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Lithic Raw Material Usage in the Archaic Northeast: Debitage Analysis of the Gaudreau Site, Weedon, Quebec

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Résumé

La période Archaïque est caractérisée dans la région du Nord-Est par des stratégies de mobilité adaptée aux forêts chez les chasseurs-cueilleurs. Ces forêts ont offert aux habitants du site des ressources diverses et abondantes. On peut définir les assemblages de la période Archaïque grâce aux outils lithiques, dont les artefacts faits par l’enlèvement des éclats et les artefacts par l’abrasion. Le site Gaudreau au Weedon, QC est un site à composantes multiples, qui inclut une occupation datée à la période Archaïque. Les occupations pendant toute la préhistoire ont perturbé l’organisation verticale et aussi la distribution horizontale au site. Malgré ces difficultés, en considérant seulement les artefacts diagnostiques de différentes périodes certaines concentrations sont révélées. Celles-ci ont permis la définition d’une zone d’échantillon. Les études précédentes ont guidé une stratégie d’analyse du débitage de cette locale. Un échantillon de cinq éclats complets est pris des trois matériaux les plus abondants de chaque quadrant des puits d’excavation, et la population entière du débitage des autres matériaux est incluse. Cette étude enregistre les attributs des pièces du débitage ainsi que l’analyse suit aux multiples axes, dont les matériaux premiers, la typologie technique, et les localisations. Les analyses ont montré l’existence des liens importants entre les matériaux, la curation des outils, la segmentation de la séquence de réduction, et les stratégies d’approvisionnement. L’étude montre que les habitantes du site Gaudreau aient utilisé les matériaux du réseau régional d’une manière plus expédiente qu’avec les matériaux importés d’une longue distance. Ils ont utilisé aussi des manières différentes pour les matériaux prismatiques et ceux qui font des fractures conchoïdales. La qualité des matériaux premiers disponibles et le coût d’approvisionnement ont fait partie des décisions quand les habitantes du site faisaient des outils lithiques, dans le contexte de l’économie régionale et la segmentation de la réduction au site.

Mots clés : Archaïque ancien, Archaïque moyen, Archaïque supérieur, analyse lithique, analyse du débitage, pierre taillée, pierre polie, matériaux premières, réduction lithique, le Nord-est

Abstract

The Archaic period in the Far Northeast is characterised by hunter-gatherer mobility strategies adapted to a closed forest, which offered diverse and abundant resources. This period can be identified archaeologically by its diverse lithic assemblage, consisting of both flaked and ground stone tools. The Gaudreau site in Weedon, Quebec, is a multicomponent site that includes an Archaic occupation. Successive occupations throughout the prehistoric period have led to extensive vertical and horizontal mixing of artefacts at the site. An initial analysis of those objects diagnostic of particular time periods revealed spatial patterns that allowed for a fifty square metre sample area to be defined for study of the Archaic lithic industry. Previous studies of the site's Archaic artefacts guided the design of an analysis of debitage from this part of the site. For the three most abundant raw materials, a sample of five complete flakes was taken from each quadrant. For all other raw materials, the entire population of debitage was examined. Attributes were recorded from each individual piece of debitage examined and these data were aggregated along multiple axes to reveal patterns among different raw materials, flake types, and locations. This revealed key patterns in raw material and tool curation, the segmentation of the reduction sequence, and resource procurement strategies. The study revealed that site inhabitants used materials sourced from within their regional network in a more expedient manner than those imported from beyond its limits, and treated prismatic materials differently than those that fractured conchoidally. The Gaudreau site inhabitants considered toolstone quality and procurement cost in making tool production choices in the context of the regional economy and on-site segmentation of the reduction sequence.

Keywords: Far Northeast, Archaic period, Late Archaic, lithic analysis, debitage analysis, flaked stone technology, ground stone technology, raw materials, reduction sequence

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List of Abbreviations

BRF: biface reduction flake

BP: years before present

CB: beige chert

CBL: white chert

CBR: brown chert

CG: gray chert

CHO: Onondaga chert

CM: marbled chert

CV: green chert

GL: local gray stone

MUN: Munsungun chert

QC: crystal quartz

QTZ: quartz

QZB: white quartzite

QZC: Cheshire quartzite

QZG: gray quartzite

QZF: smoky quartz

QZMG: marbled gray quartzite

QZT: translucent quartzite

RHY: rhyolite

SAL: local silicified mudstone

SLT: siltstone

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1 – Introduction

The Gaudreau site (BkEu-8) in Weedon, Quebec is situated in the Eastern Townships and is part of a region known as the Far Northeast, which extends from the western border of New York state to the Atlantic Ocean, and from Ramah Bay to Connecticut and Long Island (Sanger and Renouf 2006). Continuously occupied for about 12,000 years, the archaeology of this region is complex due to the multicomponent nature of most sites within the area. Activity during the historic period unfortunately means that these components are frequently mixed. This leads to challenges in interpretation and demands the rigorous application of redundant analytical techniques in studying archaeological sites. The Gaudreau site is no exception to these trends. This thesis focuses on the Gaudreau site's Archaic component through an analysis of its debitage.

Located at the confluence of the Saint-François and Salmon Rivers (see Figure 1), the Gaudreau site was first occupied during the Paleoindian period (Graillon et al. 2012), with prehistoric occupation continuing into the Archaic and Woodland periods. With the arrival of Europeans, this location became subject to the intensive construction and cultivation practices of the historic period. The land was ploughed for farming while brick and stone structures were built up, even including a mill. This led to both horizontal and vertical mixing of artefacts at the site. During excavation, most units were not continued more than five or ten centimetres beyond the plough zone. Those that did extend deeper revealed significantly decreased artefact counts, consisting primarily of debitage. Both the features of the Gaudreau site and its excavation are typical of prehistoric archaeology in the Far Northeast. The site was excavated over the course of three field seasons (2010 – 2012) and integrated participants from local communities. The excavation crew of 2010 excavated test pits to define the site's borders, and defined an area that included an upper and lower terrace, with additional artefacts recovered on the beach at the edge of the river (Graillon 2013).

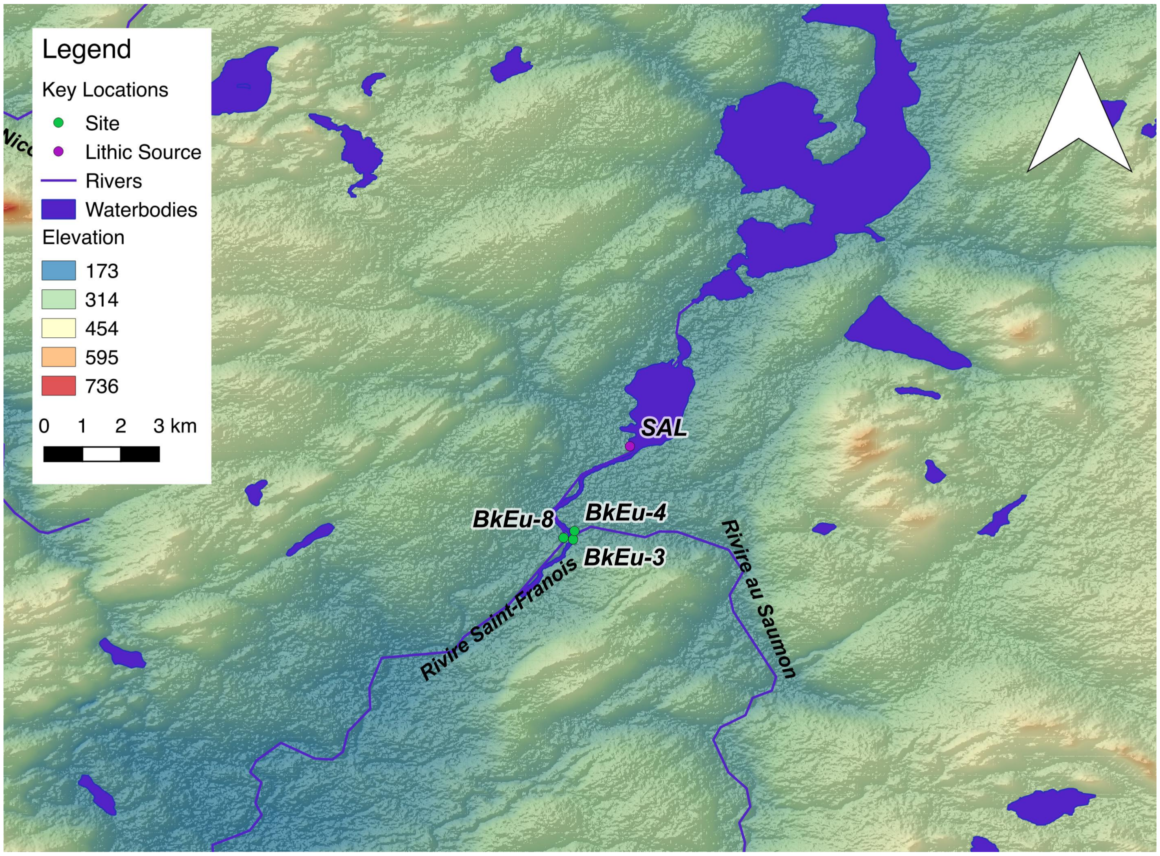


Figure 1. The Gaudreau site (BkEu-8), with nearby sites and lithic source.

This thesis is concerned with the Archaic period occupation at the Gaudreau site, which is distinguished from the preceding Paleoindian by changes to the forms of stone tools, the types of tools produced, and the methods used to produce them. These changes are closely related to decreased regional mobility and a greater length of occupation at sites (Thomas 1994; Ritchie 1938; Bourque 2001; Tuck 1974; Deal and Rutherford 2001; Robinson 2008; Gates St-Pierre 2009). In order to better understand this component of the Gaudreau site, this thesis builds on previous studies of the site's lithic artefacts (Gauvin 2016, 2014) with a debitage analysis that considers the entire range of raw materials present. Integrating debitage analyses into the study of archaeological sites offers a useful level of redundancy by confirming interpretations based on spatial analysis and tool studies. Additionally, debitage is not removed from a site, while tools may be. It ultimately provides new information about the production sequences that took place at the site, even when the tools resulting from those activities were transported away from the site after completion. These aspects mean that debitage analyses are well suited to reveal patterns of mobility and strategies of resource procurement, because they reflect the entire range of chipped stone raw material sources exploited by inhabitants at a site. This study aims to utilise these strengths of debitage analysis by comparing trends in debitage assemblage across the different raw materials present. It ultimately hopes to better understand the choices made the site's Archaic occupants in procuring, curating, working, and discarding the various toolstones available both locally and regionally.

The second chapter of this thesis presents an overview of the Archaic period, the Far Northeast region, and approaches to debitage analysis through a review of extant literature. The third chapter outlines the methodological approach employed in this thesis and justifications for both sampling strategies and attributes selected for study. The fourth chapter presents the data collected over the course of this study and the patterns revealed in its analysis. The fifth chapter discusses these results within the context of the period and geographic region. Finally, the sixth chapter summarizes the conclusions of this thesis and offers suggestions for further study.

2 – Background

2.1 – Approaches to studying hunter-gatherers in the Far Northeast

Lewis Binford laid the foundations of hunter-gatherer studies with his ethnoarchaeological studies in the 1970s and 1980s. Binford's work was vital to archaeologists because it described not only the day-to-day actions of the groups that he studied, but also the material remains left behind after a campsite or hunting stand was abandoned. Binford's observations were rigorous and his analysis thorough. In one article (Binford 1978), he offers a meticulous list of the items discarded or placed on the ground during his hours of observation, and includes scaled diagrams noting the precise locations of each observed activity at a hunting stand. His later works build on these precise observations, generalizing each specific occurrence into broader patterns of behaviour that could be applied on a global scale. These generalized categories offered rich tools to define and describe the choice and lifeways of both ethnologically and archaeologically observed cultures. Although some of his ideas, such as the collector - forager continuum (Binford 1980), have been reconceived in the years since, they remain of vital importance to describing the ways that hunter-gatherer groups organize themselves (Blair 2010). Later authors built upon Binford's research to offer insights into the mobility, subsistence, and organization of hunter-gatherers. Grove (2009), for example, summarizes these early theories in hunter-gatherer mobility and applies them to the data included in Binford's (2001) compendium to better understand the factors that influence mobility strategy choice in hunter-gatherer societies. In the context of the Northeast, Ellis (2011) analysed evidence of Paleoindian mobility in light of these theories of resource exploitation and movement, and existing ethnographic data.

The study of prehistoric hunter-gatherers in the Far Northeast relies on the theoretical base developed in these ethnographic studies. Traditionally, research in the Northeast has taken an approach guided by cultural ecology (Spiess et al. 1998). Initially outlined by Steward (1955) in his *Theory of Culture Change*, cultural ecology examines the relationship between culture and the environment, with the aim of identifying direct causal links while maintaining a "holistic" approach. It is uncommon for authors within this region to explicitly adopt an ethnoarchaeological approach, preferring to focus on the evidence offered by the archaeological and palynological records. As a result, most literature on the prehistoric archaeology of the Far Northeast region deals with reconstructing the environment, dating artefacts based on the presence of diagnostic tools, performing spatial analyses of the site in question, and inter- and intrasite comparisons of raw material use. Due to the longstanding nature of this approach, the task of explaining, critiquing, and reimagining the cultural ecological theoretical basis for archaeological interpretation in the Far Northeast has been ongoing for many years at the time this thesis was written (Robinson and Petersen 1992).

The above is not meant to criticize these approaches, but rather to make them explicit in order to better understand the way that extant literature discusses the history of this region. The limitations of the region's archaeological record and environment place unique constraints on the approaches that can reasonably be applied in the region. The Far Northeast is subject to annual freezing and thawing cycles that lead to disturbance of archaeological strata and artefacts. Most areas were wooded in the recent past and root disturbance is common throughout the region. The geography of the region leaves only a few major thoroughfares, and the areas surrounding these have been home to successive occupations (Boisvert 1999; Robinson 2008). Single component sites, which can be clearly attributed to one time period, are less common. Finally, the area was among the first to be settled after the arrival of Europeans and industrialized early. This has resulted in disturbances from ploughing, building construction, and compression due to heavy machinery, all of which had a significant effect on site formation processes and makes interpretation difficult. Thus, archaeologists of the region are particularly restricted in the lines of evidence that they can follow to reasonably defensible conclusions.

After a site has been dated, its artefacts interpreted, and its environment reconstructed, there remains the problem of how the site's assemblage will be considered in relation to the assemblages of other sites with similar dates, artefacts, and environments. That is, can two sites whose assemblages include the same style of diagnostic points be understood to represent the same culture or even the same overall technological adaptation? What of two sites in the same region or from the same time period? Robinson discusses this issue at length in his 1992 treatise on the Gulf of Maine Archaic and suggests that archaeologists should be more precise and restrained in their interpretations. In defining the Gulf of Maine Archaic, he is clear that he only means to identify a technological complex and that it may or may not be indicative of other cultural similarities (Robinson 1992). The decision of how many aspects of a given site are applicable to other sites or, conversely, how much may be inferred from the presence of any particular diagnostic element at a site, is simplified by defining material cultures along multiple axes and accepting the possibility of overlap of some but not all cultural aspects. Defining a material culture along multiple axes, rather than simply by certain diagnostic projectile points, is not always explicitly considered in the Far Northeast, but is nevertheless a longstanding practice (Ritchie 1938).

2.2 – The Archaic Period in the Far Northeast

The beginning of the Archaic period differs by region and there is by no means a clear and distinct boundary between it and the earlier Paleoindian period. Indeed, the beginning of the Archaic period is coeval with the end of the Paleoindian period (see Table 1). The Early Archaic in southern Quebec begins around 11,350 BP (years before present) and the Late Archaic ends approximately 3,000 BP (Graillon 2013; Chapdelaine 2009; Tuck 1982). The transition to the Archaic period is most obviously evidenced by a lack of the carefully fluted points found at Paleoindian archaeological sites. The dedicated use of highly exotic materials, transported over long distances, also declines sharply with the end of the Paleoindian. Instead, Archaic peoples made great use of locally available lithic materials and also began to make tools from ground stone and copper (Robinson 2008; Thomas 1994; Deal and Rutherford 2001).

Dates	Period	Lithic Assemblage Characteristics
12,500 BP	Early Paleoindian	Fluted points; heavy use of exotic raw materials
11,350 – 8,800 BP	Late Paleoindian	Parallel flaked points, may be notched; decreased focus on exotic raw materials
	Early Archaic	Side or corner notched, or stemmed points; bifurcate base; more intensive use of local raw materials
8,800 – 6,800 BP	Middle Archaic	Continued use of notched and stemmed points; increased variety in size, large ground stone tools
6,800 – 3,000 BP	Late Archaic	Lanceolate blades; greater variety of point stems present, ground stone tools including points
3,000 – 2,400 BP	Early Woodland	Less stylistic diversity; larger size becomes frequent again
2,400 – 1,000 BP	Middle Woodland	
1,000 – 400 BP	Late Woodland	

Table 1. Cultural manifestations in southeast Quebec and their associated lithic material cultures (Chapdelaine 2012; Ellis et al. 1998; Petersen et al. 2000; Ritchie 1971).

As carbon dating can be expensive, and sites in the Far Northeast often do not produce good charcoal samples for dating, most sites are dated based on their diagnostic artefacts, with particular emphasis on projectile point technology because it is present during all periods of occupation. With regard to this type of assemblage, the Early Archaic period may be marked by either the appearance of corner- and side- notched points (Ellis et al. 1998; Tuck 1974), stemmed points (Ritchie 1971, 1938), or by an overall dearth of bifaces (Pollock et al. 2008; Robinson 2008). Decreasing mobility was a defining factor of the Paleoindian to Archaic transition, and one key change in the regional record is the diversification of toolkits (Ellis et al. 1990; Robinson 2008). For the previous period, fluted points and the channel flakes that resulted from production thereof are the perfect marker, because they are both unique to the period and present throughout the continent. Distinctions between geographic regions are visible thanks to internally consistent use of unique sub-styles, which represent variations of this more general point form (Bradley et al. 2008). Indeed, early attempts to define point types for the Northeast lumped all of these varieties—from the Bull Brook-West Athens Hill, to Michaud-Neponset, to Ste. Anne-Varney—together under the term "Clovis," while simultaneously recognizing clear distinctions between different styles of Archaic and later Woodland points (Bradley et al. 2008; Ritchie 1971).

2.2.1 – Flaked Projectile Points of the Archaic Period

The Early Archaic period consists of different material cultures throughout the region. Each complex is marked by the particular way those traits noted above (stemmed points, corner-notched points, side-notched points, or a lack of flaked bifaces), are applied to tool forms. Within southern Ontario, it is side notching that appears first in the Early Archaic. Farther south, in southern New England and New York, bifurcate base points mark this period (Rainey 2005; Robinson 1992). To the north, from the coast of Maine to Québec and Labrador, the absence of bifacially flaked artefacts at sites marks the beginning of the Early Archaic (Petersen and Putnam 1992; Robinson 1992, 1996). The bifaces produced during the beginning of the Early Archaic include bifurcated base points in the northern parts of the region (Spiess et al. 1983). In order to apply these observations outside of New York, Early Archaic points can be generalised as small, side-notched or bifurcated points, which are roughly flaked with thick bases and may have an "unfinished" appearance.

The Middle Archaic saw continued use of straight stemmed and side-notched points, as well as the advent of corner notched and eared points. Points of this period also exhibit greater diversity in size, generally the points of the Middle Archaic show more basal finishing (Dincauze 1976). The trend toward diversity in size and shape continues into the Late Archaic period, with lanceolate blades, contracting stems, and expanding stems coming into use. The range of sizes used remains similarly broad, although smaller point styles are typically more common. During the Late Archaic, styles such as Lamoka demonstrate more roughly flaking, and an "unfinished" appearance (Ritchie 1971). Diversity among point styles diminishes again with the onset of the Woodland period, as points tended to be of a few styles and primarily large in size (Ritchie 1971).

The bifacial reduction sequence can result in distinctive classes of debitage. Initial reduction involves creating a rough tool shape and is often completed at the toolstone source, before being transported to a habitation site for completion. Bifacial thinning is typically done with soft hammer percussion and occurs about midway through the reduction sequence (Odell 2005; Andrefsky 2005; Whittaker 1994). Biface thinning flakes tend to have a pronounced lip and diffuse bulb of percussion, with previous flake removal scars and little to no cortex present (Whittaker 1994). The occurrence of this type of flake indicates that bifaces were being produced and reduced on the site. Production of formal tools and retouch of flakes for the creation of informal tools were both typically done through pressure flaking. These flakes are small, with a bulb of percussion and no lip. They sometimes have platforms, but may not (Towner and Warburton 1990). These indicate the final steps of tool production at a site, as well as tool resharpening.

2.2.2 – Flaked Unifaces of the Archaic Period

Just as bifacial tools can be sorted into styles based on their formal attributes, so, too, can unifacial tools. End scrapers are more common than side scrapers during the Archaic period, and this class of tool sometimes exhibits more extensive flaking than in previous periods. These tools are re-sharpened less often than in previous periods, and it is assumed that people instead replaced the tools as they became worn out rather than curating them for later use (Ellis et al. 1990). Ellis et al. (1990) also note the existence of a steeply retouched style of concave scrapers that appear to be unique to this time period. Dincauze's research on the Neville collection had previously noted that steep bitted scrapers may be diagnostic of the Archaic period (Dincauze 1976), lending further credence to this idea.

As Dincauze points out, archaeologists have typically focused on other classes of stone tools at the expense of scrapers. Thus, understanding the potential implications of each scraper style remains challenging. At the Neville site, Dincauze was able to identify six different styles within the "scraper" class that are associated with the Early and Middle Archaic periods. She also offers a description of the style's morphology and summary statistics for the size and shape of scrapers in the assemblage. Based on site stratigraphy and evidence from other sites, she assigns expanded bit scrapers, biface scrapers, and angled scrapers to the Early Archaic Period. She assigns steep flake scrapers, beaked scrapers, and carinated scrapers to the Middle Archaic. Dincauze hypothesizes that one style, called "steep-bitted flake scrapers," could eventually be shown to be diagnostic of the Archaic.

Quartz is frequently associated with the unifacial tool industry in the Far Northeast during the Archaic period. Known as the Gulf of Maine Archaic tradition, this complex is associated with Early and Middle Archaic periods and can even continue into the Late Archaic (Petersen 1995; Robinson 2006). Despite its association with this coastal region, similar debitage patterns are seen in the Eastern Townships and Tadoussac regions of Quebec (Chapdelaine 2009; Chapdelaine et al. 2015; Plourde 2006, 1999). The role of the Gulf of Maine tradition and similar complexes is best done by considering the relative frequency of associated artefacts, instead of just focusing on the presence or absence of particular markers. However, identifying this complex among prehistoric sites is difficult at best (Forrest 2003).

2.2.3 – Ground Stone Tools of the Archaic Period

Ground stone tools represent a major change from the Paleoindian period and the presence of certain ground stone tool forms in an assemblage are a clear indication of site occupation during the Archaic period. Tools of this variety include rods, gouges, adzes and axes, a style of curved knife known as an ulu, plummets or netsinkers, abraders and polishers. The basic tool form is often first created by minimally flaking or pecking the stone into shape to create a preform, and then grinding and polishing it smooth. While the mere presence or absence of certain artefacts is often sufficient in identifying the time period to which an occupation dates, it can sometimes be more helpful to compare the relative frequency and coexistence of different tool types. Such is often the case with ground stone tool forms during the Archaic period (Robinson 2008).

The process of flaking and pecking for ground stone tools relies frequently on ridged hammerstones and creates wide flakes with battered platforms (Clark and Will 2006; Will 2002). Even when there are no finished ground stone tools present at a site, their production can be inferred from the presence of debitage bearing these traits (Will 2002). However, when considering platform battering, care must be exercised because certain materials are more susceptible to this effect than others. In particular, exceptionally hard toolstones are more likely to show signs of crushing and battering than more plastic materials, which can more easily absorb and divert the shock of hard hammer percussion.

2.2.4 – Resource Use during the Archaic Period

The Archaic period begins during the transition of the Pleistocene to the Holocene, a change that affected the climate and ecology of the Far Northeast. By the Late Pleistocene, the retreat of the Laurentide ice shelf was retreating to northern Labrador, eventually leaving the rest of the region ice-free (Fitzhugh 2006). The ice-free areas gave way to tundra in the farthest north regions, soon followed by spruce cover. In most of the Far Northeast spruce parklands eventually followed the retreating ice sheets. Spruce transitioned to closed boreal pine forests and, especially south of the Great Lakes, hardwoods slowly became interspersed among the forest cover (Ellis et al. 1998; Petersen et al. 2000; Bourque 2001). These floral changes took place from about 11,000 cal BP to 8,000 cal BP. In many cases, Archaic peoples would have encountered an environment similar to what can be seen today in the southern parts of the region (Dincauze 1976; Thomas 1997, 1994). Farther north, similarity to the modern environment began around 5,000 – 6,000 cal BP (Richard 2007). As a result of the extensive and rapid changes to the floral ecology of the Far Northeast, fauna varied greatly during this time from one region to another (Ellis et al. 1998; Fitzhugh 2006; Corbeil 2007; Spiess and Lewis 2001).

The end of the Pleistocene brought with it an event known as the Quaternary Mass Extinction (QME), notable for the deaths of most species of megafauna on a global scale. While the causes of this extinction event continue to be the subject of lively debate, it is generally understood to be a combination of human and climatic causes, with the respective strengths of each varying by region (Koch and Barnosky 2006; Barnosky et al. 2004; Jackson et al. 2000). With less species of large game to prey upon, humans in Holocene North America began exploiting a large range of local game to fill their needs. This meant greater investment in discovering all the resources locally available (Ellis et al. 1990; Forrest 2003; Petersen et al. 2000; Rainey 2005). Faunal remains at Archaic sites represent a wide variety of faunaa, including mammals, fish, birds, reptiles, and amphibians (Bunker 2007). The inhabitants of these sites were true generalists, utilizing whatever locally available resources may be encountered. Archaic peoples often chose the confluence of rivers for their sites (Goodby 2001; Robinson 2008), a pattern reflected by the Gaudreau site’s location on the Salmon River and Saint-François River (Graillon 2011). The presence of sites on rivers afforded Archaic peoples the ability to rely heavily on fishing, and archaeological evidence points to the region’s inhabitants doing just that (Forrest 2003; Dincauze 1976; Bell and Renouf 2004; Hoffman 2006). This choice forms part of a general tendency among hunter-gatherer peoples to maximize the exploitation of locally available resources, and a diversification of the resources exploited.

Local resources were also preferred in the production of stone tools. In contrast to their Paleoindian predecessors, who traveled (or traded) far and wide to obtain the highest quality toolstone, Archaic peoples instead exploited more local resources (Petersen et al. 2000; Rainey

2005). While they certainly did not give up using quality materials when available, they seem to have preferred to expend less energy on obtaining exotic lithic raw materials. Exceptions to this overall trend are noteworthy and beg further investigation in order to understand the underlying motivation of this relatively unusual choice (Rainey 2005). In the case of Gaudreau, flintknappers utilized local raw materials frequently and these represent over half of all debitage. Certain high quality exotics are present, however, and their purpose at the site similarly merits further investigation to understand the regional lithic economy.

2.2.5 – Mobility and Settlement during the Archaic Period

Given the increased reliance on local materials and the production of heavy ground stone tools, the Archaic period is typically understood to reflect a decrease in mobility, with people becoming more settled into their respective core areas (Rainey 2005; Petersen et al. 2000). These traits of the Archaic result in changing needs and limitations, which shape the creation of new toolkits. Hunter-gatherers' patterns of movement can encompass both general seasonal movement and trips for a specific purpose, such as resource procurement. Binford (1980) described two types of mobility, that of the "collector" and that of the "forager." Foragers, according to Binford, move between resource patches as needed and acquire resources upon encounter. This system leaves behind many general, all-purpose campsites, at which most or all activities appropriate for the season took place. Collectors, on the other hand, utilize a logistic system. They set up long-term base camps and send activity specific parties to accomplish necessary tasks. This mobility strategy leaves behind more task-specific sites. These two patterns of mobility are by no means the only possibilities, and should be understood as providing a continuum and framework for understanding, rather than as invariable definitions (Binford 1980).

As Archaic peoples changed their strategies to become less mobile, the classes and styles of tools represented in toolkits becomes more varied. By using a greater variety of tools classes, people during the Archaic period were more frequently able to use a tool purpose-made for the task at hand. The Archaic period's decrease in mobility offers greater opportunity for storing tools and cores until they become necessary, without the added cost of transporting them. The increased morphological variations that begin with the Archaic fit with Weissner's (1982) predictions regarding risk reduction. Specifically, for groups like Paleoindians that pool risk, stylistic uniformity should be expected. For groups that can rely on storage to manage risk, on the other hand, greater stylistic variation becomes apparent (Wiessner 1982). Such is the case with biface forms during the Archaic period.

2.3 – Lithic Analysis and Debitage Analysis

Debitage analysis represents a specific subset of the general field of lithic analysis. Therefore, lithic analysis will be dealt with generally, before a more targeted discussion of debitage analysis techniques used in this thesis. As with all archaeology, lithic analyses aim to better understand the activities that occurred at a site, and the people who performed those activities. Lithic analysis simply does so through the lens of stone tool use and production. Debitage is the by-product of producing stone tools and as such can provide key insights into the tool production. Unfortunately, analyses using debitage are often hampered by the fact that they are difficult and time consuming to undertake, especially when compared to analyses that focus on finished tools.

2.3.1 – Lithic Terminology

Lithic analysis relies on precisely defined terminology in order to be successful and some terms are employed in varying ways depending on the author in question. Thus, a few terms utilised in this work deserve clear definitions. The waste created as a by-product of stone tool production is referred to collectively as debitage, "a detached piece that is discarded during the reduction process," (Andrefsky 2001a:xi). In his review of Andrefsky's book, Odell takes issue with this definition, specifically criticizing its failure to address both the possible usage of debitage as an expedient or even formal tool and the possibility that debitage would later undergo retouch (Odell 2003). This thesis takes the constrained approach of excluding cores, blanks, preforms, retouched flakes, and utilised flakes. It instead considers only those pieces that were removed and immediately discarded.

It was possible, and probably inevitable, that this approach would include some flakes that were used briefly and discarded, without undergoing sufficient wear to become clearly visible macroscopically or even at low power magnification. However, explicitly examining this site's debitage for evidence of expedient tool usage must wait for another research project. With regard to different categories of debitage, complete flakes, incomplete flakes, and debris are the general categories used here. When lithic waste can be oriented based on its proximal and distal ends, and a ventral and dorsal surface, it is called a flake (Sullivan and Rozen 1985). If it cannot be so oriented, it will be hereafter referred to as debris. Incomplete flakes that retain their striking platform will herein be referred to as proximal flake fragments, a useful category for ensuring a larger sample size than could be afforded solely by complete flakes.

2.3.2 – Common Approaches to Debitage Analysis

Analysing debitage can be and has been carried out in a number of ways depending on the goals in mind. The degree of analysis and interpretation applied to an assemblage of debitage varies greatly as well. Some methods seek to interpret the assemblage as little as possible and instead attempt to purely present information about the debitage present. In most cases, however, explicit interpretation remains the primary goal of debitage analysis. The following review will present common methods, beginning with those that minimize interpretation and moving from there to more analytical approaches.

Interpretation-Free Analysis

In 1985 Sullivan and Rozen published an attempt at "interpretation-free" debitage analysis. Dubbed the Sullivan and Rozen Technique (SRT), this approach divides debitage into four mutually exclusive categories based on their discernable attributes, including complete and broken flakes, "flake fragments" (their term for a broken flake that does not include a platform), and debris (on which it is impossible to differentiate the ventral from dorsal surface). After dividing debitage into these categories, the authors proceed to take size measurements and weigh the collective categories. From these data, they search for similar patterns at various other sites (Sullivan and Rozen 1985). The article is most noteworthy for what Sullivan and Rozen chose not to do next: they offered no possible explanations for why their debitage assemblage displayed certain characteristics. They did not try to identify past human behaviours or adaptations that resulted in this particular type of debitage, but instead left the data and inter-site comparisons as they were.

Widely read, cited, applied, and critiqued, the SRT represents something of a turning point in debitage analysis in that authors writing after its publication invariably respond to it in some way. Thanks to the "American Antiquity effect" (Johnson 2001:18), the influence of the SRT is widespread and current techniques in debitage analysis must necessarily describe their method in terms of supporting an "interpretation-free," or more aggressively interpretive approach. That is, articles and books published after the introduction of the SRT must make the explicit choice as to whether or not debitage analysis should attempt to infer past human choices, adaptations, and behaviours based on the collection of lithic debitage present at a site.

Typological Analysis

Although anything from size classes to raw material types do represent typologies (Andrefsky 2005), technological typologies will be specifically considered here and the term "typology" should be understood in this sense. Technological flake typologies are based on the fact that removing a flake in a certain way typically leaves it with a specific shape, which the researcher can identify and use to infer the sort of lithic production activity that took place at a site. In contrast to Sullivan and Rozen's goals, Odell describes typological categories as "intuitively meaningful," (Odell 2005:121). Flake typologies sometimes use terms that are primarily descriptive, and at other times utilise terms that specify a goal or activity. One such descriptive typological category is a "cortication flake," simply meaning a flake with visible cortex on the dorsal surface. Although the term is itself merely descriptive, it clearly implies that the flake was removed early in the reduction process, before all cortex had been removed. On the other hand, terms such as “biface thinning flake,” make the ultimate goal when removing these particular types of flake explicit for the analyst and reader.

This approach actually predates the publication of Sullivan and Rozen’s approach, which was meant specifically to critique the strongly interpretive approach implied by the use of typologies. Its usage has, of course, continued since that time and, indeed, has already been applied to some of the debitage from the Gaudreau site (Gauvin 2014). Those technological types broadly applicable to the Archaic period in the Far Northeast include biface reduction flakes, pressure flakes (Odell 2005; Andrefsky 2005; Whittaker 1994), core reduction flakes (Bursey and Bursey 2012), platform preparation flakes, notching flakes, and alternate flakes (Towner and Warburton 1990). Other types, such as channel and parallel flakes from the Paleoindian period, are not typically seen in the manufacture of technology utilized within the Far Northeast during the Archaic.

