron which continued to change as water level fluctuations responded to climatic adjustments (Karrow 1980:1272; Stewart 2013:29). The Nipissing Great Lakes occurred during the hypsithermal interval in which the climate was warmer than modern times, especially when compared to the cooler climate during the time of Lake Algonquin, and this warmer climate is associated with a deciduous forest (Deevey & Flint 1957; Lewis et al. 2008:133). Based on studies done on the fossil assemblages of lakes that span from deglaciation to the present, there is evidence of increasing diversity of species as the climate got warmer and soils matured (Lewis et al. 2008:133). The people occupying these lacustrine areas had reliable access to vast resources including "shellfish, shallow-water species of fish, amphibians, reptiles, migratory waterfowl, and fur-bearing mammals, as well as plants such as wild rice" (Stewart 2013:30). The lowlands supported sycamore, walnut, chestnut, and basswood trees due to the moist soils (Stewart 2013:30). The availability of resources would have allowed for a more stable occupation with longer seasonal occupations, access to rich environmental zones year-round, and reoccurring visits to said zones throughout the year (Stewart 2013:30).

Several of these wetlands have been identified and one of them, the Thedford Embayment on Lake Huron extending south from Grand Bend to the Thedford area, is of particular importance to the Ridge Pine 3 site. The perimeter of the Thedford Embayment consists of the former shorelines of the proglacial Lake Algonquin and the post-glacial Nipissing phase in the Huron Basin (Cooper 1979:32). This Algonquin-Nipissing shoreline can be traced almost due south of Grand Bend for 13 km to Parkhill Creek where it goes westward and crosses the Ausable River and then, from Northville, it travels southwest to the Kettle Point reservation (Cooper 1979:32). During the Nipissing high water phase, a baymouth bar formed across the mouth of the embayment (Cooper 1979:32-33). The Thedford Embayment itself was a large lagoon-like bay and was likely a marshy environment during the Late Archaic period (TMHC 2012).

At about 3400 cal BP (3200 RCYBP) it is believed that Lake Algoma developed and is thought to be associated with a significant rise in lake levels to 180 m following the end of the Nipissing high water phase where lake levels fell between 4500 cal BP (4050 RCYBP) and 3400 cal BP (3200 RCYBP) (Baedke & Thompson 2000:423; Larson & Schaetzl 2001:532-533; Lewis et al. 2008:133; Morrison 2017:54). The Algoma Phase lasted from 3400 cal BP (3200 RCYBP) to 2300 cal BP (2250 RCYBP) in the Michigan basin (Baedke & Thompson 2000:425; Morrison 2017:9). As well, studies of sites around Lake Michigan have shown that there was a second significant rise in water levels to 179.5 m asl after the one associated with Lake Algoma that occurred at about 1700 BP (Baedke & Thompson 2000:425; Morrison 2017:53).

Larsen (1985) discusses stratigraphic studies near Chicago which have shown recent fluctuations from 1 to 2 m above the historic means of the lakes that include high levels which occurred between 1600 and 1200 BP, 950 and 750 BP, and 450 BP and AD 1800. Prior models posited that lake levels experienced stepwise drops until they reached modern levels following the Nipissing Stage, but Larsen's (1985) discussion shows that fluctuations continued to happen, albeit at reduced variations than previously seen. More current research has focused on lake level fluctuations recorded in the Ipperwash Strandline providing a more detailed paleohydrograph for lake levels in the Huron basin after the Nipissing Transgression (Morrison 2017). These post-Nipissing water level fluctuations are important because they are correlated with the Late Archaic and showcase the dynamic hydrological system that past peoples had to work with and adapt to. Even historically, the Great Lakes are still experiencing water level fluctuations. Today, lake levels vary by less than a half meter due to seasonal changes but extended wet or dry periods can cause fluctuations of about one to two meters (Larson & Schaetzl 2001:537). In the Grand Bend-Parkhill area, Cooper (1979:6) states that the modern shoreline of Lake Huron is 177 m asl although it has fluctuated between 175.5 and 177.5 m asl in the last 35 years (https://www.abca.ca/about/lake-huron).

2.2 The Archaic

The Archaic period, spanning ca. 11500 cal BP (10000 RCYBP) to 2900 cal BP (2800 RCYBP), was conceptualized by William Ritchie and had its formal introduction in the 1930s (Emerson & McElrath 2009:24). Despite the length of the Archaic period, it remains a poorly understood time in the archaeological record, especially compared to the preceding Paleoindian and succeeding Woodland periods (Ellis et al. 2009:790; Muller 1989:3). The rarity of very early sites like those from the Paleoindian period and the presence of ceramics at Woodland sites make these types of sites more appealing than Archaic sites which are often smaller in size, have poorer preservation, and often lack diagnostic artifacts (Ellis et al. 2009:790). Specifically, the period between ca. 8200 cal BP (7500 RCYBP) and 6200 cal BP (5500 RCYBP) continues to be the poorest known period within the Ontario Archaic time span (Ellis et al. 2009:805). Apart from graduate studies (i.e., Fisher 1997; Woodley 1990; Pearce 2008) and a few academic contributions (i.e., Kenyon & Snarey 2002; Lovis 2009; Ramsden 1976; Robertson et al. 1999; Pearce & Ellis 2008; Ellis, Deller, Murphy, & Dodd 1990; Ellis et al. 2014a, b), most Archaic sites excavated in recent years are the result of CRM projects such as the excavation of Ridge Pine 3 (Ellis et al. 2009:790). This has led to a lack of knowledge concerning the Archaic period, as CRM projects by themselves often do not have the time or the budget to delve deeply into the post-excavation analysis of a site and publish the results.

The Archaic period is a huge time span within the archaeological record, comprising about 60% of the Ontario archaeological record (Ellis et al. 2014a:3). The early end of the Archaic time span is marked by "certain assemblages dominated by notched or markedly stemmed point forms dating to around 10000 RCYBP [11500 cal BP] and on the late end by the introduction of ceramics around 2800 RCYBP [ca. 2900 cal BP]" (Ellis et al. 2009:788). The Archaic has often been defined by its lack of ceramics and horticulture which creates an arbitrary distinction in the Late Archaic to Early Woodland transition (Emerson & McElrath 2009). A very early definition of the Archaic described it as "a complex which is non-ceramic, non-horticultural, old, and has a hunter-fisher-collector culture pattern" (Sears 1948:123). While Archaic assemblages contained stone and bone tools, the focus for defining the period came from the apparent lack of ceramics and agricultural products (Emerson & McElrath 2009:24, 26). However, more recent studies on the Archaic period have shown that horticulture is present in the Late Archaic and, while it does not necessarily play a major role in subsistence, Lovis (2009:743) provides specific examples of horticultural evidence in Michigan by at least ca. 4850 cal BP (4400 RCYBP). As well, there is now documented evidence of Late Archaic assemblages containing stone vessels and early fiber-tempered wares (Emerson & McElrath 2009:26). The presence of ceramics and horticultural evidence in the Archaic shows that the distinction between the Late Archaic and Early Woodland transition is relatively arbitrary with elements of the Woodland period present in the Late Archaic.

The lithic technology in the Archaic period is distinct from the Paleoindian period indicating a shift in subsistence practices. Lithics from the Archaic have a higher tendency for a portion of them to be non-diagnostic and nondescript compared to other time periods, with assemblages mostly containing simple expedient tools that are often made of raw materials found within the general vicinity of the site (Ellis et al. 2009:791). There is a predominance of notched projectile points and the stemmed and shouldered projectile points that are present are recognizably dissimilar from the Late Paleoindian forms (Fitting 1975:65). In terms of subsistence practices, Archaic peoples in Ontario are believed to be “largely non-agriculturalists who made a living by hunting and gathering or foraging for ‘natural’ foodstuffs” (Ellis et al. 2014a:4). The mobile lifestyle allowed different groups to travel to different locations on a seasonal basis to take advantage of the various resources available during certain parts of the year in certain regions (Ellis et al. 2014a:4). For example, fish runs in the early spring would have attracted people to that location during that time of the year and places with abundant acorns and nuts would have drawn people in during the fall (Ellis et al. 2014a:4). This mobility and lack of a completely sedentary lifestyle allowed Archaic peoples to be able to adapt to local environments and local resources (Fitting 1975:64). As well, regional exchanges of materials and information likely occurred in the Archaic as a result of a mobile way of life, as evidenced by Turkey Tail bifaces which were circulated in a regional exchange network during the Late Archaic-Early Woodland transition (Krakker 1997:34).

In the Archaic, there is increased sedentism and decreased specialization resulting in diffuse adaptations. These types of adaptations focus on a wide range of food types, are less energy intensive, and result in a greater range of tool types that can be used for multiple functions (Cleland 1976:64-66). Prior to this, the Paleoindian period generally had a focal adaptation as groups were very mobile and, in many cases, had a focus on big game hunting for their resource base (Cleland 1976:61; Ellis, Kenyon, & Spence 1990:66). This big game hunting focus does not apply everywhere, especially in places like the southeast, partly due to differing regional adaptations as well as our own understandings of the term “specialization” (Speth et al. 2013:113-114), but a more focal subsistence strategy can still be generally applied to the Paleoindian period.

The change in subsistence strategies was not an abrupt change but rather likely transitioned over time to incorporate a wide range of resources. Roberts (1980:41) suggests that the Early Archaic represents this transition from the focal Paleoindian adaptation to the diffuse Archaic adaptation while Cleland (1976:69) posits that these diffuse adaptations start emerging in the Middle Archaic due to environmental trauma, especially with regards to floral changes in the Great Lakes region. Climatic changes resulted in reduced numbers of large game and thus the loss of a focal resource. Regardless of how long the transition from focal to diffuse strategies took, evidence that the transition did happen in the Archaic can be seen in the appearance of a wider variety of sites as well as sites with specialized resource procurement and processing tools dating to the Archaic period but not earlier (Ellis, Kenyon, & Spence 1990:66). As a result, the Archaic appears to have had a more abundant and reliable resource base than the Paleoindian period (Emerson & McElrath 2009:26; Hayden 1982:119; Meltzer 1989:15).

2.2.1 Subdivisions

The Archaic is commonly divided into three subdivisions including the Early, Middle, and Late Archaic. In Ontario, the Early Archaic generally dates from ca. 11500 cal BP (10000 RCYBP) until 9000 cal BP (8000 RCYBP) (Ellis et al. 2009:788). The beginning of the Early Archaic is evidenced by the appearance of notched and markedly stemmed point forms in assemblages rather than the more lanceolate, occasionally slightly stemmed forms that are distinctive of the Paleoindian period (Ellis et al. 2009:791). These point forms closely resemble forms found in the southeastern United States which are well-known and have well-dated sequences (Ellis et al. 2009:791). The Early Archaic horizons in Ontario include Hi-Lo, Side-Notched, Corner-Notched, and Bifurcate which differ in terminology from the Early Archaic horizons in the United States, known as Dalton, Big Sandy, Kirk, and Bifurcate (Ellis et al. 2009:791).

The Middle Archaic covers the time period from ca. 9000 cal BP (8000 RCYBP) to 5000 cal BP (4500 RCYBP) (Ellis et al. 2009:788, 803). The end of the Middle Archaic corresponds with some major changes in items such as projectile points and the end of the Nipissing Phase with the decline of high-water levels in the eastern Great Lakes (Ellis et al. 2009:788). The Middle Archaic can be split into two sections in terms of what researchers know about this period of time. Prior to ca. 6200 cal BP (5500 RCYBP), the earliest developments of the Middle Archaic in Ontario archaeology are not very well known (Ellis et al. 2009:803). Current suggestions for this early part of the Middle Archaic, in terms of occupation, are similar to the preceding Bifurcate horizon in the Early Archaic which includes “the presence in local collections of certain point styles resembling those found elsewhere and the very occasional, small, apparently single-component site” (Ellis et al. 2009:803). It is likely that the lack of known sites dating to this period is related to the low water levels in the lower Great Lakes at this time and the likelihood that many sites were in areas that are now inundated. The better-known assemblages from the Middle Archaic postdate ca. 6200 cal BP (5500 RCYBP) which can be attributed to the fact that sites from this latter portion are 15 to 20 times more common than earlier sites and materials (Ellis 2009:806, 811). The earliest of these assemblages include broad-bladed, side-notched points that are usually related to the Otter Creek type and date to ca. 6200 cal BP (5500 RCYBP) to 5700 cal BP (5000 RCYBP) while later assemblages contain corner- and side-notched points which can be assigned to Brewerton types or their variants and are dated to ca. 5700 cal BP (5000 RCYBP) to 5000 cal BP (4500 RCYBP) (Ellis et al. 2009:806).

The Late Archaic covers the occupations and developments from ca. 5000 cal BP (4500 RCYBP) to the introduction of ceramics at ca. 2900 cal BP (2800 RCYBP) (Ellis et al. 2009:812). The three broad complexes within the Late Archaic include Narrow Point, Broad Point, and Small Point which are largely based on the form of the projectile points in this period (Ellis et al. 2009:812). The Ridge Pine 3 site has been assigned to the Late Archaic period. More details on the Late Archaic are provided in section 2.3.

2.3 The Late Archaic

The majority of sites from the Archaic are dated to the Late Archaic and with this larger database, marked changes have been observed in the archaeological record of this time (Chapdelaine 2012:253; Funk 1983:320; Lovis et al. 2005:689). There is an increase in site density and assemblage diversity, and, although present in the Middle Archaic such as on Jacobs Island and the Morrison and Allumette Islands, deliberate burial sites become more common, partly due to preservation (Conolly et al. 2014; Lovis et al. 2005:689). The increased diversity of assemblages from this time indicates, in turn, an increased diversity of activities that people were participating in “based on the presence of distinctive drill, scraper, knife, pecked, and ground stone utilitarian and sacred objects, and other tool forms” (Lovis et al. 2005:689).

There are a variety of explanations for the increase in site density and assemblages from the Late Archaic and the resultant expansion of our knowledge for this portion of the Archaic. In the past, researchers attributed this to population increases at the end of the Archaic, resulting in an increased number of sites, which is a pattern that we see in the Archaic (Ellis et al. 2009:828). More recently, it has been suggested that some of the increase in site density may be due to population packing, rather than growth, as a result of rising water levels (Ellis et al. 2009:828). Another explanation is the emergence of modern water levels in the Great Lakes region resulting in fewer destroyed sites in the Late Archaic. As noted, the low water levels in all the basins in the Great Lakes region during the Early and Middle Archaic periods has resulted in many sites from these time periods being underwater, especially coastal sites (Lovis 2009:742; Lovis et al. 2005:670). It is speculated that at least 40% of the area in southern Ontario that would allow for human occupation in the earlier part of the Archaic is now underwater (Ellis et al. 2009:789).

As well, it is possible that long-distance logistical mobility in the Middle Archaic resulted in more temporary and low-impact sites leaving a very low-visibility signature at site locations, making them difficult to find today (Lovis 2009:744-745). Logistical mobility strategies involve the movement of small groups of collectors seeking out specific resources in specific contexts to collect and bring back to the residential camp (Binford 1980:10). The site locations for these small task groups would be temporary resulting in lower visibility in the archaeological record than residential camps (Binford 1980:10). In the Late Archaic, it is believed that populations switched to a residential mobility system resulting in an increased impact on the environment and resources and thus more permanent sites with a higher visibility in the archaeological record (Ellis, Kenyon, & Spence 1990; Ellis et al. 2009; Lovis et al. 2005). Residential mobility involves the movement between various resource patches and groups may be more or less mobile depending on how many microenvironments they have access to in a specific area (Binford 1980:5-7). Unlike logistical mobility where specific resources are collected through small task groups, residential mobility is the movement of a group to various resource patches throughout the year where the entire group moves site locations and adjustments in group size are made based on the season and the heterogeneity of the resources available (Binford 1980:10). It should also be noted that the changing coastlines due to varying water levels over time skews our understanding of the settlement-subsistence system. For example, if bands employed a seasonal round with warm season macroband camps on the coast and cold season dispersal into interior nuclear family camps/hunting territories, the Nipissing rise would result in the disturbance of warm season sites occupied during low water levels as the coastline moves further inland and floods those sites. These sites are arguably the most informative part of the picture and could lead to faulty assumptions about changes in mobility practices (Robert MacDonald personal communication 2021).

Exchange may have also played a larger role in the Late Archaic than the Middle Archaic (Lovis 2009). For the Saginaw Valley in Michigan, Late Archaic groups incorporated a wide variety of different raw materials into their lithic production at the local level stemming from interregional connectivity (Lovis 2009:739). In southern Ontario, it is speculated that exchange systems became more important by the end of the late Middle Archaic and into the Late Archaic from a decline during the Early Archaic (Belyea 2019:21). Sites such as South Bend in the Grand Bend area likely used exchange to acquire the non-local materials found in the assemblage during the late Middle Archaic (Belyea 2019:114-116). As well, it is believed that by the Late Archaic the plant and animal associations in southern Ontario had stabilized to the locations and compositions found today in modern times (Funk 1983:320). The biome of this region, including oak, chestnut, deer, and turkey, was quite rich in resources (Funk 1983:320; Ritchie 1965:32).

2.3.1 Complexes

The Late Archaic is typically divided into three complexes known as Narrow Point, Broad Point, and Small Point, which are thought to largely form a time sequence from earlier to later, though there is some overlap between the complexes (Ellis et al, 1990:97). These complexes are based primarily on projectile point morphology (Ellis et al. 2009:812). The initial assessment of Ridge Pine 3 classified four of the six projectile points as the Innes type which fits in with the Small Point complex (TMHC 2012:45), however, the analysis conducted for this thesis reclassified them within the Narrow Point Complex. There appears to be a general decrease in point size over time as we move from the Broad Point to the Small Point complex (Snarey & Ellis 2008:22). This may be an indication of a change in weapon systems with the switch from spear-thrower and dart use to bow and arrow, an element that foreshadows the trends in the Woodland period (Ellis, Kenyon, & Spence 1990:106; Ellis et al. 2009:820; Snarey & Ellis 2008).

The Narrow Point complex is believed to date from ca. 5000 cal BP (4500 RCYBP) to 4100 cal BP (3800 RCYBP), following radiocarbon dates from western to central New York (Ellis et al. 2009:812). This complex tends to contain "relatively poorly made narrow, thick points with shallow side notches or expanding stems referable to types such as Lamoka and Normanskill" (Ellis et al. 2009:812). Although this complex is believed to have had a strong influence on later developments in the Late Archaic, it is still poorly understood in Ontario (Ellis et al. 2009:812). In the past, there were very few excavated sites in Ontario that included projectile points from the Narrow Point complex and those that have been investigated are usually from multi-component sites in plough-disturbed contexts (Ellis et al. 2009:812). More recently, TMHC has excavated some larger, multi-component Narrow Point sites around Kitchener (TMHC 2015a, b) though nothing has been published yet for these sites besides the site reports (Peter Timmins personal communication 2020).

The Broad Point complex dates from just before 4400 cal BP (4000 RCYBP) to ca. 3650 cal BP (3400 RCYBP), slightly overlapping with the Narrow Point complex, at least for sites in southern Ontario (Ellis et al. 2009:815). The main indicator for this complex is the presence of large, stemmed points (Ellis et al. 2009:814). The term "large" is a general descriptor with some Ontario forms like the Genesee type being very broad but it also includes examples with more narrow blades known as Adder Orchard points which are found in the southwesternmost portion of Ontario and in Michigan (Ellis et al. 2009:814). The stemmed bifaces are characteristic of this complex and they are found well into the modern Canadian biotic province, which lies in the more northerly portion of southern Ontario (Spence & Fox 1986:5), however, most sites occur on sand plains within the Carolinian biotic province to the south, where there were once substantial forests of nut-bearing deciduous trees (Spence & Fox 1986:5). In terms of spatial boundaries, the Genesee type are the most widespread while the Adder Orchard type appears to be restricted to southwestern Ontario (Ellis et al. 2009:814). Many of the projectile points in this complex are often made on coarse-grained rocks, which differentiates the Broad Point complex from earlier and later Archaic developments (Ellis et al. 2009:815). The reasoning behind the use of this type of material is likely because these large bifaces need to be made out of large, flaw-free pieces of material and if an area did not have large supplies of fine-grained material, flintknappers would turn to flakable but coarser-grained rocks to make them (Ellis et al. 2009:815; Kenyon 1980b).

The last complex in the Late Archaic is known as Small Point or Terminal and dates to ca. 3800 cal BP (3500 RCYBP) to 2900 cal BP (2800 RCYBP) (Ellis et al. 2009:818). Compared to the Broad Point complex, the projectile point forms from this complex are relatively small but there are some relatively large point styles as well (Ellis et al. 2009:818). The Small Point developments are mostly concentrated in "southwestern Ontario and along the immediate north shore of Lake Ontario west of Toronto" (Ellis et al. 2009:818). There are assemblages found outside of this area that may also be affiliated with the Small Point complex, such as in eastern Ontario where mortuary components have been found with associated Small Point types, though the presence of the Small Point complex in that region is not clear (Ellis et al. 2009:818). Compared to earlier Archaic developments, more sites and assemblages from the Small Point complex have been reported and more fully described in the literature (Ellis et al. 2009:818).

The linear sequence of complexes in the Late Archaic, as described above, may be outdated. Lovis (2009:736) believes that there is both continuity and temporal overlap in the Late Archaic point forms. He argues that the Dustin point type, which has been seen as a correlate of the Narrow Point complex Lamoka point type, is on the longer end of a size continuum leading to the projectile point types of the Small Point complex. Thus, there may be more overlap between the Narrow Point and Small Point complexes than originally thought, especially given the similarities in their toolkits. It is possible that the Narrow Point morphs into the Small Point while the Broad Point complex is a parallel or co-occurring development in southern Ontario and adjacent areas including Michigan (Lovis 2009:736-738). Similar temporal overlap is found between the late Middle Archaic and Late Archaic with radiocarbon dates associated with Brewerton points at the

Jacob Island site all post-dating 5000 cal BP, the generally accepted end of the late Middle Archaic period according to current temporal understandings of the Archaic period (Connolly et al. 2014:120). There is a clear need for revaluation of our current understandings of the Late Archaic complexes in Ontario. The overlap and relationships between complexes are likely more intricate than we understand, and more research is needed to unravel how they relate to one another.

2.3.2 Narrow Point Complex Details

2.3.2.1 Point Types

The Lamoka and Normanskill types that characterize the Narrow Point are narrow and thick with broad, shallow side notches or expanding stems and are often coarsely flaked (Ellis, Kenyon, & Spence 1990:94; Ellis et al. 2009:812; Justice 1987:127).

Lamoka is the most characteristic development of the Narrow Point complex and what Ritchie (1932) based his concept of the Archaic on (Ellis et al. 2009:812). The Lamoka point is named after the Lamoka Lake site in New York, which has radiocarbon dates indicating initial occupation occurred ca. 5000 cal BP (4500 RCYBP) (Ellis, Kenyon, & Spence 1990:95; Ritchie 1932). The Lamoka type was first thought to have regional variants, including the Dustin point from Michigan (Harrison 1966) and the Durst Stemmed point from Wisconsin (Justice 1987:127; Wittry 1959). However, as discussed, based on more recent evidence from sites in the Saginaw Bay area (i.e., 20BY387 and Weber 1) Lovis now views Dustin points as the longer end of a size continuum leading to Small Point forms such as Innes and Crawford Knoll, dating between 4850 and 2950 cal BP (Lovis 2009:736). The Wisconsin Durst points are now estimated to date between 3100 and 2500 cal BP (Pleger and Stoltman 2009: 714), which is largely contemporary with the latter part of the Small Point complex in Ontario (Ellis et al. 2009; Lovis 2009:736; Lovis & Robertson 1989:235). The Durst points are seen to be quite similar to the Ontario Innes type, particularly the Ace of Spades variant (Ellis et al. 1990:109; Kenyon 1989:18-19; Lovis 2009:736; Lovis & Robertson 1989:235).

Lamoka points are described as “small, narrow, thick points with weak to moderately pronounced side notches, or straight-stemmed with slight usually sloping shoulders" (Ritchie 1971:29). There is often an unmodified portion of the base left intact resulting in a haft region as thick as the blade (Justice 1987:127). This is a diagnostic feature of some Lamoka points; however, points with finished bases are part of the morphological variation of this point type (Justice 1987:127-129). The Lamoka points from the AiHc-423, a multi-component site in Waterloo, Ontario have a mix of finished and unfinished bases (TMHC 2015a:18).

Lamoka points are distributed throughout the Great Lakes (Justice 1987:129). Virginia and Kentucky are likely the southern limit for this point type and eastern Iowa is likely the western limit (Justice 1987:129). While most excavated sites with this point type are found in the United States, points from this complex have been reported across southern Ontario (Ellis, Kenyon, & Spence 1990:95; Ellis et al. 2009:812; Justice 1987:129). The Canada Century site (Lennox 1990), near Welland, and the Winter site (Ramsden 1990), near Guelph, are the most well-known Narrow Point sites in Ontario with seemingly pure components (Ellis et al. 2009:812). AiHc-423 (TMHC 2015a) and AiHc-429 (TMHC 2015b) are multi-component sites in Waterloo, Ontario with Narrow Point occupations based on the Lamoka points present.

Normanskill projectile points are thought to be related to both the Brewerton Side-Notched and Lamoka types (Ritchie 1971:37). They are described as "slender, thick points of medium size, with prominent side notches" (Ritchie 1971:37). Ritchie (1971:37) considers the Normanskill type to be a slender variant of the Brewerton Side-Notched form and transitional between the Lamoka side-notched and Brewerton Side-Notched forms. While Ritchie (1971:37-38) viewed this point as straddling the divide between the late Middle Archaic to Late Archaic Narrow Point, Ontario archaeologists consider the Normanskill point to be diagnostic of the Late Archaic Narrow Point complex, postdating the late Middle Archaic (Ellis, Kenyon, Spence 1990:94-97). These points are generally made on local cherts and are found in the Susquehanna River valley, Hudson River basin, Potomac River valley, and into southeastern Ontario (Ritchie 1971:37-38). They are named after the Normanskill tributary along the Hudson River in eastern New York where the point form is commonly found (Ritchie 1971:37).

2.3.2.2 Settlement-Subsistence Model

As noted, despite its seminal role as the first complex in the Late Archaic, the Narrow Point complex is still poorly understood. As such, there is no established settlement-subsistence model, as there is for the Small Point complex. However, some general settlement and subsistence points can be made for the Narrow Point complex.

As discussed previously, the Late Archaic coincided with a change in mobility strategies. Compared to the long-distance logistical mobility of the Middle Archaic, archaeologists have suggested that the Late Archaic employed a residential mobility strategy with more restrained seasonal movements resulting in more permanent sites with an increased impact on the surrounding environment and resources (Ellis, Kenyon, & Spence 1990; Ellis et al. 2009; Lovis et al. 2005; Lovis 2009:744-745). Warmer temperatures than modern times during the hypsithermal interval would have allowed for longer occupations, particularly at coastal sites, throughout the year and complimented a reduction in long-distance movements (Deevey & Flint 1957; Lewis et al. 2008:133).

The residentially mobile foraging system can provide some clues as to settlement-subsistence. It is speculated that Late Archaic populations in general may have "aggregated at favourable fishing locations near the Great Lakes and their largest tributaries throughout the warm seasons of the year when such locations would have provided the greatest quantity and diversity of aquatic, terrestrial, and avian resources" (Cowan 1999:595). For the western New York region, the larger Late Archaic sites tend to be found around fishing locations near the Great Lakes, such as the Lamoka Lake site located near a stream and two lakes and containing many netsinkers (Cowan 1999:595; Madrigal 2001:66; Ritchie 1932). Once late fall and winter comes along, the attraction to these locations on large water bodies diminishes in terms of the number of resources available at such locations compared to resources available in more interior locations (Cowan 1999:595-596). The shoreline locations would be exposed and likely uncomfortable in the winter and the winter habitats for deer would likely be in less exposed areas. Populations may have dispersed into small family groups for the move to an interior site once the food resources diminished at the coastal locations with the cold weather (Cowan 1999:565; Muller 1989:20). However, this likely does not apply to all sites as animal remains at the large Lamoka Lake site with deep middens supports the interpretation that it was occupied year-round (Madrigal 2001; Ritchie 1932). While this model is speculative and applies to the whole Late Archaic, these elements can be seen in the Small Point settlement-subsistence model which may have been derived from the settlement-subsistence strategies of the Narrow Point complex.

The small number of excavated Narrow Point sites in Ontario are an important data source for trying to understand the settlement-subsistence of the Narrow Point complex. Lennox (1990:46) argues that the Canada Century site has evidence of a structure of similar size to the inferred structures identified at the Innes site based on debitage density (Lennox 1986). The large, inferred structure at Canada Century, alongside a lack of activity areas besides the main concentration and an assemblage dominant in hunting equipment (i.e., points) and lacking in fishing equipment (i.e., netsinkers), suggested a cold season occupation (Lennox 1990:46-47). However, the major riverbank that the Canada Century site lies on (the Welland River) may have once been the shoreline of a large lake (Lennox 1990:50). The toolkit suggests that this large lacustrine resource was ignored, but it cannot be discounted, as equipment made from organic materials may have been used or lacustrine resources may have been collected at small, short-term, special purpose camp sites and brought back to the Canada Century site (Lennox 1990:50). The structures at Canada Century and Innes are larger than those structures found at the Lamoka Lake site, based on post moulds (Ritchie 1932), and the semi-subterranean house found at the Thistle Hill site (Woodley 1990:62). The larger structures may be an indication that cold season occupations needed such structures, though there is debate about whether the debitage density patterns at Innes and Canada Century sites actually represent house structures (Ellis et al. 2009:814; Lennox 1990:46).

Ramsden (1990:34-36) also argues for a late fall and winter occupation at the Winter site. The site has a relative abundance of projectile points compared to other tool types and is located in close proximity to deer habitats (Ramsden 1990:36). The surrounding environment also lends support for the interpretation of a cold season occupation as the site is situated on a low flood plain providing shelter from fall and winter weather (Ramsden 1990:36). The site location also would have been unpleasant in the warmer months due to the swampy nature of the valley (Ramsden 1990:36). As such, the Winter site may be a “fall or winter camp of a group that summered in a lakeshore environment” (Ramsden 1990:37). The surrounding hardwood forest of beech and sugar maple in the area also ties in with the idea that the Narrow Point complex may be an adaptation to nut or mast producing forests, which are common in the Carolinian biotic province (Ellis, Kenyon, & Spence 1990:94; Ramsden 1990:34).

As mentioned previously, the people of the Archaic are believed to have utilized a diffuse resource strategy wherein groups made use of a wide range of food types. This resource model is indicated by the intensive use of nuts and acorns, increased sedentism, decreased specialization, and the increased diversity of resources being exploited, particularly by the Late Archaic (Roberts 1980, 1982:18, 21, 22). Diffuse adaptations make populations more adaptable and flexible to change because groups are not “committed to a single exploitative pattern…[so] they can exploit new or old resources in new ways” (Fitting 1975:68). By seasonally hunting, gathering wild plants, and fishing, Late Archaic peoples drew from a wide range of resources that fluctuated in abundance depending on the season and the region.

Late Archaic sites are located in a wide range of environmental settings which further shows the variation in plants and animals that groups exploited (Robertson et al. 1999:95). The focus on environmental diversity for site locations ties in with the patch model from foraging theory which entails “acquiring food from clusters of prey in spatially heterogeneous environments” (Bousman 1993:60). It is the idea of Late Archaic peoples choosing site locations in pockets of microenvironments, commonly found in the Great Lakes region. This way, people can exploit a wide range of resources from that one location. It also results in increased sedentism compared to previous periods, though mobility still played a role in seasonal movements (Kelly 1983). For example, the Thistle Hill site near Brantford, Ontario is in an area that has a wide range of seasonally diverse resources which would have made occupation possible at any time of the year and fits in with the diffuse subsistence model for the Archaic (Woodley 1990).

While the two published sites with seemingly pure Narrow Point components do provide some data for Narrow Point seasonality and subsistence in Ontario, more data is needed, particularly from warm-weather sites and smaller, short-term sites to compare to larger, seasonal home base occupations. There is also the problem of a lack of faunal and floral remains at most Late Archaic sites to give seasonality and subsistence clues (Ellis et al. 2009:790). In the case of faunal remains, the acidic nature of many Ontario soils makes preservation difficult as does the issue of differential faunal preservation wherein denser faunal materials, such as mammals, are more likely to survive in the archaeological record than lighter materials, such as fish bones (Tincombe 2020:27-28).

2.3.2.3 Environment and Climate

The environment and climate in the Great Lakes region are important factors in making inferences about the archaeological past. Many archaeologists in Michigan and Ontario follow Dice's (1943) organization for modern vegetation in southern Ontario. Dice (1943) splits the region into two biotic zones, Carolinian to the west and Canadian to the east, with the boundary essentially following the divide between Rowe's (1972) Deciduous Forest region and Great Lakes–St. Lawrence Forest region (Figure 3) (Karrow & Warner 1990:8). The Carolinian biotic province, or the Deciduous Forest zone, is mainly composed of "nut-producing trees such as oak [*Quercus sp.*], hickory [*Carya sp.*], chestnut [*Castanea sp.*], walnut [*Juglans sp.*], and beech [*Fagus grandifolia*]" (Karrow & Warner 1990:8). This zone is richer than the Canadian biotic province and the wide range of resources is able to support a diffuse resource strategy (Karrow & Warner 1990:8; Spence & Fox 1986:38). The Canadian biotic province in the east, or the Great Lakes–St. Lawrence Forest zone, is "a transitional belt with a mixture of more southern-type deciduous species and more northern coniferous and deciduous species, such as maple [*Acer sp.*], birch [*Betula sp.*], pine [*Pinus sp.*], hemlock [*Tsuga canadesis*], and spruce [*Picea sp.*]" (Karrow & Warner 1990:8). Here there are less tree species that provide nuts, and the region has fewer options in terms of subsistence than in the Carolinian biotic province (Karrow & Warner 1990:8). The major distinctions between the Carolinian zone and the Canadian zone continue to be factors in explaining the variability that has been found across the region for the Archaic period (Ellis et al. 2009:790).

Most of the modern composition of vegetation and the general climate was established during the Archaic. It is hypothesized that an approximately modern climate was established by ca. 4850 cal BP (4400 RCYBP) with Late Archaic climatic conditions in southern Ontario similar to historic conditions (Roberts 1982:43; Tincombe 2020:4). This is about the same time that the post-glacial Great Lakes with their fluctuating lake levels gradually began to lower to modern levels after ca. 5000 cal BP (4500 RCYBP). While essentially modern conditions may have been reached by this point, the minor fluctuations in lake levels past this date would still have had an impact on the environment and the types of resources available.

Researchers also argue that the environment was in the process of stabilizing during the Middle Archaic, with modern vegetation compositions occurring by ca. 8200 cal BP (7500 RCYBP) (Ellis et al. 2009:790). Pollen diagrams from southwestern Ontario show that a mixed deciduous forest, including beech, maple, hemlock, and birch, was established in the region by about the same time (Bennett 1987; McAndrews 1981; Ramsden 1990:34). While general patterns of modern vegetation may have been establishing themselves during the Middle Archaic it is important to remember that, as discussed previously, water levels were still fluctuating in the Huron basin at this time so the environment would have been dynamic and changing. For example, McAndrews (1994) has noted a sudden disease-induced decline in hemlock in southern Ontario ca. 4400 cal BP (4000 RCYBP) which would have expanded the habitat for deer in southern Ontario, showing that the environment and vegetation was still changing at this point (Ellis et al. 2009:790; Ramsden 1990:34-35).

For the Ridge Pine 3 site, a major environmental factor to consider is the Thedford Embayment. This is one of the dynamic wetlands that emerged in the Grand Bend area following the Nipissing high water phase, and it is areas like this embayment that allowed for a more stable occupation (Karrow 1980:1272; Stewart 2013:29). During the high-water phase of the Nipissing period, the Thedford Embayment was a lagoon-like bay, and during most of the Late Archaic it would have likely been a marshy environment located in the former embayment area (Deller et al. 1985:3; Kenyon 1980a:15; TMHC 2012). With the fall in water levels, the Thedford Embayment was separated from Lake

Huron by “a series of sand dunes formed on the Nipissing baymouth bar…[which] created a low, marshy basin containing a small body of water known as Lake Smith” (Deller et al. 1985:3). Pollen studies from the Thedford Embayment region show “only minor vegetational changes from the Archaic to the beginning of European settlement” (Kenyon 1980a:15). Today the region looks quite different with the marsh and lake having been drained to facilitate agricultural fields (Deller et al. 1985:3), but during occupation of the Ridge Pine 3 site the Thedford Embayment would have played a large role in how groups utilized and moved about the landscape.

2.3.2.4 Lithics

The Ridge Pine 3 site assemblage mainly consists of lithics and the associated chipping detritus. Therefore, it is important to understand the general composition of the lithic toolkit from the Narrow Point Archaic as four of the six projectile points have been classified as Lamoka-like (Chapter 5). By comparing the Ridge Pine 3 assemblage with our general understanding of the Narrow Point lithic toolkit and other Late Archaic and Narrow Point sites, similarities and differences can be drawn to provide more evidence about when Ridge Pine 3 was occupied as well as the activities that took place at the site. The environment, raw material quality and abundance, mobility, and more can all affect the technological organization of a site (Bamforth 1991). If there are differences in the Ridge Pine 3 assemblage compared to the general patterns that have been noted for the Narrow Point Archaic, it may provide insight into the variables listed above.

Projectile points are distinctive in form which is why researchers use them for distinguishing time periods in the archaeological record. The other lithic artifacts that have been found on the few Narrow Point sites in Ontario are not as highly distinctive compared to other periods and the small assemblages from those sites make it difficult to understand the full scope of the lithic toolkit (Ellis, Kenyon, & Spence 1990:99). However, the site assemblages from Ontario combined with those from New York State can provide a basis for comparison. The Canada Century and Winter sites are most relevant to the Ridge Pine 3 site as they are also located in southern Ontario and have seemingly pure components. The Lamoka Lake and Cole Gravel Pit (Farrell) sites in New York can help to supplement the data from Ontario (Ellis, Kenyon, & Spence 1990:95).

Based on their compositions, the Canada Century and Winter site assemblages are not much different from the toolkits seen in the later Late Archaic complexes (Ellis, Kenyon, & Spence 1990:99). Both are "dominated by a range of simple tools such as flake scrapers, gravers or piercers, spokeshaves and wedges" (Ellis, Kenyon, & Spence 1990:99). This description fits in with current understandings of the Archaic toolkit with an emphasis on simple, expedient tools and fewer diagnostic tools (Ellis et al. 2009:791). The term flake scraper is not a formal scraper, such as an end, side, or thumbnail scraper, but is less formally curated and still resembles the flake it was made on (Lennox 1990:41). However, the Winter site has two lithic fragments with steep scraper retouch, so more formal scraper types may be part of the lithic toolkit (Ramsden 1990:31).

Based on radiocarbon dates, Lamoka Lake had initial occupation ca. 5000 cal BP (4500 RCYBP) while the Cole site was inhabited closer to the end of the Narrow Point with dates of 4850 to 4065 cal BP (3980 ± 160 RCYBP) and 4628 to 3975 cal BP (3890 ± 120 RCYBP) (Ellis, Kenyon, & Spence 1990:95; Hayes & Bergs 1969:10; Ritchie 1932). Common artifacts at both sites include rough stone mullers, pestles, pitted stones, and adzes with bevelled or facetted side margins (Ellis, Kenyon, & Spence 1990:96; Hayes & Bergs 1969:8; Ritchie 1932). The pitted stones indicate that plant food processing, such as nuts, was an important activity and the bevelled/facetted adzes are potentially diagnostic of the Lamoka phase (Ellis, Kenyon, & Spence 1990:96). Lamoka Lake and Cole have good organic preservation, so bone tools are part of their assemblages "including awls, needles, bone gouges, antler flakers, fishhooks, flutes and barber points" (Ellis, Kenyon, & Spence 1990:96; Hayes & Bergs 1969:8-9).

Hayes and Bergs (1969:4-8) describe the chipped lithic tools present at the Cole site which is similar to the tool types at the Canada Century and Winter sites. One major tool type not present at Canada Century or Winter is the knife. The Cole site has 54 complete and 32 fragmentary knives of several forms indicating that knives may be a component of the Narrow Point toolkit (Hayes & Bergs 1969:6). Cole also has 68 scrapers which are formal types including end, side, and a combination category where tools have more than one working edge (Hayes & Bergs 1969:6). Again, while more expedient flake scrapers are part of the Narrow Point toolkit, more formal types are also found. As well, it appears that multifunctional tools may be a potential pattern to look for in the toolkit with several tools at the Cole site combining multiple functions in one artifact, such as the three spokeshaves at the site which are combined with other tools, usually compound scrapers (Hayes & Bergs 1969:8).

In terms of the raw materials in the lithic toolkits, Onondaga chert seems to be the dominant material type. Both Canada Century and Winter sites are closer to the Onondaga primary outcrops along the northeastern shore of Lake Erie than Ridge Pine 3 (Cook & Lovis 2014:59; Spence & Fox 1986:21). Canada Century is about 17 km north of the northeastern shore of Lake Erie where Onondaga chert outcrops are visible today (Lennox 1990:49-50). While this coastal source location was submerged at the time of site occupation, the early and later high stand of Lake Erie, which created Lake Wainfleet, had an archipelago of islands in southern Niagara region which had outcrops of Onondaga chert on their shores (Lennox 1990:49-50; Robert MacDonald personal communication 2021). One such island northeast of Port Colborne includes a vast lithic site registered by Jim Pengelly as the Port Colborne Quarry site, about 13 km south of the Canada Century site, and this is likely where the Onondaga chert at Canada Century came from, rather than secondary sources west of the Grand River as Lennox (1990:50) proposed (Robert MacDonald personal communication 2021).

The Winter site is about 100 km north of the northern shore of Lake Erie and most of the lithics are made on varieties of Onondaga (Ramsden 1990:Figure 1). While the Onondaga primary source location may not have been where the chert was collected, Onondaga from other sources dominates both these assemblages which makes sense as this chert was commonly used throughout the Archaic (Armstrong 2018:58). The Cole site lithic artifacts are all made from varieties of Onondaga chert as well (Hayes & Bergs 1969:4). Although no Kettle Point has been noted for these four excavated sites, that may be due to their distance from the primary outcrops along the southeastern shoreline of Lake Huron in the Ausable Valley (Janusas 1984; Kenyon 1980a:15). Mobility strategies including seasonal movements and chert collection are likely related as Kettle Point and Onondaga cherts tend to occur in littoral areas which may be indicative of chert procurement happening during the warm-weather season (Muller 1989:20).

2.4 Conclusions

A wide range of topics was explored in this chapter to provide context for the rest of the thesis. The geological setting of the region has changed dramatically due to the retreat of the Laurentian Ice Sheet. Lake level fluctuations played a major role in site locations, subsistence strategies, and the layout of the surrounding environment for precontact populations and continued into the Late Archaic. Although the post-Nipissing water levels vary less than earlier times, fluctuations from the Nipissing Transgression onwards played a role in altering the landscape and influencing the people living there, especially for coastal sites. Lake levels in the Huron basin during the Narrow Point occupation at Ridge Pine 3 will be explored in the next chapter to reconstruct the lacustrine orientation of the area more accurately.

The Archaic period makes up a large part of the archaeological record in the Great Lakes region. The Late Archaic consists of three complexes. The Narrow Point complex is the oldest, dating from ca. 5000 cal BP to 4100 cal BP, although it may persist about 1000 years longer if in fact, Narrow Point forms morph into Small Point forms as suggested by Lovis (2009:736). This complex had a seminal role for the later Late Archaic complexes. The people of the Narrow Point complex generally enjoyed approximately modern vegetation and climate, and the resource rich region of southwestern Ontario would have been capable of supporting a diffuse subsistence strategy. In terms of mobility, there is no established settlement-subsistence model in place, however, some general inferences can still be made based on the small data pool of excavated Narrow Point sites. The analysis of the Ridge Pine 3 assemblage and its paleoenvironmental reconstruction will contribute to current understandings of the settlement regime. The Narrow Point toolkit mainly consists of expedient tools, used to perform a diverse range of tasks; a limited range of diagnostic tools have been documented although there appears to be some consistency in the tool types present. The composition of the toolkit will be a primary line of evidence for confirming the period of occupation and determining the function(s) of the site. Radiocarbon dating will also help to identify the period of occupation as a supplemental line of evidence.

Chapter 3: Theory and Methods

This chapter reviews the theoretical frameworks and methods used to conduct my research. The first part, section 3.1, focuses on the theory and includes (1) human behavioural ecology and environmental reconstruction; (2) chaîne opératoire, flintknapping skill, and craft learning; (3) intrasite spatial analysis and social spaces; and (4) settlement-subsistence models. Section 3.2 describes the methods used to analyze the Ridge Pine 3 assemblage. The results of those analyses are presented in Chapter 5.

3.1 Theory

3.1.1 Human Behavioural Ecology and Environmental Reconstruction

The surrounding environment and landscape played key roles in the decisions and activities of past peoples (Surovell 2012). This context is fundamental to human behavioural ecology (HBE) which examines how human and environment interactions affect human behaviour and choices. The location of the Ridge Pine 3 site has a significant geological history as the surrounding environment was affected by the fluctuating post-glacial lake levels in the Great Lakes region which would have resulted in varying opportunities or constraints depending on what the surrounding region looked like at the time. An HBE analysis will help to reveal the constraints and opportunities of the surrounding environment at the time of site occupation (Bird & O'Connell 2006). This is particularly important for the Ridge Pine 3 site as Archaic sites vary across Ontario, partly due to the environmental distinctions within each region and the transitional nature of the period (Karrow & Warner 1990; Ellis et al. 2009:790).

Following the HBE framework, it is important to understand as much as possible about the surrounding environment to gain a better understanding of the environmental constraints and opportunities that came along with choosing the site location of Ridge Pine 3. Trigger (1991:555-556) defines a constraint as a factor that humans must consider when making decisions and he notes that constraints affect human behaviour. Examples of constraints relevant to Ridge Pine 3 include the availability of raw materials in the surrounding area, the weather near Lake Huron at the time of occupation, and the types of subsistence resources available during the season(s) of occupation. Understanding the surrounding environment in this way can also help us understand why the Ridge Pine 3 location was chosen and the types of opportunities that may have drawn people there, such as meeting subsistence needs or having easy access to resources in the surrounding landscape, as well as the challenges or constraints that the location presented. The reconstruction of the environment is necessary to make such inferences (Surovell 2012).

Turning to lithics in HBE, the toolkit composition left behind at an archaeological site could indicate the costs and benefits of using those tools at that specific site and the subsistence strategies used by the occupants of the site (Bird & O'Connell 2006:152). For this research, my focus is not on doing a cost/benefit analysis of the lithic toolkit but on determining what activities may have been taking place at Ridge Pine 3, as can be inferred from the remaining lithics. I also want to understand the seasonality of the site including the types of resources available at the time of occupation. Subsistence strategies are important to understand in view of the hypothesis that the people in the Archaic period incorporated a diffuse resource strategy exploiting a wide range of resources (Cleland 1976:64-69; Ellis, Kenyon, & Spence 1990:66).

In addition to the immediate surrounding environment at Ridge Pine 3, the broader landscape is also an important factor for the environmental context of my research, particularly in terms of raw material procurement strategies. Source locations, both primary and secondary, can be either an opportunity or a constraint depending on where in the landscape they are located in proximity to the archaeological site. The initial TMHC (2012) report shows both Kettle Point and Onondaga as the most common raw materials present in the lithic assemblage. The primary and secondary locations in the landscape for these chert sources in relation to Ridge Pine 3 can provide insight into the opportunities and constraints of the site location regarding chert sources.

The differing environmental settings at various Archaic sites across Ontario and the diffuse resource strategy means that it is important to understand the types of possible resources available to the occupants at Ridge Pine 3 and their exploitation strategies for subsistence needs. For the Ridge Pine 3 site, there are a few complications to reconstructing the environment. The assemblage mostly contains lithics and chipping detritus with very few faunal remains. The lithics left behind can be an indicator of what activities were happening and perhaps the season of occupation may be inferred from the toolkit composition (Bird & O'Connell 2006:152). The lack of faunal remains will make inferring seasonality more difficult, though there is potential for paleoethnobotanical samples to be analyzed from the feature fill samples. Supplemental research will also be conducted on indicators of the surrounding environment, such as mid-Holocene water levels, geology, and historical records, to get as clear a picture as possible about the environment at the time of occupation at Ridge Pine 3.

3.1.2 Chaîne Opératoire, Flintknapping Skill, and Craft Learning

Lithic analysis is a major component of my research project as the Ridge Pine 3 assemblage contains mostly lithics. In total, 96.16% of the assemblage is chipping detritus or debitage that comes from creating these stone tools. As the making of stone tools is a reductive process and there is a large amount of debitage it can be concluded that flintknapping was an activity that occurred at Ridge Pine 3. My focus and theoretical framework for the flintknapping activity at the site will be on reduction sequences and flintknapping skill levels.

Chaîne opératoire is an approach to understanding the reduction sequences of lithics by taking into account the technical processes and social acts that go into the step-by-step production, use, and eventual discard of lithic tools as a way to understand patterns in the technological record (Bar-Yosef & Peer 2009:105,117). The chaîne opératoire approach will be useful in understanding the raw material procurement strategies of the occupants at Ridge Pine 3. It considers the process of acquiring the raw material necessary for flintknapping as part of the lithic reduction. Since flintknapping clearly occurred at Ridge Pine 3, it is important to understand where the material was coming from. Addressing this question also involves tying in the concepts of HBE and environmental constraints and opportunities based on the raw material source locations.

Another application of the chaîne opératoire approach will be in determining the function of the site and the type of lithic reduction activities that were happening.

Determining the stage of lithic reduction that was happening, such as early- or late-stage reduction, can provide indicators for specific types of flintknapping activities such as resharpening existing tools. Identifying tool types in the assemblage could provide seasonality indicators based on the activities they would likely have been used for.

The chipping detritus and lithic tools at Ridge Pine 3, while providing insight into site function and potential activities, can also shed light on flintknapping skill levels at the site. Flintknapping is a learned skill and Shelley's (1990:187) experimental study has shown that novices frequently make more errors and mistakes that are more consistent than more experienced workers. In fact, regardless of the type of reduction strategy or raw material being worked, such as chert or obsidian, novices tend to repeat the same mistakes despite these differing variables (Shelley 1990:188; Milne 2005:331). Based on these experiments, there is evidence that there are potential identifiable and patterned indicators of skill level in the lithic tools and debitage which can be analyzed and used to understand the people who are contributing to the archaeological record through lithic reduction activities (Shelley 1990:192). For worked pieces, these novice indicators may include battering of the striking platform, "stacked" sets of flake terminations on the dorsal or ventral surface of the biface and on the front of the core below the striking platform, and production of high frequencies of flake shatter regardless of reduction technique or lithic raw material (Shelley 1990:188-192; Milne 2005:331). Among flakes, skill is reflected in platform preparation, platform thinning, force loads, and flake termination states (Shelley 1990:191-192; Milne 2005:331).

Looking into the skill levels reflected in an assemblage can give an indication about whether other people besides the "experts" were contributing to the archaeological assemblage left behind. This type of research can be difficult because experts can erase evidence of novice flintknapping signatures at a site by correcting mistakes or salvaging rejected pieces (Shelley 1990:191; Milne 2012:126). However, the debris from flintknapping can be useful for finding evidence of these novice mistakes that may have been covered up in the worked lithic pieces. As well, experts can make mistakes and can produce crude-looking tools, but they are less likely to consistently repeat the same mistakes as novices and thus have lower overall rates of error (Milne 2012:126). If differing levels of flintknapping skill can be identified in an assemblage then that is evidence of inexperienced flintknappers contributing to the archaeological record, including novices, children, etc. Such patterns may also indicate that some form of craft learning to develop flintknapping skill was occurring at the site (Gero 1991; Bamforth & Finlay 2008; Goldstein 2019). For example, Milne (2005:329) studied Early Paleo-Eskimo assemblages and found that novice flintknapping activities were structured by seasonality, site location, and the availability of local lithic raw materials. So, raw material procurement and abundance may be good indicators of how novices were learning as access to abundant lithic raw material could create more opportunities for hands-on learning (Bamforth & Finlay 2008:17). If the raw material is coming from a secondary source, however, then there may not be as much hands-on learning or novices may be working more closely with the experts as there may not be as much material in terms of abundance or quality coming from secondary sources like in river gravels compared to primary chert outcrop source locations.

My research is focusing in on trying to identify if there are signatures in the assemblage that reflect flintknapping skill level and to see if craft learning played any sort of role at Ridge Pine 3. I will be looking into whether there were multiple flintknappers and several levels of skill at play, and from there, whether this could be due to craft learning as a site activity or if Ridge Pine 3 is simply a site where lots of flintknapping occurred. Understanding the type of lithic production and the skill levels of the flintknappers could indicate whether craft learning was occurring at the site, give insight into the site function(s), activities conducted, and season(s) of occupation, while shedding more light on the people contributing to the archaeological record.

3.1.3 Intrasite Spatial Analysis and Social Spaces

Spatial analysis, or the systematic study of spatial patterning via distribution maps of material remains, is one of the main tools used in archaeological analysis (Hodder & Orton 1976:1). One of the potential uses of intrasite spatial analysis includes looking at the spatial distribution of artifacts at a single site to identify activity zones or clusters. Specifically, I will conduct a spatial analysis of the lithics from the site to determine potential activity areas or zones via tool type and debitage frequencies and locations to understand the spatial structure of Ridge Pine 3. Generally, point-provenience data, or the three-dimensional location of each artifact, is ideal for spatial analysis (Bamforth et al. 2005:565), however, it is a method that is both time consuming and expensive. Ridge Pine 3 was excavated as a CRM project and piece plotting was not conducted. The Ridge Pine 3 data has artifact counts per one-metre grid square which, while not as detailed as point-provenience, is still useful for conducting a spatial analysis of the site.

For the Ridge Pine 3 site there are some complications that may obscure potential spatial patterns. Many Archaic sites are multi-component as they were used for longer periods of time than sites in the preceding Paleoindian period (Ellis et al. 2009:790). The possibility of multiple occupations from either the same group during their seasonal rounds or from a variety of different groups over time can alter or erase potential patterns from the spatial analysis (Bamforth et al. 2005:571). Various site formation processes can also influence artifact distribution maps. Archaeological sites are formed not only from human action at the time of occupation but also natural and cultural processes, such as post-depositional modifications that occur after a site is abandoned or an artifact is discarded, and it is the interaction of the two that create the patterns we see in spatial analysis (Bamforth et al. 2005:562). Post-depositional modifications include natural processes like soil movement, weathering, effects from vegetation, etc., while cultural processes can include ploughing, trampling, excavation, forest clearance, and many others. Both types of processes can cause movement of artifacts thus blurring potential activity patterns (Donahue & Burroni 2004:140-141; Rots et al. 2015:4; Shen 1999:64).

Ridge Pine 3 is currently located in a woodlot so there is likely less plough disturbance than if the site had been in an agricultural field, but disturbance is still a factor as discussed above. As well, identifying potential activity areas may be more difficult with the small size of the site (18 m in diameter) in terms of overlapping zones. However, spatial analysis has been done successfully at other Late Archaic sites with similar or worse complications than Ridge Pine 3, such as the plough disturbed Innes site (Lennox 1986), so there is potential to at least make some inferences about how the site was organized. In fact, even if there turns out to be a lack of discrete activity areas to be identified this outcome can be insightful in that it may indicate multiple occupations occurred and, due to various uses of Ridge Pine 3, ultimately obscured or erased the spatial patterns that came from human action.

By conducting an intrasite spatial analysis at Ridge Pine 3 I will also make use of the concept of social spaces to understand these constructed activity areas and the ways that the occupants used and moved around the space (Kooyman 2006). Essentially, the relationship between social and physical or geographic space is central in the social spaces that are being constructed and produced (Amit et al. 2015:11-13). The social spaces at an archaeological site are constructed and produced by different behaviours and characterized by activity areas which are separated by boundaries that can be more or less flexible and permeable depending on the type of activity (Kooyman 2006:425). The spatial analysis of lithic tools at the site will be used to interpret the use of the space at Ridge Pine 3 and how people at the site moved around and constructed these social and functional spaces. For example, if lithic production activity zones can be identified at Ridge Pine 3, then that evidence can be used to understand the use of the space. If the debitage is concentrated in specific areas that may indicate people at the site choosing specific spaces purposefully for flintknapping activity, and if the space is carefully constructed in this way, access to that activity may also be restricted or contained. If the debitage is scattered everywhere then the activity may have been moved around to make space for other activities showing the flexibility of the activity itself and perhaps its accessibility in terms of including novices, children, etc. as a form of craft learning.

3.1.4 Settlement-Subsistence Models

Hunter-gatherer settlement-subsistence models have been developed as a way of understanding site types and where sites fit into mobility and resource procurement strategies. Kelly (1983:277) describes these models in terms of mobility as they consider the seasonal movements of hunter-gatherers across specific landscapes. The mobility strategies in settlement-subsistence models are closely connected with resource acquisition in a given environment and season (Kelly 1983:277). The Late Archaic is currently hypothesized to have a residential mobility system (Ellis, Kenyon, & Spence 1990; Lovis et al. 2005:686; Ellis et al. 2009), which fits in with the forager end of Binford's (1980) hunter-gatherer spectrum. According to Binford (1980:6-7), foragers are hunter-gatherers who moved residences around various resource patches or microenvironments based on the season and typically gathered food daily. The two basic types of archaeological sites that foragers create are residential bases and location sites where tasks performed involve the acquisition of natural resources (Binford 1980:9).

For southern Ontario and the Great Lakes region, the only well-defined settlement-subsistence model in the Late Archaic is for the Small Point complex which is essentially the use of littoral sites in the warm season and interior sites in the cold season (Ellis et al. 2009:821). While not a model for the Narrow Point, some elements may be applicable for the Ridge Pine 3 site. The idea of cold season interior sites is especially relevant for sites on or near the shores of the Great Lakes. For example, in Grand Bend, where Ridge Pine 3 is located, the winds come across the lake from the northwest which would be particularly difficult to deal with in the cold season. As discussed previously, there is believed to be a lacustrine orientation for Ridge Pine 3, as evidenced by the littoral site location, with an emphasis on ecological diversity as part of a diffuse resource strategy. Even though the date of the site is argued to be older than the Small Point complex, this model may still be helpful as the Narrow Point is also in the Late Archaic and may have similar elements. As my research only involves a single archaeological site, I will not be developing a new model but rather determining whether current settlement-subsistence models in the region can shed light on Ridge Pine 3.

3.2 Methods

3.2.1 Macroscopic Analysis of Lithic Raw Materials

Macroscopic analysis involves making observations with the naked eye or a hand lens of no more than 10 X magnification to classify objects or make inferences about them (Andrefsky 2005:42). For my research, I conducted a macroscopic analysis of the raw material of the lithics in the assemblage. The report by TMHC (2012) for the Ridge Pine 3 site identified both Kettle Point and Onondaga chert as common materials in the assemblage. I examined the artifacts and confirmed or altered these observations of raw material types by making use of reference collections with common Ontario chert types and published works such as Eley and von Bitter (1989) to identify potential source locations. Late Archaic groups tend to use local raw material, so it is important to identify the raw material types and, from there, potential source locations to permit inferences about how the broader landscape was used by these groups (Ellis et al. 2009:791; Teichroeb 2006:107). A study by Teichroeb (2006:107) concluded that macroscopic analysis for determining raw material has a 78% confidence in accurately identifying chert types. As my research is not focused on provenience studies, macroscopic analysis allowed for relatively accurate raw material identification without the added cost and time required for more accurate and detailed geochemical techniques.

3.2.2 Debitage Analysis

The Ridge Pine 3 site assemblage contains about 19978 artifacts, 96.16% of which is chipping detritus or debitage. Due to these high concentrations, a sampling strategy was applied for the debitage analysis. Following the Ontario *Standards and Guidelines for Consulting Archaeologists* (2011), the sampling strategy should be a representative sample of the entire site and contain about 20% of the collection (Ministry of Tourism and Culture 2011:99-100). I used a systematic sampling strategy where flakes were selected from every fifth unit on the site to obtain a sample of at least 20%. As part of the spatial analysis, three extra units were chosen for comparative purposes and were added to the numbers from the original 20% debitage sample. Figure 4 shows the sampling strategy, with the black circles indicating units initially chosen for debitage analysis and the white circles indicating the extra units added and analyzed to allow for a more complete spatial analysis. In total, I analyzed 27.48% (n=5278) of the debitage.

To analyze the debitage, I used Pearce's (2008) technological typology method which was developed during her study of lithic procurement in the Small Point Archaic. The debitage is separated into two groups pertaining to the earlier and later stages of reduction (Pearce 2008:157-161). Early stages of reduction in debitage include primary decortication flakes, secondary decortication flakes, tertiary flakes, bipolar reduction flakes, and shatter. This is all debris that results from core reduction and preform or early biface manufacture (Pearce 2008:53). Late stages of reduction in debitage include normal biface thinning flakes, bifacial retouch flakes, biface reduction flake errors, and unifacial flakes. The biface finishing and retouch debris from the late reduction stages are the result of the "final stages of tool manufacture and the repair and curation of damaged or broken tools" (Pearce 2008:53). There are two extra categories, fragmentary flakes and potlids, that are not assigned a reduction category but can be useful for quantifying raw material types and noting post-depositional effects (Pearce 2008:53). The debitage from Ridge Pine 3 was sorted into these categories to make inferences about the stage(s) of reduction that are represented at the site and to provide insight into the site activities and function(s). Pearce (2008) provides detailed definitions for the sake of replicability and standardization (see Appendix B). The analysis of the Ridge Pine 2 site also used this method for the debitage analysis and having consistent methodology at the two sites is useful for comparative purposes (Belyea 2019).