Flake typologies can also include classifications based on stage of production. Sometimes these are as simple as identifying partially completed tools as being a preform or blank. Alternatively, it is also possible to divide production into many more stages than this. Callahan criticized the small number of steps identified by previous authors and proposed five distinct stages of tool production. He identifies these as (1) obtaining the blank, (2) initial edging, (3) primary thinning, (4) secondary thinning, and (5) shaping (Callahan 1979). Reduction stage is also sometimes identified by classifying flakes as primary, secondary, or tertiary based on the amount of cortex present on the dorsal surface, a method called a “triple cortex” typology (Andrefsky 2005). This is based on the understanding that flakes with a greater amount of cortex present will likely have been removed earlier in the reduction sequence. It is, of course, possible that a tertiary flake (removed later) will still have some cortex, or that a secondary flake could have no cortex at all. The question of how much cortex should define each stage creates difficulty in comparing analyses between different authors, too. However, even as Andrefsky offers a table showing that these problems occur regularly, the overall trend toward less cortex later in the reduction sequence is evident (Andrefsky 2005:117). Thus, while this attribute may not be definitive for any single flake, it can certainly be informative when considering an assemblage as an aggregate whole, a consideration that will be addressed in the following subsection.

Aggregate Attribute Analysis

Flake attributes are any of the characteristic flake markers, such as size, a bulb of percussion, or dorsal scars, that are used in debitage analysis. Considering these traits in an aggregate form, for all or some of an assemblage, defines aggregate attribute analysis. On its own, the term aggregate analysis typically refers solely to mass analysis of debitage (Andrefsky 2001b; Ahler 1989), but aggregate attribute analysis offers the chance to consider trends in flake attributes for an assemblage. To do this, the assemblage is treated as a whole, keeping in mind that it represents the end result of numerous production choices, rather than as a set of individual and discrete characteristics (Rinehart 2008). This allows for the added benefit of minimizing the influence of possible anomalies (Bradbury and Carr 2004).

Bradbury and Carr's 2004 argument for the inclusion for aggregate trend analysis in methods of debitage analysis follows their essay in the Andrefsky's edited volume on lithic debitage analysis. This essay offers regression analysis of debitage data from experimental lithic reduction events, whose early results were reported in a prior journal article (Bradbury and Carr 1995, 2001). The authors analysed the results of these experiments based on a range of attributes and used regression analysis to create best-fit lines that indicated how great a percentage of on-site activity was represented by any given type of reduction task. These best-fit lines rely on multiple attributes of the debitage assemblage, reinforcing the idea that the best path to understanding site activity through debitage is by considering many lines of evidence (Bradbury and Carr 2001).

Sourcing Raw Material

Debitage analysis must also consider the question of raw material procurement. Tool production requires toolstone and certain varieties are preferable to others, depending on the task at hand. Access to raw material sources for producing stone tools can take place via a specific trip with the goal of obtaining toolstone via an embedded procurement strategy, whereby obtaining tools stone is incorporated into other tasks; or by trade. Given that stone is a heavy material and costly to transport, its frequency on a site typically declines rapidly with distance from source. For Archaic period sites in the Far Northeast, the frequency of raw material usage is usually inversely proportional to the $\log_{10}$ of the distance from the source (Hoffman 2006), and Hoffman summarises these frequencies as being approximately 90% from sources within the local area, 9% from sources within the region, and 0.9% from exotic sources. Additionally, tool morphology and raw material are sometimes correlated, especially for exotic sources (Burke 2006).

Because transporting stone is costly in terms of energy expended, materials were typically reduced to a preform or blank before transport. The result of this is that, in the case of procurement via trade, the receiving group had no direct control over the initial shape of the tool. This would instead have been determined by the group who lived near the source and procured and initially reduced the raw material before trading it (Burke 2006). As Blair points out, however, using water transport offers the option of procuring raw material in bulk, via a specialized trip (i.e. not as part of an embedded procurement strategy). This reduces the effective distance to the source by reducing the difficulty of the journey and lowers the energy cost of procurement. It thereby allows the material to be treated as more local than it would be, if only straight line ("as the crow flies") distance was considered (Renfrew 1977). Bulk procurement by water can help explain large amounts of certain raw materials at some sites and not others. It also fits well with the logistic "collector" strategy, which establishes long-term base camps and sends task groups to fill specific needs, such as procuring raw materials for that camp (Binford 1980). It is this strategy that is most closely in line with patterns of mobility typically associated with the Archaic period (Ellis et al. 1990; Andrefsky 2009; Forrest 2003).

2.3.3 – Critical Responses and Key Considerations

As Odell rightly pointed out in his review of Andrefsky's volume, defining terms clearly is a vital foundation for any later analysis, and although archaeologists may generally know what is meant by "debitage," the finer points of which artefacts are included may significantly alter the database and skew comparisons between different analysts (Odell 2003). Specifically, whether or not the definition of debitage should include utilized flakes and retouched flakes is crucial. With regard to sorting debitage, once defined, into subcategories, the SRT at least offers clearly and mutually exclusive categories. When considered in conjunction with other variables, these categories become significantly more useful (Prentiss 2001; Willhite 2014). The term curation also deserves specific definition, as it can be alternatively defined as transported tools or efficiency of tool use. Here Andrefsky's (2009) definition of curation as actual use relative to maximum potential use will be implemented conceptually, although not calculated as a specific quantity in this case.

Attempts to interpret an assemblage using only one line of evidence lead to weak results generally. Instead, considering different attributes, artefact categories, and axes of evidence is preferable. Thus, interpretation of debitage is often ultimately necessary and the best response to the question of reliability for any given interpretation is additional lines of evidence. Carr and Bradbury characterise aggregate attribute analysis as "a suite of approaches that can be tailored to the analysis of a particular assemblage," (Carr and Bradbury 2000). The danger of debitage analysis lies in overstating its interpretations. Blair considers this in discussing the variable factors that contribute to mobility, beyond simple need for raw material with which to produce stone tools and argues for greater nuance in interpretation in order to recognise this reality (Blair 2010).

2.4 - Regional Ecology of Southeast Quebec

The Gaudreau site is located on the west bank of the Saint-François River, facing the mouth of the Salmon (Saumon) River. The site is part of the municipality of Weedon, within the Eastern Townships region. The Saint-François and Saumon Rivers offer easy access to the Appalachian plateau, Lake Megantic, Lake Memphremagog, Montagne de Marbre, and the St. Lawrence River (Graillon et al. 2012). During the Early Archaic, the vegetation would have been primarily pine, becoming more mixed coniferous and deciduous throughout that time. By about 8,000 cal BP, the area would be home to similar vegetation and faunal diversity as is seen today (Ellis et al. 1990; Graillon et al. 2012; Petersen et al. 2000; Reader 1996). Archaic occupation of the Gaudreau site begins during the Middle Archaic and ends with the Late Archaic, a period lasting roughly from 8,800 to 3,000 cal BP (Graillon 2013).

The region offers numerous species of mammals, birds, and fish to harvest (Corbeil 2007). The location of the site at the meeting of these two rivers was likely vital in the selection of this location, as two additional sites are located on the opposite bank (Graillon 2011). Key lithic sources within the Eastern Townships region include the rhyolite source at Montagne de Marbre, approximately 50 km to the southeast (Graillon et al. 2012); and Ledge Ridge chert, about 65 km to the southeast. More exotic sources include the Kineo-Traveller rhyolite sources in Maine (Graillon et al. 2012; Graillon 2011), about 250 km east; chert from the Munsungun Lake outcrop, about 250 km northeast (Graillon 2013); chert from the Onondaga source, in New York and Ontario, over 800 km away (Wright 1978); and chert from the Hathaway formation, just over 100 km distant (Georgiady and Brockmann 2002). Locally available materials included a gray stone with chert-like qualities, silicified mudstone found in the Lac Aylmer area, and quartz (Graillon 2012).

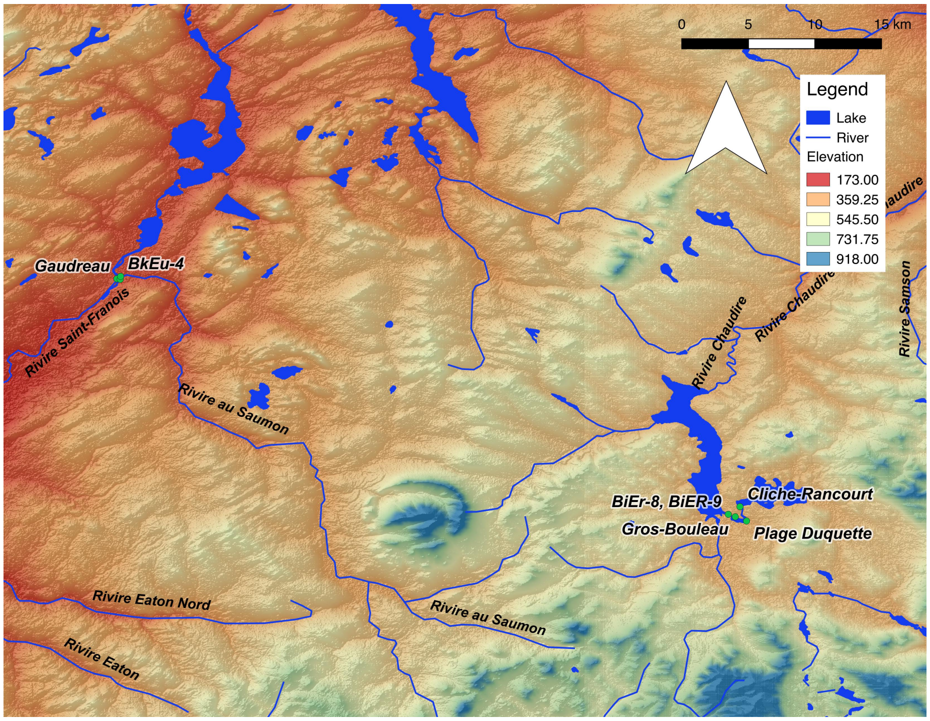


Figure 2. Location of regional sites discussed in text.

2.5 - Horizontal and Vertical Organization of the Gaudreau Site

This section will describe those sectors and areas defined in the course of excavation, as analysis reveal additional patterns to be discussed later. Locations and excavation units on the site are named based on distance north and west from a fixed datum along the riverbank to the south of the site. The excavated units are indicated in Figure 3. The Gaudreau site consists of two terraces, one lower and one upper. The upper terrace is approximately three metres above the summer level of the river in July (Graillon 2013). The upper terrace is the primary focus of this thesis, as the lower terrace consists of a significantly smaller area than the upper terrace and consequently yielded fewer artefacts.

Excavations on the upper terrace were divided into three sectors, after which three culturally significant areas were also identified. The sectors include the North, Central, and South Sectors. These sectors are located to the east of the upper terrace, toward the riverbanks (Graillon 2012). Farther west, the ground is poorly drained, swampy, and rocky (Graillon 2011).

These are shown in tan in Figure 3. The South Sector includes both the Ancient Area (Aire ancienne) - which also spills into parts of the Central Sector - and the Contact Area. Farthest south is the Mill Area, where the Trahan mill was constructed during the late 19th century. These were water-powered sawmills that served the local village of Trahan and were subsequently abandoned after a fire (Graillon 2012). The Gaudreau site's boundaries are vague due to the site's disturbed nature, and explorations in 2012 identified the extent of the worst disturbances. This information and the locations of negative test units from the 2010 excavations were used to identify appropriate limits for excavations on the site. The Contact Area and Ancient Area were subject to the most thorough excavations and their spatial organization will be further considered, especially as the area identified for sampling in this thesis spans these two site areas.

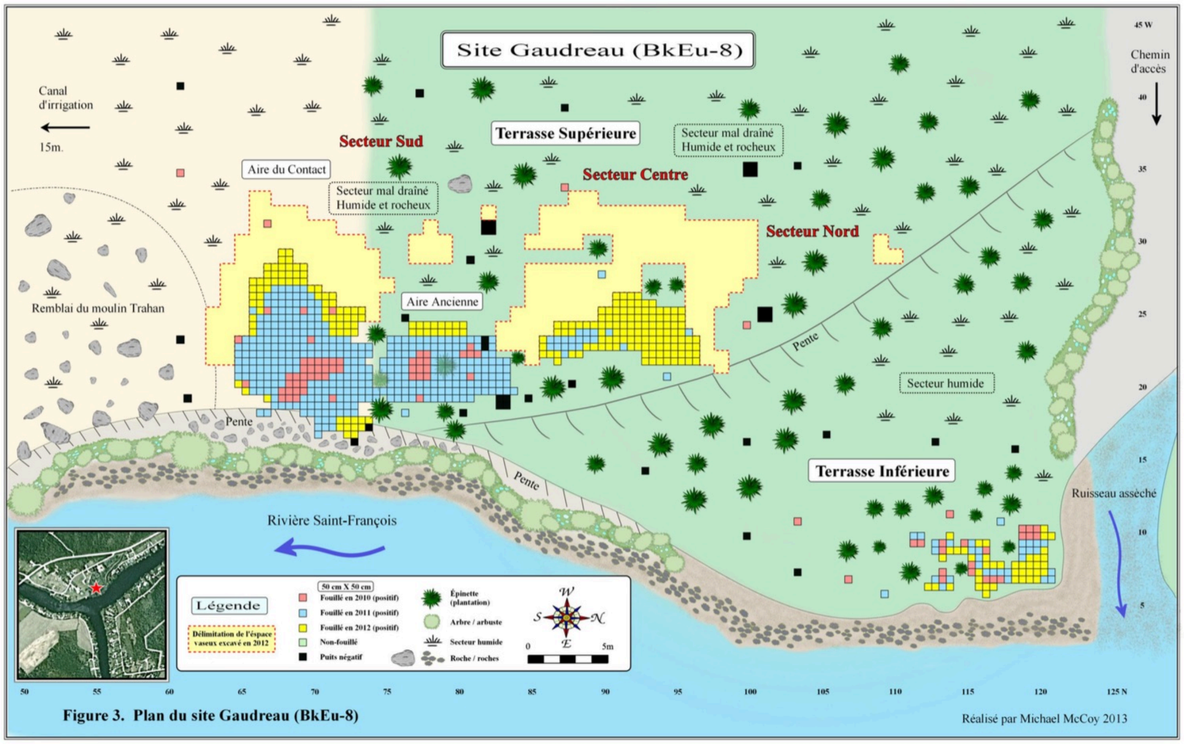


Figure 3. Site organisation as defined during excavation (Graillon 2013).

2.5.1 – The Ancient and Contact Areas

Artefacts dating to the historic occupations are found scattered throughout the Gaudreau site, but are especially concentrated in the areas from 67N 21W to 71N 19W. This area of 15 square metres yielded 12 French gunflints, four lead musket balls, a lead ingot, two copper and one silver jingle cones. Bone remains show a comparable concentration, with the only units yielding over 1,000 total calcined bone remains located between 68N 20W and 71N 20W. Ceramic artefacts, indicative of time periods after the Archaic, are found in almost every excavation unit. Ceramic artefacts (Figure 5) are particularly concentrated in the area from 67N 24W to 70N 20W. The concentration of ceramic remains peaks at 68N 22W, 70N 21W, and 70N 20W. These three square metres yielded 847 pieces of pottery, representing 28.5% of the 2,971 total pieces of pottery recovered from the Ancient and Contact Areas combined (Graillon 2013). These areas are :Aire Ancienne" and "Aire de Contact," respectively, in Figure 3. With regard to lithic tools, a similar pattern is evident. Stone tools are most frequent in 70N 21W and generally decline in frequency with distance from this unit. Totals are slightly high to the north of this unit than to the south. Beyond two metres from this unit, tool totals typically remain below ten (Graillon 2013).

The distribution of lithic debitage (Figure 4) presents an apparent departure from the distribution of ceramic artefacts (Figure 5). Although it is true that the total amount of debitage removed from any given unit is high in the areas previously identified, these above average totals are dispersed over a much larger area, closer to 20 square metres. Additionally, there are two locales that mark the areas with the highest total number of debitage pieces, and the larger of these consists of the units 69N 24W and 69N 25W. This is much farther west than the centers of the concentrations of other artefacts. The second locale is at 70N 21W, which is more in line with previous patterns. Between these two locales, total quantities of debitage remain above 1,000, distinguishing it within the Ancient and Contact Areas (Graillon 2013).

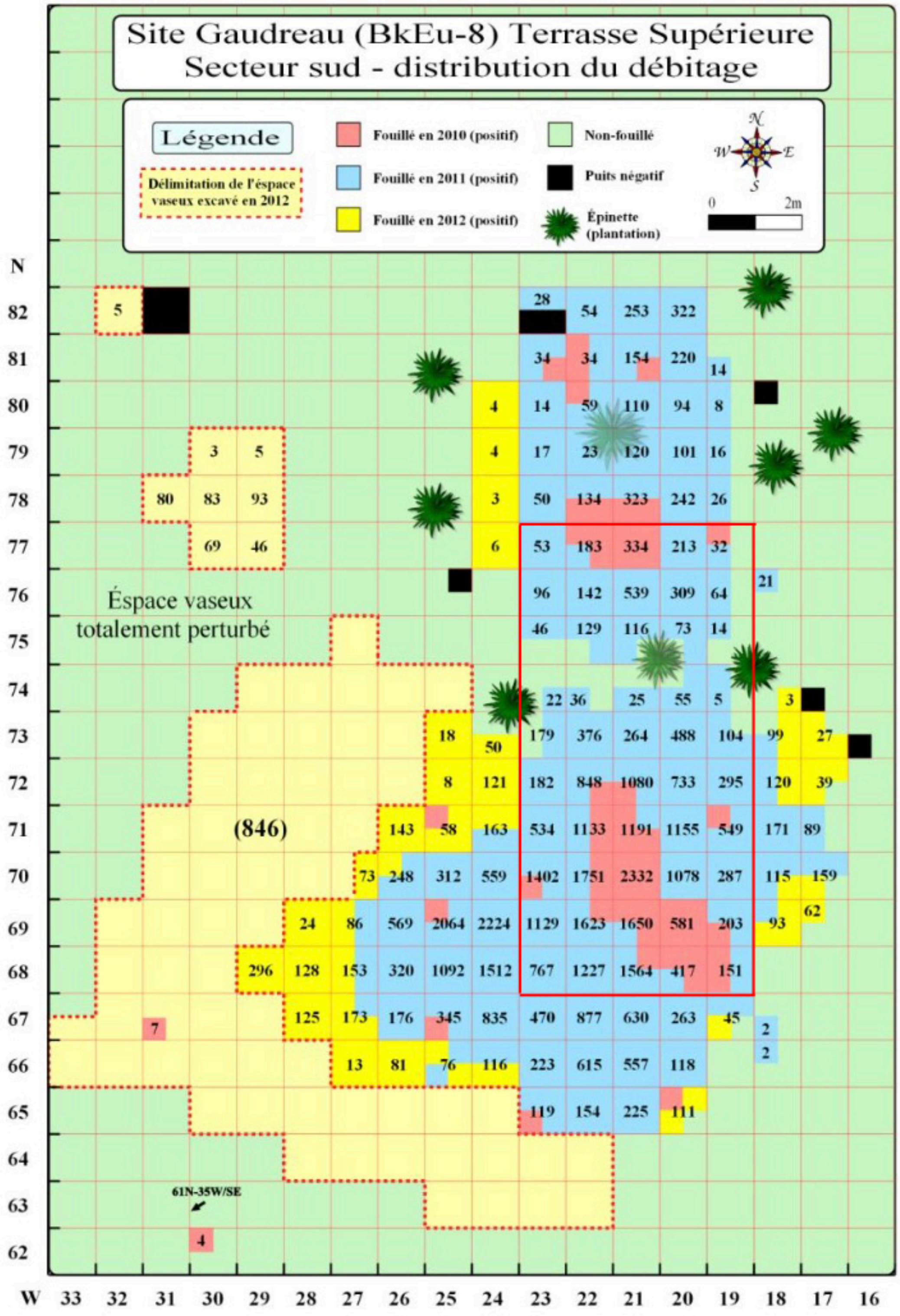


Figure 4. Map showing debitage distribution at the Gaudreau site. Squares represent 1 m x 1 m excavation units, with total pieces of debitage recovered reported for each unit (Graillon 2013).

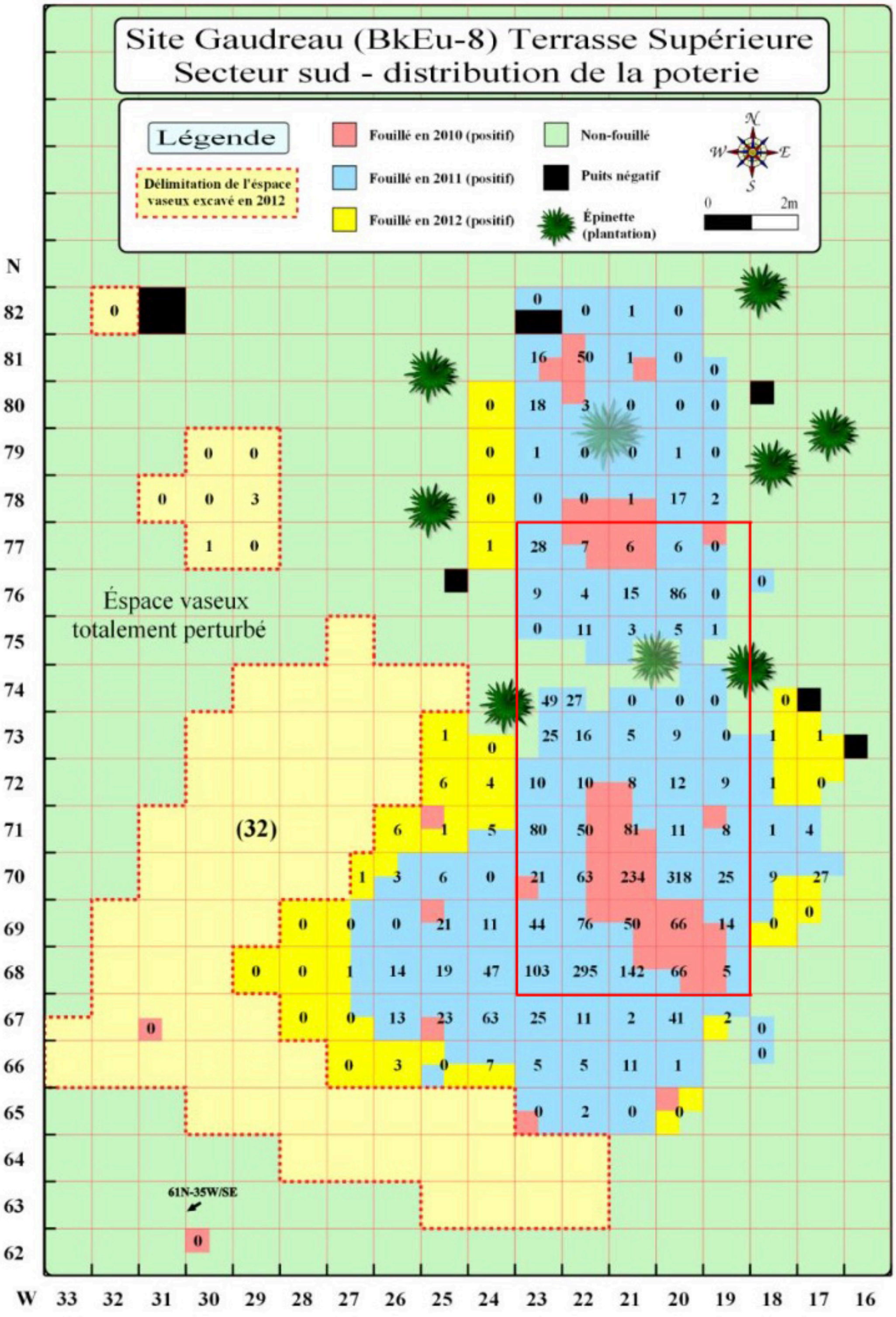


Figure 5. Map of pottery distribution in the South sector of the Gaudreau site. Squares represent 1 m x 1 m excavation units, with total pieces of pottery recovered reported for each unit (Graillon 2013).

The coincidence of three different raw materials being concentrated in the same location is interesting and was subject to some of the earliest analysis for this current study. Given the disturbed nature of the site, there existed the possibility that this concentration of artefacts resulted from taphonomic processes shifting items to the locations in which they were later discovered. However, the site reports make no mention of unusual stratigraphy in these areas or of other evidence of disturbance. There was no reason to assume that the site was disturbed in such a way as to artificially create this concentration of artefacts. Thus, it seemed that this locus represents an archaeologically significant concentration of activity (Graillon 2013). These areas of higher concentration were considered in comparison to each other and to areas with lower debitage counts, in hopes of verifying that this difference representative of a larger pattern.

2.5.2 – Site Stratigraphy

Stratigraphy of both the Ancient and Contact Areas is essentially uniform throughout. The only difference worthy of note is the greater frequency of root activity in the Ancient Area in comparison to the Contact Area. The primary matrix in both areas is a black organic soil extending about 25 cm below the surface (Figure 6). Below this is a level of beige silt. Certain areas have one or two marbled layers between the black organic soil and beige silt (Graillon 2013). All levels are referred to by their distinctive soil both in site reporting and throughout this thesis. The topmost, organic layer is referred to as *noir*. Below this, in some units, is a *noir-marbré* transitional layer. In many units continued beyond the first stratigraphic level, a layer of mottled soil called *marbré* comes next. Finally, the silty lower layer is known as *limon.* The vast majority of artefacts were found in the black organic soil layer, and most excavation units were not continued beyond this level (Graillon 2013).

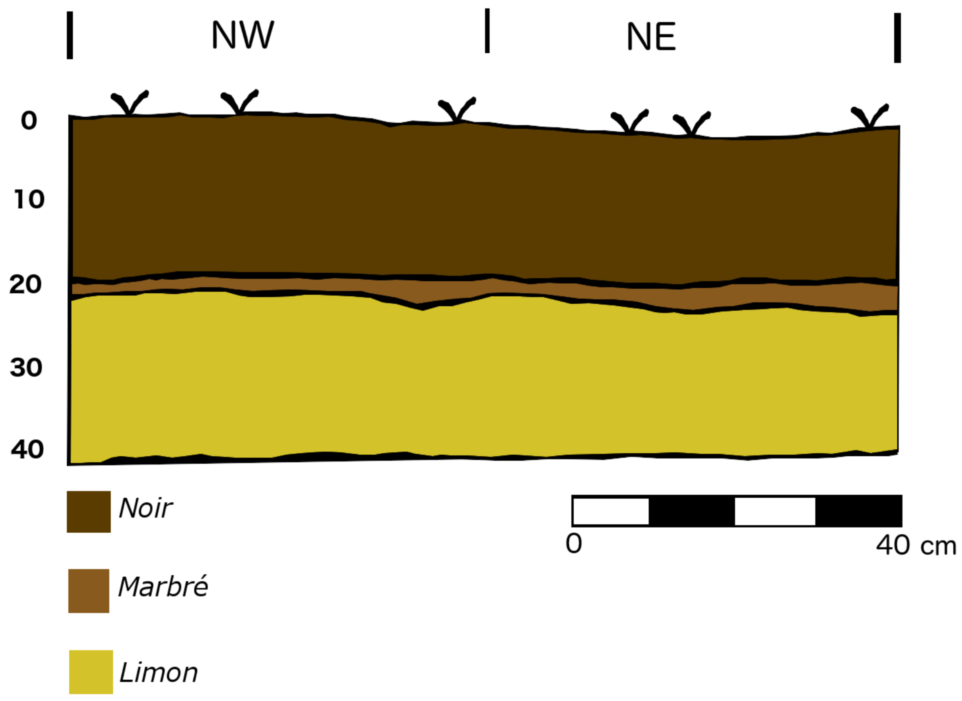


Figure 6. Typical stratigraphy at the Gaudreau site (based on Graillon 2012).

Within the wider regional context of the Eastern Townships, this stratigraphic profile is similar to that seen at sites in similar ecological contexts. At Gros-Bouleau (BiEr-8, see Figure 2), for example, the uppermost layer typically extended 25 cm in depth, and was followed by a silty layer, with frequent mixing at the interface between the two. As is seen at the Gaudreau site, most artefacts at Gros-Bouleau were recovered within the first 15 cm excavated, and very little was recovered from the silty lower layer (Corbeil 2007; Chapdelaine 2009).

2.6 – Prior Research on the Gaudreau Site

As with many sites in the Far Northeast, the Gaudreau site has multiple components, each relating to a separate occupation. That is, the length of the site's occupation means that its assemblage is the result of occupation over multiple time periods. In the case of Gaudreau, occupation begins in the Paleoindian period and lasts throughout the Archaic, Woodland, and historic periods. Recent (i.e., historic) usage of the area for farming and industry has resulted in extensive mixing of artefacts within approximately the top thirty centimetres of soil. Many of the excavation units yielded historic artefacts, sometimes even from the same units from which Paleoindian artefacts were recovered. Ceramics were found in nearly every unit, whether or not other artefacts diagnostic of the Woodland period were found. Thus, disentangling the Archaic occupation from the remains of other periods of occupation was this study's first challenge.

2.6.1 – Paleoindian Period

The first period of occupation at the Gaudreau site was during the end of the Paleoindian period and this occupation was the subject of a targeted study even while other parts of the site were still being excavated. The Paleoindian time period is characterized by finely flaked stone tools, a lack of ceramic artefacts, and heavy use of exotic raw materials for the production of stone tools. The Paleoindian points at Gaudreau are in the Ste. Anne-Varney style, one of the latest in the Far Northeast. The culture associated with this later Paleoindian time period is called Plano, and these people occupied the Gaudreau site sometime between 10,800 and 10,000 BP, following Bradley et al.'s chronology (2008). Due to the late nature of the Gaudreau site's Paleoindian occupation, one of the site's points from this period even exhibits minimal side notching. Side notches are generally associated with the Archaic complex, yet this point also exhibits parallel flaking done with extreme skill, which is characteristic of the Paleoindian period. This occupation, then, took place when the Paleoindian period was ending and as the use of Archaic technology had just begun in other parts of the region (Graillon et al. 2012).

The Paleoindian points are made of what initially appeared to excavators to be New Hampshire rhyolite. However, this material was later named a trachyte of unknown origin (Graillon 2012; Graillon et al. 2012). According to Burke, and based on geochemistry, thin section petrography and regional geology, it is a sedimentary material that includes significant input from volcanic materials (Adrian Burke, personal communication 2017). The study of the Paleoindian tools also included a number of retouched flakes, utilized flakes, and a single formal unifacial tool that is likely a scraper. The site's debitage was also studied, with a focus on implementing a technological typology. The debitage analysis revealed that flakes at the site were mainly small (70% of the sample was less than 200 mm^2 in size) and that bifacial reduction flakes represented over half of the sample. Considered in conjunction with the presence of only a single scraper, Graillon et al. interpret the Paleoindian component likely to represent a specialized hunting party's camp, at which supplies were replenished (Graillon et al. 2012).

2.6.2 – Rhyolite Study

An independent study carried out by Gétan Gauvin, a graduate student at the Université de Montréal, sampled from the rhyolite debitage, tools, and cores to understand the usage of this material at the site, especially within the context of its importance to prehistoric sites throughout the Eastern Townships region. This study took into account flake mass, number of platform facets, cortex presence, mass, and placed each flake within a technological typology. Tools and cores were measured and their production process was considered. This study limited the sampled debitage to only that which came from units that had also produced rhyolite tools (Gauvin 2014).

This study reinforced the importance of Kineo rhyolite among assemblages within the Eastern Townships, and considers the possibility that this particular raw material was acquired directly from the source. This potential procurement strategy is supported by ethnographic evidence of regular trips to Moosehead Lake by indigenous peoples of the Far Northeast during the mid 17th century (Lalement 1898, as quoted in McGuire 1908). As scrapers tended to be made on flakes, the biface industry was interpreted to have functioned as cores that were flaked for tool production, with debitage used opportunistically for production of unifacial and informal tools. The study also offered a useful series of statistics for the debitage analysis, which will later be subject to comparison with results from this study. Briefly, 62% of the rhyolite flakes studied were made by soft-hammer percussion and 18% were produced by pressure flaking. The remaining 20% fell into other categories, of which the most common were alternate flakes (9%), hard hammer flakes (3%), and ambiguous flakes (6%). All other categories produced negligible totals.

Soft hammer reduction was found to be stronger in the Ancient Area and somewhat lower in the Contact area, while pressure flakes were more common in the Contact Area and less common in the Ancient Area. Gauvin interprets this as being a result of a lithic industry that strongly focused on biface production to replaced exhausted tools (Gauvin 2014).

2.6.3 – Archaic Tool Analysis

Gauvin also undertook an analysis of Archaic period bifaces for his Masters thesis work. This thesis involved a technological analysis of flaked stone tools from the site, as well as a brief consideration of the ground stone tools. The flaked tool analysis first produced line drawings of artefacts and identified the removal sequence for the final steps of production (diacritical schemas). This allowed for the creation of production sequence schema, tracing the process of tool production from the raw material source through the steps of manufacture to the creation of each individual artefact. The thesis concluded that patterns of manufacture indicated that bifaces circulated throughout the Far Northeast at varying stages of manufacture via intergroup trade during the Archaic period, and were finished as needed by their end users (Gauvin 2016).

Most useful to the current study were the data collected for Gauvin's thesis with regard to tool retouch. In reconstructing and diagramming the discrete steps that went into the manufacture of bifacially flaked tools Gauvin also reported the presence of resharpening flake scars and their characteristics. This made it possible to deduce which materials and forms were subject to the most extensive and intensive resharpening over the tools' lifetimes. This became useful in better understanding the spatial distribution of flake types in the various raw materials present at the site.

3 – Methods

This thesis seeks to understand Archaic activities at the Gaudreau site, within the wider context of the Far Northeast, by way of a debitage analysis. The entire site produced 65,211 pieces of debitage over the three excavation seasons (Graillon 2011, 2012, 2013). Obviously, examining every piece of debitage would not be feasible, and some of this collection certainly came from the Paleoindian and Woodland periods, as both are represented at the site. Thus, the first step of this study was to identify which debitage was Archaic and determine how best to sample from that in a timely, representative, and informative way. The next step would be to determine which attributes of the debitage should be recorded. After the data was collected, analysis of the collection could begin.

3.1 – Defining the Sample Area

Although the goal of this thesis is to focus principally on the Archaic occupation, the Gaudreau site's disturbed nature prevented the identification of any given time period based on location within the site stratigraphy. Additionally, Archaic artefacts were found from areas throughout the upper terrace, from 62N to 100N and 19W to 36W. Despite the vertical mixing at the site, there is no good evidence for recent disturbances that could affect the horizontal provenience of artefacts. Therefore, the site's spatial organization was utilised to identify part of the Gaudreau site as distinctly Archaic. First, the lithic tools recovered from the site were examined and ranked based on how well they fit within the Archaic typology. Next, these tools were mapped onto the site and the strength of their fit to Archaic types was indicated using a color scale. Those tools which clearly fit into broadly accepted typologies of Archaic period points were labeled as being this strongest evidence, while exhibiting less conformity to these typologies were placed in the strong evidence or good evidence categories.

After this method was applied for the preliminary identification of a sample area, Éric Graillon, primary investigator at the Gaudreau site, was consulted to verify the plausibility of the identified Archaic sample area. His feedback and confirmation finalized the area of 50 square metres selected for study in this thesis. Unfortunately, three artefacts diagnostic of the Archaic were included among a small portion of the collection removed to a separate location, and were not identified as Archaic within the catalogue. Upon reintegration with the collection, they were identified as such and added to the artefact map. Based on this, it appears the sample area could, alternatively, have been shifted to the east by a metre. By the time this occurred, however, the data collection had already been completed and the sample area contained a sufficiently high rate of diagnostic artefacts as to be considered representative.

3.1.1 – Archaic Tools from the Gaudreau Site

Identification of Archaic artefacts relied on finished tools and preforms with a morphology defined clearly enough so that they could be compared to texts describing Paleoindian, Archaic, and Woodland artefact typologies. This meant that only complete or nearly complete bifaces could be considered. For flaked tools, Ritchie's (1961) typology for New York points was used as a preliminary guide, with Dincauze's (1976) Neville site report to supplement additional information regarding Middle Archaic point types. These styles of projectile point tend to be stemmed, notched, or eared. However, the presence of stems or notches is neither necessary nor sufficient in the identification of Archaic points. Also, ertain ground stone tool forms are closely associated with the Archaic, such as ulu knives and rods.

Forty individual artefacts with unique catalogue numbers from the Gaudreau site were initially identified by the author as likely dating to the Archaic period. However, three were eliminated due to a lack of precise provenience information and two pieces were able to refit to other artefacts, eliminating a total of five objects. Seven of the remaining artefacts were definitively Archaic and identified as being the strongest indicators of Archaic activity. An additional twenty-five artefacts were identified as very likely to be Archaic and considered as very good evidence of Archaic occupation. Three artefacts were identified as probably Archaic and considered to be good evidence of Archaic occupation. These are mapped in Figure 7, with each artefact's catalogue number listed. Red units indicate artefacts representing the strongest evidence for Archaic occupation, orange indicates very good evidence, and yellow indicates good evidence. In the case of multiple diagnostic artefacts recovered from the same unit, the color associated with the strongest artefact was applied to the map.

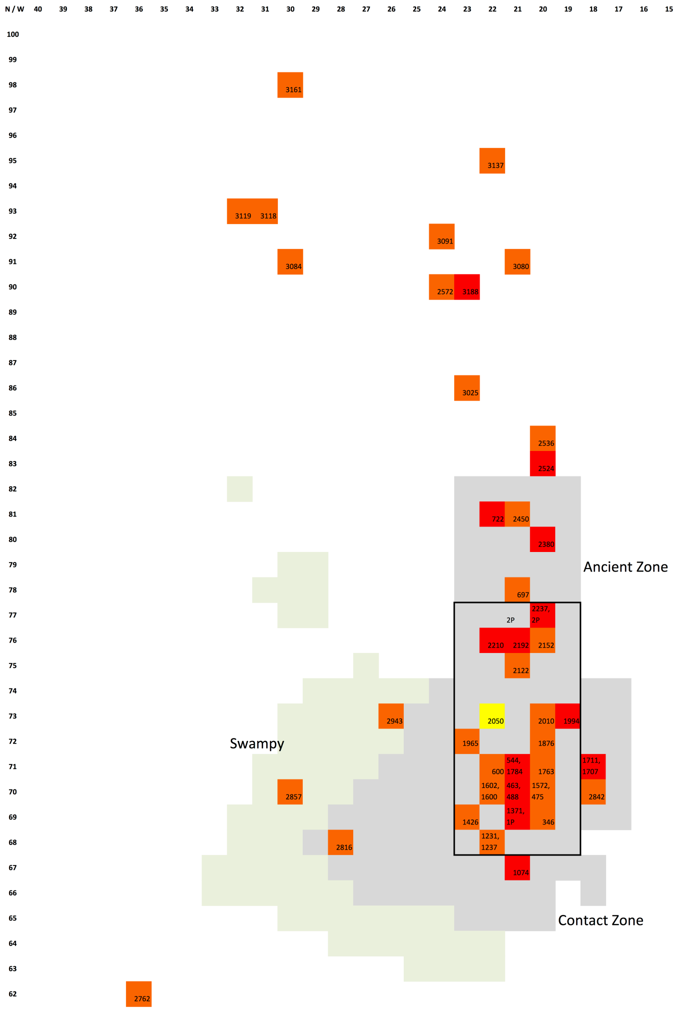


Figure 7. Distribution of diagnostic Archaic artefacts, with red representing artefacts showing the strongest conformity to Archaic typologies; orange indicating those that show strong conformity; and yellow indicating those that merely exhibit good conformity.

Based on this, an area of 50 square metres was identified that encompassed the greatest concentration of Archaic artefacts. This area contained the majority of the artefacts that represented that strongest evidence for Archaic occupation and a majority of those that represented strong evidence for Archaic occupation. Within this area, no artefact is more than one metre from its nearest neighbouring Archaic artefact. The area selected for this study extends 68N to 77N, and from 19W to 23W. This area is defined to be the likeliest center of the Archaic occupation due to its high frequency of Archaic tools. Debitage recovered from the identified area will be treated as Archaic for the purposes of this thesis, although the possibility remains that some debitage is, in fact, associated with other deposition events. The extent of vertical mixing makes horizontal distribution the obvious choice for identifying individual occupations, despite the unavoidable risk of including material from other occupations.

3.2 – Sampling Strategy

A preliminary review of all debitage from within the sample area was conducted to design a sampling strategy that would best fit the material recovered. This review revealed a total of 31,356 pieces of debitage, of which just over 50% were local silicified mudstone (*schiste ardoisier local*, or SAL). A distinction was made in the field between three colors of this local material: gray, black, and red. However, the different colors appear on single pieces of material and the distinction appears to be artificial (see Figure 7). Therefore, all shades of this material were considered together for this study. An additional 20% of the pieces of debitage were quartz, and 14% were rhyolite. The rest of the debitage was made up of various cherts, quartzites, and a local gray material. Due to the high quantities of rhyolite, quartz, and local silicified mudstone, examining all flakes of these materials would be prohibitively time consuming. However, the other materials totalled fewer than 4,000 pieces of debitage and could all be studied within a reasonable time frame.

This strategy allowed the added benefit of focusing attention on the debitage with the greatest potential to reveal information. Additionally, the rhyolite debitage had already been studied by Gauvin, while the SAL and quartz presented substantial analytical challenges due to their physical properties. Sampling was thus deemed to be the best option for these materials. The local silicified material has a tendency to break and flake poorly, and it can be difficult to obtain data regarding the reduction process from this raw material. Quartz additionally has a tendency to break angularly rather than conchoidally, and yields less information for similar reasons. Rhyolite has its own problems, tending to fracture around phenocrysts, weathering poorly to the point of breakage, and crushing under hard hammer percussion.

As the site was excavated by quadrant and certain units were only partially excavated, the sampling was done based on quadrant rather than unit. Five complete flakes of rhyolite, of quartz, and of the local silicified mudstone were randomly selected from each quadrant by blind selection from artefact bags, with care being taken to avoid bias towards larger flakes. For a few of the quads, five complete flakes were not available. In this case, proximal fragments were sampled next, and then debris, if necessary, in order to bring the total pieces of debitage sampled to five. In very few situations, there were fewer than five pieces of debitage total of one of those materials from a quad. This sampling strategy resulted in 855 pieces of quartz, 749 pieces of rhyolite, and 861 pieces of local silicified material. Other materials totalled 3,851 pieces of debitage, for a total sample of 6,319 pieces of debitage examined. This represents 9.7% of the total debitage from the site, and 20.2% of the debitage from within the sample area.

3.3 – Recorded Attributes

Attributes were selected for consideration in this study based on the reliability of identification, in addition to overall utility. The first item noted was whether or not a piece of debitage was a complete flake. Size was only recorded for complete flakes, as doing so for incomplete debitage would generate inaccurate and misleading data. Assuming that flakes of any given material are subject to breakage due to taphonomic processes on a random basis, then the complete flakes offer a sample that is representative of flake size prior to post-depositional breakage. For complete flakes, size was recorded using classes of 0 – 25 mm^2, 25 – 50 mm^2, 50 – 100 mm^2, 100 – 200 mm^2, and by increments of 200 mm^2 for all larger sizes. Categorisation was done by placing flakes on a chart with the relevant surface areas traced out in common shapes.

Flake size classes were named based on their upper bound, so that the 50 sq. mm class included flakes at least 26 sq. mm but at most 50 sq. mm, while the 100 sq. mm class contained those flakes at least 51 sq. mm but at most 100 sq. mm, and so on. For incomplete debitage, a size of zero was used as a placeholder for the sake of convenience, and these incomplete flakes were then excluded when calculating summary statistics for size. The raw material of each piece of debitage was also recorded. For complete flakes and proximal flake fragments, the presence or absence of lipping, a bulb of percussion, platform facets, platform battering, and platform abrasions were recorded. The presence or absence of dorsal scarring was recorded for all debitage.

Cortex presence was recorded and classified in increments of no coverage, ¼ coverage, ½, ¾, or complete cortex coverage. Quantities of cortex were rounded up, so that the fraction recorded indicates a range inclusive of the upper bound and exclusive of the lower bound (e.g. a flake with approximately 3/8 of its dorsal surface covered by cortex would be recorded as ½ coverage, indicating more than ¼, but less than or equal to ½ of the surface was covered). If possible, a flake was assigned to a specific technological type (Table 2), of which the most common were biface reduction flakes and pressure flakes. Other types present in the assemblage included platform preparation flakes and notching flakes. Most flakes were left unclassified, as they did not conform to enough of the characteristics of any typology. Debitage without a clear proximal end was classified as debris. In some cases, dorsal scarring or cortex was present in the debris, and in such cases this information was recorded.

Code	Type	Characteristics
DEBRIS	Debris	Cannot be oriented with regard to proximal and distal ends; may be oriented with regard to dorsal and ventral surfaces
BRF	Biface reduction	Absence of bulb of percussion; presence of platform lip, platform faceting, dorsal scarring, curvature; medium size; minimal cortex, if any
PRSR	Pressure	Absence of lip; presence of bulb of percussion; small size, longer in length than width, and thin; may have platform faceting and dorsal scarring; no cortex
CRRD	Hard hammer core reduction	Bulb of percussion; absence of lip; medium to large size; likely platform faceting and dorsal scarring; possible cortex present
PLPR	Platform preparation	Absence of platform faceting; small bulb of percussion; approximately 1 cm in length, although possibly larger; strong curvature and steep angle between ventral surface and platform
NTCH	Notching	Round shape; small size; v-shaped platform; possible platform crushing or battering
WIDE	Wide	Battered platform; greater in width than length; may have either dorsal scars or cortex cover

Table 2. Flake types used in the present debitage analysis. Underlined characteristics indicate major characteristics used to assign flake to a type during the second round of identification.

The characteristics used to assign flakes to particular typologies are shown in Table 2 (Odell 2003, 2005, Andrefsky 2005, 2001b; Will 2002; Clark and Will 2006; Towner and Warburton 1990; Patterson and Sollberger 1978). Flakes assigned during the initial analysis were missing at most one indicative characteristic. Some leeway was given to allow the classification of incomplete flakes as biface reduction flakes or pressure flakes if the remaining portion was complete enough to infer that it would fit the expected size and shape of this type. The attributes recorded during the examination of debitage allowed flakes unclassified during the initial examination to be retroactively categorized, with the caveat that flakes thus identified were a slightly weaker example of the specific type, due to conforming to fewer diagnostic elements. For these additional classifications, those flakes that included the major characteristics, indicated by underlining in Table 2, were assigned to the typology as well. This was done for the major categories, including biface reduction flakes, pressure flakes, and core reduction flakes.

Provenience information was recorded for all flakes, including catalogue number, north transect, west transect, quadrant, soil level. In some quadrant, multiple levels were excavated. In these cases, each level was treated separately and a sample taken from the collection of each. This was done so that material recovered from lower stratigraphic levels could be compared to that from the organic black layer, and excluded or included as necessary for analysis. All attributes were recorded using Microsoft Excel, to allow ease of later calculations, sorting and analysis. A microscope was used at 15x – 20x power to better examine platforms for abrasions and battering.

4 – Results

This chapter is divided into six sections, each dealing with a different way of understanding the lithic industry at the Gaudreau site. The first section presents the raw materials utilised within the sample area. It accounts first for the broadest variety, as represented in the debitage, and second for the smaller range of materials represented in the tools. Most of these materials will be familiar to anyone who has worked with lithic assemblages from the region, but the section serves to highlight those fracture and other raw material properties that have proven to be important to this work.

The second section deals with the vertical distribution of artefacts and its relation to site stratigraphy. Next, the horizontal organisation of artefacts is presented. The distributions of multiple variables and attributes are considered, including flake typologies, flake sizes, faceting, and raw materials. The distribution of tools and ceramic artefacts are also briefly described to offer greater context to the assemblage of lithic debitage. The next section deals with different types of reduction that occurred in the sample area, as represented by flake typologies. These are compared between different raw materials. Reduction stage is then described, considering multiple attributes, and these are again compared among the different raw materials present. In carrying out these analyses, unanticipated patterns appeared among the assemblage from within the sampled area. The last section of this chapter tests these newly observed trends against the larger assemblage, in the hope of demonstrating their validity. These tests consider raw material, spatial organisation of tool production, and stages of the reduction sequence.

4.1 – Raw Materials

The raw materials represented in the assemblage at the Gaudreau site were initially considered in terms of three categories based on distance from the site: local materials, regional materials, and exotic materials (Figure 8). Local materials come from a radius of 20 km around the site and include SAL, various forms of quartz, and a gray stone similar to chert. The regional classification consists primarily of quartzite, but also includes certain cherts, and originates from a radius of more than 20 km but less than 100 km from the site. The exotic classification included most cherts, Cheshire quartzite, and rhyolite that are found more that 100 km from the site. These definitions were initially used in creating comparative groups, but later modified as necessary.

4.1.1 – Raw Materials of the Debitage

A greater variety of raw materials were observed among the debitage than among the tools. As the debitage offers the truest representation of onsite tools production activity, it is considered first. The raw materials present among the tools will follow, and the context of the debitage assemblage will be considered.

Local Silicified Mudstone

This material was coded during analysis as SAL, for *schiste ardoisier local*. The SAL comes in a range of colors including black, gray, and red (Figure 9). Of these, red is by far more common than the black and gray. However, certain debitage recovered from the Gaudreau site indicates that these three colors are simply variations within the same source, as they show all three colors present within a single flake. One difficulty in identifying this material is the similarity in color of the red SAL to Munsungun chert. Munsungun chert is exotic and higher quality, while a distinctly rough, grainy feel distinguishes SAL. To the less experienced excavator examining an unwashed flake, Munsungun chert may be easily misidentified at Gaudreau as the infinitely more common SAL. This was the case in a few quadrants and significantly increased the amount of Munsungun chert recognised in the sample area.

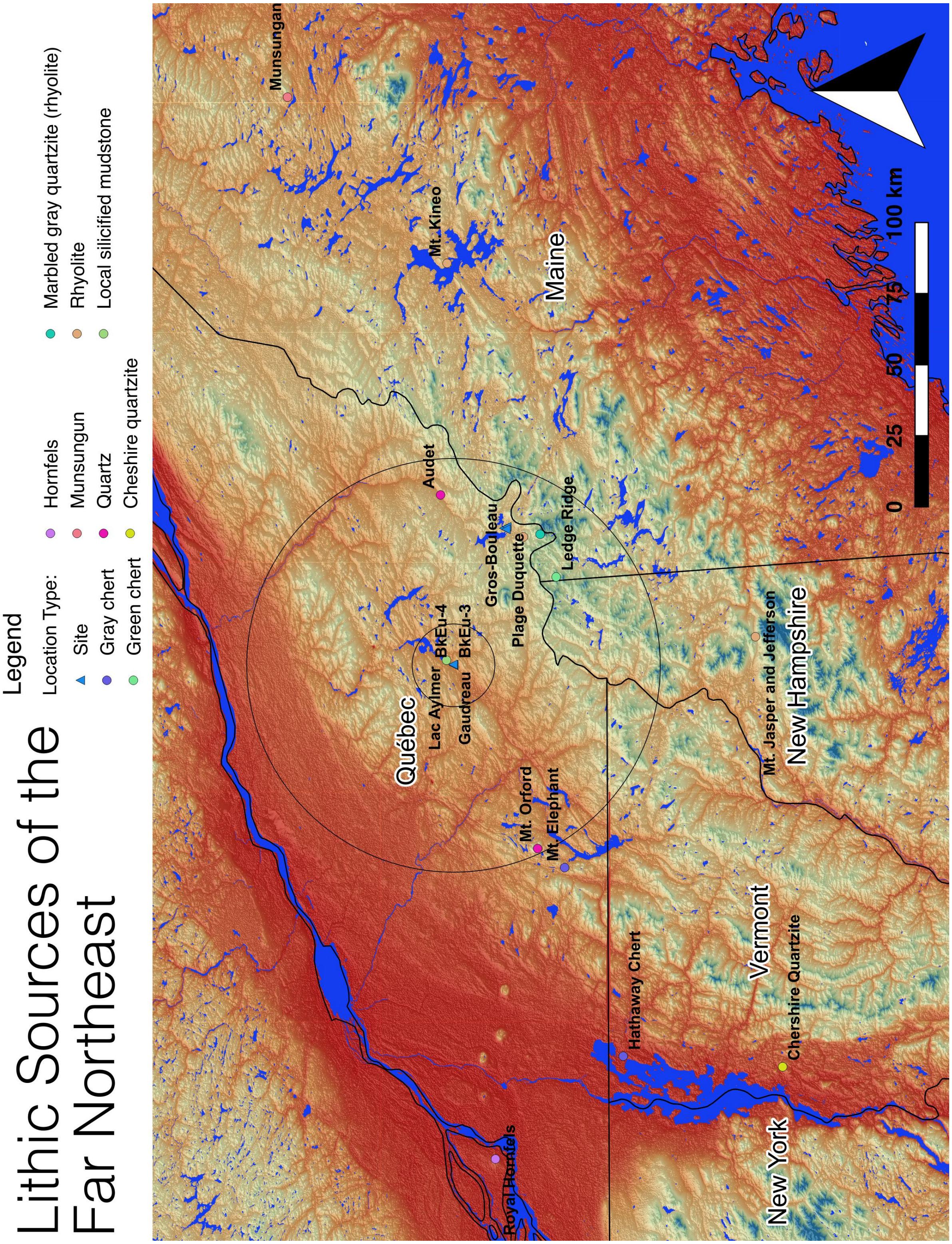


Figure 8. The Gaudreau site and lithic sources of the Far Northeast. Smaller circle encompasses local sources (r = 20 km); larger circle encompasses regional sources (r = 100 km).

Although SAL seems to have produced many conchoidal flakes, it is more coarse-grained than chert and flaking, especially retouch, is less precise than the flaking observed in tools made of chert. In addition to flaked tools, SAL was also used for ground stone tools. The material is brittle, and many flakes show signs of post-depositional and even post-excavation breakage. In some cases, more pieces of debitage were found in a field bag than were recorded on its tag, due to this material's tendency to fracture easily. However, these properties were somewhat mitigated by the ease with which this raw material could be obtained by occupants of the Gaudreau site. Its probable source is at Lac Aylmer, a short walk away. This source is even easier to access by way of the Saint-François River. In terms of the time cost to obtain this stone, SAL was incredibly cheap.

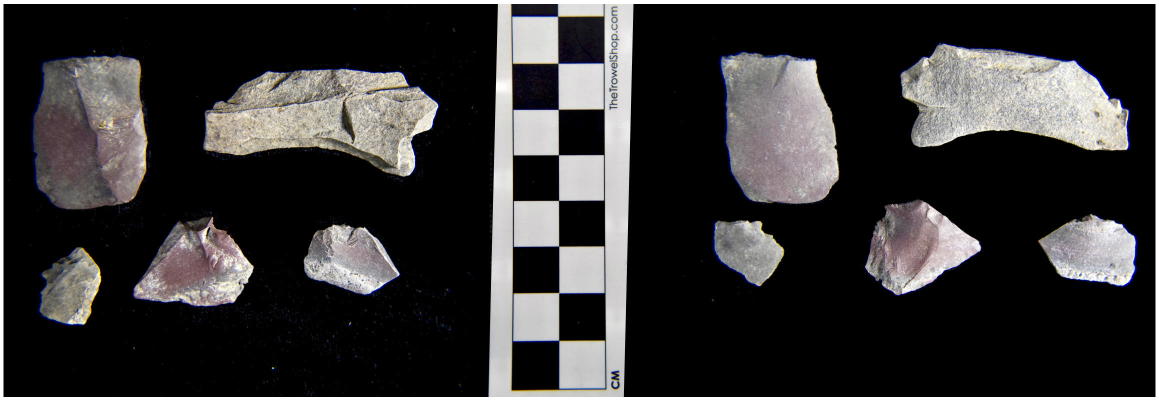


Figure 9. Debitage in SAL, showing the materials three primary colors – red, gray, and black – appearing within a few flakes recovered from the same quadrant.

Quartz

This material was coded during analysis as QTZ. Most quartz from the Gaudreau site is cloudy in color, as is typical throughout the region, while crystal quartz is also present. Both are assumed to be locally available, given their prevalence and accessibility in the Far Northeast. Although quartz does fracture conchoidally, its crystalline habit (Chesterman 1995) makes this difficult to achieve without ample skill. Determining whether excavated pieces of quartz are artefacts or naturally occurring is a challenge at first, as the material's morphology differs from that of other, finer materials. Quartz fractures in diverse ways with a tendency toward breakage and shatter (Driscoll 2011).

Local Gray Stone

This material was coded during analysis as GL, for *gris local*. The chert-like gray material has not been precisely sourced, but is identified as being local based on Graillon's observations of sites in the Lac Aylmer region (Graillon 2013). It is of poorer quality than true cherts, but more apparently easily accessible. It is a coarser material than chert, although somewhat finer than SAL. It flakes well for a local material and a cursory comparison indicated more frequent conchoidal flaking of this material than of the SAL. This material often contains inclusions, but infrequently enough as to not deter the Gaudreau site's occupants from utilising the material.

Siltstone

This material was coded as SLT. A local material of which only a few flakes were recovered from within the sample area, siltstone is gray and coarse grained. It flakes conchoidally, but is brittle and weathers poorly. A specific source was not identified for this material, but is likely near the Gaudreau site because siltstone debitage tended to be extremely large.

Gray and White Quartzite

These materials were coded during analysis as QZG, for *quartzite gris* and QZB, for *quartzite blanche*. Quartzite is not ubiquitous in the Far Northeast in the same way as quartz, but sources of it are more numerous than those of chert. Both white and gray quartzites are present onsite, but only one flake was clearly identified as Cheshire quartzite. This was the only type of quartzite classified as exotic, due to the long distance between the site and the source. Some white quartzite tools excavated during the 2011 and 2012 field seasons were sourced to the Mistassini quarry (Graillon 2013, 2012), some 700 kilometres to the north (Denton and

McCaffrey 1988). However, the debitage in white quartzite was not as fine grained as that from Mistassini and was therefore not classified as such.

Rhyolite and Trachyte

These materials were coded during analysis as RHY, and all rhyolite debitage from the sample area was imported from the Mt. Kineo quarry site in western Maine. One piece of debitage was the material associated with the site's Paleoindian occupation (identified as trachyte). Although it had been visually identified as rhyolite during excavation, it was later chemically identified as a sedimentary rock whose source is likely within the Eastern Townships region. Both materials are included together here because site reports and artefact catalogues initially considered both to be rhyolite from exotic sources, and treated them as such. As only a single piece of the "trachyte" came from within the sample area, it was easy to exclude from the study. Other areas of the Gaudreau site, in particular the lower terrace, do contain additional debitage in trachyte (Graillon 2012). The distance from the Mt. Kineo source to the Gaudreau site is 133 km, assuming a direct path of travel. In reality a straight path would certainly not be used and an even longer distance would be required, meaning that Kineo rhyolite should be considered exotic at this site.

Gray Chert

This material was coded during analysis as CG, for *chert gris*. Those materials classified gray chert at the Gaudreau site encompass a wide range of colors and textures (Figure 10). This is true both for the initial classification during excavation, and for this analysis. During excavation, the categories of "gray," "dark gray," and "black" were used to describe a range of colors of chert. Due to the nature of volunteer excavations however, these terms were not applied uniformly across the site. Preliminary analyses revealed that the same color was often classified differently depending on the excavator, even between neighbouring units. Given the continuous range of shades present among this class of debitage, any distinction between gray, dark gray, and black would be arbitrary at best. For the purposes of analysis all three categories were considered to be “gray chert.” This allowed for easy manipulation and integration with catalogued site data, while avoiding the potential pitfalls of overlapping categories.

Figure 10. A refit point in gray chert, showing visually apparent difference in weathering between its two halves.

Materials in this class range from light gray (Munsell color 10Y 4/1) to black (10YR 1/1). Materials that exhibited distinctive chroma beyond this were classified based on the color that corresponded most closely. Most often, materials in need of reclassification in this way were green chert. In all hues and values of the gray chert, lustre was most often waxy and sometimes vitreous. These cherts were rarely dull. Inclusions were common, becoming more so among the darker varieties. Some variation in color was due to the weathering processes, as evidenced by a refit point recovered from the sample area (Figure 8). Each side of this broken artefact was located approximately a metre from its other half, and the two halves weathered to remarkably different colors. The sheer variety of color in this class makes it difficult to identify any single source, and it is more likely that gray chert was obtained from many sources over the course of the site’s occupation. One possible source is the Hathaway formation in Vermont. Parts of the gray chert assemblage are a good visual match to chert from this source, which is approximately

200 km distant from the Gaudreau site (Georgiady and Brockmann 2002). A similar chert is noted for the Megantic sites, and the Appalachian region of northeast Quebec and the Hathaway formation are both noted as possible sources (Letendre 2007a). Although either source would be well beyond the 100 km radius that circumscribes regional sources, both are close enough to be accessible via direct procurement as well as trade.

Green Chert

This material was coded during analysis as CV, for *chert vert*. The category of green chert consists primarily of material that could be described as grayish greens or olive grays (Munsell colors 5GY 5/1, 5G 5/1, etc.), and the material is primarily of dull lustre. While inclusions do occur in some of this material, it is more often free of them. A small portion of the debitage in this category is much brighter in color and could even be described as teal or turquoise. These certainly came from a different source than the majority of this class. The material produces conchoidal flakes and step fractures appear to be rare. It is not overly abundant in the sample area, and no Archaic tools made of this material were recovered from the site. The material has limited distribution, with almost the entirety of the debitage in this material (n = 219, see Table 3) falling between the 68N and 72N transects. Based on this, it seems likely a small quantity of this material was obtained and only one or two bifaces were produced during a single knapping event before those tools were transported and discarded offsite.

This most common color among the material sampled may have come from Ledge Ridge, in Maine. It is a good visual match to that material and the source is easily accessible from the Gaudreau site via the Saumon river (Georgiady and Brockmann 2002). This material matches closely to green and grayish green cherts recovered at the nearby BiEr-8 and BiEr-9 sites located on the drainage from Lac des Joncs to Lac Mégantic (see Figure 2). These cherts were placed in the same class based on their close match to Appalachian lithology in color and the presence of inclusions. Chert from the Ledge Ridge source was not included in the sourced samples analysed with activated neutron analysis for a sourcing study based on that site (Letendre 2007a, 2007b), so confirmation of this is not possible with existing data. Located at the edges of the Appalachian range, Ledge Ridge fits with the general patterns identified among Appalachian cherts and would be a reasonably accessible source for both the Gaudreau and Lac des Joncs sites.

Name	Code	Total	Percent of total
Beige Chert	CB	33	0.1%
White Chert	CBL	21	0.1%
Brown Chert	CBR	10	0.0%
Gray Chert	CG	2,340	7.5%
Onondaga Chert	CHO	78	0.2%
Marbled Chert	CM	26	0.1%
Green Chert	CV	219	0.7%
Munsungun Chert	MUN	21	0.1%
Cheshire Quartzite	QZC	1	0.0%
Rhyolite	RHY	4,486	14.4%
Local Gray Stone	GL	491	1.6%
Crystal Quartz	QC	35	0.1%
Quartz	QTZ	6,484	20.8%
Local silicified mudstone	SAL	16,497	52.8%
Siltstone	SLT	9	0.0%
White Quartzite	QZB	105	0.3%
Smoky Quartzite	QZF	32	0.1%
Gray Quartzite	QZG	88	0.3%
Marbled Gray Quartzite	QZMG	263	0.8%
Translucent Quartzite	QZT	3	0.0%
Total		**31,242**	**99.6%**

Table 3. Materials recovered from the Gaudreau site, with material code and quantity of debitage recovered from sample area. The percentages total to less than 100% due to rounding within individual material categories.

Other Cherts

These materials were coded during analysis as CM for *chert marbré* (marbled chert), CB for *chert beige*, CBR for *chert brun* (brown chert), CBL for *chert blanc* (white chert), MUN for Munsungun chert, and CHO for Onondaga chert. Some of the cherts at the Gaudreau site can be sourced based on macroscopic criteria—notably Munsungun and Onondaga chert—but most cannot. Primary and secondary deposits of chert in the Far Northeast are less frequent than sources of materials, so these raw materials were almost certainly imported from a relatively great distance. The low frequency of chert compared to local materials confirms that cherts were more difficult to obtain for inhabitants of the Gaudreau site, as they were knapped more sparingly. Table 3 summarizes the raw materials represented within the debitage recovered from the sample area, the quantity of each examined for this study, and the location of their source, whenever identification is possible.

4.1.2 – Raw Materials of the Tools

A total of 19 tools diagnostic of the Archaic period were recovered from the sample area (Table 4), comprised of 20 total artefacts due to refitting. Of these tools, six are made of gray chert, four of SAL, three of rhyolite, two of quartz, and one each of gray quartzite, local gray stone, and beige chert. Of the 21 different raw materials represented in the debitage of the Gaudreau site, only seven are represented within the tool assemblage. If the frequency of raw materials in the site's debitage were an accurate predictor of the raw materials represented by the tools, a much different distribution would be expected. Table 4 summarizes the raw materials observed among the tools from within the sample area, and the distribution of tools by raw material that would be expected based on the debitage from the sample area.

In addition to the Archaic artefacts found within the sample area, three Paleoindian artefacts were recovered as well. However, all occur near the edges of the sample area and so the vast majority of the excavation units sampled were not adjacent to units associated with that period. The presence of ceramics within the site presents a bigger problem. Within the sample area, and throughout the entire site, few quadrants were devoid of ceramic artefacts. In the area examined for this study, over 90% of quadrants yielded ceramic artefacts. Although these were mostly from the highest stratigraphic level, the same is true of lithic artefacts: within the 50 square metre area sampled for this study, 91% of artefacts occurred within the top stratigraphic layer of black organic soil. Archaic diagnostic tools occur in this layer, confirming the extensive vertical mixing present at the site. Given the ubiquity of this issue at the Gaudreau site, the presence of ceramics cannot be understood to invalidate the sample area as a representation of the Archaic period. Instead, the horizontal clustering of Archaic artefacts in this location should be viewed as the best representation of an Archaic occupation possible for the purposes of site analysis.

Code	Material	Tools Observed	Tools Expected
CB	Beige chert	1	0
CBL	White chert	0	0
CBR	Brown chert	0	0
CG	Gray chert	6	1
CHO	Onondaga chert	0	0
CM	Marbled chert	0	0
CV	Green chert	0	0
GL	Local gray stone	1	0
MUN	Munsungun chert	0	0
QC	Crystal quartz	0	0
QTZ	Quartz	2	4
QZB	White quartzite	0	0
QZC	Cheshire quartzite	0	0
QZF	Smokey quartzite	0	0
QZG	Gray quartzite	1	0
QZMG	Marbled gray quartzite	0	0
QZT	Translucent quartzite	0	0
RHY	Rhyolite	3	3
SAL	Local silicified mudstone	5	10
SLT	Siltstone	0	0
Total		19	18

Table 4. Distribution of raw materials of tools recovered from the sample area, compared to that expected based on the distribution of debitage. The expected number of tools was rounded to the nearest whole number for each raw material category (as artefacts are not counted as fractions of a tool), and thus the total expected sums to only 18.

The raw materials of artefacts recovered from the sample area are a representative sample of those present in the larger Archaic assemblage (Table 5). Of the forty total artefacts that represent the Archaic complex across the entire site, two are refits and thus 38 total tools comprise the assemblage. Of these, one lacks provenience information and two are surface finds, meaning their provenience is unreliable when compare to those recovered through excavation. Thus, 35 tools are considered in the total sample of Archaic diagnostics. Using the frequency of different raw materials within this assemblage, it is possible to predict what the frequencies of raw materials of a smaller, representative sample should be. The frequencies within the sample area conform to this and a chi-square test yields a p-value of 0.962. This reinforces the utility of this sample area, as it not only represents a concentration of activity, but the choices of which raw materials to utilize for bifaces within this area do not deviate substantially from those choices implemented over the site at large.

Code	Material	Observed in Sample Area	Expected in Sample Area	Site Total
CB	Beige chert	1	1	2
CBL	White chert	0	1	1
CG	Gray chert	5	6	12
CHO	Onondaga chert	0	1	1
GL	Local gray stone	2	2	4
QTZ	Quartz	2	2	4
QZG	Gray quartzite	1	1	2
RHY	Rhyolite	3	3	6
SAL	Local silicified mudstone	5	3	6
Total		19	19	38

Table 5. Observed and expected distribution of raw materials among Archaic tools from within the sample area, based on the assemblage from the entire site.

4.2 – Vertical Distribution of Artefacts

The Gaudreau site was not excavated using arbitrary levels (e.g. 5 cm or 10 cm levels), but rather followed the site's natural soil stratigraphy. This leaves little vertical control and complicates attempts to understand the distribution of artefacts vertically throughout the site. For the purposes of this analysis, an early level classification of *fin noir* has been reclassified based on its nearest matching level, taking into consideration both depth and soil quality. The *fin noir* classification was inconsistent between excavation seasons and excavators; understanding vertical distribution is thus easier after correcting these inconsistencies.