3.2.3 Flintknapping Expertise/Skill Level Analysis

To identify flintknapping novices in the lithic tools and debris, I conducted an attribute analysis by focusing on the types of terminations on flakes in the assemblage for determining whether novices contributed to the archaeological record at the site. A flake termination occurs on the distal end of the detached flake and shows how force exited a nodule (Andrefsky 2005:87; Odell 2004:56). The type of termination on a flake can provide information about the direction of the applied force, the quality of the raw material, the type of reduction technique being used, and how skilled the flintknapper was (Shelley 1990; Odell 2004:56-58).

Odell (2004:56-58) identifies five different forms of flake termination shown in Figure 5. These include feather, hinge, step, outrepassé or plunging, and axial. Feathered terminations are "smooth terminations that gradually shear the flake from the objective piece" (Andrefsky 2005:87). They are associated with expert flintknappers and are often the desired outcome resulting in a flake with a relatively thin edge all around (Shelley 1990:191; Odell 2004:57). Hinge terminations have a curved-over distal end because of instability in the crack path (Cotterell & Kamminga 1987; Odell 2004:56-57) where the "direction of force is deflected suddenly toward the outside of the core" (Odell 2004:57). Step terminations are broken at the distal end which is caused by either a "complete dissipation of energy or by the intersection of the fracture front with an internal crack or impurity" (Odell 2004:58). Hinge and step terminations are associated with novice flintknappers as they more consistently produce these forms of terminations (Shelley 1990:191). Outrepassé or plunging terminations are the result of the flake curving under the core to the opposite face rather than exiting on the near side (Odell 2004:58). Axial terminations are associated with bipolar technologies where the fracture goes through the core and bisects the nucleus (Cotterell & Kamminga 1987:699-700; Odell 2004:58).

To determine whether novices are present in the archaeological assemblage and how much of a role they played, I recorded the frequency of hinge vs. feather terminations on the debitage then compared those frequencies to Shelley's (1990) experiments. While multiple variables can affect the type of terminations formed, such as raw material quality and human error, Shelley's (1990:Table 3) experimental debitage data shows that experienced flintknappers produce less hinge/step terminations than novices and produce more feather terminations than novices. Shelley's (1990) experiments combine hinge and step terminations however the step terminations in the Ridge Pine 3 debitage may either be due to flintknapping skill or post-depositional damage such as trampling and plowing (Burroni et al. 2002:1279; McBrearty et al. 1998:111; Shen 1999:64; Teichroeb 2006:82-83). Therefore, I recorded the step terminations, but comparison between Shelley's (1990) experimental outcomes and the Ridge Pine 3 data was only done for the feather and hinge terminations. Due to the high frequency of debitage in the Ridge Pine 3 site, the terminations data was used as the main line of evidence for flintknapping skill. I also looked at the frequency of the shatter flake type as higher numbers may be indicative of novice flintknappers at work. Another line of evidence involves the width/thickness ratios for finished bifaces, which can be indicative of multiple flintknappers. While not directly indicative of skill, evidence of whether multiple flintknappers were working at Ridge Pine 3 can add another layer to understanding how flintknapping was happening and the extent of the activity at the site.

3.2.4 Retouched Flakes and Utilized Flakes

Both retouched and utilized flakes fit under the label of informal stone tools. Ridge Pine 3 has 23 retouched flakes and 184 utilized flakes making them the two biggest informal tool types from the site (TMHC 2012:54-59). Retouched flakes were identified by the presence of purposeful human modification on one or more of the flake edges for various task-specific purposes (King 2018:5; Pearce 2008:155). Although this type of flake tool has been deliberately altered for a certain function, retouched flakes are expedient tools not intended for long-term use and were not extensively curated, as opposed to what is seen with a projectile point (King 2018:5-6; Pearce 2008:155).

Identifying retouched flakes is a more straightforward process than utilized flakes as the intentional modifications to the flake's edges create continuous flake scars along that edge. The DAACS Cataloguing Manual from the Florida Museum of Natural History (2017:17) suggests a conservative approach where the presence of at least five continuous flake scars is indicative of retouch to distinguish between intentional human modification and post-depositional modifications such as plowing, trampling, and excavation. A common criterion for retouched flakes is that the flake scars created from edge modification extend at least 2 mm from the edge (King 2018:4; Kooyman 2000:154; Tippit & Daniel 2003:99). In this study, retouched flakes were classified based on the presence of at least five continuous flake scars along the potentially modified edge and extending at least 2 mm from the edge. For the retouched flakes from Ridge Pine 3, I recorded the length of the retouched edge in terms of the number of flake scars and the dimension (mm) as well as the height of the flake scars to confirm that each one was a retouched flake as outlined by the classification criteria.

Utilized flakes are like retouched flakes in that they are also expedient tools (King 2018:5; Pearce 2008:154). Unlike retouched flakes, the patterned flake scars found on utilized flakes were unintentionally made as a result of performing a task with that flake and generally do not extend more than 2 mm from the flake edge (King 2018:4-5). Utilized flakes display no deliberate retouching making identification more difficult, which is seen in how the classification of utilized flakes has been under scrutiny in the archaeological community. Shen (1999) draws attention to the fact that archaeologists are not being critical enough in their analysis of utilized flakes, to the point where he believes too many of these flakes are being classified as "utilized" when they may not have been, due in part to the assumption that edge modification is caused by human use.

Post-depositional modifications can play a big role in an artifact's life once it has been discarded. As these processes can mimic, modify, or erase use-wear features on stone tools (Odell 1985:29; Grace 1990:9; Shea 1992:149; Shen 1999:64; Donahue & Burroni 2004:140), the question becomes whether indications of use are the result of human use or post-depositional modifications. Young and Bamforth (1990) conducted a blind test and determined that macroscopic approaches to identify utilized flakes are not accurate enough to make that distinction. King (2018:3) takes this conclusion further and posits that "microscopic use-wear analysis is necessary to differentiate use-modified edges from those produced as the result of natural taphonomic processes." Following this argument, I used a low-power microscopic methodology stemming from use-wear analysis to confirm or alter the classification of the utilized flakes from Ridge Pine 3. I used a Wild M3 stereomicroscope with magnifications at 6.4, 16, and 40 X to identify use-wear features on potential utilized edges including microflakes, striations, polish, and edge rounding. Cracks were also recorded. Examples of all five are in Figures 6 and 7.

Microflakes, also known as microfractures or scars, are cavities that form when the edge is unable to sustain the pressure or load being put on it (Shea 1992:143). Four microflake types were recorded as present or absent with their maximum height in millimeters taken during data collection: continuous, close, clumped, and isolated. Continuous microflakes run along an edge of a utilized flake with no space between the microflakes, comparable to what we see with retouched flakes. Close microflakes do not form a uniform line but have some space between them at random intervals. Clumped microflakes consist of only two or three side-by-side, rather than a uniform line. Isolated microflakes are the occurrence of a single microflake that is randomly situated at the edge of a utilized flake. The type of microflake present can give a good indication of its origin. Continuous and close microflakes would have taken more time and repetitive action to form such a uniform pattern compared to clumped or isolated microflakes making them good indications of human use. Continuous and close microflakes were the only ones considered to be indicators of use. Clumped and isolated microflakes were still recorded.

Striations result from "friction produced when particles are dragged along the surface of the used piece" (Bello-Alonso et al. 2019:176), forming linear grooves in the surface (Shea 1992:143). Edge rounding, or edge dulling, is a use-wear feature which, as the name suggests, is the rounding of edges from prolonged usage and is "a combination of small-scale microfracturing, striation, and polishing" (Shea 1992:144). It is a good indicator of human use as an accessory use-wear feature (Dockall 1997:324). Striations and edge rounding were recorded as present or absent. Polish is the modification of light reflection off surfaces caused by interaction with another material and were recorded as continuous or discontinuous if present (Shea 1992:144; Bello-Alonso et al. 2019:175).

Cracks on the surface of chert can result from several processes including frost action due to the fluctuating climate, impurities in the chert, the reduction sequence during flintknapping, a flake coming into contact with harder objects, and more (Stapert 1976:11). They were recorded as present or absent and can be a good indicator of post-depositional modifications as they are one of the most common use-wear features to occur from natural causes (Odell & Odell-Vereecken 1980:96; Burroni et al. 2002:1278).

The presence of more than one use-wear feature supports the possibility of the edge modification originating from human use due to the repetitive action and time it would take for the use-wear features to form together on a single portion of an edge. Keeley and Newcomer (1977:37) note that when looking for a used edge, at least two use-wear features including microflakes, striations, polish, and edge rounding should be seen together. This criterion of identifying multiple use-wear indicators on a single edge, though not perfect by any means, may be useful in narrowing down what is edge modification from human use rather than alterations caused by post-depositional modifications. To tackle or at least acknowledge the classification problems associated with the utilized flake tool type, the Ridge Pine 3 utilized flakes were microscopically analyzed for use-wear features on their "used" edges and their classification was determined based on the presence of multiple use-wear features, the types of microflakes if present, and the height of the microflakes if present.

3.2.5 Typological Analysis of Lithic Tools

Comparative typological analysis was used to identify the specific Late Archaic complex to which the Ridge Pine 3 site belongs. According to the Stage 4 archaeological assessment, six projectile points were found at the site and four of them have been classified as examples of the Late Archaic Innes type, which is part of the Small Point cultural complex (Ellis et al. 2009; TMHC 2012:45-46). My analysis was done to confirm or modify the initial assessment provided by TMHC (2012) with regards to the specific temporal context of Ridge Pine 3 by making use of reference collections and published works such as those produced by Ellis et al. (1987), Justice (1987), Kenyon (1989), Lovis (2009), (Ritchie (1971), and TMHC (2018d). The typological analysis was also done to determine if there were multiple occupations represented at Ridge Pine 3. Accelerator mass spectrometry (AMS) radiocarbon analysis (see section 3.2.9) assisted in clarifying the age of the site and supplemented the point typology data. Other formal lithic tools were also assessed for evidence of age and cultural affiliation.

3.2.6 Formal Flaked Stone Tool Analysis

The formal tools in the assemblage were analyzed, typed, and sorted based on raw material type. TMHC (2018a, b, c) created a lithics training manual which was used as a guide to record specific characteristics. The formal tools include knives, scrapers, scraper-knives, bifaces, and projectile points. The main purpose for this analysis was to identify the formal tools for potential activity zones in the spatial analysis, as potential subsistence indicators, and as evidence for multiple occupations at Ridge Pine 3.

3.2.7 Biface Analysis

For biface analysis, I followed the reduction stages from unfinished to finished bifaces that Andrefsky (2005:188-190) proposes. Stage one is a blank cobble or spall of chert, likely with cortex. However, this stage does not follow Andrefsky's (2005) definition of a biface, with bifacial flaking all around the entire circumference of the tool. While this definition is merely a guideline, I only identified bifaces from stage two onwards, as stage one generally lacks any modification that differentiates it from other debitage pieces. Stage two is called an edged biface with small chips removed from the edges and a few flake scars across the face. Stage three, a thinned biface, has flakes removed to the center of the biface and most of the cortex removed. Stage four, known as a preform, has large, flat flake scars and a flat cross-section. Stage five is a finished biface or point with refined trimming of the edges and was possibly hafted. There is also a stage six that deals with reworked broken points (Andrefsky 2005:188). Lastly, there is an indeterminant biface stage for cases where the stage of reduction cannot be determined for various reasons such as a piece being too fragmented to confidently assign a stage. For incomplete pieces, I assumed that they were flaked bifacially all the way around their circumference. By assigning stages of reduction to the bifaces in the assemblage I was able to make observations about the types of lithic reduction activities at the site based on the frequency of each of the stages in the assemblage.

As well, once the bifaces were assigned a stage, I was able to look at the variation in width/thickness ratios in each stage. Andrefsky (2005:188) provides width/thickness ratios for each stage as a guide. Much variation within each stage could indicate that multiple flintknappers were performing the lithic reduction activities. In Eerkens (2000) discussion on standardization within an assemblage, he argues that increased variation in an assemblage corresponds to multiple flintknappers while less variation indicates fewer flintknappers as mental templates, skill levels, and experience differ between individuals.

There was also some indication of flintknapping skill levels in the appearance of the bifaces themselves. In the later stages of biface production, bifaces are more refined than earlier stages so if crude and thick bifaces appear in the later stages that may be a good indication of a novice at work. In the earlier stages it is harder to distinguish between novice and expert flintknappers as the early-stage bifaces are typically crude. While indications of flintknapping skill levels mostly came from observations of later stage bifaces in terms of overall aesthetic refinement, the early-stage bifaces were also included as some had a rougher appearance than others in the same stage.

3.2.8 Intrasite Spatial Analysis

As discussed in the theory section, the spatial analysis was done to see if there are any activity zones that could be identified based on the frequencies of formal tools and debitage locations. As noted, the spatial data for the Ridge Pine 3 site consists of artifact counts per grid square. I looked at how the lithics are spatially related to the four features on the site to understand how the site was organized and if there were any indications of multiple occupations, such as overlapping or closely situated features. The concept of social space was incorporated here to try to understand how people moved around the site by interpreting the activity zones via tool types and debitage frequencies.

The lithic tool types and materials may reflect the choices and strategies chosen by the Ridge Pine 3 occupants (Andrefsky 2005, 2009; Robinson & Sellet 2018; Surovell 2012), especially when it comes to subsistence strategies. While it is understood that lithic tools may not be deposited in the places they were used, understanding the tool types and where they are concentrated at the site could provide indicators for the types of subsistence activities people were engaged in. For example, if projectile points and related manufacture and maintenance debris dominate the assemblage then hunting and retooling may be a possible function of the site. Or if knives and scrapers are abundant then food/animal processing activities likely occurred. Combining these lines of evidence with intrasite spatial analysis may result in a better understanding of both the activities conducted at the site and how the site itself was organized to perform these tasks.

For site formation processes that may affect the spatial analysis, plough disturbance at a site can have a major effect on the artifact distributions. During excavation, soil profiles were taken by TMHC (2012:36-44) which may provide indications for the extent of ploughing done at the site. Parts of the woodlot appear to be secondary growth, as evidenced by the many younger trees in the area, but other parts around Ridge Pine 3 have several larger and older trees. I searched for old aerial photographs to see what they show about site conditions (cleared field or forest) going back to the mid-twentieth century which may provide further evidence of land clearance and ploughing. Although Ridge Pine 3 is fairly small at 18 m in diameter and appears to be slightly plough disturbed with natural processes at play, some spatial patterns may still emerge. Alternately, a lack of patterns in the analysis may also be informative.

3.2.9 Specialist Analysis

Paleoethnobotanical analysis involved analyzing floral seasonality indicators from the feature fill samples to help with reconstructing the surrounding environment and the season of occupation (Pearsall 2015; VanDerwalker et al. 2010). I conducted this analysis at TMHC under the supervision of Breanne Riebl, the archaeobotanist at the firm. We examined heavy and light fraction soil samples from flotation taken from the four features at Ridge Pine 3.

The second specialty analysis is AMS radiocarbon dating. Selected organic samples from the paleoethnobotanical analysis that met minimum weight requirements were sent to the André E. Lalonde (AEL) AMS Laboratory (University of Ottawa) for dating. This analysis was conducted to supplement the typological analysis which, due to the fluid nature of lithic tool use, can sometimes be problematic in assigning a relative date based on projectile point typology (Belyea 2019:43). Six samples were sent to be radiocarbon dated including a single piece of nutshell from Feature 1, an aggregate sample of nutshell from Feature 1, three pieces of wood charcoal from Feature 1, an aggregate sample of wood charcoal from Feature 3, and two pieces of wood charcoal from Feature 4 that were sent in as separate samples.

3.3 Conclusion

The theoretical frameworks applied to my research and the methods I chose to analyze the collection have been outlined in sections 3.1 and 3.2 respectively. Several different methods were applied to the collection to provide multiple lines of evidence to gain a better understanding of the site and address the research questions. Late Archaic assemblages are noted to have a more diverse range of tools compared to earlier sites stemming from an increase in the range of activities people were participating in (Lovis et al. 2005:689), so more data collection analyses are needed to address this diversity.

The need for an environmental reconstruction at the time of site occupation has been mentioned several times in this chapter. It will help provide a better understanding of the resources available to the people living at Ridge Pine 3 and the site's place in the surrounding environment and landscape. Chapter 4 will reconstruct the environment using multiple lines of evidence to get a clearer picture of what opportunities and constraints people were facing to meet their subsistence needs and to provide insight into the function(s) of the site.

Chapter 4: Paleoenvironment

This chapter reconstructs the surrounding environment and landscape at Ridge Pine 3 during the Late Archaic when site occupation occurred. Lines of evidence include forest regions, paleoethnobotanical analysis, vegetation data from eighteenth to nineteenth century land surveys, twentieth century soil surveys, pollen diagrams and soil cores, data from nearby archaeological sites, water levels in the Lake Huron basin, paleoclimate, and the locations of potential chert sources.

4.1 Forest Regions

The Ridge Pine 3 site is located near two modern forest regions, the Deciduous Forest Region, also known as the Carolinian Biotic Province, and the Great Lakes-St. Lawrence Forest Region, otherwise known as the Canadian Biotic Province. Ridge Pine 3 lies within the Ausable Valley which is the northernmost point of the Deciduous Forest Region before transitioning into the Great Lakes-St. Lawrence Forest Region on the Ontario side of Lake Huron (Deller et al. 1985:3; Kenyon 1980a:19). The complex and varied geological events from the retreating glacier have changed the environment of the lower Ausable drainage and created an area where flora and fauna are diverse and rich (Deller et al. 1985:3). Ultimately, this makes the area an attractive place for human settlement as evidenced by the fairly intensive occupation throughout most of the precontact period (Deller et al. 1985:3). With the boundary between these two forest regions located close to the Ridge Pine 3 site (see Figure 3), it is important to take both regions into account as possible sources of subsistence resources.

The Deciduous Forest region in southwestern Ontario is the northern limit of this region which extends north from the eastern United States and, as the name suggests, contains mostly deciduous trees with only a scattered distribution of conifers (Hosie 1969:21). Based on information from early seventeenth century explorer notes and records, the Deciduous Forest Region consisted of sugar maple (*Acer saccharum*), beech, hickory, and oaks (Dean 1994:Map 1.5). Later mid-twentieth century studies of the region and pollen diagrams have shown that this forest region is “dominated by maple, elm [*Ulmus sp.*], oak, beech, ash [*Fraxinus sp.*], and other deciduous species with evergreen species less than 2%" (McAndrews 1994:181). Specific evergreen species, though quite sparse, include eastern white pine (*Pinus strobus*), tamarack (*Larix laricina*), eastern red cedar (*Juniperus virginiana*), and eastern hemlock (*Tsuga canadensis*) (Hosie 1969:21).

The Great Lakes-St. Lawrence Forest Region is north of the Deciduous Forest Region and extends inland from the Great Lakes and the St. Lawrence River (Hosie 1969:22). Unlike the Deciduous Forest Region, the Great Lakes-St. Lawrence Forest Region has a mixed nature with "23% evergreens led by white cedar [*Thuja occidentalis*], white pine, and hemlock with the deciduous maple, elm, poplar [*Populus sp.*], birch, and beech each over 4%" (McAndrews 1994:181). Several species decrease in abundance further north and eventually disappear before the northern limit of the forest region (Bennett 1987:1792). The vegetation is quite different between these two forest regions, providing a diverse array of resources, but the animals living in the two regions are quite similar according to notes by early seventeenth century explorers (Dean 1994:16). Some of these species include woodland caribou and moose, white-tailed deer, elk, raccoon, squirrel, chipmunk, mice, several species of bats, hare, fish, and several reptiles and amphibians including turtles, salamanders, and frogs (Dean 1994:16-17).

4.2 Paleoethnobotanical Analysis

The Ridge Pine 3 site has four sub-surface features. Samples were taken from each for flotation analysis. The heavy and light fractions of the four features underwent paleoethnobotanical analysis for floral and faunal indicators. I conducted the analysis at TMHC under the supervision of Breanne Riebl. A more detailed report including methods, specifications on the instruments used, and inventories is in Appendix C.

Components found in the paleoethnobotanical analysis include unidentifiable floral material, nutshell, bone, charcoal, and chert flakes. Table 1 shows a breakdown of the components per feature and their weights while Table 2 and Figure 8 show the frequencies of identified species and their distributions in the Ridge Pine 3 features. Unidentifiable floral remains were found in all four features and are the most common component from all the feature samples. Due to the age of the site, this is not unexpected with natural decaying processes making identification difficult for older sites like Ridge Pine 3. Nutshell remains were present in features 1, 2, and 3 and in total there were 27 fragmented pieces of nutshell. Fragmentary pieces of bone were found in features 2 and 3 but they are too small for species identification. Charcoal was present in all four features but due to the fragility and small size of the charcoal pieces only nine pieces were identified or partially identified. There were three pieces of beech and six pieces of indeterminate diffuse porous, which indicated that they are from deciduous trees, but no specific species could be identified. Two chert flakes were found in the Feature 4 heavy fraction and have been catalogued and put with the rest of the artifacts from that feature.

4.2.1 Nutshell Analysis

Of the 27 nutshell fragments, only one was identified as hickory while the rest were too small and fragmentary to identify further. While the *Carya sp.* is not a definitive identification it is a probable conclusion based on comparisons to a modern reference sample. It is possible that the unidentifiable remains may contain more nutshell fragments that could not be identified from Feature 2 due to their fragmentary and degraded nature.

Of the various species of hickory, there are six that can be found in Canada (Hosie 1969:138). Of these six, shagbark hickory (*Carya ovata*) and bitternut hickory (*Carya cordiformis*) are the most common and widely distributed (Hosie 1969:138). Shagbark hickory can be found in both the Deciduous Forest region and the southern parts of the Great Lakes-St. Lawrence Forest region, growing on “rich moist soils in valleys, on hillsides and at the edges of some swamps” (Hosie 1969:140). It is also a source of nuts with the kernels described as “sweet and edible” (Hosie 1969:140). The bitternut hickory is the most common hickory species in Canada and is often found with other deciduous species including silver maple (*Acer saccharinum*), beech, and shagbark hickory (Hosie 1969:148). Bitternut hickory is shade tolerant and can grow in “low moist situations and on richer soils of higher ground” (Hosie 1969:148). Unlike shagbark hickory, the fruit from bitternut hickory is inedible with very bitter kernels though they can be made palatable by leeching the nuts (Hosie 1969:148; Fecteau 1985:10). Shellbark hickory (*Carya laciniosa*) occurs less abundantly than shagbark hickory and bitternut hickory but there is a small pocket where it grows in the Deciduous Forest region which is near the general area of the Ridge Pine 3 site. It tends to grow "best on moist, well-drained, rich, loamy soils in valleys and on gradual slopes of low hills, and on the banks of streams" (Hosie 1969:142). The other three hickory species, including mockernut (*Carya tomentosa*), pignut (*Carya glabra*), and red hickory (*Carya ovalis*), are confined to pockets to the very south and east of Ontario which makes them unlikely candidates compared to the three described above (Hosie 1969:144-147).

Although not much can be said about which specific species of hickory was in the Feature 2 sample, the fact that it is likely hickory allows for some interpretations to be made. Hickory ripens in the autumn from September to November (Fecteau 1994:50; Fecteau 2005:18). Although not definitive, this may mean that occupation at the Ridge Pine 3 site was in the autumn based on the presence of nutshell remains and hickory specifically. While it is possible for nuts to be stored, dry hickory nuts can only be stored for about one month (Grant 2021). Nuts were a common food source for hunter-gatherers, especially with the diffuse adaptations of the Archaic, and a common find at Ontario Late Archaic sites though in small numbers (Christenson 1986:43; Egan 1988:91; Emerson & McElrath 2009:26; Fecteau 2004:4; Hayden 1982:119; Meltzer 1989:15; Roberts 1980, 1982; Talalay et al. 1984:338; Turner & Aderkas 2012:308).

Following a comparative survey of Late Archaic sites in southern Ontario done by Fecteau (2014) for the carbonized plant remains from the Middle to Late Archaic Shaver Knoll site, there are notable similarities between other Late Archaic sites and the Ridge Pine 3 site. Black walnut (*Juglans nigra*) is the most frequent nut amongst the sites, showcasing it as a primary food source (Fecteau 2014:10, Table 6). The next most common nut remains are oak and hickory (Fecteau 2014:10, Table 6). The comparison of nut remains at the Late Archaic sites in southern Ontario in Table 3 shows that hickory was an important food source, so finding the hickory nutshell remain at the Ridge Pine 3 follows this subsistence pattern. Throughout the northeast United States, including New York, Michigan, and Connecticut, hickory nut was one of the primary food sources for Late Archaic sites (Fecteau 2014:10, Table 5). As well, a study conducted in northwest Pennsylvania found there was a "close correspondence between oak-hickory-chestnut forests and sites of prolonged Native American occupation" (Black et al. 2006:1271).

4.2.2 Wood Charcoal

For wood charcoal remains, six pieces were partially identified as diffuse porous wood from deciduous trees. Although a more complete identification could not be made, this partial identification makes sense based on the location of the Ridge Pine 3 site. As mentioned above in section 4.1, Ridge Pine 3 is located on the boundary between the Deciduous Forest region and the Great Lakes-St. Lawrence Forest region. While the vegetation between the two is different there is overlap of several deciduous tree species in both regions (Hosie 1969:21-22). Having six pieces of diffuse porous wood in the charcoal remains from Ridge Pine 3 ties in with the proximity to both forest regions.

The wood charcoal remains also contained three pieces of beech from Feature 4. There is only one species of beech that is native to North America known as *Fagus grandifolia* (Hosie 1969:176). This tree species is in both the Deciduous Forest and Great Lakes-St. Lawrence Forest regions and is “usually found on moist well-drained slopes and rich bottomlands” (Hosie 1969:176). It is often found with sugar maple, yellow birch (*Betula alleghaniensis*), and eastern hemlock tree species (Hosie 1969:176). Beech trees also provide edible nuts which ripen from September to November, like the hickory nuts (Fecteau 1994:50; Fecteau 2005:18; Hosie 1969:176). Although no beech nut fragments were identified from Ridge Pine 3, it is still a possible subsistence resource.

Wood charcoal assemblages likely represent a good sample of the local forest community at the time of occupation. There is close correspondence between the taxa of the charcoal remains at southern Ontario sites and pollen and biomass analyses for forest regions of the thirteenth century (Monckton 1998:115). The close relation supports the hypothesis that past peoples conducted non-selective collection of wood likely from the forest floor (Monckton 1992:90, 1998:115). The presence of beech wood at Ridge Pine 3 is a good indicator that beech was part of the surrounding forest composition.

According to the comparative study of charcoal remains at other southern Ontario Late Archaic sites that Fecteau (2014:10, Table 7) conducted, it appears that southern Ontario had a beech-maple dominated forest during Late Archaic times (see Table 4). This is reflected at the Ridge Pine 3 site with the three pieces of beech, the six indeterminate diffuse porous wood fragments which are deciduous tree fragments, and the possible hickory which is also common in wood charcoal and nut remains at Late Archaic sites in southern Ontario. Along with maple, beech is a major component of charcoal assemblages from most southern Ontario archaeological sites (Fecteau 1994:36).

4.3 18th to 19th c. Land Records and 20th c. Soil Records

Between 1784 and 1859, southern Ontario was subjected to a series of land surveys prior to European settlement for the purposes of land division, settlement, and the acquisition of the various resources available in the area (Karrow & Suffling 2016:136). These types of early survey data (ESD) are a valuable record of human settlement in the historic period (Karrow & Suffling 2016:136). There have also been several soil surveys conducted in the various southern Ontario counties, providing supplemental data to ESD. For counties relevant to the study of Ridge Pine 3, soil surveys were done in the 1900s and focus on land use and soil management problems in agriculture (Haggerty & Kingston 1992; Hoffman et al. 1952; Matthews et al. 1957).

There are several benefits to using ESD as a line of evidence for pre-settlement vegetation. Researchers argue that by ca. 8200 cal BP (7500 RCYBP) an essentially modern vegetation was in place throughout southern Ontario except for fluctuations in certain species over time (Ellis et al. 2009:790). With roughly modern conditions in place since the Middle Archaic, the eighteenth to nineteenth century records from ESD can provide information on what the vegetation and forest communities would have looked like in the Late Archaic prior to historical modifications on the landscape. Pre-European settlement, southern Ontario was a mass of forests and extensive wetlands (Jameson 1839). Drastic changes to the natural landscape in modern times include a decline in forest cover from over 80% to less than 17% and a significant reduction in natural wetlands due to draining for agricultural purposes (Butt et al. 2005:91). The environment and landscape today are not what it was prior to European settlement. The digitization of ESD and county maps, such as those by Findlay (1973a, b, c) (Figure 9), have provided a way to infer the forests and tree species in the Ridge Pine 3 environmental reconstruction.

While ESD provides many benefits for research purposes there are also some interpretative issues that come along with this line of evidence. These include spatial inaccuracies from basic equipment, biases in recording certain species, the use of old or colloquial names for animal species, and differing skill levels amongst survey crews (Karrow & Suffling 2016:136-139). Other variables such as weather, the presence of indigenous populations, general crew attitudes and conflict, and equipment malfunction or loss also played a role in the work of surveyors (Karrow & Suffling 2016:139). Despite interpretative issues from these discrepancies, ESD continues to "represent the most comprehensive, spatially explicit, and systematic snapshot of pre-settlement vegetation that we shall ever have" (Karrow & Suffling 2016:139).

4.3.1 Applying land surveys and soil records to Ridge Pine 3

Turning the focus onto the Ridge Pine 3 site, multiple land and soil surveys were looked at to understand the surrounding environment at the time of occupation. The site is technically located in Huron County on the eastern edge of the Grand Bend community (TMHC 2012:1), but it is right near the border of Lambton County to the west and there is also Middlesex County, about 8 km directly south. So, to get a full picture, the soil and early land survey data for Lambton, Huron, and Middlesex Counties were all looked at.

4.3.1.1 Lambton County

The Lambton County map created by Findlay (1973a) for the region of southwestern Ontario is the only land survey map I was able to access out of the three relevant counties. The Huron and Middlesex County maps (Findlay 1973b, c) have been misplaced and at present have not been digitized (Karrow & Suffling 2016:140; Robert MacDonald personal communication 2020). Focusing on the northern portion of Lambton County, I looked at the vegetation for the areas running from the Kettle Point chert outcrops to Grand Bend between the shoreline of Lake Huron to the Thedford Embayment. Moving from west to east, this area includes the Kettle Point Reserve, Ipperwash Beach, Stoney Point and the Ipperwash Provincial Park, Port Franks, and the Pinery Provincial Park (Figure 10). This entire area, with different pockets of vegetation and microenvironments, is relevant because the occupants likely would have traversed these areas looking for subsistence resources and accessing the Kettle Point chert. For example, there are large belts of sand dunes between the Lake Huron shoreline and the Thedford Embayment, often attributed to Lakes Algonquin and Nipissing, with a xeric forest of predominately white pine and oak (Chapman & Putnam 1984:100). This is quite different to the marshy environment of the Thedford Embayment, so it is important to consider all variations in vegetation and microenvironments.

The northern Lambton County map (Findlay 1973a) shows a variety of tree species in the area. The Kettle Point Reserve is mostly cedar (*Juniperus sp./Thuja sp.*) and pine with some elm and swamp designation. For Ipperwash Beach, the prominent species are cedar and pine. Moving east towards Stoney Point brings hemlock, birch, and poplar with some swamp designations. Stoney Point and the Ipperwash Provincial Park was mostly elm with some basswood, pine, oak, birch, and ironwood (*Olneya tesota)* present. Near Port Franks there are small amounts of oak, ironwood, hickory, and elm as it transitions to mainly poplar and pine. The Pinery Provincial Park shows mainly pine and poplar on the ESD maps, although it is widely known as an important area of oak savanna today (The Friends of Pinery Park 2021). Grand Bend is in the northeast corner of the north Lambton County map (Findlay 1973a). Pine is the dominant species in this area until it switches to a cluster of cedar trees directly south of Ridge Pine 3. Cedar is a subordinate marsh or wetland taxon adapted to moist soil conditions, a common occurrence in this locality, especially with the proximity to the Ausable River (Goman & Leigh 2004:260; Hosie 1969:96; Robert MacDonald personal communication 2020).

For soil series from the Kettle Point Reserve to Grand Bend, there is excessive drainage and light surface texture near the Lake Huron shoreline which matches up with the xeric forest zone and sand dunes discussed above (Matthews et al. 1957:Figure 2, Figure 3). Moving inland brings imperfect to poor drainage associated with heavy surface textures and very poor drainage with organic surface textures in the general vicinity of the Thedford Embayment (Matthews et al. 1957:Figure 2, Figure 3). The soil series for the upland areas in Lambton County is poorly to imperfectly drained clay loam making the conditions for the uplands overlooking the Thedford Embayment specifically relatively moist (Robert MacDonald personal communication 2020).

In summary, before Lambton County was settled by European populations and developed, the region consisted of deciduous and coniferous trees and swamps (Matthews et al. 1957:27). Many southern tree species, including oak, hickory, and chestnut, grew in association with more common species such as beech, sugar maple, and basswood (Matthews et al. 1957:27). The areas with poorly drained land produced mostly elm (Matthews et al. 1957:27). Native coniferous tree species only had a minor representation except on the dry sand area, or xeric forest, near the Lake Huron shoreline (Matthews et al. 1957:28). The remnants of the local forests from the past include mixed hardwoods and interspersed conifers, a composition which has been relatively static for millennia (Robert MacDonald personal communication 2020).

4.3.1.2 Huron County

The Huron County map produced by Findlay (1973b) is currently misplaced and thus was not able to be incorporated into the digital meta-map. The soil survey completed for this county by Hoffman et al. (1952) covers soil types, drainage, and vegetation which helped to supplement the missing data from Findlay's (1973b) map. The southwest corner of Huron County borders Lambton County and the southern portion borders Middlesex County (Hoffman et al. 1952:11, Figure 1). The northerly part of Grand Bend is in Stephen Township in Huron County (Hoffman et al. 1952:12, Figure 2).

For the natural vegetation in Huron County, an Elm-Ash-Cedar zone covers the east Ausable River shoreline, Grand Bend, and continues eastwards (Hoffman et al. 1952:Figure 10). The mostly poor to imperfectly drained soils support the elm, ash, and cedar vegetation. This tree zone also often contains spruce (*Picea sp.*), silver maple, and aspen (*Populus sp.*) (Hoffman et al. 1952:24).

4.3.1.3 Middlesex County

Like Huron County I did not have access to the Middlesex County map created by Findlay (1973c). Based on correspondence with Robert MacDonald (personal communication 2020), who has a few fragments of the map, the most common upland forest on the upland clay till soils was dominated by maple and beech, with subordinate representation by basswood and elm. It is a mesic to moist forest community (Robert MacDonald personal communication 2020).

Based on the soil survey done by Haggerty and Kingston (1992) it appears that the soils are quite moist on upland areas. This fits with the maple and beech species seen on the Middlesex County map (Findlay 1973c) fragments as well as the information derived from the soil survey for Huron County (Hoffman et al. 1952). So, a predominately beech and maple forest community with subordinate representation of basswood and elm appears to be typical of the moist upland soils for this region.

4.4 Pollen Diagrams

For the paleoenvironment, soil cores and their pollen diagrams have the potential to be rich sources of information. They shed light on compositions of forest communities and interactions that happened in the past to produce the modern arrangements we see today (Bennett 1987:1795). Researchers divide the pollen record into different zones. I follow the four major pollen zone system that McAndrew’s (1981, 1994) uses, though some researchers use a five zone system (i.e., Bernabo & Webb III 1977).

In the four zone system, Zone 3 is the relevant pollen zone for Ridge Pine 3. It runs from ca. 9000 cal BP (8000 RCYBP) to about 130 years ago and represents a mixed evergreen and deciduous forest containing more modern aspects than previous zones (Morgan et al. 2000:17). Within Zone 3 pine pollen decreases while elm, maple, beech, hemlock, hickory, ash, and others increase (Morgan et al. 2000:17). Zone 3 covers a large time span and the pollen assemblages varied throughout, so four subzones, a through d, can be recognized within Zone 3 (Morgan et al. 2000:17).

4.4.1 Generalized Pollen Diagram for Southwestern Ontario

For southwestern Ontario, there are several pollen diagrams available. Karrow and Warner (1990) created a generalized representative pollen diagram for southwestern Ontario by combining data from several individual pollen diagrams from the Great Lakes region (Figure 11). This is a good starting point to get the general idea of various changes in forest compositions that led to the modern forest communities before narrowing in on the specific area of the Ridge Pine 3 site (section 4.5.2).

By ca. 12600 cal BP (10600 RCYBP) pine dominates the pollen records with jack pine (*Pinus banksiana*) and red pine (*Pinus resinosa*) in the uplands and eastern white cedar, tamarack, black spruce (*Picea mariana*), and some balsam (*Abies balsamea*) in the lowlands (Karrow & Warner 1990:29). By ca. 10200 cal BP (9000 RCYBP), white pine became the forest dominant in jack and red pine stands with new deciduous species, such as elm and ash, joining the forests (Karrow & Warner 1990:29). Between ca. 9000 cal BP (8000 RCYBP) and 8200 cal BP (7500 RCYBP) there is a spread of hemlock, though this species pollen record is variable at various sites, followed by a decline at ca. 5700 cal BP (5000 RCYBP) (Karrow & Warner 1990:30). During the hemlock spread, "oak, elm, maple (most likely sugar maple), ash, and ironwood/blue beech [*Carpinus caroliniana*] (most likely ironwood) gradually increased their representation in the regional forests of southwestern Ontario" (Karrow & Warner 1990:30). Many of these are nut-bearing deciduous species, an important food source in the past (Karrow & Warner 1990:30).

By ca. 8200 cal BP (7500 RCYBP) hickory, basswood, and walnut became part of the forest compositions and after ca. 7400 cal BP (6500 RCYBP) beech became abundant too, particularly after the decline in hemlock around 5700 cal BP (5000 RCYBP). Since then, the forests during the Middle and Late Holocene remained relatively stable apart from the more recent arrival of chestnut to the southwestern Ontario regional forests (Karrow & Warner 1990:31). Even with water level changes in the Great Lakes, the forest compositions remained relatively unaffected (Karrow & Warner 1990:31). So, vegetation was largely stabilized in the Late Archaic when Ridge Pine 3 was occupied.

4.4.2 The Parkhill Site

There are several archaeological sites in the Ausable Valley that have been investigated. One is the Parkhill site, a large Early Paleoindian site located near Parkhill, about 21 km southeast of Grand Bend (Ellis & Deller 2000:1). The large size of the site and its location near a major river-like inlet of a lake is interpreted to be an aggregation site for communal hunting of game such as caribou (Ellis & Deller 2000:250-251).

Geological and paleoenvironmental data was collected from various locations to interpret the environment at the time of the Parkhill site occupation. Bore holes were made south of the site along a tributary of the Parkhill Creek providing continuous core samples (Morgan et al. 2000:17). Geographically, these are the closest analyzed soil cores to the Ridge Pine 3 site and can provide information on the environment for the Late Archaic site occupation. Three core samples were taken about 1.3 km south of and inland from the Thedford Embayment and the Parkhill site (Morgan et al. 2000:21).

Unit 5 in the continuous core sample is relevant to Ridge Pine 3. It dates to 6395 – 5990 cal BP (5410 ± 100 RCYBP) (Morgan et al. 2000:23). It correlates to a Zone 3 pollen assemblage (McAndrews' 1981, 1994), and is described as a mixed coniferous and deciduous forest (Morgan et al. 2000:23). This pollen assemblage is dominated by beech, elm, and oak (Morgan et al. 2000:23) which is consistent with the findings from the eighteenth to nineteenth century land surveys. The pollen assemblage continues into Unit 6 (Morgan et al 2000:23). The dates from Units 5 and 6 fit with a post-glacial Nipissing Phase assignment (Morgan et al. 2000:23). Near the top of Unit 6 is a Zone 3d pollen assemblage, occurring at ca. 900 cal BP (1000 RCYBP), so the occupation of Ridge Pine 3 fits within the timespan for Units 5 and 6 (Morgan et al. 2000:23). Based on the lithology created for Units 5 and 6, beech is the most common followed by elm, oak, hemlock, pine, and sugar maple (Morgan et al. 2000:Figure 2.9). All these tree species were recorded in the land surveys as well as some of the soil surveys from the region. The high frequency of beech also fits in with the paleoethnobotanical findings.

4.5 The Thedford Embayment

The Thedford Embayment would have been a significant environmental feature in the landscape especially considering its proximity to the Ridge Pine 3 site. As discussed previously in Chapter 2, it was a large lagoon-like bay that existed during the Lake Algonquin (ca. 13200 cal BP to 12500 cal BP) and the Nipissing (ca. 5700 cal BP) high water stages in the Lake Huron basin (Belyea 2019:7; Cooper 1979:6-7; Deller et al. 1985:3; Ellis et al. 2009:811; Karrow & Warner 1990:15; Kenyon 1980a:15; Prest 1970:730). Primary site occupation at Ridge Pine 3 (ca. 5000 cal BP to 4100 cal BP) occurs during the Nipissing high water stages and the rapidly falling lake levels between ca. 4500 cal BP and 3400 cal BP, turning the Thedford Embayment into a marshy environment (Baedke & Thompson 2000:423; Karrow 1980:1272; Lewis et al. 2008:133; Stewart 2013:29; TMHC 2012). The fact that the area has numerous sites, particularly from the Middle and Late Archaic, shows that the area was suitable for human occupation and the Thedford Embayment may have played a role in the attraction. It is possible that many of these sites may have been oriented towards these wetlands as a lacustrine resource and this may also be the case for Ridge Pine 3.

4.5.1 Description

The Thedford Embayment is located between Grand Bend and Thedford, encompassed by the abandoned shorelines of Lakes Algonquin and Nipissing which form the rim (Figure 10) (Cooper 1979:5). In terms of size, between Kettle Point and Stoney Point the Thedford Embayment extends 2 km inland from the modern Lake Huron shoreline and increases in size to 10 km inland between Port Franks and Grand Bend (Morrison 2017:19). The embayment is isolated from Lake Huron thanks to the two large baymouth bars which are present within it (Cooper 1979:32-33; Deller et al. 1985:3).

The two large baymouth bars are identified as the eastern and western bars. The width of the eastern bar averages out to just under 1.5 km and "extends southward from Grand Bend in an arc to join the shore bluff about halfway between Thedford and Northville" (Cooper 1979:33). It is the innermost bar and likely formed during the Lake Algonquin high water phase (Cooper 1979:33). The western outermost bar, "extends roughly along Highway 21 between Northville and Grand Bend" (Cooper 1979:33). The high-water phase during Nipissing times created this outermost bar with the return of water levels to about 184 m asl (Cooper 1979:33). Recent archaeological surveys have revealed several archaeological sites along the Nipissing bar (TMHC 2003, 2004, 2005).

4.5.2 Soils and Vegetation

The Thedford Marsh, located in the western basin of the Thedford Embayment area, is a large area of several square kilometres where peat occurs in thicknesses ranging from about 2 m to a maximum of 10 m making peat the dominant sediment for that area (Cooper 1979:32-33, 36; Matthews et al. 1957:63). Peat is often interpreted as an active marsh (Fraser et al. 1990:16, Figure 15). It is an organic soil that developed from the remains of reeds and sedges (Matthews et al. 1957:63). The peat overlies and is layered with shelly marl and lacustrine silty clay deposits forming the base of the Thedford Marsh (Cooper 1979:36). These lacustrine, marl, and peat deposits range from Nipissing to modern times with unpublished analyses of Thedford Marsh soil cores providing a maximum age of 7900 cal BP (7000 RCYBP) to 6800 cal BP (6000 RCYBP) for the bottom sediments (Cooper 1979:36). Muck, an organic deposit, occurs in thicknesses exceeding 5 m in the Thedford Embayment (Cooper 1979:50). In Lambton County, these deposits occur in the western part of the Thedford Marsh (Matthews et al. 1957:61).

The soil survey of Lambton County (Matthews et al. 1957) and pollen studies in the area provide information on what vegetation was present prior to European settlement. The Thedford Embayment originally consisted of wet grassland and marsh grass based on the deep black soils (Matthews et al. 1957:28). In the Thedford Marsh, peat soils specifically had a native vegetation of "reeds and sedges with poplars encroaching on the border areas" (Matthews et al. 1957:63). Based on a pollen study done on the Thedford Marsh only minor vegetation changes occurred between the Archaic period and European settlement, so the environment was relatively stable (Kenyon 1980a:15). As well, engineering borings were done at the eastern edge of the embayment in 1961 prior to the construction of a bridge over Parkhill Creek (Karrow 1980:1272). These samples contained molluscs which indicate "lake, slow-flowing vegetated stream, and terrestrial environments such as can be found in an estuarine situation" (Karrow 1980:1272). The pollen within the samples came from "predominantly hardwood tree types with generally minor conifer and non-tree pollen, suggesting an age of about 4000 [RCYBP (4400 cal BP)]" (Karrow 1980:1272).

4.6 Water Levels and Paleoclimate

As discussed in Chapter 2, the Great Lakes are a dynamic hydrological feature in southern Ontario. The deglaciation of the Great Lakes watershed led to dramatic changes in water levels throughout the basins. Based on radiocarbon dates and projectile point typology as discussed in Chapter 5, Ridge Pine 3 is contemporary with the Nipissing Stage and the beginning of its decline as water levels rapidly fell.

4.6.1 Nipissing Phase and Climatic Conditions

The Nipissing Great Lakes formed due to uplift of the North Bay outlet for Lake Hough causing water to spill over outlets at Port Huron and Chicago (Larson & Schaetzl 2001:532). The Nipissing Transgression, the high-water phase, occurred around 5700 cal BP resulting in water levels of about 184.5 m asl in Lake Huron, about 9 m above modern water levels for Lake Huron (Cooper 1979:6-7; Karrow 1980:1272; Jackson et al. 2000:427; Larsen 1985:65; Larson & Schaetzl 2001:532; Lewis et al. 2005:190; Lewis et al. 2008:133; Prest 1970:730; Thompson et al. 2011:568). Between ca. 4500 cal BP and 3400 cal BP, water levels fell signalling the end of the Nipissing Phase (Baedke & Thompson 2000:423; Larson & Schaetzl 2001:532-533; Lewis et al. 2008:133).

The Narrow Point complex, ca. 5000 cal BP to 4100 cal BP, occurs during the Nipissing Transgression and overlaps with the beginning of the end of the Nipissing Phase with lake levels falling. Depending on when people occupied the site in the Narrow Point complex, they may have experienced different variations in the environment including changes in the water levels which would have altered the coastline and a transitioning of the Thedford Embayment into a marshy environment from the large lagoon-like bay it was during the Nipissing high water stage (Belyea 2019:7; Cooper 1979:6-7; Deller et al. 1985:3; Ellis et al. 2009:811; Karrow & Warner 1990:15; Kenyon 1980a:15; Prest 1970:730). Broad Point sites in the area also occur by ca. 4600 cal BP, overlapping with the environmental setting of the Narrow Point (Ellis et al. 2014b:37). Water levels would not rise again until about 3400 cal BP (3200 RCYBP) when Lake Algoma developed (Larson & Schaetzl 2001:532-533). The Algoma Phase lasted from ca. 3400 cal BP (3200 RCYBP) to 2300 cal BP (2250 RCYBP) with water levels fluctuating between about 178.5 and 180 m asl (Baedke & Thompson 2000:425; Morrison 2017:Figure 26).

The Nipissing Great Lakes formed during the warmer climate of the hypsithermal interval which brought more warm-weather seasons and longer habitable coastal sites (Deevey & Flint 1957; Lewis et al. 2008:133). While the hypsithermal interval was warmer than both modern times and the cooler climate during Lake Algonquin, fluctuations still occurred within it (Deevey & Flint 1957; Lewis et al. 2008:133; Shuman

& Marsicek 2016). Between ca. 5500 cal BP (4900 RCYBP) and 4700 cal BP (4250 RCYBP), there was an anomalous low temperature, high moisture interval, though still warmer than modern times, which corresponds with the development of the Nipissing Transgression and lake levels of 184.5 m asl in the Huron basin (Shuman & Marsicek 2016:42). These cool, wet conditions ended as warming and widespread drought developed ca. 4700 cal BP (4250 RCYBP) and persisted until 4000 cal BP (3700 RCYBP), tying in with the falling water levels of the Nipissing Phase (ca. 4500 cal BP [4050 RCYBP] to 3400 cal BP [3200 RCYBP]) (Shuman & Marsicek 2016:42). Thus, changes in the climate are associated with changes we see in the Huron basin lake levels.

4.6.2 The Great Lakes and Ontario's Climate

In the previous section, it was argued that climatic conditions may affect water levels, but it is also important to understand the type of impact the Great Lakes have on the climate. Many people living in southwestern Ontario have heard of the "lake effect" and it is acknowledged that the Great Lakes affect Ontario's climate. Canada is well-known for its extreme climatic conditions, but in southern Ontario the Great Lakes curb some of the extremes in climate by moderating them to a certain degree (Dean 1994:7). Because of how long it takes the water to warm back up after the winter season, the Great Lakes delay the rapid warming up of the land in spring and early summer (Dean 1994:7). At the same time, the bodies of water also retain their heat for longer once summer is over which extends the autumn season (Dean 1994:7). The moderation of the climatic extremes in Ontario means that the Great Lakes region would have been more suitable for human occupation with the water acting as a natural climatic control system allowing for more hospitable winters and summers. The Great Lakes are also an important moisture source throughout the year resulting in fairly uniform precipitation during all four seasons in southern Ontario (Dean 1994:7). This unusual regularity in precipitation is important for the vegetation in the area as it supplies consistent water allowing for growth and, again, making southwestern Ontario an attractive place to live throughout the year.

4.7 Chert Sources

The Ridge Pine 3 lithic assemblage contains both Kettle Point and Onondaga cherts. This section looks at potential chert sources, both primary and secondary, in the surrounding landscape (Figure 12). Identifying possible source locations in the landscape can help understand the opportunities and constraints in the surrounding environment.

4.7.1 Kettle Point Chert

Kettle Point chert outcrops along the modern shoreline of Lake Huron and is the only significant source of chert near the Ausable Valley area (Deller et al. 1985:3; Janusas 1984; Kenyon 1980a:15). This primary deposit of Kettle Point chert is approximately 20 km south of the Ridge Pine 3 site and is located within the boundaries of the Kettle Point and Stony Point First Nation (Ellis et al. 2014a:21). Cooper (1979:11) describes the formation as a “fissile dark grey to black bituminous shale…of Middle Devonian age.” It is part of the Ipperwash Formation of the Hamilton group (Janusas 1984:2).

Secondary deposits of Kettle Point chert are present within the Ausable Basin. However, unlike the primary source location, much less is known about their distribution in the area (Kenyon 1980a:15). These secondary deposits may come in the form of till or river gravels, but with a primary deposit located relatively close to Ridge Pine 3 it is likely that the occupants of Ridge Pine 3 would have taken advantage of the resource. In the Ausable and Maitland valleys, archaeological assemblages show “Kettle Point chert as a widely used raw material, except in the Early Paleoindian period” (Deller et al. 1985:3). With the Kettle Point chert outcrops as a high-quality primary source, it is not surprising that many groups in the area made use of them.

The Kettle Point chert outcrops are a good source of raw material to be used for lithic reduction activities. But were they a viable option for the occupants at Ridge Pine 3 in terms of exposure and water levels? Lake Huron is currently about 177 m asl and the Kettle Point outcrops are mostly located in the shallow waters which are between 0 and 2 m in depth (Janusas 1984:5). During the Nipissing Great Lakes, the water levels reached a maximum of about 184.5 m asl, the same as Lake Algonquin, during its earlier high-water stage (Larsen 1985:65; Janusas 1984:Table 1). This high-water level flooded the Kettle Point outcrops (Janusas 1984:6). During the Algoma Great Lakes, ca. 3400 cal BP to 2300 cal BP, the maximum water level reached was lower than during Nipissing times at 180 m asl, but water levels fluctuated and dropped rapidly between 3520 RCYP (ca. 3800 cal BP) and 2180 RCYBP (ca. 2300 cal BP) to a minimum of 178.5 m asl (Larsen 1985:65; Janusas 1984:Table 1; Morrison 2017:59).

Previous research into water levels in the Lake Huron basin have shown that low water levels exposed the Kettle Point chert outcrops. They were a visibly available resource during the Lake Stanley Low-Water Stage starting around 11500 cal BP at 55 m asl until the Nipissing Transgression (Janusas 1984:6, Table 1). The periods before and after this low-water level phase submerged the Kettle Point outcrops, however this lack of visibility did not stop the primary source for Kettle Point chert from being used as a resource (Janusas 1984:6). Even though the outcrop has remained submerged in shallow water from the Nipissing Transgression to modern times, analysis of raw material types at archaeological sites in southwestern Ontario shows increased utilization of Kettle Point chert by Archaic peoples, although the heaviest utilization occurred in the Early and Middle Woodland periods (Janusas 1984:85-86). Since the outcrops are located along a major waterway, the Kettle Point chert is "easily accessible to many and widely spread prehistoric peoples as is evidenced by the distance that Kettle Point chert is used from the source" (Janusas 1984:86). Even though the Kettle Point chert outcrops were shallowly submerged during the Late Archaic, it was still a viable resource and likely the source location for the Kettle Point chert at Ridge Pine 3. Possible secondary till deposits in the area may also have been used at Ridge Pine 3.

4.7.2 Onondaga Chert

As mentioned above, the Kettle Point chert outcrops are the only significant chert source in the Ausable Valley, so Onondaga chert is not found in this area, at least as a primary deposit (Kenyon 1980a:15, 17). Ridge Pine 3 is a considerable distance from the Onondaga chert outcrops which are located along the northeastern shore of Lake Erie (Cook & Lovis 2014:59; Spence & Fox 1986:21). Like the Kettle Point chert, the Onondaga chert outcrop is of Middle Devonian age and is exposed in the Appalachian

Basin bedrock (Fox 2009:361-362). The colour can vary “from dark grey to a light grey mottled variant” (Fox 2009:362). It is possible that this is the source location for the Onondaga chert in the Ridge Pine 3 assemblage, perhaps collected during seasonal rounds, however it has been noted that most of the Onondaga chert appears to be of low quality (TMHC 2012). The low quality may be an indication that the Onondaga chert came from secondary deposits, such as till and river gravels. Secondary source Onondaga has been documented north of the Lake Erie shoreline to the London area and west at least as far as Chatham (Figure 12). Further analysis of the debitage and tools (Chapter 5) may be able to shed more light on whether the Onondaga chert is more from primary or secondary deposits based on its quality and evidence of lithic reduction activities.

4.8 Opportunities and Constraints

Now that the surrounding environment and landscape during the time of occupation at Ridge Pine 3 has been described, this information can be tied in with the human behavioural ecology (HBE) framework and Trigger’s (1991) discussion on environmental constraints and opportunities. The Ausable Valley has many resources to offer, which may help explain why it was so heavily occupied throughout precontact history. The proximity to two different forest regions as well as a variety of microenvironments, including the Thedford Embayment, the xeric forest zone, and the mesic to moist forest zones, provides a wide range of available resources. The presence of several nut-bearing deciduous species in the area would have been an important food resource, particularly if the occupants of Ridge Pine 3 were present during the autumn season as the nutshell remains may suggest. Despite the inability to identify species from the fragmented faunal remains, there would have been a wide range of species available to the Ridge Pine 3 occupants including forest, avian, and water species. The lacustrine orientation of the landscape features, such as the Thedford Embayment and Lake Huron, can be considered an opportunity because their aquatic resources open up more possibilities in terms of subsistence practices when paired with available forest animals and forest plant foods such as nuts. In addition to subsistence resources, there is the primary Kettle Point chert source which, though shallowly submerged during the Late Archaic, was an important accessible resource for the Ridge Pine 3 occupants and their lithic tool assemblage. Paleoclimate models (Shuman & Marsciek 2016) also show that the climate at the time of occupation was wet and cool in the beginning of the Narrow Point period then dry and warm after ca. 4700 cal BP. The warmer, dryer conditions (ca. 4700 cal BP to 4000 cal BP), combined with the lake effect extending the autumn season, would have made living in the region an appealing prospect for the summer and fall.

Despite all the opportunities that the surrounding environment provides, there are also some constraints. The Onondaga primary chert source is a great distance from Ridge Pine 3 and unless the occupants picked up some chert from there during extensive seasonal rounds, they would have been restricted to using secondary deposits of Onondaga, which are not as high quality as the primary source material. The secondary source Onondaga was available in the London region, 50 to 60 km to the south, and possibly closer, as a systematic survey for secondary sources north of the London area has not been conducted.

Based on the paleoethnobotanical analysis, Ridge Pine 3 may have been occupied during the autumn. While the autumn season is extended thanks to the effects of the Great Lakes and the warmer climate during this time compared to modern times, the occupants would still have to think about cold temperatures as winter approached. As well as low temperatures, the lake effect would have created high winds coming off Lake Huron, which would not be pleasant in the winter months. The uniform precipitation would also make the area less appealing in the colder months as the rain turns to sleet and snow. Today, the Grand Bend area experiences a high amount of precipitation, with an average rainfall of 899 mm per year (Climate-Data.org n.d.), and though the climate was drier in the Late Archaic than it is today there still would have been high amounts of precipitation to deal with which may have been a constraint, at least for the colder months.

Now that the environment and landscape at the time of Ridge Pine 3 occupation has been explored, the next chapter will look at the results of the analysis of the assemblage. These analyses include the various lithic analyses introduced in Chapter 3, the intrasite spatial analysis, and the radiocarbon analysis.

Chapter 5: Results

This chapter provides the results from the various analyses applied to the artifacts from Ridge Pine 3. The overall frequencies of artifact types can be seen in Table 5 which does not combine mended pieces and includes artifacts found in features which were analyzed separately from the rest of the collection.

5.1 Debitage Analysis

For analysis of the debitage from Ridge Pine 3, two methods were used. First, Pearce’s (2008) technological typology was applied to make inferences about stage(s) of lithic reduction at the site and find potential indicators of activities and site function(s) by sorting the debitage into different types. Second, the terminations or distal ends of the flakes were morphologically identified to try to understand flintknapping skill levels. The debitage analysis was done on a sample of 27.48% of the total debitage collected from the site. While making observations all flakes were oriented with the proximal end at the top and the dorsal side facing the analyst. Appendix D has tables on flake types per unit.

5.1.1 Technological Typology

A total of 5278 flakes were analyzed with Pearce’s (2008) technological typology. A breakdown of the flake types per material type in tabular form can be found in Table 6. Flakes were sorted into nine different types which correspond with early and late stages of reduction and two extra ones that are not assigned a reduction stage. Definitions of flake types can be found in Appendix B. The raw material of the flakes was also noted to provide information about raw material procurement strategies.

The final raw material counts can be seen in Figure 13. Onondaga chert makes up the majority at 62.75% including burnt Onondaga, with Kettle Point coming in second at 28.95% including burnt Kettle Point. Onondaga is known to be extensively used throughout the Archaic, so it is not surprising that it is present at Ridge Pine 3 (Armstrong 2018:58). The primary deposits for Onondaga, as mentioned previously, are far from Ridge Pine 3 however, much of the Onondaga was of low quality so secondary deposits such as river gravels and till likely accounts for a large portion of this sample.

The rest of the material types are quite low in frequency. They include Huronia, Flint Ridge, possibly Jasper, possibly Collingwood, unknown burnt materials, and unknown materials. Huronia chert was generally collected as pebbles, about 2 cm in diameter, from secondary deposits rather than primary deposits of which there is no evidence of utilization (Fox 2021: personal communication). Flint Ridge is found in central Ohio and is distributed at sites all through the Great Lakes and further north, particularly at Ontario sites associated with the Middle Woodland (Fox 2021: personal communication). Jasper, an orange to red chert, is exotic to Ontario and the source is in Berks County in southeastern Pennsylvania (TMHC 2018a:17). The Collingwood material was originally in the unknown category before Bill Fox compared the material to a reference "micro-collection" of Mid-West U.S. and Ontario cherts at Trent University with a Dino Lite microscope. The closest match, though not conclusive, was Collingwood chert from the Fossil Hill formation (Fox 2021: personal communication). Primary outcrops of this cream-coloured Collingwood chert occur in the Beaver Valley in southern Ontario (Fox 2009:360). The chert also bears some similarity to the Burlington formation chert from southern Illinois in its texture and colour unlike other variants in the Fossil Hill formation (Fox 2021: personal communication). White cherts are not common in Ontario, so it is interesting that there is some representation of this material in the Ridge Pine 3 debitage sample. The unknown burnt materials make up 6.25% and the unknown materials make up 1.53% of the debitage sample.

Figure 14 shows the flake type counts for the debitage sample. With respect to raw materials, for most of the flake types, Onondaga chert makes up the majority of the flakes. Fragmentary flakes are the most frequent at 41.10% and are commonly produced during flintknapping, especially with lower quality chert. Some may also have been broken after discard giving us an indication of the impacts that post-depositional modifications have on archaeological assemblages.

The next highest category is the biface thinning flakes at 36.09% of the debitage sample. These come from bifacial reduction and they are a product of late-stage reduction activity. So, biface reduction was likely a major activity at Ridge Pine 3, which agrees with the interpretations from the TMHC (2012:61) report.

Compared to the biface thinning and the fragmentary flakes, the rest of the flake types are low in frequency. The next highest categories are secondary decortication and tertiary flakes at 7.52% and 8.36% respectively. These represent early-stage reduction debris and are the result of core reduction and early stage “roughing out” of preform for biface manufacture (Pearce 2008:53). The presence of these flakes ties in with the high frequency of biface thinning flakes and the associated biface reduction activities. Bifacial retouch flakes, primary flakes, bipolar flakes, and shatter are each less than 3%.

The shatter flake type is a category that may provide some insight into the flintknapping skill levels at the Ridge Pine 3 site. Shatter consists of blocky fragments of chert with no face or edge orientation (Pearce 2008:158). The presence of shatter is often an indicator of novice flintknappers as more experienced flintknappers tend to create fewer errors and as such less shatter from tool manufacture (Shelley 1990:188-192; Milne 2005:331). The debitage sample from Ridge Pine 3 includes 2.52% of shatter which is the fifth highest type of flake at the site. Although it is not the least represented category, the low frequency indicates a low number of errors in the tool manufacture process. The low frequency of biface reduction error flakes at 0.47% also supports this conclusion. Flintknapping expertise and skill levels will be explored further in the next section.

5.1.2 Termination Types

All 5278 flakes from the debitage sample were analyzed for termination type or the morphological shape of the distal end. Figure 15 shows the termination type breakdown. Feather terminations are the highest at 44.54%. A good proportion of the flakes have this ideal distal end with thin, sharp edges indicating a high level of flintknapping expertise at the site. Hinge terminations account for 7.37% of the sample; these rounded distal ends are associated with novice level flintknapping. The low number indicates that more expert level flintknappers were performing the lithic activities and is also supported by the low frequency of shatter in the sample. Flakes with plunging terminations are interpreted as errors too (Odell 2004:58), and the low frequency (1.59%) ties in with the idea that flintknapping expertise was present at Ridge Pine 3. However, this is not a definitive conclusion because there are several modes of learning that may have taken place. Some of these can erase the presence of novice flintknappers in the archaeological record, such as cases where novices and experts work closely together on the same piece of chert (Bamforth & Finlay 2008:19; Hildebrand 2012:30). The presence or absence of novices at Ridge Pine 3 will be explored further with other data sets.

The axial termination category has the smallest representation at 0.15%. It is typically associated with bipolar technologies and this outcome, alongside the low frequency of bipolar flakes, indicates there is a low presence of bipolar technologies at Ridge Pine 3 (Odell 2004:58). Cores will provide more data for this interpretation.

The step termination category is the second highest at 42.25% of the debitage sample. This is an interesting and/or problematic category because it is unclear whether the broken off termination is coming from the original flintknapping episode or post-depositional modifications. The fact that it represents over 40% of the sample showcases both the poor quality of the Onondaga chert and that what may happen to the lithics after they have been discarded can influence what we can interpret about an archaeological site. This result is like the conclusions drawn from the fragmentary flake type category, insofar as we cannot tell what portion of the step fractures resulted from poor quality chert, limited expertise, or post-depositional formation processes.

5.2 Cores

Cores are nodules of lithic materials with flakes removed from one or more surfaces and lacking the features that would classify them as flakes or biface tools (Andrefsky 2005:81), although it is acknowledged that bifaces may also be considered cores in some circumstances. Cores are used to create flakes to produce other tools, but they can also be used as tools themselves, such as for cutting or chopping purposes (Andrefsky 2005:81). For the classification of cores there are three types recognized at Ridge Pine 3: unidirectional, multidirectional, and bipolar. Unidirectional cores have one striking platform with flakes removed in one direction (Andrefsky 2005:16). Multidirectional cores have more than one striking platform and flakes removed in multiple directions (Andrefsky 2005:16). Bipolar cores have flakes removed from opposing ends by striking them while held on an anvil (Binford & Quimby 1963:277).

A total of 69 potential cores and core fragments were analyzed and 67 of these pieces have been confirmed as cores. One was rejected and reclassified as a perforator, and another was reclassified as a chert pebble. Eight of the confirmed cores were reclassified from the debitage. Examples of each type of core from Ridge Pine 3 are shown in Figure 16. Details of the core analysis can be found in Table 7.

Onondaga is the most represented chert type among the cores comprising 50.75% of the cores. Kettle Point chert, including the burnt ones, represents 38.80% and unknown burnt materials make up 8.96%. Cat. No. 27 is different from the others as it is likely Ancaster chert which has primary deposits in the Hamilton region (Fox 2009:360-361).

Core types at Ridge Pine 3 are primarily multidirectional (79.10%). Unidirectional cores make up 11.94% and bipolar cores, 8.96%. The presence of bipolar technology at Ridge Pine 3 may be an adaptive technological response to making use of lower quality secondary Onondaga deposits as this strategy is an efficient way to get workable flakes from small tabular pebbles or cobbles (Binford & Quimby 1963:305). The combination of a low number of bipolar flakes, axial terminations, and bipolar cores indicates that this technology was not performed regularly at Ridge Pine 3. It should be noted that the frequencies of bipolar flakes and axial terminations are coming from a 27.48% sample of all the debitage at the site. A more comprehensive analysis of the debitage may change this interpretation given that almost 10% of the cores are bipolar.

I also noted whether cores were exhausted or not. Exhausted cores are those that are in their last phase of use and are essentially finished (Andrefsky 2005:14). Of the 67 cores and fragments, 16.42% are exhausted based on their overall size, shape, and accumulated step or hinge terminations. Five of the eleven exhausted cores are Kettle Point including the burnt one, four are Onondaga, and two are unknown burnt materials.

The measurements of the cores consisted of taking the maximum linear dimension in centimeters and multiplying it by the weight in grams to calculate the size value (Andrefsky 2005:145-146). The range of size values for all cores and core fragments is 2 to 444 and the range for complete cores only is 13 to 444. Figure 17 shows a breakdown of the size values in terms of ranges for all cores and core fragments. There is an almost exponential decreasing trend as we move from low to high size values. Looking at complete cores only, most of them belong to the 100 to 199 range at 40.74% followed by the 0 to 99 range at 33.33%. Range 200 to 299 has 11.11% and ranges 300 to 399 and 400 to 499 have 7.41% each. The ranges of core size values show they were not all exhausted before discard. There are several cores in the collection, particularly multidirectional cores, which are large and could be further reduced. This suggests that people at Ridge Pine 3 had fairly reliable access to both Kettle Point and Onondaga chert for lithic production activities. If chert materials were scarce in the surrounding area, the cores would likely all be exhausted and/or reduced into tool forms (Lennox 1990:37-39).

5.3 Informal Tools

This section discusses analyses conducted on the informal stone tools from Ridge Pine 3. Tool forms include retouched flakes, utilized flakes, gravers, burins, perforators, notched flakes, spokeshaves, and wedges. A representative sample is shown in Figure 18.

5.3.1 Retouched Flakes

Retouched flakes are informal stone tools which exhibit purposeful human modification on one or more edges for various task-specific purposes (King 2018:5; Pearce 2008:155). Criteria established for identifying retouched flakes include the presence of at least five continuous flake scars along the potentially modified edge and flakes scars extending at least 2 mm from the tool edge (Florida Museum of Natural History 2017:17; King 2018:4). A total of 33 potential retouched flakes were analyzed and resulted in 30 confirmed retouched flakes and three rejected retouched flakes. Ten of these retouched flakes were reclassified from their original identification, two from debitage, two from utilized flakes, three from scrapers, and three from bifaces. Four of them have a utilized edge in addition to a retouched edge (Cat. Nos. 137, 489, 668, and 881). Detailed data tables for the retouched flakes are in Table 8.

Only Onondaga, Kettle Point, and unknown burnt materials are present in the Ridge Pine 3 retouched flakes. Fifteen (50.00%) are made with Kettle Point, twelve (43.33%) are made with Onondaga, and two (6.67%) are made with unknown burnt materials. Unlike the debitage sample, Kettle Point chert represents most of the retouched flakes and is about 7% higher in frequency than Onondaga for this tool type.

The majority of the retouch occurs on the dorsal face with 72.97% of the retouched flakes showing this trend and only 27.03% showing retouch on the ventral face. Most of the retouch occurs on the lateral edge followed by the distal edge and then the proximal edge. The frequencies are 67.65% for lateral, 26.47% for distal, and 5.88% for proximal. The high percentage of tools with retouch occurring on the dorsal surface and lateral edge may indicate a scraping function for these tools. A more in-depth study involving edge angles would be needed to help confirm this function.

Of the 30 retouched flakes, only four (13.33%) had more than one edge retouched and there were never more than two retouched edges on a flake. Generally, only one edge was retouched for a flake, representing 86.67% of this tool category. This makes sense as retouched flakes were not meant for long-term use or extensive curation.

For retouched edge dimensions, the height of the flake scars is anywhere between 2.00 and 14.20 mm with an average of 3.53 mm and the most common height at 2.10 mm. The length is between 4.40 and 27.90 mm with an average of 13.24 and the most common at 8.50 mm. The number of continuous flake scars on an edge is between 5 and 14 with an average of 7.83 flake scars and the most common at 6 continuous flake scars.

Three of the 28 confirmed retouched flakes (10.7%) are made on linear flakes. These are blade-like flakes, where the length is at least twice as long as the width, with retouch on one or more edges (Pearce 2008:154).

5.3.2 Utilized Flakes

Utilized flakes are also expedient tools but without the deliberate retouch seen on the retouched flakes (King 2018:4-5; Pearce 2008:154). Use-wear features, including microflakes, striations, edge rounding, and polish, are unintentionally made from performing a task or multiple tasks with that flake (King 2018:4-5). Cracks are another common use-wear feature on utilized flakes, although they often occur from natural causes (Odell & Odell-Vereecken 1980:96; Burroni et al. 2002:1278). Examples of these use-wear features are shown in Figures 6 and 7. Criteria established for identifying utilized flakes with edge modification from human use include the presence of at least two or more use-wear features on an edge, the types of microflakes (continuous/close vs. clumped/isolated) if present, and a microflake height of less than 2 mm if present, to differentiate between deliberate retouch and unintentional modification from performing a task (Keeley and Newcomer 1977:37; Shea 1992:143).

A total of 200 potential utilized flakes were analyzed and resulted in 155 confirmed utilized flakes and 45 rejected utilized flakes which were added to the chipping detritus from the units they came from. Four of these utilized flakes were originally classified as retouched flakes, fourteen were originally classified as debitage, and two potential utilized flakes were reclassified as retouched flakes. One utilized flake (Cat. No. 216) that was part of the original report is missing from the assemblage. Of the 200 potential utilized flakes, 22.50% were rejected and it was concluded that they were chipping detritus affected by post-depositional modifications. From this analysis we can see that Shen’s (1999) arguments about Ontario archaeologists not being critical enough about the utilized flake category have merit. Again, this shows the effect that this major variable of post-depositional modifications may have on archaeological assemblages as well as the importance of remaining critical of our own classification systems and attributes we see as stemming from deliberate human use. At the same time, the documentation of 155 utilized flakes from Ridge Pine 3 establishes this tool form as the most common form in the assemblage. Table 9 details the utilized flake data.

Kettle Point, Onondaga, burnt Kettle Point, burnt Onondaga, unknown burnt materials, and an unknown material are present in the utilized flakes. Seventy-nine are made on Kettle Point, 59 on Onondaga, one on burnt Kettle Point, five on burnt Onondaga, ten on unknown burnt materials, and one on an unknown material. Kettle Point, both burnt and unburnt, makes up 51.62% of the utilized flakes while Onondaga, both burnt and unburnt, makes up 41.29%. Like the retouched flakes, Kettle Point chert represents the majority of the utilized flakes with a frequency about 10% higher than Onondaga for this tool type. The unknown burnt materials and the unknown material respectively represent 6.45% and 0.65% of the utilized flakes at Ridge Pine 3. The fact that more retouched flakes and utilized flakes were made of Kettle Point, despite there being more Onondaga flakes and cores in the assemblage, may indicate that larger, more useable flakes were being made from the Kettle Point material.

For the location of the utilization, most of the use-wear occurs on the dorsal face with 74.73% of the utilized flakes showing this trend and only 25.27% with use-wear on the ventral face. In terms of the edges that were utilized, only lateral and distal edges show evidence of use which is likely because these edges have a greater likelihood of being sharp and thin enough to perform tasks without needing deliberate modification than the proximal edge containing the striking platform. The frequencies are 76.09% for lateral and 23.91% for distal. Of the 155 utilized flakes, only 20 (12.90%) have two utilized edges present. Generally, only one edge has indicators of use-wear for a flake, representing 87.10% of this tool type, much like what is seen with the retouched flakes. This may be due in part to the fact that debitage is quite ubiquitous at the site, so there would have been a high number of flakes to choose from to perform tasks with. For the utilized edge dimensions, the height of the microflakes is anywhere between 0.20 and 1.90 mm. The average is 0.83 mm with the most common being 0.60 mm.

Tables 10, 11, and 12 show the frequencies of use-wear features and cracks, frequencies of the types of microflakes, and the frequencies of the types of polish. These tables represent confirmed utilized flakes only. Microfractures are the most common use-wear feature followed by edge rounding, striations, cracks, and polish. Microfractures are only about 5% higher in frequency than edge rounding which makes sense as these two use-wear features almost always occurred together in the Ridge Pine 3 utilized flakes. The low frequency of polish (4.63%) may be due to post-depositional modifications where processes such as soil movement or ploughing may have rubbed away the polish over time, not to mention the archaeological practice of cleaning the artifacts.

The frequencies for the types of microfractures or microflakes is good evidence that certain types of use-wear features are more likely to be attributed to human use than others. It is thought that continuous or close microfractures are a good indication of human use because it would have taken more time and repetitive action to form such uniform patterns and Table 11 supports this line of thinking. Close microflakes are the highest at 70.59% followed by continuous microflakes at 28.82%. Only one confirmed utilized flake (0.59%) has clumped microfractures which also has close microfractures present along that same edge. No confirmed utilized flakes have isolated microfractures.

For the types of polish, only continuous and discontinuous were recorded. Discontinuous polish makes up 95.83% of the polish seen while continuous polish makes up only 4.17%. Considering post-depositional modifications, the fact that more discontinuous polish is present makes sense with the number of processes the assemblage was subjected to which likely rubbed away portions of the polish previously present.

5.3.3 Gravers

Gravers are informal tools made on flakes or blades that are modified to have a defining concave shape either side of a small spur element known as the tip, which was the working edge/part of the tool (see Figure 18) (TMHC 2018b:15). The concave modifications are created through unifacial retouch on one of the faces of the flake or blade. Graver functions are believed to be mainly grooving or engraving and use-wear studies have shown that cutting/scraping tasks were also performed with gravers (Noone 1934:92; Sørensen 2017:212). Five potential gravers were examined. Four were confirmed as gravers and one was rejected and reclassified as a perforator. One of the confirmed gravers, Cat. No. 783, was reclassified from a scraper and also has a utilized edge on the lower left lateral/distal edge.

Only one graver is made on Kettle Point chert (25.00%) while the other three are made on Onondaga chert (75.00%), one of which was burnt. Two gravers are made on biface thinning flakes and the other two are made on fragmentary flakes with missing striking platforms.

All gravers only contain one spur or projection on the flake. Three of the four gravers are retouched on the dorsal face and only one on the ventral face. Three of the modifications are made on a lateral edge while the last one is made on an unknown edge due to the artifact being too fragmented to accurately determine the orientation and edge.

Lastly, for the graver modification dimensions, the modification lengths or widths have a range of 5.40 to 10.60 mm with an average of 7.33 mm.

5.3.4 Burins (BUR)

Burins were only found in the New World when excavations in 1948 in the northern Bering Sea region recovered some (Giddings 1956:229). They are commonly found in the Arctic where they are present at several early sites (Giddings 1956:229). Burins are like gravers in terms of function. The difference between the two is in the way they are created. The working edge has a spur or small projection, made by "removal, probably by percussion, of a small sliver or narrow strip of flint… called a spall, from each of the two opposite margins at the end of the piece" (Noone 1934:82). Rather than being retouched along one of the flakes faces, as we see with gravers, burins have spalls removed from the edge itself to create the spur. As well, some burins, known as converted burins, make use of a pre-existing break to make the tip, meaning that only one side needs to have a spall removed, which is also seen with the gravers (Noone 1934:85). Giddings (1956:230) notes that burins often have prominent stems likely for hafting.

At Ridge Pine 3, two burins have been identified, and both were originally classified as bifaces. The identification of burins in the Ridge Pine 3 assemblage is significant as they are a tool form that is rarely recognized on Late Archaic sites (Peter Timmins personal communication 2021). Cat. No. 852 (see Figure 18) is made of an unknown burnt material on a biface thinning flake which was bifacially worked before being burinated on the right lateral edge. According to Noone (1934), this is a converted burin as a spall was only removed from the right side of the tip while the left side had a pre-existing break. The modification length/width is 21.8 mm and polish is present on and near the tip. The opposite end of the burin has tapered edges, which are not as sharp or worked as the other edges and is elongated making it a probable hafting end.

The second burin is broken into three pieces (Cat. No. 525, 526, and 527), and made of Onondaga chert. The tip (Cat. No. 525) is the only burnt piece. The burin was originally a biface that was reworked into a burin on the distal edge. The modification length/width is close to Cat. No. 852 at 20.1 mm. There is a potential haft area with dull and ground lateral edges as well as a substantial stem present. The tip also has polish.

5.3.5 Perforators

Perforators are similar to gravers and burins as they are also usually made on flakes and considered expedient tools. They have elongated projections which differentiates them from the squat spurs seen on gravers and burins, and function like a drill for boring, but without the more formal bifacial manufacture (TMHC 2018b:1).

A total of three perforators have been identified and one of those, Cat. No. 294, was originally classified as a graver. Cat. No. 294, which is a perforator tip and midsection, is made on Kettle Point chert. The modification location is on the dorsal face, but the edge (i.e., lateral/distal/proximal) could not be determined. Recorded dimensions, though incomplete, are 8.7 mm for modification length/width and 15.6 mm for haft length. It is not a very long worked bit end likely due to how the natural breaks occurred, so it did not need as much retouch.

Cat. No. 732 is a complete perforator made from an Onondaga chert biface thinning flake. The modification is located on the ventral face and distal edge. Recorded dimensions include 10.1 mm for modification length/width and 37.9 mm for haft length. The worked bit end is not very long likely because the break makes the flake naturally come to a point, so it did not need much of retouch to create the elongated projection.

Cat. No. 664 (see Figure 18) is different from the other two perforators because it was originally an exhausted core before being reworked into a perforator. The final shape of the exhausted core made it useful to use as a perforator with the distal end coming to a natural point. Cat. No. 664 is made of Kettle Point chert and is complete. There is modification on the dorsal face at the distal edge with a concave modification shape. Recorded dimensions include 18.4 mm for the modification length/width and 29.4 mm for the haft length. It did not need much retouch as the final form of the core naturally created the elongated projection distinctive of perforators. Cat. No. 664 is reminiscent of some perforators seen in Early Archaic collections (i.e., the Nettling site), but they are bifacial while all the Ridge Pine 3 perforators are unifacial (Ellis et al. 1991).

5.3.6 Notched Flakes

Notched flakes have use modifications in the form of small notches (Ellis & Deller 2013:10). These notch modifications are believed to have been used for various functional tasks, formed as a result of resharpening or recycling, and possibly to facilitate hafting (Eren 2012:12). Eren (2012) notes that notched flakes tend to have more notches on the lateral edges than if they were created on the distal end indicating a possible hafting function. Like the utilized flakes, modification height of the microflakes creating the notches should be less than 2 mm. There should also be at least five continuous microflakes to confirm that the notches are made through human modification (Florida Museum of Natural History 2017:17).

For Ridge Pine 3, two notched flakes were confirmed in the assemblage. Both are made out of Kettle Point chert. One is burnt (No. 444) while the other is not (No. 628). Both flakes have feather terminations and show signs of use at the notches.

Cat. No. 444 (see Figure 18), made of burnt Kettle Point, is a biface thinning flake with modifications on the dorsal face. It has two notches on opposite lateral edges just below the proximal edge and they are about opposite with one another. The right lateral notch is 6.3 mm in length, 5 microflakes in length, and 1.2 mm in height. The left lateral notch is 7.8 mm in length, 8 microflakes in length, and 1.6 mm in height. This notched flake follows the trend that Eren (2012) pointed out with notched flakes having more notches if they occur on the lateral edges. Use-wear features are present in both notches and are quite smooth which may be an indication of hafting. The right lateral edge from the end of the notch to the distal end (11.2 mm) has striations, microflakes, and edge rounding indicating use. So, if it is a hafted notched flake, the right lateral edge is likely the utilized working edge.

Cat. No. 628, made of Kettle Point chert, is a secondary flake with modifications also on the dorsal face. Unlike Cat. No. 444, this notched flake only has one notch located on the distal edge. There are use-wear features exhibited, and it is slightly shiny though not to the same degree as Cat. No. 444. Recorded modification dimensions are 6.7 mm in length, 5 microflakes in length, and 1.4 mm in height.

Based on this very small sample size of notched flakes, it is possible that lateral notches may have been used for hafting purposes as Eren (2012) suggests. Although there is not a big enough sample size to confirm this, it is still a possible interpretation for this tool type, especially considering how smooth the notches are on the bilateral notched flake (Cat. No. 444) and evidence of utilization on the right lateral edge.

5.3.7 Spokeshaves

Spokeshaves are flakes with larger notches than notched flakes that are also concave in shape (Ellis & Deller 2013:1, 26). They have also been termed concave scrapers (Ellis & Deller 2013:1). Modification criteria include the presence of microflakes with a height of more than 2 mm, similar to retouched flakes and to differentiate spokeshaves from notched flakes, as well as having at least five continuous microflakes in a row (Florida Museum of Natural History 2017:17; King 2018:4).

There are only two spokeshaves in the Ridge Pine 3 assemblage, both of which are made of Onondaga chert. Both have hinge terminations and the concave spokeshave notches on both occur on a lateral edge about midway along the edge.

Cat. No. 675 is a fragmented flake as it broke right below the striking platform. The modification is located on the dorsal face and on the right lateral edge, about midway between the proximal and distal edges. Recorded modification dimensions include a length of 10.4 mm, 6 microflakes in length, and a maximum height of 3.3 mm.

Cat. No. 827 (see Figure 18) is a biface thinning flake. The modification is located on the ventral face and on the left lateral edge at about the midway point, similar to Cat. No. 675. Recorded modification dimensions include a length of 9.4 mm, 6 microflakes in length, and a maximum height of 3.6 mm.

Like the notched flakes, there is very small sample size for the spokeshaves so no definitive conclusions can be drawn. However, it is interesting that both spokeshaves have notches about midway on a lateral edge. As well, both spokeshaves were made on flakes with hinge terminations unlike the feather terminations of the notched flakes.

5.3.8 Wedges

Wedges are informal tools that are also known as “pièce esquillées” or “scaled pieces” in the literature because the overlapping flake scars, which are a defining feature for these tools, resemble fish scales (Pearce & Ellis 2008:7). The general definition for this tool type includes having “small artifact forms with squarish to circular outlines which exhibit extensive battering on at least two opposing edges or ends” (Ellis, Kenyon, & Spence 1990:109). These tools can be difficult to analyze as there is much disagreement amongst researchers about their function and the defining morphological characteristics that serve as indicators for that function (Pearce & Ellis 2008:7).

There are two main functional interpretations for this tool type, with one side arguing that they are tools and the other side arguing that they are bipolar cores. In the tool interpretation, researchers argue that they would have been used as wedges to split organic materials such as wood or bone (Pearce & Ellis 2008:7). The prominent feature of multiple flake scars suggestive of battering along various margins comes from rotating the wedges during use (Pearce & Ellis 2008:7). To identify these tools as wedges, Hayden (1980:2-3) provides a set of criteria, arguing that they are generally made on flakes or exhausted tool fragments, are relatively thin, and that the flakes removed by battering rarely extend the full length of the piece, as is expected with cores.

In the bipolar core interpretation, researchers suggest that the battering on opposing margins comes from smashing chert pieces on a stone anvil to get useable flakes, especially at sites where the chert pieces are small (Pearce & Ellis 2008:7). For example, secondary deposits of raw materials in the form of pebbles or cobbles may be subjected to this bipolar battering to produce flakes more easily. If this is the case, then there should be pitted anvil stones present at the site alongside the bipolar cores (Hayden 1980:4; Pearce & Ellis 2008:8). Identification criteria for bipolar cores, according to

Hayden (1980:3), include having a thick or chunky form, no indication of the tool ever being a flake (i.e. no ventral scar, no ventral curvature, etc.), and the fact that flakes removed by the battering often extend the full length of the piece.

For Ridge Pine 3, the three pièce esquillées are believed to be tools in the form of wedges. This conclusion was reached because, based on the debitage sample, there is a rarity of bipolar flakes, there is only one pitted rough stone tool from the site, and the pièce esquillée forms adhere closer to the criteria associated with wedge function. All three are made on flakes, flake scars do not extend the entire length of the artifacts, and, compared to the small number of bipolar cores identified, they do not morphologically resemble cores. As well, two of the three wedges are made from Kettle Point chert which fits in with the recognized but unexplained trend that these tools are often made on Kettle Point chert (Ellis, Kenyon, & Spence 1990:109). Figure 19 compares a Ridge Pine 3 bipolar core and a wedge.

Table 13 shows the data for the Ridge Pine 3 wedges. All three have battering on both lateral edges and Cat. No. 255 also has battering present on the distal edge. Where battering occurs, it is present on both ventral and dorsal surfaces. The height of the battering flake scars never extends the full length of the artifacts and the identification of flake types for all three supports the functional interpretation that they are wedges.

5.4 Formal Tools

This section summarizes the analyses conducted on the formal stone tools at Ridge Pine 3. Tool types include knives, scrapers, scraper-knives, and bifaces.

5.4.1 Knives

Knives are considered formal tools with a considerable amount of variability in form and finish (TMHC 2018a:3). For example, some may be bifacially or unifacially worked and possibly hafted while others are handheld or backed. The main distinguishing characteristic is at least one area along a lateral edge that is regularly flaked and linearly retouched to create a more acute edge angle than scrapers for slicing purposes (TMHC 2018a:3). The modified edge is usually straight to convex, but this can vary (TMHC

2018a:3). The hafted knife form tends to be more formalized in the creation of the hafting element (TMHC 2018a:3). With the backed knife form, the edge opposite the working edge is either steeply retouched or unmodified to be easily hand-held (TMHC 2018a:3).

At Ridge Pine 3, there are six confirmed knives which were all reclassified from other tool categories. Three were previously classified as bifaces, two were originally identified as scrapers, and one was first thought to be a uniface. There are use-wear features present along the working edges for all six of these knives. Figure 20 shows an example of a couple of knives from Ridge Pine 3. Table 14 summarizes the knife data.

As indicated in Table 14, Kettle Point and Onondaga chert are equally represented in the raw material used for knives. In terms of flake types, four (66.67%, Cat. Nos. 51, 58, 172, and 758) are made from fragmentary flakes, one (16.67%, Cat. No. 59) is made from a biface thinning flake, and one (16.67%, Cat. No. 336) is a secondary flake.

Three (50.00%) of the knives are backed knives (Cat. Nos. 59, 172, and 336) because they do not display any indication of hafting and the spine, the edge opposite the working edge, is either worked to be hand-held or unmodified. For example, Cat. No. 336 (Figure 20) has cortex covering the spine which makes it easily hand-held. One (16.67%) is a hafted knife, Cat. No. 51 (Figure 20). The edge angle is too shallow to be a scraper at 45 degrees and the tapering of the lateral edges is an indication of hafting. The other two (33.33%) are unknown knife types because one has an incomplete spine (Cat. No. 758) and the other has no spine present at all (Cat. No. 58) which makes it impossible to identify whether they were backed knives or not. There are a variety of cross sections represented and although a rhomboid shape is the most common (n=2, 33.33%) there is no one cross section that makes up the majority. The other cross section shapes include lenticular, irregular, median ridged, and plano-convex, all of which occur once.

Two of the knives (33.33%, Cat. Nos. 51 and 172) are modified on two edges while the other four (66.67%, Cat. Nos. 58, 59, 336, and 758) only have one edge modified. For modification shapes, five of the edges (62.50%, Cat. Nos. 51, 172, 336, and 758) are convex, two (25.00%, Cat. Nos. 58 and 172) are irregular, and one (12.50%, Cat. No. 59) is straight. The modification location on the face of the flake includes four edges (50.00%, Cat. Nos. 51, 172, and 758) modified on the dorsal face, two (25.00%, Cat. Nos. 59 and 336) on the ventral face, and the last two (25.00%, Cat. Nos. 58 and 172) are bifacially worked with modification on both ventral and dorsal faces. For edge location, six of the edge modifications (75.00%) occur on lateral edges and two (25.00%) occur on the distal edge.

Modification dimensions for knives include blade length and haft length. Only one knife provided a haft length, Cat. No. 51, at 17.0 mm. Blade lengths have a range of 13.8 to 44.8 mm, averaging 33.4 mm. No repeating blade lengths resulted in no mode.

5.4.2 Scrapers (SCR)

Scrapers are formal tools whose function is believed to be working hides and wood (TMHC 2018c:1). They are technically unifacial tools though they are differentiated from unifaces because scrapers are considered more formalized and tend to have greater modification heights than unifaces (TMHC 2018c:1). Scrapers are sub-divided into types based on the location of the working edge (TMHC 2018c:1). Scraper types in the collection include side, end, and thumbnail. Side scrapers are modified along the long or lateral edge and are quite variable in terms of size and shape (TMHC 2018c:3). End scrapers have modification on the end of the tool, either the distal or proximal edge, and the bit or worked end is often convex in shape while the overall size can vary greatly (TMHC 2018c:2). Some end scrapers may have been hafted as indicated by grinding or retouch along the lateral edges at the proximal end of the tool (TMHC 2018c:2). Thumbnail scrapers are similar to end scrapers but do not have the same variability in overall shape and size (TMHC 2018c:2). Generally, they are small and handheld, fitting between the thumb and forefinger (TMHC 2018c:2). They often have a strong bevelled edge with retouch around the majority or all the edges (TMHC 2018c:2). Thumbnail scrapers were likely not hafted as they do not have a haft area.

In terms of criteria for identifying scrapers, I chose a modification height threshold, to differentiate them from unifaces, and a modification length threshold, to differentiate them from retouched flakes. For scrapers, the modification height should be greater than or equal to 3 mm, as suggested in the TMHC Lithic Training Manual

(2018c:1), and the modification length should be greater than or equal to 20 mm unless it is a small sized scraper, such as a thumbnail scraper, then the modification should take up the whole length of the edge. There is one exception to these guidelines, Cat. No. 348 (Figure 21), which is an end scraper. The modification height is slightly less than 3 mm at 2.6 mm; however, the modification takes up the entire length of the distal edge and the tool is morphologically similar to an end scraper. It was considered a scraper despite not meeting the modification height criteria, with the small modification height possibly stemming from the small size of the flake or reduction from use.

In the Ridge Pine 3 assemblage, a total of 24 potential scrapers were analyzed and 18 of those (75.00%) were confirmed as scrapers while 6 (25.00%) were rejected and assigned other classifications. One of the 18 confirmed scrapers is in two pieces, Cat. No. 846 and 847, so there are 19 individual scraper artifacts but 18 scrapers total. Three of the confirmed scrapers were originally classified as bifaces and one was originally classified as debitage. Two of the confirmed scrapers also have a separate utilized edge (Cat. Nos. 577 and 828), another two also have a separate retouched edge (Cat. No. 93 and 577, Figure 21), and one of the scrapers with a retouched edge also has a graver tip (Cat. No. 93). Use-wear features were present on all bit ends of the confirmed scrapers except for one, Cat. No. 860 (Figure 21), because it is a preform scraper that was abandoned before completion. Figure 21 is a representative scraper sample. Table 15 summarizes the data.

Onondaga represents the majority of the scrapers at 50.00%, including burnt and unburnt with Kettle Point coming in close behind at 44.44% including burnt and unburnt. One scraper (5.56%) is made of an unknown burnt material. For scraper types, end scrapers dominate (n=8, 44.44%) with side and thumbnail scrapers at 22.22% (n=4) each. Two of the scrapers (11.11%) are unknown types because the fragments were too small to accurately orient the flake and determine what edge was worked. Six (33.33%) of the scrapers are made on secondary flakes, five (27.78%) on biface thinning flakes, five (27.78%) on fragmentary flakes, and two (11.11%) on tertiary flakes.

Twelve of the scrapers (66.67%) only have one modified scraper edge, four (22.22%) have two modified scraper edges, and two (11.11%) have three modified scraper edges, both of which were thumbnail scrapers. The majority of the modification shapes are convex as is typical for end scrapers (n=17, 65.38%) followed by concave (n=5, 19.23%) and irregular and straight (n=2, 7.69%) for each. The location of the modification mostly occurs on the dorsal face representing 23 (88.46%) of the scraper edges while ventral face modification only occurred on three (11.54%) scraper edges. Modified edge representation includes lateral (n=12, 46.15%), distal (n=10, 38.46%), proximal (n=2, 7.69%), and unknown (n=2, 7.69%) for the two untyped scrapers where orientation of the flake and edge identification could not be accurately determined.

The modification lengths have a range of 14.6 mm to 41.0 mm with an average of 23.15 mm and a mode of 21.5 mm. The range for modification heights is 2.6 to 14.6 mm, due to the inclusion of Cat. No. 348 as a scraper, discussed above. The average modification height is 6.81 mm and the mode is 6.4 mm. In terms of the angle of the scraper edge, the range is 50 to 75 degrees with an average of 63.60 degrees and a mode of 65 degrees. These edge angles approach the angles used for hide scraping (75 to 90 degrees) according to Andrefsky (2005:161).

Some of the scrapers show signs of possible hafting, especially the end scrapers. Cat. No. 348, the end scraper with a height modification of 2.6 mm, has notches present near the bit end. They are located on the right lateral edge on the ventral face and the left lateral edge on the dorsal face possibly for hafting purposes. It looks similar to the hafted end scrapers Andrefsky (2005:Figure 2.17) has illustrated. Cat. No. 116 (Figure 21) is an end scraper that was originally classified as a biface. Although it is broken along one lower lateral edge, the extant portion is tapered and dull at the proximal end, which may be an indication of hafting. This tool is flaked over the entire dorsal surface and is reminiscent of Early Archaic end scrapers with similar dorsal flaking (Ellis et al. 1990:74-76), as discussed in Chapter 6. Cat. No. 652 is another end scraper originally classified as a biface. The lateral edges opposite the distal bit end taper in which may be a sign of hafting too. All three are shown in Figure 22.

Cat. No. 93 (Figure 21) is a good example of a multifunctional tool. Its primary classification is a thumbnail scraper with convex scraper modifications on the left lateral and distal edges. It also has a unifacially retouched right lateral edge. The straight right lateral retouched edge has about 20 continuous flake scars along that edge with a height of 2.0 mm and edge rounding indicating use, possibly for a cutting activity, and an edge angle of 55 degrees. The proximal edge has a graver tip with concave modifications either side of the tip on the dorsal face. Multifunctional tools were also present at the Narrow Point Cole site in New York (Hayes & Bergs 1969).

Cat. No. 491 (Figure 21), a side scraper, has an almost denticulate shape on the modified scraping edge, similar to the potentially diagnostic blade-like scrapers of the Small Point Archaic complex. While Cat. No. 491 is not made on a blade and thus is not the same as the Small Point scrapers found at the Green Hill Area C site (Pearce & Ellis 2008), it does share the almost denticulate shaped bit end. Pearce and Ellis (2008:14) interpret this as an indication that the scrapers were used as cutting tools, which may also be the case for Cat. No. 491.

5.4.3 Scraper-Knife

A new tool type, the scraper-knife, was created for catalogue numbers 191 and 204. They were both originally classified as biface fragments and mend together. Cat. No. 191 was found in unit 2000N 490E:21 and Cat. No. 204 was found in unit 1995N 490E:22, about 5 m apart. The scraper-knife is made of Onondaga and Cat. No. 191 is burnt while Cat. No. 204 is not. It is mostly complete, apart from a missing portion of the dorsal surface at the distal end. The original flake type of the tool is secondary. The scraper-knife has a plano-convex cross section. Images are in Figures 23 and 24.

The left lateral and left distal edges have been modified into a knife. Modification occurs on both the dorsal and ventral faces for the knife edges. The left lateral edge is straight with a blade length of 19.1 mm and an edge angle of 35 degrees. The distal edge is convex in shape with a blade length of 15.6 mm and an unknown edge angle due to a missing portion of the dorsal surface. There is use-wear present on both edges. The knife edge is not as steep as the opposite scraper edge on the right lateral. The ventral face has the uniform, linear retouch typical of knives along the right lateral and right distal edges. There is also retouch on the dorsal face of the right lateral edge and what is present of the right distal edge, though not as uniform or linear, making it a bifacial knife edge. Whether this tool is a hafted or backed knife is unknown. There are potential hafting indications including how the edges near the proximal edge taper in and are duller than the other edges. However, it could also be a backed knife with the left lateral edge (the scraper edge), as a backing to be easily handheld. Without more evidence, I cannot say for sure if it was meant to be hafted or not. If it was hafted, the haft length is 19.5 mm.

The left lateral and left distal edges of this tool have been modified into a scraper making it a side/end scraper. The scraper edge modification occurs on the dorsal face creating a straight left lateral edge and a convex left distal edge. There is use-wear present on both edges as well. The left lateral scraper edge has a modification length of 28.7 mm and height of 9.7 mm with an edge angle of 60 degrees. The left distal scraper edge has a modification length of 14.6 mm and height of 6.9* mm. As mentioned above, there is a piece of the dorsal surface missing at the distal edge due to Cat. No. 191 missing its distal end, so the modification height is an incomplete measurement, and the edge angle is unknown. The break may be from end scraper use where pressure applied to the scraper edge during scraping may have caused the distal edge to break off. An alternative explanation may be that the break is a classic example of an outrepassé termination resulting from an attempt to remove an end biface thinning flake while trying to thin the tool (Chris Ellis personal communication 2021).

5.4.4 Bifaces

According to Andrefsky (2005:177), a biface has been worked bifacially to create "two sides that meet to form a single edge that circumscribes the entire artifact." Due to this definition, the assigned stages of the Ridge Pine 3 bifaces (2 to 5) did not include stage one which is an unworked flake blank or cortical cobble. Stage one does not fit Andrefsky's (2005) definition of bifacial work around the circumference.

Originally there were 92 individual biface artifacts at Ridge Pine 3. After analysis, 20 pieces were rejected, which is actually 17 rejected bifaces because Cat. Nos. 191 and 204 mend together, as do Cat. Nos. 525, 526, and 527. In terms of reclassification for the 17 rejected bifaces, one was debitage, three were retouched flakes, two were burins, three were knives, three were scrapers, one was a scraper-knife, one was a wedge, and three were projectile point fragments. A total of 72 biface artifacts were confirmed which, after mending eight pieces, makes up 68 bifaces in the Ridge Pine 3 assemblage. Mended bifaces count as one in the following analysis. A representative sample of bifaces is shown in Figure 25. A summary of the biface data can be found in Table 16.

For the material types of the Ridge Pine 3 bifaces, Onondaga dominates at 53.63% (n=37) including the burnt Onondaga. One of the mended bifaces has one burnt Onondaga piece (Cat. No. 259) and one unburnt Onondaga piece (Cat. No. 666) so each piece counted as one for the material types. Kettle Point represents 34.78% (n=24) of the bifaces, including burnt Kettle Point. Onondaga was used almost 20% more than Kettle Point for the bifaces. Unknown burnt materials represent 11.59% (n=8) of the bifaces.

The stages assigned to the bifaces steadily decrease in frequency from stage 2 to stage 5. There are 25 stage 2 bifaces representing 36.76% of the collection, 20 stage 3 bifaces representing 29.41%, 14 stage 4 bifaces representing 20.59% and eight stage 5 bifaces representing 11.76%. The indeterminant stage only has one biface fragment representing 1.47%. Figure 26 breaks down the stages by material types. Onondaga chert dominates stages 2 (n=15, 57.69%), 3 (n=12, 60.00%), 5 (n=4, 50.00%), and the indeterminant stage (n=1, 100.00%). Kettle Point chert is most common in the stage 4 bifaces (n=7, 50.00%). There are a couple of bifaces of unknown burnt materials. Because the debitage sample analysis showed Onondaga as the dominant material type and the majority of the flake types are biface thinning flakes assigned to late-stage biface reduction, it is not surprising to see more Onondaga in the Ridge Pine 3 bifaces.

Bifaces can be made from cortical cobbles (cores) or from flake blanks detached from cores. With stage 2 and 3 bifaces it is easier to identify what the bifaces were originally made from because they are less refined than stages 4 and 5 which can erase features indicative of flake blanks or cortical cobbles. Looking at just the stage 2 and 3 bifaces, which represent 66.18% (n=55) of the Ridge Pine 3 bifaces, 42.22% (n=19) appear to have been made on cortical cobbles and 57.78% (n=26) on flake blanks. I also attempted to identify flake blanks vs. cortical cobbles for stages 4, 5, and indeterminant stage bifaces. These tentative identifications are not conclusive. Combining them with stages 2 and 3, flake blanks make up 67.65% (n=46), cortical cobbles make up 27.94% (n=19), and 4.41% (n=3) are unknown due to their fragmentary state.

In terms of morphological characteristics, I looked at shape, cross section, and crudeness/refinement. Both shape and cross section have a variety of attribute states represented. For shape, ovate is the most common at 47.06% (n=32) followed by triangular at 10.29% (n=7). Unknown shape types make up 30.88% (n=21) of the bifaces because a high frequency were fragmented, and I could not accurately determine the overall shape. The rest of the shapes, including pentagonal (n=3, 4.41%), lenticular (n=2, 2.94%), lanceolate (n=2, 2.94%), and circular (n=1, 1.47%), are all relatively low in frequency. For the cross sections, plano-convex is the most represented at 44.12% (n=30) followed by hexagonal (n=9, 13.24%), lenticular (n=7, 10.29%), rhomboid (n=5, 7.35%), and median ridged (n=4, 5.88%). Unknown cross sections make up 19.12% (n=13).

The crudeness/refinement of the bifaces was also examined based on visual assessment and comparison with other bifaces in the same stage. Overall, 61.76% (n=42) were determined to be refined and 38.24% (n=26) as crude. This is a good indicator that there was some level of skill involved in the biface manufacture. All the crude bifaces came from stages 2 and 3 while stage 4 and 5 have all refined artifacts, which makes sense given that refinement is what the stage system is based on (Andrefsky 2005:188-190). So, despite working with some poor-quality Onondaga chert, the flintknappers at Ridge Pine 3 were able to manufacture a high number of refined bifaces showcasing the more expert flintknapping skill levels present at the site.

In terms of dimensions, width/thickness ratios were determined for the Ridge Pine 3 bifaces. I broke down these ratios by stage for bifaces with complete widths and thicknesses only, which is 20 of the bifaces, as width/thickness ratios of incomplete artifacts would skew the results. At Ridge Pine 3, width/thickness ratios range from 1.8 to 3.2 for stage 2, 2.5 to 3.3 for stage 3, 2.7 to 4.1 for stage 4, and 3.1 for stage 5 as there was only one stage 5 biface with complete width and thickness measurements. The variability of artifacts within each stage, as calculated through the Coefficient of

Variation or CV (Eerkens & Bettinger 2001), can be an indication of whether a high number or a low number of flintknappers were at work manufacturing bifaces (Eerkens 2000). Stage 2 has a CV of 18.45%, Stage 3 has a CV of 14.08%, and Stage 4 has a CV of 17.19%. As Stage 5 only has the one complete biface, a CV cannot be calculated.

Eerkens and Bettinger (2001) provide baseline values of CV to compare with the CV of an artifact sample. The highest degree of standardization, or upper limit, humans can achieve without external aids such as templates or rulers is 1.7% and the variation for random production with no attempt at standardization, or lower limit, is 57.7%. Higher variability can be caused by more people with differing mental templates creating the artifacts, poor-quality raw material, and different skill levels. Considering the CV values for the biface production stages above, they all fall closer to the 1.7% upper limit despite the poor quality of some of the Onondaga chert materials. This is an indication that the flintknappers producing these bifaces were skilled enough to achieve a relatively high level of standardization within the stages despite the limitations of the lower quality chert present in the assemblage. The size of the site, about 18 m in diameter, also comes into play here as its small size likely means that only one or two families occupied the space. With a low number of flintknappers and fewer mental templates, this results in less variability present. Considering all these variables, it is likely that the flintknappers at Ridge Pine 3 were few in number and had high skill levels.

There are also some potential diagnostic Small Point preforms in the Ridge Pine 3 bifaces. These preforms are small and tear-dropped to triangular in shape and are often found in the Small Point toolkit (Pearce & Ellis 2008:12). Cat. Nos. 7, 44, 45, 47, 63, 73, 76+78, 91, 103, 123, 130+600, 167, 471, and 805 (Figure 25) are all stages 4 or 5 with small, triangular to tear-dropped shaped outlines and may all be diagnostic Small Point preforms, although some could be preforms for the Lamoka-like points described below.

5.5 Projectile Points

At Ridge Pine 3 there are six projectile points and three small projectile point fragments that were originally classified as bifaces. One fragment, Cat. No. 815 is a base fragment that mends with Cat. No. 69 completing the base for that projectile point, so there are actually eight projectile points represented in the assemblage. The other two fragments are unknown types and are discussed separately in section 5.5.4. Images are in Figure 27. Table 17 is a summary of the key attributes for each projectile point. More detailed tables can be found in Appendix E. Figure 28 shows width/thickness ratios for Cat. Nos. 50, 53, 69+815, 71, 72, and 558 in comparison to points from the Winter (Ramsden 1990), Canada Century (Lennox 1990), AiHc-423 (TMHC 2015a), and AiHc-429 (TMHC 2015b) sites and average width/thickness measurements for Nettling, Kirk Corner-Notched, and Brewerton Side-Notched point types. Figure 29 shows shoulder height/base width ratios for the Ridge Pine 3 points and compares them to points from the Crawford Knoll (Kenyon & Snarey 2002), Innes (Lennox 1986), Winter, Canada Century, AiHc-423, 20BY28 (Cook & Lovis 2014), and 20BY387 (Cook & Lovis 2014) sites. Types represented include Lamoka-like, Brewerton Side-Notched/Feeheley, and a possible Nettling point.

5.5.1 Lamoka-like Points

Cat. No. 69+815, 71, 72, and 558 share a number of features and look the most similar to one another compared to the other two discussed below. All four are made of similar low-quality Onondaga with half of them burnt (Cat. Nos. 69+815 and 558). Cat. No. 71 is the only complete one of the four while the rest are nearly complete. Cat. Nos. 69+815 and 558 are missing their tips and Cat. No. 72 is missing a shoulder. Cat. No. 558 is somewhat different from the other three and will be described after the first three have been discussed. Originally, Cat. Nos. 69, 71, and 72 were classified as Innes type points (TMHC 2012:45-46), but I provide a different conclusion based on my assessment below.

Before describing the projectile point analysis, it should be noted that Narrow Point projectile points are often mistaken with those from the Small Point complex. This thesis argues for a Narrow Point occupation at Ridge Pine 3 while the original site report (TMHC 2012) argued that the site was occupied during the Small Point complex. Accordingly, it is important to compare the Ridge Pine 3 points to both Narrow Point and Small Point sites to support my conclusions, especially given the ambiguity with the classification of Late Archaic point forms and how the complexes relate to one another temporally in the region. The confusion between Narrow Point and Small Point projectile points also ties in with Lovis' (2009) ideas about continuity in the Late Archaic point forms and suggests that there may be more overlap between the Narrow Point and Small Point complexes than originally thought. For example, Lovis (2009:736) argues that Dustin points, which have been seen as Lamoka correlates and are narrow in width, form part of a size continuum with Small Point projectiles. This may help explain why Narrow Point projectile points are often confused with Small Point ones.

In order to take into account the confusion among Late Archaic projectile point types, the Ridge Pine 3 points were subjected to both quantitative and qualitative assessments. A scatterplot was created for the Ridge Pine 3 projectile points based on width vs. thickness as they were the metrics with the most complete measurements (see Figure 28). The four Lamoka-like points all cluster together nicely, which supports the conclusion that they are all the same type. Another was created based on shoulder height and base width (Figure 29). This one deals with measurements from the diagnostic base which tends to have less reworking than the blade. Again, Cat. Nos. 69+815, 71, 72, and 558 all cluster together along with Cat. No. 53. Cat. No. 50 has an incomplete base with incomplete measurements resulting in its exclusion in the graph.

To help determine what point types Cat. Nos. 69+815, 71, and 72 are most similar to, Euclidean distances were calculated to compare the Ridge Pine 3 points with typed points from other relevant sites. Cat. No. 558 was not included in the calculations as it is a reworked projectile point, as described later in this section, and the reworking would have skewed the calculations which were based on measurements from the points. Based on the scatterplots (Figures 28 and 29), Cat. No. 558 does cluster with the other three Ridge Pine 3 points, so the Euclidean distance results can be safely extrapolated to Cat. No. 558 as well.

Appendix F shows the data tables from calculating the Euclidean distances (ED) and describes what was done for any missing measurement variables. Based on the results in Appendix F, the Ridge Pine 3 points are most similar to the Narrow Point AiHc-423 site (ED = 31.13) in Kitchener, followed by the "narrow point" 20BY28 (ED = 34.01) and 20BY387 (ED = 35.82) sites near Saginaw Bay, Michigan, the Narrow Point

AiHc-429 site (38.85) near Kitchener, and the Small Point Innes site (ED = 38.95) near Brantford. The Narrow Point Canada Century (ED = 51.97) and Winter (ED = 52.27) sites, and the Small Point Crawford Knoll (ED = 70.03) site are least like the Ridge Pine 3 points. Compared to other Narrow Point sites, Canada Century and Winter have greater Euclidean distance measures in relation to Ridge Pine 3. This is likely due to sample size and point variety. Both of these sites have small sample sizes at three mostly complete or complete projectile points for each site and there is great variability in their sizes within the Lamoka ranges (Lennox 1990:43). Both of these would result in greater Euclidean distances as the size variability would affect the averages calculated and the small sample sizes result in less data to compare to Ridge Pine 3.

While the Ridge Pine 3 points are mostly similar to Lamoka points from Narrow Point sites, the Innes site points are similar to them as well. Again, this shows the similarity between Narrow Point and Small Point projectile points. Since the Ridge Pine 3 point metrics are similar to the Innes site points, though to a lesser degree than Lamoka points from both southwestern Ontario and similar forms from Michigan, a consideration of qualitative characteristics was needed to draw a conclusion. After morphologically comparing the Ridge Pine 3 points to both Lamoka and Innes types, described below, it was determined that their characteristics were more representative of the Lamoka type.

The Lamoka type is characterized as a small, narrow, and thick form with convex to straight blade edges, expanding to straight stems, sloping shoulders, weak to moderately pronounced side notches, convex to oblique to straight base shapes, and lenticular to diamond-shaped cross section (Justice 1987:127; Ritchie 1971:29). All four Ridge Pine 3 Lamoka-like points have weak side notches with sloping shoulders, random flaking patterns, and expanding stems. Most of them have lenticular cross sections, convex blade edges, and convex base shapes with a couple of exceptions. Cat. No. 71 has a plano-convex cross section rather than lenticular, Cat. No. 69+815 has a diamond cross section rather than lenticular, Cat. No. 72 has a biconcave base shape rather than convex, and Cat. No. 558 has straight blade edges rather than convex. Cat. No. 72 also has an alternately bevelled blade tip from resharpening of the blade. Lamoka points tend to be made on local materials, and these four points are made on local Onondaga materials

(Ritchie 1971:30). Although these four points are not easily classified, a problem noted in the site report (TMHC 2012:45), in my view they are most similar to the Lamoka type.

The only feature they do not share with the Lamoka type is an unfinished base with an unflaked surface, resulting in a haft element as thick as the blade (Justice 1987:127). All four points have finished bases, although the base of Cat. No. 72 is irregular and crudely finished, and while this feature is considered diagnostic of this type, finished bases do occur within the type (Justice 1987:127, 129). For example, in the AiHc-423 report (TMHC 2012:18) discusses the mix of worked and unworked bases on the Lamoka points from the site.

The Innes type is a medium-sized projectile point with "convex lateral blade edges, slightly sloping to slightly barbed shoulders and an expanding base stem with a convex to straight basal edge" (Ellis et al. 1987:13). Based on outline drawings provided by Kenyon (1989:Figure 2a), the four Ridge Pine 3 points are similar to the Innes type, however there are some key differences. Some of the Innes points have more outflaring and better-defined shoulders and some are slightly barbed. Cat. Nos. 69+815, 71, 72, and 558 all have weak side notches with slightly expanding shoulders that are also not well-defined, which fits better with the Lamoka type description. None of these Ridge Pine 3 points have barbed shoulders either. They are also larger than most of the Innes ones illustrated by Kenyon (1989) which is a quantitative characteristic that was considered in the Euclidean distance calculations.

Based on metrics and morphological features, it can be concluded that all four are Lamoka-like types. Dates associated with this point type range from ca. 5000 cal BP (4500 RCYBP) to 4100 cal BP (3800 RCYBP) (Ellis et al. 2009:812; Justice 1987:129).

Cat. No. 558, one of the burnt Onondaga points, fits the Lamoka type metrics and characteristics. Unlike the other three, it has evidence of reworking (see Figure 30). The left lateral edge has step fractures present all the way along until the break where the tip is missing. This reworking has created a thin, straight, sharp edge with use-wear features present including close/continuous microflakes, edge rounding, striations, and cracks. This pattern indicates use of this edge while the right lateral edge only has cracks present.

The reworked left lateral edge has an angle of 25 degrees while the right lateral edge has an angle of 40 degrees. It appears that Cat. No. 558 is a Lamoka-like type projectile point with evidence of reworking to create a sharp knife edge making cutting a likely primary function in its use-life prior to being left behind at Ridge Pine 3. With only the left notch present, it is possible that Cat. No. 558 was not a finished Lamoka-like point before being reworked into a knife, or that it simply exhibits the weak notching that seems to be a trait of the Ridge Pine 3 Lamoka-like points. Cat. No. 558 demonstrates the multifunctionality of the projectile point category, which is a purely morphological term and only describes one possible function of this tool type (Andrefsky 2005:203-205).

The width/thickness ratios of the four Lamoka-like types resulted in a CV of 10.33%. This is an even smaller CV than the biface stages 2 to 4 which makes sense for a finished form. Eerkens and Bettinger (2001:Table 1) provided the average CV for Great Basin projectile points, which was 22%. The four Lamoka-like points at Ridge Pine 3 have a CV of half that showing a high degree of standardization. Despite the poor quality of the Onondaga chert used, the variability between points is quite low and visually they look very similar to one another. Similar to the bifaces discussed in section 5.4.4, this indicates that a low number of people with high skill levels may have knapped these finished forms, possibly one or two people when considering the small size of the site and the likelihood that only one or two families resided there.

5.5.2 Brewerton Side-Notched/Feeheley Point

Cat. No. 53, a complete projectile point, is made of a similar quality Onondaga chert as the four Lamoka-like points. Morphologically, this point has many of the same features as the Lamoka-like points including convex blade edges and base shape, a weak side notch, expanding stem, and similar length and thickness measurements. The difference between those points and this one is that Cat. No. 53 is noticeably broader than the other four as well as having one corner and one side notch present.

Based on morphological characteristics and metrics, Cat. No. 53 is classified as a Brewerton Side-Notched/Feeheley point. Brewerton Side-Notched points are thick and broad-bladed with the distinctive feature of very wide shoulders that extend beyond the basal ears (Justice 1987:115). Other features include trianguloid blade, biconvex cross section, straight to convex blades, straight to convex bases, basal grinding, and the use of local Onondaga chert (Justice 1987:115; Ritchie 1971:16, 19). Corner-notched forms tend to have prominent downward shoulder barbs and more pronounced convex blades, which side-notched forms lack as resharpened variants of the corner-notched form (Justice 1987:115). Although Cat. No. 53 has one corner and one side notch, it also has a convex base, no shoulder barbs, and evidence of resharpening on one of the edges which makes it more similar to the side-notched form. The one missing feature is basal grinding.

In the Figure 28 scatterplot, Cat. No. 53 is separated from the other four Lamoka-like types indicating that it is different than those four. The metrics for the Brewerton Side-Notched form are 20.64 to 98.43 mm in length with the majority at 31.75 to 57.15 mm, and 6.35 to 12.7 mm in thickness with the majority at 7.94 to 9.53 mm, based on the side-notched forms from New York (Justice 1987:248; Ritchie 1971). Cat. No. 53 fits right in the middle of the majority ranges for both. The only width range provided by Justice (1987:248) is from the Mixter site in Ohio (Shane 1975:136) based on four side-points which range from 15 to 24 mm. Conolly (2018:77) provides a Brewerton Side-Notched blade width of 21.4 mm ± 4.4 from measurements of 215 individual points. While this is a larger sample pool, Conolly (2018:76) took the measurements from images of the points so this may have had an impact on the accuracy (Belyea 2019:50). Ritchie (1971:19) states that the side-notched form length is usually 1.25 to 1.5 times the width and Cat. No. 53 is about 1.5 times long (43.1 mm) as it is wide (27.6 mm). The southwestern Ontario projectile point type descriptions give a maximum width range of 20 to 40 mm for Brewerton Corner-Notched points and states that haft elements can include nearly side notched forms like Cat. No. 53 (Ellis et al. 1987:10). This width range was used in the scatterplot (Figure 28) and Cat. No. 53 fits nicely in this range as well.

The nearby Ridge Pine 2 site has 16 Brewerton Corner-Notched projectile points in its collection (Belyea 2019:49). Cat. No. 53 is smaller than the Ridge Pine 2 Brewerton points. Of the seven complete Ridge Pine 2 Brewerton points, the average metrics were 49.68 mm (length), 31.54 mm (width), and 7 mm (thickness) (Belyea 2019:53). While Cat. No. 53 is thicker than the average thickness, the Ridge Pine 2 complete Brewerton

Corner-Notched length and width averages are 6.58 mm longer and 3.94 mm wider than the Ridge Pine 3 Brewerton Side-Notched form. The smaller size of Cat. No. 53 makes sense considering the side-notched form is a resharpened corner-notched form (Justice 1987:115). The presence of Brewerton points at both Ridge Pine 2 and 3 may indicate continuity between the two sites.

The Brewerton points are also morphologically correlated with Feeheley points (Lovis & Robertson 1989:232). The Feeheley point type is not well-established or well-described like other point types because researchers are not sure where to place them in relation to the existing typology, although Justice (1987:116) considers Feeheley to be a Michigan variant of the Brewerton type. The Feeheley site in Michigan provides a radiocarbon date of 3950 ± 150 RCYBP or 4831 to 4069 cal BP (Lovis 2009:12; Lovis & Robertson 1989:228). Morphologically, Cat. No. 53 looks very similar to the Feeheley points illustrated by Lovis (2009:Figure 20.8). Until further research is done on the Feeheley type, it is difficult to determine which variant Cat. No. 53 is most similar to, so it has been classified as a Brewerton Side-Notched/Feeheley projectile point.

The Brewerton Corner and Side-Notched forms are dated to the late Middle Archaic, ca. 6200 cal BP (5500 RCYBP) to 5000 cal BP (4500 RCYBP) (Ellis et al. 2009:806; Justice 1987:115). However, more recent research has revealed later dates associated with the Brewerton type. At the Jacob's Island burial site, none of the radiocarbon dates from the contexts where Brewerton points were found pre-date 5000 cal BP (4500 RCYBP) (Connolly et al. 2014:120). Similar to Lovis' (2009) arguments that the Late Archaic complexes may overlap more than we currently believe, the Brewerton type may carry on later than we thought and into the Late Archaic. The newer post-5000 cal BP dates may tie in with the date from the Feeheley site and could help shed more light on the Feeheley point type and its relationship to the Brewerton type. Figure 29 also shows Cat. No. 53 clustering with the four Lamoka-like points based on diagnostic base dimensions which could be evidence of continuity between the late Middle Archaic and the Late Archaic. As well, both the AiHc-423 and AiHc-429 sites have Brewerton and Lamoka points present, like Ridge Pine 3, which may mean that the

Brewerton and Lamoka point types and temporal sequences have a closer relationship than previously thought.

The presence of the Brewerton point type, which dates just prior to the Lamoka phase, provides evidence that Ridge Pine 3 does not represent a single occupation but a site with multiple reoccupations. On the other hand, the Feeheley date and the new Brewerton dates from Jacob's Island may indicate that Cat. No. 53 is contemporary with the Lamoka-like points at Ridge Pine 3. This will be further discussed in Chapter 6.

5.5.3 Nettling Point

Cat. No. 50, a midsection/base fragment, is different from the other five projectile points. It is the only one made from Kettle Point chert, is noticeably thinner than the rest, is the only one with slight barbs present at the notches, and the only corner notched projectile point in the assemblage. The edges are also slightly serrated which is different from the other five. Since the base is not complete, a firm conclusion cannot be made as to the type of projectile point it represents because typologies tend to depend on the characteristics of the hafting element of projectile points which are subjected to less reworking than the blade element (Andrefsky 2005:184). Based on what is present, a tentative guess can be made as to the type.

Cat. No. 50 is a corner notched projectile point with straight and slightly serrated edges. While much of the length is missing, the width and thickness measurements taken are likely close to the maximums of the full point. Considering the morphological features and dimensions, Cat. No. 50 is a possible Nettling type. Nettling points display lateral edge serration on about 60% of specimens, are corner notched, trianguloid, and generally thin (Ellis et al. 1987:9). They have a width range of 17 to 35 mm and a thickness range of 4 to 7 mm which Cat. No. 50 fits nicely within. In Figure 28, the midpoint of the width and thickness ranges for the Nettling type were included, and this ideal Nettling type lies close to Cat. No. 50 in Figure 28. The average measurements for the Kirk Corner-Notch type (Coe 1964:69-70) were also included in the graph for comparison purposes as it is similar to the Nettling type. Cat. No. 50 does not match up as well with the average Kirk Corner-Notch width/thickness ratio as it does with the Nettling type which makes Nettling a more likely type candidate for this projectile point.

The other established point type that Cat. No. 50 could be related to is the Crawford Knoll type (Ellis et al. 2009:819; Kenyon and Snarey 2002). Crawford Knoll points are small side-notched to expanding stemmed forms that are sometimes serrated and date to the Late Archaic Small Point period. However, even in its fragmentary state, Cat. No. 50 appears to be larger and better made than most Crawford Knoll points, with scars from well controlled pressure flaking extending across the midline of the biface. Further, the incomplete width of this specimen, at 22.2 mm, exceeds the maximum width range for the Crawford Knoll type (Table 17). Therefore, it seems unlikely that Cat. No. 50 is a Crawford Knoll point.