4.2.1 – Vertical Distribution of Debitage

The top layer excavated, recorded as *noir* in site and artefact records is by far the thickest and most disturbed layer. As the top layer, it was subject to both natural and man-made disturbance, including ploughing during the historic period. While all other layers are 10 or 15 cm in depth, the *noir* layer typically extends at least 20 cm and sometimes as much as 30 cm deep. As this layer represents the vast majority of excavation on site and the only layer excavated in most units, it is no surprise that 97.1% of all debitage recovered from the Archaic sample area came from this layer. Less than 0.1% (n = 13) of all pieces of debitage were recovered from the deepest, silty layer. A few patterns worthy of note do appear in the distribution of raw materials by layer however.

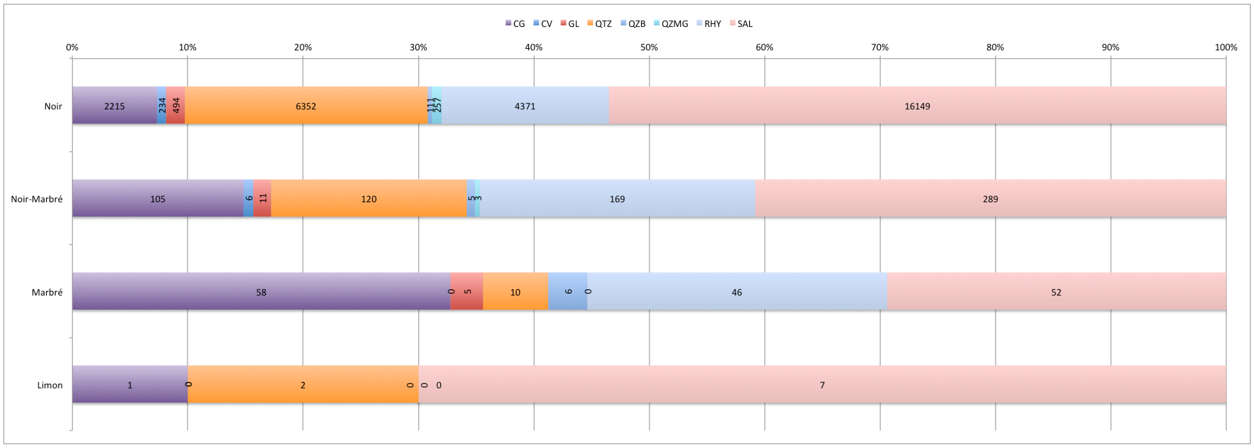


Figure 11. Distribution of raw materials in each natural stratigraphic layer.

Although there are few flakes in the deepest layer, SAL is clearly the dominant material, while quartz and crystal quartz also occur. A single flake of gray chert was recovered from this level. The next layer up, a *marbré* transition between organic soil and silt, reflects a strong shift towards favouring gray chert as a material. Rhyolite also becomes prominent in this layer, although the local silicified mudstone does remain in use. Closer to the surface in the mixed *noir-marbré* layer, quartz gains importance and rhyolite remains key. SAL gains some of its prior prominence at the expense of gray chert. Finally, in the topmost *noir* layer, SAL strongly dominates, followed by quartz and then rhyolite. Combining the lower three layers yields a general trend of increasing proportions of SAL and quartz towards the surface, and a decrease in gray chert and rhyolite. It is also possible, therefore, to classify the lower three levels as being associated with the Paleoindian and *noir* with the later periods, given the tendency of Paleoindian peoples to favour higher quality, imported lithic raw materials and the general trend away from this preference during later time periods. The distribution of this assemblage into three visually and texturally distinct soil layers could be easily attributable to site formation processes and disturbance.

Figure 12. Vertical distribution of raw materials from *noir* layer and bottom three stratigraphic layers.

4.2.2 – Vertical Distribution of Ceramics

Ceramic artefacts at the Gaudreau site show a similar pattern of concentration in the upper *noir* layer. This pattern is significantly stronger among the ceramics than among the lithic debitage. While the lowest three layers- *noir-marbré*, *marbré*, and *limon*- yielded some 2.9% of the debitage from this area, they yielded a meagre 0.7% (n = 16) of ceramic artefacts. The entirety of these ceramics recovered below the *noir* level came from the transitional *noir-marbré*. That is, no ceramics were recovered from the *marbré* or *limon* layers. Given how small a proportion of the debitage assemblage was recovered from the *marbré* and *limon* layers, the difference in artefact distribution is most noticeable in the *noir-marbré*.

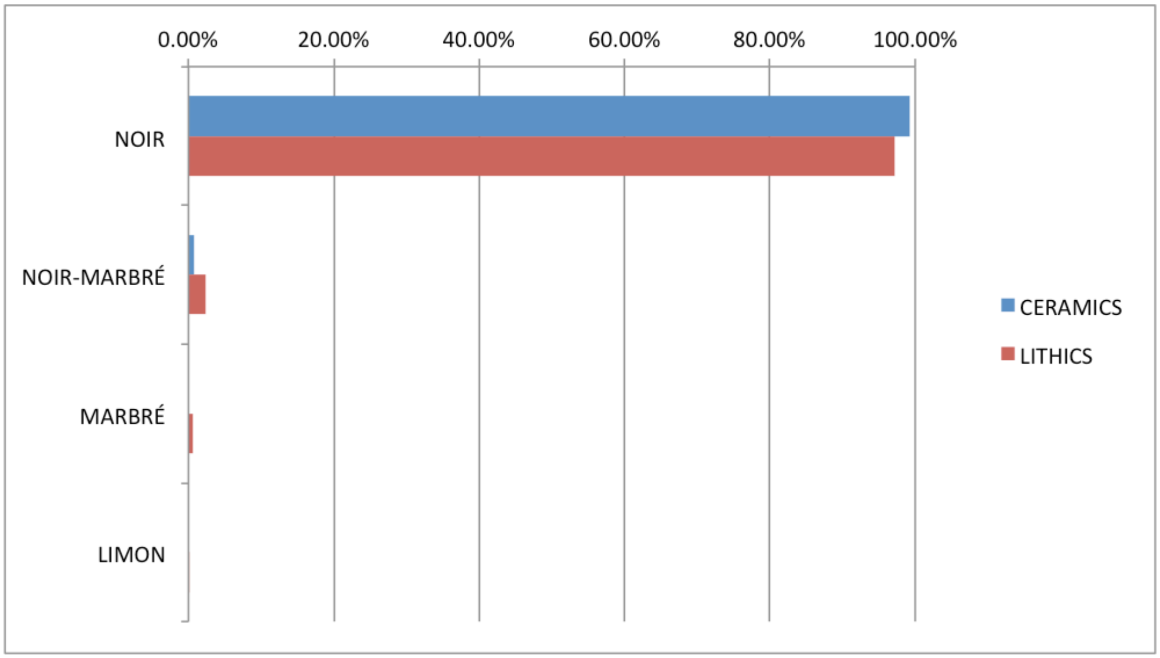


Figure 13. Comparative vertical distribution of lithic and ceramic artefacts by stratigraphic layer, as a percentage of total assemblage

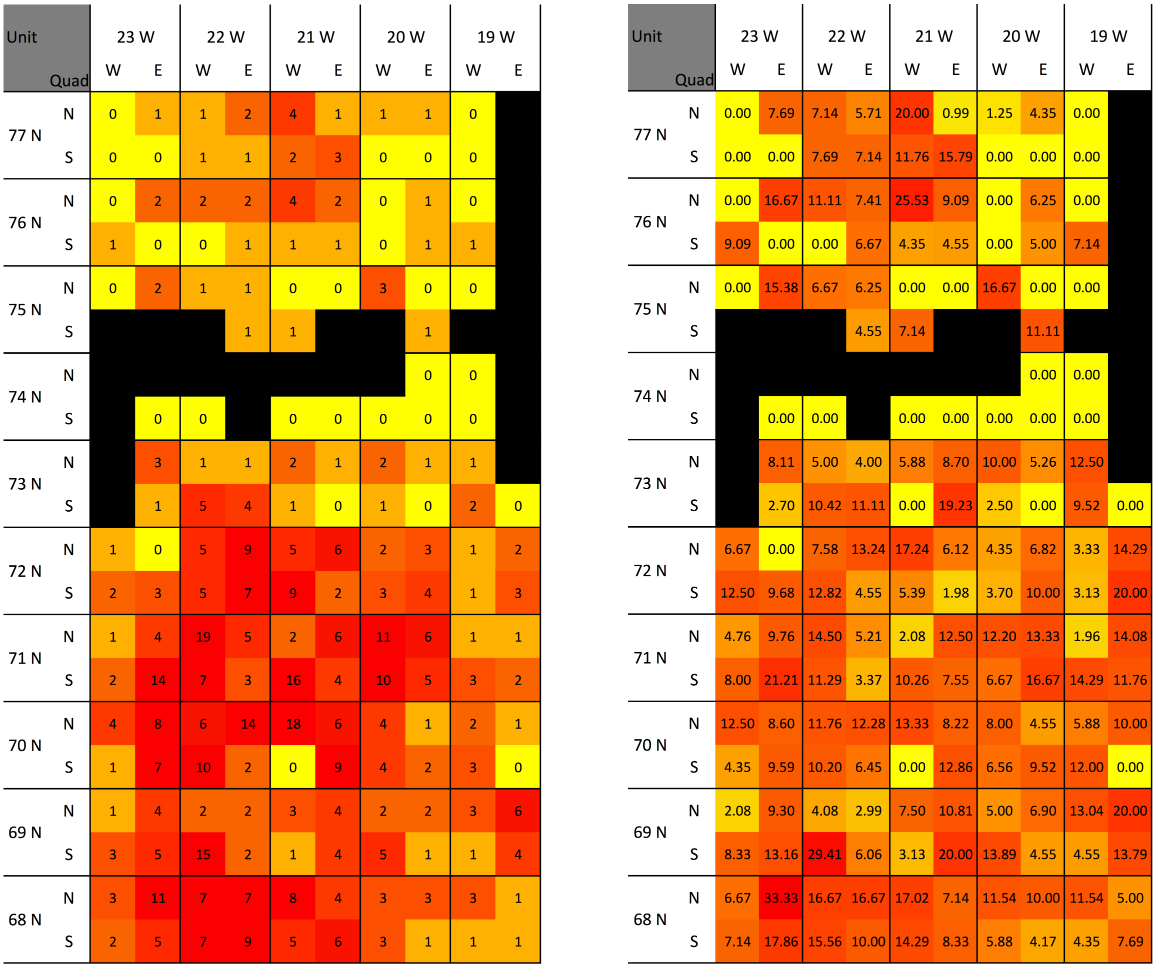
To better understand the vertical distribution of these artefacts, it is worth also considering which units contained ceramics below the *noir* level. In the case of ceramics, only five quadrants yielded ceramics in the *noir-marbré* level, all of which contained fewer than ten fragments. Each of these quadrants, however, directly bounded an unexcavated quadrant. As the excavations continued in all directions beyond the sample area, the choice to leave quadrants here unexcavated was made due to the presence of cultivated spruce. The combination of the initial planting and later root activity would have made those areas near the spruce trees subject to more extensive disturbance than in other areas. This may partially explain the minimal extension of ceramic artefacts below the top *noir* layer. This is further confirmed by the fact that the lithic debitage shows a similar patterning with *noir-marbré* artefacts clustered around the unexcavated areas that were planted with spruce.

4.3 – Horizontal Distribution of Artefacts

Considering the broader horizontal distribution of artefacts from the Archaic sample area, a few key patterns emerge. The distribution of flakes with different attributes, flakes that fit within certain typologies, and the respective distributions of exotic, regional, and local materials should be considered individually and in concert. As excavations were conducted by quadrants of square metre units, the resolution of all mapping is 50 cm. Twenty-six quadrants were left unexcavated due to the presence of cultivated spruce trees in the area. In mapping, these unexcavated quadrants are represented with solid black fill.

4.3.1 – Pressure Flakes

Pressure flakes were mapped using two different measures: the number of pressure flakes per quadrant, and the proportion of pressure flakes among all debitage examined from that quadrant. This was done to ensure that an unusually high or low count of total debitage did not misrepresent any spatial patterning present. Both methods, however, showed similar trends in spatial distribution (Figure 14). Pressure flakes were most common in two areas. The first was along a diagonal path from 69N 22W to 72N 19W. The other is smaller, and runs from 77N 22W to 76N 21W. These areas yielded the highest total numbers of pressure flakes and the highest rates of pressure flakes as a percentage of all flakes examined. These areas also overlap closely with the units that have the highest total quantities of debitage.



Unit		23 W		22 W		21 W		20 W		19 W	
	Quad	W	E	W	E	W	E	W	E	W	E
77 N	N	0	1	1	2	4	1	1	1	0	
	S	0	0	1	1	2	3	0	0	0	
76 N	N	0	2	2	2	4	2	0	1	0	
	S	1	0	0	1	1	1	0	1	1	
75 N	N	0	2	1	1	0	0	3	0	0	
	S				1	1			1		
74 N	N								0	0	
	S		0	0		0	0	0	0	0	
73 N	N		3	1	1	2	1	2	1	1	
	S		1	5	4	1	0	1	0	2	0
72 N	N	1	0	5	9	5	6	2	3	1	2
	S	2	3	5	7	9	2	3	4	1	3
71 N	N	1	4	19	5	2	6	11	6	1	1
	S	2	14	7	3	16	4	10	5	3	2
70 N	N	4	8	6	14	18	6	4	1	2	1
	S	1	7	10	2	0	9	4	2	3	0
69 N	N	1	4	2	2	3	4	2	2	3	6
	S	3	5	15	2	1	4	5	1	1	4
68 N	N	3	11	7	7	8	4	3	3	3	1
	S	2	5	7	9	5	6	3	1	1	1

Unit		23 W		22 W		21 W		20 W		19 W	
	Quad	W	E	W	E	W	E	W	E	W	E
77 N	N	0.00	7.69	7.14	5.71	20.00	0.99	1.25	4.35	0.00	
	S	0.00	0.00	7.69	7.14	11.76	15.79	0.00	0.00	0.00	
76 N	N	0.00	16.67	11.11	7.41	25.53	9.09	0.00	6.25	0.00	
	S	9.09	0.00	0.00	6.67	4.35	4.55	0.00	5.00	7.14	
75 N	N	0.00	15.38	6.67	6.25	0.00	0.00	16.67	0.00	0.00	
	S				4.55	7.14			11.11		
74 N	N								0.00	0.00	
	S		0.00	0.00		0.00	0.00	0.00	0.00	0.00	
73 N	N		8.11	5.00	4.00	5.88	8.70	10.00	5.26	12.50	
	S		2.70	10.42	11.11	0.00	19.23	2.50	0.00	9.52	0.00
72 N	N	6.67	0.00	7.58	13.24	17.24	6.12	4.35	6.82	3.33	14.29
	S	12.50	9.68	12.82	4.55	5.39	1.98	3.70	10.00	3.13	20.00
71 N	N	4.76	9.76	14.50	5.21	2.08	12.50	12.20	13.33	1.96	14.08
	S	8.00	21.21	11.29	3.37	10.26	7.55	6.67	16.67	14.29	11.76
70 N	N	12.50	8.60	11.76	12.28	13.33	8.22	8.00	4.55	5.88	10.00
	S	4.35	9.59	10.20	6.45	0.00	12.86	6.56	9.52	12.00	0.00
69 N	N	2.08	9.30	4.08	2.99	7.50	10.81	5.00	6.90	13.04	20.00
	S	8.33	13.16	29.41	6.06	3.13	20.00	13.89	4.55	4.55	13.79
68 N	N	6.67	33.33	16.67	16.67	17.02	7.14	11.54	10.00	11.54	5.00
	S	7.14	17.86	15.56	10.00	14.29	8.33	5.88	4.17	4.35	7.69

Figure 14. Pressure flakes, total number per quadrants (left) and percentage of debitage per quadrant (right).

Outside these areas, rates of pressure flaking are noticeably lower and the rate of pressure flaking generally declines toward the north within the sample area. Although the northern concentration of pressure flakes shows noticeably higher rates than the areas that surround it, it remains significantly weaker than the more southern concentration. To an extent, these patterns follow the same trend established by the formal and diagnostic Archaic period tools recovered from within the sample area. This is especially true with regard to the presence of a strong concentration of both diagnostic tools and pressure flakes within the 70N and 71N transects, between 21W and 22W. More interesting, however, is the fact that some of the strongest indicators of Archaic occupation come from just to the east of the northern, weaker concentration of pressure flakes. This indicates a certain, although minimal, disparity between the presence of pressure flakes and the Archaic occupation, which is reasonable give that the Archaic also involved strong focuses on ground stone tools, unifacial tools, and tools with less finely flaked tools than in previous Paleoindian period.

Specific Pressure Flake Types

Certain flakes produced with pressure indicate specific types of finishing or retouch. Both notching and platform preparation flakes were identified among the debitage from the sample area. Notching flakes were in gray chert and rhyolite, while platform preparation flakes were in gray chert, rhyolite, green chert, and quartz. Their distribution is shown in Figure 13. This corresponds strongly with the general distribution of pressure flakes and is a strong indication that this area was used for the final retouch of tools.

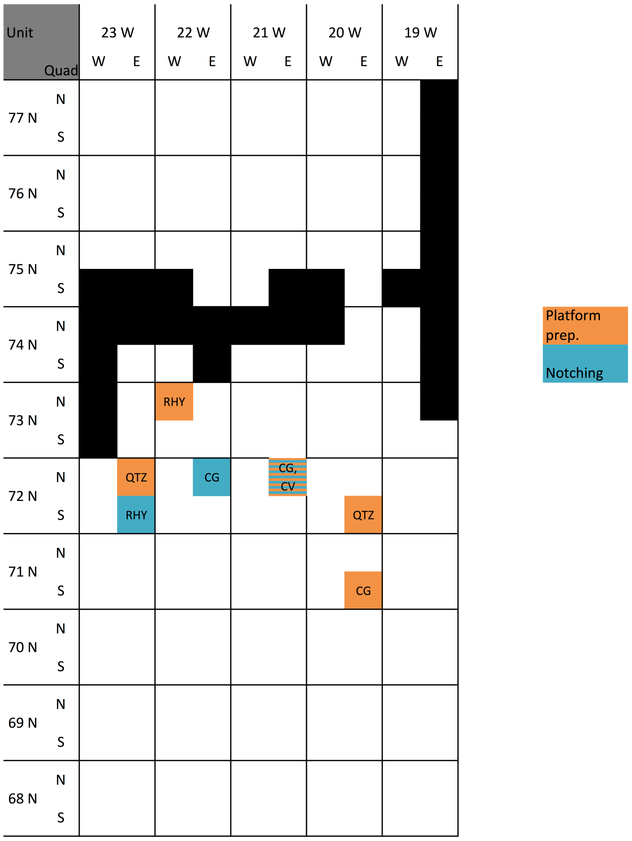
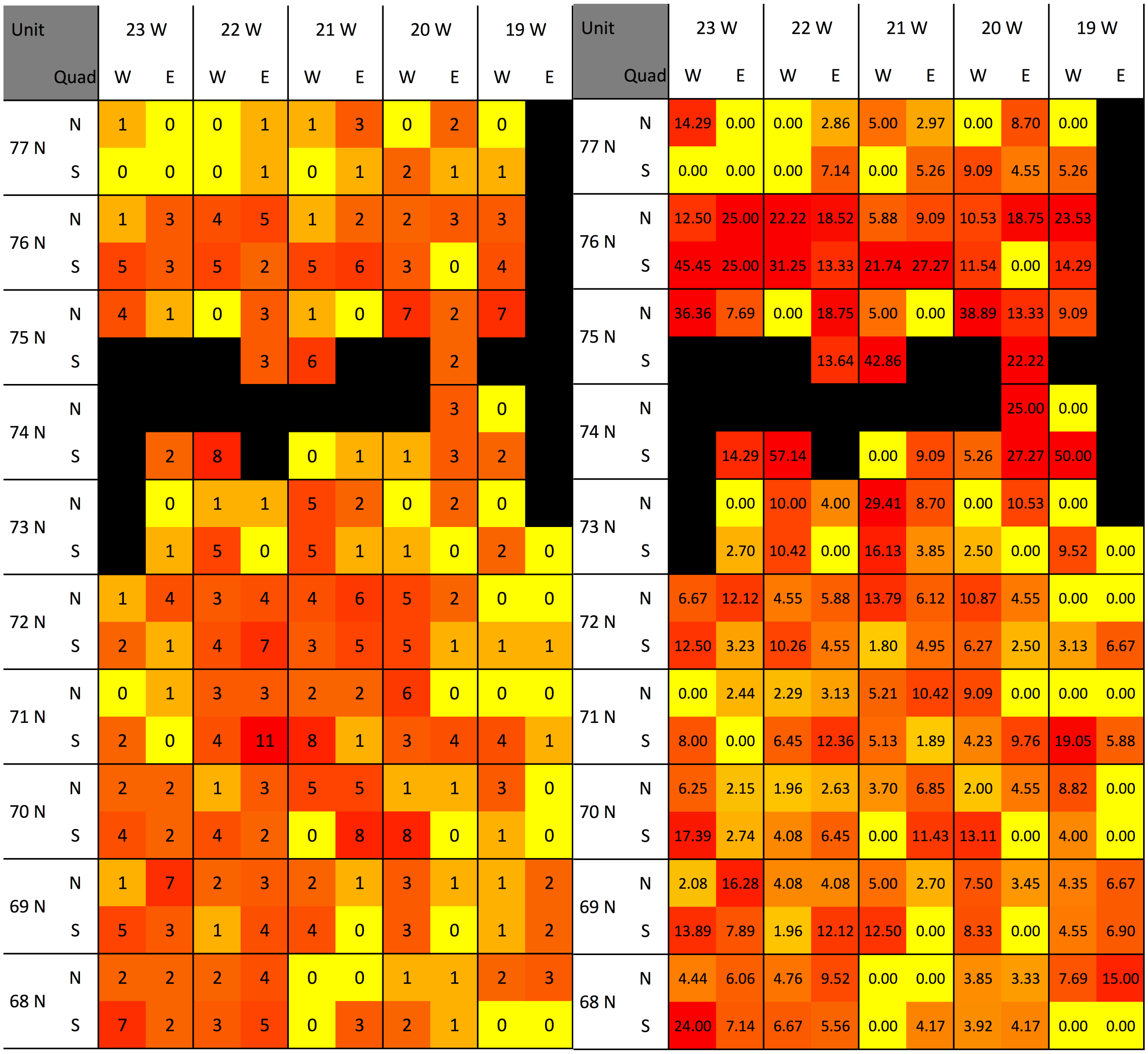


Figure 15. Pressure flakes specific to finishing and retouch.

4.3.2 - Biface Reduction Flakes

Biface reduction flakes were mapped following the same protocol as pressure flakes, again to avoid the possible skewing influence of quadrants with especially high or low debitage quantities. Unlike the patterning derived from pressure flake rates, biface reduction flake deposition patterning differs significantly when comparing the total number of flakes of this type versus the proportion of debitage represented by this type of flake. While the raw number of biface reduction flakes generally reflects the overall frequency of debitage and is similar to pressure flake patterning, the proportion of debitage represented by biface reduction flakes reveals a different pattern. The northern concentration of the raw totals of biface reduction flakes is simply shifted about a metre to the east of that produced by pressure flakes. The southern concentration of biface reduction flakes reflects the pressure flake concentration shifted a metre west.



Unit		23 W		22 W		21 W		20 W		19 W	
	Quad	W	E	W	E	W	E	W	E	W	E
77 N	N	1	0	0	1	1	3	0	2	0	
	S	0	0	0	1	0	1	2	1	1	
76 N	N	1	3	4	5	1	2	2	3	3	
	S	5	3	5	2	5	6	3	0	4	
75 N	N	4	1	0	3	1	0	7	2	7	
	S				3	6			2		
74 N	N								3	0	
	S		2	8		0	1	1	3	2	
73 N	N		0	1	1	5	2	0	2	0	
	S		1	5	0	5	1	1	0	2	0
72 N	N	1	4	3	4	4	6	5	2	0	0
	S	2	1	4	7	3	5	5	1	1	1
71 N	N	0	1	3	3	2	2	6	0	0	0
	S	2	0	4	11	8	1	3	4	4	1
70 N	N	2	2	1	3	5	5	1	1	3	0
	S	4	2	4	2	0	8	8	0	1	0
69 N	N	1	7	2	3	2	1	3	1	1	2
	S	5	3	1	4	4	0	3	0	1	2
68 N	N	2	2	2	4	0	0	1	1	2	3
	S	7	2	3	5	0	3	2	1	0	0

Unit		23 W		22 W		21 W		20 W		19 W	
	Quad	W	E	W	E	W	E	W	E	W	E
77 N	N	14.29	0.00	0.00	2.86	5.00	2.97	0.00	8.70	0.00	
	S	0.00	0.00	0.00	7.14	0.00	5.26	9.09	4.55	5.26	
76 N	N	12.50	25.00	22.22	18.52	5.88	9.09	10.53	18.75	23.53	
	S	45.45	25.00	31.25	13.33	21.74	27.27	11.54	0.00	14.29	
75 N	N	36.36	7.69	0.00	18.75	5.00	0.00	38.89	13.33	9.09	
	S				13.64	42.86			22.22		
74 N	N								25.00	0.00	
	S		14.29	57.14		0.00	9.09	5.26	27.27	50.00	
73 N	N		0.00	10.00	4.00	29.41	8.70	0.00	10.53	0.00	
	S		2.70	10.42	0.00	16.13	3.85	2.50	0.00	9.52	0.00
72 N	N	6.67	12.12	4.55	5.88	13.79	6.12	10.87	4.55	0.00	0.00
	S	12.50	3.23	10.26	4.55	1.80	4.95	6.27	2.50	3.13	6.67
71 N	N	0.00	2.44	2.29	3.13	5.21	10.42	9.09	0.00	0.00	0.00
	S	8.00	0.00	6.45	12.36	5.13	1.89	4.23	9.76	19.05	5.88
70 N	N	6.25	2.15	1.96	2.63	3.70	6.85	2.00	4.55	8.82	0.00
	S	17.39	2.74	4.08	6.45	0.00	11.43	13.11	0.00	4.00	0.00
69 N	N	2.08	16.28	4.08	4.08	5.00	2.70	7.50	3.45	4.35	6.67
	S	13.89	7.89	1.96	12.12	12.50	0.00	8.33	0.00	4.55	6.90
68 N	N	4.44	6.06	4.76	9.52	0.00	0.00	3.85	3.33	7.69	15.00
	S	24.00	7.14	6.67	5.56	0.00	4.17	3.92	4.17	0.00	0.00

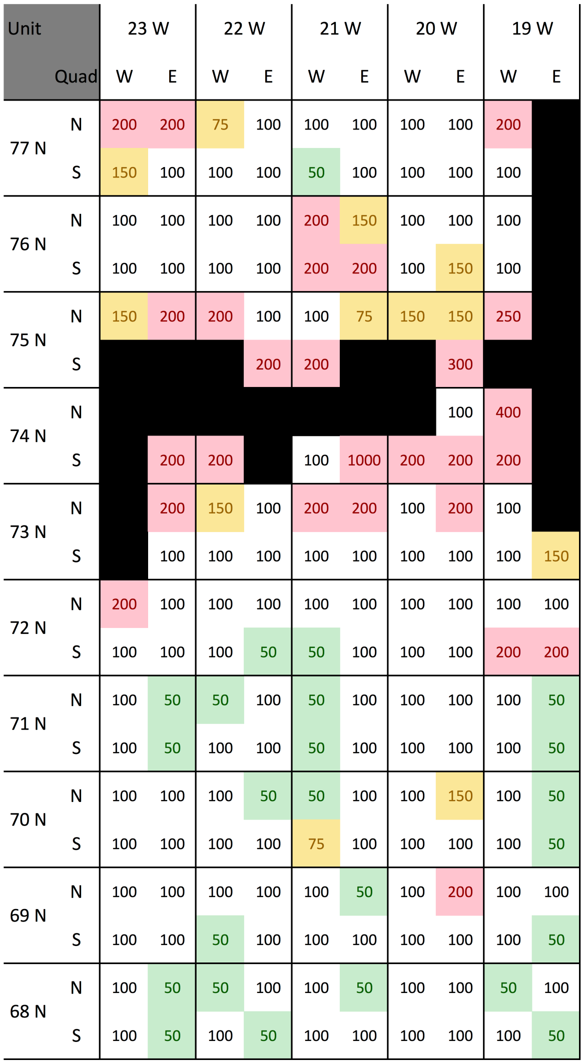
Figure 16. Distribution of biface reduction flakes as total quantity per quadrant (left) and percent of total debitage per quadrant (right).

The concentration of biface flakes as a proportion of all flakes examined shows something different. Instead of two concentrations, there is only one, and rather than being towards the south of the studied area, this concentration is in the northern part of the area examined. Biface reduction flakes as a proportion of debitage peaks from approximately 76N 23W to 74N 20W. While it is tempting to surmise that these must simply result from abnormally low debitage counts that allowed a few flakes to skew the percentage, on the whole this is not the case. Instead, the units in this part of the site yielded quantities of debitage within the middle 50% (for quadrants, Q1 = 32 and Q3 = 237.75; for metre square units, Q1 = 128 and Q3 = 951).

None of the values were so extreme as to be considered outliers. Those areas with the particularly high debitage totals have biface reduction rates are close to that of the entire sample area, 6.4%. Although there exist a few other individual quadrants with high rates of biface reduction flakes, nowhere else within the sample area does such a strong cluster of high rates exist.

4.3.3 – Flake Size

In considering spatial patterning by flake size, median was used instead of arithmetic mean in order to ensure that outliers, such as the extremely large cortical flakes present in some quadrants, did not skew results and obscure any patterns that existed. The likelihood that this would happen is confirmed by the fact that the median flake size for the entire sample area is 100 sq. mm, while the mean is 155.24 sq. mm. For the entire site, the first and third quartiles are 50 sq. mm and 200 sq. mm, respectively. By mapping the median flake size of each quadrant and highlighting those that deviate from the overall median, areas with unusually large and small flake sizes can be identified (Figure 17). A yellow highlight was used for those quadrants that deviated from the overall median, but still remained within the middle 50%. Those quadrants whose medians were at least the third quartile of the sample area were highlighted in light red, and those whose medians were at most the first quartile of the sample area were highlighted in light green.



Unit		23 W		22 W		21 W		20 W		19 W	
	Quad	W	E	W	E	W	E	W	E	W	E
77 N	N	200	200	75	100	100	100	100	100	200	
	S	150	100	100	100	50	100	100	100	100	
76 N	N	100	100	100	100	200	150	100	100	100	
	S	100	100	100	100	200	200	100	150	100	
75 N	N	150	200	200	100	100	75	150	150	250	
	S				200	200			300		
74 N	N								100	400	
	S		200	200		100	1000	200	200	200	
73 N	N		200	150	100	200	200	100	200	100	
	S		100	100	100	100	100	100	100	100	150
72 N	N	200	100	100	100	100	100	100	100	100	100
	S	100	100	100	50	50	100	100	100	200	200
71 N	N	100	50	50	100	50	100	100	100	100	50
	S	100	50	100	100	50	100	100	100	100	50
70 N	N	100	100	100	50	50	100	100	150	100	50
	S	100	100	100	100	75	100	100	100	100	50
69 N	N	100	100	100	100	100	50	100	200	100	100
	S	100	100	50	100	100	100	100	100	100	50
68 N	N	100	50	50	100	100	50	100	100	50	100
	S	100	50	100	50	100	100	100	100	100	50

Figure 17. Median flake sizes.

One trend is immediately apparent: that larger flakes tend to be found toward the northern part of the sample area, and smaller flakes to the southern part. These concentrations do not align perfectly with those displayed by pressure flakes and biface reduction flakes, but the three certainly have key similarities. Larger flake sizes are concentrated from the northern quadrants of the 73N transect to the 75N transect. Importantly, this includes the concentration of high rates of biface reduction flakes. Small flakes sizes are more scattered, but tend to occur from the 71N transect and southward. This area includes the most significant concentration of pressure flakes. The two trends—flake typology and flake size—are necessarily related due to the very nature of typology. However, as the vast majority of flakes were not assigned to a specific type as they did not clearly fit a category, it seems the trends in typology are a reflection of a more general trend in flake size. As a reflection of biface production stage, horizontal patterning in flake sizes would indicate that earlier stages of biface reduction occurred near the northern parts of the sample areas, while the final steps to finish a tool (Callahan's stage 5, 1979) typically occurred in the southern part of the sample area.

Using flakes as expedient tools, with or without retouch, requires that flakes be a certain size. Thus, the distribution of flakes at least 600 sq. mm in size was also considered in light of this distribution. As size appeared to follow a general north-south trend, these large flakes were considered by northing to see if their frequency reflected the same pattern. The frequency of large flakes decreased for the 69N, 70N, 71N, 74N, and 75N transects, where the concentrations of exotic debitage occur. The remaining transects comprise over half of all large sized flakes. This is generally in line with the trend observed with median flake size, with smaller sizes from the 71N transect and southward. However, it reveals an interesting corollary, that although the median size increases 73N to 75N, the largest flake sizes decrease in quantity over that same area.

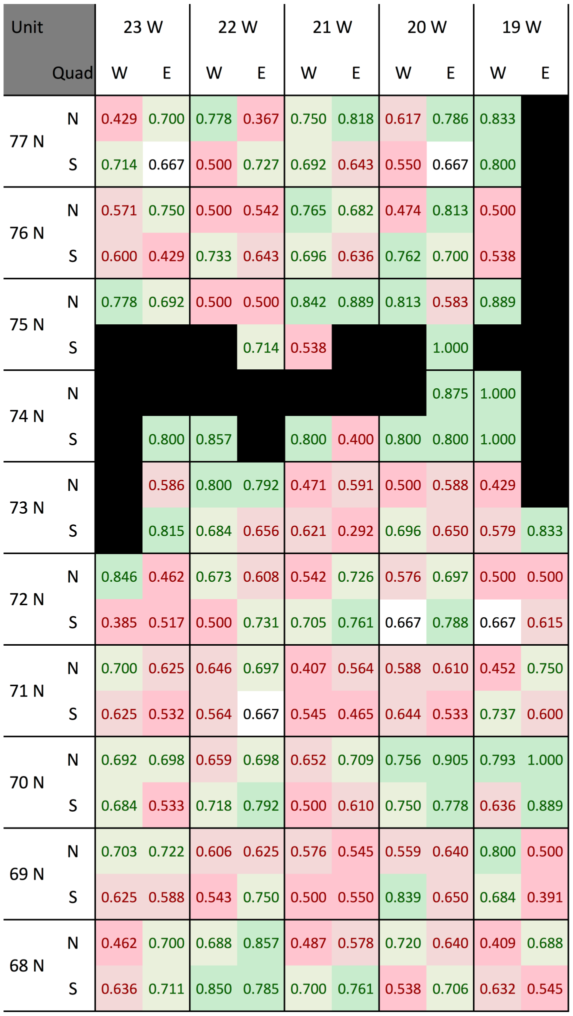
Transect	Large flakes recovered	Percent of large flakes
68N	17	10.8%
69N	13	8.5%
70N	14	8.9%
71N	15	9.5%
72N	29	18.4%
73N	24	15.2%
74N	8	5.1%
75N	8	5.1%
76N	16	10.1%
77N	14	8.9%
Total	*158*	*100.0%*

Table 6. Frequency of all flakes 600 sq. mm in size or larger, by northing.