Assuming that Cat. No. 50 is likely a Nettling point, this may indicate that there is an Early Archaic occupation at the Ridge Pine 3 site, further supporting the idea that the Ridge Pine 3 site is a multi-component site. This point type is part of the Corner-Notched Horizon within the Early Archaic and dates to ca. 11300 cal BP (9800 RCYBP) to 10000 cal BP (8900 RCYBP) (Ellis, Kenyon, & Spence 1990:73). In terms of distribution, Nettling points are found in small numbers in southwestern Ontario, particularly throughout the northwestern Erie drainage basin (Ellis et al. 1987:9). In fact, the Ridge Pine 3 site is about 90 km north of the Nettling site, the first major Early Archaic reported in the Great Lakes region, which is near the northern Lake Erie shoreline (Ellis et al. 1991). It is thought that the Nettling point type, which is named after the Nettling site, is "one of the earliest Archaic styles to reach Ontario" (Ellis et al. 1987:9).

5.5.4 Fragments

In addition to the six projectile points described above, there are two projectile point fragments. These two fragments are presently untyped and further work is needed to determine if they can be typed.

Cat. No. 120 is a tip made of Onondaga chert of similar quality to the four Lamoka-like points. Based on what is present, the blade edges appear to be straight or convex with a random flaking pattern.

The other fragment, Cat. No. 667 is either a midsection fragment near the tip or a base fragment from the stem. It is made of Kettle Point chert with straight and possibly serrated edges and a horizontal transverse flaking pattern. The morphological characteristics present on this fragment are similar to Cat. No. 50, the possible Nettling type. It is possible that Cat. No. 667 is a midsection fragment or a well-worked, small, thin base fragment with straight edges. Due to the small size of this fragment, it is difficult to draw definite conclusions about it.

5.6 Rough Stone Artifacts

Broadly speaking, rough stone artifacts are defined as “any stone item that is primarily manufactured through mechanisms of abrasion, polish, or impaction, or is itself used to grind, abrade, polish, or impact” (Adams 2002:1). Generally, this definition encompasses what rough stone tools are, however it should be noted that there is still some ambiguity in certain cases where rough stone tools are flaked, such as axes or knives, or when flaked lithics are ground for various purposes (Adams 2002:1). Ridge Pine 3 has a total of eight rough stone artifacts including six hammerstones (see Figures 31 and 32) and two rough stone tool fragments (see Figure 33).

Table 18 provides metric and other data on the six hammerstones. In terms of use-wear on the artifacts, there is no flaking present, but all except Cat. No. 49 have evidence of grinding and all six have evidence of pecking or impact fractures. Based on the type of use-wear present, wear mechanisms can be identified to understand how these use-wear patterns were formed (Adams 2014:130). All six hammerstone show fatigue wear which is a crushing mechanism where impact fractures known as pecking or peck marks form usually from percussion activities (Adams 2014:132-133). The five hammerstones exhibiting grinding have abrasive wear where striations or gouges form on the stone’s surface due to movement between two different surfaces (Adams 2014:133). One hammerstone, Cat. No. 4, displays possible adhesive wear which is created when two surfaces come into contact with little to no movement (Adams 2014:132). The most common example of this is when hand oils are left behind on a stone where it was held. The purple staining that covers both ends and one of the faces for this hammerstone may be a result of being held in that spot or a chemical reaction between the materials being worked and the hammerstone's surface. Cat. No. 4 is also the only hammerstone that may show evidence of tribochemical wear via the purple staining. This wear mechanism is the combination of adhesive, abrasive, and fatigue wear on a surface creating chemical reactions that allow for films and oxides to buildup on the surface (Adams 2014:133).

Cat. No. 54, the burnt hammerstone, has two pits present on one of the faces. The pits have sharp margins and generally unform impact fractures that are rough. These may stem from pecking, possibly from nut cracking or bipolar technology (Odell 2004:79).

Cat. No. 500 and 700 are both rough stone tool fragments made of slate. Cat. No. 500 is a nearly complete backed or handheld knife. The modification, convex and serrated in shape, is on the ventral face of the distal and left lateral edges and is 95.9 mm in length with a 45 to 50 degree edge angle. The modification encompasses about half the perimeter of the tool. The retouch is linear and uniform, a distinguishing feature of a knife, and use-wear is present in the form of microflakes, edge rounding, and striations.

Cat. No. 700, made of burnt slate, is also a knife though the type is unknown as only the blade is present. The modification, straight and serrated in shape, is on the ventral face of the left lateral edge. The modification length is 53.6 mm and use-wear is present in the form of edge rounding, minor striations, and minor microflakes.

5.7 Non-Chert Detritus

Non-chert detritus is debitage of non-chert materials such as quartzite and slate. The original Stage 4 report for Ridge Pine 3 had separate non-chert detritus and slate categories but both were analyzed the same way and have been combined into one non-chert detritus category. This material was likely produced during the manufacture of rough and rough stone tools (i.e. slate knives, celts, etc.). A total of 96 non-chert debitage pieces were looked at and two were reclassified from debitage. They were analyzed the same way as the debitage, described in Section 5.1.

Of the 96 pieces of non-chert detritus, 14 were made of quartzite (14.58%), 48 were burnt (50.00%), and 34 were made of an unknown non-chert material (35.42%). Figure 34 shows a breakdown of the flake types present in the non-chert detritus. As with the debitage sample analysis, fragmentary flakes are the most represented in the non-chert detritus at 38.54% (n=37). However, unlike the chert debitage, flakes associated with early-stage reduction are more common than late-stage reduction flake types. Primary (n=12), secondary (n=20), and tertiary (n=7) flakes together make up 40.62% of the non-chert detritus. Biface thinning flakes, a late-stage reduction flake type, represents 19.79% (n=19). There is one piece of shatter (1.04%).

Figure 35 shows the termination types represented in the non-chert detritus. The numbers here reflect the numbers found for the debitage sample. Feather terminations are the highest representation at 46.88% (n=45) followed by step terminations at 43.75% (n=42). Hinge terminations only account for 8.33% (n=8) and unidentifiable terminations make up 1.04% (n=1) of the non-chert detritus. Again, we see evidence of higher level flintknapping with the high frequency of feather and low frequency of hinge terminations especially considering that chert materials are easier to flake than non-chert materials.

Two (2.08%) non-chert detritus pieces are modified. One piece from Cat. No. 730 has modification on the dorsal face of the distal edge with edge rounding and microflakes present on the worked edge and is quite worn. Another piece (Cat. No. 782), broken in two, has modification on the ventral face of the right lateral edge. The modification is a notch, possibly created through abrasion, with edge rounding and striations present. The used edge is lighter in colour possibly from being in contact with another material.

5.8 Other

5.8.1 Fire Cracked Rock

A total of 278 pieces of fire cracked rock were kept from the Stage 3 and Stage 4 excavations at Ridge Pine 3. According to the report, 5208 pieces were discarded during the Stage 4 excavation (TMHC 2012:61). Of the 278 kept pieces, four came from Feature 3. A total of 189 pieces of fire cracked rock appears to be missing as they were not in the boxes of artifacts provided by TMHC. They may have been discarded during artifact processing. The 89 pieces that are present weigh 1648.41 g combined, for an average of 18.52 g. The quantity of fire cracked rock provides evidence of the use of hearths/fire on the site and the use of these rocks for stone boiling or as a heat source (TMHC 2012:61).

5.8.2 Faunal Remains

Two small burnt fragments of animal bone were found in the Stage 3 and 4 excavations of Ridge Pine 3. Cat. No. 16, from unit 2000N 485E:5 in the Stage 3 excavation, has been identified as a mammal bone. Cat. No. 419, from unit 2000N 485E:17 in the Stage 4 excavation, has not been identified to class. The specimens are too small for further classification or for radiocarbon dating.

Features 2 and 3 also had fragmentary pieces of bone recovered from the paleoethnobotanical analysis. Feature 2 had 11 pieces of bone weighing 0.08 g in total. Feature 3 had one piece of bone weighing less than 0.01 g. Fragmentary bone pieces recovered from features 2 and 3 were all too small for any species identification.

5.8.3 Recent Material

One intrusive piece of black plastic was found during the Stage 4 excavations.

5.9 Features

There are four features at the Ridge Pine 3 site. The original report (TMHC 2012) listed only three features with Feature 4 being redesignated as a natural subsoil stain. I have chosen to accept the original identification of Feature 4 as a feature as there are artifacts, paleoethnobotanical materials, and AMS dated wood charcoal from that feature. The contents of each feature are described below.

5.9.1 Feature 1

Feature 1 is located in unit 2000N 495E:9 on the east side of the site (Figure 44). It is an ovate pit (80 cm long, 66 cm wide, 12 cm deep) with fill consisting of black, organic clay loam (see Appendix G) (TMHC 2012:39). A fill sample was taken and processed by flotation resulting in heavy and light fractions (see Chapter 4 for results).

Feature 1 has 27 artifacts including 24 pieces of debitage, one non-chert detritus, one retouched flake, and one knife. Kettle Point chert (including burnt Kettle Point) dominates the 27 artifacts making up 55.56% (n=15) of the feature assemblage. Unknown burnt materials make up 22.22% (n=6), Onondaga chert comes in at 18.52% (n=5), and non-chert materials make up 3.70% (n=1) of the feature.

For the 24 pieces of debitage, Kettle Point again dominates representing 54.16% (n=13) including burnt Kettle Point. Unknown burnt materials make up 25.00% (n=6) and unburnt Onondaga chert makes up the remaining 20.83% (n=5). Unlike the overall debitage sample analysis, Kettle Point is the dominant chert type for this feature's debitage. In terms of flake types, biface thinning flakes are the most represented at 58.33% (n=14) and fragmentary flakes come in second at 33.33% (n=8). Secondary and bipolar flakes each represent 4.17% (n=1) of the debitage in Feature 1. This mirrors the site-wide debitage sample analysis with high numbers of late-stage reduction debris, low numbers of early-stage reduction debris, and a high number of fragmentary flakes. For termination types, step terminations are most common at 41.67% (n=10) followed by feather at 37.50% (n=9), hinge and plunging at 8.33% (n=2) each, and axial at 4.17% (n=1). Again, we see similar trends in the termination types in Feature 1 that are seen in the site-wide debitage analysis, with high numbers of feather and step terminations and lower numbers of hinge, plunging, and axial terminations.

The single piece of non-chert detritus is a secondary flake of unidentified material with a hinge termination. The retouched flake, Cat. No. 98, is made of Kettle Point chert and has retouch on the ventral face of a lateral edge. Length of retouch is 12.4 mm, length in terms of continuous flakes is 8, and maximum height of modification is 2.0 mm.

The knife, Cat. No. 141 (Figure 36), is also made on Kettle Point chert. It is a complete hafted knife made on a tertiary flake with a plano-convex cross section. Modification is on the dorsal face of the right lateral edge and is straight with use-wear present on the edge. The blade length is 29.8 mm, and the haft length is 20.6 mm. The right lateral edge has a notch below the blade and the left lateral edge has retouch along the edge likely for hafting purposes.

5.9.2 Feature 2

Feature 2 is located in the western half of unit 2000N 490E:3 just south of the center of the site (Figure 44). It was a shallow ovate depression (49 cm long, 43 cm wide, 10 cm deep) filled with light grey sandy loam on top of mottled brown clay has a (see Appendix G) (TMHC 2012:39, 41). It was interpreted as a refuse-filled depression (TMHC 2012:39). A fill sample was taken and processed by flotation resulting in heavy and light fractions.

Feature 2 has 14 artifacts all of which are debitage. Kettle Point and Onondaga are the only cherts present at 28.57% (n=4) and 71.43% (n = 10) respectively. Unlike Feature 1, Onondaga dominates this feature, like the debitage sample analysis. There are a variety of flake types in Feature 2 including fragmentary (n=5, 35.71%), biface retouch (n=4, 28.57%), primary (n=1, 7.14%), secondary (n=1, 7.14%), tertiary (n=1, 7.41%), shatter (n=1, 7.14%), and uniface retouch (n=1, 7.14%). Again, later-stage reduction makes up the majority of the debitage in Feature 2 however there are more early-stage reduction flakes represented here than in Feature 1. Termination types for Feature 2 include feather (n=8, 57.14%), step (n=5, 35.71%), and unidentifiable (n=1, 7.14%). Like Feature 1 and the debitage sample analysis, feather and step are the most represented.

5.9.3 Feature 3

Feature 3 is located in the eastern half of unit 2000N 490E:3 directly beside Feature 2 (Figure 44). It was a shallow circular pit (85 cm, long, 72 cm wide, 10 cm deep) filled with the same soils as Feature 2 (see Appendix G) (TMHC 2012:39). There are also two tree root intrusions in this feature. A fill sample was taken and processed by flotation resulting in heavy and light fractions.

Feature 3 contains 70 pieces of debitage and 21 fire cracked rocks of which only four were kept. The four remaining pieces of fire cracked rock weigh 13.70 g together. For the material types of the debitage, Onondaga is the most represented at 41.43%

(n=29) for burnt and unburnt. Kettle Point follows closely at 37.14% (n=26) including the burnt pieces, and unknown burnt materials represent 21.43% (n=15) of the debitage. Unlike Features 1 and 2 where either Kettle Point or Onondaga dominates the debitage, Feature 3 shows a relatively even representation of both chert types.

There are six flake types represented in the 70 pieces of debitage. Fragmentary flakes are the highest at 42.86% (n=30) followed by biface thinning flakes (n=23, 32.86%), biface retouch flakes (n=8, 11.43%), and secondary, tertiary, and shatter at 4.29% (n=3) each. Like the other two features and the debitage sample analysis, we see a higher representation of late-stage reduction flakes and a high number of fragmentary flakes. Termination types include feather (n=34, 48.57%), step (n=29, 41.43%), hinge (n=3, 4.29%), unidentifiable (n=3, 4.29%), and plunging (n=1, 1.43%). These frequencies are following the trends noted in the other features and the debitage sample analysis.

5.9.4 Feature 4

Feature 4 is located in units 2000N 490E:24 and 25 just northeast of the center of the site (Figure 44). It was an ovate feature (10 cm deep, 111 cm long, 61 cm wide) with dark brown organic clay fill (see Appendix G) (TMHC 2012). A fill sample was taken and processed by flotation, resulting in heavy and light fractions.

There are 12 artifacts from Feature 4 including 11 pieces of debitage and one biface fragment. The biface is a midsection fragment made from Onondaga chert with cortex present. It is a fairly small fragment so not much can be said about it except that it appears to be a stage 3 biface produced from a flake blank and appears to be refined.

The debitage is mostly Onondaga chert, both burnt and unburnt, representing 63.65% (n=7) while the rest are unknown burnt materials at 36.36% (n=4). The flake types include fragmentary (n=5, 45.45%), biface thinning (n=2, 18.18%), biface retouch (n=2, 18.18%), secondary (n=1, 9.09%), and tertiary (n=1, 9.09%) which follow previously noted trends. Termination types are represented by feather (n=7, 63.64%), step (n=3, 27.27%), and hinge (n=1, 9.09%) following previously noted trends.

This feature is interesting because it may represent a single biface manufacture episode related to the thinning of the biface during the Stage 3 reduction. The identified chert from the debitage, Onondaga, matches the biface material. The flake types are mostly late-stage reduction flakes coming from mid- to late-stage biface reduction which lines up with the stage of the biface fragment. The possible representation of early-stage reduction indicated by the secondary and tertiary flakes may be attributed to the fact that a major identification factor for these two flakes is the presence of cortex. The biface fragment has cortex present, and this would be reflected in the flakes removed even at stage 3 in the process. It is possible that the biface was in the process of being manufactured but broke before completion, which would explain why it was not completed and why biface thinning flakes and biface retouch flakes are equally represented. Stage 3 is seen as the biface thinning stage which would require biface thinning and biface retouch flakes to be present for such a flintknapping episode. The termination types, with feathered as the most represented, may also be an indication that the flintknapper working on this biface had experience and a high skill level.

5.10 Intrasite Spatial Analysis

Following the lithic assemblage analyses, an intrasite spatial analysis was conducted. Before delving into the spatial analysis of Ridge Pine 3, it is important to note that the site has multiple occupations based on the presence of diagnostic tools from multiple time periods. This results in a site where successive activities from various occupations are superimposed (Bailey 2007:203). To take these multiple occupations into account, I am looking at the Ridge Pine 3 site as a spatial palimpsest. This macroscopic approach views the site as one single data set, essentially condensing the multiple occupations into a single episode, while also looking for indications of past peoples beyond the inferred site date (Bailey 2007:207). For Ridge Pine 3, this means looking for indications of occupations outside the Late Archaic Narrow Point complex (Lamoka) occupation, which may have occurred before or after the Narrow Point occupation, such as possible Early and Middle Archaic occupations, blurring the spatial patterns from the Narrow Point occupation. The tool kit at Ridge Pine 3 shows a primarily bifacial tool production strategy as well as a focus on producing flake tools from cores which matches the general tool kit composition of the Late Archaic (Cowan 1999:Figure 2, 604).

Post-depositional modifications at the site can alter the spatial patterns of the artifact distribution. Compared to Ridge Pine 1 and 2, Ridge Pine 3 appears to be less disturbed based on the widely fluctuating artifact densities which would have been homogenized with extensive ploughing (TMHC 2012:37). The property is a wooded area with most of the trees being small secondary growth and very few large trees, so it is likely that the land was cleared in the past (TMHC 2012:5). As well, soil profiles look quite homogenous which is expected for a ploughzone soil layer. Aerial photos from 1954 show the property is still wooded at this time. However, it is likely that the secondary growth trees were around 20 to 30 years old during excavation so it is possible that land clearing may have occurred post-1954 leaving time for forest regrowth prior to excavation of the sites (Peter Timmins personal communication 2021). So, there was likely minimal plough disturbance but not to the degree seen at Ridge Pine 1 and 2.

Figure 37 shows a map of the artifact distribution at Ridge Pine 3 and the six clusters I visually identified based on high density concentrations. Detailed data tables on each of the identified clusters can be found in Appendix H. Clusters were identified based on groupings of individual units with at least 100 artifacts in each one and feature locations. Units with less than 100 artifacts were not included in the clusters except for Cluster 5, because it is isolated from other clusters and to include tools around the two high density units, and Cluster 6 because the debitage sample did not include the single high-count unit for that cluster so it was expanded to include three units analyzed surrounding the 100+ artifact unit. High density areas of flakes are interpreted as possible discrete flintknapping episodes where cores are reduced during a single flintknapping event to generate many flakes at one time (Clark 2019:1019-1021). From these high-density flake areas, flakes are picked up and moved around the site to be modified or used as is to complete certain tasks (Clark 2019:1020). Based on ethnographic research, it is often not the knapper who picks up and moves the lithics and it is possible that long time intervals may have occurred between the original flintknapping episode and the removal of flakes due to the multiple occupations at Ridge Pine 3 (Clark 2019:1021).

Cluster 1, or the northwest cluster, is one of the two highest artifact concentration clusters. The northwest corner of this cluster has about double the representation of primary, secondary, and tertiary flakes as the aggregate debitage sample indicating increased early-stage or core reduction activities in this area. Biface thinning flakes are lower than the aggregate sample in this area which makes sense with the increased early-stage representation and indicates less late-stage reduction or biface manufacture. The east edge of Cluster 1 (Unit 2005N 490E:7) has a slightly higher representation of early-stage/core reduction than the aggregate sample as well as late-stage reduction or biface manufacture present in similar frequencies to the aggregate sample. The southern portion shows a decrease in early-stage reduction activities and a focus on late-stage reduction and biface manufacture. Cluster 1 is very Onondaga dominant (n=2192, 91.22%) with some Kettle Point (n=123, 5.12%), more so in the southern portion of the cluster.

Figure 38 shows the tool types present in Cluster 1. This cluster has a high number of discarded bifaces and scrapers possibly indicating use or manufacture of these tools in this area. The high frequency of cores links with the idea that early-stage/core reduction occurred in this cluster. There are diverse tool types represented in low numbers in Cluster 1, likely because the higher numbers of debitage in this cluster would allow for the manufacture of a variety of tools. Utilized flakes are also well represented.

Cluster 2, which contains Feature 4, is the other very high artifact concentration on the site. Generally, this cluster shows equal or less representation of early-stage/core reduction than the aggregate sample and an increase in late-stage and biface manufacture debris. There is more fire use evident in this cluster as the frequency of burnt chert materials are higher than the aggregate sample, particularly in the middle of the cluster. This may be an indication that Feature 4 is a heat related feature or that fire use occurred in this area of the site. Onondaga (n=688, 57.62%) is again the dominant chert, however there is more Kettle Point (n=249, 20.85%) present than in Cluster 1.

Figure 39 shows the tool types present in this cluster. There are a high number of bifaces perhaps indicating a biface manufacture or biface use area as well as a diverse number of tools in low frequencies like Cluster 1. Unlike Cluster 1, there are no scrapers present which may be a significant pattern if the presence of scrapers can be taken as evidence of hide or woodworking. Notably, there are also two projectile points in Cluster 2, while there were none recovered from Cluster 1. The smaller number of cores in this cluster agrees with the interpretation that this is a predominantly a late-stage reduction and biface manufacture area, while Cluster 1 shows a mix of biface and early-stage/core reduction. Utilized flakes are high in frequency for this cluster too.

Cluster 3 corresponds to the locations of Features 2 and 3. It contains late-stage reduction and biface manufacture flakes in frequencies that are about equal to the aggregate sample. Early-stage/core reduction flakes are lower than the aggregate sample. Unlike Clusters 1 and 2, Kettle Point chert (n=620, 78.98%) is dominant especially in the western portion of the cluster, though Onondaga (n=116, 14.78%) is still present. The features are both Onondaga dominant, however, Feature 3 is nearly equal in Onondaga and Kettle Point chert. Figure 40 shows the tool types for this cluster. Like Cluster 2, Cluster 3 is a possible biface manufacture/use cluster with other tools manufactured or used and deposited there in low numbers. Flake types in this cluster are mostly biface thinning flakes and biface retouch flakes. Again, lots of utilized flake are represented showing the importance of expedient tools in the Late Archaic toolkit. Fewer cores are present compared to Cluster 1, which supports the idea that this cluster is for late-stage reduction and biface manufacture. The higher representation of Kettle Point chert may indicate that more of the Kettle Point bifaces and tools were made in this area of the site.

Cluster 4 encompasses Feature 1 and is like Cluster 3 with equal or less early-stage reduction representation compared to the aggregate sample and increased evidence of late-stage or biface manufacture. Kettle Point chert (n=118, 50.86%) is dominant in this cluster with Onondaga (n=92, 39.66%) present as well. Burnt materials are higher than the aggregate sample in this cluster so the use of fire may have been more common in this cluster as well. Figure 41 shows the tool types present in the cluster. Cluster 4 has the highest concentration of projectile points, all of which are the Lamoka-like type, and the flakes present support the importance of biface manufacture activities, including manufacture or retooling of projectile points. The locations of hafted tools at a site do not represent where they were used but where they were retooled or replaced in hafts (Keeley

1991:259). So, this may be an activity area focused on the resharpening, rehafting, or retooling of projectile points as well as the manufacture of other tools in low numbers. The fact that the Lamoka-like point reworked into a knife is in this cluster is further evidence that this is likely a rehafting/retooling/resharpening activity area. However, hafts are usually made from organic materials, so it is difficult to definitively conclude that rehafting occurred here. Biface frequencies are low in Cluster 4 compared to the first three clusters discussed above, which may be another indication that the focus is on projectile points in this cluster. Cluster 4 has the second highest number of cores after Cluster 1, but core reduction is low in terms of primary, secondary, and tertiary flake representation. It may be that the cores here were first subjected to early-stage reduction elsewhere on the site or at the outcrop extraction location and moved to this area for further late-stage reduction here. Again, utilized flakes are plentiful in Cluster 4.

Cluster 5, the most easterly cluster, is interesting because it is the only cluster that is isolated and has a discrete boundary separating it from Cluster 4 where no tools are present in the area between the two. There is not much evidence of early-stage/core reduction in this cluster with primary, secondary, and tertiary flakes combined representing about 10% less than in the aggregate sample. Biface manufacture and late-stage reduction debris is present in this cluster at a slightly higher representation than the aggregate sample. This area of the site is largely Kettle Point dominant (n=247, 98.41%). Figure 42 shows the tool types present in this cluster. Mostly expedient tools are present, such as utilized flakes and retouched flakes, while formal tools are low in number. All tools and the core are also made from Kettle Point chert, matching the flakes from this area. The low frequency of early-stage reduction flakes lends support to the idea that the Kettle Point cores may have been reduced at the primary outcrops before being further knapped in this cluster resulting in high frequencies of late-stage reduction to create some of the tools deposited here, although it is understood that the location of tool discard may not coincide with the location of manufacture. The hammerstone present, Cat. No. 54, has two pits on its surface and is a possible pecking stone.

Cluster 5 is an activity area with a focus on expedient tools to complete tasks that require a lot of cutting tools. The discrete boundary around the cluster as well as the presence of various cutting tools may indicate that this cluster was used for food/animal processing and kept away from the rest of the site for that purpose. Kooyman (2006:427) explains that animal/food processing areas often have less permeable and flexible boundaries, meaning that they are concentrated in one area of the site with less people allowed to cross the "threshold" into this space. The lack of faunal remains from the site means that this speculation cannot be confirmed, but it remains a possible inference for this isolated cluster on the eastern edge of the site.

Cluster 6, the south cluster, is a bit set back from the high-density areas, like Cluster 5, however the boundary is not as discrete with a couple of tools connecting it to Cluster 3. Late-stage reduction flakes are present in this cluster while there is a low incidence of early-stage/core reduction. It is again a Kettle Point (n=37, 78.72%) dominant cluster with a higher incidence of burnt materials than the aggregate sample. It is likely that fire use was conducted nearby or in the cluster. Figure 43 shows the breakdown of the tool types in this cluster, all of which are made on Kettle Point chert. This is the only cluster with no bifaces present. It is the lowest artifact and debitage count cluster with a general lack of formal tools except for one knife. This is possibly an activity area where tasks that mainly expedient tools can be used to complete is the focus.

The boundary between Cluster 6 and Cluster 3 (Units 1995N 490E:11, 17, 18, 19) contains a couple of tools, indicating that while Cluster 6 is more isolated than Clusters 1 through 4, it is not as inflexible as the boundary surrounding Cluster 5. Clusters 5 and 6 both contain a high number of cutting tools and knives are present in both. Kooyman's (2006) discussion on food/animal processing areas goes further to discuss primary and secondary processing areas. Primary processing areas, for the initial processing of the food, have low permeability in the boundaries to minimize contamination (Kooyman 2006:427). Secondary processing involves small, moveable portions of the food and can have more flexible boundaries with activities conducted nearby, as contamination is less of an issue (Kooyman 2006:427). It is possible that Cluster 5 may represent a primary processing location while Cluster 6 is a secondary processing location for food, however this is difficult to confirm with a lack of floral and faunal remains.

Based on this intrasite spatial analysis, some general patterns can be noted. In terms of raw material types, Onondaga is dominant in the northwest while Kettle Point is dominant in the southeast and the clusters show that transition with Cluster 1 as Onondaga dominant, Clusters 2, 3, and 4 containing a mix of the two, and Clusters 5 and 6 as Kettle Point dominant. Tool densities tend to correlate with the high-density flake concentrations. Generally in the north, tool distributions cluster around the high-density areas associated with flintknapping episodes while the south and west shows tools more spread out into the low-density areas. This spreading of tools in the south and west could be an indication that social boundaries were more flexible in those areas. Children's play can result in larger artifacts, such as formal tools or cores, to be picked up and moved away from activity areas to the more peripheral areas of the site (Stevenson 1991:273). However, this same spatial pattern may also stem from adults removing tools to low-density areas to perform tasks in peripheral areas of the site (Clark 2019:1020). The north, where we see more high artifact concentrations, may have more rigid boundaries as these likely represent intensive flintknapping episodes which are often reduced by a single flintknapper at a time per core (Clark 2019:1021). These episodes would need more rigid boundaries to allow the flintknapper to concentrate on their tasks as well as keep people safe from flakes flying off or sharp flakes lying on the surface.

Cluster 1 has the highest representation of early-stage reduction debris. The northwest corner of the cluster is likely where early-stage reduction mostly occurred for the Onondaga chert brought to the site. The lack of Kettle Point early-stage reduction flakes in Cluster 1 and low numbers across the site may be due to early-stage reduction occurring during extraction at the outcrops before being brought to Ridge Pine 3.

Looking at the distribution of specific tool types in Figure 44, scrapers primarily cluster in the northwest area of the site in the high-density concentrations there as well as a smaller cluster in the southeast in and near Clusters 4 and 5. These could be specific areas for using the scrapers, possibly for preparing hides. Seven of the eight end scrapers are in or on the periphery of Cluster 1 while the last one is located just outside of Cluster 4. End scrapers are believed to be hide-scraping tools which is further evidence for hide preparation in the northwest part of the site (Ellis et al. 2009:823).

Bifaces mostly cluster around the high-density areas along with a high number of biface thinning flakes indicating that these may be manufacture locations. To the west, there are a few bifaces isolated in low-density areas where they may have been moved to for completing tasks in areas with less debris. Cores also tend to cluster around the high-density areas where they were intensively reduced. They are also spread out across low density areas particularly to the west and south which may be due to children playing with the cores or to use/generate flakes in low-density areas for various tasks. Between Clusters 1 and 2 there is a cluster of the Brewerton/Feeheley point, a projectile point fragment, and a Lamoka-like point which may indicate another rehafting area like in Cluster 4.

The possible Nettling point is in a low-density area just west of Cluster 3. If this point represents an Early Archaic occupation, it is possible that the spatial patterns created by that occupation have been erased or blurred by subsequent occupations. It may also have been moved from its original location by children playing with the tools left behind by previous groups, if children were present at Ridge Pine 3. The debitage units analyzed around the point are Kettle Point dominant which may indicate that the area does in fact represent an early occupation period as the debitage chert matches the point's chert. However, the erasure or blurring of spatial patterns due to multiple occupations makes it difficult to confirm that an early occupation activity area was located here. As well, it is located about 4 to 5 m west of features 2 and 3 so it is likely not associated with any potential radiocarbon dates from those features.

The locations of diagnostic points in relation to features is shown in Figure 44. Cat. No. 72, a Lamoka-like point, is located in Cluster 2 and Cat. No. 53, a Brewerton/Feeheley point, is between Clusters 1 and 2. Cat. No. 72 is in the same unit as Feature 4 and Cat. No. 53 is about 2 to 3 m southwest of that feature. Either of these points may be associated with the Feature 4 radiocarbon date (see section 5.11) or they may both be associated with it. Cat. No. 53 is also about 3 to 4 m northwest of features 2 and 3. The other three Lamoka-like points, Cat. Nos. 69+815, 71, and 558 are all around Feature 1. Cat. No. 667, a midsection or base fragment, is in Cluster 3 right beside features 2 and 3. Cat. No. 120, a point tip, is in Cluster 2 near Feature 4.

Turning to mended artifacts from different units as depicted in Figure 45, the two halves of the scraper-knife are on the outskirts of two different clusters, Clusters 1 and 3 (shown by the black line in Figure 45), which may indicate that these are contemporary clusters (Deller & Ellis 1992:101). In Cluster 1 in the northwest, two pieces of a biface mend. One is in the northeast portion, and one is in the southern portion indicating that the various high artifact count locations within the cluster may be contemporary. Two pieces of a biface from Clusters 2 and 3 respectively also mend (shown by the centrally located white line) possibly showing that these areas may be contemporary as well (Deller & Ellis 1992:101). The last mended artifact (shown by the light blue line) is in Cluster 4 which is a Lamoka-like projectile point mend from separate units.

5.11 Radiocarbon Dating

Six organic samples from the paleoethnobotanical analysis were sent to the AEL AMS Laboratory affiliated with the University of Ottawa for radiocarbon dating. This analysis was conducted to supplement the typological analysis which, due to the fluid nature of lithic tool use and stylistic change, can be complicated and sometimes problematic in assigning a date (Belyea 2019:43). Samples of nutshell and wood charcoal from features 1, 3, and 4 were sent in. Table 19 details the samples submitted, and the corresponding dates received from the lab.

The dates of the two nutshell samples (Cat. Nos. 30A, UOC-15546 and 30B, UOC-15547) from Feature 1 make them modern intrusions. The wood charcoal sample (Cat. No. 30C, UOC-15766) also confirms this. Feature 1 is likely a modern intrusive feature and the artifacts found within it are likely not in primary context. Although the only nutshell samples submitted are modern, that does not mean that the other nutshell fragments in features 2 and 3 are also modern. The collection of nuts to meet subsistence needs may still have occurred at Ridge Pine 3.

Cat. No. 36 (UOC-15767), a wood charcoal sample from Feature 3 dates to 3260 to 3075 cal BP (3005 ± 31 RCYBP). This fits within the Small Point complex, ca. 3800 cal BP (3500 RCYBP) to 2900 cal BP (2800 RCYBP) (Ellis et al. 2009:818), the last

Late Archaic complex and supports the interpretation that Ridge Pine 3 had multiple occupations.

Cat. No. 41A (UOC-15548), a wood charcoal sample from Feature 4 has a date of 4978 to 4844 cal BP (4346 ± 34 RCYBP). This date fits within the time frame of the Narrow Point complex, ca. 5000 cal BP (4500 RCYBP) to 4100 cal BP (3800 RCYBP) and supports the interpretation that Ridge Pine 3 was primarily occupied during the Narrow Point complex of the Late Archaic (Ellis et al. 2009:812; Justice 1987:129). Cat. No. 41B (UOC-15768), another wood charcoal sample from Feature 4, dates to 5081 to 4867 cal BP (4426 ± 44 RCYBP). This date corresponds with the very end of the late Middle Archaic, ca. 6200 cal BP (5500 RCYBP) to 5000 cal BP (4500 RCYBP) and the start of the Narrow Point complex (Ellis et al. 2009:806; Justice 1987:115), confirming the Cat. No. 41A date.

5.11.1 Radiocarbon Dates in a Regional Context

The radiocarbon dates from features 3 and 4 at Ridge Pine 3 can help shed light on the Late Archaic complexes by looking at them with radiocarbon dates from other sites in both the Ausable Valley and Michigan. The calibrated dates for Ridge Pine 3's Feature 4 bracket the age of that feature between 5081 and 4844 cal BP. The calibrated date for Feature 3 from Ridge Pine 3 is 3260 to 3075 cal BP. It should be noted that all the acceptable radiocarbon dates from Ridge Pine 3 are on wood charcoal which may introduce an error due to the "old wood" problem. At the Davidson site, comparison of dates on wood charcoal versus nutshell suggest that the wood charcoal dates are, on average, about 120 years older than the nutshell dates (Ellis et al. in press).

At the Ridge Pine 2 site, about 160 m west of Ridge Pine 3, a single date on the lone feature is 4522 to 4421 cal BP (Belyea 2019:47). This date is younger than the date from Feature 4 at Ridge Pine 3. The dominant component at Ridge Pine 2 is a late Middle Archaic Brewerton occupation, however there is evidence for a Broad Point component as well. So, this 4522 to 4421 cal BP date may relate to the Broad Point occupation as it falls within the range of Broad Point occupations at both the Davidson and Adder Orchard sites as discussed below.

At the nearby Davidson site in the Ausable Valley, analysis of several radiocarbon dates has revealed a cluster of Small Point dates between 3500 and 2900 cal BP (Ellis et al. in press). The Feature 3 date from Ridge Pine 3 fits nicely within this range. As well, a cluster of earlier dates are related to the Broad Point occupation at the Davidson site. They date to between 4700 and 3700 cal BP (Ellis et al. in press). These dates are more recent than the 5081 to 4844 cal BP dates for Feature 4 at Ridge Pine 3, but older than the Feature 3 date.

At the Adder Orchard site, also in the Ausable Valley, four radiocarbon dates yield calibrated age ranges between 4881 and 4313 cal BP (Fisher 1997). These dates fall within the date range for the Broad Point occupation at Davidson, and slightly overlap with the dates on Feature 4 at Ridge Pine 3.

In Michigan, the Broad Point or Satchell complex dates fall between 4130 and 3113 cal BP (Lovis 2009:737). This time range overlaps both the Broad Point and Small Point age ranges in the Ausable Valley.

At the Maquette Viaduct site (20BY387), near Saginaw Bay, Michigan, Dustin points date between 4925 and 4204 cal BP (Lovis 2009:733). This time range overlaps with the dates from Feature 4 at Ridge Pine 3. At the Fletcher-Marquette Viaduct site (20BY28) in Michigan, which also has Dustin points, radiocarbon dates span 4323 to 3947 cal BP (Lovis 2009:732). These dates fall within the Broad Point occupation at the Davidson site but are later than the Ridge Pine 3 Feature 4 dates. Feeheley points at the Feeheley site in Michigan date between 4601 and 4197 cal BP (Lovis 2009:732). This date range is slightly more recent than the dates for Feature 4 at Ridge Pine 3. The original uncalibrated date from the Feeheley site also has a fairly large associated error of ± 150 years (3930 ± 150) (Lovis 2009:732).

This comparison of accepted radiocarbon dates from sites in the Ausable Valley and Michigan shows that the Feature 4 dates from Ridge Pine 3 are likely the earliest Late Archaic dates in the Ausable Valley. They also line up with the early dates for the Dustin points in Michigan. Taking the Michigan Dustin dates into consideration, there is clear overlap between these Narrow Point sites and Broad Point. This ties in with Lovis'

(2009) ideas about the Late Archaic complexes having more overlap in their temporal sequences than previously thought. By pulling together the accepted Late Archaic radiocarbon dates, it shows that reconsideration and reinvestigation is needed into the how the Late Archaic complexes relate to one another both temporally and characteristically. Looking at just these sites shows that there is more overlap occurring between complexes than what is outlined in the current Late Archaic models.

5.12 Conclusion

This chapter discussed the analyses and results of the Ridge Pine 3 assemblage. Debitage, cores, informal tools, formal tools, rough stone artifacts, non-chert detritus, fire cracked rock, faunal remains, and recent materials were all analyzed and discussed. As well, an intrasite spatial analysis was conducted to attempt to understand potential activity areas at Ridge Pine 3. The results of the radiocarbon dating from six samples sent to the AEL AMS Laboratory were discussed. While there are not many preserved floral or faunal remains, the lithic analyses provide valuable information. All these analyses and results help to understand the Ridge Pine site and will be used to answer the three research questions I investigate in the next chapter.

Chapter 6: Discussion

This chapter brings together the research and analyses from previous chapters to answer the three research questions I outlined in Chapter 1. Site comparisons will be included throughout this chapter when necessary to provide more robust answers by drawing on data mainly from the local region and beyond when applicable. By the end of this chapter, the Ridge Pine 3 site will be better understood both as an individual site and as part of the Late Archaic archaeological record in southwestern Ontario.

6.1 Research Question 1

What is the time period of the Ridge Pine 3 site and are there any indications of multiple occupations at the site?

6.1.1 Age of Ridge Pine 3

Starting with the age for the primary occupation of Ridge Pine 3, one of the main lines of evidence for this question comes from the Ridge Pine 3 lithic toolkit. Ridge Pine 3 has a diverse range of informal and formal tools as outlined in Chapter 5. This is a common characteristic found in Late Archaic assemblages as a result of an increased diversity of activities that people were participating in (Lovis et al. 2005:689). To showcase this diversity in the toolkit, about 160 m northwest of Ridge Pine 3 is the Ridge Pine 2 site (AhHk-136), a primarily late Middle Archaic site (ca. 6200 cal BP [5500 RCYBP] to 5000 cal BP [4500 RCYBP]) with a radiocarbon date of 4522 to 4421 cal BP (4003 ± 24 RCYBP) and of similar size to Ridge Pine 3 (Belyea 2019; TMHC 2012:Figure 3). Ridge Pine 2 also has a small Late Archaic Broad Point component, and the radiocarbon date may relate to that occupation (Belyea 2019). After comparing the toolkits present at both sites, Ridge Pine 3 has more tool types present in the assemblage than Ridge Pine 2. In fact, despite the small size of the Ridge Pine 3 site, it has a more diverse range of tool types than other sites in both the local vicinity and beyond. These include Johnstone 2 (AhHk-124/AhHk-117), Johnstone 3 (AhHk-125/AhHk-118), Johnstone 7 (AhHk-126/AhHk-119), and South Bend (AhHk-97) which are late Middle Archaic sites and Green Hill Area C (AhHk-59), Thedford II (AhHk-6), Crawford Knoll (AdHo-5), and Welke-Tonkonoh (AfHj-5) which are Late Archaic sites. The Johnstone sites have two different borden numbers for each site due to miscommunication when excavations were taken over by Mayer Heritage Consultants Inc. after TMHC finished the Stage 2 assessment (Peter Timmins personal communication 2021).

Alongside having a diverse toolkit, Ridge Pine 3 also follows Cowan's (1999:Figure 2, 604) composition of a Late Archaic toolkit with a primarily bifacial tool production strategy, as evidenced by the high frequency of bifaces and late stage debitage at the site, and the high frequency of flake tools. So generally, the Ridge Pine 3 assemblage fits in with our current understandings of the Late Archaic toolkit. To further narrow down the time period of Ridge Pine 3, projectile point typologies and radiocarbon dating are the main lines of evidence.

As described in Chapter 5, the projectile points were not easily classified. The original site report (TMHC 2012) typed four of the six (Cat. Nos. 53, 69, 71, and 72) as being most like the Late Archaic Innes type and dated the primary occupation of the site to ca. 4100 cal BP to 3200 cal BP. However, based on my own analysis and with supplemental evidence of radiocarbon dating, I argue that four of the six projectile points (Cat. Nos. 69+815, 71, 72, and 558) are most similar to the Lamoka type within the Narrow Point complex which dates to ca. 5000 cal BP to 4100 cal BP (Ellis et al. 2009:812; Justice 1987:129). The radiocarbon dates from two wood charcoal samples in Feature 4 fits within this range with dates of 4978 to 4844 cal BP (4346 ± 34 RCYBP) for Cat. No. 41A and 5081 to 4867 cal BP (4426 ± 44 RCYBP) for Cat. No. 41B (AEL AMS 2021a, b). Cat. No. 72, a Lamoka-like point, was found in the same unit that Feature 4 was half in (it straddled two units) and supports the association of this radiocarbon date with the Narrow Point complex. The other three points were found near Feature 1 which gave modern dates and were dismissed as too recent. As noted previously, the location of Ridge Pine 3 falls within the northern range of distribution for the Lamoka type (Justice 1987:Map 55, 129).

Further evidence for a Narrow Point occupation comes from the toolkit as well as the surrounding environment. Based on seemingly pure Narrow Point components from the Canada Century site (Lennox 1990) and the Winter site (Ramsden 1990), the lithic toolkit is “dominated by a range of simple tools such as flake scrapers, gravers or piercers, spokeshaves and wedges” (Ellis, Kenyon, & Spence 1990:99). While later Late Archaic complexes also contain similar lithic artifacts in their toolkits, it is a good sign that Ridge Pine 3 has all these tool types in the assemblage. While the Late Archaic sites in the local vicinity of Ridge Pine 3 and beyond listed above, which are not assigned to the Narrow Point complex, do have some or most of these chipped lithic artifacts in their assemblages, Ridge Pine 3 is the only one with all of them present.

Ridge Pine 3 has similar artifacts to both the Canada Century (Lennox 1990) and Winter (Ramsden 1990) Narrow Point sites. In the Canada Century site discussion, Lennox (1990:47) notes that the Narrow Point toolkit often has a low number of scrapers present. Canada Century has 10 scrapers making up 0.18% of the assemblage and Ridge Pine 3 has 19 making up 0.10% of the assemblage. So, while there are more scrapers at Ridge Pine 3 than Canada Century, there are far less compared to other tool types at the site such as bifaces (n=73, 0.37%) or utilized flakes (n=156, 0.78%). Although Lennox (1990:47) mentions that the Canada Century scrapers are not formal types (i.e., end, side, thumbnail), some of the Ridge Pine 3 end and thumbnail scrapers may be diagnostic of other occupations (see section 6.1.2). Some of the Ridge Pine 3 scrapers (Cat. Nos. 504, 577, and 848) are less formally curated and still resemble the flakes they were made on, much like flake scrapers. Canada Century also has several fragments that may have been formal scraping tools, so formal scraper types cannot be discounted as potential tool types of the Narrow Point toolkit (Ellis, Kenyon, & Spence 1990:99; Lennox 1990:41). For example, the Winter site has two lithic fragments with steep scraper retouch present on both indicating more formal curation than what is present at Canada Century (Ramsden 1990:31). As well, the Canada Century utilized flakes show the majority of use on the dorsal surface on a lateral edge indicating a possible scraping function, like the retouched and utilized flakes at Ridge Pine 3 (Lennox 1990:40). Lennox (1990:40) noted that several multidirectional cores appeared to be rejected before they were exhausted, a similar pattern to the Ridge Pine 3 cores. Wedges are present at Canada Century, Winter, and Ridge Pine 3 sites (Lennox 1990:Table 1; Ramsden 1990:31). Gravers and spokeshaves are present at Ridge Pine 3 and the Winter site (Ramdsen 1990:31).

The Lamoka Lake and Cole sites are also useful for comparative purposes with the Ridge Pine 3 site. The Cole site has several formal scraper types, again indicating that formal types and flake scrapers can be found in the Narrow Point assemblage (Hayes & Bergs 1969:6). A major tool type at the Cole site is the knife and there are also knives present at Ridge Pine 3 which also supports a Narrow Point occupation (Hayes & Bergs 1969:6). In terms of rough stone tools, the Lamoka site (Ritchie 1932), which is the type site for the Lamoka phase, has rough stone mullers, pestles, and pitted stones (Ellis, Kenyon, & Spence 1990:96). Ridge Pine 3 also has a pitted rough stone tool, Cat. No. 54, a burnt hammerstone with two pits present on one of the faces. It is possible that the pitted stone from Ridge Pine 3 may have been used for nut cracking which is believed to be a significant activity in the Lamoka phase (Ellis, Kenyon, & Spence 1990:96; Odell 2004:79). This also ties in with the idea that the Narrow Point complex is a mast forest adaptation which, for Ontario, means sites should be found in areas with oak and hickory present such as the southern Ontario Huron basin (Ellis, Kenyon, & Spence 1990:98; Snow 1980). This fits with the location and surrounding environment of Ridge Pine 3.

The Ridge Pine 3 assemblage has many parallels with other Narrow Point sites both in Ontario and New York. However, the site lacks the bevelled adze which was found at both the Lamoka and Cole sites and is potentially diagnostic of the Lamoka phase (Ellis, Spence, Kenyon 1990:96; Hayes & Bergs 1969; Ritchie 1932). On the other hand, both Ontario Narrow Point sites, Canada Century and Winter, did not yield bevelled adzes either (Lennox 1990:45; Ramsden 1990). Perhaps the lack of this artifact is unique to the southern Ontario Great Lakes region for the Narrow Point complex, but a larger data pool of sites would be needed to confirm this.

So, rather than a Small Point occupation, I argue that Ridge Pine 3 contains evidence of having a Narrow Point occupation, which is still a poorly understood period in Ontario's precontact history despite its seminal role in the Late Archaic. As Ontario has few excavated and published sites dating to this complex, Ridge Pine 3 is an important site to add to our limited database of sites from this time. It is also true that the Ridge Pine 3 points could be seen as both Lamoka-like and Innes-like, as evidenced by the differing conclusions of this thesis and the original report (TMHC 2012). Perhaps the

Ridge Pine 3 points are transitional between the two types, following Lovis' (2009) ideas of continuity among Late Archaic point types and overlapping complexes. Given our limited understanding of the Late Archaic in southern Ontario, this is certainly a possibility.

6.1.2 Evidence of Multiple Occupations

The second part of the first research question deals with identifying any indications of multiple occupations at Ridge Pine 3. The Archaic is known for having site locations that are multi-component because of reoccupation over long periods of time due to the relative stability of the environment and landscape compared to the Paleoindian period (Ellis et al. 2009:790). To understand the full scope of the Ridge Pine 3 site, it is important to identify if the site has various episodes of occupation superimposed on one another (Bailey 2007:203). This can give insight into how the Ridge Pine 3 site relates to other sites in the local vicinity as well as why the location was chosen.

As discussed, the inherent problem with reoccupation of a site is that successive occupations tend to blur the spatial patterns from previous occupations. This makes identifying multiple occupations a challenge especially if the reoccupations occur from complexes with similar tool forms, such as the complexes within the Late Archaic. Similar to how I assessed the age of the primary occupation at Ridge Pine 3, I looked at the diagnostic forms of the projectile points that were not classified as Lamoka-like types and radiocarbon dating from features to determine if there is evidence of occupations prior to the Narrow Point complex. I also looked at other diagnostic tool forms in the toolkit which provided tentative but not conclusive suggestions of other occupations as tool forms are often found in multiple complexes throughout precontact history.

Cat. No. 50, as described in Chapter 5 section 5.5.3, is a possible Nettling projectile point. This is a tentative identification as it is only a midsection/base fragment but based on the morphological characteristics and metrics present it does seem to fit in with this type. The Nettling type is part of the Corner-Notched Horizon within the Early Archaic and dates to ca. 11300 cal BP to 10000 cal BP (Ellis et al. 1987:9). If Cat. No. 50 is a Nettling point, then it may represent evidence of an Early Archaic occupation at

Ridge Pine 3. It remains possible that the point was collected by a Late Archaic occupant and deposited on the site. Nonetheless, it is notable that the point is made of Kettle Point chert, as the outcrops of Kettle Point would have been exposed at this time after Lake Algonquin drained and low-water levels were present (ca. 11500 cal BP to 8500 cal BP) (Breckenridge & Johnson 2009:398; Larson & Schaetzl 2001:532; Lewis et al. 2005:194). The debitage in the units surrounding where this potential Nettling point was found in Cluster 3 are Kettle Point dominant, the material the point is made of, which may indicate that that area of Ridge Pine 3 was an early occupation period. However, spatial patterning is often blurred over time with multiple occupations (Bailey 2007:203), so it is difficult to confirm if that area is related to that specific Early Archaic Nettling point or if it was moved by subsequent occupants of the site.

Further evidence of an Early Archaic Corner-Notched horizon occupation comes from the scrapers. The small, hafted end scraper with slightly expanding sides and flaking all over is a common tool form for this complex (Ellis, Kenyon, & Spence 1990:74; Ellis et al. 1991:11). They can also be thumbnail in outline (Ellis, Kenyon & Spence 1990:74). One of the scrapers at Ridge Pine 3 (Cat. No. 116) is an end scraper that was possibly hafted and fits this description with tapered edges and regular overall dorsal flaking. It is possible that this scraper may be associated with an Early Archaic Corner-Notched horizon occupation. It is also located between Clusters 1 and 2 (unit 2000N 490E:16) which may indicate that Early Archaic activities occurred in that area.

The Early Archaic occupation at Ridge Pine 3 may also be associated with the Thedford Embayment in a wetland form. The Lake Stanley low-water stage in the Huron basin, following the end of Lake Algonquin ca. 11500 cal BP, had lake levels much lower than modern Lake Huron and persisted until ca. 8500 cal BP, falling within the date range for the Early Archaic (Breckenridge & Johnson 2009:398; Lewis et al. 2005:203; Morgan et al. 2000:12). These low water levels would have initially caused the Thedford Embayment to be a wetland environment rather than the lagoon-like bay it was during the high-water stages of Lake Algonquin and Nipissing.

Cat. No. 53, as described in Chapter 5 section 5.5.2, is classified as a Brewerton Side-Notched/Feeheley type projectile point. The Brewerton type is from the late Middle Archaic and dates to ca. 6200 cal BP to 5000 cal BP (Ellis et al. 2009:806; Justice 1987:115). The Ridge Pine 2 site, about 160 m west of the Ridge Pine 3 site, has 16 Brewerton Corner-Notched projectile points in its assemblage, which date to the same time as the side-notched variant (Belyea 2019; Ellis et al. 2009:806). Cat. No. 53 is smaller than the corner-notched points at Ridge Pine 2, which may be due to the side-notched forms being resharpened variants of the corner-notched form (Ellis et al. 1987:10; Justice 1987:115). Cat. No. 53 does show evidence of reworking/resharpening along one of the edges with its straighter shape and thinned edge as well as at the notches with one side and one corner notch present. The fact that variants of the same type and age are present at both Ridge Pine locations may indicate continuity between the two sites especially given their proximity to one another. Cat. No. 53 may have even been found and collected from the Ridge Pine 2 site and resharpened into its smaller, side-notched form. This Brewerton Side-Notched point then may be further evidence of reoccupation over time.

More potential evidence of a late Middle Archaic occupation can be found in the toolkit. Bifacial knives are a common tool type in these assemblages (Ellis, Kenyon, & Spence 1990:86). Two knives at Ridge Pine 3 (Cat. Nos. 58 and 172) have a bifacially worked knife edge. While this tool type description is vague, it is possible that one or both knives may be related to the late Middle Archaic occupation considering that they are the only two out of the seven knives, including the one in Feature 1, that are bifacially worked on an edge. As well, end scrapers are typical of the Middle Archaic toolkit, and they are the dominant type of the Ridge Pine 3 scrapers (Belyea 2019:57). However, Middle Archaic scrapers tend to be ovate and thick in shape with steep scraping edges (Belyea 2019:85). For example, the South Bend Middle Archaic scrapers have edge angles with a mode of 80 degrees (Belyea 2019:Table 13) while the Ridge Pine 3 scrapers have less steep edge angles with a mode of 65 degrees. But three of the Ridge Pine 3 scrapers have edge angles of 75 degrees (Cat. Nos. 828, 848, and 871) which may fit with the Middle Archaic forms. As well, Cat. Nos. 191+204 and 860, the scraper-knife and preform scraper respectively, have a thick, ovate shape which may tie in with this occupation. Cat. Nos. 828, 848, 860, and 191 are all in Cluster 1 which may indicate that late Middle Archaic activities occurred in that area especially given that the Brewerton/Feeheley projectile point (Cat. No. 53) is on the southeast periphery of Cluster 1 between Clusters 1 and 2. Cat. No. 172 (one of the bifacial knives) is in Cluster 2, about 3 m east of the projectile point. The other half of the scraper-knife (Cat. No. 204) is in Cluster 5. Cluster 5 has Cat. Nos. 58 (the other bifacial knife) and 871 (one of the steeply retouched scrapers) also possibly indicating late Middle Archaic activities in that area.

On the other hand, as discussed in Chapter 5, the Feeheley point type is associated with the radiocarbon date of 4831 to 4069 cal BP at the Feeheley site in Michigan (Lovis & Robertson 1989:228). More recent investigations have also derived radiocarbon dates post-dating 5000 cal BP for the Brewerton projectile points from Jacob Island (Connolly et al. 2014:120). These dates may point to extended use of the Brewerton/Feeheley type into the Late Archaic and a possible overlapping between the late Middle Archaic and Late Archaic periods. As well, the Brewerton/Feeheley point (Cat. No. 53) was found about 2 to 3 m southwest of Feature 4 which provided the 4978 to 4844 cal BP and 5081 to 4867 cal BP dates. While Cat. No. 72, a Lamoka-like point, was found closer to Feature 4, Cat. No. 53 is still close by and could indicate a near contemporary occupation if it is also associated with those dates.

One other possible occupation period outside of the primary Narrow Point occupation may be a Late Archaic Small Point occupation (ca. 3800 cal BP to 2900 cal BP) as originally suggested in the TMHC (2012) report. Although projectile points from this complex have not been identified, the similarity between the Lamoka type and the Innes type has been acknowledged. Further, a radiocarbon date as well as some possible evidence from the toolkit support this additional occupation. An aggregate sample of wood charcoal from Feature 3 (Cat. No. 36) has provided a radiocarbon date of 3260 to 3075 cal BP (3005 ± 31 RCYBP) which fits near the end of the time range for the Small Point complex. As well, the date fits within the 3500 to 2900 cal BP range of Small Point dates from the Davidson site in the Ausable Valley (Ellis et al. in press). The Ridge Pine 3 date from Feature 3 is in Cluster 3 (see Figure 37) where Kettle Point chert (n=620, 78.98%) is dominant. The radiocarbon date can be related to the Algoma lake levels at that time, which were about 179.7 m asl, lower than they were during the Narrow Point occupation (Morrison 2017:Figure 28). The Kettle Point chert outcrops, located in shallow waters about 20 km south of Ridge Pine 3, would have been more accessible during a Small Point reoccupation and may have been used more than the secondary sources of Onondaga. As it is likely there is minimal disturbance to the artifact distributions, it is possible that this southerly concentration may be where some of the Small Point activities occurred, based on the amount of Kettle Point chert there.

Another diagnostic Small Point tool form is the small, tear-dropped to triangular shaped preform (Pearce & Ellis 2008:12). As mentioned in section 5.4.4, there are 14 bifaces that fit this description. Cat. Nos. 7, 44, 76+78, 91, 103, 130+600, and 471 are all in or around Cluster 1. This pattern supports the idea that Small Point activities may have occurred in this northwest area of the site. Cat. No. 73 is in Cluster 3 located right beside the unit Feature 3 was in which gave a Small Point date of 3260 to 3075 cal BP and may be associated with this radiocarbon date. Cat. Nos. 45 and 47 are in the western low-density area of the site and may have been moved there by children playing or to be used for a certain task away from the other activities. Cat. No. 63 is in Cluster 5, the isolated eastern cluster. Cat. Nos. 123, 167, and 805 are in Cluster 2 which could indicate Small Point activities there. These bifaces are also near Cat. No. 72, the Lamoka-like point, and Feature 4 with the Narrow Point radiocarbon dates. It is possible that the mixing of Narrow Point and Small Point tool forms in this cluster indicates a closer relationship between these two complexes, both temporally and characteristically, than originally thought, based on their overlapping toolkits.

Small end scrapers with fan-shaped to thumbnail outlines and tapered edges, which are common in Early Archaic Corner-Notched Horizon toolkits, are also found in Small Point toolkits (Ellis, Kenyon, & Spence 1990:109). So, the potentially hafted end scraper (Cat. No. 116) may be associated with either the Early Archaic or the Small Point. As well, the unhafted thumbnail scraper type, of which there are four at Ridge Pine 3 (Cat. Nos. 77, 93, 586, and 846+847), are commonly found at sites with Small Point components such as Welke-Tonkonoh and Thedford II (Deller & Ellis 1992:56-57; Ellis, Kenyon, & Spence 1990:110; Muller 1989). All the potentially hafted end scrapers and unhafted thumbnail scrapers are in or on the periphery (Cat. Nos. 93 and 116) of Cluster 1. This pattern further supports that this may be where Small Point activities occurred.

Wedges are commonly associated with the Small Point toolkit, but they are also found at Narrow Point sites (Ellis, Kenyon, & Spence 1990:109). The three at Ridge Pine 3 (Cat. Nos. 246, 255, and 661) could be associated with either occupation. Tools with pointed projections (i.e., gravers, perforators, burins) are also found in Narrow Point and Small Point components (Ellis, Kenyon, & Spence 1990:110). The Ridge Pine 3 gravers (n=4), burins (n=2), and perforators (n=3) could support either occupation or both.

The overlapping Narrow Point and Small Point toolkits reflect Lovis' (2009) arguments about projectile point types in the Saginaw Valley in Michigan where the Narrow Point, Broad Point, and Small Point complexes all appear to overlap. It is possible that the Narrow Point and Small Point complexes may be closer in time and more entangled than we believe, and the arbitrary temporal distinctions used in the past may be too rigid to reflect what is really going on. A closer relationship between the Late Archaic complexes could help explain the number of tools that overlap in both Narrow and Small Point toolkits as well as the confusion between projectile points from the two complexes and why the Ridge Pine 3 Lamoka-like points have similarities to Innes and Lamoka points. The late Middle Archaic Brewerton/Feeheley type may also be associated with this idea as Ridge Pine 3, AiHc-423, and AiHc-429, multicomponent sites, all have Brewerton and Lamoka represented.

In summary, although the spatial patterning is speculative, it does supplement the other lines of evidence in suggesting that multiple occupations likely occurred at Ridge Pine 3. The potential occupation of the Ridge Pine 3 site in the Early Archaic, the late Middle Archaic, and the end of the Late Archaic reinforces the idea that the environment and landscape was relatively stable during the Archaic despite significant fluctuations in water levels in the Lake Huron basin (Ellis et al. 2009:790). As well, it emphasizes the fact that the Ausable Valley was an attractive region for people to settle in with diverse and rich resources at their disposal (Dean 1985:3).

6.2 Research Question 2

What were the functions of the Ridge Pine 3 site and what role might it have played in the settlement-subsistence system of the site occupants?

6.2.1 Functions of Ridge Pine 3

Determining the potential functions of the Ridge Pine 3 site involves multiple lines of evidence. The lithic assemblage, including the debitage, can give insights into the activities performed. Intrasite spatial analysis can help identify potential activity areas at the site. Site comparisons will also help to better understand the potential functions.

The largest component of the lithic assemblage at Ridge Pine 3 is the debitage which makes up 96.16%. Based on the debitage analysis which involved the analysis of a 27.48% sample of 5278 flakes, the highest flake category is fragmentary flakes at 41.10%. While not an indicator of flintknapping activities *per se*, the high number of fragmentary flakes does give an indication of the impact that post-depositional modifications have on archaeological assemblages, even those from sites with minimal ploughing, and the low-quality Onondaga chert they were working with. The next highest category is the biface thinning flakes at 36.09% of the debitage sample. This flake type is classified as a late-stage reduction activity from bifacial reduction (Pearce 2008:53). From this data, it can be inferred that biface reduction was a major flintknapping activity at Ridge Pine 3, which is also evidenced by the 73 bifaces, the most common formal tool in the assemblage. To compare, the next most common formal tools are the 19 scrapers. This dichotomy showcases the focus on biface manufacture at the site compared to other tool types. Late-stage reduction flakes, including biface thinning flakes (36.09%), bifacial retouch flakes (2.39%), and biface reduction error flakes (0.47%), make up the majority of the debitage sample, excluding fragmentary flakes. So, much of the flintknapping revolved around bifacial reduction during tool making.

There is also evidence of some early-stage reduction at Ridge Pine 3. Primary (2.39%), secondary (7.52%), and tertiary flakes (8.36%) are the result of core reduction and early stage preform or biface manufacture (Pearce 2008:53). The fact that there are bifaces from all stages present at Ridge Pine 3 agrees with these findings, so while the majority of the flintknapping was focused on late-stage reduction and maintenance of bifaces and tools, there is still some focus on early-stage reduction. Late to early-stage reduction debris ratios for Kettle Point and Onondaga chert respectively are 4.46:1 and 1.49:1. So, most of the early-stage reduction was done on Onondaga chert which likely indicates that the Kettle Point used at the site was subjected to early-stage reduction prior to being brought to Ridge Pine 3 for further reduction which was a common practice (Binford & Quimby 1963:279). This pattern also ties in with the higher number of Onondaga cores (50.75%) at the site and the idea that mostly secondary local or near-local Onondaga sources to the south were being used and reduced at Ridge Pine 3. As well, the intrasite spatial analysis indicates that most of the early-stage debris occurred in the northwest area of the site, and the high incidence of Onondaga chert in this area also agrees with this pattern as most of the early-stage reduction flakes are Onondaga.

These late to early-stage reduction debris ratios are the opposite to what is seen at the Welke-Tonkonoh site located just west of London, Ontario (Muller 1989). Welke-Tonkonoh ratios show more early-stage reduction occurring on Kettle Point than Onondaga (Pearce 2008:73). Muller (1989:15-17) argues that the Onondaga was collected near the primary source and reduced or roughed out before being brought to Welke-Tonkonoh. At Ridge Pine 3, the opposite pattern is shown indicating that the Kettle Point was collected and reduced at the primary source location before being brought in roughed out forms to Ridge Pine 3 for further reduction. The higher rates of early-stage reduction conducted on Onondaga indicates that much of the Onondaga was collected from local secondary deposits resulting in more of the entire reduction sequence being visible within the Onondaga sample at Ridge Pine 3.

The Ridge Pine 2 site also has a high percentage of late-stage reduction flakes present in the debitage sample showing a similarity in flintknapping activities (Belyea 2019:64). However, unlike Ridge Pine 3, Ridge Pine 2 has very little early-stage reduction debris which supports the idea that the Onondaga bifaces were reduced elsewhere, likely at or near the primary source, before being brought to Ridge Pine 2 for further reduction into tools (Belyea 2019:64-65). This difference between the two sites suggests that the early-stage reduction of the Onondaga was being performed at Ridge

Pine 3. As well, the Kettle Point at Ridge Pine 3 follows a similar pattern as the Onondaga at Ridge Pine 2 which further supports the idea that the Kettle Point was brought to Ridge Pine 3 in reduced forms. The secondary source Onondaga is also poorer quality than the Kettle Point chert, so there would be more early-stage waste.

We can compare the Ridge Pine 3 debitage to that from the Green Hill site (Pearce & Ellis 2008) located 20 km southeast of Ridge Pine 3, which includes a Small Point Archaic base camp occupation in Area C, and had similar access to resources across the landscape as the Ridge Pine 3 site. Area C has high proportions of Kettle Point chert in the debitage compared to Onondaga which is very different from the proportions of raw material types at Ridge Pine 3. This pattern may be related to lower water levels during the Algoma phase than during the Nipissing Transgression (Pearce & Ellis 2008:8-9). Green Hill Area C shows a very different flake type distribution compared to both Ridge Pine 2 and 3. Apart from the high proportion of fragmentary flakes at Green Hill, all the other flake types have a fairly even distribution at lower frequencies than Ridge Pine 3, with biface thinning flakes and shatter at 14.5% and 16.5% respectively followed by secondary, bipolar, and primary flakes at 1.0%, 0.7%, and 0.3% for each (Pearce & Ellis 2008:9). Compared to the 36.09% of biface thinning flakes at Ridge Pine 3 this is quite different. Unfortunately, Area C is not fully excavated and has a smaller sample size, so comparisons are difficult (the excavated area is about 5 m by 5 m) (Pearce & Ellis 2008:Figure 2). However, even Ridge Pine 2, which is similar in size to Ridge Pine 3, only has 23.12% biface thinning flakes (Belyea 2019:66). The high incidence of biface thinning flakes suggests biface manufacture is a function of Ridge Pine 3 and the high percentage of debitage indicates intensive manufacture at the site which is also supported by the number and diversity of formal and informal tools present.

The formal and informal tools at Ridge Pine 3 are quite diverse. Compared to other sites in the local vicinity and beyond, Ridge Pine 3 has more tool types present showing the diversity of the toolkit and subsequently the diversity of activities performed at the site. For example, Ridge Pine 2 has nine tool types present in the toolkit compared to Ridge Pine 3's 13 types, which may partially be explained by the Late Archaic toolkit being more diverse as a result of performing a wider range of activities (Lovis et al.

2005:689). But even compared to other Late Archaic sites in the region, such as Green Hill Area C, Thedford II, Crawford Knoll, and Welke-Tonkonoh, Ridge Pine 3 has more tool types present in the toolkit. The Canada Century site, another Lamoka age site in Ontario near the city of Welland, has fewer tool types than Ridge Pine 3 as well (Lennox 1990:36). So, the range of activities carried out at Ridge Pine 3 was likely diverse.

Formal tools include projectile points (n=9), bifaces (n=73), scrapers (n=19), knives (n=7), and a scraper-knife (n=2). Biface manufacture, including projectile points which are finished bifaces, was clearly a function of Ridge Pine 3. In fact, the intrasite spatial analysis showed a couple of potential rehafting or resharpening areas for the projectile points in Cluster 4, east of the center of the site, and between Clusters 1 and 2, northwest of the center of the site. The presence of projectile points is an indication of hunting activities, and those tools, combined with the scrapers and knives, suggest that food and animal processing activities likely occurred. Kooyman (2006:427) explains that animal/food processing areas often have less permeable and flexible boundaries, meaning that they are concentrated in one area of the site with less people allowed to cross the "threshold" into this space. The spatial analysis showed two clusters, one to the east and one to the south, that are more isolated from the other clusters. Both contain high numbers of expedient cutting tools and knives and may be areas where animal/food processing tasks occurred. However, only a small amount of faunal remains was recovered, so it is difficult to understand the extent of animal processing tasks conducted, especially given the acidic nature of many Ontario soils and the likelihood of lighter, more fragile materials being destroyed more quickly than others (Tincombe 2020:27-28).

The informal tools include gravers (n=4), burins (n=4), spokeshaves (n=2), notched flakes (n=2), perforators (n=3), wedges (n=3), utilized flakes (n=156), and retouched flakes (n=31). The high incidence of utilized flakes fits with our understandings of the Late Archaic toolkit and is the most common lithic form (Ellis, Kenyon, & Spence 1990:109). Many of these tools can be used for cutting and scraping tasks which fits in with the formal tools and their potential functions. The high incidence of use-wear and retouch on the dorsal surface and lateral edges may indicate a scraping function for many of the utilized and retouched flakes, which coincides with the formal scrapers and a possible focus on hide or bone processing (Andrefsky 2005:62). Further analysis of edge angles would be needed to confirm this interpretation (Andrefsky 2005:160-162). In sum, hunting and food and animal processing tasks may have been another function of the site. The diversity of the toolkit also points towards a wide range of tasks and activities performed at Ridge Pine 3, particularly ones that could be completed with expedient tools.

Debris to tool ratios, including formal and informal tools, for Onondaga and Kettle Point cherts can also shed light on flintknapping activities. Kettle Point and Onondaga debris to tool ratios are respectively 9.61:1 and 21.34:1. More reduction is occurring on Onondaga chert than Kettle Point chert, and Onondaga is more represented throughout the reduction sequence based on the late to early-stage reduction debris ratios. Given the higher number of Onondaga cores and the prevalence of Onondaga debris at Ridge Pine 3, it appears that Onondaga was used for retooling purposes. While Kettle Point chert is present in the toolkit at 49.14%, Onondaga is more prevalent in the formal tools representing 61.00% of the formal tools while Kettle Point makes up 39.00% of the formal tools. Kettle Point makes up just over half the informal tools at 54.45% likely due to the better quality of flakes coming off during the late-stage reduction of the reduced Kettle Point forms. It is possible that the high-water levels played a role in creating this pattern, restricting the access people at Ridge Pine 3 had to the Kettle Point chert outcrops and leading them to rely more on the locally or near locally available secondary sources to supplement their chert procurement and toolkit.

One of the foci of my analysis of the lithic assemblage was the flintknapping skill levels at the site and if craft learning was being carried out. For flake types, shatter is often an indicator of novice flintknappers as more experienced flintknappers tend to create fewer errors and as such, less shatter from tool manufacture (Shelley 1990:188-192; Milne 2005:331). The debitage sample from Ridge Pine 3 includes 2.52% of shatter indicating a low number of errors in the tool manufacture process as well as a low frequency of biface reduction error flakes at 0.47%. Termination types of the flakes show that 44.54% have feather terminations and 7.37% have hinge terminations. Based on experiments by Shelley (1990:Table 3), expert flintknappers produced 38% hinge/step terminations and 62% feather terminations while novice flintknappers produced 50% hinge/step terminations and 50% feather terminations. While I could not include step terminations in my analysis as it is unclear if they are a result of post-depositional modifications or the original flintknapping episode, the low number of hinge terminations points to expert level flintknappers performing the flintknapping at Ridge Pine 3. The hinge terminations were also evenly dispersed across the site and there were no concentrations that pointed to a novice at work. For non-chert debitage, the flintknappers were able to get 46.88% feather terminations and only 8.33% hinge terminations. Non-chert materials are not as flakeable as chert, which again showcases the level of skill of the flintknappers at Ridge Pine 3.

As well, only 38.24% of the bifaces were identified as crude and they were exclusively from stages 2 and 3 or the early-stage reduction bifaces which is typical of the biface manufacture reduction sequence. That finding, alongside the low CV values for the bifaces and projectile points as well as the poor quality of the Onondaga chert that they worked with, indicates more experienced flintknappers at work. In sum, all the evidence points to expert level flintknappers at work at Ridge Pine 3. However, this conclusion does not exclude novices from being part of the manufacture process or residing at Ridge Pine 3. Learning could have happened in many ways including novices working closely with experts on tools and observing experts at work, activities which would erase the novice from the archaeological record (Hildebrand 2012:30). This may be the case for Ridge Pine 3 especially with the Kettle Point chert less accessible during the primary Narrow Point occupation due to higher water levels. The secondary sources of Onondaga chert were likely more reliable and used more often based on the debitage, formal tool, informal tool, and core analyses with Onondaga making up 62.57%, 61.00%, 45.55%, and 50.75% of each collection respectively. Raw materials from secondary sources may mean less hands-on learning for novices or people working more closely with the experts than they would if they were close to an accessible and abundant primary source (Bamforth & Finlay 2008:17; Milne 2005:329). It is also possible that the evidence for the procurement of Kettle Point chert involving early-stage reduction before bringing it to the site could mean that novices may have had more opportunities for hands-on learning at the primary source location than at the Ridge Pine 3 site.

In terms of trends in tool types, local sites Ridge Pine 2, Johnstone 2, Johnstone 3, Johnstone 7, and the South Bend paleosol component all have similar frequencies in tool types that are also present at Ridge Pine 3 (see Table 20), although the South Bend site has very few utilized flakes (Belyea 2019; Wilson 2008). This makes sense as they are all in the same local area with an orientation towards the Thedford Embayment and access to the same resources. The Innes site (Lennox 1986) and the Welke-Tonkonoh site (Muller 1989) also have similar trends in tool types, but both have nearly equal frequencies of projectile points and bifaces present which indicates a bigger emphasis on hunting than at Ridge Pine 3. The same can be said for Ridge Pine 2 which has nearly equal frequencies of projectile points (n=18) and bifaces (n=22).

The proportions of tools in the toolkit most similar to Ridge Pine 3 is Johnstone 7 which is located about 500 m west of Ridge Pine 3 (Wilson 2008:Figure 1). It is dated to the late Middle Archaic, ca. 6200 cal BP to 5000 cal BP, based on the presence of two Brewerton Side Notched and one Brewerton Corner Notched point (Ellis et al. 2009:806; Justice 1987:115). The parallels to Ridge Pine 3 are interesting. Although no knives are present at Johnstone 7, showing the emphasis of cutting tasks at Ridge Pine 3, and no boring tools are present, the proportions of the tools present are very similar (Wilson 2008:23). Johnstone 7 is interpreted as a camp site for lithic tool production based on the lithic assemblage, which is likely the case for Ridge Pine 3 (Wilson 2008:33).

As discussed, there is a clear emphasis at Ridge Pine 3 for biface manufacture. To put this in perspective, the Ridge Pine 3 site is about 18 m in diameter with 164 excavated units and the Johnstone 7 site is almost the same size at about 15 m in diameter with 229 excavated units (TMHC 2012:37; Wilson 2008:30). Johnstone 7 has 6787 pieces of debitage and 141 formal and informal chipped tools including cores (Wilson 2008:23). Ridge Pine 3 has 19210 pieces of debitage and 381 formal and informal chipped tools including cores. Ridge Pine 3 has nearly three times as much debitage and 240 more formal and informal chipped tools including cores. Lithic tool production was more intensive at Ridge Pine 3 and was probably conducted over a larger time span than at Johnstone 7, based on the evidence of multiple occupations.

The spatial patterning at Johnstone 7 is also similar to Ridge Pine 3. Johnstone 7 has clusters of high concentrations of artifacts across the site, unlike Johnstone 2 and 3 which have one concentration in the middle of the sites indicating single use camp sites (Wilson 2008:29, 34). Wilson (2008:34) posits that two scenarios can explain the spatial patterning at Johnstone 7. First, that each high concentration cluster represents a different group of people producing lithic tools at the same time. Second, one group continued to come back to this site over a period of time and produced a distinct artifact concentration cluster each time they did. The amount of debris and tools at Ridge Pine 3, as well as the evidence for multiple occupations, suggests that Ridge Pine 3 was a site used multiple times. As well, the small size of Ridge Pine 3 indicates that only one or two families likely resided there at a time. While some of these clusters at Ridge Pine 3 are likely contemporary (see section 5.10), the continued use of the site over time likely also helped to create these distinct artifact concentrations across the site.

In summary, based on the lithic toolkit and debris, intrasite spatial analysis, and site comparisons, Ridge Pine 3 is a camp site with a major focus on lithic tool production, particularly biface manufacture and, on a smaller scale, rehafting and resharpening in the case of projectile points. Lithic procurement strategies for tool manufacture included collecting local secondary deposits of Onondaga and performing both early and late-stage reduction of it at the site. The Kettle Point chert was likely brought in reduced forms to Ridge Pine 3 after some early-stage reduction was done at the primary source location. Retooling was conducted mainly on Onondaga chert but there is representation of Kettle Point in the toolkit particularly with the informal tools. Another function of the site is hunting and food and animal processing. Although there is less evidence for these activities than for tool production, the presence of projectile points, scrapers, cutting tools, and the possible scraper functions of the retouched flakes is a good indication of these activities. The small pieces of faunal remains collected and possibly the nutshell fragments from the paleoethnobotanical analysis (though at least some are modern intrusions) also support a hunting and food processing function for the site. Spatial analysis and other evidence indicate that people continued to return to Ridge Pine 3 over time, whether that was over the course of a year and/or over long periods of time.

Occupation at Ridge Pine 3 resulted in intensive manufacture of tools and the amount of debris and tools left behind is quite impressive especially considering the small size.

6.2.2 Settlement-subsistence of Ridge Pine 3

The settlement-subsistence system at Ridge Pine 3 is more difficult to determine, mainly because the Narrow Point complex in the Late Archaic is not well known in Ontario and lacks a widely accepted settlement-subsistence model (Ellis et al. 2009:812; Justice 1987:129). Another complication is the relatively poor preservation of floral and faunal evidence from the site which is a common problem for Archaic sites (Ellis et al. 2009:790). Despite this, there are some indicators from the Ridge Pine 3 site that allow for speculation on the settlement-subsistence at the site based on paleoethnobotanical analysis, the lithic assemblage, and the paleoenvironmental reconstruction.

The paleoethnobotanical analysis performed on the feature samples provided hints about subsistence strategies and seasonality.

Features 2 and 3 had fragmentary pieces of bone in the samples. Although they were too small for any species identification or radiocarbon dating, those pieces and the two faunal bone pieces found during unit excavations show that animals were obviously part of the subsistence strategy at Ridge Pine 3. One of the faunal pieces found during excavation is mammal which indicates hunting of land animals at the site. The lithic tools at the site also point towards hunting and food/animal processing tasks performed there. Projectile points suggest hunting animals for subsistence. The scrapers, knives, and other cutting implements may have all been used to process animals that had been hunted and collected. Eight of the scrapers at Ridge Pine 3 are end scrapers which are thought to be hide-scraping tools and could be further evidence of hunting subsistence strategies and cold-weather occupation because “hunting and hide preparation are generally considered important late fall and winter activities when skins are in their prime” (Lennox 1990:238). This evidence was also used to argue for cold-weather occupation at the Canada Century and Winter sites (Lennox 1990:46-47; Ramsden 1990:36).

Nutshell remains were present in features 1, 2, and 3. One of the nutshell fragments from Feature 2 was identified as likely hickory which ripens in the autumn between September and November possibly indicating a fall occupation at the site (Fecteau 1994:50; Fecteau 2005:18). Although radiocarbon dates for nutshell samples from Feature 1 returned recent dates indicating that they are modern intrusions, it is still likely that the other nutshell remains from features 2 and 3 are contemporary with the Narrow Point or Small Point occupations especially given the prevalence of nut-bearing trees in the region (Karrow & Warner 1990:30). As well, the pitted hammerstone in the assemblage may be a result of nut cracking and preparation (Odell 2004:79).

Wood charcoal was also present in all four features. Most were unidentifiable in terms of species, but three pieces were identified as beech and six pieces were partially identified as coming from deciduous species. This data agrees with the tree species present in southern Ontario during the Late Archaic with a beech-maple dominated forest (Fecteau 2014:10, Table 7). The presence of wood charcoal in the features also ties in with the 278 pieces of fire cracked rock collected across the site and in Feature 3, the 5208 pieces of fire cracked rock discarded during excavation, and the presence of burnt chert materials in the assemblage. The quantity of fire cracked rock and burnt chert materials suggests that heat-related features were important, with the rocks used for either stone boiling or as a heat source. This may indicate cold season occupation, relating back to the presence of nut remains and the likelihood of a fall occupation (TMHC 2012:61).

The inferred dates of the Ridge Pine 3 site occupations, during the Late Archaic Small Point and Narrow Point complexes, the late Middle Archaic, and possibly the Early Archaic, also provides hints towards subsistence strategies. The Thedford Embayment was a significant environmental feature in the landscape located close to the site. As discussed, it was a large lagoon-like bay during the Nipissing high water stages in the Lake Huron basin, ca. 5900 cal BP (5100 RCYBP) to 4800 cal BP (4300 RCYBP) (Belyea 2019:12). The Narrow Point Lamoka phase comes shortly after this period, ca. 5000 cal BP to 4100 cal BP and correlates with the rapid fall of lake levels between ca. 4500 cal BP and 3400 cal BP, turning the Thedford Embayment into a marshy environment (Baedke & Thompson 2000:423; Larson & Schaetzl 2001:532-533; Lewis et al. 2008:133; TMHC 2012). The embayment would have been present during the late Middle Archaic occupation and because it also existed during the high-water stage of Lake Algonquin (ca. 13200 cal BP to 12500 cal BP) (Lewis et al. 2008:130), would likely have been a marsh environment during the Late Archaic. The presence of the Thedford Embayment points to a lacustrine orientation for Ridge Pine 3 and the other sites in the local vicinity. These lacustrine areas had reliable access to vast resources including “shellfish, shallow-water species of fish, amphibians, reptiles, migratory waterfowl, and fur-bearing mammals, as well as plants such as wild rice” (Stewart 2013:30). In fact, the paleosol excavation of South Bend (Middle to Late Archaic) has a large quantity of preserved turtle remains comprising about 40% of the faunal collection (Belyea 2019:74). All these resources, including the nut-bearing trees in the area, likely would have been taken advantage of by the people at Ridge Pine 3 in their subsistence practices.

Tentatively, evidence hints at possible fall occupation based on nut remains and fire use at Ridge Pine 3 with a wide range of subsistence resources available to the people at Ridge Pine 3. However, there is significant ambiguity due to the relative lack of floral and faunal materials, so it is difficult to pin down a seasonality for the site based on this limited evidence. The proximity to the adjacent embayment/wetland and the Lake Huron shoreline also indicates a possible warm-weather occupation (TMHC 2005:37). This, combined with the lake effect in the region allowing bodies of water to retain their heat into the autumn season and the warmer climate during this time, may indicate a summer and fall occupation (Dean 1994:7; Deevey & Flint 1957; Lewis et al. 2008:133).

The Small Point complex has a settlement-subsistence model for warm-weather coastal and cold-weather interior sites, and it is possible that elements of this system were derived from the settlement-subsistence practices in the Narrow Point (Ellis et al. 2009:812, 821). Although the model is considered unsubstantiated and requires further investigation, the idea of warm-weather coastal sites could be tentatively extrapolated onto the Ridge Pine 3 site based on the proximity to the Thedford Embayment and Lake Huron shoreline. Perhaps the fire use at Ridge Pine 3 hints at continued occupation into late fall/early winter until temperatures dropped too low and made the shoreline location uncomfortable and drove mammals inland. It is important to note that the availability of lacustrine, terrestrial, and avian resources would have allowed for a more stable occupation with longer seasonal stays, access to rich environmental zones throughout the year, and reoccurring visits to said zones throughout the year (Stewart 2013:30). Similar to Woodley's (1990) argument for the Thistle Hill site, the diverse range of resources in microenvironments around Ridge Pine 3 makes occupation possible almost any time of year except the winter when northwesterly winds off the lake would create poor living conditions.

Despite the lack of an accepted settlement-subsistence model for the Narrow Point Archaic, there are indications of mobility and settlement in the lithic assemblage. The use of secondary sources of Onondaga chert indicates that mobility has changed from the Middle Archaic, even in this first complex of the Late Archaic. Belyea (2019:111) argues that the late Middle Archaic inhabitants of Ridge Pine 2 directly procured Onondaga chert from its primary source location on the northeastern shore of Lake Erie and brought it back to the site. This long-distance logistical mobility is a noted pattern for the Middle Archaic (Lovis 2009:744-745). The use of secondary sources of Onondaga at Ridge Pine 3 differs from this pattern and shows that mobility had changed within the earliest part of the Late Archaic. The residential mobility system of the Late Archaic has more constrained movements resulting in high-visibility signatures left behind at site locations and this pattern may help explain the high density of lithics at the site compared to other slightly older sites from the late Middle Archaic in the local vicinity (Ellis, Kenyon, & Spence 1990; Ellis et al. 2009; Lovis et al. 2005).

6.3 Research Question 3

How did the occupants of Ridge Pine 3 use the local environment and broader landscape to meet subsistence needs and was it constraining in any way?

The Ausable Valley where Ridge Pine 3 is located was heavily occupied throughout precontact history likely due to its accessibility to a wide range of resources. Ridge Pine 3 is in proximity to lacustrine, terrestrial, and avian resources which would have allowed for significant variety and choice for meeting peoples' subsistence needs. The Ausable Valley is made up of several different microenvironments. First there is the

Deciduous (Carolinian Biotic Province) and Great Lakes-St. Lawrence (Canadian Biotic Province) forest regions, with the boundary close to Ridge Pine 3 (Deller er al. 1985:3; Kenyon 1980a:19). Both forest regions include several nut-bearing trees, such as beech and hickory, and the forests were home to several different big and small game animal species, such as white-tailed deer and turtles (Dean 1994:16-17; McAndrews 1994:181). The xeric forest zone between Lake Huron and the Thedford Embayment and the mesic to moist forest zones on upland areas in Middlesex County also provided resources (Chapman & Putnam 1986:100; Rob MacDonald personal communication 2020).

There was also the Thedford Embayment which would have provided lacustrine resources as a large lagoon-like bay and later as a marshy environment when the Nipissing water levels dropped rapidly between ca. 4500 cal BP and 3400 cal BP (Baedke & Thompson 2000:423; Larson & Schaetzl 2001:532-533; Lewis et al. 2008:133; TMHC 2012). While the faunal remains at Ridge Pine 3 are very scarce, it is certain that the animal species associated with the Thedford Embayment (fish, amphibians, reptiles, waterfowl, and mammals) played a role in the subsistence practices of the site occupants (Stewart 2013:30). The number of sites in the area indicate that the Thedford Embayment was a major lacustrine orientation for the people who chose to reside there. In addition to the Thedford Embayment, the proximity of the site to Lake Huron is another major lacustrine resource that would have opened other possibilities in terms of resources. The location of Ridge Pine 3 takes advantage of the diverse and rich flora and fauna resources available in the area and likely easily met the subsistence needs of the people at Ridge Pine 3.

During Narrow Point occupation, Lake Huron water levels were higher than modern times. The Nipissing Transgression reached a high of 184.5 m asl around 5700 cal BP, about 9 m above modern levels, and a fall in water levels occurred between 4500 cal BP and 3400 cal BP (Baedke & Thompson 2000:423; Cooper 1979:6-7; Karrow 1980:1272; Jackson et al. 2000:427; Larsen 1985:65; Larson & Schaetzl 2001:532-533; Lewis et al. 2005:190; Lewis et al. 2008:133; Prest 1970:730; Thompson et al. 2011:568). So, in the Narrow Point complex changes in water levels were occurring, with very high levels in the first half and falling levels in the second half, correlating with a widespread drought in the region from 4700 cal BP to 4000 cal BP (Shuman and Marsicek 2016:42). The warmer climate of the hypsithermal interval likely caused warmer summers and longer habitable coastal sites (Deevey & Flint 1957).

To meet subsistence needs, chert sources were required to manufacture the tools needed for hunting and animal and food processing tasks. As discussed, Kettle Point chert outcrops along the modern Lake Huron shoreline, approximately 20 km south of Ridge Pine 3 (Deller et al. 1985:3; Ellis et al. 2014a:21; Janusas 1984; Kenyon 1980a:15). The outcrops are mostly located in shallow waters which are currently between 0 and 2 m in depth (Janusas 1984:5). Although the outcrops have remained submerged in shallow water from the Nipissing Transgression, ca. 5700 cal BP, to modern times, archaeological sites in southwestern Ontario show that the chert continued to be collected, and Archaic peoples increased their utilization of this chert type over time (Janusas 1984:85-86). Evidence of this can be seen at Ridge Pine 3 where 39.00% of formal tools, 54.45% of informal tools, 38.80% of cores, and 28.95% of the debitage sample were made on Kettle Point chert. Despite being shallowly submerged in the Late Archaic, the Kettle Point outcrops were easily accessible to people due to their location along a major waterway and were still a viable resource that the people at Ridge Pine 3 used (Janusas 1984:86). As well, if people occupied the site during the latter half of the Narrow Point complex, the dropping lake levels of the Nipissing Phase at this time (ca. 4500 cal BP to 3400 cal BP) would make the Kettle Point outcrops closer to the surface in the shallows (Baedke & Thompson 2000:423). Occupation in the latter half of the Narrow Point complex or multiple occupations throughout the Narrow Point complex could help explain the amount of Kettle Point chert at Ridge Pine 3.

The primary source location for Onondaga chert on the other hand is on or near the northeastern shore of Lake Erie (Cook & Lovis 2014:59; Spence & Fox 1986:21). With the primary source location about 150 km east of Ridge Pine 3, Ridge Pine 3 occupants were likely restricted to secondary deposits of lesser quality Onondaga as evidenced by the amount of low quality Onondaga in the assemblage (Ellis, Kenyon, & Spence 1990; Ellis et al. 2009; Lovis et al. 2005; Pearce 2008:Table 5.2). According to James Keron (personal communication 2021), secondary Onondaga deposits start at the

Lake Erie shoreline and go inland into south London and beyond, although its northerly extent has not been well documented (Keron 2003:32-34). Ian Kenyon (1980a) also suggested that secondary Onondaga sources extended into the London area as shown in Figure 12. It is possible that the lower quality Onondaga was from till chert near Grand Bend, which has not been systematically studied, or from secondary sources in the southern part of the seasonal round of the Ridge Pine 3 people. The Nettling site, about 75 km south of Ridge Pine 3 along the north shore of Lake Erie, is noted to have abundant local secondary deposits of Onondaga (Ellis et al. 1991:5). The people at Ridge Pine 3 may have been moving south into these areas where secondary Onondaga is more common as part of their seasonal round. It is also possible that some of the better quality Onondaga chert left behind at Ridge Pine 2 was collected by people at Ridge Pine 3 due to its proximity to the site and the possibility of continuity between the two based on the Brewerton Side-Notched/Feeheley projectile point from Ridge Pine 3.

The people at Ridge Pine 3 undoubtedly made use of the diverse range of resources available to them in the local environment and surrounding landscape. Although their subsistence needs appear to have been well taken care of with the variety of microenvironments at their disposal, there were some constraints that people had to work around. The reliance on poorer quality secondary deposits of Onondaga was a major one, based on its dominance in the lithic assemblage. Despite the poor quality of this chert, flintknappers were able to work with it showing their high skill levels in lithic production. Shallowly submerged Kettle Point outcrops likely posed some difficulties, but its presence in the tool assemblage at Ridge Pine 3 indicates that people found a way to acquire this material. The better quality of Kettle Point chert was particularly useful for expedient tasks given its dominance in utilized (51.62%) and retouched flakes (50.00%).

Despite the warmer climate than modern times extending the length of habitable occupation at coastal sites, the approaching winter with cold temperatures and high winds off Lake Huron would have been a factor to consider in meeting subsistence needs and an incentive for moving to more sheltered locations. The location of Ridge Pine 3 allowed for successful occupation, although there were environmental constraints that people had to consider. Ultimately, the occupation of Ridge Pine 3 met subsistence needs and the functions of the site allowing for productive tool manufacture, hunting, and food processing tasks.

Chapter 7: Conclusion

Ridge Pine 3 is one of many sites located in the Ausable Valley about 1.3 km from the Lake Huron shoreline on the eastern edge of the Grand Bend community. It was originally believed to be dated to the Small Point complex, ca. 4100 cal BP to 3200 cal BP, the last complex in the Late Archaic, based on the fact that four of the six projectile points were typed as Innes (TMHC 2012:63). However, projectile point typology, radiocarbon dates, and analyses of the lithic toolkit support a different conclusion. The Ridge Pine 3 site is inferred to be primarily a Narrow Point site, ca. 5000 cal BP to 4100 cal BP, the first complex in the Late Archaic.

Four of the six projectile points are most like the Lamoka type within the Narrow Point complex. Two radiocarbon dates from wood charcoal samples in Feature 4 supplement the point typology with dates of 4978 to 4844 cal BP (4346 ± 34 RCYBP) and 5081 to 4876 cal BP (4426 ± 44 RCYBP). The Ridge Pine 3 lithic toolkit also shares several similar tool types with other Narrow Point sites excavated in Ontario and New York (Ellis, Kenyon, & Spence 1990:96; Hayes & Bergs 1969; Odell 2004:79; Ritchie 1932).

While the Narrow point complex is the primary occupation, there is evidence for other occupations at the site, including the Early Archaic Corner-Notched horizon, late Middle Archaic, and the Late Archaic Small Point complex. It is common for Archaic sites to have multiple components (Ellis et al. 2009:790). Evidence for an Early Archaic occupation mainly stems from a possible Nettling projectile point dating to ca. 11300 cal BP to 10000 cal BP (Ellis, Kenyon, & Spence 1990:73). As well, one of the small, hafted end scrapers in the collection may be associated with an Early Archaic Corner-Notched horizon as this is a common tool type from this time (Ellis, Kenyon, & Spence 1990:74; Ellis et al. 1991:11).

The late Middle Archaic occupation also has evidence from point typology, considering the presence of the single Brewerton Side-Notched/Feeheley type point (Cat. No. 53). The Brewerton Side-Notched type dates to ca. 6200 cal BP to 5000 cal BP (Justice 1987:115). This may indicate some level of continuity with the Ridge Pine 2 site, just 160 m west of Ridge Pine 3, as 16 Brewerton Corner-Notched forms were found at that site. The Feeheley site in Michigan provides a date of 4831 to 4069 cal BP for Feeheley points, which are considered to be a morphological variant of Brewerton (Lovis 2009:736; Lovis & Robertson 1989:228). Morphologically, Cat. No. 53 looks very similar to the Feeheley points illustrated by Lovis (2009:Figure 20.8). Considering the post-5000 cal BP dates associated with Brewerton points at the Jacob Island (Connolly et al. 2014:120) and Cat. No. 53's proximity location to Feature 4, which clearly dates in the 4800 to 5100 BP range, it is possible that this point may be contemporary or near contemporary with the Lamoka-like points at Ridge Pine 3.

The Late Archaic Small Point occupation, ca. 3800 cal BP to 2900 cal BP, does not have associated projectile points, but a radiocarbon date supports this inferred occupation. A sample of wood charcoal from Feature 3 was dated to 3260 to 3075 cal BP (3005 ± 31 RCYBP), close to the end of this complex. This date also fits nicely within the Small Point date ranges from the Davidson site in the Ausable Valley (Ellis et al. in press). Some of the small, hafted end scrapers, a common tool form in the Early Archaic, are also common in the Small Point complex and could be attributed to either complex. The unhafted thumbnail scrapers at Ridge Pine 3 are also a common form at Small Point sites. Other tool forms at Ridge Pine 3 associated with both the Narrow Point and Small Point complexes include wedges, gravers, perforators, and burins (Ellis, Kenyon, & Spence 1990:109-110).

The artifacts and spatial patterning left behind aided interpretations of the potential functions of the site. The debitage makes up 96.16% of the assemblage with late-stage reduction flakes making up the majority, especially biface thinning flakes at 36.09%. The presence of many biface thinning flakes and 73 bifaces, the most common formal tool in the assemblage, indicates that biface reduction was a major activity at Ridge Pine 3. The assemblage includes the most diverse range of tool types compared to other sites in the local vicinity and beyond. It is clear that the manufacture and maintenance of tools was a major function of the site.

Another function of Ridge Pine 3 is hunting and animal processing. The presence of projectile points indicates hunting activities, which makes sense given the wide range of terrestrial, avian, and aquatic species in the local environment. The projectile points are concentrated in two areas, east and northwest of the center of the site, which are interpreted as potential rehafting and resharpening areas for these tools. The scrapers and knives in the toolkit point to food and animal processing activities. The high incidence of utilized flakes (n=156) and retouched flakes (n=31) which can be used for cutting and scraping tasks also supports this inference. The presence of boring tools such as perforators, gravers, and burins as well as spokeshaves and notched flakes may also tie in with bone processing tasks.

In sum, lithic tool production, hunting and food and animal processing were likely all key activities at Ridge Pine 3. The focus was biface manufacture and, on a smaller scale, rehafting and resharpening tools such as projectile points. A low incidence of hinge terminations and shatter in the debitage and low Coefficient of Variation values for bifaces and projectile points, indicate that a small number of expert level flintknappers manufactured the tools. However, novices and children may also have been part of the manufacture process in ways that erased them from the archaeological record, such as working closely with an expert.

Reconstruction of the paleoenvironment has provided insight into what opportunities were available to people and the constraints they faced based on the site location. Microenvironments in the area include the Deciduous and Great Lakes-St. Lawrence Forest regions, the xeric forest zone between the Lake Huron shoreline and the Thedford Embayment, the mesic to moist forest zones on upland areas in Middlesex County, and the lacustrine resources of Lake Huron and the Thedford Embayment. The area provided a diverse range of lacustrine, terrestrial, and avian resources which would have allowed people to meet their subsistence needs. As well, the proximity of the Kettle Point primary source, though submerged throughout the Late Archaic, was a viable resource of good quality chert that people continued to access despite higher water levels as evidenced by its use at Ridge Pine 3 (Janusas 1984:86).

While there were several benefits and opportunities, environmental constraints were still present. The Ridge Pine 3 people relied mostly on secondary sources for Onondaga chert that was of lesser quality than the material from primary sources and would have been more difficult to work with (Pearce 2008:Table 5.2). As well, the location near Lake Huron meant that colder temperatures and high winds off the lake would be a cold season concern and a factor to consider in seasonal movements.

The seasons of occupation of the site are difficult to ascertain due to the lack of floral and faunal remains. However, it can be tentatively suggested that occupation occurred during the summer and into late fall. The proximity to the Thedford Embayment and Lake Huron shoreline indicates a possible warm-weather occupation (TMHC 2005:37). The lake effect in the region allows for bodies of water to retain their heat into the autumn season allowing for longer stays at coastal sites that would have enabled the Ridge Pine 3 occupants to stay through the summer into fall (Dean 1994:7; Deevey & Flint 1957; Lewis et al. 2008:133). Nutshell remains also point to occupation in the fall. The large quantity of chert at Ridge Pine 3 and the presence of unexhausted cores also suggests a warm-weather occupation as Kettle Point and Onondaga cherts tend to occur in littoral areas where people often resided in the warm seasons, which was likely when chert procurement occurred (Muller 1989:20). On the other hand, the quantity of fire cracked rocks, either for stone boiling or as a heat source, and burnt chert materials provides evidence for the use of hearths/fire and perhaps for a fall occupation (TMHC 2012:61). The microenvironments in the surrounding environment would have allowed for occupation throughout the year as a wide range of subsistence resources would have been available.

Ridge Pine 3 is important to our understanding of precontact history in the Lake Huron basin. Its association with the Late Archaic Narrow Point complex represents an addition to our limited database on this poorly understood complex. Ridge Pine 3 also demonstrates the importance of reconstructing the paleoenvironment and understanding responses to dynamic environmental changes. This thesis contributes to our understanding of the Late Archaic in the Grand Bend area and the Ausable Valley but there is still much to learn about the Late Archaic in this region.

7.1 Future Research

It is well known in the archaeological community that the Archaic remains a poorly understood period in the archaeological record. While Ridge Pine 3 provides important data for the Late Archaic and the Narrow Point complex in particular, our current understandings are still lacking. A part of this lack of data stems from the difficulty in accessing reports on sites excavated in the CRM sector. Reports from these sites are in government databases, such as Past Portal, which can be awkward to use. While reports and data can be obtained directly from CRM consultants, it would be more efficient if a more user-friendly database was used to store the CRM data for those in academia to access as needed for further and more robust studies to add to our data pool on the Late Archaic and the Archaic as a whole. Combining academic and CRM sector archaeological data would allow for a more comprehensive understanding of the Archaic in southwestern Ontario.

The combination of CRM work and academic research could be useful in further understanding the relationships between the complexes in the Late Archaic, specifically regarding the Late Archaic projectile point typologies and how they relate to one another temporally, geographically, and morphologically. Lovis' (2009) ideas on the continuity of Late Archaic complexes may be a better way of looking at the Late Archaic than the established linear timeline (Ellis et al. 2009). A revaluation of the complexes of the Late Archaic is needed to better understand how the complexes relate to one another and to help with the issue of point types from the Narrow Point and Small Point complexes being commonly confused. The discussion on Late Archaic radiocarbon dates in the Ausable Valley and Michigan in section 5.11.1 show that the relationships between complexes are closer than current models show. There may be more overlap with the Narrow Point and Small Point than previously thought, especially considering the similarities in their toolkits and the continuity/similarity in the Narrow Point projectile point size range and temporal depth that runs right into the Small Point. It may be that instead of a linear development, the Narrow Point could have morphed into the Small Point while the Broad Point complex is a parallel development occurring at the same time. The ambiguity of the Ridge Pine 3 projectile points in being similar to both Lamoka and Innes types showcases the need for further research into how the complexes relate to one another.

Further research studies should also be focused on trying to understand who was contributing to the lithic artifacts left behind. Lithics are an important source of information, particularly for older sites, as they are the most well-persevered artifact type in the archaeological record. Learning a skill such as flintknapping requires time and practice. Studies by Shelley (1990) and Milne (2005, 2012) were used in this thesis to try to understand who was part of the lithic tool manufacture that was so prevalent at Ridge Pine 3. Their studies were useful in trying to identify signatures other than experts to gain a better understanding on the roles that children and novices had at Ridge Pine 3. Although evidence of novices was not visibly present at Ridge Pine 3, they may have been present and learning through methods that erased them from the archaeological record or practicing at locations away from the site. Further studies on trying to identify craft learning can broaden our understandings on the role that learning and education had in precontact history. Further, identifying signatures of children and novices in the archaeological record may help to improve our understanding of how people moved around and used the space at a site to perform activities and if there are differences in movements/uses of the site that are dependent on age.

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Appendices

Appendix A: Figures and Tables

Chapter 1: Introduction

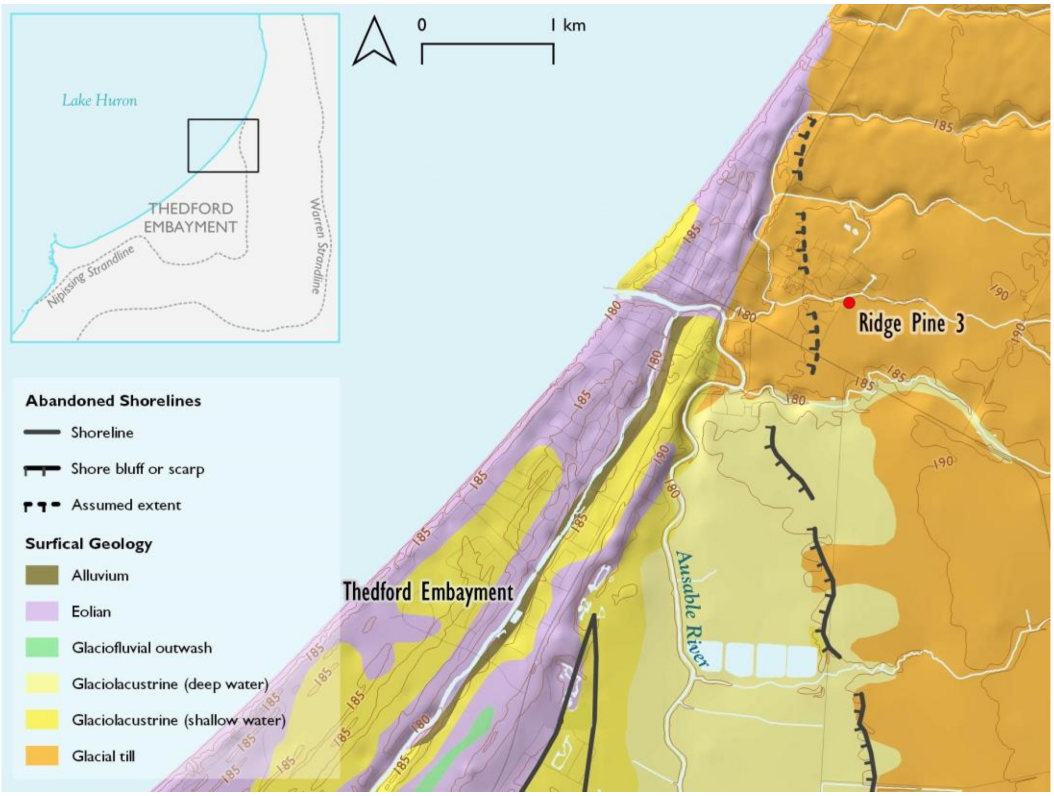

Figure 1: Map depicting the location of Ridge Pine 3 in relation to Lake Huron, the assumed extent of the Nipissing high-water stage shoreline and the Thedford Embayment (adapted from Belyea 2019:13, courtesy of TMHC)

Chapter 2: Theory and Methods

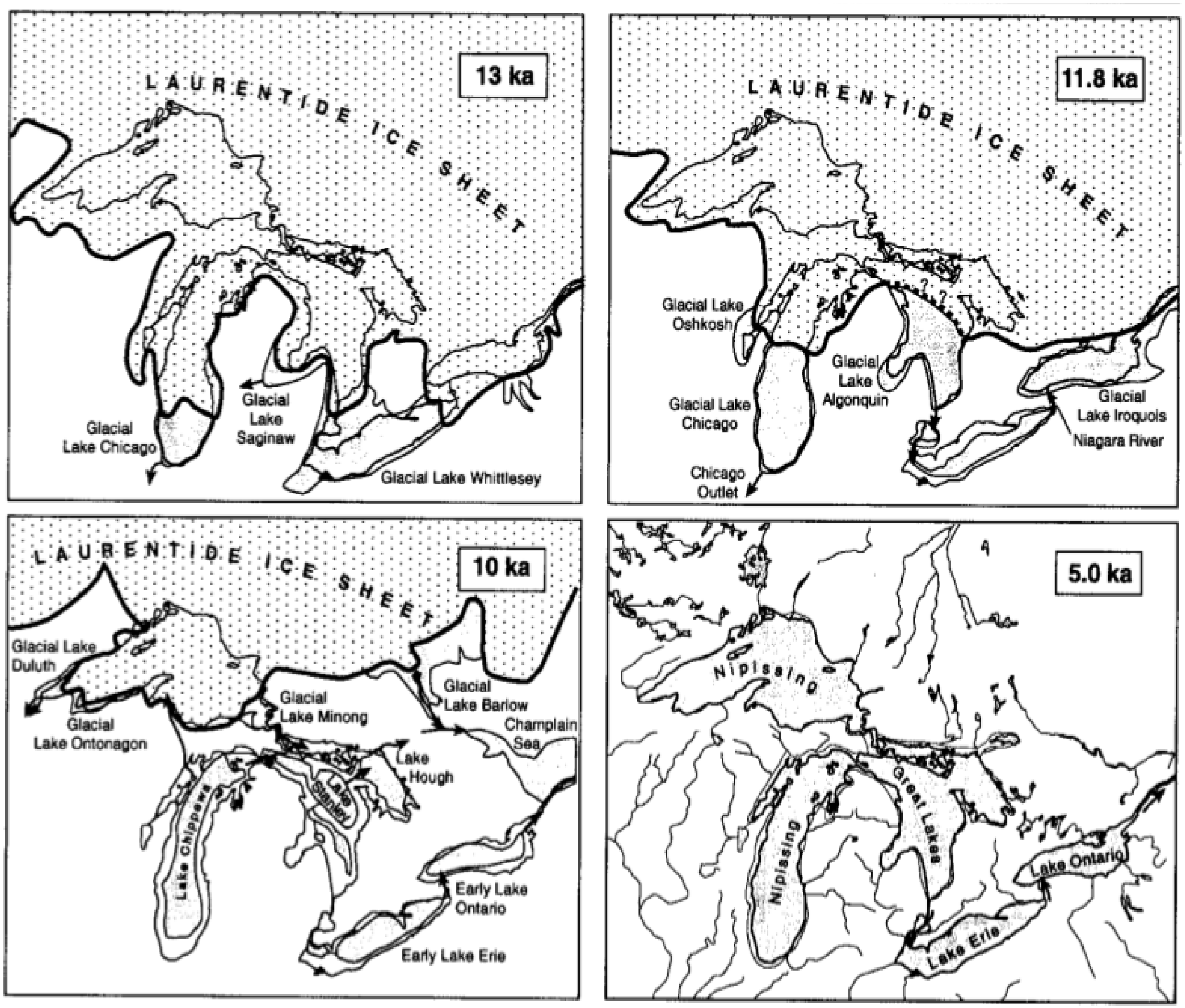

Figure 2: Extent and locations of major proglacial lakes associated with the Laurentian ice sheet retreat (figure adapted from Larson & Schaetzl 2001:Figure 8)

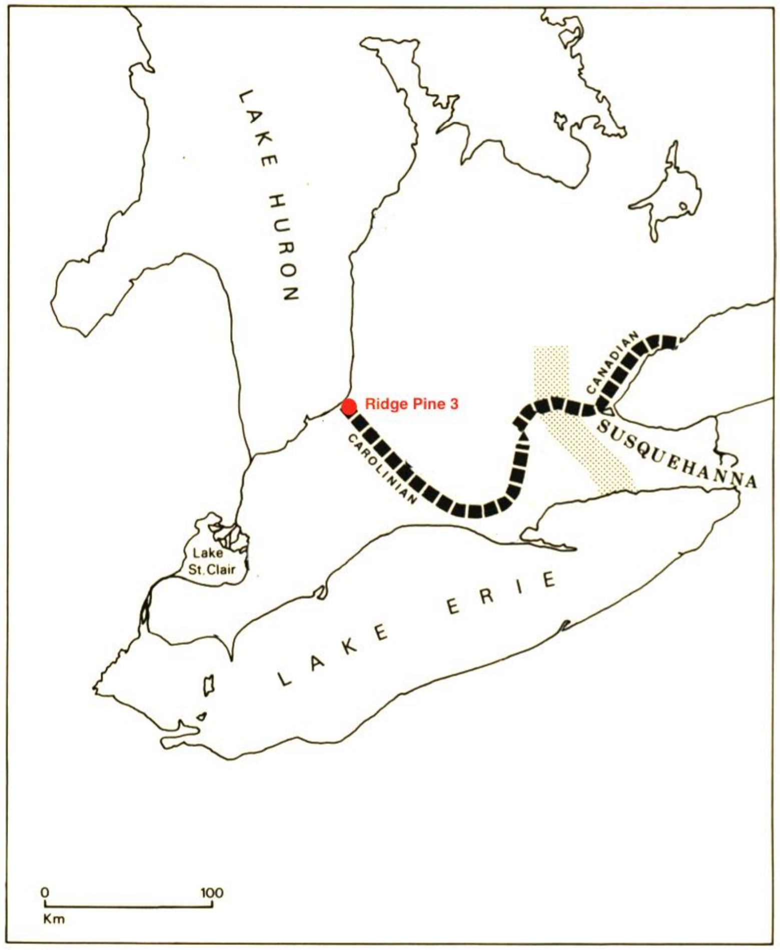

Figure 3: Carolinian/Canadian Biotic Provinces Boundary in Southern Ontario (figure adapted from Spence & Fox 1986:Figure 1.3)

Chapter 3: Theory and Methods

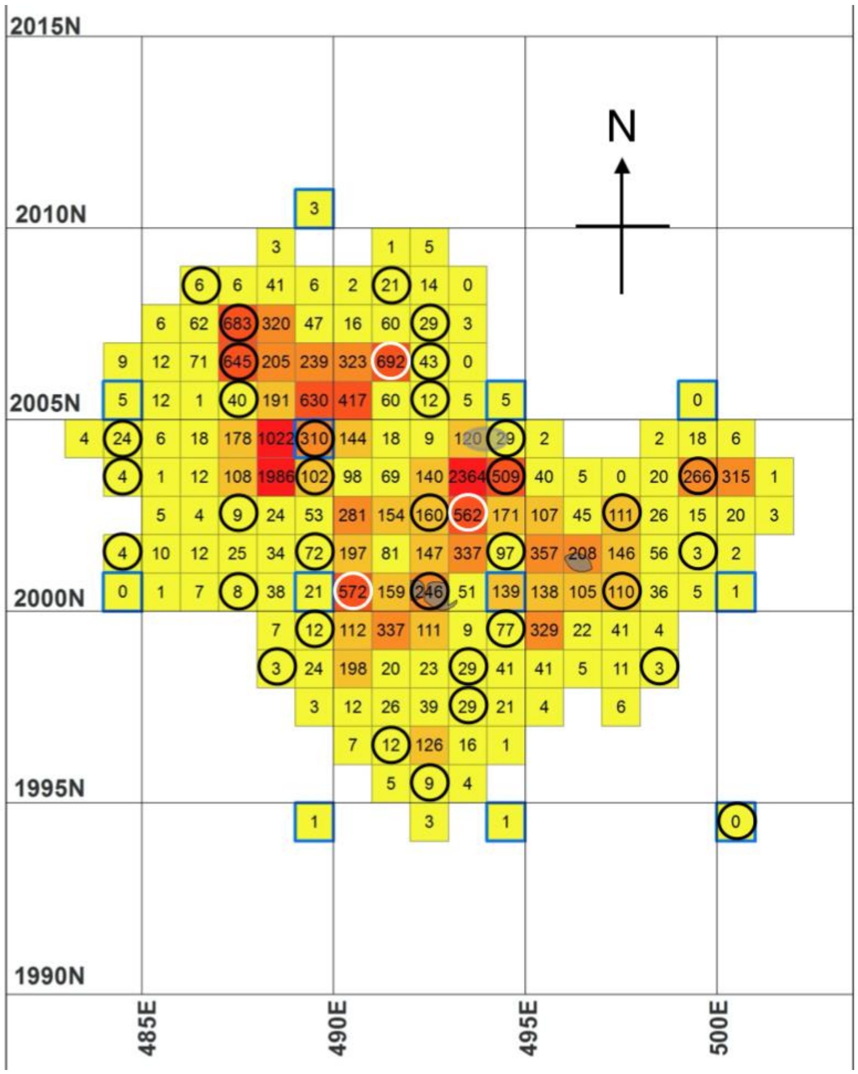

Figure 4: Unit map of Ridge Pine 3 showing units selected for debitage analysis in black and extra units chosen in white (adapted from TMHC 2012:38)

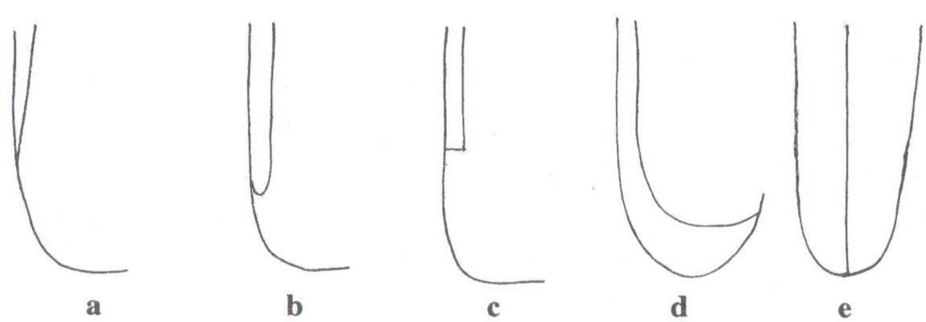

Figure 5: Flake termination types. A) Feather, B) Hinge, C) Step, D) Outrepassé or plunging, E) Axial (image taken from Odell 2004:57)

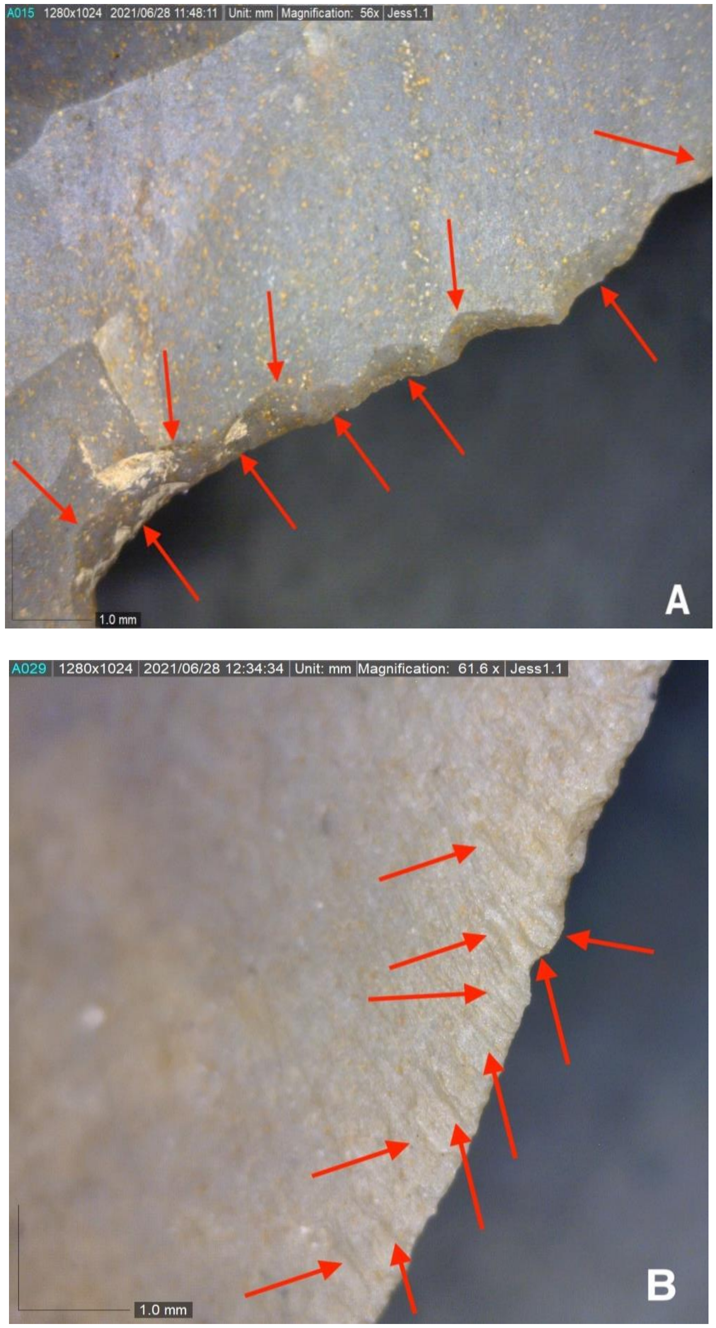

Figure 6: A) Continuous and close microflakes (Cat. No. 352 dorsal face left lateral edge). B) Striations (Cat. No. 876 ventral face distal edge). Images taken with Dino Lite digital microscope (10 X to 140 X magnification)

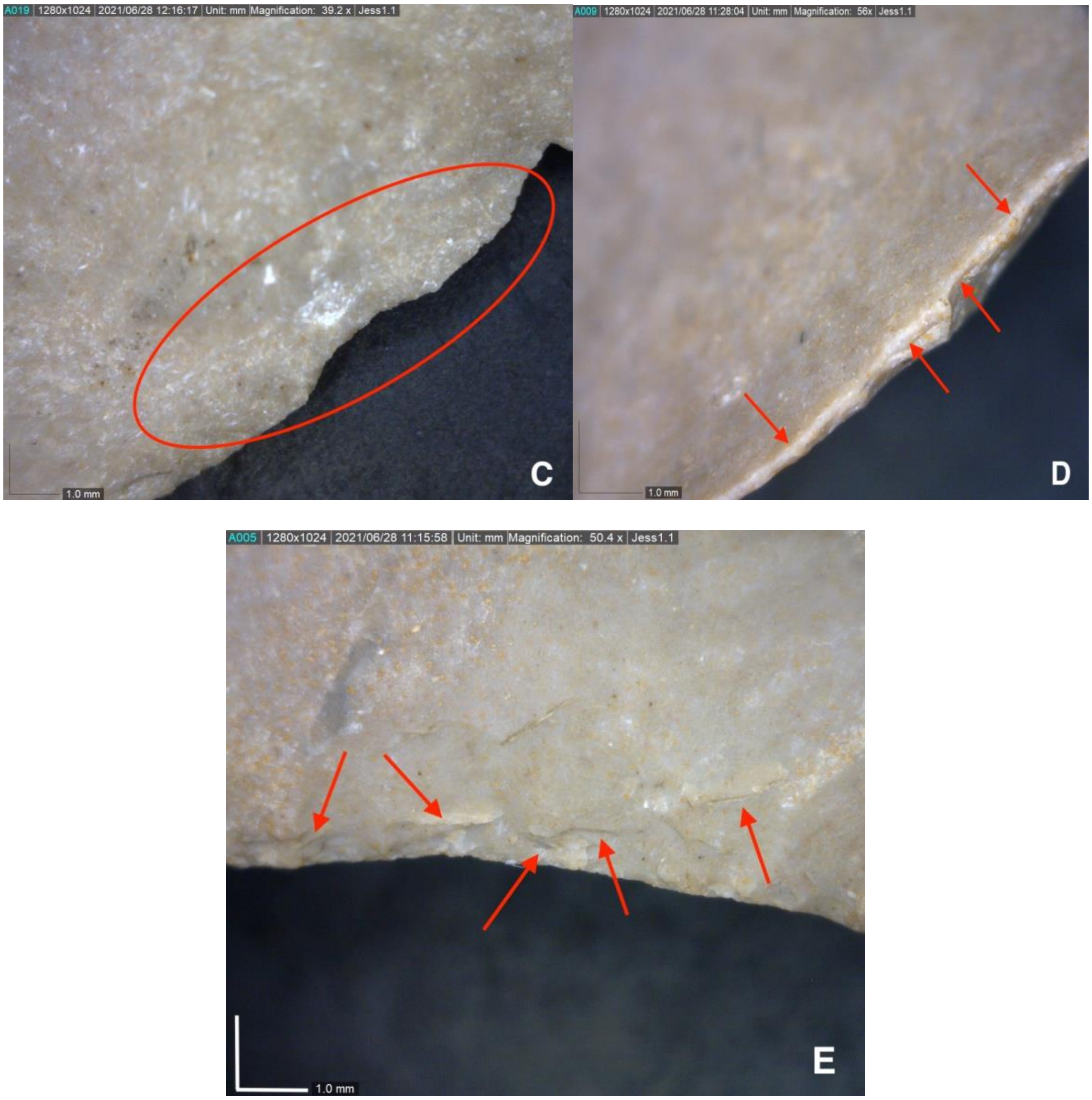

Figure 7: C) Discontinuous polish (Cat. No. 06 dorsal face right lateral edge). D) Edge rounding (Cat. No. 849 ventral face distal edge). E) Cracks (Cat. No. 212 ventral face right lateral edge). Images taken with a Dino Lite digital microscope (10 X to 140 X magnification)

Chapter 4: Paleoenvironment

Table 1: Component weights (g) for Ridge Pine 3 samples and feature locations.