4.3.4 – Rate of Platform Faceting

The percent of examined flakes that exhibited platform faceting was also mapped by quadrants, to see if any spatial patterning existed (Figure 18). Quadrants whose rate for platform faceting fell above the median but within the middle 50% of values were highlighted in a light green, and those that were at least the third quartile were highlighted in a darker green. Values below the median but within the middle 50% were labeled in light red, and those at or below the first quartile labeled in a darker red. Although some small degree of clustering existed in the southern portion of the sample area, the only significant concentration of faceting rates is along the 75N and 74N transects. Here rates of platform faceting are unusually high, with most percentage being at least the third quartile.

Among those materials that yielded at least 50 combined proximal flake fragments and complete flakes, gray chert and local gray stone had the highest rates of platform faceting at 68.2% and 68.3%, respectively. Green chert and marbled gray quartzite had the lowest rates at 54.0% and 53.4%, respectively. Among other materials that yielded at least 50 proximal flake fragments, the rate of platform faceting fell within the middle 50% of the range. The low rate of platform faceting among marbled gray quartzite and green chert likely reflects its particular usage, while the high rate among gray chert is to be expected given its rate of use for formal bifacial tools. The high rate of faceting among local gray stone was unexpected, but is likely due to the fact that, although local, it is closer to a chert than the SAL is, and was continued to later production stages more frequently than other raw materials.



Unit		23 W		22 W		21 W		20 W		19 W	
	Quad	W	E	W	E	W	E	W	E	W	E
77 N	N	0.429	0.700	0.778	0.367	0.750	0.818	0.617	0.786	0.833	
	S	0.714	0.667	0.500	0.727	0.692	0.643	0.550	0.667	0.800	
76 N	N	0.571	0.750	0.500	0.542	0.765	0.682	0.474	0.813	0.500	
	S	0.600	0.429	0.733	0.643	0.696	0.636	0.762	0.700	0.538	
75 N	N	0.778	0.692	0.500	0.500	0.842	0.889	0.813	0.583	0.889	
	S				0.714	0.538			1.000		
74 N	N								0.875	1.000	
	S		0.800	0.857		0.800	0.400	0.800	0.800	1.000	
73 N	N		0.586	0.800	0.792	0.471	0.591	0.500	0.588	0.429	
	S		0.815	0.684	0.656	0.621	0.292	0.696	0.650	0.579	0.833
72 N	N	0.846	0.462	0.673	0.608	0.542	0.726	0.576	0.697	0.500	0.500
	S	0.385	0.517	0.500	0.731	0.705	0.761	0.667	0.788	0.667	0.615
71 N	N	0.700	0.625	0.646	0.697	0.407	0.564	0.588	0.610	0.452	0.750
	S	0.625	0.532	0.564	0.667	0.545	0.465	0.644	0.533	0.737	0.600
70 N	N	0.692	0.698	0.659	0.698	0.652	0.709	0.756	0.905	0.793	1.000
	S	0.684	0.533	0.718	0.792	0.500	0.610	0.750	0.778	0.636	0.889
69 N	N	0.703	0.722	0.606	0.625	0.576	0.545	0.559	0.640	0.800	0.500
	S	0.625	0.588	0.543	0.750	0.500	0.550	0.839	0.650	0.684	0.391
68 N	N	0.462	0.700	0.688	0.857	0.487	0.578	0.720	0.640	0.409	0.688
	S	0.636	0.711	0.850	0.785	0.700	0.761	0.538	0.706	0.632	0.545

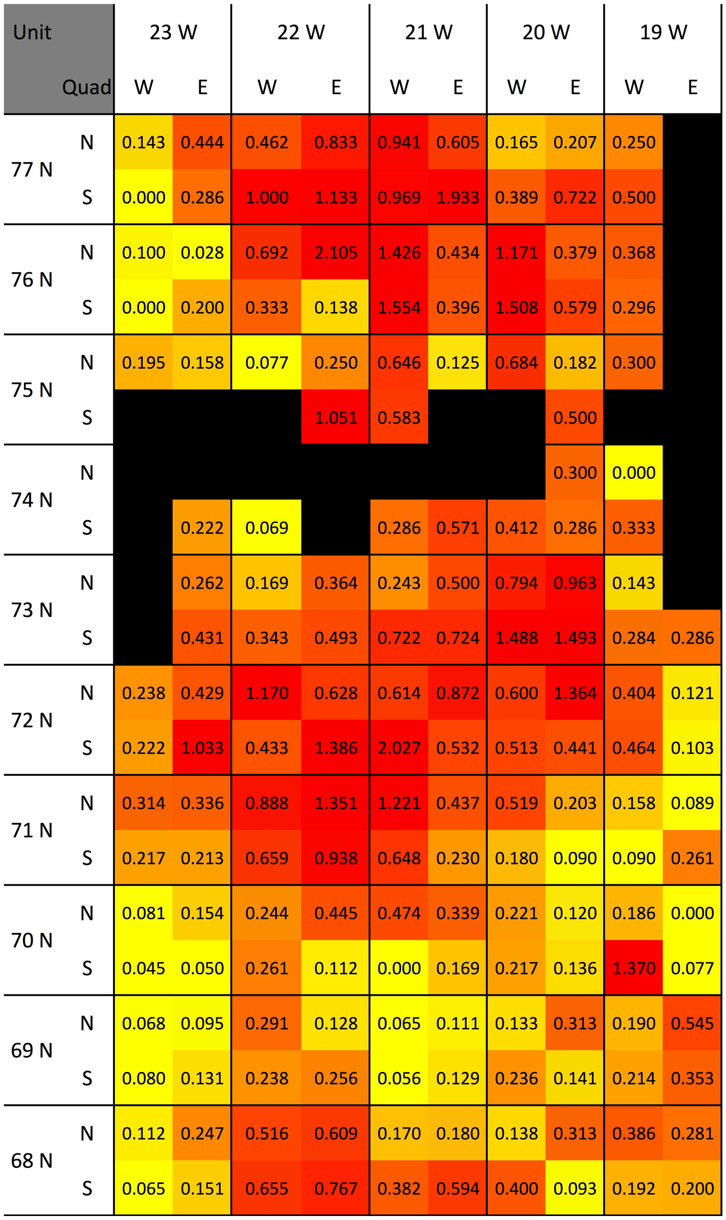
Figure 18. Distribution of platform faceting rates, with low rates highlighted in red and high rates in green.

This area corresponds closely with the concentration of larger sized flakes. Extreme values do not cluster so strongly elsewhere and the distribution of platform facets appears more random. When considering an entire assemblage, a high proportion of flakes with platform facets indicates a later stage of production. However, small flakes can have platforms small enough that they do not intersect the ridges left from previous removals and therefore do not display faceting (Towner and Warburton 1990). This is similar to the more random patterning seen in areas where smaller and pressure flakes were more common. With the frequency of platform facets among larger flakes and biface reduction flakes, it appears that most material worked at the Gaudreau site was reduced prior to arriving on site, likely begun at the raw material source and then transported as blanks or preforms.

4.3.5 – Exotic Materials

The distribution of exotic materials was considered as the ratio of debitage from exotic sources to debitage from local and regional sources. Thus, for example, a quadrant would be assigned a value of 1.00 if it yielded as much exotic debitage as it did debitage from both local and regional sources combined. If half as much exotic debitage as local and regional debitage were recovered from a quadrant, it would receive a value of 0.5. Using this ratio, rather than simply calculating exotic materials as a percentage of all debitage, emphasizes the difference between the quantities present of each type of material. Mapping these and applying a gradient to highlight the highest values revealed two key concentrations, similar to those previously seen. The more northern concentration of exotic materials stretches from 77N 22W to 76N 20W. The southern concentration spans the area from 71N 22W to 73N 20W.

Based on the resulting map (Figure 19), it appears that those areas with previously discerned attribute patterns—including type, size, and faceting—also tend to have much higher rates of exotic materials. Not only are these materials imported over a great distance, but this is done specifically because they are of a higher quality and therefore prized. Thus, the areas with high rates of exotic materials also represent concentrations of high quality lithic raw material. The most common exotic materials are rhyolite and gray chert, which together comprise 55% (n = 11) of the formal tools recovered from the sample area. The concentrations of exotic materials represent the areas where these tools—or their replacements after discard—were produced.

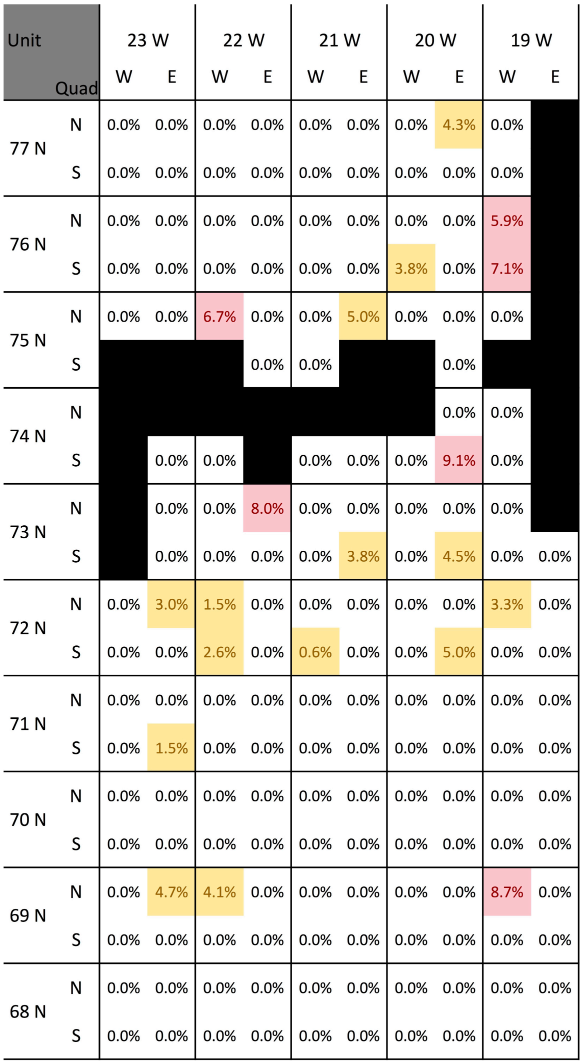


Unit		23 W		22 W		21 W		20 W		19 W	
	Quad	W	E	W	E	W	E	W	E	W	E
77 N	N	0.143	0.444	0.462	0.833	0.941	0.605	0.165	0.207	0.250	
	S	0.000	0.286	1.000	1.133	0.969	1.933	0.389	0.722	0.500	
76 N	N	0.100	0.028	0.692	2.105	1.426	0.434	1.171	0.379	0.368	
	S	0.000	0.200	0.333	0.138	1.554	0.396	1.508	0.579	0.296	
75 N	N	0.195	0.158	0.077	0.250	0.646	0.125	0.684	0.182	0.300	
	S				1.051	0.583			0.500		
74 N	N								0.300	0.000	
	S		0.222	0.069		0.286	0.571	0.412	0.286	0.333	
73 N	N		0.262	0.169	0.364	0.243	0.500	0.794	0.963	0.143	
	S		0.431	0.343	0.493	0.722	0.724	1.488	1.493	0.284	0.286
72 N	N	0.238	0.429	1.170	0.628	0.614	0.872	0.600	1.364	0.404	0.121
	S	0.222	1.033	0.433	1.386	2.027	0.532	0.513	0.441	0.464	0.103
71 N	N	0.314	0.336	0.888	1.351	1.221	0.437	0.519	0.203	0.158	0.089
	S	0.217	0.213	0.659	0.938	0.648	0.230	0.180	0.090	0.090	0.261
70 N	N	0.081	0.154	0.244	0.445	0.474	0.339	0.221	0.120	0.186	0.000
	S	0.045	0.050	0.261	0.112	0.000	0.169	0.217	0.136	1.370	0.077
69 N	N	0.068	0.095	0.291	0.128	0.065	0.111	0.133	0.313	0.190	0.545
	S	0.080	0.131	0.238	0.256	0.056	0.129	0.236	0.141	0.214	0.353
68 N	N	0.112	0.247	0.516	0.609	0.170	0.180	0.138	0.313	0.386	0.281
	S	0.065	0.151	0.655	0.767	0.382	0.594	0.400	0.093	0.192	0.200

Figure 19. Ratio of exotic raw materials to combined local and regional materials.

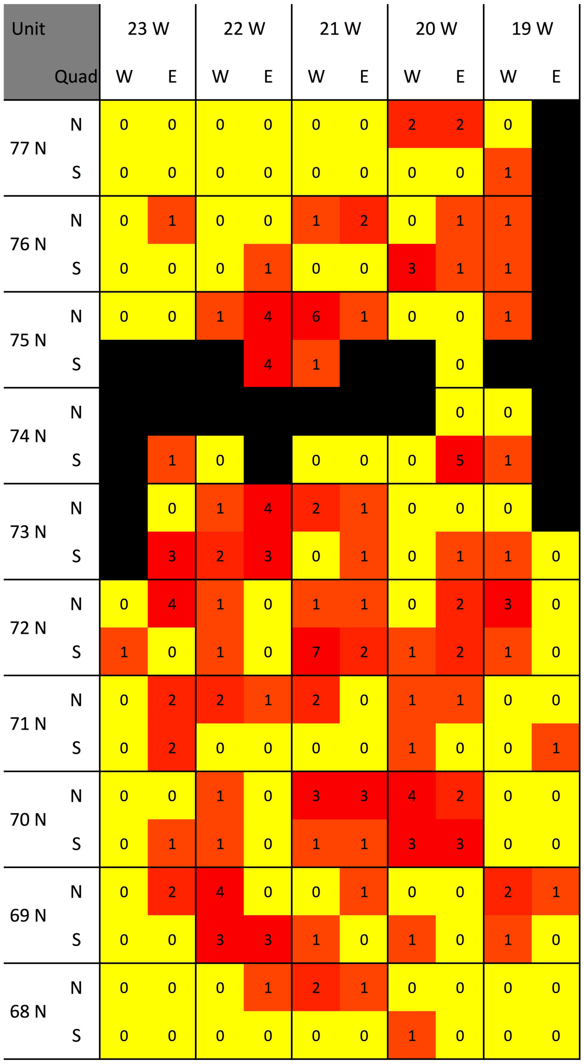
4.3.6 – Wide and Battered Flakes

Wide flakes with platform battering were rare among the Gaudreau debitage, with an overall rate of 0.4%. The vast majority of excavated quadrants yielded no flakes both with battered platforms and a greater width than length, as only 25 were identified in the sample and no quadrants yielded more than two. These flakes are scattered throughout the sample area and are primarily concentrated toward the center of this area (Figure 20). Generally, the distribution reflects both that of other specific flake types and exotic materials. Although the small sample size makes it difficult to identify any major concentration area of this sort for wide flakes, their distribution does not contradict those areas previously established. More importantly, the distribution of all flakes with battered platforms (Figure 21) shows a similar pattern to those established previously. This distribution relies on a much larger sample size, and reinforces these same patterns. The wide battered flakes trace the edges defined by the distribution of all flakes with battered platforms, and this, too, reflects the combined distributions of biface reduction and pressure flakes.



Unit	Quad	23 W		22 W		21 W		20 W		19 W	
		W	E	W	E	W	E	W	E	W	E
77 N	N	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	4.3%	0.0%	
	S	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	
76 N	N	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	5.9%	
	S	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	3.8%	0.0%	7.1%	
75 N	N	0.0%	0.0%	6.7%	0.0%	0.0%	5.0%	0.0%	0.0%	0.0%	
	S				0.0%	0.0%			0.0%		
74 N	N								0.0%	0.0%	
	S		0.0%	0.0%		0.0%	0.0%	0.0%	9.1%	0.0%	
73 N	N		0.0%	0.0%	8.0%	0.0%	0.0%	0.0%	0.0%	0.0%	
	S		0.0%	0.0%	0.0%	0.0%	3.8%	0.0%	4.5%	0.0%	0.0%
72 N	N	0.0%	3.0%	1.5%	0.0%	0.0%	0.0%	0.0%	0.0%	3.3%	0.0%
	S	0.0%	0.0%	2.6%	0.0%	0.6%	0.0%	0.0%	5.0%	0.0%	0.0%
71 N	N	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%
	S	0.0%	1.5%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%
70 N	N	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%
	S	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%
69 N	N	0.0%	4.7%	4.1%	0.0%	0.0%	0.0%	0.0%	0.0%	8.7%	0.0%
	S	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%
68 N	N	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%
	S	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%

Figure 20. Wide flakes with battered platforms (percent of debitage per quadrant).

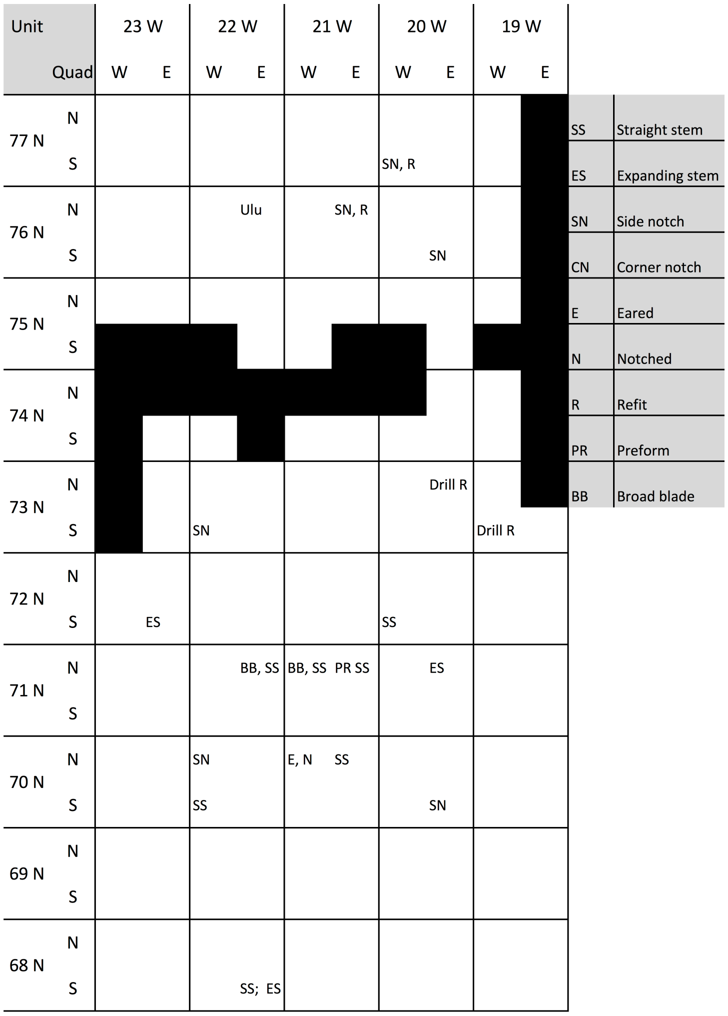


Unit		23 W		22 W		21 W		20 W		19 W	
	Quad	W	E	W	E	W	E	W	E	W	E
77 N	N	0	0	0	0	0	0	2	2	0	
	S	0	0	0	0	0	0	0	0	1	
76 N	N	0	1	0	0	1	2	0	1	1	
	S	0	0	0	1	0	0	3	1	1	
75 N	N	0	0	1	4	6	1	0	0	1	
	S				4	1			0		
74 N	N								0	0	
	S		1	0		0	0	0	5	1	
73 N	N		0	1	4	2	1	0	0	0	
	S		3	2	3	0	1	0	1	1	0
72 N	N	0	4	1	0	1	1	0	2	3	0
	S	1	0	1	0	7	2	1	2	1	0
71 N	N	0	2	2	1	2	0	1	1	0	0
	S	0	2	0	0	0	0	1	0	0	1
70 N	N	0	0	1	0	3	3	4	2	0	0
	S	0	1	1	0	1	1	3	3	0	0
69 N	N	0	2	4	0	0	1	0	0	2	1
	S	0	0	3	3	1	0	1	0	1	0
68 N	N	0	0	0	1	2	1	0	0	0	0
	S	0	0	0	0	0	0	1	0	0	0

Figure 21. Flakes with battered platforms (total number per quadrant).

4.3.7 – Formal Tools

Twenty artefacts were recovered from the sample area that could be classified as formal tools diagnostic of the Archaic period. These include bifaces, a drill, and an ulu. Considering the distribution of formal tools by raw material types reveals that tools made of exotic materials follow the same distribution as debitage of exotic materials. Formal tools do not appear where exotic rates are lowest, but rather among the middle range of exotic materials. That is, tools made of local and regional materials occur where the ratio of exotic debitage to regional and local debitage is near its median of 0.345. This indicates that formal tool deposition occurred most often in those parts of the sample area that contain ratios of exotic to local and regional debitage in the highest 50%.



Unit	Quad	23 W W	23 W E	22 W W	22 W E	21 W W	21 W E	20 W W	20 W E	19 W W	19 W E
77 N	N										■
	S							SN, R			■
76 N	N				Ulu		SN, R				■
	S								SN		■
75 N	N										■
	S	■	■	■			■	■		■	■
74 N	N	■	■	■	■	■	■	■			■
	S	■			■						■
73 N	N	■							Drill R		■
	S	■		SN						Drill R	
72 N	N										
	S		ES					SS			
71 N	N				BB, SS	BB, SS	PR SS		ES		
	S										
70 N	N			SN		E, N	SS				
	S			SS					SN		
69 N	N										
	S										
68 N	N										
	S				SS; ES						

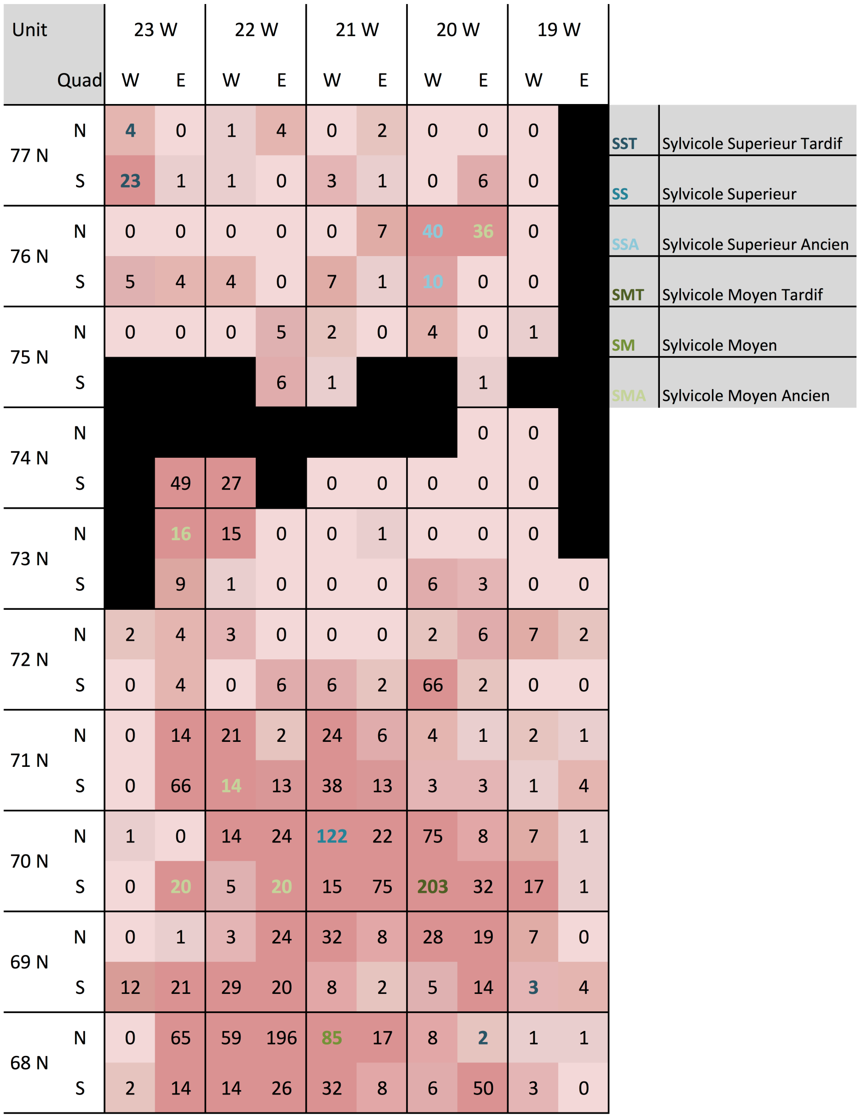
SS	Straight stem
ES	Expanding stem
SN	Side notch
CN	Corner notch
E	Eared
N	Notched
R	Refit
PR	Preform
BB	Broad blade

Figure 22. Distribution of Archaic diagnostic tools within the sample area.

4.3.8 – Ceramics

The distribution of ceramic artefacts merits discussion in considering the horizontal distribution of artefacts within the sample area. The distribution of ceramic sherds does not follow those patterns previously defined by the distribution of lithic artefacts. Ceramics are concentrated in an approximately rectangular area whose corners are located at 71N 21W, 70N

20W, 68N 21W, and 69N 22W. Given that this abuts the edge of the Archaic sample area, it is not unreasonable to conclude that this concentration continues to the south. Most dateable sherds in this area are associated with the Middle Woodland period, while most dateable sherds that come from the northern section of the sample area date to the Late Woodland. There is, however, a certain degree of overlap and mixing. Most importantly, the depositional patterns of ceramics and lithics appear to be largely independent, making lithic distribution a good indicator of Archaic period site activity at Gaudreau.



Unit		23 W		22 W		21 W		20 W		19 W	
	Quad	W	E	W	E	W	E	W	E	W	E
77 N	N	4	0	1	4	0	2	0	0	0	
	S	23	1	1	0	3	1	0	6	0	
76 N	N	0	0	0	0	0	7	40	36	0	
	S	5	4	4	0	7	1	10	0	0	
75 N	N	0	0	0	5	2	0	4	0	1	
	S				6	1			1		
74 N	N								0	0	
	S		49	27		0	0	0	0	0	
73 N	N		16	15	0	0	1	0	0	0	
	S		9	1	0	0	0	6	3	0	0
72 N	N	2	4	3	0	0	0	2	6	7	2
	S	0	4	0	6	6	2	66	2	0	0
71 N	N	0	14	21	2	24	6	4	1	2	1
	S	0	66	14	13	38	13	3	3	1	4
70 N	N	1	0	14	24	122	22	75	8	7	1
	S	0	20	5	20	15	75	203	32	17	1
69 N	N	0	1	3	24	32	8	28	19	7	0
	S	12	21	29	20	8	2	5	14	3	4
68 N	N	0	65	59	196	85	17	8	2	1	1
	S	2	14	14	26	32	8	6	50	3	0

SST	Sylvicole Superieur Tardif
SS	Sylvicole Superieur
SSA	Sylvicole Superieur Ancien
SMT	Sylvicole Moyen Tardif
SM	Sylvicole Moyen
SMA	Sylvicole Moyen Ancien

Figure 23. Ceramic artefact density by quadrant in the sample area, identifiable periods indicated if possible.

4.4 – Types of Lithic Reduction at the Gaudreau Site

Although the Archaic tools within the Gaudreau assemblage should be understood to represent those items important to the toolkit of site inhabitants, they do not necessarily represent the production activities at the site. It is entirely possible that the tools were instead transported to the site and discarded when other activities became the focus of the site inhabitants. The best representation of the lithic tool production that actually took place on the Gaudreau site is that represented by the debitage. Three major types of reduction were identified in the assemblage through flake typology: biface reduction, pressure flaking (retouch), and ground stone tool preparation. Two additional flake types that were minimally represented—notching and platform preparation flakes—still offer vital evidence of site activity despite their low frequency. However, the vast majority of flakes were not classified during the initial stages of this study. Instead, emphasis was placed on assigning flakes within a technological typology if and only if they clearly and unequivocally fit that type. When comparing frequency of flakes by typology, only complete flakes and proximal fragments were included for comparison and analysis. All debris was excluded, as they could represent the distal extremity of a previously counted piece of debitage. Only considering those pieces of debitage that include the proximal end ensured that none were counted twice.

	Biface Reduction	**Pressure**	**Wide with battering**	**Core Reduction**	**Unable to Classify**	**Total**
First round	406	123	28	0	4,336	4,893
Second round	1,110	400	0	725	- 2,235	0
Final Total	1,516	523	28	725	2,101	4,893
Percent	*30.98%*	*10.69%*	*0.57%*	*14.82%*	*42.94%*	*100.00%*

Table 7. Flake classification by type during initial and secondary stages of study.

4.4.1 – Core Reduction

The simplest form of lithic tool is the expedient tool: a retouched or utilized flake. Although any flake produced during reduction could be used for this purpose, it is also possible to produce flakes expressly for this purpose through core reduction. This technique makes use of hard hammer percussion and can be distinguished by those traits. These flakes typically display a bulb of percussion, no lipping, and may occur early or late in the reduction sequence (Whittaker 1994). Eliminating other possible formation processes for a debitage assemblage, such as soft-hammer reduction or grinding, is helpful in identifying core reduction activity, akin to a diagnosis by exclusion.

The first stage of visual debitage analysis did not search for characteristics that could identify these flakes, and instead categorization was done after data had been collected. Flakes that were at least 100 sq. mm in size and that exhibited a bulb of percussion in conjunction with a lack of lipping were assigned to the category of core reduction. Of the proximal flakes and flake fragments examined (n = 4,893), a total of 725 flakes fit this categorization. This represents 14.82% of the lithic reduction activity that left proximal flake fragments. The relative frequency of the raw materials represented by this activity is non-random, with $p < 0.001$.

One deviation from expected values occurs with quartz, of which core reduction flakes are much more frequent than would be expected based on their overall frequency in the assemblage. Hard hammer reduction techniques, including core reduction, appear to have utilised quartz at rates significantly higher than for other raw materials. The use of core reduction techniques suggests that expedient tool production, as opposed to the production of formal tools, was also a goal of reduction activity. The presence of Archaic bifaces in quartz on the site does imply that the inhabitants were not opposed to using tools made from this material. Of the materials worked on site, quartz was favoured for informal unifacial tool production. Given that this trend exists despite the fact that only five quartz flakes per unit were examined, compared to all debitage in most other materials, this choice is even more striking.

A second interesting deviation is that of gray chert. Gray chert is a common material within the sample area, comprising approximately 7.6% of all pieces of debitage recovered (n = 2,378) and 37.6% of all debitage examined for this study. Based on its frequency, a much greater proportion of gray chert core reduction flakes would be expected than was actually observed. This low rate of occurrence indicates that when carrying out core reduction activities, site inhabitants specifically avoided utilising gray chert. Hard hammer reduction was not often used on gray chert compared to use on other materials. Thus, the gray chert debitage represents a different type of reduction than the creation of expedient tools.

4.4.2 – Biface Reduction

In contrast to core reduction, the aim of biface reduction is to produce a formal, pre-planned tool. The knapper may begin with either a flake blank or core, and the general shape of the biface is roughed out, corresponding to Callahan's stages three and four. It is thinned and the shape is refined, with most final touches being done with pressure flaking, corresponding to Callahan's stage five. Until this point, the reduction process typically utilizes soft hammer percussion. The distinguishing features of this sort of debris are a diffuse bulb of percussion, platform lipping and faceting, and dorsal scarring (Whittaker 1994). Flakes of this sort also frequently display a slight curvature.

Biface reduction was carried out in most of the raw materials present on site, but the frequency of biface flakes by raw material does not align with that expected based simply on their overall frequency within the sample area. A chi-square test yielded a p-value of 0.0002, but this is to be expected given the large number of raw material categories. Despite this, comparing the expected and observed frequencies does offer insight into the preferences of the Gaudreau site's inhabitants. Of the raw materials, quartz and SAL displayed the most striking deviation from their expected values. While other materials had greater deviation in proportion to the total quantity expected, in the most extreme cases this deviation was high because there was little of that material within the sample area. In the cases of SAL and quartz, the total amount expected was high and the degree of deviation from that was also high. Understanding why these deviations occur requires consideration of raw material's source and its flaking properties.

Material	BRF-Observed	BRF-Expected
CB	6	6
CBL	6	5
CBR	3	5
CG	485	480
CHO	5	7
CM	7	7
CV	49	54
MUN	10	9
QZC	0	0
RHY	227	213
GL	125	111
QC	5	11
QTZ	175	253
SAL	317	253
SLT	1	2
QZB	29	29
QZF	4	3
QZG	14	18
QZMG	48	50
QZT	0	1
TOTAL	**1516**	**1516**

Table 8. Observed and expected frequencies of biface reduction flakes (BRF).

If biface reduction activities utilized quartz at a rate proportional to its frequency within the sample area, significantly more quartz biface reduction flakes would be expected within the assemblage. Instead, their frequency is relatively low in comparison to the total number present in the sample area. Indeed, it is low even when compared to the small fraction examined from the sample area. It is clear from the bifaces present at the Gaudreau site that the inhabitants were not opposed to using formal tools made of quartz. Rather, when producing bifaces at this location, they simply preferred to use other types of material (see Figure 24). This is confirmed by the formal Archaic period tools recovered from the sample area, of which only 11% (n = 2) were made from quartz. This could simply be to the availability of other raw materials, or the difficulty of working with quartz. Both possibilities will be explored more fully in the following chapter.