Location	Components				
Feature	**Unidentifiable (g)**	**Nutshell (g)**	**Bone (g)**	**Charcoal (g)**	**Flakes (g)**
1	5.21	0.39	-	0.93	-
2	0.31	0.08	0.08	0.04	-
3	<0.01	<0.01	<0.01	0.07	-
4	<0.01	-	-	1.76	<0.01

Table 2: Frequencies of identified floral species from Ridge Pine 3.

Species	Feature				Total
	1	**2**	**3**	**4**	
Carya sp. (hickory)*	-	1	-	-	**1**
Fagus grandifolia (beech)	-	-	-	3	**3**
Indeterminate Diffuse Porous	1	1	2	2	**6**
Total	**1**	**2**	**2**	**5**	**10**

***Note:** the *Carya sp.* identification is likely but not a definitive identification

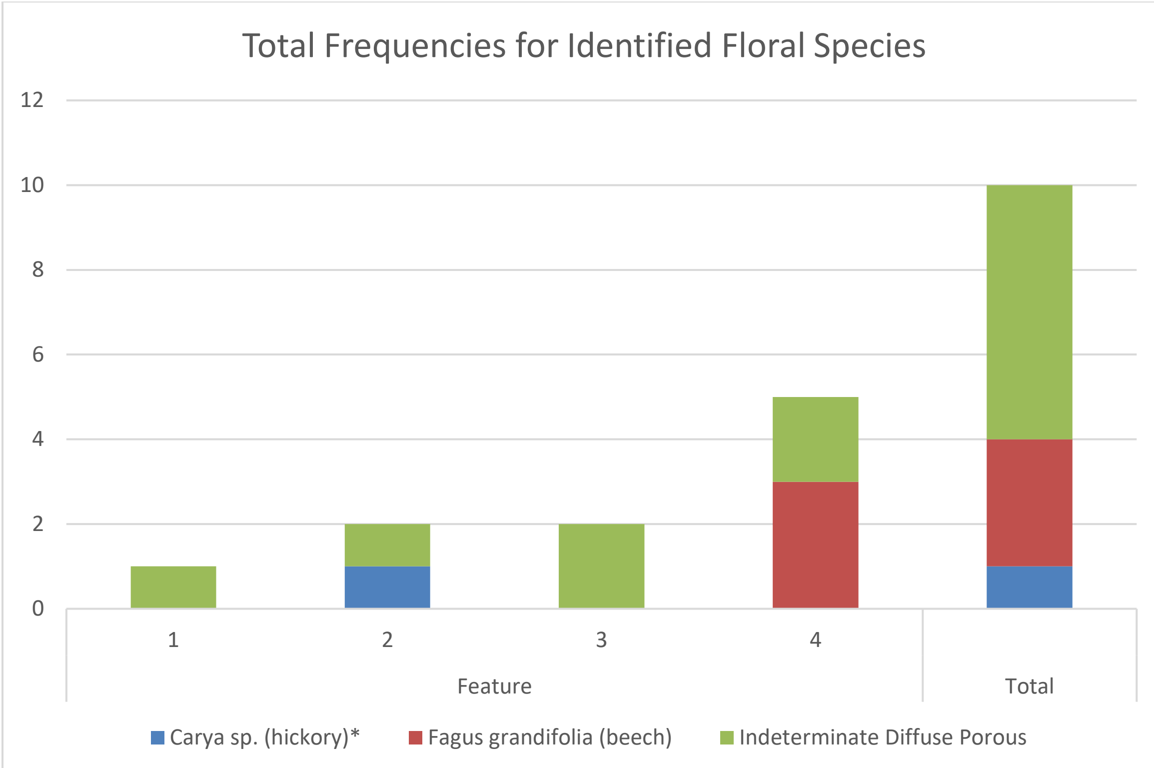

Figure 8: Total frequencies of identified floral species from Ridge Pine 3.

Note: The Carya sp. identification (hickory) is not definitive but it is likely based on comparison with a modern reference collection

Table 3: List of nut remains from Late Archaic sites in southern Ontario.

Context			Nut Remains					
Site	**Date (cal BP)**	**Date (RCYBP)**	**be**	**bw**	**bu**	**ha**	**oa**	**hi**
Ridge Pine 3	ca. 5000-4100	ca. 4500-3800	-	-	-	-	-	X
Canada Century	ca. 5000	ca. 4450	-	*	*	-	-	X
Shaver Knoll	ca. 4400	ca. 3950	-	X	-	-	-	-
Muldoon	ca. 4400	3950	-	-	X	-	X	X
Adder Orchard	ca. 4250	3850	-	X	-	-	-	-
George Davidson	ca. 4150	3785	-	X	X	-	X	-
McIntyre	ca. 4000	3650	X	-	X	X	X	X
Staffen	ca. 3700	3450	-	X	-	-	-	-
Crawford Knoll	ca. 3650	ca. 3400	-	X	-	-	-	-
Innes	ca. 3600	3350	-	X	-	-	-	-
Thedford II	ca. 3200	3020	-	-	X	-	-	-
Morpeth South	ca. 3000	2850	-	X	-	-	-	-

Key: be = beech, bw = black walnut, bu = butternut, ha = hazelnut, oa = oak, hi = hickory; * = butternut or walnut from that site.

Note: This is a modified table of the data from Fecteau (2014:Table 6)

References: Ridge Pine 3 (Russell this report; TMHC 2012); Canada Century (Lennox 1990); Shaver Knoll (Fecteau 2014); Muldoon (Fecteau 2004, 2005); Adder Orchard (Fisher 1990); George Davidson (Ellis et al. 2014b); McIntyre (Yarnell 1984); Staffen (Fecteau 1983); Crawford Knoll (Kenyon & Snarey 2002); Innes (Lennox 1990); Thedford II (Ellis, Deller, Murphy, & Dodd 1990); Morpeth South (Fecteau 1979)

Table 4: List of wood charcoal remains from Late Archaic sites in southern Ontario.

Context			Wood Charcoal Remains														
Site	Date (cal BP)	Date (RCYBP)	ma	sm	be	as	bi	ir	sy	elm	we	ro	wo	oa	hi	ju	pi
Ridge Pine 3	ca. 5000-4100	ca. 3500-2800	-	-	X	-	-	-	-	-	-	-	-	-	-	-	-
Canada Century	ca. 5000	ca. 4450	X	-	X	-	-	-	-	-	-	-	-	-	-	-	-
Quaker Park	ca. 5000	4450	-	X	X	-	-	-	-	-	X	-	X	-	X	-	-
Muldoon	ca. 4400	ca. 3950	X	X	-	X	X	-	-	-	-	X	-	-	-	-	-
Shaver Knoll	ca. 4400	ca. 3950	-	X	X	-	-	-	-	-	-	-	X	-	X	-	-
Tegis	ca. 4400	ca. 3950	-	X	X	-	-	-	-	-	-	-	-	-	-	-	-
Adder Orchard	ca. 4250	3850	X	-	X	X	X	-	-	X	-	-	-	X	X	X	-
George Davidson	ca. 4150	3785	-	-	X	-	-	X	-	X	-	-	-	-	-	-	-
Thistle Hill	ca. 3800	ca. 3500	-	-	-	-	-	-	-	-	-	-	-	-	-	-	X
Staffen	ca. 3700	3450	-	-	X	-	-	-	-	-	-	-	-	-	-	-	-
Innes	ca. 3600	3350	X	-	-	-	X	X	-	-	-	X	-	-	-	-	-
Thedford II	ca. 3200	3020	-	-	X	X	-	-	-	X	-	-	-	X	-	-	-
Morpeth South	ca. 3000	2850	-	X	X	X	X	X	X	-	X	X	X	-	-	-	-

Key: ma = maple, sm = sugar maple, be = beech, as = ash, bi = birch, ir = ironwood, sy = sycamore, elm = elm, we = white elm, ro = red oak, wo = white oak, oa = oak, hi = hickory, ju = Juglans sp. (butternut/black walnut), pi = pine

Note: This is a modified table of the data from Fecteau 2014 (2014:Table 7)

References: Ridge Pine 3 (Russell this report; TMHC 2012); Canada Century (Lennox 1990); Quaker Park (Fecteau 1985); Muldoon (Fecteau 2004, 2005); Shaver Knoll (Fecteau 2014); Tegis (Fecteau 1993); Adder

Orchard (Fisher 1990); George Davidson (Ellis et al. 2014b); Thistle Hill (Woodley 1990); Staffen (Fecteau 1983); Innes (Lennox 1986); Thedford II (Ellis, Deller, Murphy, & Dodd 1990); Morpeth South (Fecteau 1979)

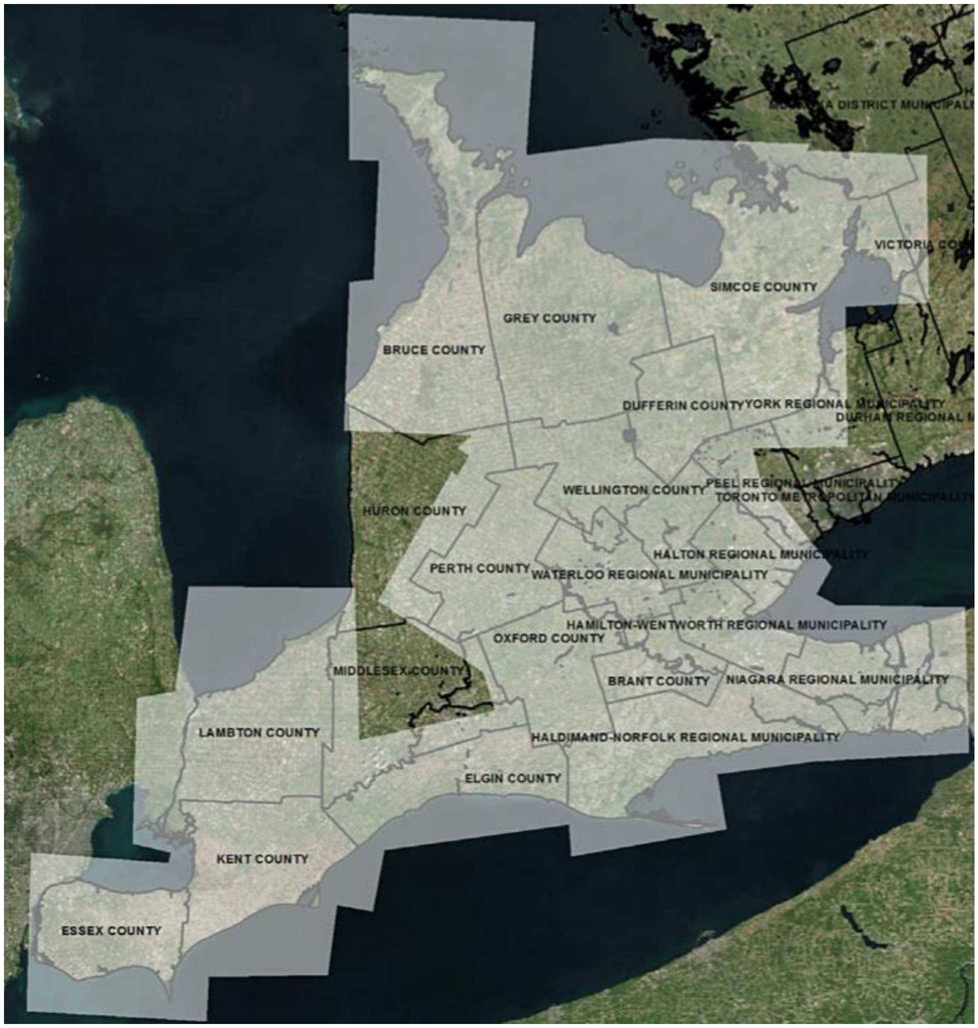

Figure 9: Meta-map of Peter Findlay's (1973a, b, c) completed pre-settlement vegetation maps in southern Ontario (image adapted from Karrow & Suffling 2016:Figure 1)

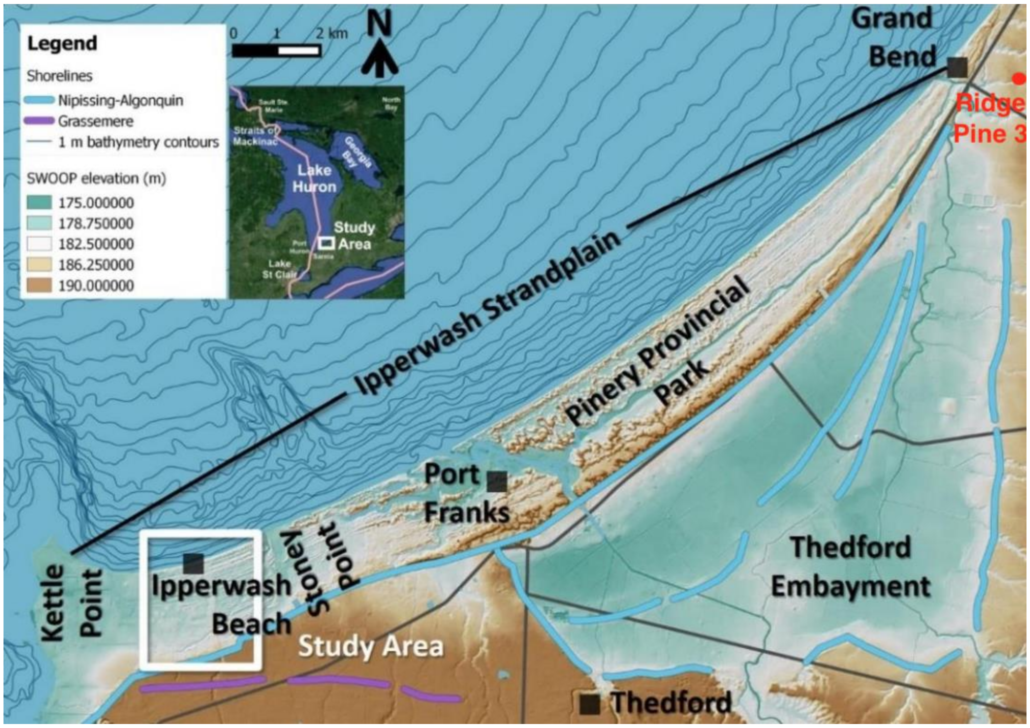

Figure 10: Thedford Embayment, the modern Lake Huron shoreline, and the location of Ridge Pine 3 (image adapted from Morrison 2017:Figure 7)

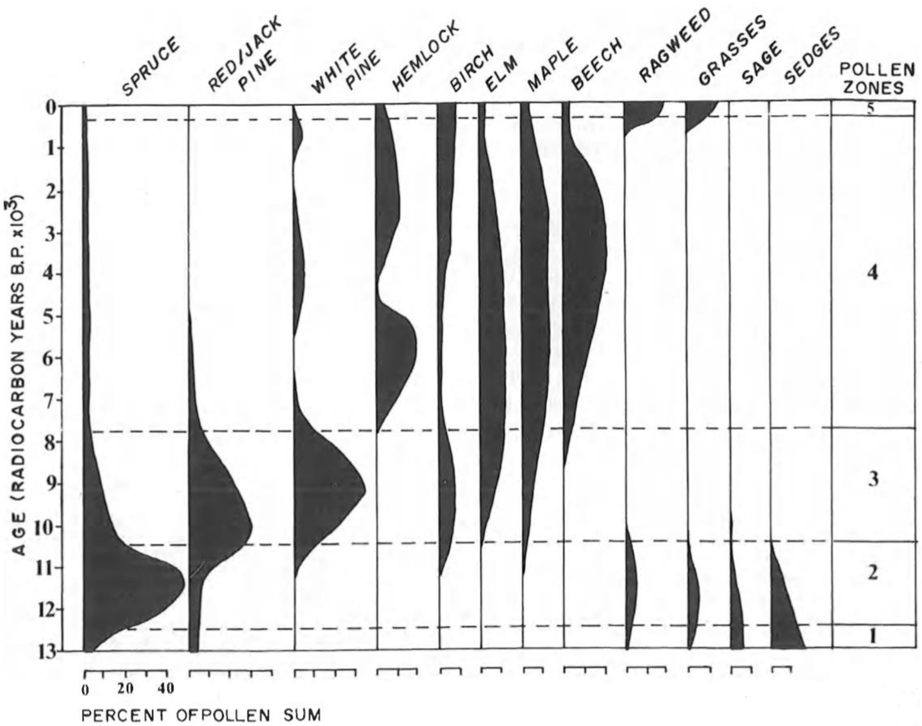

Figure 11: Generalized representative pollen diagram for southwestern Ontario (image taken from Karrow & Warner 1990:Figure 2.14)

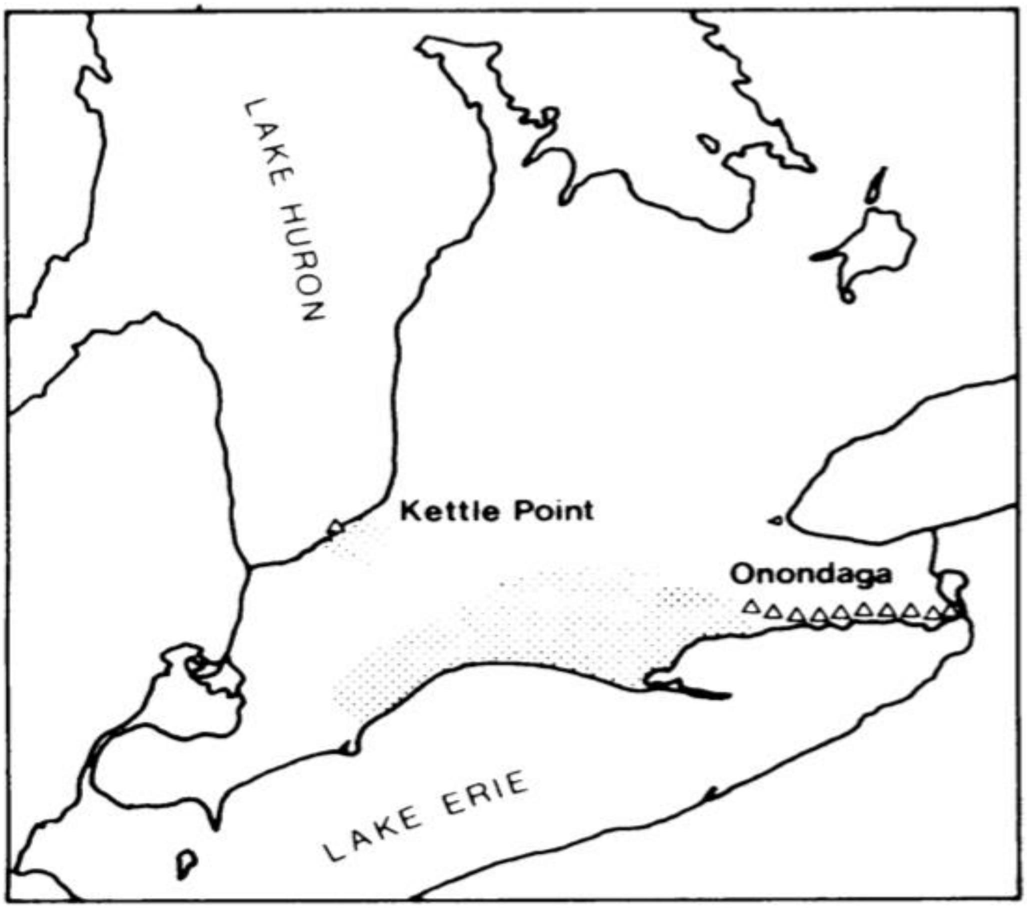

Figure 12: Distribution of Kettle Point and Onondaga chert sources. Triangles = primary source; dots = secondary source. Secondary source locations are approximate (image adapted from Kenyon 1980a:Figure 4)

Chapter 5: Results

Table 5: Ridge Pine 3 Artifact Summary

Artifact	Total (n)	Total (%)	Total Analyzed (n)	Total Analyzed (%)
Chipping Detritus (CDE)	19210	96.16%	5397	28.09%
Fire Cracked Rock (FCR)	278	1.39%	89	32.01%
Utilized Flake (UFL)	156	0.78%	155	99.36%
Non-Chert Detritus (NCD)	97	0.49%	97	100.00%
Biface (BIF)	73	0.37%	73	100.00%
Core (COR)	67	0.34%	67	100.00%
Retouched Flake (RTF)	31	0.16%	31	100.00%
Scraper (SCR)	19	0.10%	19	100.00%
Projectile Point (PPO)	9	0.05%	9	100.00%
Knife (KNI)	7	0.04%	7	100.00%
Hammerstone (HAM)	6	0.03%	6	100.00%
Graver (GRA)	4	0.02%	4	100.00%
Burin (BUR)	4	0.02%	4	100.00%
Perforator (PERF)	3	0.02%	3	100.00%
Wedge (WED)	3	0.02%	3	100.00%
Notched Flake (NFL)	2	0.01%	2	100.00%
Rough Stone Fragment (RSF)	2	0.01%	2	100.00%
Spokeshave (SPO)	2	0.01%	2	100.00%
Scraper-Knife (SCR-KNI)	2	0.01%	2	100.00%
Faunal Remains (BAF)	2	0.01%	2	100.00%
Plastic	1	0.01%	1	100.00%
Total	**19978**	**100.00%**	**5975**	**29.91%**

Note: One utilized flake (Cat. No. 216) is missing from the collection and could not be analyzed.

Table 6: Debitage Sample Flake Type and Material Summary

Flake Type	PRIM		SEC		TERT		BPO		SHAT		BFT		BRT		BRE		FRAG		Total	
	n	%	n	%	n	%	n	%	n	%	n	%	n	%	n	%	n	%	n	%
Onondaga	63	1.19%	305	5.78%	330	6.25%	2	0.04%	83	1.57%	1067	20.22%	84	1.59%	13	0.25%	1212	22.96%	3159	59.85%
Kettle Point	5	0.09%	29	0.55%	70	1.33%	0	0.00%	27	0.51%	541	10.25%	35	0.66%	8	0.15%	659	12.49%	1374	26.03%
Flint Ridge	0	0.00%	0	0.00%	0	0.00%	0	0.00%	0	0.00%	0	0.00%	0	0.00%	0	0.00%	0	0.00%	0	0.00%
Huronia	0	0.00%	0	0.00%	0	0.00%	0	0.00%	0	0.00%	0	0.00%	0	0.00%	0	0.00%	0	0.00%	0	0.00%
Jasper	0	0.00%	0	0.00%	0	0.00%	0	0.00%	0	0.00%	0	0.00%	1	0.02%	0	0.00%	1	0.02%	2	0.04%
Collingwood	0	0.00%	0	0.00%	0	0.00%	0	0.00%	0	0.00%	8	0.15%	1	0.02%	0	0.00%	11	0.21%	20	0.38%
Burnt Onondaga	6	0.11%	36	0.68%	8	0.15%	0	0.00%	9	0.17%	43	0.81%	1	0.02%	0	0.00%	50	0.95%	153	2.90%
Burnt Kettle Point	0	0.00%	5	0.09%	8	0.15%	0	0.00%	7	0.13%	75	1.42%	1	0.02%	2	0.04%	56	1.06%	154	2.92%
Burnt Flint Ridge	0	0.00%	0	0.00%	0	0.00%	0	0.00%	1	0.02%	0	0.00%	0	0.00%	0	0.00%	3	0.06%	4	0.08%
Burnt Huronia	0	0.00%	0	0.00%	0	0.00%	0	0.00%	0	0.00%	1	0.02%	0	0.00%	0	0.00%	0	0.00%	1	0.02%
Burnt Jasper	0	0.00%	0	0.00%	0	0.00%	0	0.00%	0	0.00%	0	0.00%	0	0.00%	0	0.00%	0	0.00%	0	0.00%
Burnt Collingwood	0	0.00%	0	0.00%	0	0.00%	0	0.00%	0	0.00%	0	0.00%	0	0.00%	0	0.00%	0	0.00%	0	0.00%
Burnt	4	0.08%	22	0.42%	24	0.45%	2	0.04%	6	0.11%	131	2.48%	2	0.04%	2	0.04%	137	2.60%	330	6.25%
Unknown	0	0.00%	0	0.00%	1	0.02%	0	0.00%	0	0.00%	39	0.74%	1	0.02%	0	0.00%	40	0.76%	81	1.53%
Total	**78**	**1.48%**	**397**	**7.52%**	**441**	**8.36%**	**4**	**0.08%**	**133**	**2.52%**	**1905**	**36.09%**	**126**	**2.39%**	**25**	**0.47%**	**2169**	**41.10%**	**5278**	**100.00%**

Key: PRIM: primary flake; SEC: secondary flake; TERT: tertiary flake; BPO: bipolar flake; SHAT: shatter; BFT: biface thinning flake; BRT: biface retouch flake; BRE: biface reduction flake error; URT: uniface retouch flake; FRAG: fragmentary flake; PTL: potlids

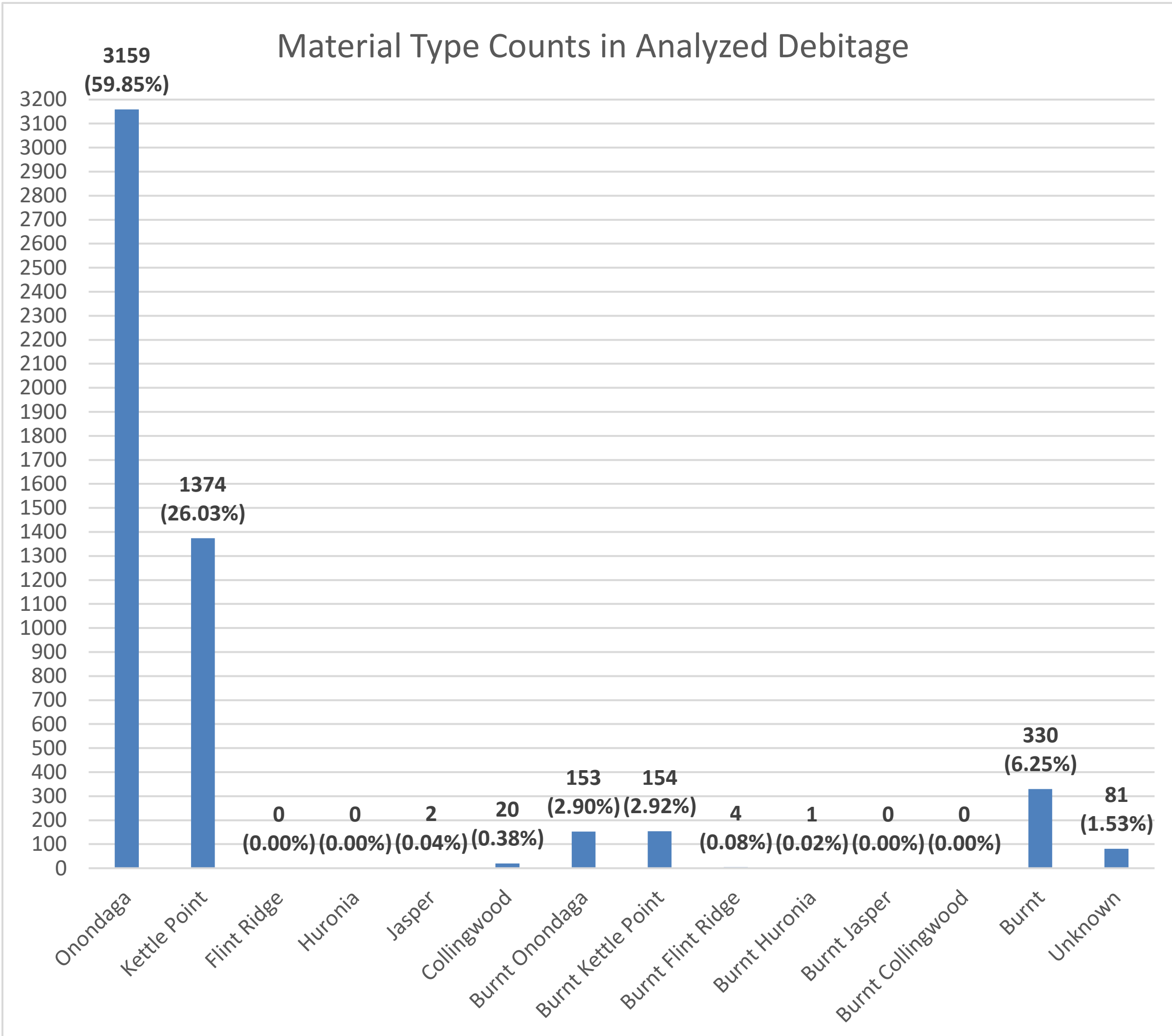

Figure 13: Material Types in the Analyzed Debitage Sample

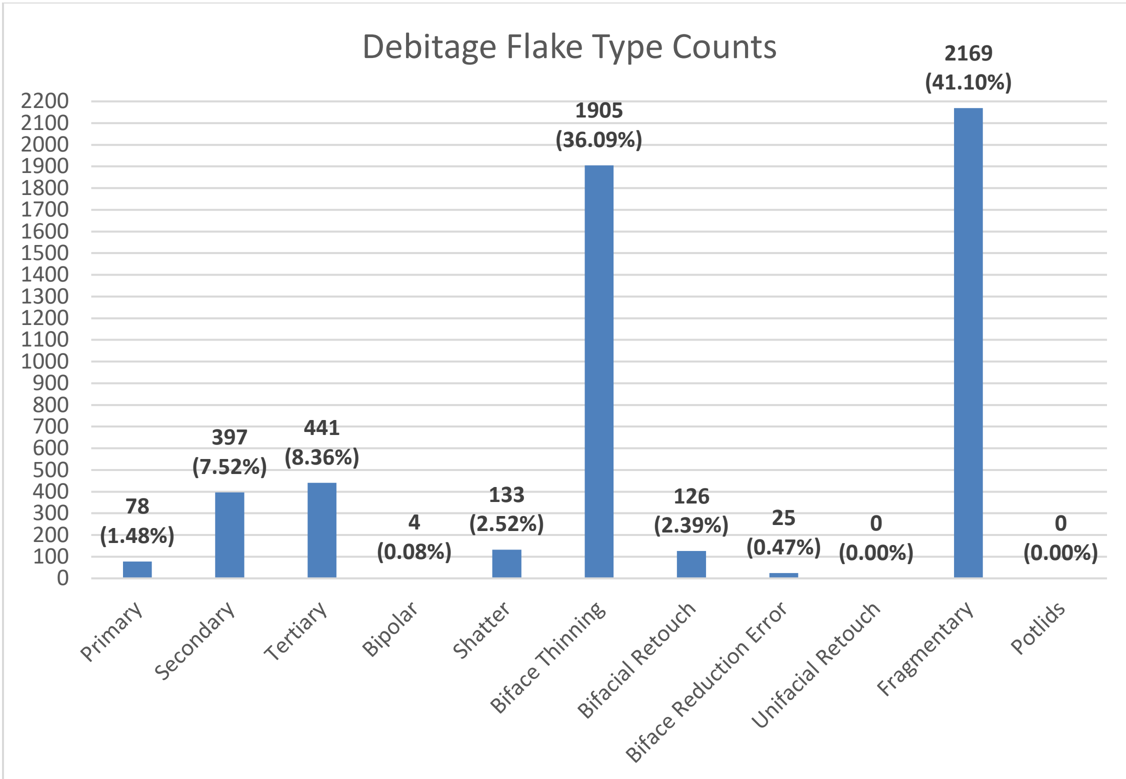

Figure 14: Debitage Sample Flake Type Counts

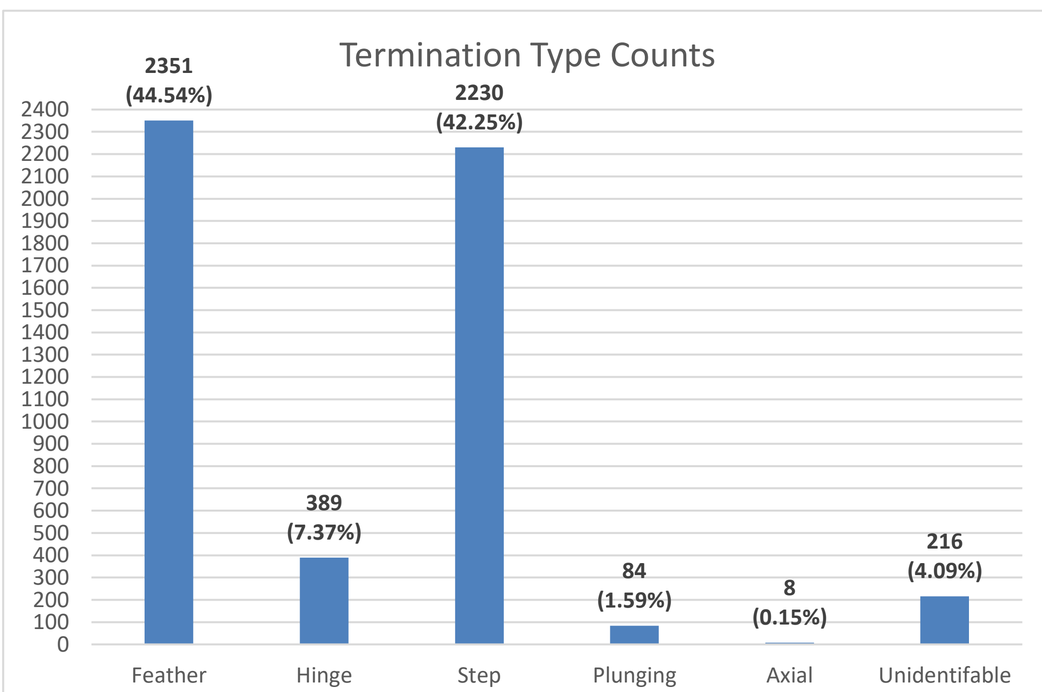

Figure 15: Debitage Sample Termination Type Counts

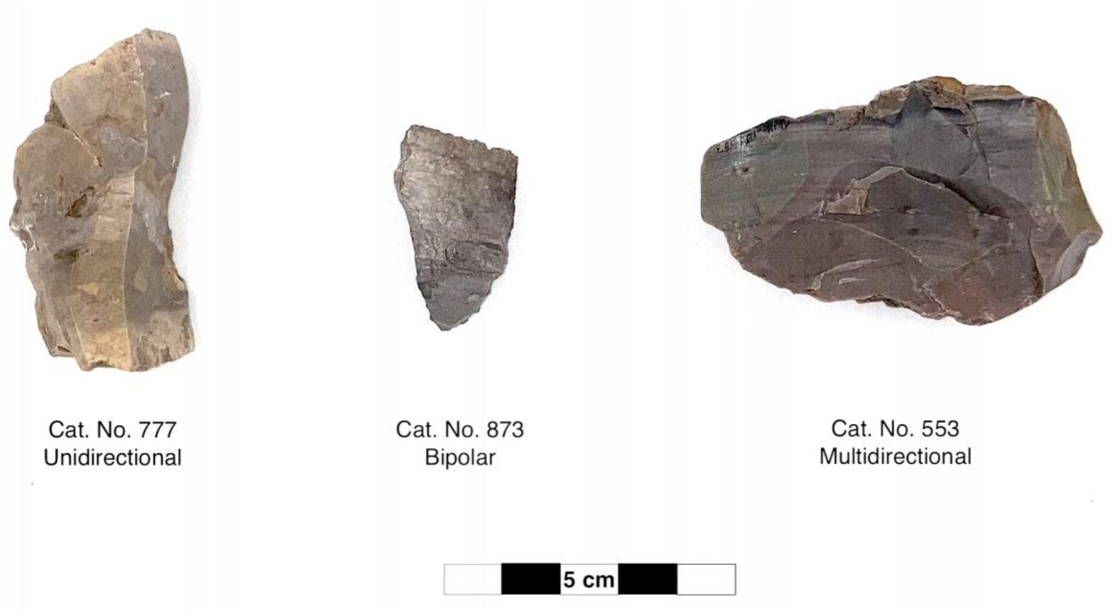

Figure 16: Ridge Pine 3 Core Types

Table 7: Core Data Table

Cat. No.	Material	Portion	Core Type
9	Onondaga	Fragment	Bipolar
12	Kettle Point	Fragment	Multidirectional
13	Onondaga	Complete	Unidirectional
14	Onondaga	Complete	Multidirectional
15	Onondaga	Complete	Multidirectional
27	Ancaster?	Fragment	Multidirectional
48	Kettle Point	Fragment	Multidirectional
52	Kettle Point	Fragment	Multidirectional
57	Kettle Point	Fragment	Unidirectional
80	Burnt Kettle Point	Complete	Bipolar
81	Kettle Point	Complete	Multidirectional
90	Onondaga	Complete	Unidirectional

96	Kettle Point	Complete	Multidirectional
108	Kettle Point	Complete	Multidirectional
114	Burnt Kettle Point	Complete	Multidirectional
115	Kettle Point	Complete	Bipolar
117	Kettle Point	Complete	Multidirectional
127	Onondaga	Fragment	Multidirectional
148	Kettle Point	Complete	Multidirectional
242	Onondaga	Complete	Multidirectional
273	Onondaga	Complete	Multidirectional
275	Onondaga	Fragment	Multidirectional
277	Onondaga	Complete	Multidirectional
305	Kettle Point	Fragment	Multidirectional
308	Onondaga	Fragment	Multidirectional
311	Kettle Point	Fragment	Multidirectional
346	Onondaga	Fragment	Multidirectional
350	Kettle Point	Fragment	Bipolar
369	Kettle Point	Complete	Multidirectional
405	Onondaga	Fragment	Multidirectional
460	Burnt Kettle Point	Fragment	Multidirectional
472	Onondaga	Fragment	Multidirectional
477	Onondaga	Fragment	Multidirectional
478	Onondaga	Fragment	Multidirectional
479	Burnt	Fragment	Multidirectional
480	Onondaga	Fragment	Multidirectional

493	Onondaga	Complete	Multidirectional
494	Burnt Kettle Point	Fragment	Multidirectional
502	Kettle Point	Fragment	Unidirectional
516	Onondaga	Complete	Multidirectional
528	Burnt	Fragment	Multidirectional
547	Burnt Kettle Point	Fragment	Multidirectional
553	Kettle Point	Complete	Multidirectional
561	Onondaga	Fragment	Multidirectional
572	Onondaga	Fragment	Multidirectional
576	Kettle Point	Fragment	Multidirectional
638	Onondaga	Fragment	Multidirectional
648	Onondaga	Complete	Multidirectional
649	Burnt	Fragment	Multidirectional
670	Onondaga	Fragment	Multidirectional
680	Kettle Point	Fragment	Multidirectional
709	Onondaga	Complete	Multidirectional
710	Onondaga	Fragment	Multidirectional
741	Onondaga	Fragment	Unidirectional
759	Onondaga	Fragment	Unidirectional
768	Onondaga	Fragment	Multidirectional
777	Onondaga	Fragment	Unidirectional
850	Burnt	Complete	Unidirectional
851	Kettle Point	Fragment	Bipolar
867	Onondaga	Complete	Unidirectional

868	Onondaga	Fragment	Multidirectional
869	Kettle Point	Complete	Multidirectional
870	Kettle Point	Fragment	Multidirectional
872	Onondaga	Complete	Multidirectional
873	Burnt	Complete	Bipolar
874	Onondaga	Complete	Multidirectional
875	Burnt	Fragment	Multidirectional

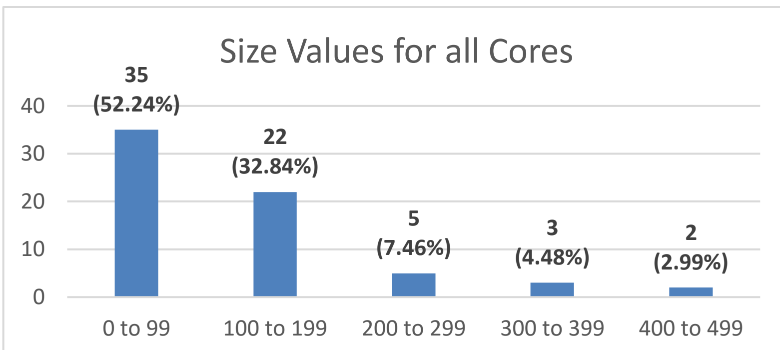

Figure 17: Frequency of Size Values for all Cores

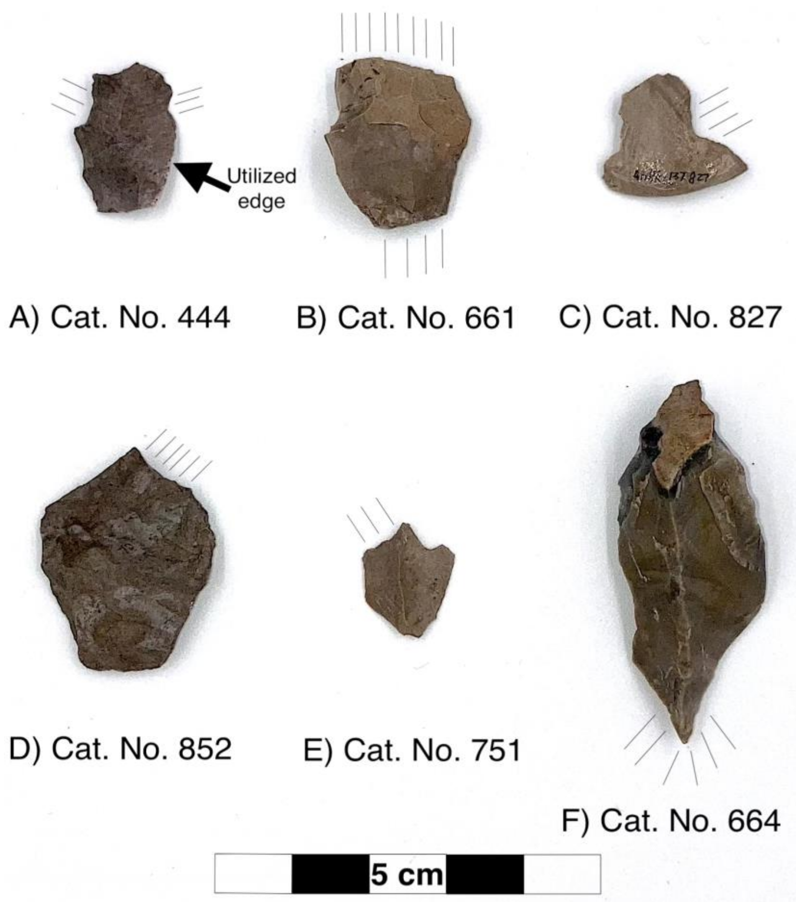

Figure 18: Representative sample of Ridge Pine 3 informal tools. A) Notched flake; B) Wedge; C) Spokeshave; D) Burin; E) Graver; F) Perforator. Lines show modified edges.

Table 8: Retouched Flake Data

Cat. No.	Material	Dimensions (mm)			Location of Retouch		Notes
		Length	Width	Thickness	Face	Edge	
60	Kettle Point	38.8*	30.3*	12.5*	ventral+dorsal	distal	
					ventral+dorsal	lateral	
95	Kettle Point	22.7	15.1	3.8	dorsal	lateral	
136	Kettle Point	26.7	11.1	4.4	dorsal	lateral	Linear flake
137	Kettle Point	31.2	24.7	3.6	dorsal	lateral	Utilized on alternate lateral
153	Kettle Point	31.1	13.3	2.8	dorsal	lateral	Linear flake

171	Onondaga	13.9	18.9	4.1	dorsal	distal	
174	Onondaga	25.0	33.8	10.5	dorsal	distal	
210	Kettle Point	20.9*	15.4*	2.7*	dorsal	lateral	
302	Kettle Point	10.1*	19.0*	3.9*	ventral	distal	
						proximal	
353	Kettle Point	22.7	19.5	3.9	dorsal	lateral	
361	Onondaga	26.1	12.9	3.1	dorsal	lateral	Linear flake
380	Kettle Point	33.4*	27.7*	4.7*	dorsal	distal	
381	Kettle Point	32.8	29.1	9.3	dorsal	lateral	
383	Kettle Point	27.7	28.5	8.7	dorsal	lateral	
489	Onondaga	17.3	11.1	3.2	dorsal	lateral	Utilized on alternate lateral
587	Burnt	30.2	16.4	3.3	dorsal	lateral	
640	Kettle Point	29.1*	18.7*	5.1*	dorsal	lateral	
645	Onondaga	13.8*	27.4*	3.6*	ventral	proximal	
668	Kettle Point	21.8*	22.9*	6.6*	dorsal	lateral	Utilized on distal
681	Onondaga	24.5	20.4	5.2	dorsal	lateral	
711	Onondaga	27.7*	16.8*	3.3*	dorsal	lateral	
						alternate lateral	
712	Onondaga	24.9	32.1	6.1	ventral	lateral	
726	Onondaga	14.7*	14.0*	3.2*	dorsal	distal	
737	Onondaga	18.5	17.5	6.5	dorsal	lateral	
806	Burnt	17.6	17.6	5.6	dorsal	distal	
808	Kettle Point	41.1*	20.8*	9.0*	dorsal	lateral	

					ventral	distal	
833	Onondaga	15.7	15.7	3.2	dorsal	distal	
838	Onondaga	29.9	7.9	2.2	ventral+dorsal	lateral	
877	Kettle Point	21.5*	19.4*	3.1*	ventral	lateral	
881	Onondaga	35.7*	25.4*	5.8*	ventral	lateral	Utilized on alternate lateral

Table 9: Utilized Flake Data

Cat. No.	Material	Dimensions (mm)			Location of Utilization	
		L	W	T	Face	Edge
6	Onondaga	31.3	24.6	6.0	dorsal	lateral
55	Kettle Point	32.1	27.5	3.9	ventral	lateral
56	Kettle Point	25.9	28.1	6.1	ventral	lateral
64	Kettle Point	34.9	20.5	5.4	ventral	lateral
65	Kettle Point	34.3	28.8	7.2	dorsal	distal
66	Kettle Point	44.8	32.5	6.1	dorsal	lateral
					ventral	alternate lateral
70	Kettle Point	29.1	25.2	5.5	dorsal	lateral
85	Kettle Point	29.2	26.1	4.7	dorsal	lateral
86	Kettle Point	28.2	44.0	4.8	dorsal	distal
97	Onondaga	44.0	28.6	13.0	ventral	lateral
						alternate lateral
119	Onondaga	28.9	26.5	5.1	dorsal	lateral
124	Burnt	32.3	18.0	4.4	dorsal	lateral
129	Unknown	39.3	37.3	10.4	ventral	lateral
131	Kettle Point	31.1	30.5	9.4	dorsal	distal

138	Kettle Point	24.2	22.0	5.4	dorsal	distal
142	Kettle Point	18.7	20.3	4.0	dorsal	lateral
143	Kettle Point	14.8	19.6	5.9	dorsal	distal
145	Kettle Point	17.9	10.7	2.8	ventral	lateral
146	Kettle Point	13.3*	33.8*	12.9*	dorsal	lateral/distal
147	Kettle Point	18.2	23.1	2.6	dorsal	lateral
149	Kettle Point	15.1	17.3	2.2	dorsal	lateral/distal
150	Kettle Point	17.4	12.3	2.7	dorsal	lateral
154	Burnt	20.5	24.1	5.1	dorsal	lateral alternate lateral
169	Onondaga	19.0	19.7	2.9	ventral	lateral
170	Onondaga	12.9*	22.0*	3.1	dorsal	distal
185	Kettle Point	15.3	21.5	4.1	dorsal	distal
190	Burnt Onondaga	37.7	20.2	5.4	dorsal ventral	lateral
212	Onondaga	32.8	13.2	6.1	ventral	lateral
215	Burnt	13.8*	16.6*	5.2	dorsal	distal
235	Onondaga	26.3*	10.0*	5.7*	dorsal	lateral
236	Onondaga	19.1	25.1	8.5	dorsal	lateral
241	Onondaga	29.1	14.9	4.6	dorsal	lateral
301	Kettle Point	18.2	17.2	2.6	dorsal	lateral
316	Kettle Point	17.4*	12.7*	4.3*	dorsal	lateral
327	Kettle Point	38.4	26.4	4.5	dorsal	lateral
337	Onondaga	24.0	22.0	8.0	dorsal	lateral

338	Onondaga	35.4*	14.5*	11.1*	ventral	lateral
339	Onondaga	22.9	23.6	5.7	dorsal	lateral
341	Onondaga	16.7	11.2	3.3	dorsal	lateral
342	Onondaga	28.4	19.2	4.1	dorsal	lateral
352	Kettle Point	24.5	22.9	3.6	dorsal	lateral
354	Kettle Point	36.1	27.0	3.6	dorsal	lateral
355	Kettle Point	16.3*	20.5*	2.9*	dorsal	lateral
362	Burnt Onondaga	18.6	15.9	6.5	dorsal	lateral
364	Onondaga	32.7	22.1	4.0	ventral	lateral
						alternate lateral
365	Onondaga	31.4	15.4	4.0	dorsal	distal
366	Onondaga	29.1	25.5	6.3	dorsal	lateral
					ventral	
367	Onondaga	30.9	31.6	4.7	ventral	lateral
368	Onondaga	21.3	30.4	7.6	dorsal	lateral
382	Kettle Point	29.3	26.3	8.9	dorsal	lateral
385	Kettle Point	23.1	23.9	4.8	dorsal	distal
					ventral	
386	Kettle Point	13.8*	23.0*	3.4*	ventral	lateral
401	Kettle Point	30.5	21.5	8.9	dorsal	lateral
					ventral	lateral
411	Onondaga	35.9	21.2	3.5	dorsal	lateral
425	Onondaga	18.2	27.2	9.2	dorsal	distal
431	Onondaga	13.3*	22.4*	3.3*	dorsal	lateral

					ventral	alternate lateral
461	Kettle Point	24.4	24.7	3.9	dorsal	distal
481	Onondaga	23.7	16	14.6	dorsal	distal
503	Kettle Point	8.4*	12.1*	2.2*	dorsal	lateral/distal
506	Kettle Point	18.2	23.3	4.1	dorsal	distal
507	Kettle Point	29.6	23.8	3.3	ventral	lateral
508	Kettle Point	30.7	37.7	5.1	dorsal	lateral
511	Kettle Point	23.2	28.1	5.5	dorsal	lateral
512	Kettle Point	29.7	20.3	4.3	dorsal	distal
514	Kettle Point	30.5	18.8	4.7	dorsal	lateral
530	Onondaga	10.1*	8.2*	2.0*	ventral	lateral
557	Kettle Point	28.2	45.2	7.0	dorsal	lateral
560	Onondaga	27.4	37.1	6.3	dorsal	lateral
					ventral	distal
562	Kettle Point	19.6	18.2	5.2	dorsal	lateral
571	Kettle Point	42.5	35.4	6.7	dorsal	lateral
573	Onondaga	28.1	15.6	10.0	ventral	lateral
589	Burnt Onondaga	32.3	36.1	10.3	dorsal	lateral
599	Burnt Onondaga	15.1	24.9	5.7	dorsal	distal
602	Kettle Point	20.8	24.0	5.1	dorsal	distal
604	Kettle Point	15.7*	17.9*	1.7*	dorsal	lateral
605	Kettle Point	40.1	22.0	6.4	dorsal	lateral
609	Onondaga	22.9	13.8	4.8	dorsal	lateral
613	Kettle Point	29.5	26.3	2.9	dorsal	lateral

615	Kettle Point	23.5	13.7	2.9	dorsal	lateral
616	Kettle Point	16.9*	12.1*	4.5*	dorsal	lateral
632	Kettle Point	37.4	30.4	13.7	dorsal	lateral
639	Kettle Point	16.0	15.7	3.3	dorsal	lateral
651	Kettle Point	16.7*	18.8*	2.5*	dorsal	lateral
659	Kettle Point	15.4	20.8	6.1	dorsal	lateral/distal
682	Kettle Point	21.6	23.1	2.5	dorsal	distal
689	Kettle Point	29.5	34.2	5.6	ventral	lateral
690	Kettle Point	26.0	23.0	5.4	dorsal	lateral/distal
696	Burnt Onondaga	28.9	28.0	9.5	dorsal	lateral
697	Onondaga	13.1*	17.9*	5.0*	dorsal	lateral
706	Onondaga	20.6	8.8	4.3	ventral	lateral
729	Kettle Point	29.0	24.8	3.8	dorsal	lateral
738	Onondaga	22.5	21.5	6.7	dorsal	lateral
739	Onondaga	23.5	23.4	8.3	dorsal	lateral
750	Kettle Point	19.8	15.5	5.0	dorsal	lateral
761	Onondaga	39.7	18.9	8.1	ventral	lateral
770	Onondaga	12.1	18.2	2.6	dorsal	lateral
772	Onondaga	16.7*	16.6*	2.3*	dorsal	lateral
776	Onondaga	19.1	26.4	3.5	dorsal	lateral
781	Kettle Point	17.8	9.8	1.6	dorsal	lateral
787	Onondaga	16.6*	21.4*	4.4*	ventral	lateral
788	Onondaga	27.3	18.8	4.5	dorsal	lateral
789	Onondaga	15.3*	17.4*	2.4*	dorsal	lateral

					ventral	
791	Onondaga	25.2	27.1	7.8	dorsal	distal
793	Onondaga	15.1	13.7	3.4	dorsal	lateral
794	Burnt	25.9	22.5	12.5	ventral	lateral
					dorsal	
795	Kettle Point	16.0	15.3	5.7	dorsal	lateral
797	Kettle Point	14.7	20.4	2.2	dorsal	lateral/distal
798	Kettle Point	12.4*	16.0*	3.1*	dorsal	lateral
799	Burnt	14.1	17.0	3.0	dorsal	lateral/distal
801	Burnt Kettle Point	31.4	20.0	4.4	dorsal	lateral
807	Kettle Point	30.6	27.1	7.2	dorsal	lateral
809	Kettle Point	34.1	17.9	3.0	dorsal	lateral
					ventral	
					ventral	alternate lateral
810	Kettle Point	14.6	23.7	4.3	dorsal	lateral
811	Kettle Point	16.7*	15.4*	3.3*	dorsal	lateral
813	Kettle Point	11.3*	18.6*	1.7	dorsal	distal
814	Kettle Point	14.8*	15.5*	4.3*	dorsal	lateral
					ventral	
816	Kettle Point	27.9	29.6	8.5	dorsal	distal
818	Onondaga	24.3	26.4	6.4	dorsal	lateral
819	Onondaga	13.9	22.2	5.4	dorsal	lateral/distal
820	Onondaga	18.2	20.6	4.6	dorsal	lateral
821	Onondaga	14.9	8.0	2.1	dorsal	lateral

822	Onondaga	12.2*	7.8*	2.0*	dorsal	lateral
824	Burnt	30.4	13.8	3.3	dorsal	lateral
825	Burnt	32.5	16.0	4.1	dorsal	distal
830	Burnt	16.9	18.1	4.4	dorsal	distal
831	Onondaga	36.1	40.6	7.9	dorsal	lateral
						alternate lateral
832	Onondaga	15.6	12.3	2.5	dorsal	lateral
836	Burnt	20.7	19.2	4.9	dorsal	lateral
839	Onondaga	29.0	23.2	8.6	dorsal	distal
840	Onondaga	43.2	25.7	8.7	dorsal	lateral
842	Onondaga	14.3	18.0	6.8	ventral	lateral
849	Onondaga	16.4*	19.2*	5.1*	dorsal	distal
854	Onondaga	30.4	28.6	9.3	dorsal	lateral
855	Burnt	31.0	21.7	8.4	dorsal	lateral
					ventral	
856	Onondaga	22.0	20.2	5.4	dorsal	lateral
						alternate lateral
857	Onondaga	22.3	17.6	3.7	ventral	lateral
861	Onondaga	11.4	14.9	3.4	dorsal	distal
862	Onondaga	23.9*	22.8*	6.5*	dorsal	lateral
863	Kettle Point	25.4	16.4	5.2	dorsal	distal
864	Kettle Point	17.3*	18.5*	3.5*	dorsal	lateral/distal
865	Kettle Point	22.8	18.4	5.1	dorsal	lateral
876	Onondaga	21.9	21.00	5.7	ventral	distal

878	Onondaga	25.7	24.0	5.5	ventral	lateral
879	Kettle Point	31.7*	12.6*	3.1*	dorsal ventral	lateral
880	Kettle Point	22.9	22.2	3.3	dorsal ventral	distal
882	Kettle Point	22.9	23.7	3.1	ventral	distal
883	Kettle Point	16.2*	17.6*	3.6*	dorsal	lateral
884	Onondaga	20.4*	14.4*	2.1*	ventral	lateral
885	Kettle Point	18.8	28.3	4.4	dorsal	lateral/distal
886	Kettle Point	23.9*	17.0*	3.1	dorsal	lateral
887	Kettle Point	15.2*	17.2*	3.0*	dorsal ventral	lateral/distal
888	Kettle Point	19.0*	18.2*	6.2*	dorsal ventral	lateral
889	Kettle Point	11.7*	18.0*	5.7*	ventral	distal
890	Kettle Point	18.2*	10.3*	2.3*	ventral	lateral
891	Kettle Point	18.0*	22.5*	3.2*	ventral	distal

Key: * = incomplete measurement

Table 10: Frequencies of Use-Wear Features and Cracks for Confirmed UFLs

Use-Wear Features	Total Analyzed	Total Analyzed (%)
Microfractures	170	32.82%
Striations	96	18.53%
Polish	24	4.63%
Edge Rounding	146	28.19%

Cracks	82	15.83%
Total	**518**	**100.00%**

Note: As per the criteria, the UFLs display at least two types of use-wear each so the total number of use-wear observations is 518.

Table 11: Frequencies for Types of Microfractures on Confirmed UFLs

Types of Microfractures	Total analyzed	Total Analyzed (%)
Continuous	49	28.82%
Close	120	70.59%
Clumped	1	0.59%
Isolated	0	0.00%
Total	**170**	**100.00%**

Table 12: Frequencies for Types of Polish on Confirmed UFLs

Types of Polish	Total Analyzed	Total Analyzed (%)
Continuous	1	4.17%
Discontinuous	23	95.83%
Total	**24**	**100.00%**

Figure 19: Comparison of a bipolar core (left) and a wedge (right) from Ridge Pine 3

Table 13: Ridge Pine 3 Wedges

Cat. No.	Material	Flake Type	L (mm)	W (mm)	T (mm)	Battering Location		Mod. L/W (mm)	Mod. H (mm)
						Face	Edge		
246	Kettle Point	FRAG	18.4*	23.7*	6.8*	D/V	left lateral	16.9*	8.4 (V); 5.0 (D)
						D/V	right lateral	13.0*	5.5 (V); 13.2 (D)
255	Kettle Point	BFT	20.4	24.3	5.7	D/V	distal	23.1	2.7 (V); 2.1 (D)
						D/V	left lateral	24.2	2.4 (V); 5.4 (D)
						D/V	right lateral	7.4	1.4 (V); 3.7 (D)
661	Onondaga	FRAG	20.2*	24.0*	7.8*	D/V	left lateral	12.1*	10.4 (V); 14.4 (D)
						D/V	right lateral	18.5*	5.4 (V); 10.1 (D)

Key: FRAG = fragmentary flake, BFT = biface thinning flake; L = Length, W = Width, T = Thickness, H = Height; Mod. = Modification; V = Ventral, D = Dorsal; * = incomplete measurement

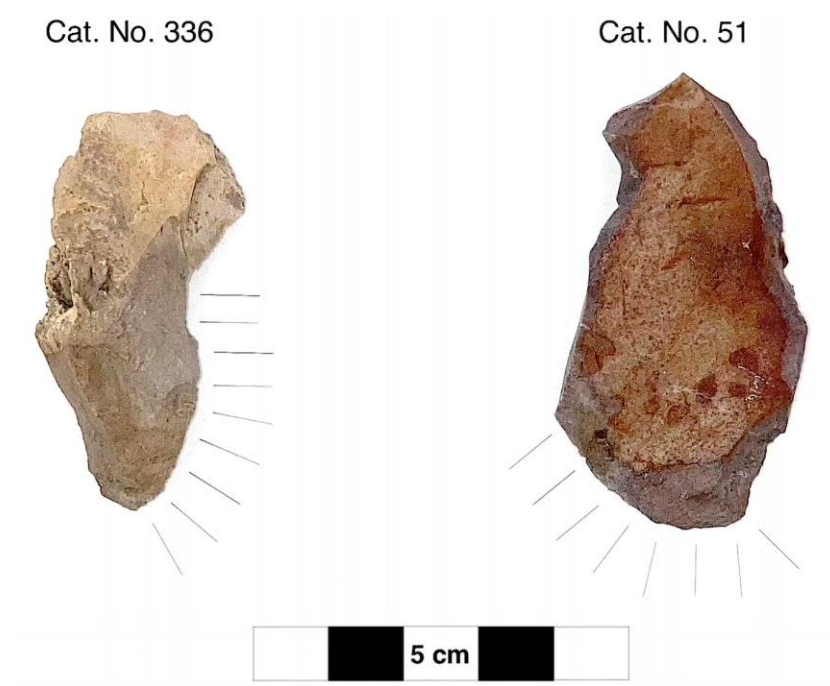

Figure 20: Ridge Pine 3 backed (left) and hafted (right) knives. Lines show modified edges.

Table 14: Ridge Pine 3 Knives

Cat. No.	Material	Portion	Type	Modification Shape and Edge	Unifacially or Bifacially Worked	Blade Length (mm)	Haft Length (mm)
51	Burnt Kettle Point	Tip and haft	Hafted	Convex (Distal+Lat L)	Unifacial	13.8*	17.0
58	Kettle Point	Midsection	Unknown	Irregular (Lat)	Bifacial	34.9*	N/A
59	Kettle Point	Complete	Backed	Straight (Distal)	Unifacial	44.8	N/A
172	Onondaga	Midsection	Backed	Convex (Lat R); Irregular (Lat L)	Unifacial (Lat R); Bifacial (Lat L)	33.2 (Lat R); 25.2 (Lat L)	N/A
336	Onondaga	Complete	Backed	Convex (Lat R)	Unifacial	38.5	N/A
758	Onondaga	Midsection	Unknown	Convex (Lat)	Unifacial	43.3*	N/A

Key: Lat = Lateral edge; R = Right; L = Left; * = measurement on an incomplete tool. **Note:** Cat. Nos. 58 and 758 are modified on the lateral edge but whether it is left or right is unknown.