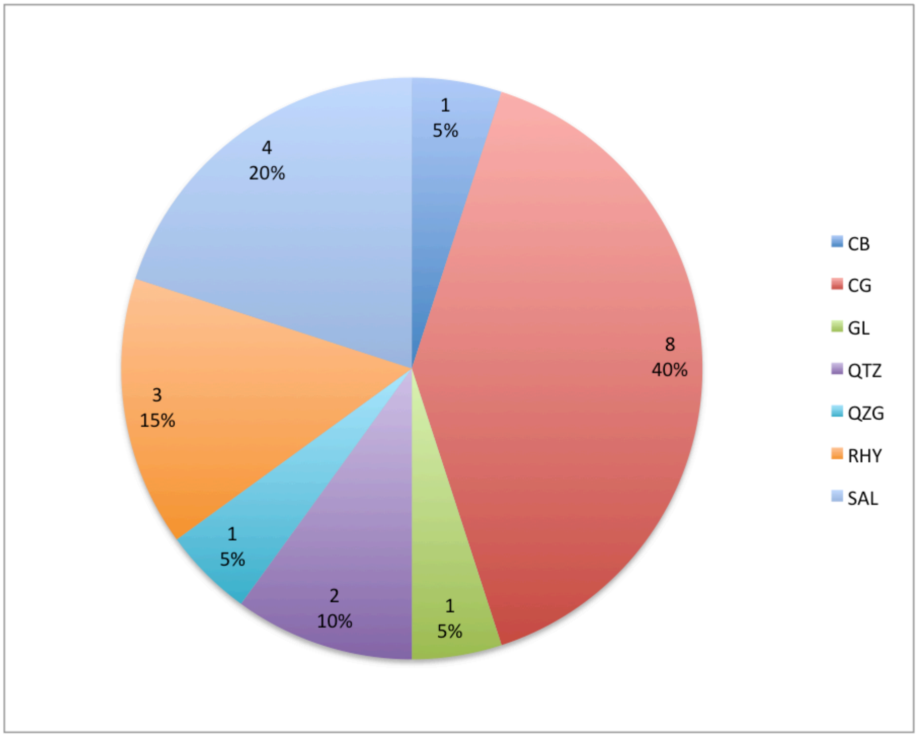


Figure 24. Raw material frequency for Archaic tools within the sample area.

On the other hand, the local silicified mudstone was utilized at much higher rate than its overall frequency would suggest, representing the only significant occurrence of a higher rate of biface reduction activity than expected. Observed biface reduction flakes in SAL are both numerous, and deviate from the expected frequency as a large proportion of that frequency. Despite its low quality, this material was favoured for the production of formal bifacial tools. This is confirmed by its frequency in the tools assemblage from the sample area, as 20% of formal Archaic tools (n = 4) were made of SAL. This material seems to have been often subject to soft hammer reduction and its abundance made it a natural choice for creating new lithic tools.

Although it does not deviate significantly from its expected frequency of biface reduction flakes, gray chert deserves mention here as well. Its frequency as a result of biface reduction activity is approximately average for the sample area. It is tempting to ascribe this to its dominance in the assemblage, as more abundant materials—quartz, rhyolite, and SAL—were merely sampled, leaving gray chert as one of the largest raw material categories even after eliminating debris. However, after excluding gray chert from the population of complete and proximal flakes fragments, the frequency of biface reduction flakes changes by less than 1%. It seems instead that gray chert is a fair representation of the rate of biface flaking in the sample area, and that this material had an important role in the biface production industry at the Gaudreau site.

4.4.3 – Reduction by Pressure Flaking

Pressure flakes are small, thin, and narrow. Despite occurring late in the reduction sequence, their small size means they sometimes lack the platform facets or dorsal scars that frequently indicate this. Pressure flakes typically have a small, but distinct bulbs of percussion and minimal lipping (Towner and Warburton 1990; Whittaker 1994). In addition to generic pressure flakes, some are removed for a specific purpose, such as creating a notch in a biface or preparing a platform. These have distinctly shaped platforms or curvature that allow them to be distinguished. Otherwise, they share the same general traits as other pressure flakes. The first round of study identified 123 pressure flakes by visual analysis, and a second round identified an additional 400 based on their distinctive characteristics, for a total of 523 pressure flakes.

Material Code	Raw Material	Observed Flakes	Expected Flakes	Total Flakes
CB	Beige chert	0	1	20
CBL	White chert	0	0	17
CBR	Brown chert	0	0	17
CG	Gray chert	26	43	1548
CHO	Onondaga chert	1	1	21
CM	Marbled chert	2	1	24
CV	Green chert	0	5	174
MUN	Munsungun chert	0	1	28
QZC	Cheshire quartzite	0	0	1
RHY	Rhyolite	28	19	689
GL	Local gray stone	24	10	357
QC	Crystal quartz	0	1	33
QTZ	Quartz	13	22	815
SAL	Silicified mudstone	34	23	818
SLT	Siltstone	0	0	7
QZB	White quartzite	0	3	93
QZF	Smokey quartzite	0	0	10
QZG	Gray quartzite	2	2	58
QZMG	Marbled gray quartzite	5	4	161
QZT	Translucent quartzite	0	0	2
Total		135	135	4893

Table 9. Observed and expected frequency of pressure flakes in raw materials present in the sample area.

The number of pressure flakes is significantly fewer than the number of biface reduction flakes, and this may be due, in part, to their small size. Most units excavated during the 2011 field season in the contact and ancient zones were screened using ⅛ inch mesh. Some, however, utilized ¼ inch mesh. During the 2010 field season, ¼ inch mesh was common and only some units were completed with ⅛ inch mesh. Unfortunately, information regarding which size was used for which units was not recorded on bag tags or in the artefact catalogue. While many small pressure flakes would be retained with ⅛ inch mesh, some would not. Additionally, ¼ inch mesh would retain very few at all. Using screens with smaller mesh would have been impractical, due to the wet nature of the soil that results from its low position and proximity to two rivers. Indeed, the site reports already note the difficulty that screening posed for the volunteer excavators

(Graillon 2013, 2012). Over the course of excavations of the sample area during 2010 and 2011, it is likely that many pressure flakes were not retained due to the difficulty of implementing excavation techniques that would retain debitage of such a small size.

As with other types of flaking, frequency of pressure flakes by raw material does not correspond to those frequencies that would be expected if the distribution were representative of that within the overall sample area ($p < 0.01$). In this case, a few different raw materials deserve attention, namely: white quartzite, marbled gray quartzite, gray chert, local gray stone, quartz, and local silicified mudstone. White quartzite, quartz and gray chert yielded a greater number of pressure flakes than was expected; the marbled gray quartzite, local gray and SAL yielded fewer pressure flakes (see Table 9). The greatest difference between expected and observed values occurred with gray chert, although the large number of flakes means that the deviation was small as a proportion of the total number of gray chert pressure flakes. However, most materials with a greater degree of variation had yielded few flakes in the sample area; the few exceptions to this trend will be discussed in this section. Retouching of gray chert seems to have been a frequent occurrence at the Gaudreau site, given how frequently this material appears among pressure flakes. As biface reduction flakes barely deviated from their expected rate, it appears that although larger, soft hammer removals of gray chert were essentially average, the retouch of these tools was extensive. Additionally, gray chert is the most common material for formal tools at the Gaudreau site, comprising 32% (n = 6) of that assemblage. Tools were not only begun in gray chert, but the production process was followed through to completion, with tools likely curated for long-term use.

Interestingly, quartz pressure flakes occur at a rate much higher than predicted by their overall rate among the assemblage of debitage. At first glance, it appears that this may simply be due to the lower totals of quartz debitage, as this was one of the materials that were sampled. However, SAL and rhyolite were also sampled, and yielded even fewer pressure flakes than would be predicted based on their overall frequency. Thus, the high rate of quartz pressure flakes appears to be an actual trend and not one fabricated by other factors. The hard nature of quartz and the difficulty associated with producing conchoidal fractures may have led the inhabitants of the Gaudreau site to begin pressure flaking earlier in the reduction process than they otherwise would have. This technique would allow for more control and thus greater precision in flake removal than simple percussion flaking. Alternatively, the low rate of biface reduction flakes but high rate of pressure flakes may indicate a preference for using quartz to create unifacial tools, rather than bifacial tools. This tendency fits the larger regional pattern, as it is also seen among the Archaic assemblages within the Mégantic complex (Chapdelaine 2009:159).

Although fewer than a hundred complete and proximal fragments of white quartzite were recovered from the sample area, the material's unusually high frequency among pressure flakes merits mention here. Pressure flakes are made of white quartzite at a much higher rate than expected, 50% higher than predicted by its overall frequency within the sample area. In comparison, biface reduction flakes from this material were proportional to overall frequency, while core reduction flakes occurred at a somewhat lower rate. Although not all the white quartzite on site came from the Mistassini source, some of it can be traced to that source. Overall, the white quartzite recovered from the Gaudreau site represents a finer quality of knapping material than more common and local materials, such as quartz or SAL. Pressure flakes make up 16.13% of all complete flakes and proximal fragments of white quartzite, as compared to only 10.69% of these flakes in all materials. This indicates that most reduction activity involving white quartzite was focused on retouching and finishing tools, rather than the entire production sequence. It is possible that these earlier stages of production took place elsewhere—probably at sites between the distant source and Weedon—rather than at the Gaudreau site.

Two local materials, SAL and local gray stone, yielded pressure flakes at a much lower rate than predicted based on their overall frequency within the sample area. Both materials are relatively low quality, although the local gray certainly flakes more predictably than the SAL. As the local gray stone is one of the least common materials represented among formal Archaic tools from the sample area (n = 1), it stands to reason that pressure flakes of this material are uncommon. The reason behind the low rates of SAL pressure flakes is somewhat less clear. The material is common among Archaic tools from this part of the site, representing 26% of the assemblage (n = 5).

The marbled gray quartzite was not subject to pressure flaking at the rate that would be expected based on its frequency within the site area. Instead, pressures flakes are rare in this material, despite the fact that complete flakes of this material tend to cluster towards the smaller end of the scale when compared to other materials. However, this is likely due to the nature of the material itself. Flakes of this raw material tend to be angular, as conchoidal fractures are difficult to obtain. Instead of travelling smoothly through the material, the forces quickly bend outwards and leave frequent step fractures and poorly defined flaking attributes. Given these characteristics, it is possible that pressure flakes only rarely occurred during knapping. It is also possible the site inhabitants avoided pressure retouch with this material because they knew it would not yield favourable results. In either case, pressure retouch in the marbled gray quartzite rarely took place at the Gaudreau site.

4.4.4 – Platform Battering

Only 2.8% of all flakes had battered platforms, but the importance of ground stone tools in defining the Archaic period makes them worthy of consideration despite their infrequency. Gray chert and quartz had lower rates of battered platforms than were expected, while rhyolite, local gray stone, and silicified mudstone had higher rates. Platform battering is a hallmark of lithic reduction with a ridged hammerstone, a tool that is particular to preparation for ground stone tool production. Variations in the rate of platform battering can highlight unusually high or low uses of any given raw material for ground stone tools. This is particularly relevant to this assemblage as a ridged hammerstone in quartz was recovered during the 2011 season (Graillon 2013).

The low rate of battering among the gray chert and quartz flakes is to be expected, as these materials are not represented in the ground tool assemblage at the Gaudreau site. Cherts are high quality raw materials for making flaked stone tools due to how predictably they flake. Given this, it is unsurprising that other materials would be selected for the production of ground stone tools. Quartz is a prismatic material and would be difficult to grind into a smooth shape, which explains the lack of ground tools in this material on the site. Local gray stone and silicified mudstone, however, do appear in the assemblage of ground stone tools from the Gaudreau site. The high rates of battered platforms among these materials reflect the preference for these materials in producing ground stone tools.

The high rate of platform battering among rhyolite was not expected based the tool forms in this material present on the site. The Gaudreau site did not yield ground stone tools in this material and there is no evidence of it being used for this purpose elsewhere in the Far Northeast. However, physical properties of rhyolite help to explain this. Kineo rhyolite is a particularly hard material and does not absorb hard hammer impact well. It tends to become crushed more easily, and thus yields a higher rate of platform battering than otherwise anticipated.

4.5 – Stages of Reduction at the Gaudreau Site

Stages of lithic reduction are estimated by combining different lines of evidence, including flake size, platform faceting, and dorsal scarring. As reduction progresses, debitage sizes becomes smaller, while faceting and scarring increase in frequency. Flake size can only be calculated for complete flakes, as attaching that information to incomplete debitage fragments would produce misleading information. Platform faceting information can be collected from proximal fragments, as well as complete flakes. Finally, information regarding dorsal scarring can be collected from any piece of debitage, regardless of platform presence or completeness. These limitations will define sample size for each line of evidence.

4.5.1 – Debitage Size

Complete flakes at the Gaudreau site were assigned to size classes based on the smallest possible size that could contain the piece of debitage in question, as described in the Methods chapter. The 25 and 50 sq. mm classes were defined as small debitage, the 100 and 200 sq. mm classes as medium debitage, and all others as large debitage. This distinction is based on Will's experimental results, which revealed a maximum size of about 30 sq. mm for later stage debitage

(Will 2000). A flake of 30 sq. mm would be categorized with the 50 sq. mm class, based on the system in use for this study. Therefore the 50 sq. mm and all smaller classes are considered to be small, and to therefore represent late stage reduction (Callahan's stage 5). For consistency, the next two classes (100 sq. mm and 200 sq. mm) are considered to be medium debitage and represent the middle stages of reduction (Callahan's stages 3 and 4). The 400 sq. mm and all larger classes are considered to be large debitage and represent early stages of reduction (Callahan's stages 1 and 2). Debitage larger than 600 sq. mm was also examined separately in considering the distribution of extra large flakes. This corresponds closely to the classes suggested by Prentiss (2001) as a modification of Sullivan and Rozen's (1985) approach, but shifted to include finer distinction among smaller flakes sizes, as Prentiss later suggests in retrospect.

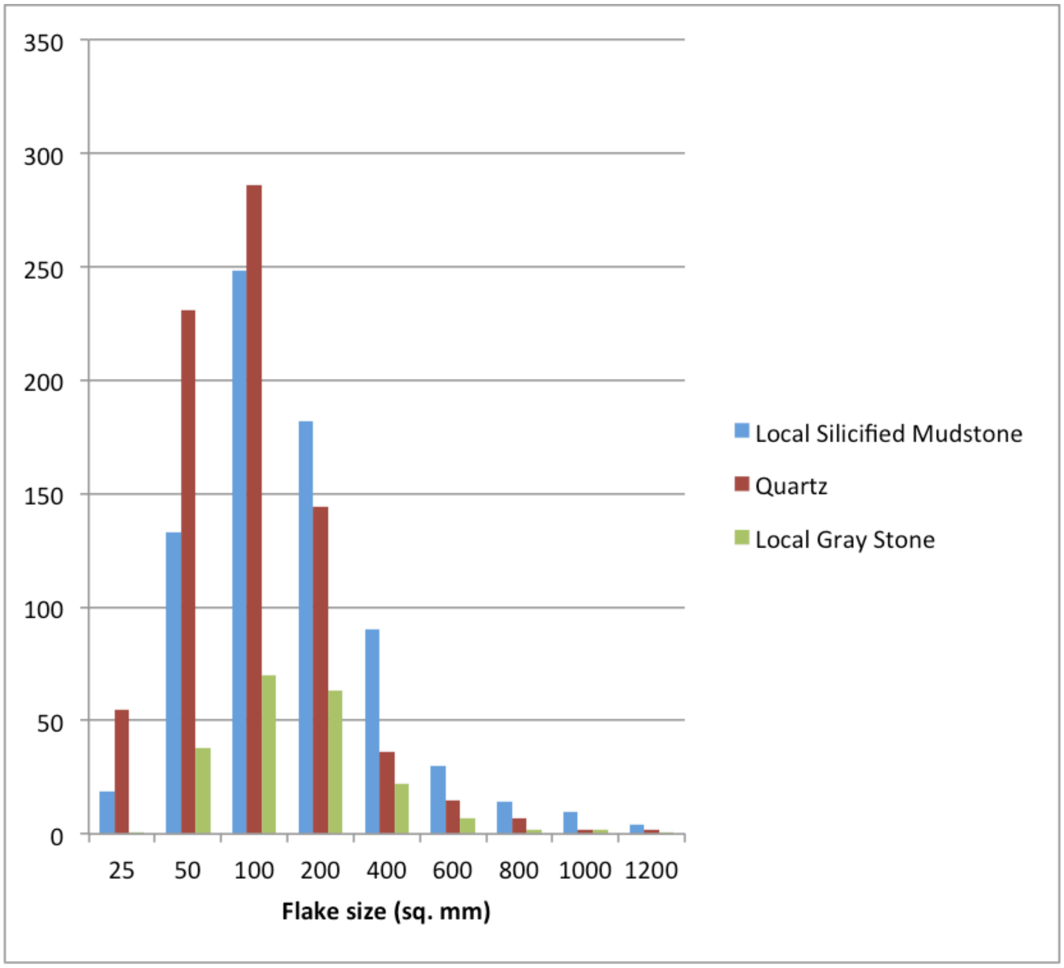


Figure 25. Local material flake sizes.

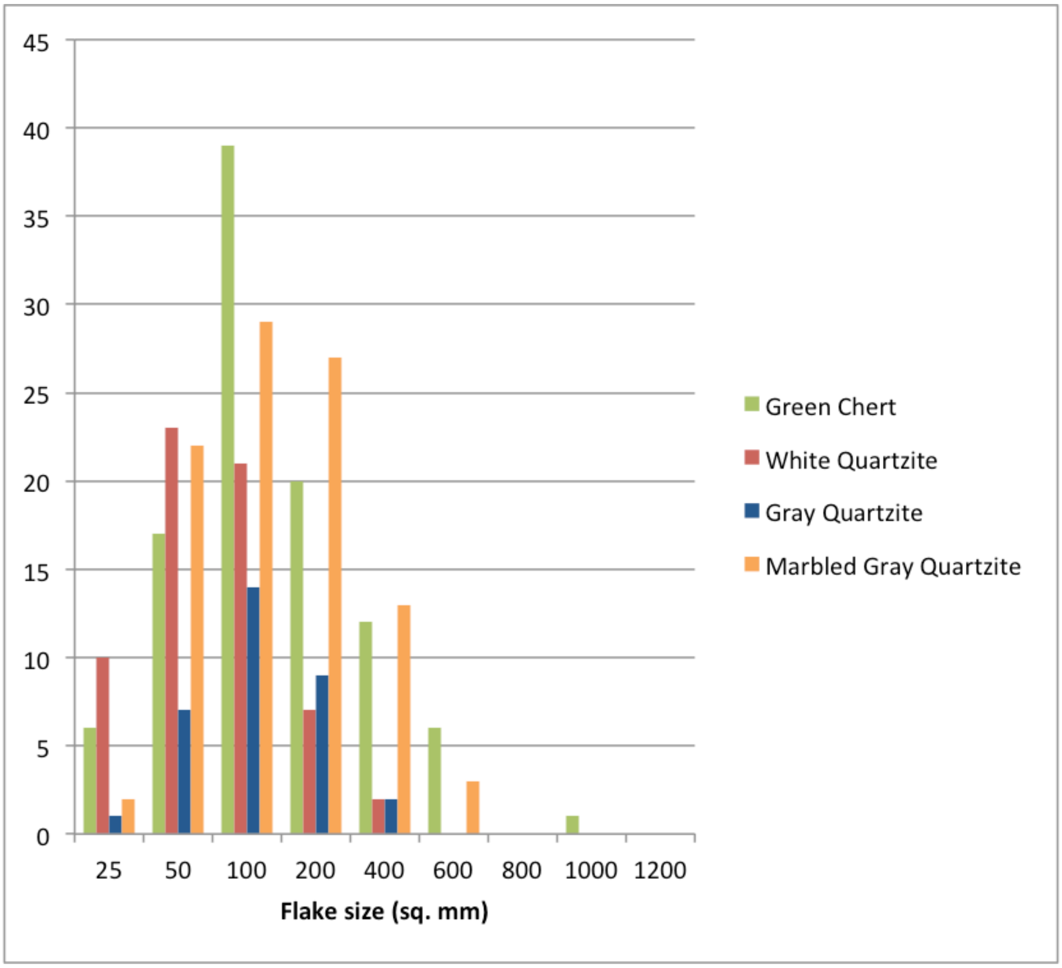


Figure 26. Flakes sizes of regional materials.

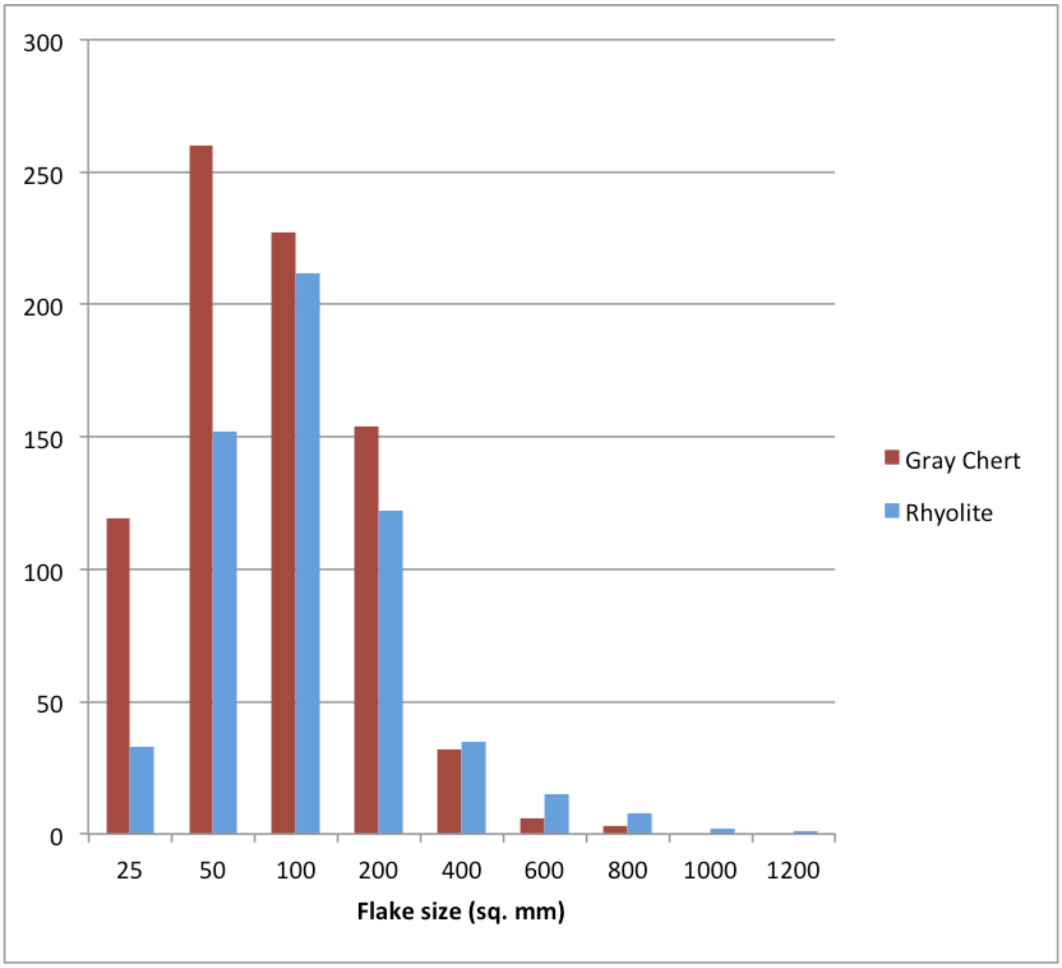


Figure 27. Flake sizes of exotic materials.

The distribution of flakes by size is shown in Figures 23 through 25. The median size for the entire assemblage is 100 sq. mm, which is also the mode of the dataset. At first glance, the distribution appears skewed towards the small and medium size classes, with few flakes larger than 400 sq. mm. Crucial in understanding this trend are the constraints of sampling and the taphonomic processes that took place at the site prior to excavation. Size could only be recorded for complete flakes, but larger flakes are more likely to break than smaller flakes. Thus, complete flakes naturally tend to be smaller in size, a fact that should be considered when reviewing the size of debitage recovered from the Gaudreau site. Additionally, there are clear distinctions in size distribution between different raw materials sourced from similar distances. Rhyolite flakes tend to be larger than gray chert flakes, although both are exotic. This is due to the fact that raw material transport can also make use of social networks, even between distant groups. This allows, for example, the people of the Gaudreau site to treat Kineo rhyolite as local, or to gain access to the Munsungun, despite its distance from the site. Marbled gray quartzite tends to be larger than other regional materials, while white quartzite is smaller. Quartz shows less diversity in flakes size than other local materials. After a brief overview of the connection between flake size and typology, the connection between size and raw material will be further explored.

Debitage Size and Typology

Considering different types of reduction separately, the distribution of flake size and typology generally reflect what would be expected (Figure 28). Pressure flake sizes cluster strongly to the smaller side of the scale. Most are 50 sq. mm, while some are 25 sq. mm. Few pressure flakes are larger than this, although certain examples of long, thin, and narrow pressure flakes are represented in the assemblage. This is to be expected, as pressure flaking is used to finish tools, and debitage of this variety typically represents resharpening, retouch, or the final steps of producing a tool. Core reduction flakes trend in the opposite direction, as larger sizes are necessary for use as a blank or expedient tools. Biface reduction flakes more closely reflect trends in the overall assemblage, being clustered around the 100 sq. mm size class.

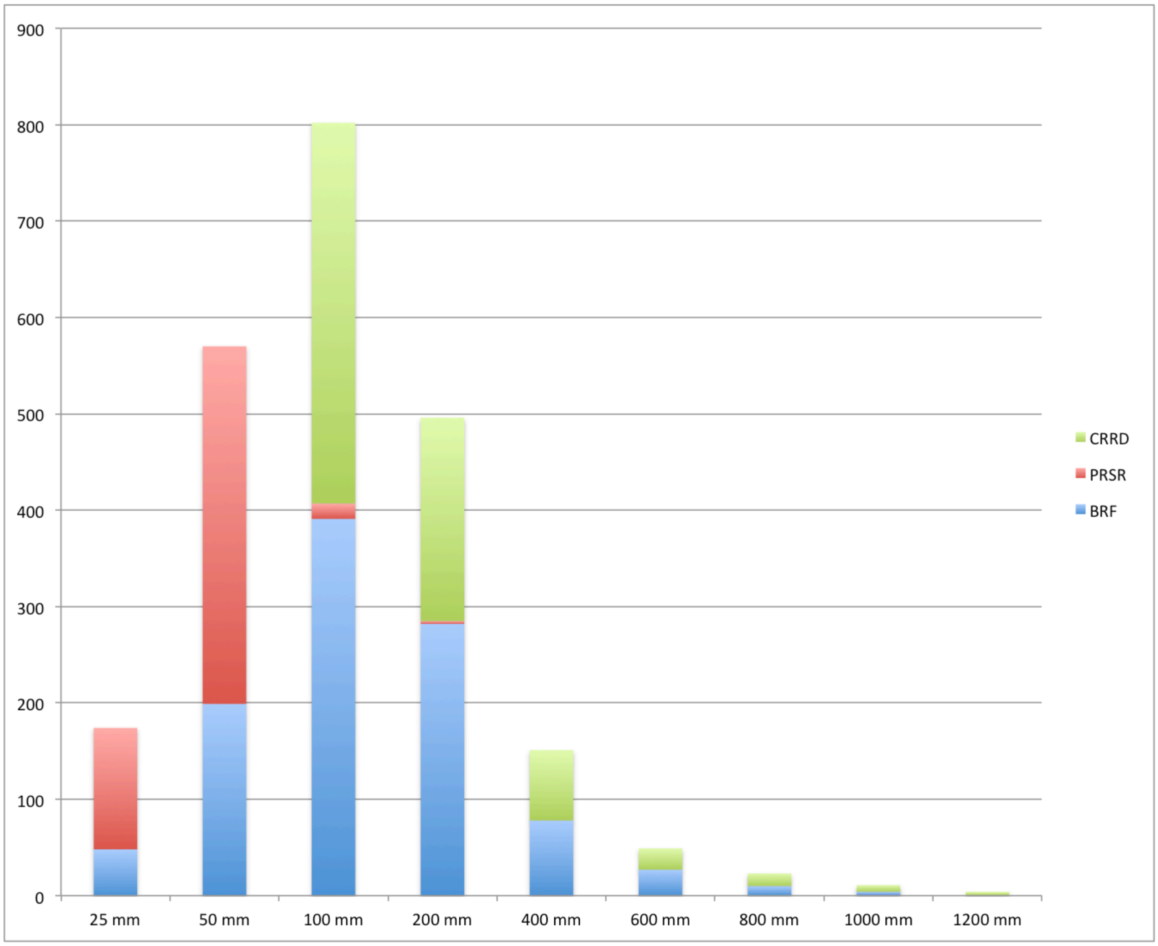


Figure 28. Flake size frequency, with typology.

Debitage Size and Raw Material

Trends in debitage size vary by type of raw material. Most generally fit the overall pattern, but some materials are notable exceptions. Gray chert, local gray stone, quartz, SAL, and siltstone all deviated from the expected size distribution by a statistically significant degree. Although Cheshire quartzite also varies to a significant degree, this is simply because only one flake was identified as being of this material, and it was a particularly large flake. While it is interesting that so large a flake of this material is present on the site, its consideration can be saved for the discussion chapter.

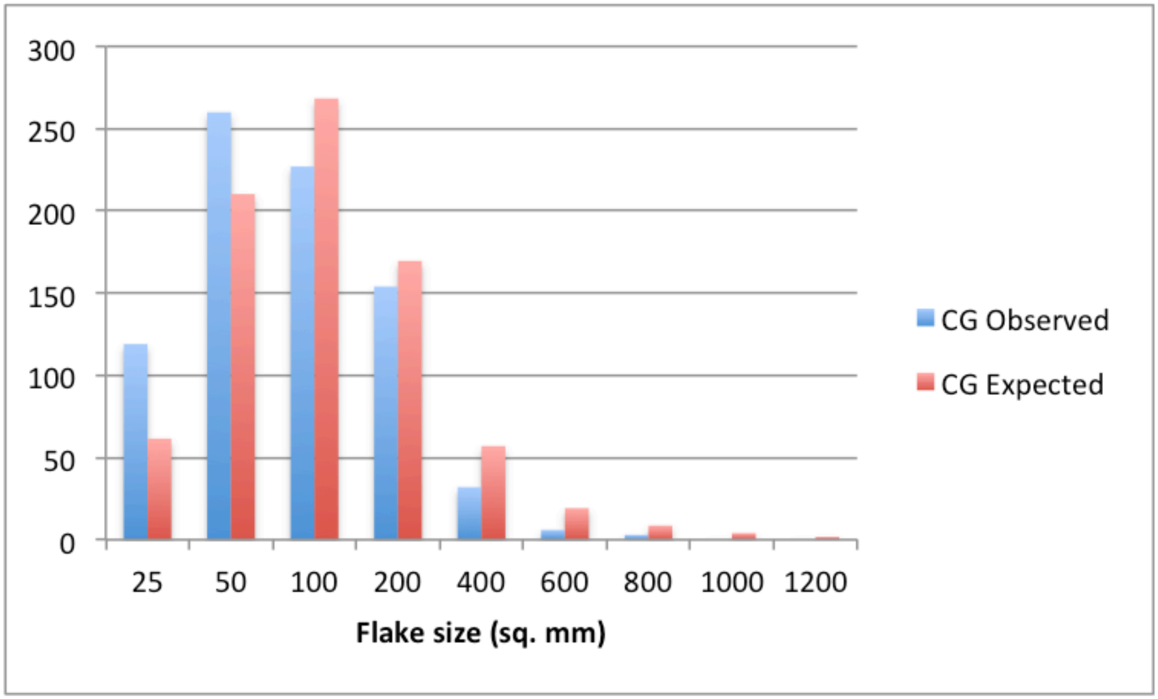


Figure 29. Expected and observed frequency of gray chert by size classification.

Gray chert displays a strong tendency to be smaller in size than predicted based on overall trends in the sample area (Figure 29). Flakes in the 25 sq. mm class were approximately twice as common as predicted, and the 50 sq. mm class was also larger than expected. All other classes were smaller than would have been expected if gray chert were treated the way most other materials were. This is a stark contrast from other materials that bucked the area's trend, as they tended to skew larger than was otherwise predicted. This makes gray chert unique, in that greater attention was lavished on small retouch and finishing of tool made from this material. This stands to reason, given that it is the most common material for formal Archaic tools within the sample area, appearing at a rate disproportionate to its representation within the debitage. Gray cherts represent about 7.6% of the debitage within the 50 sq. metres examined for this study, but they form about 38.1% of the formal tools from the same area, indicating a preference for using this material for the creation of tools that required extensive planning and workmanship.

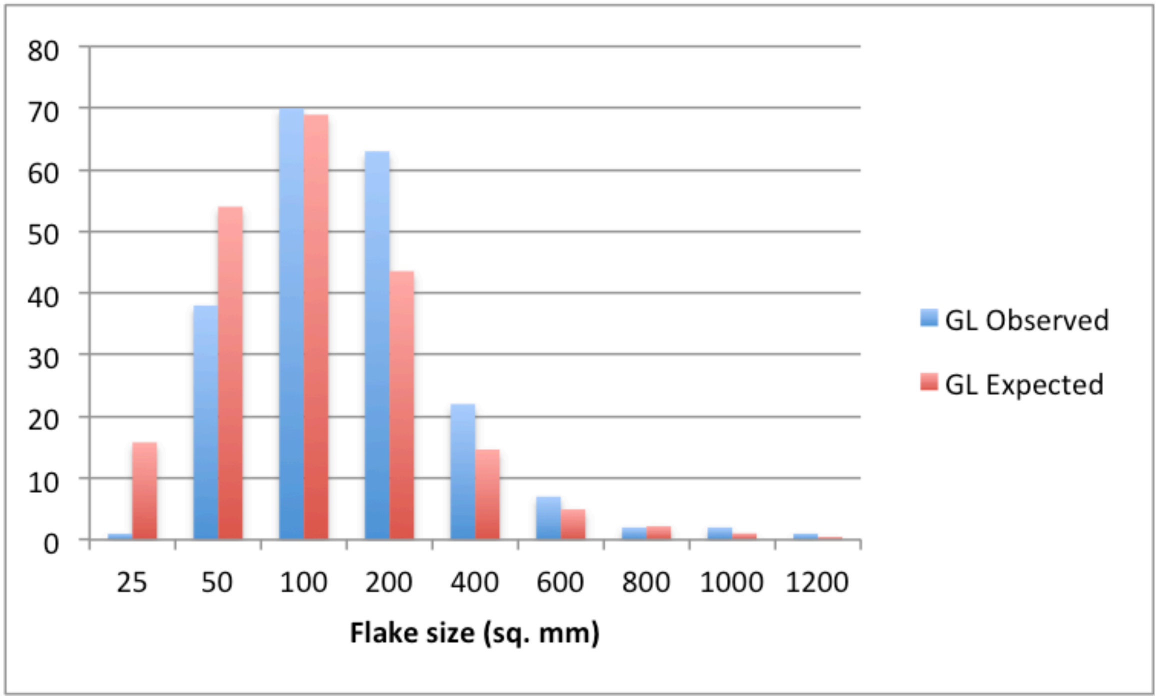


Figure 30. Expected and observed frequency of local gray stone by size classification.

Local gray stone, on the other hand, tend to be much larger than predicted by the general distribution within the sample area and this variation is statistically significant ($p < 0.01$). The frequency of small flakes (i.e. those in the 25 and 50 sq. mm classes) is much lower than predicted, while the frequency of medium flakes is somewhat higher and that of large flakes is significantly higher. This local gray stone is not a common material on the site, either among the debitage or finished tools. Most reduction begun in this local material was left unfinished or perhaps finished another way. It is also possible that the goal for this material was to finish tools by grinding, rather than flaking or chipping. Indeed, flakes with battered platforms—a type of debitage indicative of ridged hammerstone flaking in preparation for grinding—occur at a higher rate among the local gray stone than among any other material.

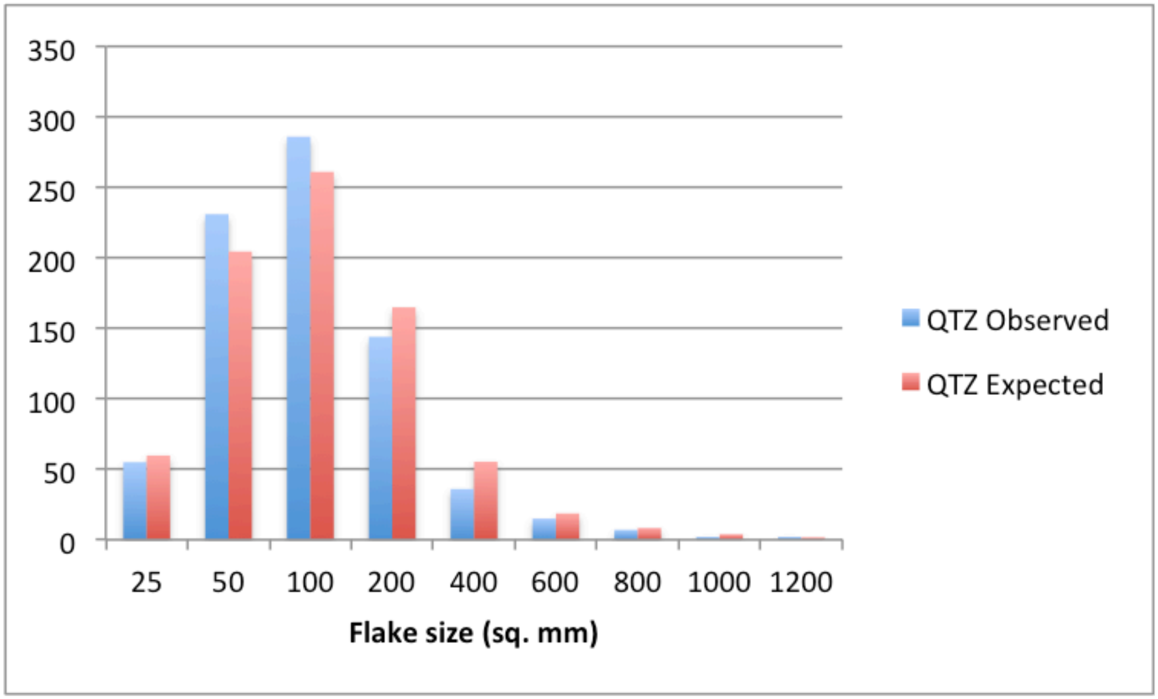


Figure 31. Expected and observed quartz flake sizes.

Quartz also deviates interestingly from the flake size distribution that would be expected based on the overall assemblage from the sample area ($p < 0.05$). Rather than skewing strongly towards large or small flakes, quartz shows a concentration among the midrange sizes. Flakes of the 100 sq. mm and 200 sq. mm classes are more common than predicted, with fewer flakes in the classes both above and below that. Although the center of this distribution as defined by its median reflects that of the overall assemblage, there is much less variation: the standard deviation of the sizes of all complete flakes from the sample area is 187.7, while the standard deviation for quartz flake size is 150.8. Removing outliers (defined as 1.5 times the interquartile range beyond the first or third quartile) and recalculating the average yields a standard deviation of 84.5 for quartz and 97.0 for the entire assemblage of complete flakes. This may be a result of a narrow focus at the site on the middle stages of reduction for quartz, with beginning and completion elsewhere. It could also result from the use of quartz for tools that required little finishing or retouch. Both possibilities would be best explored in light of the complete range of evidence regarding the quartz assemblage.

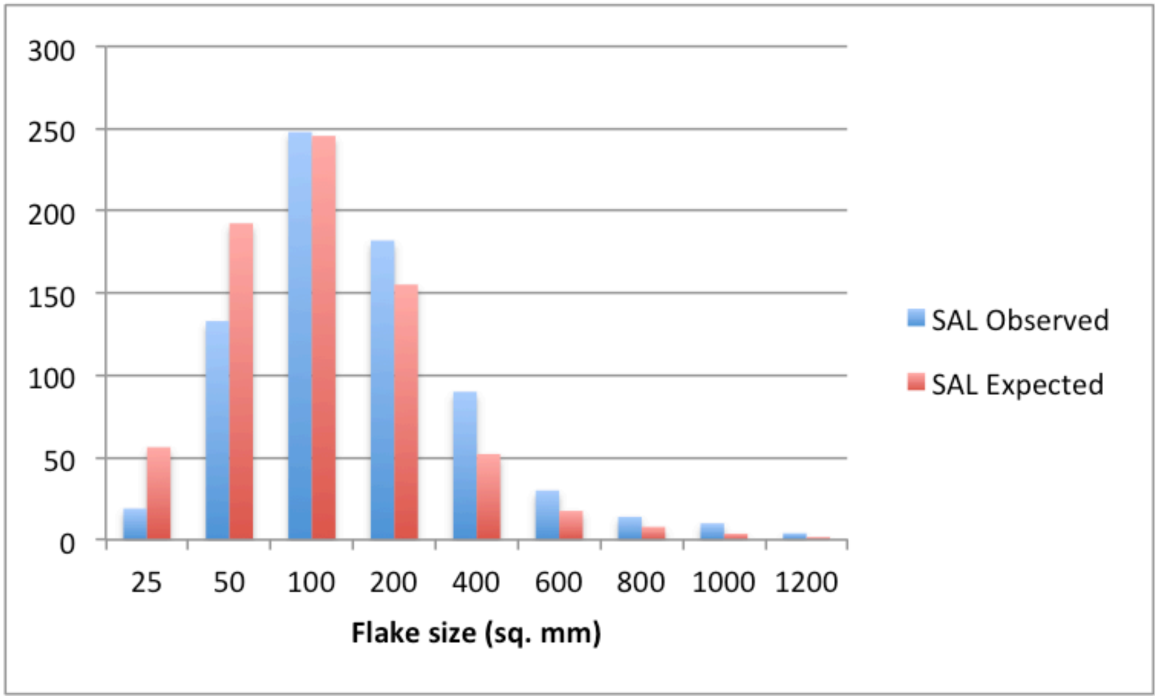


Figure 32. Observed and expected frequencies of local silicified mudstone by size classification.

Larger flakes sizes are also more common among the local silicified mudstone. Both the 25 and 50 sq. mm classes show lower frequency than anticipated and the trend towards larger sizes begins with the 200 sq. mm flakes. For this category and all larger classes, SAL flakes occur with greater frequency that predicted by the greater assemblage. The low rate of small sized flakes is particularly interesting in the case of SAL, as it represents the second most common material (n = 5) for Archaic formal tools among the sample area. One of these tools, the ulu, was finished by grinding and thus its completion would not have contributed small size debitage to the assemblage. Considering the proportion of SAL tools among the assemblage of flaked (not ground) Archaic tools reveals that this material still comprises 20% of the assemblage. The low rate of small flakes is likely due to the low quality of the material and the resultant difficulty in knapping with it.

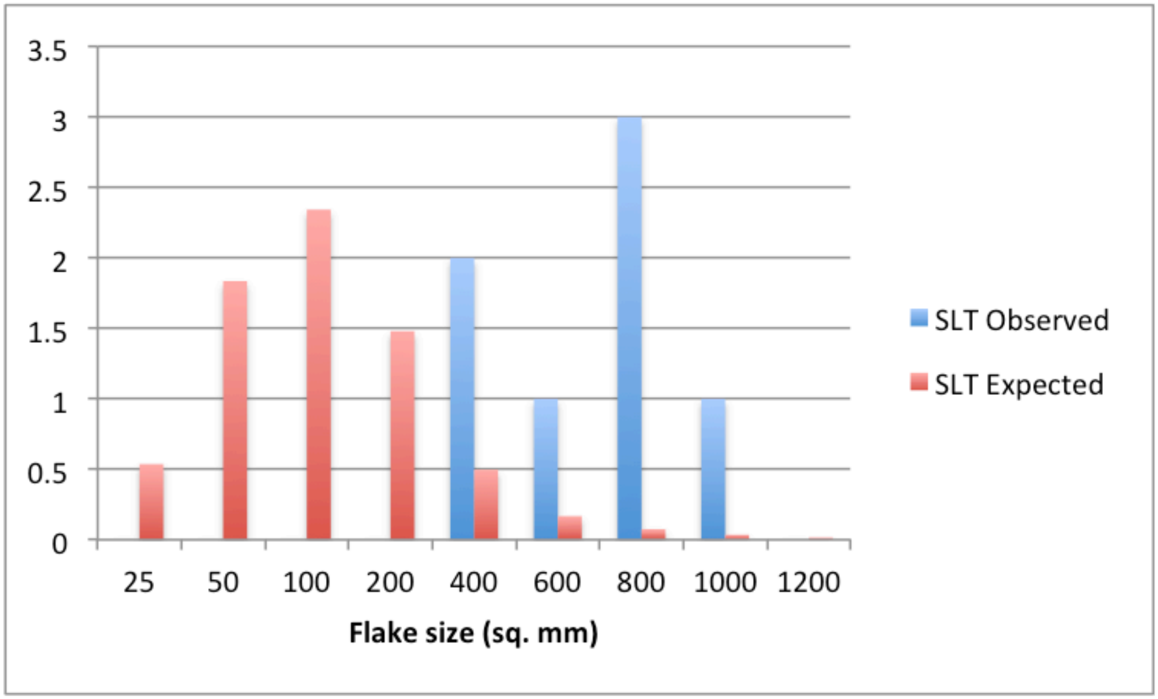


Figure 33. Expected and observed frequencies of siltstone by size classification.

Finally, the Gaudreau site yielded a few instances of flakes of a local siltstone. Seven of these came from the Archaic sample area, and the small number likely influenced their deviation from the more general size trends. However, it is worth noting that no flakes of this material smaller than 400 sq. mm were recovered, and that the median size was 800 sq. mm. Although apparently used rarely or sparingly, this material was only slightly modified by flaking before being put to use or subjected to other forms of modification and reduction. Neither ground nor flaked stone tools were recovered of this material. It is possible, given the few flakes, that only one item was produced and then transported offsite. It is also possible that a few flakes were removed, the material deemed unusable, and the core discarded elsewhere. Whatever the case, despite its interestingly large flake sizes, the role of this material within the sample area seems to be negligible at best.

4.5.2 – Cortex Cover

The quantity of debitage with each categorised rate of cortex cover (no cortex, ≤ ¼, ≤ ½, etc.) was calculated for all debitage examined for this study. As might be expected, the vast majority of debitage fell into the zero cortex cover category. The frequency of debitage decreases significantly for ¼ cortex cover, and declines continually beyond this. For the entire assemblage of debitage, this pattern is shown in Figure 34. A trend line was computed using a power model, with a constantly increasing rate of decline. The power model was a strong fit for describing the declining frequency of flakes with increasing amounts of cortex cover, with an R^2 value of 0.953. This indicates that 95.3% of the variation in this data can be accounted for by the line's associated equation. More interesting, however, were the trends among cortex present on different raw materials.

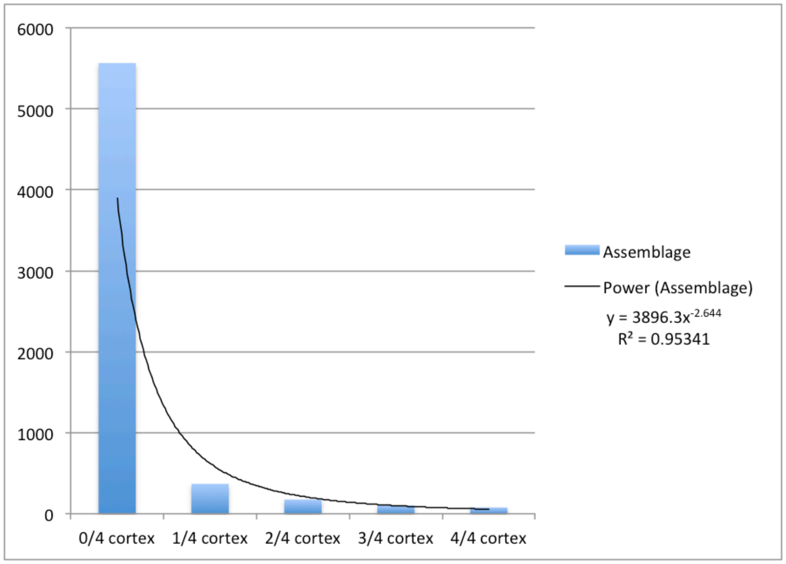


Figure 34. Frequency of debitage with increasing amounts of cortex and trendline representing the best-fit model for the decreasing frequency.

The respective frequency of cortex cover was considered more closely for those individual raw materials that yielded at least 100 pieces of debitage from within the sample area. The rate at each level of cortex cover was calculated for gray chert, green chert, rhyolite, white quartzite, marbled gray quartzite, local gray stone, quartz, and silicified mudstone. In order to compare distributions, the percentage of these raw materials that fit each level of cortex cover was calculated. All materials were then placed on the same bar graph, and trend lines were drawn, again using a power law. Some of these trend lines appeared to cluster, although not in a way that was initially expected. This apparent clustering was confirmed after viewing the equations for the trend lines, indicating that the amount of cortex present tends to decline in similar ways for some materials. As all materials had high rates of flakes with no cortex cover, most variation originated within the other levels, and these were prioritised in creating groups. Trend lines were first examined as local, regional, and exotic groups, but did not show strong internal consistency. The qualities of each material were then also considered, and this produced strong groupings (see Table 10 and Figure 35).

Three groups were thus defined: fine-grained exotic materials (gray chert and white quartzite), conchoidal regional materials (green chert, local gray stone, rhyolite, and SAL), and prismatic regional materials (quartz and marbled gray quartzite). Although rhyolite falls outside the 100 km radius that defined regional materials for this study, the strength of its associated regional trade network made it possible to overlook the distance between the Gaudreau site and Mt. Kineo in this case. The fine-grained exotic materials both have y-intercepts of approximately 0.50, and a power of about -3.0. The conchoidal regional materials have y-intercepts of about 0.7, and powers around -2.8. The prismatic regional group has a y-intercept of about 0.55, and a power of -1.9. The local gray stone's trend line is the poorest fit, and its equation suggests that it could belong in either of the other groups. However, given the material's similar properties to those in its group and the visually apparent conformity with other conchoidal regional materials, it was left with this group.

The fine-grained exotic materials show a rapid decline in frequency beyond the zero cortex category, indicating that little early-stage reduction took place on site in these materials. Instead, most work was focused on finishing tools begun elsewhere. This stands to reason, as transporting raw material is less costly the farther along it is in the production sequence. For conchoidal regional materials, some early-stage reduction did take place at the Gaudreau site. For the prismatic materials, finishing of tools is less extensive although reduction may be begun elsewhere. This is in line with the unusual trends in size shown by quartz and previously discussed.

Code	**Raw material**	**Best-fit equation**	**R^2 value**
CG	Gray chert	y = 0.567x^(-2.989)	R^2 = 0.92322
QZB	White quartzite	y = 0.594x^(-3.005)	R^2 = 0.93888
CV	Green chert	y = 0.724x^(-3.012)	R^2 = 0.95063
GL	Local gray stone	y = 0.520x^(-2.411)	R^2 = 0.84609
RHY	Rhyolite	y = 0.843x^(-3.205)	R^2 = 0.99299
SAL	Silicified mudstone	y = 0.746x (-2.786)	R^2 = 0.98895
QTZ	Quartz	y = 0.519x^(-1.988)	R^2 = 0.87519
QZMG	Marbled gray quartzite	y = 0.629x^(-1.977)	R^2 = 0.96784

Table 10. Best-fit trendline equations and R^2 values (representing goodness of fit) for cortex cover among major raw materials.

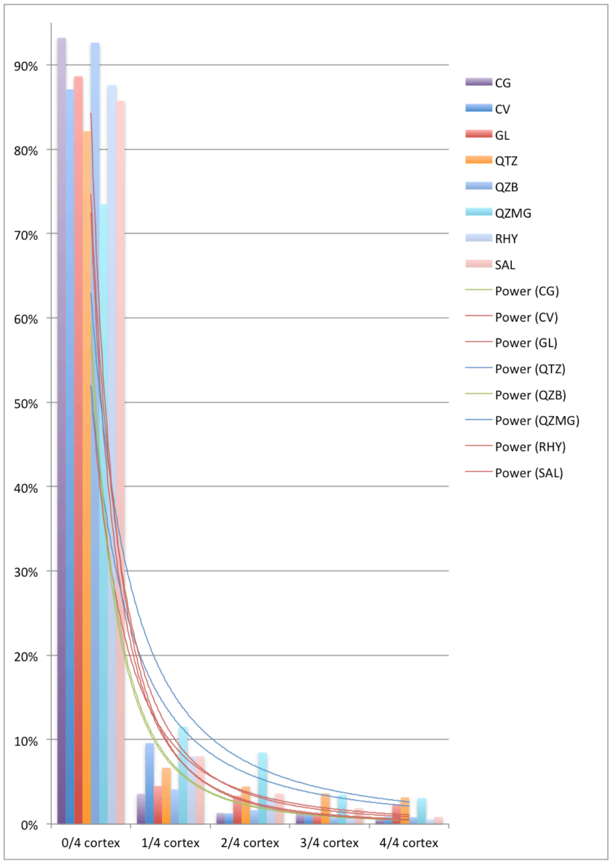


Figure 35. Cortex cover among major raw materials and power regression curves with best fit to the data.

4.5.3 – Platform Faceting and Dorsal Scarring

Platform faceting offers a line of evidence that, in combination with size and dorsal scarring, reveals reduction stage to a reasonably accurate degree. Carr and Bradbury's long-term experiment in reduction techniques and flake attributes reveals a strong negative correlation between the percentage of flakes with zero platform facets and the percentage of biface reduction activity among an assemblage (Bradbury and Carr 2001). Considering both proximal flake fragments and complete flakes from the sample area of this thesis, 35% of flakes had zero platform facets, corresponding to a biface reduction rate of approximately 70% based on Carr and Bradbury's scatterplot of experimental data. The authors also offer a scatterplot showing the correlation between the percentage of debitage with zero or one dorsal scar, and the percentage of the assemblage representing core reduction. Less than 10% of debitage at the Gaudreau site exhibited less than two dorsal scars, indicating an extremely low rate of core reduction activity of less than 10%. This corresponds well with the high number of biface reduction flakes and low total number of core reduction flakes identified.

The rate of platform faceting does vary greatly by the class of raw material in question. Considering local, regional, and exotic materials each as a discrete category reveals platform faceting rates of 6%, 56%, and 65%, respectively. The overall rate for all complete flakes and proximal fragments is 35%. In the case of exotic materials, platform faceting occurs at a rate almost twice that of the entire assemblage, while local materials have platform facets at a fraction of the overall rate. The sheer size of this discrepancy underscores the different stages of reduction that took place at the Gaudreau site with each type of material. The low rate of platform facets among the local materials indicates that early stages of reduction were clearly an important on-site activity when using these materials. On the other hand, very little early stage reduction (as represented by flakes with zero platform facets) was carried out with exotic raw materials. Instead, reduction was likely already begun before these materials even arrived on site.

The overall rate of platform faceting also varies significantly within the northern and southern concentration areas previously identified as being defined by the extent of flakes with battered platforms and exotic raw materials. Within the northern concentration area, 33% of all flakes had zero platform facets. In the southern concentration area, only 20% had zero platform facets. Both rates are lower than the platform faceting rate of 35% from the overall sample area. These data help to clarify the distribution of platform faceting rates observed previously when considering the site's spatial organisation. Although the distribution of high and low rates of platform faceting in the southern concentration area appeared random, together these quadrants had a very high combined rate of faceting, generally indicating later stages of production than occurred within the northern concentration area. The random patterning previously observed appears, upon further inspection, to have resulted from a few quadrants with low total numbers of flakes that skewed the data. Additionally, in applying Carr and Bradbury's model (2001), both locations correspond to significantly higher rates of biface production activity than the site's overall rate of 70%. For the northern concentration area, a biface production rate just over 80% is expected. For the southern area, almost 100% of activity represented was biface reduction. This reinforces the idea that these two activity areas were focused predominantly on formal tool production.

The rates of platform faceting and dorsal scarring were calculated for those raw material groups identified via analysis of cortex cover. The results are summarised in Table 11. Overall, the prismatic local materials had a high rate of flakes with zero or just one dorsal scar, indicating a rate of core reduction activity of about 20% (Bradbury and Carr 2001). The rate of debitage with zero or one dorsal scar was lower for conchoidal regional materials, and indicated that core reduction activity was minimal. For the fine-grained exotic group, this rate was even lower and indicates that almost no core reduction activity took place. Oddly, rhyolite had a rate of debitage without flake scars (12.9%) that was closer to that of prismatic local materials than of conchoidal regional materials, indicating that it was also subject to high rates of core reduction activity.

Group	0-1 scars	2+ scars	Total
Prismatic	182	934	1,116
Percent	*16%*	*84%*	
Exotic fine	84	2,416	2,500
Percent	*3%*	*97%*	
Regional Conchoidal	202	2,158	2,360
Percent	*9%*	*91%*	

Table 11. Percent of flakes with less than two dorsal scars and two or more dorsal scars, by raw material type.

4.6 – Further Analysis

Some of the trends identified during analysis were further investigated. The hope was that these additional analyses would reveal that identified correlations could be successfully applied beyond the specific situation through which they were initially identified. The proposed spatial organisation of the site and hypothesised raw material categories are both considered.

4.6.1 – Testing Spatial Organisation against Raw Materials

The organisation of different activities into different areas of the site was tested against the entire sample area's most prevalent raw materials, that is, those that included at least 100 pieces of debitage. For the northern and southern concentration areas, and for the areas outside these, the numbers of biface reduction flakes, pressure flakes, and flakes with zero platform facets were calculated for each raw material. These were then divided by the total quantity of complete and proximal flakes in each material and categorised by area, giving the percentage of proximal, early stage debitage in the three areas for each major material. These percentages were then placed on a bar graph to visualise trends by site area for each raw material. For this analysis, only the strongest examples of biface reduction and pressure flakes were utilised, that is, those selected during the first round of identification and missing at most one characteristic that defines the type. As proportions were to be compared rather than raw totals, any trends would remain the same and using the strongest examples of each flake type would ensure the highest possible accuracy of these trends. This was particularly important as this analysis was implemented to verify previously identified trends.

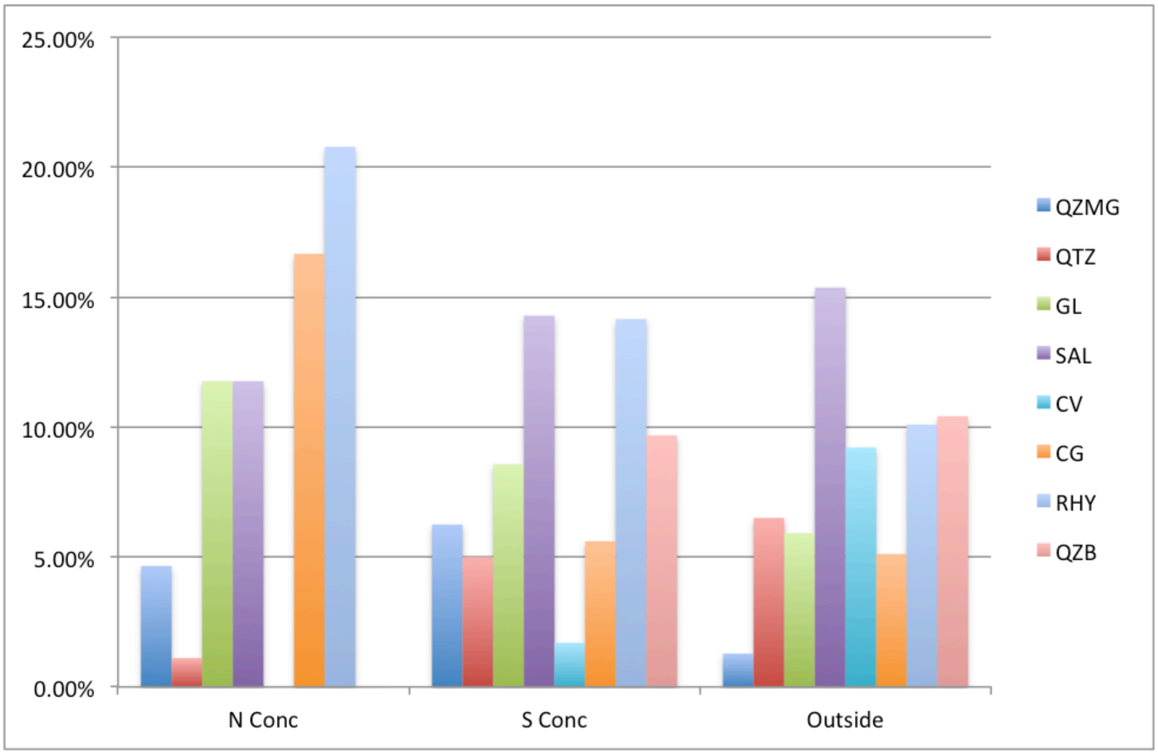


Figure 36. Proportion of biface reduction flakes among complete and proximal flakes, within each of three areas for major raw materials.

The distribution of biface reduction activity in certain materials matches that expected based on activity rates within these areas, while other deviate. Local gray stone, white quartzite, marbled gray quartzite, and gray chert are used predominantly for biface reduction activity within the northern concentration. This occurs at somewhat lower rates in the southern concentration, and even lower rates outside these two areas. Green chert, as has previously been discussed, occurs in a very limited area and biface reduction in this material was dominant beyond these concentration areas. Rhyolite, quartz, and local silicified mudstone trend in the opposite direction, with areas outside the two concentrations showing the highest proportion of biface reduction activity in these materials. For rhyolite, quartz, and SAL, the northern concentration is instead the area with the lowest rate of biface reduction activity.

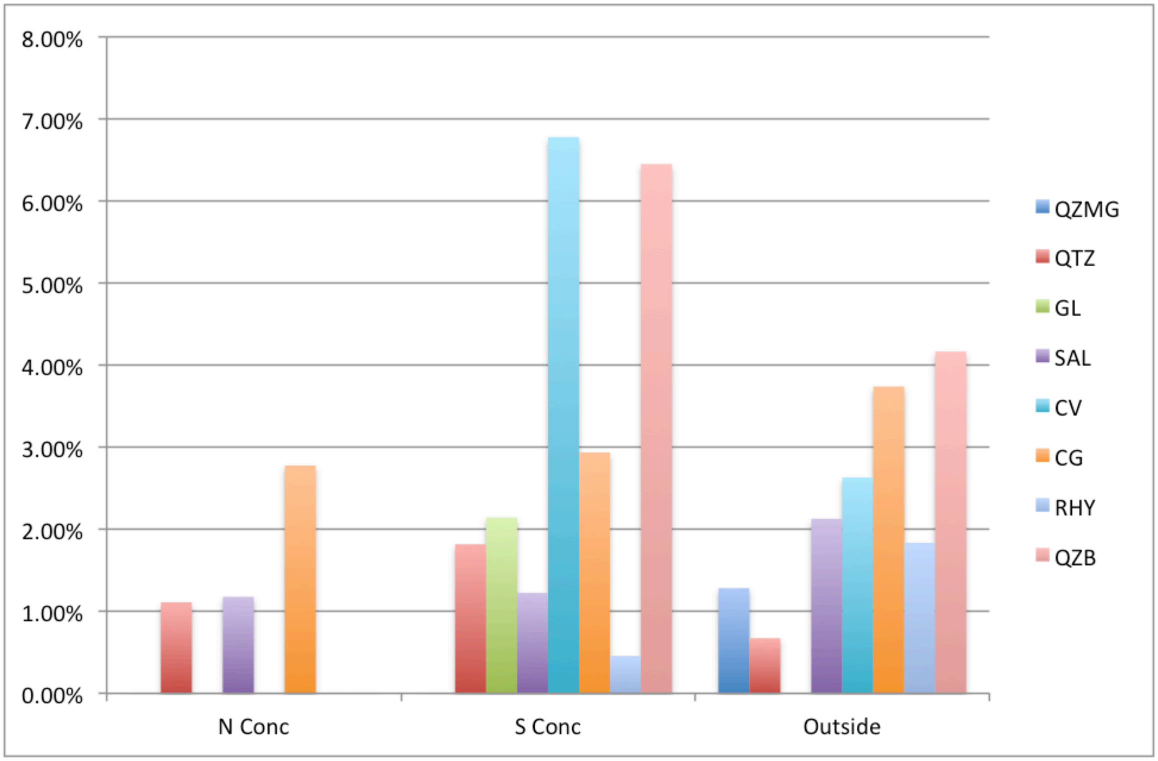


Figure 37. Proportion of pressure reduction flakes among complete and proximal flakes, within each of three areas for major raw materials.

The distribution of pressure flakes was analysed in the same fashion (Figure 37). For green chert, white quartzite, quartz, and local gray stone, the southern concentration was the area with the highest proportion of pressure flakes. These materials appear to have held to the hypothesized pattern of finishing formal tools in this southern activity concentration. There were no raw materials for which the northern concentration held the greatest proportion of pressure flakes. For gray chert, local silicified mudstone, rhyolite, and marbled gray quartzite, however, the area outside either concentration was the one in which pressure flakes made up the greatest proportion of the assemblage. For marbled gray quartzite, this is because only a single pressure flake was identified, most likely due to the fracturing properties of this prismatic material.

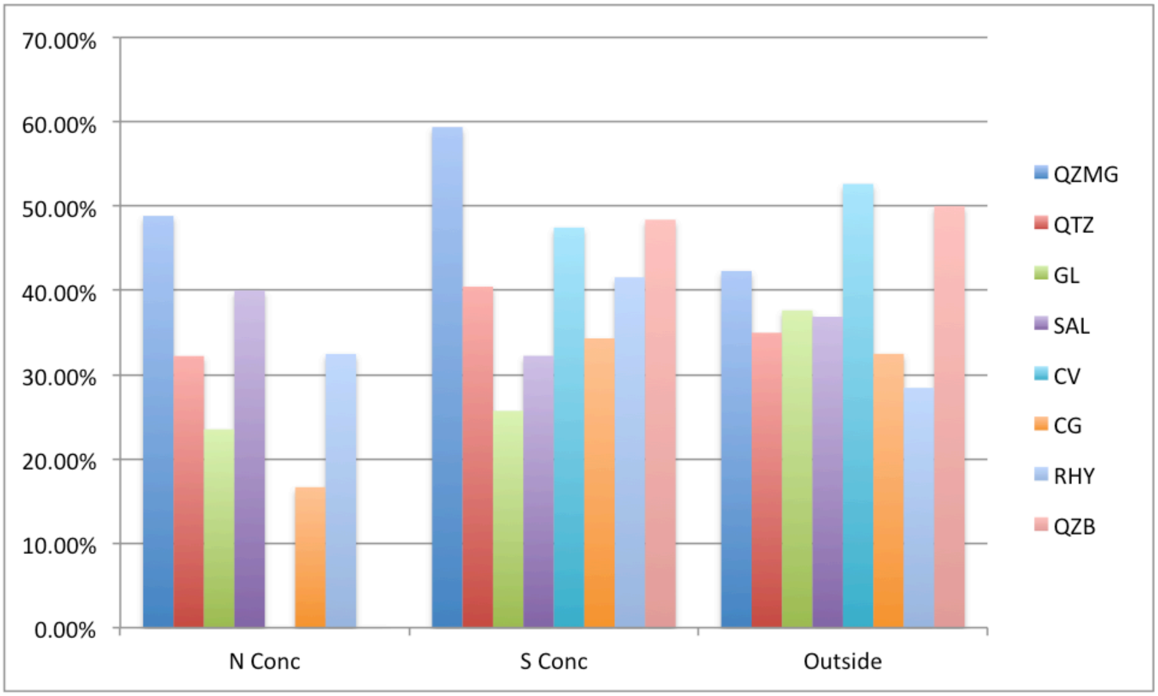


Figure 38. Proportion of flakes with zero platform facets among complete and proximal flakes, within each of three areas for major raw materials.

Finally, the proportion of proximal debitage with zero platform facets was analysed along the same lines, with the rate of this attribute being used as a proxy for production stage. For half of the raw materials, the northern concentration had the lowest rate of debitage with zero platform facets, followed by the southern concentration, and then the areas outside that. This was true for green chert, white quartzite, local silicified mudstone, and local gray stone. In the case of quartz and gray chert, the northern concentration still had the lowest rate of debitage with zero platform facets, but the southern concentration had the highest rate. For marbled gray quartzite, the southern concentration had the lowest rate, followed by those areas outside the concentration, and finally the northern concentration area with the highest rate of debitage with zero platform facets. For rhyolite, the areas outside the two concentration areas had the lowest rates of debitage with zero platform facets, followed by the northern concentration area and then the southern area.

4.6.2 – Flake Typology and Raw Material Classifications

Each of the three raw materials classifications was considered in terms of its representation among the two most common flake typology categories, biface reduction and pressure. As these categories were initially defined based on cortex cover, comparing them to other attributes allows a test of their validity. Approximately 50% of all biface reduction flakes were made of conchoidal regional materials, while about 33% of biface reduction flakes are of fine-grained exotic materials. It is likely that the high proportion of conchoidal regional materials is due to the sheer number of flakes in that category, as it includes both rhyolite and local silicified mudstone. Given this, the low portion of prismatic regional materials is particularly telling, given the quantity of quartz in the sample area.