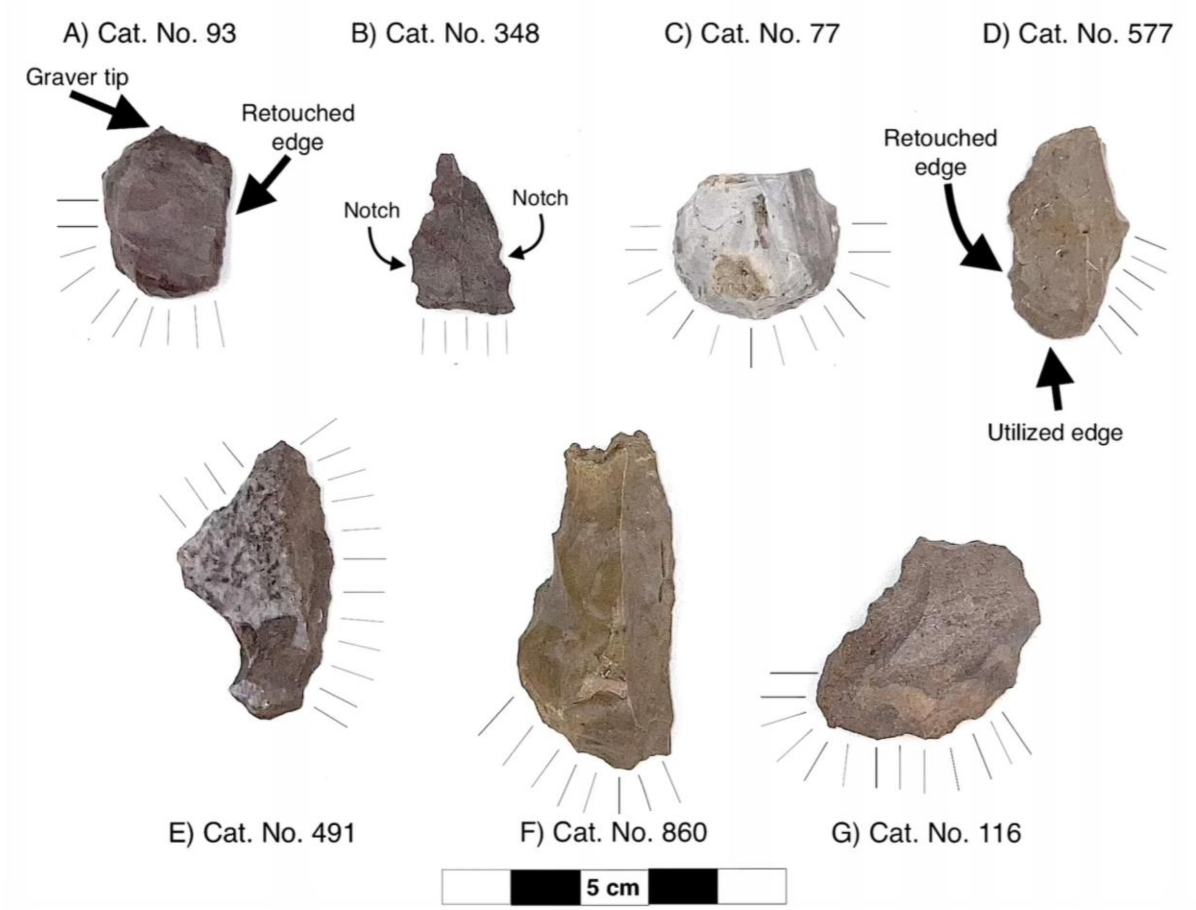

Figure 21: Representative sample of Ridge Pine 3 scrapers. A) Multifunctional thumbnail; B) End; C) Thumbnail; D) Side; E) Side; F) End; G) End. Lines show modified edges.

Table 15: Ridge Pine 3 Scraper Data

Cat. No.	Material	Complete?	Type	Edge Angle	Length (mm)	Width (mm)	Thickness (mm)
77	Kettle Point	Yes	Thumbnail	70 (D); 60 (L Lat); 55 (R Lat)	21.8	24.9	8.4
93	Kettle Point	Yes	Thumbnail	60 (D); 65 (L Lat)	24.4	21.6	6.8
101	Onondaga	Yes	Side	70	35.3	40.6	16.4
116	Kettle Point	Yes	End	55	28.2	35.0	13.0
132	Burnt Onondaga	No	End	65	17.5*	35.0*	10.7*
335	Onondaga	No	End	55	21.1*	27.9*	9.9*

348	Burnt Kettle Point	Yes	End	65	24.3	15.3	5.0
491	Burnt Onondaga	Yes	Side	65 (L Lat); 55 (R Lat)	41.0	22.6	5.4
504	Kettle Point	Yes	Side	70	24.1	22.2	5.2
577	Onondaga	Yes	Side	70	30.7	17.7	8.9
586	Burnt Kettle Point	Yes	Thumbnail	70 (D); 60 (L Lat)	25.7	22.5	8.5
588	Burnt Onondaga	No	Unknown	60	22.5*	10.6*	5.5*
652	Burnt	Yes	End	55	36.2	25.6	8.9
828	Onondaga	Yes	End	75	24.7	42.3	10.0
846+847	Kettle Point	Yes	Thumbnail	65 (D); 65 (L Lat); 50 (R Lat)	18.1	22.4	7.5
848	Onondaga	Yes	End	75	18.3	32.3	8.1
860	Onondaga	No	End	60	49.8*	24.3*	15.6*
871	Kettle Point	No	Unknown	75	23.2*	11.3*	8.9*

Key: D = Distal; L Lat = Left lateral; R Lat = Right lateral; * = measurement taken on an incomplete tool

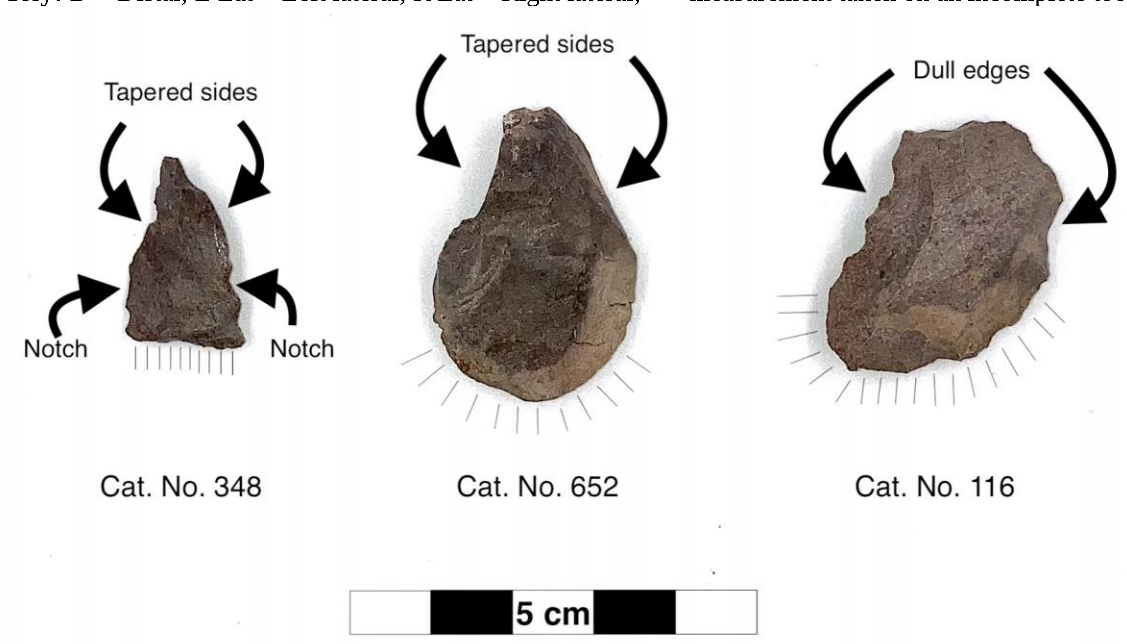

Figure 22: Ridge Pine 3 potentially hafted end scrapers

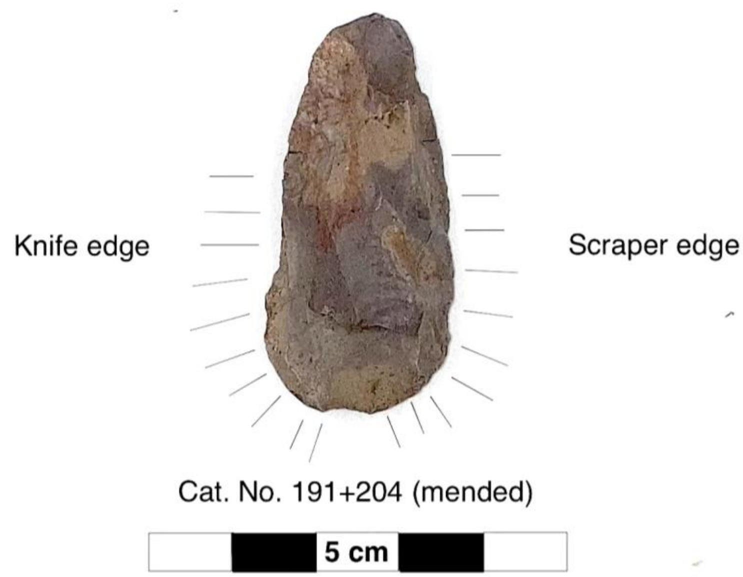

Figure 23: Ridge Pine 3 scraper-knife (mended)

Figure 24: Scraper-knife (separated). Ventral face (left) and dorsal face (right)

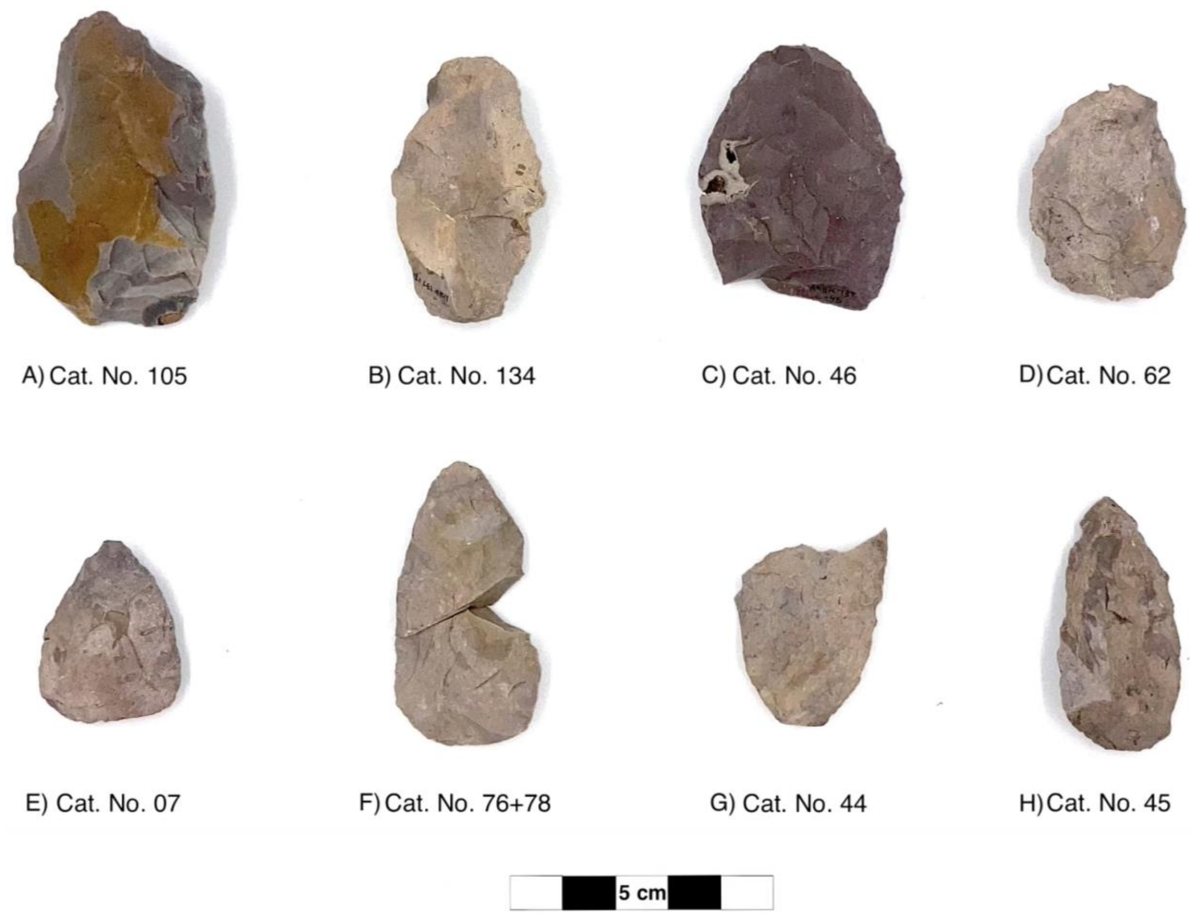

Figure 25: Ridge Pine 3 bifaces (representative sample). A) Stage 2; B) Stage 2; C) Stage 3; D) Stage 3; E) Stage 4; F) Stage 4; G) Stage 5; H) Stage 5

Table 16: Biface Data

Cat. No.	Material	Section	Stage	Shape	Max. Dimensions (mm)		
					Length	Width	Thickness
7	Burnt	complete	4	triangular	34.0	27.5	8.6
11	Burnt	base	3	unknown	19.5*	29.1*	8.9*
44	Kettle Point	base	5	ovate	37.8*	28.6*	7.1*
45	Kettle Point	complete	5	ovate	46.7	24.2	7.8
46	Kettle Point	nearly complete	3	ovate	52.3*	40.1	14.1
47	Onondaga	base	4	triangular	39.0*	24.5*	9.3*

61	Onondaga	base	3	unknown	23.5*	27.4*	9.2*
62	Onondaga	complete	3	ovate	42.1	29.6	11.9
63	Burnt Kettle Point	complete	4	ovate	71.9	41.6	15.0
67	Burnt Onondaga	complete	2	triangular	40.7	28.8	12.3
68	Onondaga	base	3	triangular	42.7*	33.0	9.9*
73	Kettle Point	edge fragment	5	ovate	50.4*	13.8*	9.9*
76+78	Onondaga	nearly complete	4	ovate	53.0	28.4	6.9
79	Onondaga	base	3	ovate	39.3*	35.6*	11.3*
82	Onondaga	tip	5	unknown	26.6*	28.3*	7.9*
83	Kettle Point	base	3	ovate	28.5*	35.0*	13.1*
84	Burnt Kettle Point	base	4	lenticular	32.5*	31.6*	9.7*
87	Onondaga	nearly complete	2	ovate	51.1	26.5*	17.6
88	Burnt Kettle Point	base	3	lenticular	34.6*	28.3*	12.6*
89+125	Onondaga	nearly complete	3	ovate	42.4*	29.0	13.8*
91	Kettle Point	complete	4	ovate	42.2	29.3	10.8
102	Burnt	end fragment	4	unknown	35.4*	28.9*	9.2*
103	Onondaga	nearly complete	4	ovate	35.7*	29.4	10.9
104	Onondaga	base	2	ovate	41.7*	40.2*	18.7*
105	Kettle Point	complete	2	ovate	62.0	43.1	15.2
106	Onondaga	nearly complete	2	ovate	41.8*	29.2	13.5*

107	Onondaga	tip	5	unknown	37.4*	25.8*	6.1*
110	Burnt Kettle Point	base + edge fragment	2	ovate	41.6*	26.5*	13.2*
111	Onondaga	2 ends and 1 edge	2	ovate	39.1*	30.7*	17.8*
118	Burnt Kettle Point	end fragment	3	ovate	28.2*	29.4*	9.4*
121	Onondaga	end fragment	3	circular	30.7*	28.1*	7.8*
122	Onondaga	end fragment	3	unknown	36.0*	19.2*	9.4*
123	Kettle Point	edge fragment	4	ovate	45.5*	13.2*	6.8*
126	Burnt Kettle Point	base	3	unknown	28.7*	36.9*	10.6*
130+600	Burnt Kettle Point	complete	4	triangular	41.2	21.3	6.9
134	Onondaga	complete	2	ovate	52.6	30.8	14.3
167	Onondaga	tip	4	ovate	41.2*	25.4*	6.7*
175	Onondaga	complete	2	pentagonal	46.2	34.5	18.2
187	Kettle Point	base	2	ovate	25.1*	39.3*	14.1*
223	Kettle Point	fragment	3	unknown	36.3*	17.9*	12.7*
252	Burnt	tip	2	unknown	39.1*	31.8*	14.2*
253	Burnt Kettle Point	base fragment	2	unknown	20.4*	32.0*	10.7*
259+666	Onondaga (259 is burnt)	complete	2	ovate	42.3	27.1	8.6
359	Onondaga	base	3	unknown	18.0*	26.1*	8.9*
439	Onondaga	end fragment	2	unknown	26.1*	23.4*	8.9*
471	Burnt	edge fragment	5	ovate	32.6*	14.3*	8.6*

474	Burnt Onondaga	fragment	2	unknown	34.1*	21.2*	8.9*
487	Onondaga	base fragment	2	triangular	42.1*	29.1*	10.5*
492	Burnt Kettle Point	edge fragment+tip	2	unknown	44.0*	35.0*	14.7*
513	Kettle Point	tip	4	unknown	25.8*	22.7*	13.5*
529	Onondaga	edge fragment	5	unknown	26.0*	16.4*	5.9*
536	Onondaga	complete	2	ovate	48.4	34.4	18.9
545	Onondaga	nearly complete	3	ovate	38.4*	30.1	9.1
548	Kettle Point	base	2	pentagonal	39.1*	33.6*	21.7*
564	Onondaga	complete	2	pentagonal	35.9	31.8	13.4
585	Kettle Point	complete	2	triangular	47.0	25.4	11.9
621	Kettle Point	fragment	2	unknown	31.7*	16.1*	9.1*
665	Onondaga	complete	2	lanceolate	35.1	28.4	12.6
684	Burnt	almost complete	3	lanceolate	39.5	26.1*	14.0*
704	Onondaga	base	3	ovate	34.0*	34.1*	13.1*
705	Onondaga	base	3	ovate	36.1*	37.2*	16.4*
714	Burnt	end fragment	2	ovate	22.2*	21.4*	4.7*
731	Burnt	complete	2	ovate	38.7	32.4	17.5
805	Burnt Kettle Point	edge fragment	4	ovate	33.1*	13.0*	7.4*
844	Onondaga	fragment	Indeterminant	unknown	21.3*	7.7*	7.3*
845	Onondaga	base	3	unknown	25.9*	30.4*	10.0*
853	Onondaga	tip	4	unknown	15.2*	15.8*	6.4*
859	Onondaga	base	5	unknown	12.7*	18.1*	8.3*

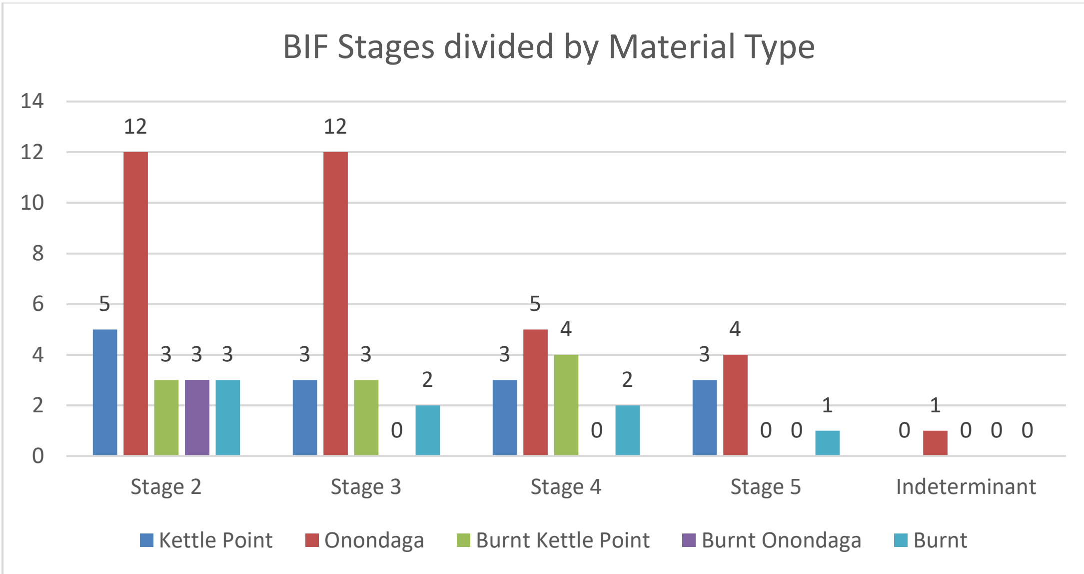

Figure 26: Ridge Pine 3 Biface Stages divided by Material Type

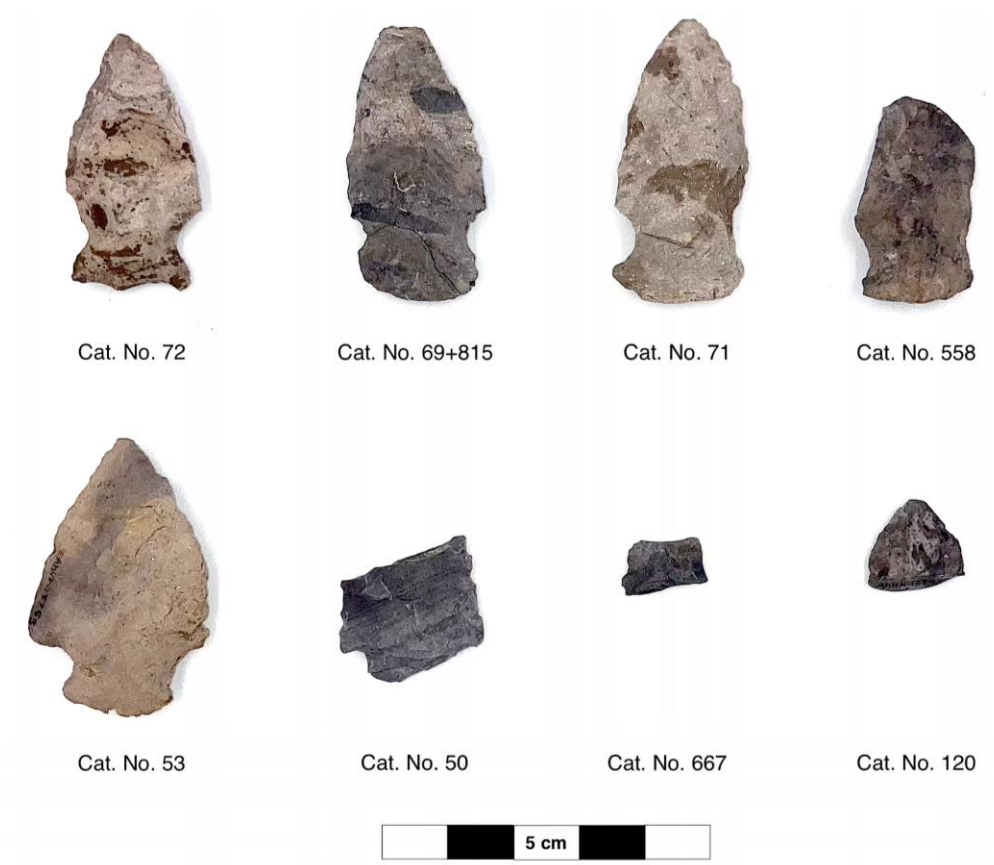

Figure 27: Ridge Pine 3 projectile points and fragments

Table 17: Ridge Pine 3 Projectile Point Summary

Cat. No.	Material	Portion	Blade Edges	Base	Notches	Measurements (mm)			Type
						L	W	T	
50	Kettle Point	Midsection/base fragment	Straight, slightly serrated	Unknown	Corner	22.5*	22.2*	5.1*	N
53	Onondaga	Complete	Convex	Convex	1 side (weak), 1 corner	43.1	27.6	8.5	B/F
69+815	Burnt Onondaga	Nearly complete	Convex	Convex	Side, weak	43.4*	21.9	9.2	L
71	Onondaga	Complete	Convex	Convex	Side, weak	45.6	20.8	8.0	L
72	Onondaga	Nearly complete	Convex	Biconcave	Side, weak on one side	41.6	21.5*	7.6	L
558	Burnt Onondaga	Base	Straight (one edge reworked)	Convex	Side, weak	32.8*	19.0*	8.8*	L
120	Onondaga	Tip	Convex/Straight	Unknown	Unknown	14.0*	14.4*	5.6*	U
667	Kettle Point	Midsection fragment or base fragment	Straight, slightly serrated	Unknown	Unknown	8.3*	13.3*	3.8*	U

Key: L = Lamoka; B/F = Brewerton Side-Notched/Feeheley, N = Nettling, U = Unknown, * = incomplete measurement

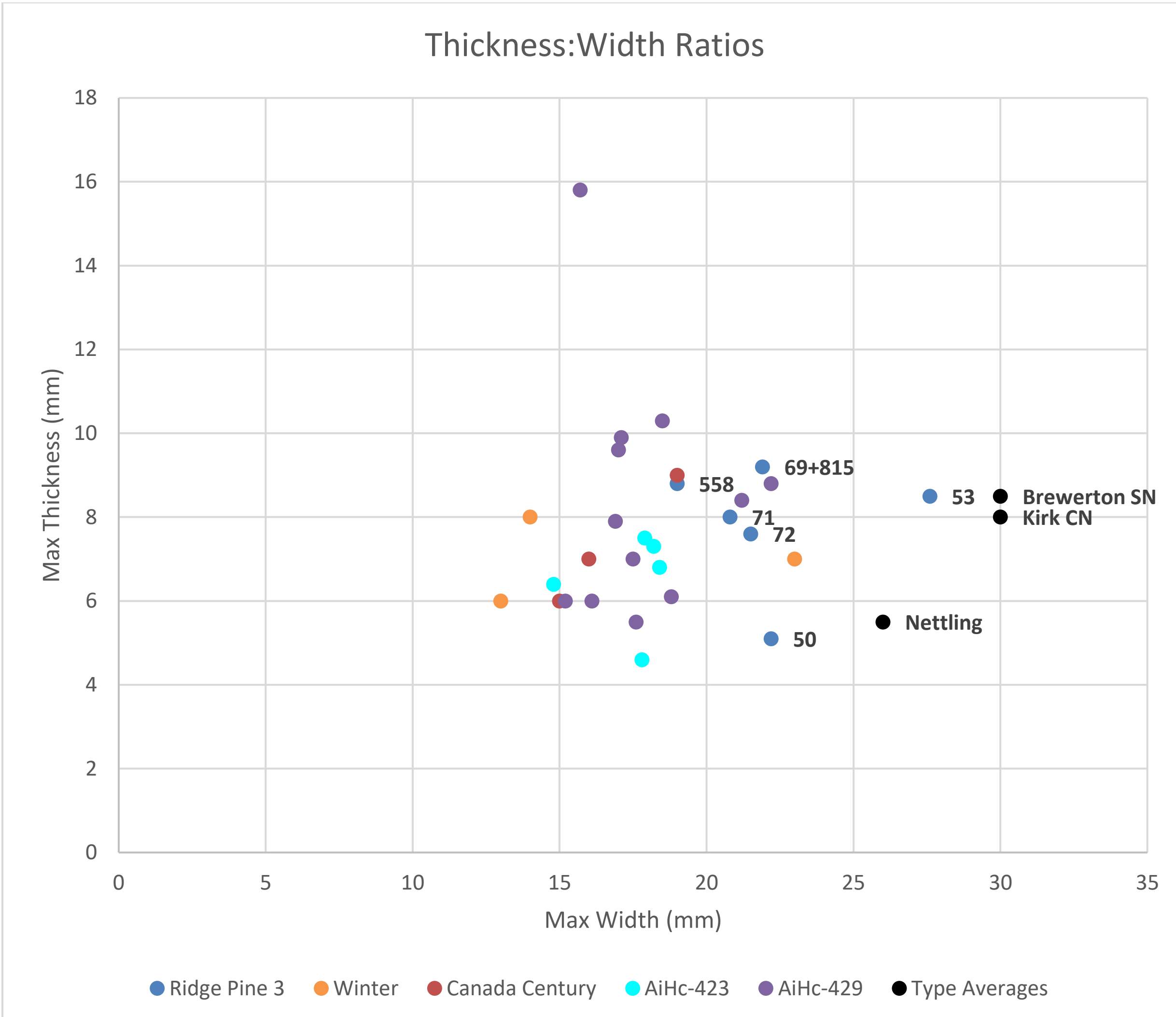

Figure 28: Width/Thickness ratios of Ridge Pine 3 projectile points compared to point type averages (Brewerton Side-Notched, Kirk Corner-Notched, and Nettling) and points from applicable Narrow Point sites (Winter, Canada Century, AiHc-423, and AiHc-429).

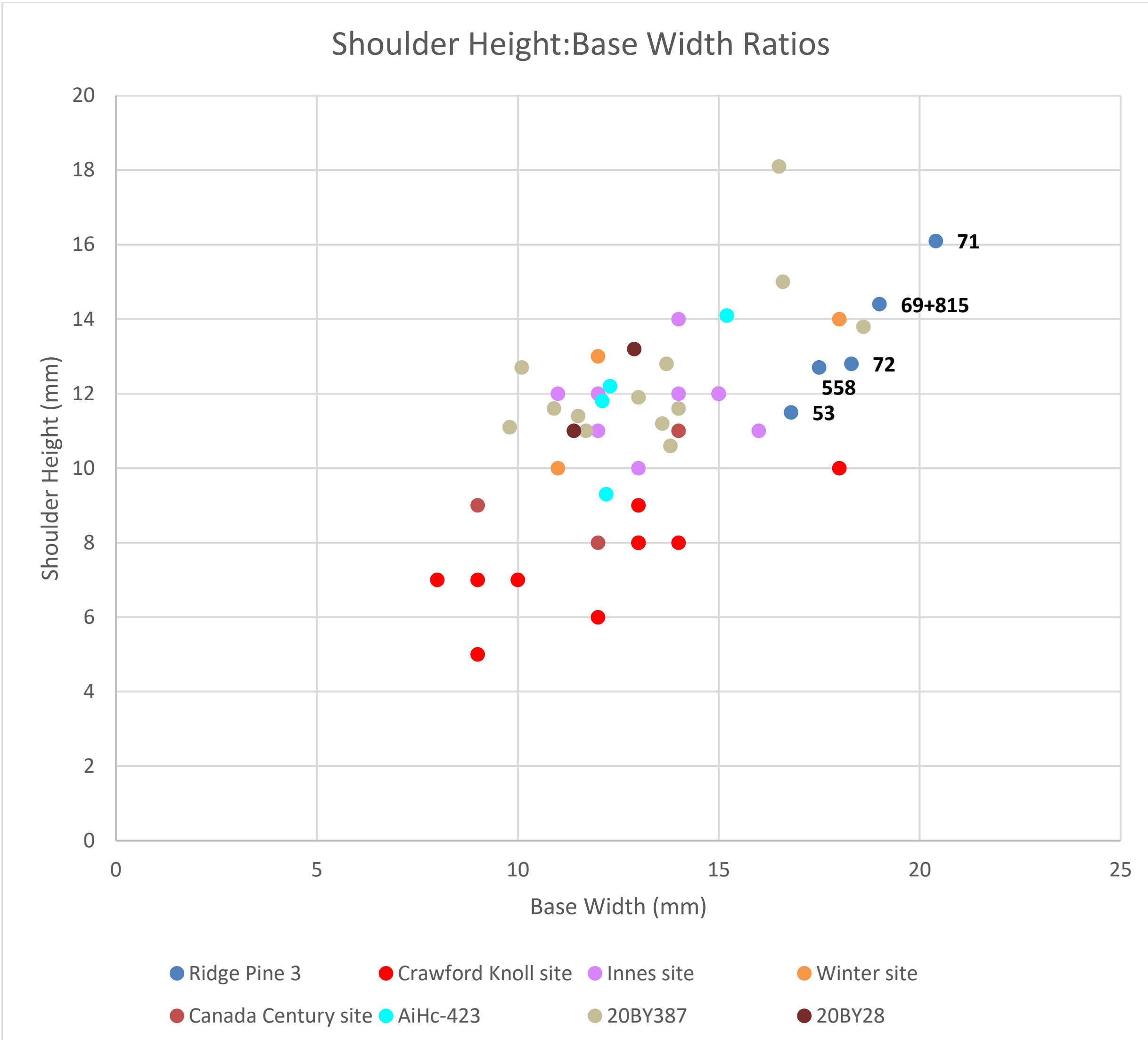

Figure 29: Shoulder height/base width ratios of Ridge Pine 3 points and comparable Small Point (Crawford Knoll and Innes) sites and Narrow Point (Winter, Canada Century, AiHc-423, 20BY28, and 20BY387) sites.

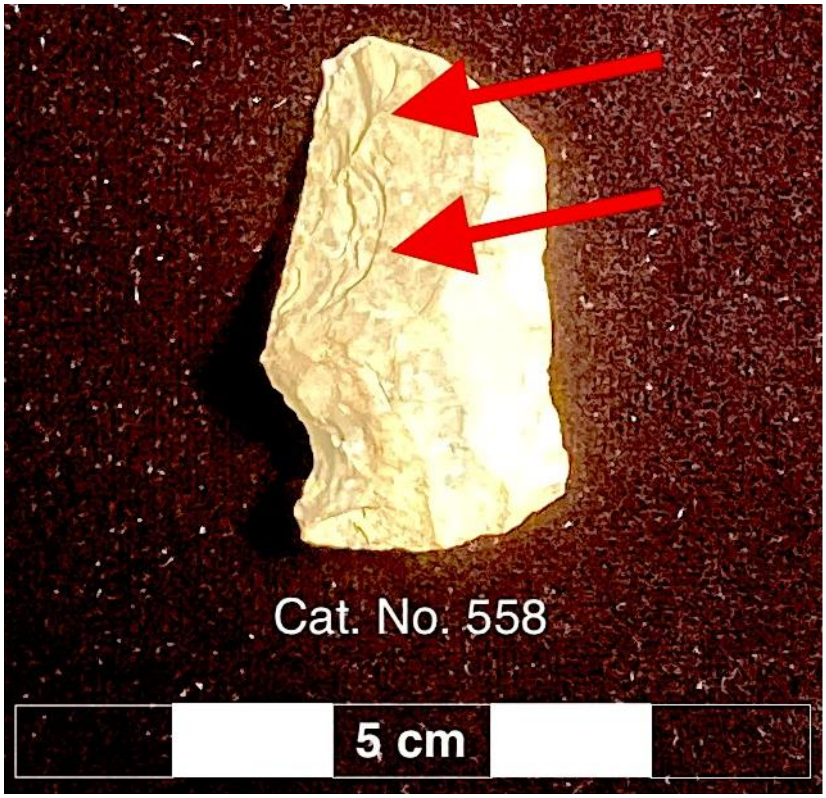

Figure 30: Reworked projectile point. Arrows show the step fractures from reworking

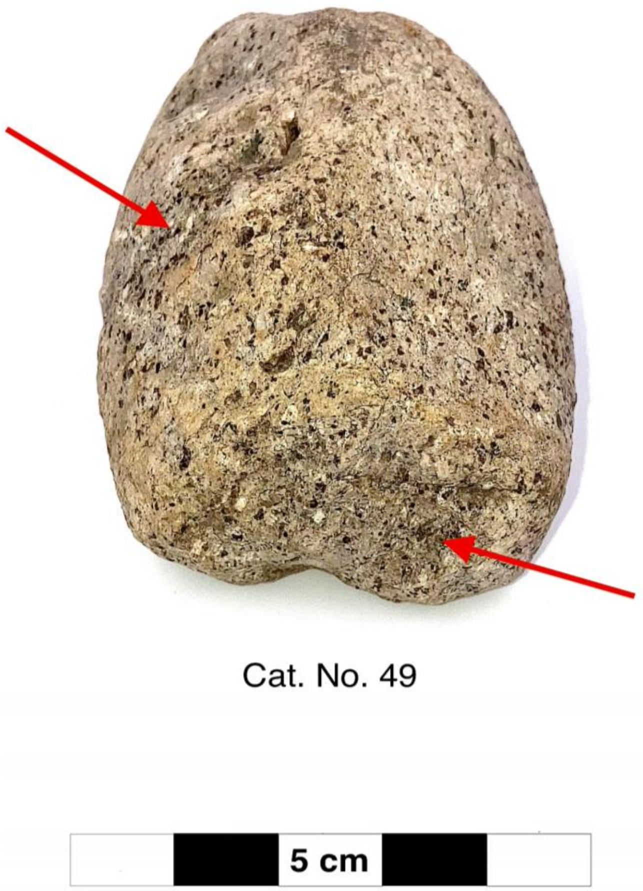

Figure 31: Ridge Pine 3 hammerstone. Arrows pointing to impact fractures

Figure 32: Ridge Pine 3 hammerstones. Left: arrows pointing to the two pits. Right: arrows pointing visible surfaces with the purple staining

Table 18: Ridge Pine 3 Hammerstones Summary

Cat. No.	Material	Shape	Measurements (mm)			Comments
			Length	Width	Thickness	
4	Igneous, Basalt	Irregular	76.3	62.7	45.9	Purple staining on both ends and one face
21	Igneous, Rhyolite	Circular	65.9	65.1	37.2	Finely ground
49	Igneous, Granite	Irregular	87.5	55.2	47.8	
54	Igneous, Basalt, Burnt	Oval	95.5	67.5	33.6	Finely ground; 2 pits present on one face
92	Igneous, Rhyolite	Circular	68.6	62.6	31.6	Finely ground
135	Igneous, Granite	Oval	62.9	51.9	33.7	Finely ground

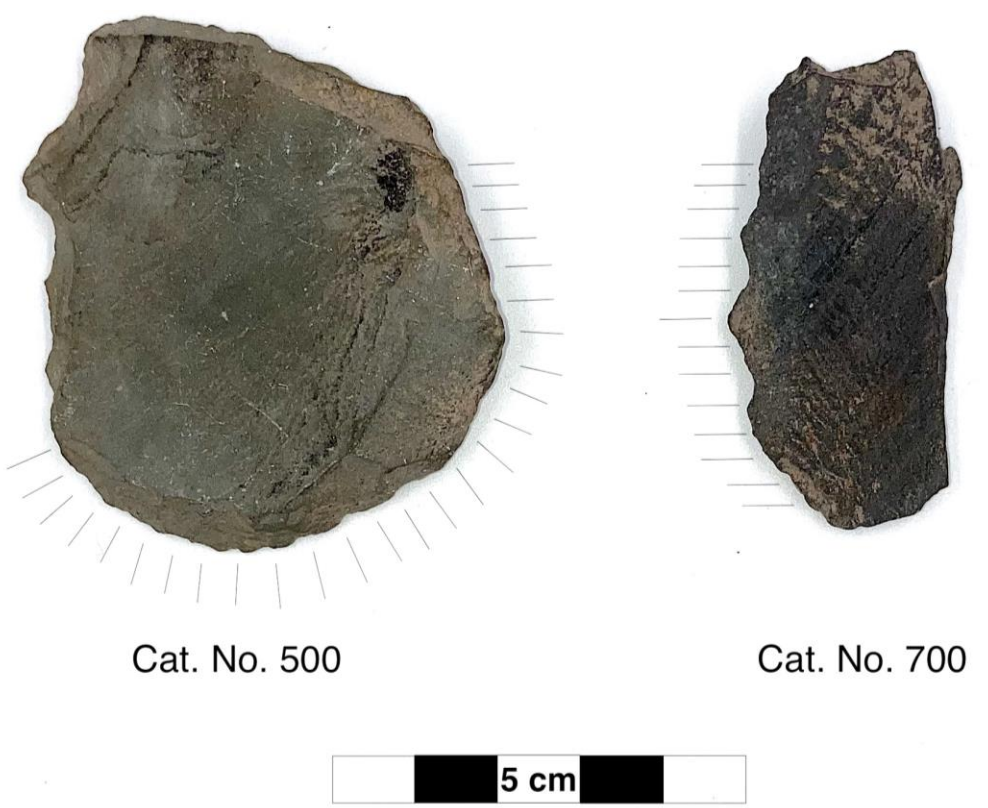

Figure 33: Ridge Pine 3 rough stone tool fragments (GSF)

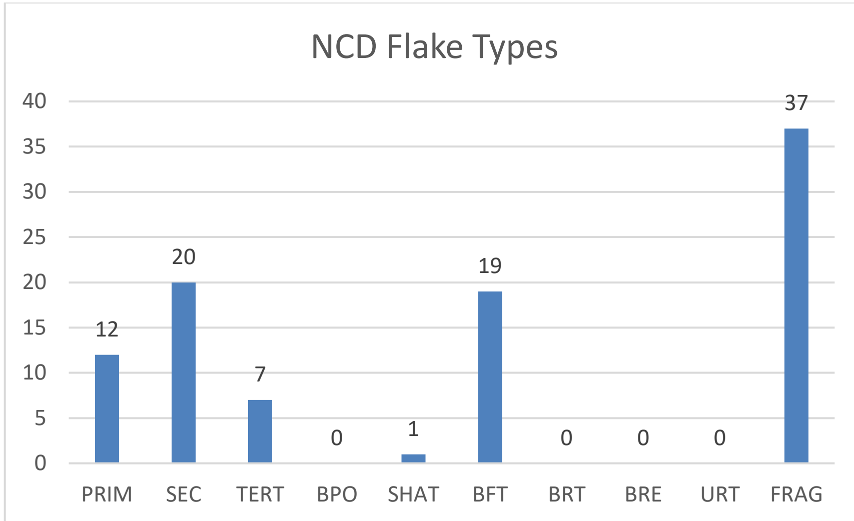

Figure 34: Flake Types present in the Non-Chert Detritus

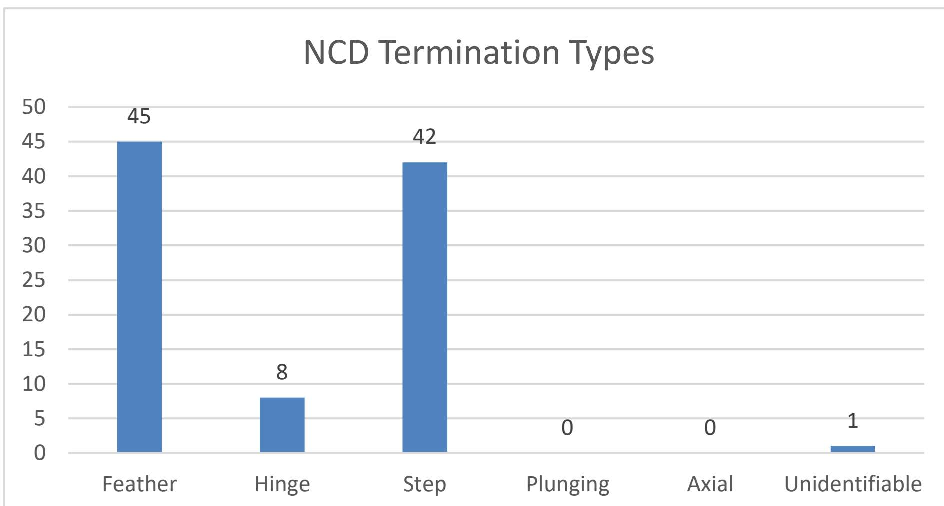

Figure 35: Termination Types present in the Non-Chert Detritus

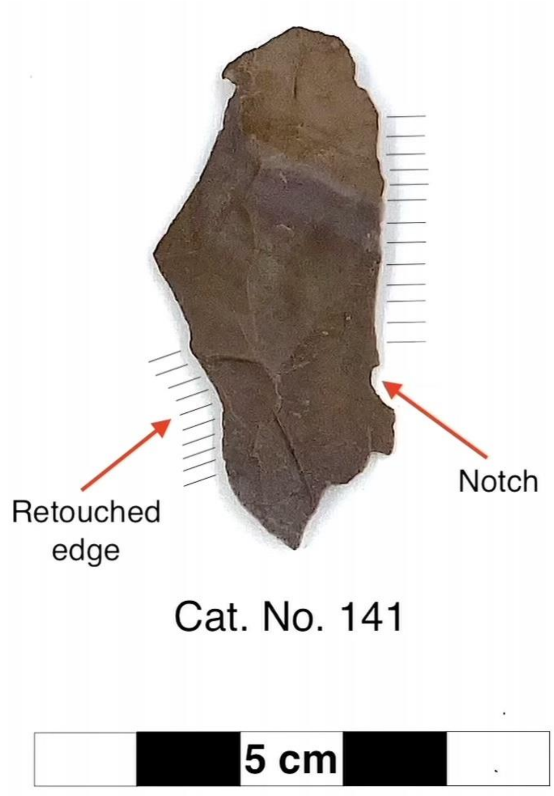

Figure 36: Hafted knife from Feature 1

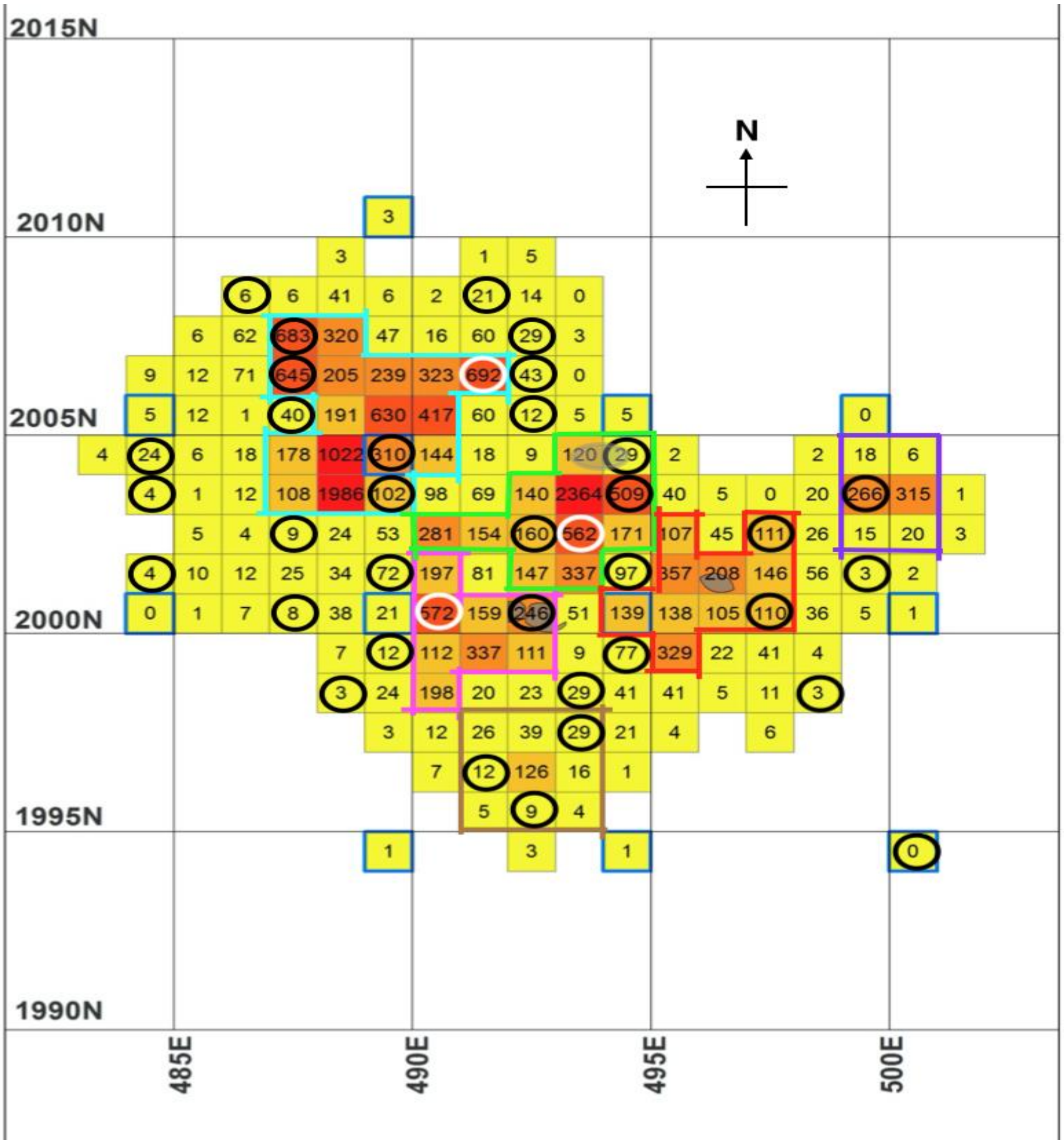

Figure 37: Spatial analysis clusters and debitage sample units (image adapted from TMHC 2012:38). Black circles indicate units initially analyzed for the debitage sample analysis. White circles indicate extra units analyzed for the spatial analysis that were also included in the debitage sample analysis. Cluster designations: Cluster 1, Cluster 2, Cluster 3, Cluster 4, Cluster 5, Cluster 6. Single units outlined in blue are Stage 3 units.

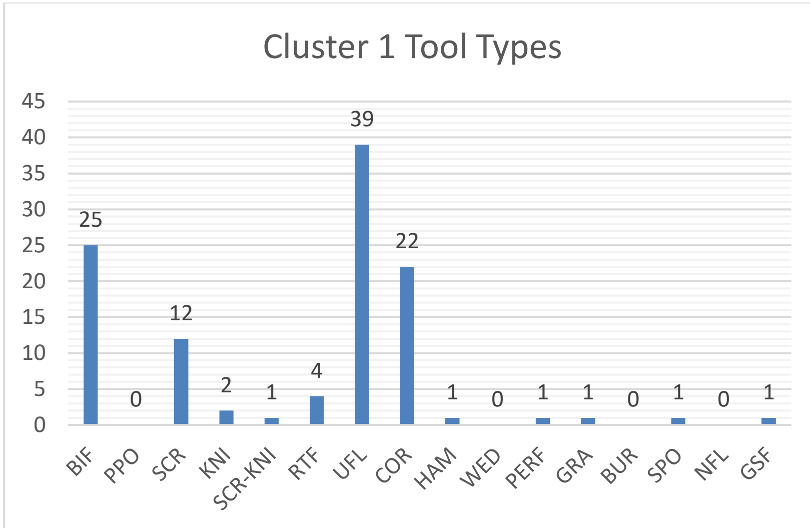

Figure 38: Tool types located within Cluster 1. The counts do not combine mended artifacts

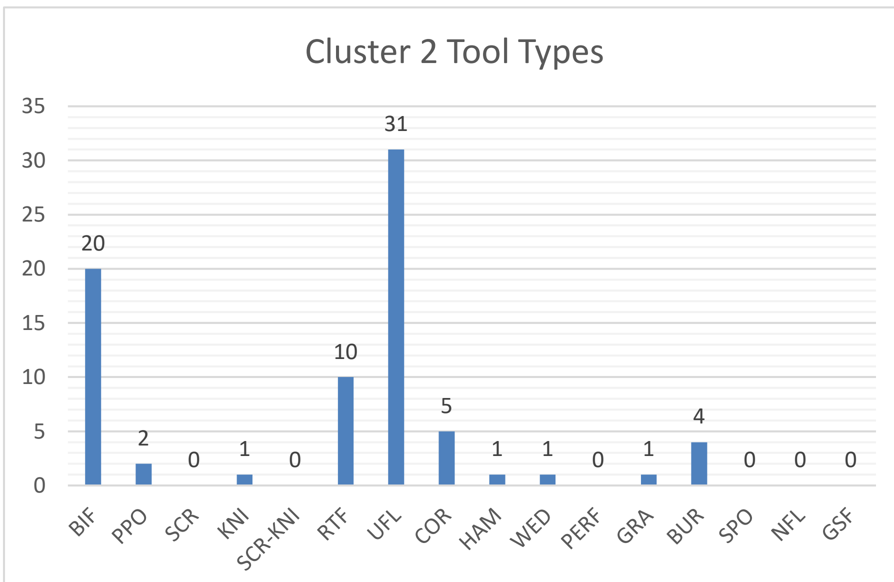

Figure 39: Tool types located within Cluster 2. The counts do not combine mended artifacts

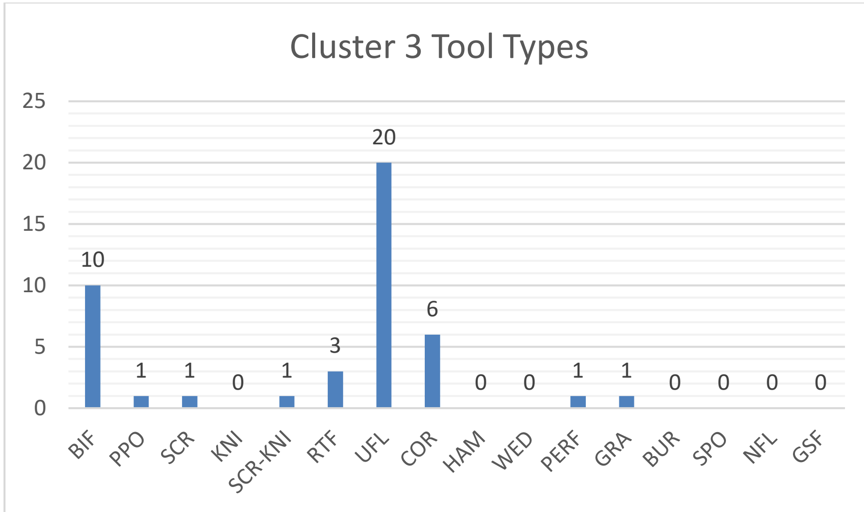

Figure 40: Tool types located within Cluster 3. The counts do not combine mended artifacts

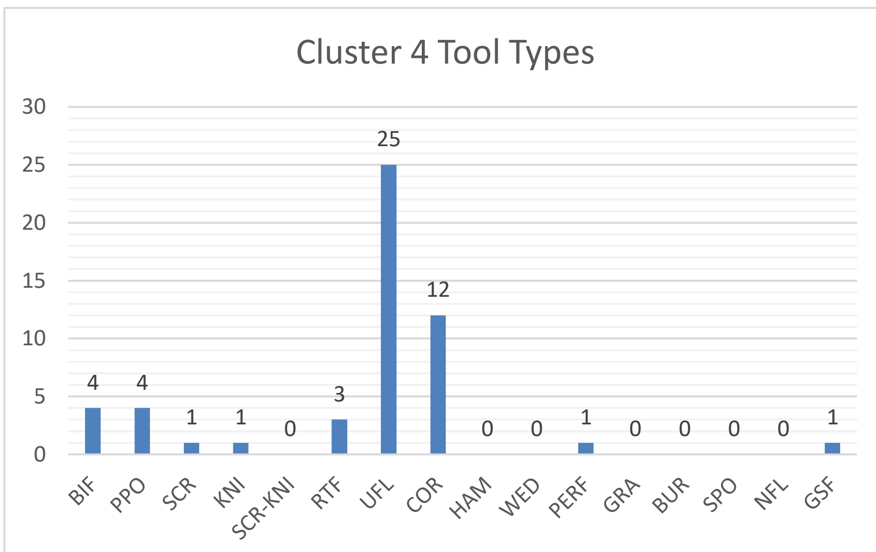

Figure 41: Tool types located within Cluster 4. The counts do not combine mended artifacts

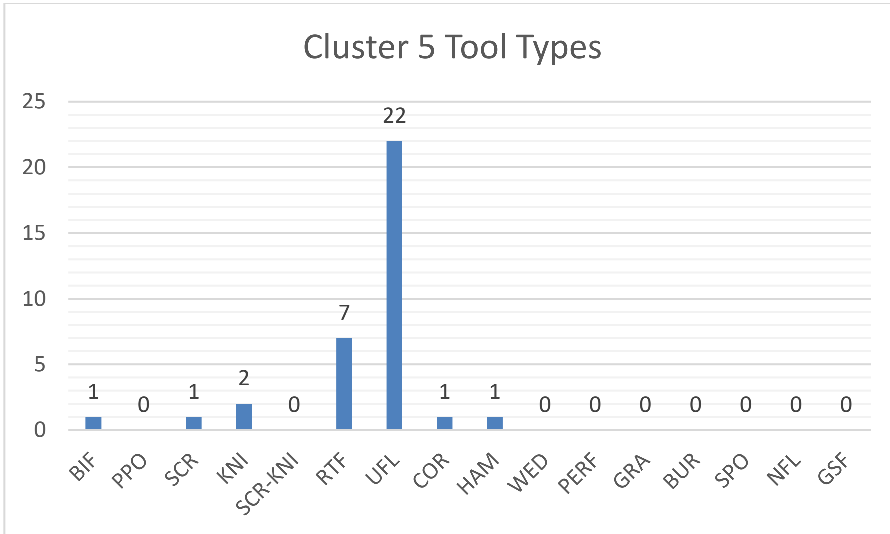

Figure 42: Tool types located within Cluster 5. The counts do not combine mended artifacts

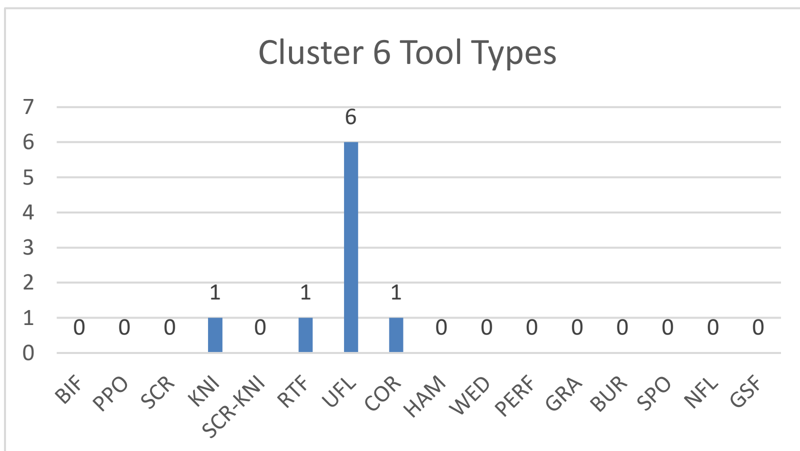

Figure 43: Tool types located within Cluster 6. The counts do not combine mended artifacts.

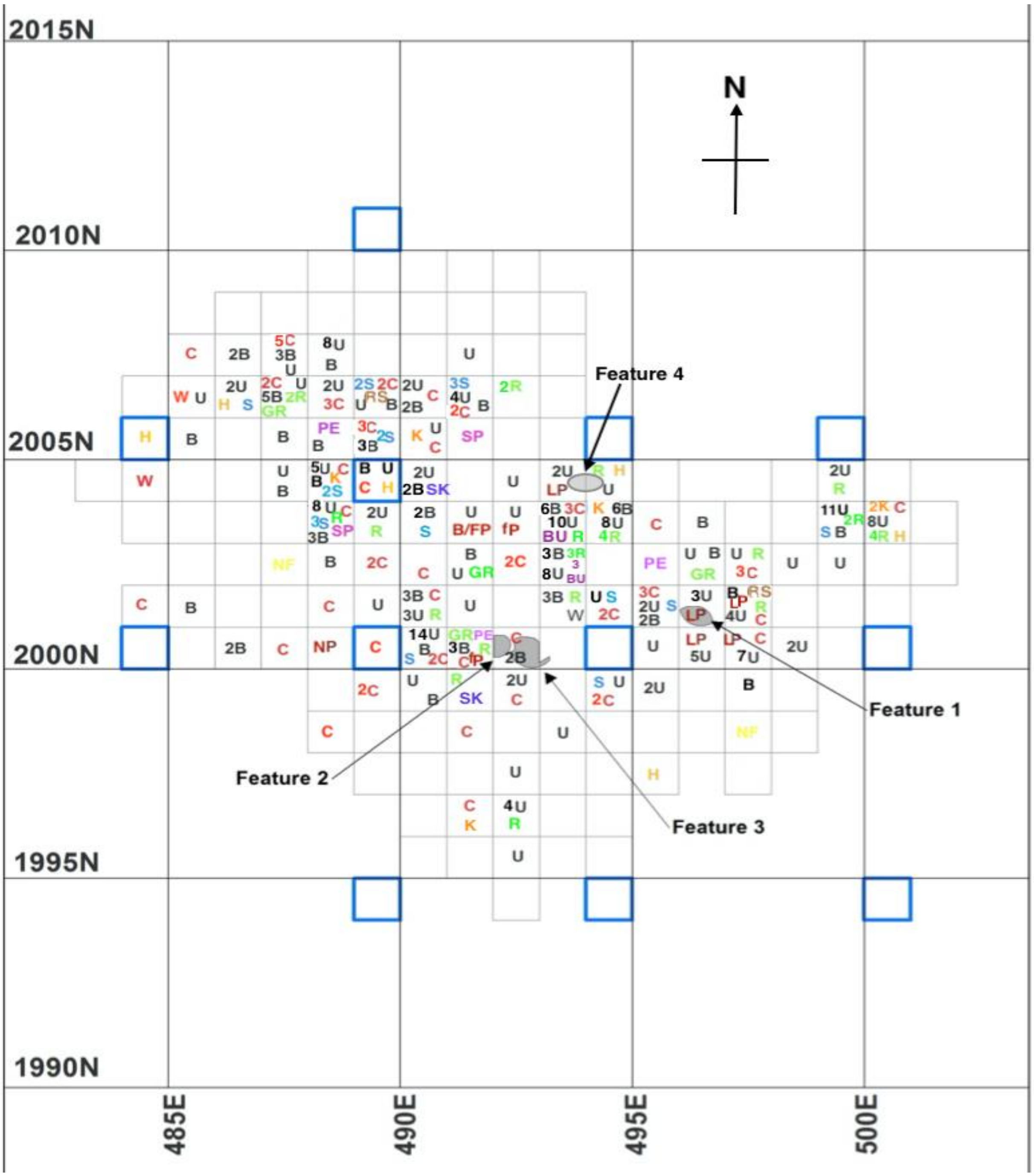

Figure 44: Unit map showing Ridge Pine 3 tool distribution (adapted from TMHC 2012:38)

Key: B = biface, LP = Lamoka-like projectile point, B/FP = Brewerton/Feeheley projectile point, NP = Nettling projectile point, fP = fragment projectile point, S = scraper, K = knife, SK = scraper-knife, PE = perforator, SP = spokeshave, RS = rough stone fragment, BU = burin, GR = graver, W = wedge, H = hammerstone, C = core, U = utilized flake, R = retouched flake, NF = notched flake. Units outlined in blue are Stage 3 units.

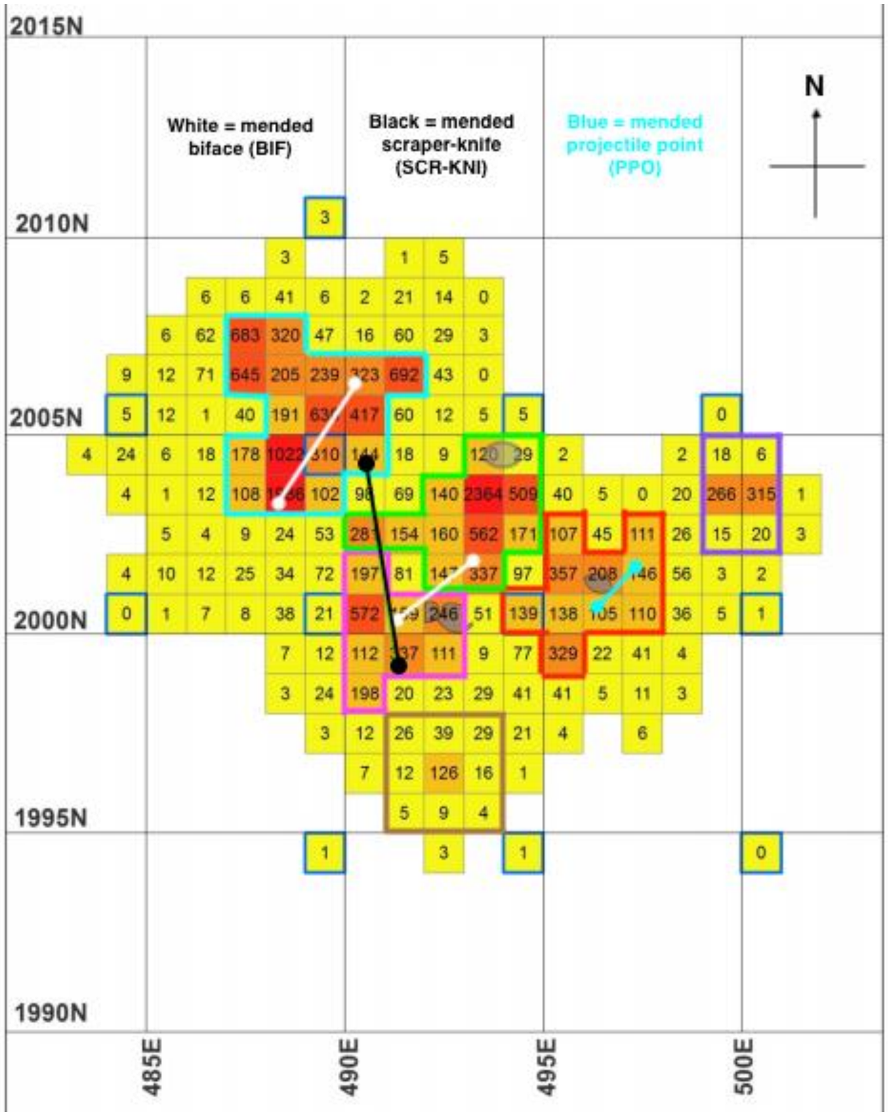

Figure 45: Unit map with distribution of mended artifacts (adapted from TMHC 2012:38)

Table 19: Radiocarbon Dating Results

Cat. No.	Lab ID	Material	Amount	Feature	RCYBP	Cal BP	Note
30A	UOC-15546	Nutshell	1 piece	1	159 ± 37	288 to 55	Modern
30B	UOC-15547	Nutshell	Aggregate	1	203 ± 32	225 to 138	Modern
30C	UOC-15766	Wood charcoal	3 pieces	1	103 ± 31	148 to 14	Modern
36	UOC-15767	Wood charcoal	Aggregate	3	3005 ± 31	3260 to 3075	Small Point (Late Archaic)
41A	UOC-15548	Wood charcoal	1 piece	4	4346 ± 34	4978 to 4844	Narrow Point (Late Archaic)
41B	UOC-15768	Wood charcoal	1 piece	4	4426 ± 44	5081 to 4867	Very end of late Middle Archaic and beginning of Narrow Point

Note: Radiocarbon analysis was performed a 3MV accelerator mass spectrometer at the AEL AMS Laboratory affiliated with the University of Ottawa (AEL AMS Radiocarbon Laboratory Analysis Report 2021a, b). Calibration was performed by the AEL lab using OxCal v4.2.4 (Bronk Ramsey 2009).

Chapter 6: Discussion:

Table 20: Local sites tool type comparisons

Tool Type	Ridge Pine 3		Ridge Pine 2		Johnstone 2		Johnstone 3		Johnstone 7		South Bend	
	n	%	n	%	n	%	n	%	n	%	n	%
Projectile Point	9	2.36%	18	9.94%	1	4.00%	0	0.00%	3	2.17%	14	11.97%
Biface	73	19.16%	22	12.15%	7	28.00%	9	7.63%	28	20.29%	36	30.77%
End Scraper	8	2.10%	7	3.87%	2	8.00%	5	4.24%	4	2.90%	10	8.55%
Other Scrapers	10	2.62%	1	0.55%	1	4.00%	0	0.00%	2	1.45%	1	0.85%
Knife	7	1.84%	0	0.00%	0	0.00%	0	0.00%	0	0.00%	0	0.00%
Scraper-Knife	2	0.52%	0	0.00%	0	0.00%	0	0.00%	0	0.00%	0	0.00%
Core	67	17.59%	8	4.42%	4	16.00%	15	12.71%	40	28.99%	43	36.75%
Graver	4	1.05%	0	0.00%	0	0.00%	0	0.00%	0	0.00%	0	0.00%
Burin	4	1.05%	0	0.00%	0	0.00%	0	0.00%	0	0.00%	0	0.00%
Spokeshave	2	0.52%	4	2.21%	1	4.00%	2	1.69%	2	1.45%	0	0.00%
Notched Flake	2	0.52%	0	0.00%	0	0.00%	3	2.54%	2	1.45%	0	0.00%
Perforator	3	0.79%	2	1.10%	0	0.00%	0	0.00%	0	0.00%	0	0.00%
Wedge	3	0.79%	4	2.21%	0	0.00%	0	0.00%	2	1.45%	5	4.27%
Utilized Flake	156	40.94%	108	59.67%	9	36.00%	82	69.49%	55	39.86%	5	4.27%
Retouched Flake	31	8.14%	1	0.55%	0	0.00%	2	1.69%	0	0.00%	1	0.85%
Drill	0	0.00%	6	3.31%	0	0.00%	0	0.00%	0	0.00%	2	1.71%
Total	**381**	**100.00%**	**181**	**100.00%**	**25**	**100.00%**	**118**	**100.00%**	**138**	**100.00%**	**117**	**100.00%**

Note: South Bend artifacts are from the buried paleosol Middle and Late Archaic component

References: Ridge Pine 3 (Russell, this report); Ridge Pine 2 (Belyea 2019); Johnstone 2, 3, and 7 (Wilson 2008); South Bend (Belyea 2019)

Appendix B: Flake Types

These flake typologies are summarized from pages 157 to 161 in Sherri Pearce's 2008 thesis, "Small Point Archaic Lithic Procurement and Use". This approach for analyzing the debitage sample was chosen for Pearce's replicability and for continuity as the Ridge Pine 2 site also used this approach with the debitage analysis (Belyea 2019).

Early-Stage Reduction Debris:

These categories are associated with early-stage reduction techniques

Primary (PRIM)

- Cortex covers entire outer dorsal surface of the flake
- Striking platform at approximately 90 degrees to ventral surface
- Ventral surface lacks curvature
- Generally larger in size
- Dorsal surface has low number of scars

Secondary (SEC)

- Cortex covers only part of the outer dorsal surface of the flake
- Striking platform at approximately 90 degrees to ventral surface
- Ventral surface lacks curvature
- Generally larger in size
- Dorsal surface has low number of scars

Tertiary (TERT)

- Generated from core trimming activities
- No cortex on surface other than striking platform (>10%)
- Striking platform has few facets and is at approximately right angles
- Dorsal surface has low number of scars

Bipolar (BPO)

- Shattered or pointed platforms with little or no surface area

- Evidence of force at both ends of the flake
- Angular polyhedral cross section
- Steep lateral edge angles
- Lack of definite positive bulb of force
- Pronounced ripple marks
- Lack of a clear distinction between dorsal and ventral flake surfaces

Shatter (SHAT)

- No clear ventral or dorsal surface
- No orientation – distal or proximal, dorsally or ventrally
- Blocky fragments
- No visible negative bulbs if percussion

Late-Stage Reduction Debris:

These categories are associated with late-stage reduction techniques

Biface Thinning (BFT)

- Large in relation to most other flakes, except for flakes used as tool blanks
- Striking platforms are ground, faceted, and acute-angled, usually exhibiting a lip
- Lateral edges are consistently expanding
- Curvature is usually symmetrical or distal and ranges from slight to pronounced
- Smooth ventral surface
- Dorsal surface exhibits bidirectional flake scars

Bifacial Retouch (BRT)

- Associated with re-sharpening and curated technologies
- Smaller than biface thinning flakes
- Thin and flat transverse cross section lacking pronounced dorsal ridges
- Thin longitudinal cross section
- Frequently curved so the flake is concave on the ventral surface
- Feathered edges both laterally and distally

- High number of flake scars which are bidirectional or multi-directional/centripetal
- Striking platform faceted, thin, lipped, and often ground
- Little or no cortex on dorsal surface
- Expanding lateral edges from platform is dominant
- Small or subdued bulb of force
- Acute platform to dorsal angle

Biface Reduction Error (BRE)

- Overall size is small, especially in length, but exhibit very large platforms with pronounced lips
- Platforms are always ground, faceted, and acute angled
- At least one, but usually both lateral edges are contracting from the platform

Unifacial Retouch (UFT)

- Almost always a complete flake
- Platform approximates the ventral surface of a uniface and is right angled
- Small, circular to irregular in outline, and can have a pronounced bulb of force
- Parallel scars on dorsal surface (old working edge)
- Use wear on working edge adjacent to platform
- Pronounced curvature
- Usually feathered termination (may also be hinged or stepped)
- Lateral edges are often expanding from platform
- On the surface adjacent to the platform, a series of small, overlapping, hinged or stepped-out flake scars are present perhaps representing previous use of the tool edge

Other Debris:

Fragmentary (FRAG)

- Lack striking platform but are thin in cross-section (unlike shatter)
- Distal portion of broken flake
- Clear dorsal and ventral surfaces

- Break termination proximally

Potlids (PTL)

- Do not result from purposeful flaking activities but because of rapid heating of chert and are unintentional and usually due to post-depositional burning (i.e. Discard in hearths)
- Small, circular flakes exhibiting no platforms
- Usually burnt

Appendix C: Paleoethnobotanical Report

The Late Archaic Ridge Pine 3 site, AhHk-137, has four features on the site. Samples were taken from each for flotation analysis. The heavy and light fractions for each of the four features underwent paleoethnobotanical analysis. I conducted the analysis at Timmins Martelle Heritage Consultants Inc. under the supervision of Breanne Riebl as part of the practicum for the Applied Anthropology program at the University of Western Ontario.

This report discusses the results of the paleoethnobotanical analysis for the light and heavy fractions from the four features of the Ridge Pine 3 site (Table 21).

Methods

At TMHC the light and heavy fractions from the Ridge Pine 3 site were each weighed prior to being sieved through a set of standard geological sieves of mesh No. 5 (4.00 mm), 16 (1.19 mm), 18 (1.00 mm), 30 (595 µm), 40 (420 µm), and 100 (149 µm). This was done in order to make sorting easier in identifying paleoethnobotanical remains. The starting weights from each light and heavy sample were weighed on a scale with a decimal interval of one-tenth while the component weights were taken on a scale with a decimal interval of one-hundredth.

All samples were examined using either a Wild M3 stereomicroscope at 6.4, 16, and 40 X magnifications or a Zeiss Stemi 305 stereomicroscope at 8 to 40 X magnifications. Identifications were made using reference specimens and reference manuals (Bonner & Karrfalt 2008; McAndrews n.d.).

Table 21: Inventory of flotation samples from Ridge Pine 3

Provenience		Total Weights		
Feature	Level	Light Fraction (g)	Heavy Fraction (g)	Total Unsorted (g)
1	S 1/2, all	12.2	263.6	275.8

2	S 1/2, all, 0-19 cm	3.5	158.5	162.0
3	NWQ, all, 0-10 cm	4.4	215.4	219.8
4	N 1/2, all, 10 cm	5.9	205.3	211.2

Components

See Table 22 and Figure 45 below for the component weights per feature.

Wood Charcoal

Charcoal or carbonized wood was identified by breaking the pieces transversely for a clear cross-section view of the end grains. Identification was made using an illustrated wood charcoal identification manual (McAndrews n.d.). Where a specific species could not be identified, partial identification of angiosperm or deciduous wood was classified as indeterminate diffuse porous or indeterminate ring porous. Carbonized wood that was too small, distorted, or delicate to make an identification was classified as charcoal.

Charcoal was present in all four features from the Ridge Pine 3 site. Unfortunately, due to the fragility and small size of the charcoal pieces I was not able to identify many of the pieces. The two categories of classification that were identified for the charcoal included beech (*Fagus grandifolia*) and indeterminate diffuse porous. In total there were three pieces of beech and six pieces of indeterminate diffuse porous.

Nut Remains

Nutshell remains from the Ridge Pine 3 site were found in the samples from feature 1 (n=25, 0.39 g), feature 2 (n=1, 0.08 g), and feature 3 (n=1, <0.01 g). The majority of the nutshell remains come from feature 1. In total, 27 pieces of nutshell were identified however species identification was only possible for one of the pieces. The nutshell piece in the light fraction sample from feature 2 is likely hickory (*Carya sp.*) based on a comparison with a modern sample, though the piece is too small and fragmentary for a decisive conclusion or for speculation on the specific hickory species.

The rest of the nutshell remains are too small and fragmentary for further classification beyond nutshell fragments.

Bone

Fragmentary pieces of bone were found in feature 2 (n=11, 0.08 g) and in feature 3 (n=1, <0.01 g). The fragments of bone are too small for species identification.

Flakes

Two small chert flakes were found in the heavy fraction from feature 4 (n=2, <0.01 g). They were catalogued and placed with the rest of the artifacts from that feature.

Unidentifiable

Remains that were unidentifiable were found in all four of the features. See Table 22 for a breakdown. The unidentifiable remains are the most common component from all the feature samples at Ridge Pine 3. Due to the age of the site, this is not unexpected with natural decaying processes making identification difficult for older sites.

Table 22: Component weights (g) for Ridge Pine 3 samples and feature locations

Location	Total Weights			Components				
Feature	Light Fraction (g)	Heavy Fraction (g)	Total Unsorted (g)	Unidentifiable (g)	Nutshell (g)	Bone (g)	Charcoal (g)	Flakes (g)
1	12.2	263.6	275.8	5.21	0.39	-	0.93	-
2	3.5	158.5	162.0	0.31	0.08	0.08	0.04	-
3	4.4	215.4	219.8	<0.01	<0.01	<0.01	0.07	-
4	5.9	205.3	211.2	<0.01	-	-	1.76	<0.01

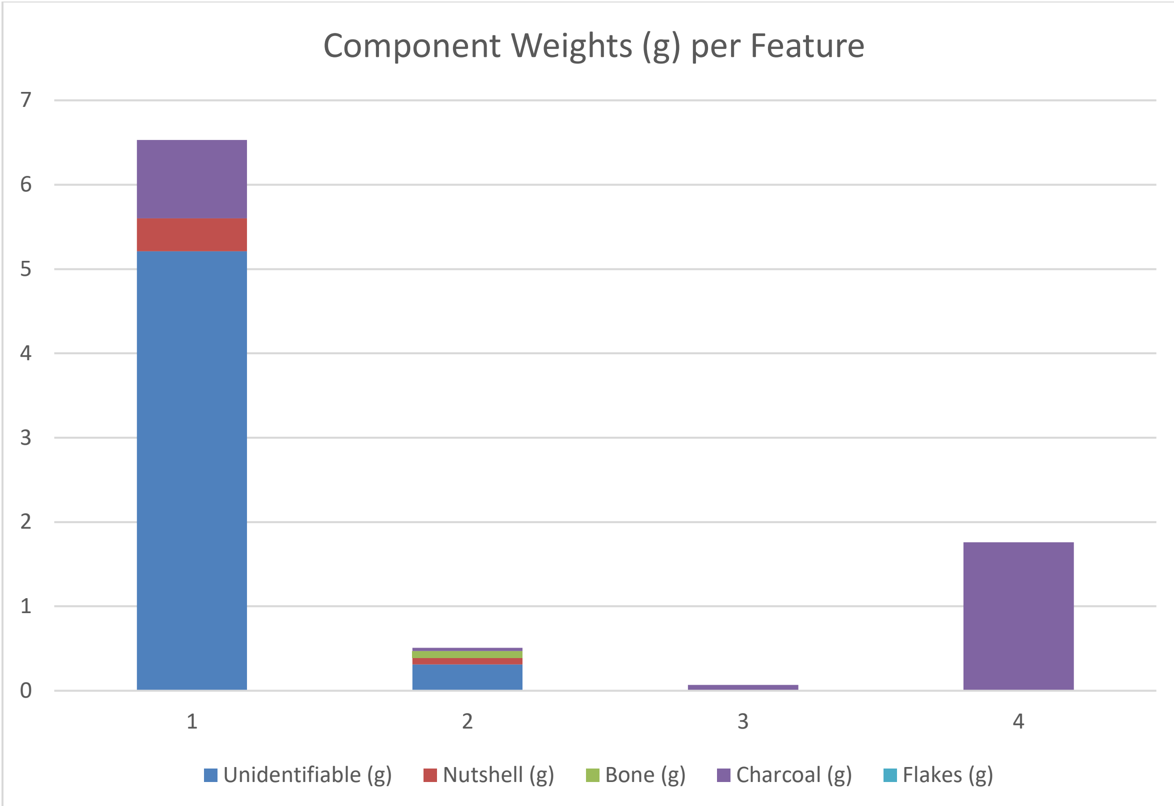

Figure 46: Component weights (g) broken down per feature

Discussion

See Chapter 4 section 4.2

Appendix D: Flake Types per Unit

O = Onondaga; KP = Kettle Point; FR = Flint Ridge; H = Huronia; J = Jasper; CW = Collingwood; U = Unknown.

Original 20% debitage sample units:

Unit 1990N 500E:21 was also in the sample, but no artifacts were found in that unit.

Unit/Cat.	563, 566 2005N 485E:3	PRIM	SEC	TERT	SHAT	BFT	BRT	BRE	FRAG
Raw Material	O	1	3	3	2	12	1		11
	KP					1	1	1	1
	Burnt O				1				1
	Burnt								
	U								

Unit/Cat.	713 2005N 485E:8	PRIM	SEC	TERT	SHAT	BFT	BRT	BRE	FRAG
Raw Material	O	16	69	66	14	176	26	6	233
	KP			2	3	2			1
	Burnt O		3		1	3			6
	Burnt				1	2			4
	U					1			

Unit/Cat.	476, 483, 485, 488	PRIM	SEC	TERT	SHAT	BFT	BRT	BRE	FRAG

	2005N 485E:13								
Raw Material	O	24	119	86	30	149	14	3	213
	KP			2		1	1		1
	CW					1			
	Burnt O	2	10	1	2	7	1		5
	Burnt					2			3
	U								

Unit/Cat.	421 2005N 485E:17	PRIM	SEC	TERT	FRAG
Raw Material	O	1	1	1	3
	KP				
	Burnt				
	U				

Unit/Cat.	551, 552 2005N 490E:3	SEC	TERT	BFT	FRAG
Raw Material	O	3	1	2	7
	KP				
	Burnt				
	U				

Unit/Cat.	725 2005N 490E:8	SEC	TERT	SHAT	BFT	BRT	FRAG
Raw Material	O	2	1	1	9	1	17
	KP	1			1		2
	J					1	
	Burnt O	1					
	Burnt				1		1
	U						

Unit/Cat.	625, 627 / 2005N 490E:13	SEC	TERT	BFT	FRAG
Raw Material	O	1	4	8	11
	KP			1	
	CW				1
	Burnt O				1
	Burnt				
	U				

Unit/Cat.	417 / 2005N 490E:17	TERT	SHAT	BFT	BRT	FRAG
Raw Material	O	1	1	6	1	4
	KP					
	Burnt O			2		4
	Burnt					
	U					

Unit/Cat.	395 / 2000N 480E:10	SHAT	BFT
Raw Material	O		1
	KP		1

	Burnt KP	1	
	Burnt		
	U		

Unit/Cat.	163 2000N 480E:20	SHAT	BFT	FRAG
Raw Material	O	1	2	
	KP			1
	Burnt			
	U			

Unit/Cat.	306, 309 2000N 480E:25	SEC	TERT	SHAT	BFT	BRT	FRAG
Raw Material	O	1			2	1	1
	KP		2	1	5		3
	Burnt						
	U						

Unit/Cat.	554 2000N 485E:3	SEC	BFT	FRAG
Raw Material	O			
	KP	2	4	1

	Burnt			
	U			

Unit/Cat.	400, 404 2000N 485E:10	SEC	TERT	SHAT	BFT	BRT	BRE	FRAG
Raw Material	O				3			3
	KP	1	3	5	26	2	2	23
	Burnt KP	1						1
	Burnt							
	U							

Unit/Cat.	629 2000N 485E:13	SEC	TERT	BFT
Raw Material	O			
	KP	2		4
	Burnt O		1	
	Burnt			
	U			

Unit/Cat.	155, 156 2000N 485E:20	SEC	TERT	SHAT	BFT	BRT	BRE	FRAG
Raw Material	O		4	2	20	2	1	19
	KP	1			19			11

	CW								1
	Burnt O		1		1				
	Burnt KP			1	7	1			
	Burnt	2			4				2
	U								

Unit/Cat.	05 (Stage 3 unit) 2000N 485E:25	PRIM	SEC	TERT	SHAT	BFT	BRT	BRE	FRAG
Raw Material	O	3	6	16	4	54	15	1	84
	KP		2	2	2	8	2	1	23
	CW					1			3
	Burnt O		1			8			18
	Burnt KP		1	5	1	5		1	4
	Burnt			1		6			9
	U					8			9

Unit/Cat.	546 2000N 490E:3	PRIM	SEC	TERT	SHAT	BFT	BRT	BRE	FRAG
Raw Material	O	2	4	3	7	12	1		23
	KP			2	3	34	5	1	24
	Burnt O				2	1			2
	Burnt KP				3	3			3
	Burnt					4			4

	U					4			8

Unit/Cat.	462, 464, 465, 466 2000N 490E:10	PRIM	SEC	TERT	SHAT	BFT	BRT	FRAG
Raw Material	O		5	3	2	23		23
	KP					7	2	6
	Burnt O			1		1		1
	Burnt KP					1		
	Burnt FR							1
	Burnt	1	1	1		4		4
	U					3		1

Unit/Cat.	644, 646 2000N 490E:13	PRIM	SEC	TERT	SHAT	BFT	BRT	BRE	FRAG
Raw Material	O		1	2	3	20		1	32
	KP		1	1	1	22	1		14
	CW					1			1
	Burnt O	1	2	1		2			
	Burnt KP			3		5		1	4
	Burnt FR				1				
	Burnt		5			13		1	13
	U					5			2

Unit/Cat.	168, 177, 178, 180, 310 / 2000N 490E:20	PRIM	SEC	TERT	SHAT	BFT	BRT	FRAG
Raw Material	O	3	28	33	5	170	6	143
	KP		1			13		9
	Burnt O		13		1	16		6
	Burnt KP					2		
	Burnt		4	3	1	17	1	12
	U					2	1	1

Unit/Cat.	303, 304 / 2000N 490E:25	SEC	TERT	BFT	FRAG
Raw Material	O	1	3	10	4
	KP			1	
	Burnt O				1
	Burnt KP			1	
	Burnt			1	4
	U				

Unit/Cat.	559, 567 / 2000N 495E:3	PRIM	SEC	TERT	SHAT	BFT	BRT	FRAG
Raw Material	O		2	2	1	22	2	10
	KP		1			17	1	9

	Burnt O		3	1	1			1
	Burnt KP		2			9		6
	Burnt	1	2			3		2
	U					3		

Unit/Cat.	396 2000N 495E:10	SHAT	BFT	FRAG
Raw Material	O			
	KP	1		
	Burnt KP		1	1
	Burnt			
	U			

Unit/Cat.	637, 641, 642 2000N 495E:13	PRIM	SEC	TERT	SHAT	BFT	BRT	BRE	FRAG
Raw Material	O		2	7		14	1	1	12
	KP			2	1	22	1		22
	Burnt O	1		1		1			2
	Burnt KP					5			7
	Burnt					1	1		1
	U					1			1

Unit/Cat.	151, 152	PRIM	SEC	TERT	BFT	BRT	BRE	FRAG

	2000N 495E:20							
Raw Material	O							
	KP	1	4	12	89	6	1	113
	Burnt KP		1		13			7
	Burnt							4
	U							

Unit/Cat.	313 1995N 485E:19	FRAG
Raw Material	O	2
	KP	
	Burnt	
	U	

Unit/Cat.	312 1995N 485E:25	TERT	BFT	BRT	FRAG
Raw Material	O	1			1
	KP	1	3	1	2
	Burnt FR				1
	Burnt				
	U				

Unit/Cat.	556 1995N 490E:3	SHAT	BFT	FRAG
Raw Material	O			1
	KP		2	2
	Burnt O	1		
	Burnt KP		1	
	Burnt		1	
	U			

Unit/Cat.	688 1995N 490E:7	BFT	FRAG
Raw Material	O	1	
	KP		2
	Burnt KP		3
	Burnt	1	1
	U	1	1

Unit/Cat.	523, 524 1995N 490E:14	SEC	TERT	SHAT	BFT	BRT	FRAG
Raw Material	O		1		1		2
	KP	1	2	1	9	2	6
	Burnt KP				2		1
	Burnt H				1		
	Burnt						
	U						

Unit/Cat.	317, 320 1995N 490E:19	PRIM	SEC	TERT	SHAT	BFT	BRT	FRAG
Raw Material	O		1		1	2		2
	KP		1	2		3	1	5
	Burnt O	1				1		1

	Burnt KP					3		1
	Burnt FR							1
	Burnt							
	U							

Unit/Cat.	349, 358 1995N 490E:25	PRIM	SEC	TERT	BPO	SHAT	BFT	BRE	FRAG
Raw Material	O		1	6			12		9
	KP			1		1	14	1	14
	Burnt O	1	1	1					
	Burnt KP						1		1
	Burnt			3	1		2		3
	U								

Unit/Cat.	270 1995N 495E:19	BFT	FRAG
Raw Material	O		
	KP	1	1
	Burnt KP	1	
	Burnt		
	U		

Extra debitage units pulled for spatial analysis:

Unit/Cat.	771, 773,774,778 2005N 490E:7	PRIM	SEC	TERT	BPO	SHAT	BFT	BRT	FRAG
Raw Material	O	10	40	65	1	6	244	10	270
	KP		1	2			5		4
	CW							1	3
	Burnt O		1						
	Burnt KP								1
	Burnt		1	3			10		8
	U						1		1

Unit/Cat.	531,534,535 2000N 490E:14	PRIM	SEC	TERT	BPO	SHAT	BFT	BRT	BRE	FRAG
Raw Material	O	3	11	18	1	1	89	3		65
	KP		1	3		6	61			88
	CW						5			2
	Burnt O									1
	Burnt KP						5			7
	Burnt	2	7	12	1	3	57		1	57
	U						9			13

Unit/Cat.	128,517,518 2000N 490E:1	PRIM	SEC	TERT	SHAT	BFT	BRT	BRE	FRAG
Raw Material	O		4	3	2	3			7
	KP	4	9	31	2	165	9	1	271
	Burnt O		1						
	Burnt KP				1	10			9
	Burnt			1	1	2			5
	U			1		1			3

Total debitage analyzed: 5278 flakes (27.48%)

Appendix E: Projectile Point Data Tables

Key: L = length; W = width; T = Thickness; H = Height; SBC = Shoulder to corner; SW = Shoulder width; IW = Internotch width; * = incomplete measurement

Point: 50	**Measurements (mm)**							**Characteristics**
Unit: 2000N 485E:4	**L**	**W**	**T**	**H**	**SBC**	**SW**	**IW**	Kettle Point
Full Point	22.5*	22.2*	5.1*		4.8*	22.1	13.5*	Lenticular cross section
Blade	17.4*	22.1						Straight, slightly serrated edges
Haft	5.0*	13.7*						Unknown base shape, straight or expanding stem
Neck		13.5*		5.0*				Corner notched, slight barbs present

Point: 53	**Measurements (mm)**							**Characteristics**
Unit: 2000N 490E:17	**L**	**W**	**T**	**H**	**SBC**	**SW**	**IW**	Onondaga
Full Point	43.1	27.6	8.5		8.7	27.5	15.4	Lenticular cross section
Blade	32.0	27.5						Convex edges
Haft	11.5	16.8						Convex base, expanding stem
Neck		15.4		11.5				1 side (weak) and 1 corner notch

Point: 69+815	Measurements (mm)							Characteristics
Unit: 2000N 495E:2 (69); 2000N 495E:8 (815)	**L**	**W**	**T**	**H**	**SBC**	**SW**	**IW**	Burnt Onondaga
Full Point	43.4*	21.9	9.2		11.8	21.3	15.8	Lenticular cross section
Blade	29.5*	21.3						Convex edges
Haft	14.4	19.0						Convex base, expanding stem
Neck		15.8		14.4				Side notched, weak

Point: 71	Measurements (mm)							Characteristics
2000N 495E:7	**L**	**W**	**T**	**H**	**SBC**	**SW**	**IW**	Onondaga
Full Point	45.6	20.8	8.0		11.2	19.9	15.1	Diamond cross section
Blade	29.9	19.9						Convex edges
Haft	16.1	20.4						Convex base, expanding stem
Neck		15.1		16.1				Side notched, weak

Point: 72	Measurements (mm)							Characteristics
2000N 490E:24	**L**	**W**	**T**	**H**	**SBC**	**SW**	**IW**	Onondaga
Full Point	41.6	21.5*	7.6		13.1	18.9*	13.3	Lenticular cross section
Blade	29.1	18.9*						Convex edges

Haft	12.8	18.3						Biconcave base, expanding stem
Neck		13.3		12.8				Side notched, weak on one side

Point: 558	**Measurements (mm)**							**Characteristics**
2000N 495E:3	**L**	**W**	**T**	**H**	**SBC**	**SW**	**IW**	Burnt Onondaga
Full Point	32.8*	19.0*	8.8*		11.4	18.4*	15.3*	Lenticular cross section
Blade	19.8*	18.4*						Straight edges, 1 reworked
Haft	12.7	17.5						Convex base, expanding stem
Neck		15.3*		12.7				Side notched, weak

Point: 120	**Measurements (mm)**							**Characteristics**
2000N 490E:18	**L**	**W**	**T**	**H**	**SBC**	**SW**	**IW**	Onondaga
Full Point	14.0*	14.4*	5.6*		N/A	N/A	N/A	Lenticular cross section
Blade	14.0*	N/A						Convex or straight edges
Haft	N/A	N/A						Unknown base and stem shape
Neck		N/A		N/A				Unknown notches

Point: 667	Measurements (mm)							Characteristics
2000N 490E:2	**L**	**W**	**T**	**H**	**SBC**	**SW**	**IW**	Kettle Point
Full Point	8.3*	13.3*	3.8*		N/A	N/A	N/A	Either midsection or base fragment
Blade	N/A	N/A						If midsection fragment: lenticular cross section with straight blade edges
Haft	N/A	N/A						Unknown base and stem shape
Neck		N/A		N/A				Unknown notches

Appendix F: Euclidean Distance Calculations

Euclidean distances were calculated in order to determine how quantitatively similar the Ridge Pine 3 projectile points (Cat. Nos. 69+815, 71, 72, and 558) were to points from both Narrow Point and Small Point sites. Cat. No. 558 was excluded from the calculations due to it being reworked into a knife which would likely skew the measurements taken from the points. Comparable sites include Crawford Knoll (Small Point, Ontario), Innes (Small Point, Ontario), Winter (Narrow Point, Ontario), Canada Century (Narrow Point, Ontario), AiHc-423 (Narrow Point, Ontario), AiHc-429 (Narrow Point, Ontario), 20BY28 (Narrow Point, Michigan), and 20BY387 (Narrow Point, Michigan). Euclidean distances take the means of all the dimensions taken from the points from all the sites to calculate which one is comparatively closer to the target site. The smaller the Euclidean distance, the more similar they are to Ridge Pine 3.

First, metrics in millimetres were taken for all complete or nearly complete points from the sites. Metrics include length, width, thickness, shoulder width (ShW), stem width (StW), base width (BaW), and shoulder height (ShH). Crawford Knoll and Innes site point metrics were copied from Kenyon (1989) and the missing thickness measurements were supplemented with the average thickness for those point types from Ellis et al. (1989). Winter site point measurements were taken from those recorded by Ramsden (1990:Table 4). Length, width, and thickness measurements for the Canada Century site were provided by Lennox (1990:43) while the rest were derived from the images given using the scale provided and a ruler (Lennox 1990:Figure 10). Length, width, and thickness were provided for all AiHc-423 points by TMHC (2015a), and base width and shoulder height were provided for all except Cat. No. 290a. Length, width, and thickness was provided for the AiHc-429 points by TMHC (2015b). The missing shoulder width, stem width, base width, and shoulder height raw data measurements for AiHc-423 and AiHc-429 were calculated with simple imputation by taking the average of each variable from all the sites being compared and using that metric average for each of the points. All measurements for 20BY28 and 20BY387 were taken from images in Cook and Lovis (2014:Figure 9, Figure 5) using the scale provided and calipers, except for the thickness measurement. Thickness was calculated by taking the average thickness of only the Narrow Point sites with Lamoka points (Winter, Canada Century, AiHc-423, and AiHc-429).

Raw Metrics for Projectile Point Comparisons (Step 1)								
Cat. No.	**Site**	**L**	**W**	**T**	**ShW**	**StW**	**BaW**	**ShH**
69+815	Ridge Pine 3	43.4	21.9	9.2	21.3	15.8	19	14.4
71	Ridge Pine 3	45.6	20.8	8.0	19.9	15.1	20.4	16.1
72	Ridge Pine 3	41.6	21.5	7.6	18.9	13.3	18.3	12.8
1	Crawford Knoll	51	13	6.0	26	13	15	12
2	Crawford Knoll	38	12	6.0	19	12	18	10
3	Crawford Knoll	30	10	6.0	17	10	13	9
4	Crawford Knoll	28	9	6.0	16	9	14	8
5	Crawford Knoll	24	8	6.0	14	8	9	5
6	Crawford Knoll	30	11	6.0	18	11	13	8
7	Crawford Knoll	37	10	6.0	18	10	13	8
8	Crawford Knoll	37	9	6.0	20	9	10	7
9	Crawford Knoll	31	9	6.0	15	9	9	7
10	Crawford Knoll	26	7	6.0	15	7	8	7
11	Crawford Knoll	28	9	6.0	15	9	12	6
12	Innes	42	11	6.3	19	11	14	14
13	Innes	35	10	6.3	18	10	12	11
14	Innes	45	12	6.3	21	12	14	12
15	Innes	38	12	6.3	30	12	16	11
16	Innes	39	9	6.3	21	9	12	12
17	Innes	50	12	6.3	31	12	13	10
18	Innes	32	9	6.3	23	9	11	12
19	Innes	39	12	6.3	23	12	15	12
1	Winter	27	13	6	13	9	11	10
2	Winter	44	14	8	14	11	12	13
5	Winter	40	23	7	23	13	18	14
2S13W	Canada Century	59	19	9	17	9	12	8
3N15W	Canada Century	40	16	7	16	10	14	11
1S14W	Canada Century	24	15	6	15	10	9	9
752	AiHc-423	40	18.4	6.8	17.9	10.6	12.2	9.3
795	AiHc-423	30.3	14.8	6.4	17.9	10.6	12.1	11.8
820	AiHc-423	39.1	18.2	7.3	17.9	10.6	15.2	14.1
886	AiHc-423	36.8	17.9	7.5	17.9	10.6	12.3	12.2
290a	AiHc-423	40.1	17.8	4.6	17.9	10.6	13.3	11.1
452	AiHc-429	53.9	17.1	9.9	17.9	10.6	13.3	11.1

523+804	AiHc-429	41.7	15.7	15.8	17.9	10.6	13.3	11.1
753	AiHc-429	30.6	18.8	6.1	17.9	10.6	13.3	11.1
788	AiHc-429	53.6	22.2	8.8	17.9	10.6	13.3	11.1
821	AiHc-429	42.2	21.2	8.4	17.9	10.6	13.3	11.1
914	AiHc-429	31.2	16.1	6	17.9	10.6	13.3	11.1
1111	AiHc-429	40.2	17.6	5.5	17.9	10.6	13.3	11.1
1125	AiHc-429	32.5	15.2	6	17.9	10.6	13.3	11.1
1343+1483	AiHc-429	46	17.5	7	17.9	10.6	13.3	11.1
1767	AiHc-429	45.6	16.9	7.9	17.9	10.6	13.3	11.1
1823	AiHc-429	41	18.5	10.3	17.9	10.6	13.3	11.1
1871	AiHc-429	41.4	17	9.6	17.9	10.6	13.3	11.1
5a	20BY387	52.1	17.8	7.7	17.8	10.7	16.6	15
5b	20BY387	53.9	18.5	7.7	18.5	11.2	16.5	18.1
5c	20BY387	48.1	18.8	7.7	17.7	9.8	13.7	12.8
5d	20BY387	35.4	14.4	7.7	14	9	13	11.9
5e	20BY387	35.2	15.1	7.7	15.1	9.1	10.9	11.6
5f	20BY387	28.2	17.5	7.7	17.5	12.7	18.6	13.8
5g	20BY387	35.8	14.2	7.7	14.2	9.3	9.8	11.1
5h	20BY387	32.3	12.4	7.7	12.4	10	11.5	11.4
5i	20BY387	27.3	14.4	7.7	14.4	10.2	14	11.6
5j	20BY387	34.9	16.4	7.7	14.4	9.7	13.8	10.6
5k	20BY387	33.4	15.3	7.7	15.3	10.6	13.6	11.2
5l	20BY387	31.1	18.6	7.7	17.9	12.2	11.7	11
5m	20BY387	23.1	16.1	7.7	15.5	8.1	10.1	12.7
9e	20BY28	34	15.6	7.7	15.1	10.5	11.4	11
9f	20BY28	35.3	15	7.7	14.5	11.8	12.9	13.2

Key: L = length, W = width, T = thickness, ShW = shoulder width, StW = stem width, BaW = base width, ShH = shoulder height

Next, averages and standard deviations of each metric variable from each site were taken. This summarizes the variables in each site to describe the characteristics of each site. The mean or average provides average performance and standard deviation is the variation of performance. Calculating both the average and standard deviation of each of the seven variables resulted in 14 variables per site to be included in the calculations.

Then, the average variable values were standardized using the equation (A1-mean of A)/std of A. Letters are the metric variable (i.e. A = length, B= width, etc.), numbers are the site (i.e. 1 = Ridge Pine 3, 2 = Crawford Knoll, etc.), and std stands for the standard deviation of that variable.

Finally, the Euclidean distances were calculated for each comparable site using the L2-norm equation where Euclidean distance = $(A1-A2)^2 + (B1-B2)^2 + (C1-C2)^2$. This is the most common formula of the three that are most often used to calculate Euclidean distances. Due to a lack of statistical testing regarding point types in the archaeological literature, L2-norm was chosen as it is the most used in other fields. Results are in the table below. The smallest number is the closest comparatively to Ridge Pine 3. Crawford Knoll site points are the least similar to the Ridge Pine 3 points while the points from AiHc-423 are the most similar.

Euclidean Distance to Ridge Pine 3 PPOs	
Site	**Euclidean Distance (L2-norm)**
Crawford Knoll	70.03
Winter	52.27
Canada Century	51.97
Innes	38.95
AiHc-429	38.85
20BY387	35.82
20BY28	34.01
AiHc-423	31.13

Appendix G: Feature Plans and Profiles

Feature 1

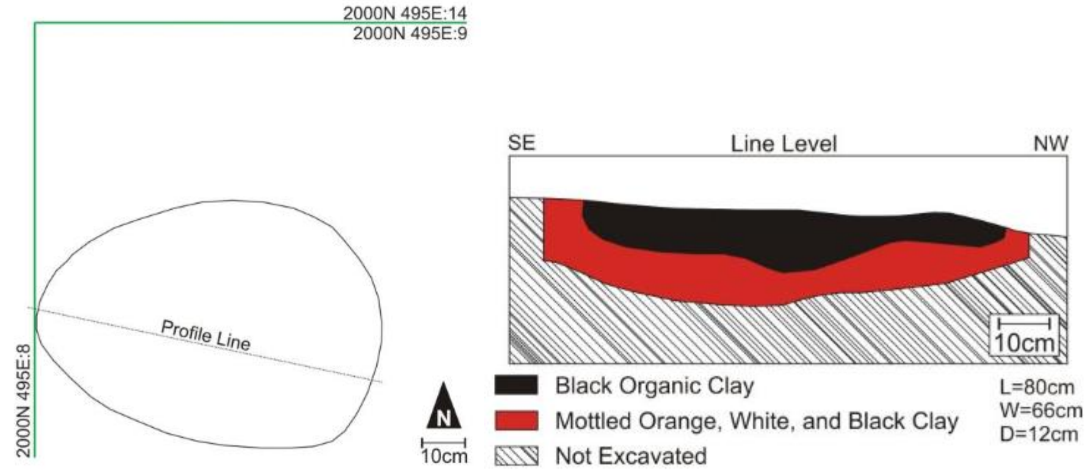

Figure 47: Feature 1 Top Plan (left) and Profile (right) (images taken from TMHC 2012:39)

Feature 2

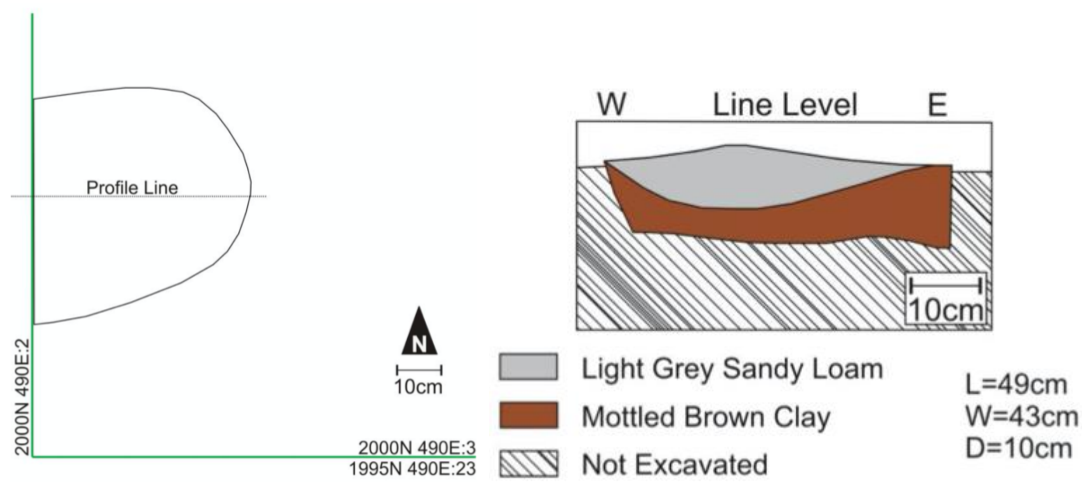

Figure 48: Feature 2 Top Plan (left) and Profile (right) (images taken from TMHC 2012:41)

Feature 3

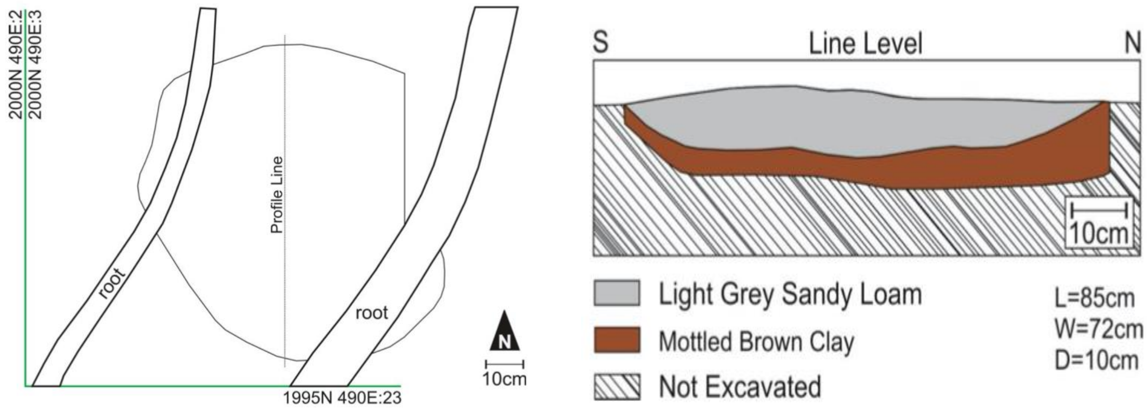

Figure 49: Feature 3 Top Plan (left) and Profile (right) (images taken from TMHC 2012:43)

Feature 4

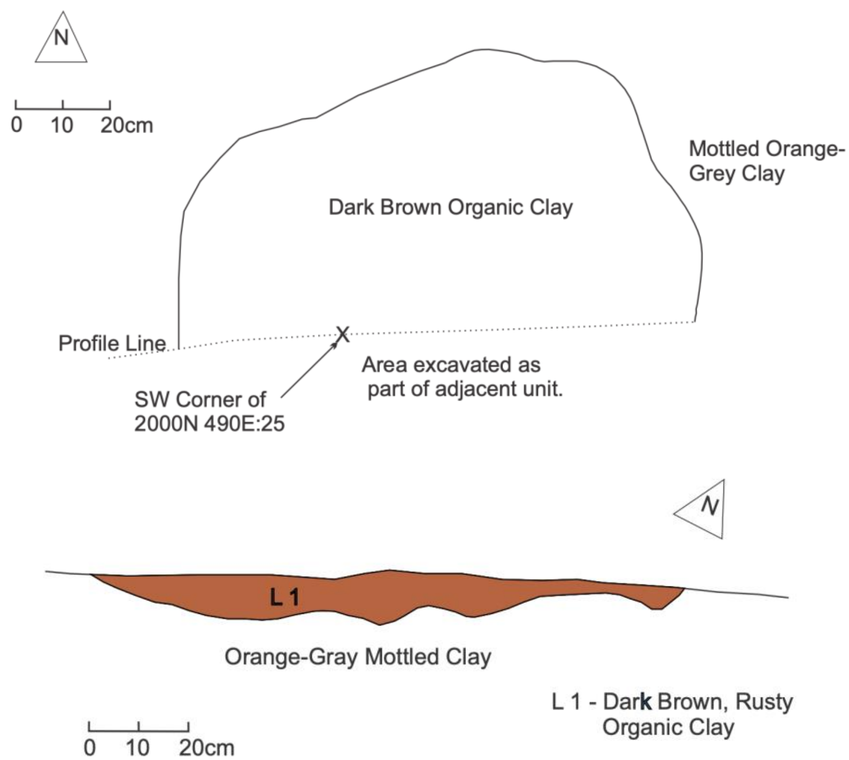

Figure 50: Feature 4 Top Plan (top) and Profile (right) (images created by Peter Timmins 2021)

Appendix H: Intrasite Spatial Analysis Data

Key: Flake Type: PRIM = Primary, SEC = Secondary, TERT = Tertiary, BPO = Bipolar, SHAT = Shatter, BFT = Biface thinning, BRT = Biface retouch, FRAG = Fragmentary, PTL = Potlid

Raw Material: O = Onondaga, KP = Kettle Point; CW = Collingwood; H = Huronia

Cluster 1

Analyzed debitage units: 2005N 485E:8, 13; 2005N 490E:7; 2000N 485E:20, 25

CLUSTER 1 Flake Types		PRIM	SEC	TERT	BPO	SHAT	BFT	BRT	BRE	FRAG	**Total**	**Percentage**
Raw Material	O	53	234	237	1	56	643	67	11	819	**2121**	**88.23%**
	KP	0	4	8	0	5	35	3	1	40	**96**	**3.99%**
	CW	0	0	0	0	0	2	1	0	7	**10**	**0.42%**
	Burnt O	2	15	2	0	3	19	1	0	29	**71**	**2.95%**
	Burnt KP	0	1	5	0	2	12	1	1	5	**27**	**1.12%**
	Burnt FR	0	0	0	0	1	0	0	0	0	**1**	**0.04%**
	Burnt	0	3	4	0	1	24	0	0	26	**58**	**2.41%**
	U	0	0	0	0	0	10	0	0	10	**20**	**0.83%**
Total		**55**	**257**	**256**	**1**	**68**	**745**	**73**	**13**	**936**	**2404**	**100.00%**
Percentage		**2.29%**	**10.69%**	**10.65%**	**0.04%**	**2.83%**	**30.99%**	**3.04%**	**0.54%**	**38.94%**	**100.00%**	

CLUSTER 1	**Termination**						**Total**
	Feather	**Hinge**	**Step**	**Plunging**	**Axial**	**Unidentifiable**	

Termination Types	1094	196	934	41	5	133	2403
Percentage	**45.53%**	**8.16%**	**38.87%**	**1.71%**	**0.21%**	**5.53%**	**100.00%**

Units with tools present: 2005N 485E:4, 5, 8, 9, 10, 13, 14; 2005N 490E:1, 6, 7; 2000N 485E:19, 20, 23, 24, 25; 2000N 490E:21

Cluster 1: Tool Types	Total	Percentage
Biface	25	**22.73%**
Projectile Point	0	**0.00%**
Scraper	12	**10.91%**
Knife	2	**1.82%**
Scraper-Knife	1	**0.91%**
Retouched Flake	4	**3.64%**
Utilized Flake	39	**35.45%**
Core	22	**20.00%**
Hammerstone	1	**0.91%**
Wedge	0	**0.00%**
Perforator	1	**0.91%**
Graver	1	**0.91%**
Burin	0	**0.00%**
Spokeshave	1	**0.91%**
Notched Flake	0	**0.00%**
Rough Stone Fragment	1	**0.91%**
Total	**110**	**100.00%**

Cluster 2

Analyzed debitage units: 2000N 490E:13, 14, 20; Feature 4

CLUSTER 2 Flake Types		PRIM	SEC	TERT	BPO	SHAT	BFT	BRT	BRE	FRAG	**Total**	**Percentage**
Raw Material	O	6	40	54	1	9	281	10	1	242	**644**	**53.94%**
	KP	0	3	4	0	7	96	1	0	111	**222**	**18.59%**
	CW	0	0	0	0	0	6	0	0	3	**9**	**0.75%**
	Burnt O	1	16	1	0	1	18	0	0	7	**44**	**3.69%**
	Burnt KP	0	0	3	0	0	12	0	1	11	**27**	**2.26%**
	Burnt FR	0	0	0	0	1	0	0	0	0	**1**	**0.08%**
	Burnt	2	16	15	1	4	87	2	2	85	**214**	**17.92%**
	U	0	0	0	0	0	16	1	0	16	**33**	**2.76%**
Total		**9**	**75**	**77**	**2**	**22**	**516**	**14**	**4**	**475**	**1194**	**100.00%**
Percentage		**0.75%**	**6.28%**	**6.45%**	**0.17%**	**1.84%**	**43.22%**	**1.17%**	**0.34%**	**39.78%**	**100.00%**	

CLUSTER 2 **Termination Types**	**Termination**						**Total**
	Feather	**Hinge**	**Step**	**Plunging**	**Axial**	**Unidentifiable**	
	524	98	525	15	2	30	**1194**
Percentage	**43.89%**	**8.21%**	**43.97%**	**1.26%**	**0.17%**	**2.51%**	**100.00%**

Units with tools present: 2000N 490E:9, 11, 12, 13, 14, 18, 19, 20, 24, 25; Feature 4

Cluster 2: Tool Types	**Total**	**Percentage**
Biface	20	**26.32%**
Projectile Point	2	**2.63%**
Scraper	0	**0.00%**

Knife	1	**1.32%**
Scraper-Knife	0	**0.00%**
Retouched Flake	10	**13.16%**
Utilized Flake	31	**40.79%**
Core	5	**6.58%**
Hammerstone	1	**1.32%**
Wedge	1	**1.32%**
Perforator	0	**0.00%**
Graver	1	**1.32%**
Burin	4	**5.26%**
Spokeshave	0	**0.00%**
Notched Flake	0	**0.00%**
Rough Stone Fragment	0	**0.00%**
Total	**76**	**100.00%**

Cluster 3

Analyzed debitage units: 2000N 490E:1, 3; Feature 2; Feature 3

CLUSTER 3 **Flake Types**		PRIM	SEC	TERT	SHAT	BFT	BRT	BRE	URT	FRAG	**Total**	**Percentage**
Raw Material	O	2	10	10	11	25	4	0	1	45	**108**	**13.76%**
	KP	5	9	33	5	206	23	2	0	303	**586**	**74.65%**
	Burnt O	0	2	0	2	2	0	0	0	2	**8**	**1.02%**
	Burnt KP	0	1	0	4	14	0	0	0	15	**34**	**4.33%**
	Burnt	0	0	1	3	10	0	0	0	18	**32**	**4.08%**

	U	0	0	1	0	5	0	0	0	11	**17**	**2.17%**
Total		**7**	**22**	**45**	**25**	**262**	**27**	**2**	**1**	**394**	**785**	**100.00%**
Percentage		**0.89%**	**2.80%**	**5.73%**	**3.18%**	**33.38%**	**3.44%**	**0.25%**	**0.13%**	**50.19%**	**100.00%**	

CLUSTER 3 Termination Types	**Termination**						**Total**
	Feather	**Hinge**	**Step**	**Plunging**	**Axial**	**Unidentifiable**	
	365	28	360	6	0	26	**785**
Percentage	**46.50%**	**3.57%**	**45.86%**	**0.76%**	**0.00%**	**3.31%**	**100.00%**

Units with tools present: 2000N 490E:1, 2, 3, 6; 1995N 490E:21, 22, 23

Cluster 3: Tool Types	**Total**	**Percentage**
Biface	10	**22.73%**
Projectile Point	1	**2.27%**
Scraper	1	**2.27%**
Knife	0	**0.00%**
Scraper-Knife	1	**2.27%**
Retouched Flake	3	**6.82%**
Utilized Flake	20	**45.45%**
Core	6	**13.64%**
Hammerstone	0	**0.00%**
Wedge	0	**0.00%**
Perforator	1	**2.27%**
Graver	1	**2.27%**
Burin	0	**0.00%**
Spokeshave	0	**0.00%**

Notched Flake	0	**0.00%**
Rough Stone Fragment	0	**0.00%**
Total	**44**	**100.00%**

Cluster 4

Analyzed debitage units: 2000N 495E:3, 13; Feature 1

CLUSTER 4 Flake Types		PRIM	SEC	TERT	BPO	SHAT	BFT	BRT	BRE	FRAG	**Total**	**Percentage**
Raw Material	O	0	4	9	0	1	39	3	1	24	**81**	**34.91%**
	KP	0	1	2	0	1	46	2	0	35	**87**	**37.50%**
	Burnt O	1	3	2	0	1	1	0	0	3	**11**	**4.74%**
	Burnt KP	0	3	0	0	0	14	0	0	14	**31**	**13.36%**
	Burnt	1	2	0	1	0	8	1	0	4	**17**	**7.33%**
	U	0	0	0	0	0	4	0	0	1	**5**	**2.16%**
Total		**2**	**13**	**13**	**1**	**3**	**112**	**6**	**1**	**81**	**232**	**100.00%**
Percentage		**0.86%**	**5.60%**	**5.60%**	**0.43%**	**1.29%**	**48.28%**	**2.59%**	**0.43%**	**34.91%**	**100.00%**	

CLUSTER 4 Termination Types	**Termination**						**Total**
	Feather	**Hinge**	**Step**	**Plunging**	**Axial**	**Unidentifiable**	
	105	15	99	9	1	3	**232**
Percentage	**45.26%**	**6.47%**	**42.67%**	**3.88%**	**0.43%**	**1.29%**	**100.00%**

Units with tools present: 2000N 490E:5; 2000N 495E:2, 3, 6, 7, 8, 11, 13; 1995N 495E:21; Feature 1

Cluster 4: Tool Types	Total	Percentage
Biface	4	**7.69%**
Projectile Point	4	**7.69%**
Scraper	1	**1.92%**
Knife	1	**1.92%**
Scraper-Knife	0	**0.00%**
Retouched Flake	3	**5.77%**
Utilized Flake	25	**48.08%**
Core	12	**23.08%**
Hammerstone	0	**0.00%**
Wedge	0	**0.00%**
Perforator	1	**1.92%**
Graver	0	**0.00%**
Burin	0	**0.00%**
Spokeshave	0	**0.00%**
Notched Flake	0	**0.00%**
Rough Stone Fragment	1	**1.92%**
Total	**52**	**100.00%**

Cluster 5

Analyzed debitage units: 2000N 495E:20

CLUSTER 5 Flake Types		PRIM	SEC	TERT	BFT	BRT	BRE	FRAG	Total	Percentage
Raw Material	O								**0**	**0.00%**
	KP	1	4	12	89	6	1	113	**226**	**90.04%**

	Burnt O								**0**	**0.00%**
	Burnt KP		1		13			7	**21**	**8.37%**
	Burnt							4	**4**	**1.59%**
	U								**0**	**0.00%**
Total		**1**	**5**	**12**	**102**	**6**	**1**	**124**	**251**	**100.00%**
Percentage		**0.40%**	**1.99%**	**4.78%**	**40.64%**	**2.39%**	**0.40%**	**49.40%**	**100.00%**	

CLUSTER 5	**Termination**						**Total**
Termination Types	**Feather**	**Hinge**	**Step**	**Plunging**	**Axial**	**Unidentifiable**	
	104	12	127	7	1	0	**251**
Percentage	**41.43%**	**4.78%**	**50.60%**	**2.79%**	**0.40%**	**0.00%**	**100.00%**

Units with tools present: 2000N 495E:15, 20, 25; 2000N 500E:16

Cluster 5: Tool Types	**Total**	**Percentage**
Biface	1	**2.86%**
Projectile Point	0	**0.00%**
Scraper	1	**2.86%**
Knife	2	**5.71%**
Scraper-Knife	0	**0.00%**
Retouched Flake	7	**20.00%**
Utilized Flake	22	**62.86%**
Core	1	**2.86%**
Hammerstone	1	**2.86%**
Wedge	0	**0.00%**

Perforator	0	**0.00%**
Graver	0	**0.00%**
Burin	0	**0.00%**
Spokeshave	0	**0.00%**
Notched Flake	0	**0.00%**
Rough Stone Fragment	0	**0.00%**
Total	**35**	**100.00%**

Cluster 6

Analyzed debitage units: 1995N 490E:3, 7, 14

CLUSTER 6 Flake Types		SEC	TERT	SHAT	BFT	BRT	FRAG	**Total**	**Percentage**
Raw Material	O	0	1	0	2	0	3	**6**	**12.77%**
	KP	1	2	1	11	2	10	**27**	**57.45%**
	Burnt O	0	0	1	0	0	0	**1**	**2.13%**
	Burnt KP	0	0	0	3	0	4	**7**	**14.89%**
	Burnt H	0	0	0	1	0	0	**1**	**2.13%**
	Burnt	0	0	0	2	0	1	**3**	**6.38%**
	U	0	0	0	1	0	1	**2**	**4.26%**
Total		**1**	**3**	**2**	**20**	**2**	**19**	**47**	**100.00%**
Percentage		**2.13%**	**6.38%**	**4.26%**	**42.55%**	**4.26%**	**40.43%**	**100.00%**	

CLUSTER 6 Termination Types	Termination						Total
	Feather	Hinge	Step	Plunging	Axial	Unidentifiable	
	15	2	28	0	0	2	**47**
Percentage	**31.91%**	**4.26%**	**59.57%**	**0.00%**	**0.00%**	**4.26%**	**100.00%**

Units with tools present: 1995N 490E:3, 7, 8, 13

Cluster 6: Tool Types	Total	Percentage
Biface	0	**0.00%**
Projectile Point	0	**0.00%**
Scraper	0	**0.00%**
Knife	1	**11.11%**
Scraper-Knife	0	**0.00%**
Retouched Flake	1	**11.11%**
Utilized Flake	6	**66.67%**
Core	1	**11.11%**
Hammerstone	0	**0.00%**
Wedge	0	**0.00%**
Perforator	0	**0.00%**
Graver	0	**0.00%**
Burin	0	**0.00%**
Spokeshave	0	**0.00%**
Notched Flake	0	**0.00%**
Rough Stone Fragment	0	**0.00%**
Total	**9**	**100.00%**

Curriculum Vitae

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