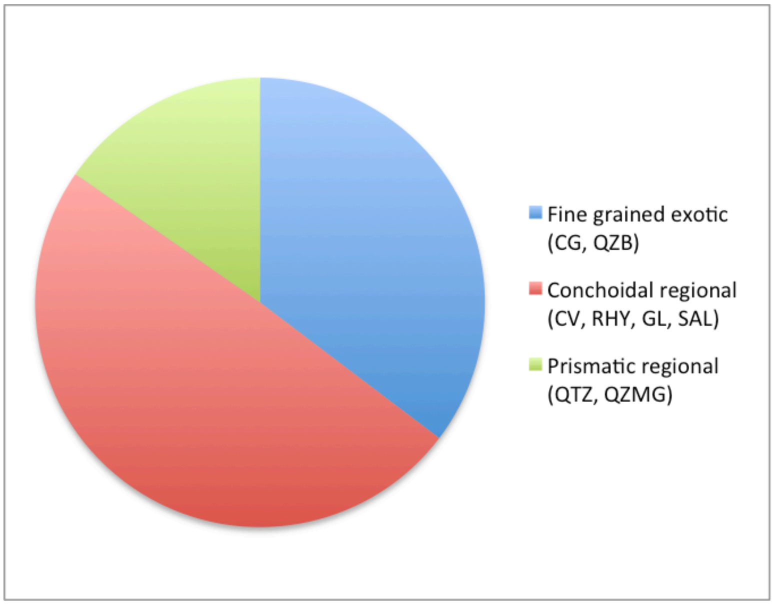


Figure 39. Raw material categories represented among the assemblage of biface reduction flakes.

Almost half of the assemblage of pressure flakes is made up of fine-grained exotic materials, while just over 25% of pressure flakes are conchoidal regional materials. Just less than 25% of pressure flakes are made of prismatic local materials. Although the prismatic regional materials represent a very small portion of biface reduction flakes, they form a significantly larger proportion of the pressure flakes. This is very likely the result of a primarily unifacial industry in these raw materials. While biface reduction appears to be a key focus for both fine-grained exotic materials and conchoidal regional materials, attention to retouch and resharpening was much more extensive for the exotic materials. This confirms those patterns seen previously among debitage analysis as well as the utility of understanding raw materials in terms of both effective distance to source and flaking properties.

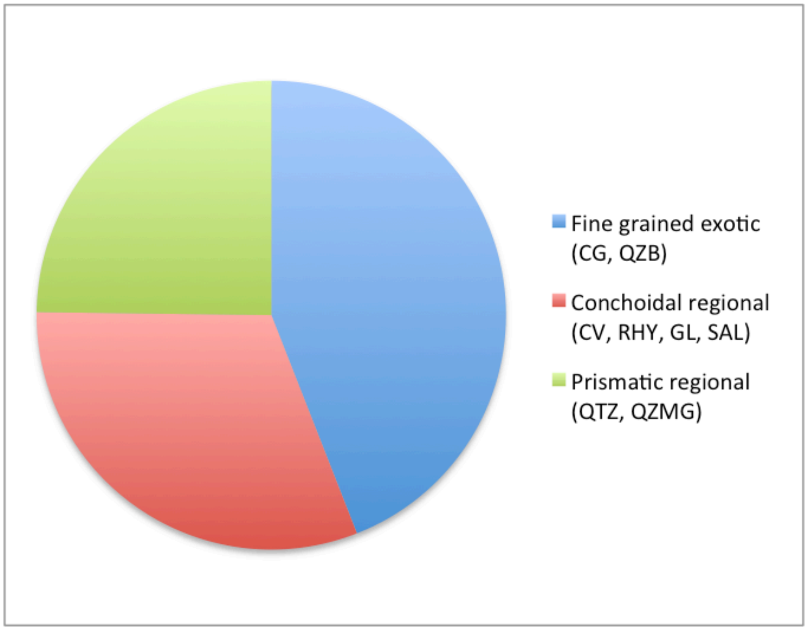


Figure 40. Raw material categories represented among the assemblage of pressure flakes.

5 – Discussion

As the Gaudreau site hosted multiple occupations over different time periods and their associated cultures, identifying each event clearly and separating its representative assemblage from those of other occupations is crucial. Once this is established, two general paths of interpretation deserve consideration with regard to evidence from the Gaudreau site. First, what does the debitage reveal about activity on the site and, more specifically, in the 50 sq. metres considered during the Archaic period? Second, what does the debitage reveal about activity beyond the site, including long-term choices and seasonal behaviour? In attempting to answer both questions, further implications are developed and possible avenues for future research are considered.

5.1 - Eliminating Evidence from Other Periods of Occupation

All major periods of occupation recognised in the archaeology of the Far Northeast are represented at the Gaudreau site, but not all periods are represented to the same degree or in the same way. Disentangling the mixed assemblage is the first step toward understanding the Archaic occupation and what it reveals of life within the region during that time. As the designation of the Archaic period was initially devised as a definition by exclusion (Ritchie 1938), so, too, will it be identified at Gaudreau by excluding interference and evidence from other periods of occupation.

5.1.1 - Paleoindian Occupation

The Paleoindian occupation at the Gaudreau site is represented by points, bifaces, drills, utilised flakes, a scraper, and debitage in a unique regional raw material identified as trachyte. This material was initially visually identified as a rhyolite or trachyte, but it is likely that it is in fact an immature sedimentary rock with an igneous input. This was the only material associated with Paleoindian tools, and artefacts in this material are confined to a small area of the Gaudreau site, with the highest amounts of debitage recovered from 77N 21W to 78N 22W. While "trachyte" tools and debitage extend beyond this locus, their frequency declines rapidly with distance from this center. Unfortunately, the Paleoindian assemblage is completely limited to a single stratigraphic layer, the *limon* level. Sstratigraphy is helpful in distinguishing the Archaic from the Paleoindian occupation at Gaudreau (Graillon et al. 2012:70).

Although present in Late Paleoindian assemblages of the Eastern Townships, Kineo rhyolite was not utilized during this period of occupation at Gaudreau, further solidifying the limited nature of the Paleoindian occupation (Graillon et al. 2012). Exclusion of the Paleoindian period, for the purpose of identifying the Gaudreau site's Archaic component, can best be done by eliminating all artefacts and debitage in trachyte, as those artefacts representative of Paleoindian activity occur in areas that also hosted subsequent occupations. Luckily, this has a minimal impact on the total quantity of debitage recovered from the sample area, leaving a population of artefacts easily large enough for carrying out analysis.

5.1.2 – Historic Occupation

The historic period occupation at the Gaudreau site is marked by the presence of artefacts made of European materials or manufacturing processes. These include lead shot, glazed ceramics, metal objects, and gunflints made of European flint. These artefacts are spread from 68N 20W to 71N 22W. This falls directly within the sample area, and some European flint was contained among the debitage. This material was recorded alongside other debitage for this study, to ensure that data corresponded with what was recorded in the field. It was, however, later excluded from analysis due to its European origins. This allows for the consideration of only those lithics that could be sourced by the site's inhabitants before European contact.

One complication in disentangling the historic occupation from earlier site activity is the extensive vertical mixing that took place. Historic artefacts are found in every stratigraphic layer, including *limon*, which yielded the majority of Paleoindian artefacts. Although the *noir* and *limon* layers are distinct in appearance, artefacts have clearly shifted between these layers, likely due to root or rodent activity. Given these realities, eliminating the historic period activity is best done by simply eliminating those artefacts associated with European presence in the New World.

There is no definite area or stratigraphic layer associated with this period, so the best—and only feasible—way to avoid the influence of this period on the Archaic analysis is to simply remove those artefacts from the assemblage under consideration.

5.1.3 – Woodland Occupation

The mere presence of a ceramic assemblage at Gaudreau clearly marks an occupation dating to the Woodland period. Within the sample area, dateable ceramic sherds indicated occupations during the Middle and Late Woodland periods. None of the individual styles present offers a clear spatial pattern that would indicate a discrete and unmixed occupation. Instead, sherds from both the Late and Middle Woodland are scattered throughout the sample area, with a distinct area of concentration to the south. This area is distinct from assemblages dating to either the Paleoindian or historic periods. Although it overlaps the major concentration of historic artefacts, its shape and orientation are clearly distinct (see Figures 23 and 5). As with artefacts unique to other occupations at Gaudreau, the ceramic assemblage shows some evidence of vertical mixing. This is likely due to size, as the ceramic sherds identified tended not to be as small as other categories of artefacts and this assemblage shows a much smaller vertical range. As no smaller levels were recorded than the site's natural stratigraphy, most artefacts—regardless of type—came from the topmost soil layer. While it is tempting simply to separate the vertical area that yielded ceramics to disentangle the Woodland assemblage, this would not leave a large enough sample to complete a viable and representative debitage analysis.

Instead, it is the spatial patterning that should be considered. A clear concentration towards the south of the sample area, and likely continuing beyond its edges, indicates an area of Woodland period activity. Any other subgrouping of artefacts that follow this same horizontal patterning should be considered as part of the same deposition event as the ceramics, and thus part of the Woodland period occupation. Although the area is somewhat close to the southern concentration of biface reduction and pressure flakes, the Woodland ceramic concentration is south and east of these debitage concentrations. As none of the debitage patterning shows enough correspondence to Woodland spatial distribution to cause alarm, the bulk of the

Woodland occupation can be understood to have occupied a distinct spatial area. It is inevitable that some of the lithic artefacts considered in the sample will have been produced during the Woodland period, but the respective spatial distributions of artefacts from different periods of occupation indicate that the sample is primarily representative of the Archaic occupation.

5.2 – Archaic Activity Organisation at the Gaudreau Site

Activity dating to the Archaic period seems to have taken place across the area sampled, but certain loci show evidence of specialized activity, including specialized production stages, focused reduction on certain types of material, and particular technologies of tool production. Not only does this reveal spatial organization within the site, but it also reveals choices regarding the segmentation of the lithic tool production sequence. Not all of Callahan's stages of production are present within the sample area of the Gaudreau site, but rather only the later stages are represented. The initial reduction of a piece into a preform or blank appears to have taken place away from the site.

A wide range of reduction technology was utilised at the Gaudreau site, with various approaches to flaking, pecking, and grinding represented among both the tools and the debitage. Site inhabitants used hard, soft, and ridged hammerstones in the production of their stone tools. While hard and soft hammerstones are used primarily for flaked stone tools, ridged hammerstones are linked to preparation of ground stone tools (Will 2002). A rough shape is typically achieved through flaking and pecking, after which the piece is ground and polished. Not only were ground tools recovered from the site, but also the polishing tools used in their production. This indicated the presence of ground stone tool production activity on site, an activity further confirmed by debitage with battered platforms.

5.2.1 – Spatial Organisation

The Archaic area is represented throughout the area sampled. This time period is best represented by flakes with battered platforms, and especially those that are also wide. These appear throughout the area sampled, confirming that the area defined for the study was well chosen. Two areas of key importance have especially high rates of platform battering. The first and southern Archaic concentration is in the 69N and 70N transects, from 20W to 22W, while the second and northern Archaic concentration is at 75N, from 21W to 22W. These areas are each within a metre of the two major concentrations of Archaic formal tools, again validating the non-random nature of these concentrations. These concentrations also reflect high rates of exotic raw materials, abnormal flake sizes, and trends in flake typology.

These two concentrations of Archaic tools and debitage represent areas of activity focused on different stages of production and types of technology. Flake size in the northern concentration area trends to the larger end of the range represented within the sample area. Within this concentration, biface reduction flakes represent a higher proportion of debitage than elsewhere within the area sampled. Additionally, the ratio of exotic materials to local and regional materials is particularly high here, as is the proportion of flakes with battered platforms. Finally, platform faceting is marginally more common here than elsewhere within the sample area. In the southern concentration area, a similarly high ratio of exotic to local and regional materials was present. Here, pressure flakes occurred at an unusually high rate rather than biface reduction flakes. Platform faceting did not occur at a rate notably higher than elsewhere in the sample area. However, flake size tended to be small in comparison to the entire assemblage from the sample area. Flakes with battered platforms occurred more frequently within this area than they did in areas not part of either concentration.

The northern concentration appears to represent an area focused on the middle stages of biface production, or Callahan’s stages four and five. A strong focus on bifacial reduction and thinning occurred within this area and flakes are too large to represent the finishing stages of manufacture, retouch, or resharpening. The exceptionally high rate of exotic materials indicates that manufacture here was likely aimed at producing tools with a more difficult manufacture process, which required a significant investment of time. High quality raw materials would be chosen for this sort of manufacture, because the ease and predictability with which they flaked offered a greater probability of a successful outcome. The preference for tools in exotic materials, such as chert and rhyolite, is reflected in the disproportionately high representation of these materials among the Archaic tools from the sample area.

The southern concentration, on the other hand, was the location of finishing and retouching activities, or Callahan's stage six. This focus would directly cause a disproportionately high number of pressure flakes. Even when flakes are not identifiable as the result of pressure flaking, the trend towards smaller sizes implies the reduction here was the later stages of tool production. The low rate of platform faceting could be interpreted to counter the idea that reduction here was primarily late stage, but that is not necessarily the case. Given the combined evidence for the final stages of tool production occurring here, it is more likely that the low rate of platform facets results instead from flake platforms being smaller and therefore less likely to intersect scars from previous removals (Towner and Warburton 1990). The high ratio of exotic materials is a result of using higher quality materials for formal tools, as was also done in the northern concentration area. Additionally, the high rate of platform battering in both concentration areas strengthens their connection with the Archaic period.

Outside these two concentrations, debitage is less likely to be from exotic sources and is instead predominantly locally obtained materials. Biface reduction flakes and pressure flakes are not especially common in these areas, nor is the rate of platform battering particularly high. Flakes tend to be the same as for the site as a whole, although those transects with the greatest proportion of flakes at least 600 sq. mm in size occur outside the two major concentration areas. The total frequency of debitage present is also lower in the areas outside those concentrations. Thus, while less production overall of lithic tools took place in these parts of the sample area, what did occur utilized local materials and left behind large waste flakes more often than within the either northern and southern concentration areas. As these were not the areas focused on producing formal tools during the Archaic occupation, the lithic activity here most likely represents the production of expedient tools that were created and discarded in rapid succession. Although of poor quality, local raw materials were preferred for this because they were cheaper to obtain and so their rapid discard was of less consequence.

5.2.2 – Production Sequence

Lithic tool production represented at the Gaudreau site resulted from a combination of reduction carried out offsite, in addition to what took place at the site. This is specifically important for imported raw materials, to maximize efficiency during transportation. Biface reduction is the primary activity represented among the debitage, although core reduction, expedient tool production, and ground stone tool production also took place. This is closely in line with what Gauvin observed among the rhyolite debitage (2016), although interestingly rhyolite itself had one of the higher rates of core reduction activity of any single raw material. This complicates what would otherwise be a relatively straightforward pattern.

Production of bifacial tools was segmented at this site into discrete steps, with biface thinning and shaping taking place separately from final retouch. This is demonstrated by the placement of these activities in distinct locations at the site. This focused segmentation was primarily implemented for exotic raw materials. Despite this, biface reduction was particularly high among local silicified mudstone and this was one of the most common materials among the assemblage of finished, formal tools within the sample area. However, this material also had a lower overall rate of platform faceting compared to other materials, indicating that a greater range of production sequence activities took place on site in this material. This is confirmed by the slow decline in debitage frequency as cortex cover increases, and the tendency towards larger flake sizes when compared to the assemblage as a whole.

Among exotic materials other than the Kineo rhyolite, all but the final stages of the production sequence appear to have taken place offsite. Tools in these materials were transported to the site in a finished or nearly finished state. Reduction in these materials included retouch and resharpening activities almost exclusively. These exhibited a much sharper decline in debitage frequency when cortex cover increased, indicating a narrower range of reduction stages taking place on site. Flakes in these materials tended to be smaller than the pattern seen for the sample area’s entire assemblage, a trend most visible among the abundant debitage in gray chert.

Local materials with prismatic structures and a tendency towards angular fracturing showed a distinct set of patterns. Flake size clustered strongly around the center of the dataset, in contrast to the more dispersed distribution seen in the total assemblage. Attributes of flakes in these materials tended to occur at rates below those of exotic materials and above those of conchoidal regional materials. However, rates of pressure flaking was high among quartz, and bifaces made of this materials were recovered from the sample area. It appears that reduction for both bifacial and unifacial tools were undertaken with these materials.

The evidence at the Gaudreau site points to two parallel lithic economies at the Gaudreau site, one focused on formal tools and the other focused on expedient tools. Andrefsky argues that these should be seen as extremes on a continuum rather than as mutually exclusive categories, and this is helpful in considering how different raw materials were treated at Gaudreau (Andrefsky 2009), as key raw materials seem to have operated in both spheres. When site residents wanted to create a new bifacial tool, they tended to select gray chert. Kineo rhyolite was also used for this, despite being sometimes treated as though it were more local. This is due to its unique characteristics as a regional but accessible material that flakes relatively well when compared to the stone available locally. Local prismatic materials were used for unifacial flake tools that did not require bifacial reduction and which could be made by retouching medium-sized flakes. Other activities, including core reduction, took place using more local materials. Given that these were also used for formal tools, it appears they served as a multipurpose material, serving for expedient tools and standing in for biface production if better quality materials were unavailable.

5.3 – The Archaic Lithic Economy of the Far Northeast

The Gaudreau site certainly did not exist in a vacuum, and choices made there can reveal larger patterns that existed in the region during the Archaic period. This is particularly true of the lithic assemblage, as the relative reliability of visual source identification and its durability make the assemblage of tools and debitage a unique marker of the choices site inhabitants made. In the case of the Gaudreau site, the assemblage reveals preferential usage of materials dependant on the task at hand and segmentation of formal tool production from more exotic materials. These choices should be understood within the context of available raw material sources and the unique needs of Archaic period peoples.

5.3.1 - Obtaining Raw Materials

Inhabitants of the Gaudreau site made ample use of locally available raw materials, in particular a silicified mudstone obtained from the Lac Aylmer area that made up over 52% of the total debitage recovered from the sample area. Quartz was also heavily exploited, comprising 20% of the debitage yielded by the sample area. Although neither of the major identified quartz sources occurs within the 20 km radius used to define "local" sources, quartz is considered to be local due to its regional ubiquity. Additionally, it fits the patterns identified for local materials, reinforcing this interpretation. A local gray stone was also utilized, but was less common within the sample area.

The declining use of raw material based on source distance, while still an important trend within the sample area, differs markedly from the distance decline model applied by Hoffman (2006). Predicted debitage totals based on this are presented in Table 13. Generally, there is less usage of local and regional materials than Hoffman predicted, and a much higher rate of exotic materials. This is particularly striking given the expectation that Archaic peoples be well acquainted with their local resources and to exploit them at high rates. Instead, the inhabitants at the Gaudreau site often relied on materials from distant sources and seem to have strongly preferred these toolstones for certain tasks. This suggests that a different model would perhaps be more appropriate in understanding the circulation of lithic raw materials during the Archaic period and is in line with the trends seen at other sites (Wilson 2007a).

Category	Materials	Predicted frequency	Actual frequency	Difference
Local	SAL	27,797	23,472	- 4,325
	GL			
	QTZ			

Regional	QZMG QZB CV	2,780	587	- 2,193
Exotic	RHY CG	278	6,826	+ 6,548
Total		30,854	30,885	

Table 12. Predicted frequency of raw materials in local, regional, and exotic categories for those with at least 100 pieces of debitage recovered from within the sample area.

Gray stone, silicified mudstone, and quartz were all located within a 20 km radius, or approximately four hours walking time. This means that a trip to the source, extraction, and the return trip to the Gaudreau site could easily be completed in a single day or during a short trip. The closest lithic source, at Lac Aylmer, is just over 4 km away from the site and could be reached with just an hour of walking. The Saint-François River connects the site and the lake, which would allow for the transport of bulk quantities and lower the effective distance to the site (Gauvin 2016; Renfrew 1977; Blair 2010). Mobile groups typically obtain most of their resources from within a 10 km radius (Vita-Finzi and Higgs, E. 1970), and lithic procurement at the Gaudreau site fits this pattern. Beyond the 10 km radius, resources tend to offer diminishing returns due to the cost of transport. Thus, the attractive properties of quality toolstone may be partially or completely negated by the difficulty associated with procuring it, and vice versa (Wilson 2007b). This is reflected in Hoffman's model for the source of materials used at any given site (Hoffman 2006). However, the use of chert and rhyolite for manufacturing formal tools offers a counterpoint to this trend.

Vita-Finzi and Higgs's analysis relies on data from relatively dry regions, especially when compared to the extensive network of rivers and lakes in the Eastern Townships and Western Maine. These waterways significantly reduce the cost of travel and make long-distance bulk procurement more feasible than would otherwise be possible (Blair 2010). This probably explains the high quantities of Kineo rhyolite among the Gaudreau assemblage, as it is connected to the site via the rivers that traverse these regions. Given that the straight-line distance between Mt. Kineo and the Gaudeau site is about 200 km, it is possible that this material was obtained through down-the-line trade, but the use of waterways permitted it to be transported and traded in bulk. Indeed, there is evidence of the Abenaki making regular trips by canoe to Moosehead Lake, associated with seasonal hunting activities (Lalement 1898; McGuire 1908). The catchment model seems to therefore be a better fit for the raw material frequencies within the sample area, with the Gaudreau site's catchment understood to include the regional trade network of Western Maine and the Eastern Townships, although this would require portage south of Mt. Megantic.

Materials farther than could be obtained in a day, but still within a 100 km radius, are less frequent at the Gaudreau site. There are few sources for lithic raw material that both fall within this area and are of a high enough quality to make them worth the cost required to obtain them. In addition to rhyolite, this category included green chert. The Ledge Ridge source falls easily within this category, at approximately 65 km from the Gaudreau site or 13 hours by foot. Ledge Ridge chert includes green and gray shades, and likely represents some of the tools and debitage at the site. For the purposes of analysis, the source was classified as a green chert as artefacts of this material were more uniformly the color and lustre associated with this source in comparison to those of gray chert (Georgiady and Brockmann 2002). Ledge Ridge and the Gaudeau site are connected nearly directly by water, although current water depths would require portage at times. It is possible that some gray chert was obtained from this source, too, but certainly not most of the debitage in gray chert category.

One possible issue in obtaining cherts from Maine via boat is that of river depth. Certain rivers may not have been navigable during the time the Gaudreau site was occupied, meaning that portage would be required during the voyage (Graillon 2013). However, the Quebec City region is also a source of cherts that are possible macroscopic matches to those in use at Gaudreau (Letendre 2007b, 2007a). Access to the Quebec City region would likely have been possible by accessing the Saint Lawrence River via the Chaudière River, whose source is at Lake Megantic (Chapdelaine 2009). This may have been a more accessible source of chert, as reaching Western Maine requires crossing mountain passes. While the amount of Kineo rhyolite present on site attests to the feasibility of this journey, obtaining raw materials from the Quebec City region may have simply been easier.

Overall, materials in the exotic category are more diverse, in that the category is made up of a small number of artefacts that fit into numerous categories. Even within the general categories of, for example, gray or beige chert, a wide range of colors, textures, inclusions, and lustres are represented. These materials appear not to have been obtained in bulk, but rather in smaller quantities via down-the-line trade. This fits with the overall small size of flakes in this category compared to flake size of local and regional materials. These materials also display a very high rate of platform faceting compared to other materials, indicating that most flake removals for this class of raw material occurred after the piece had already undergone a certain amount of reduction. These materials were likely reduced to the form of blanks or cores at their source, and transported and traded in this form in order to minimize cost and maximize efficiency.

5.3.2 – Curating Raw Materials

After raw materials were acquired, locally or over great distances, the choice had to be made regarding how and when each material should be used. Materials do not appear to have been simply used up in order of acquisition at the Gaudreau site. Instead, site inhabitants displayed strong preferences based on both acquisition cost and fracture properties, depending upon the task undertaken or tool being made. Local materials, especially the gray stone, were easy to work and abundant enough to provide for all tools that the Gaudreau inhabitants may have needed to manufacture. In the current archaeological understanding of Archaic peoples in the Northeast, this is precisely what they should have been expected to do. Archaic peoples are believed to exploit local materials, as they are less mobile, and thus able to better learn what local resources are available to them (Dincauze 1971; Ellis et al. 1998). Instead, Gaudreau site inhabitants preferred to invest in procuring exotic materials, and save these for the production of formal bifacial tools.

The use of exotics for these formal tools is not, however, exclusive. Formal tools are also made of local materials, and this is especially true for ground stone tools at Gaudreau. Not only are the ground stone tools recovered from the sample area typically made from local lithic materials, but also the rate of platform battering is highest among this class of material. Flaked bifaces are also made of local materials, and are the second most common material for this sort of tool, after gray chert. However, their representation among formal tools is disproportionately low. Additionally, SAL had a rate of biface reduction flakes that was higher than anticipated. Most likely, the low rate of pressure flaking represents a low proportion of tools completed in comparison to those begun. As the material was easy to access and of mediocre quality, the site inhabitants would have begun many more tools than they finished. Obtaining additional SAL, if necessary, was low-cost and there was little incentive not to begin as many bifaces as necessary to produce the requisite tools. Given the unpredictable nature of the raw material, a great deal of initial biface reduction compared to the amount of finishing work in SAL. As local materials tend to have larger flakes sizes and fewer platform facets, this material appears to have been transported in a more "raw" form and worked less extensively. This material seems to have been favoured for the production of expedient tools, such as retouched flakes. These tools were produced as needed and discarded quickly, meaning that cheap materials were best suited to this purposes.

Interestingly, the assemblage of utilised flakes from within the sample area does not reflect this sort of patterning. Of the 22 utilised flakes identified during excavation and noted within the artefact catalogue, 77.3% (n = 17) are made of gray chert. However, it is possible that this resulted from an error in identification and reporting, due to the challenges associated with analysing SAL. This material weathers quickly and breaks easily, both of which would lead to difficulty in identifying utilised and retouched flakes. Additionally, there is simply such a large volume of this material that excavators would have found the tasks of examining each flake for signs of wear and retouch to be overly burdensome. SAL is over ten times as frequent as gray chert in the sample area, and excavators would have found it much easier to examine flakes of the less abundant material. Finally, the cherts found here weather less extensively than does the SAL, making identification of utilised flakes much easier.

A brief overview of all utilised and retouched flakes in gray chert and silicified mudstone identified during initial excavation and cataloguing at the Gaudreau site revealed interesting patterns in both size and probable production technologies. Many more small size utilised flakes of gray chert were present when compared to the utilised flakes in SAL. While there were large flakes in CG, most utilised flakes of this material fit the 100 sq. mm size class. In comparison, utilised flakes in SAL were more often 400 or 600 sq. mm in size. Although both materials had higher rates of lipped platforms than of percussion bulbs, this trend was much more pronounced in the gray chert. For the SAL, of all utilised flakes with identifiable platforms, two displayed bulbs of percussion while three had lipped platforms. Among the gray chert, only three had bulbs of percussion while 13 had lipped platforms. Both materials had high rates of platform faceting. While the small sample size makes it difficult to say anything conclusively, these data support the hypothesis that utilised flakes in gray chert were predominantly the by-products of biface reduction, while those in SAL were more likely to have been produced as required, via hard hammer technology.

There are not enough formal tools in local materials recovered within the sample area to account for the vast quantities of debitage in these materials under normal circumstances, even considering the scant preforms and blanks. These local materials could have been used for some other purpose. The attributes of the assemblage of local debitage point to reduction focused on the creation of large and medium flakes that could be used as expedient tools. The local raw materials were also preferred for ground stone tools. Although local materials were not ignored when formal bifaces were needed, higher quality exotic materials were preferred for this sort of task. Alternatively, it is also possible that the SAL was so poor a material that it truly required that much flaking to produce a single tool. Given the number of utilised and retouched flakes made of gray chert that were identified during excavation, there are likely a good deal of these expedient tools, even as many as a hundred or more, waiting to be identified within the assemblage of local materials. This would be a useful project that could be undertaken and that may reveal how these tools—easily created, quickly discarded, and showing obvious but minimal evidence of use—fit into the rest of the assemblage from the Gaudreau site.

On the other hand, high rates of pressure flaking in gray chert, local silicified mudstone, and rhyolite, in the areas outside the two major concentrations, deserves consideration. In the case of gray chert, fewer pressure flakes of this material were recovered outside the two concentration areas, but this activity represents a greater proportion of the debitage in this material recovered from that area simply because there was less of it in total outside the major concentrations. Given the higher total quantity within the two concentration areas in question and the high rate of biface reduction with the northern concentration, it is possible that those pressure flakes outside the two concentrations were a result of tool maintenance being performed as necessary. A preference for producing and curating formal flaked tools in chert over other available materials has been noted in the Far Northeast, even during the Archaic period (Thomas 1997). Given the high number of formal flaked tools in this material and its excellent flaking properties, these tools were worth curating and were subject to resharpening after wear. Indeed, all gray chert bifaces examined by Gauvin exhibited evidence of resharpening, with one example repurposed for use as a scraper. The only other material to exhibit a 100% resharpening rate in this study was green chert. Other materials exhibited, at most, a resharpening rate of 66.7%, observed for SAL and rhyolite based on Gauvin's observations of points made of these materials (2016). If this resharpening was done by the tool's user at the moment it was needed, the observed rate of pressure flaking outside the two major concentration areas could be explained for gray chert, rhyolite, and the local silicified mudstone.

5.4 – The Gaudreau Site in Context

Although the Archaic period is typically characterised as a time of strong preference for local raw materials over exotic sources, the Gaudreau site reveals that the situation does not apply to all sites. The Paleoindian period and Archaic period do not each exist in a vacuum. Certainly, the people who lived in those periods did not understand them as being two distinct time periods with strong internal consistency and major differences with preceding and subsequent periods. Rather, those who experienced the Pleistocene to Holocene transition would have seen each change as a small and barely significant step, as the human lifespan is simply not long enough to grasp the scope of change on an archaeological scale. With this in mind, then, what become important are the points of continuity from one material culture to the next. In the case of the lithic economy, this continuity is visible in the persistent preference for more fine-grained and cherty raw materials in biface production. This final discussion section considers the role of the Gaudreau site's debitage assemblage within the broader context of the Far Northeast.

5.4.1 – Raw Material Procurement and Utilisation

Raw material usage at the Gaudreau site differed significantly between raw materials. Although this study was begun with the expectation that primary differences would be between those materials from local, regional, and exotic sources, this was proved to be only partially true. The physical properties of the lithic materials used and the influence of social networks also played a role in making tool production decisions. Despite the existence of these preferences, none appear to have been so strong as to completely deter site inhabitants from using any given material, regardless of what the task at hand may be. Although they may have preferred a different material, they were typically willing to work with what they had. Each of the most abundant raw materials will be considered individually and within the larger patterns observed among similar materials at the site.

The most well-recognised industry specific to a particular raw material during the Archaic period is the heavy use of quartz during the Early Archaic period, often to the near-exclusion of other materials (Dincauze 1975; Fitzhugh 1975; Ellis et al. 1998; Chapdelaine 2009; Robinson 2008; Chapdelaine et al. 2015). This is not the case seen at the Gaudreau site, where quartz was used for bifacial tools as well as unifacial. This fits with the site's primary period of occupation dating to the Late Archaic. More importantly, the low rate of biface reduction flakes indicates that biface production was not the most common sequence undertaken with quartz. Pressure flakes are common, however, and flakes in this material tend to cluster strongly around the 100 mm^2 size class with little variation. In the context of the Gaudreau site, the importance of understanding quartz also calls to mind the importance of the marbled gray quartzite, a similarly prismatic and regionally sourced material that shares commonalities of usage among the raw materials present at Gaudreau.

Marbled gray quartzite (although technically a rhyolite, referred to as a quartzite due to its field classification) likely was procured from the Montagne de Marbre source, located almost exactly halfway between the Gaudreau site and the Kineo rhyolite source at Moosehead Lake. Although it looks likes a quartzite, the material is in fact a rhyolite (Graillon et al. 2012). No formal tools of this material were recovered from the sample area—or, indeed, from the entire site—and this is unsurprising, given the angular nature of the flakes produced by this material. Debitage in this material is relatively plentiful, and it is the most common of all regional materials recovered from the sample area. Both quartz and marbled gray quartzite tended to have low rates of biface reduction flakes, and pressure flakes occurred in both materials. Flake sizes in these materials tended to cluster strongly in the medium range, and particularly among quartz showed relatively low variation. Trends in cortex cover were very similar between these two materials, confirming that these two assemblages reflect similar production stages. Given these patterns and the known propensity of Archaic peoples in this region to using quartz for unifacial tools, these materials at Gaudreau likely reflect similar activities, but not exclusively. Considering the Archaic occupation beyond mere considerations of presence and absence as Robinson suggests, it appears that a unifacial industry in quartz was present on site and it also included marbled gray quartzite. A bifacial industry in this second material existed at the regional scale, with Middle Archaic bifaces from the Montagne de Marbre source identified at the BiEr-6 site on Lac de Joncs (Chapdelaine, forthcoming 2017). As both materials have similar fracture properties and can be obtained from within the region, this class is defined as prismatic regional materials.

Possibly obtained as part of the same seasonal cycle as marbled gray quartzite, Kineo rhyolite is a trademark of the Archaic period within the Eastern Townships (Corbeil 2007), so its presence at the Gaudreau site was to be expected despite the source's distance from the site. Given the geography of the Eastern Townships and Western Maine, it seems likely that an economic and social network extended from Moosehead Lake westward to the St. Lawrence River. This area, including that surrounding the Montagne de Marbre, is primarily low lying, with extensive lakes and rivers. Although any single group frequently covering the distance to the Kineo rhyolite source at Moosehead Lake seems unlikely, a trade network based on social ties would offer the same benefit of raw material access without costly travel required for an individual group. The existence of a network such as this would allow Archaic peoples of the Eastern Townships, the Saint-François River Valley, and Western Maine to treat Kineo rhyolite as a locally abundant material, no matter how far from the source they may be located at any given time, thereby explaining its ubiquity throughout the region.

This economic network would likely also be linked to any aggregation practices, such as might be expected at Moosehead Lake, as encountered by Lalement, during his encounters with later peoples (1898). Although aggregation is not strongly demonstrated for the Far Northeast Archaic, it remains an open possibility and is known in Paleoindian contexts in this region and in the Southeast during the Archaic (Bursey and Bursey 2012; Alvey 2005; Dumais 2000; Robinson et al. 2009). The evidence that does exist comes from the lengthy Archaic occupation of the Smyth and Neville sites (Dincauze 1976). This sort of social and economic network would allow inhabitants of the Gaudreau site to treat both marbled gray quartzite and Kineo rhyolite in a manner similar to how they treated local materials. Additionally, the Megantic region was heavily occupied from the Paleoindian period onward, and is only 45 km from the Gaudreau site, easily accessible within a day of walking. The Gaudreau site could easily be considered a satellite of this larger occupation network centered at the Lac des Joncs, Megantic, and Lac aux Araignées system.

Similar to the commonalities in usage among the prismatic regional materials, rhyolite shows use patterns like those seen in other conchoidal materials accessible within the Eastern Townships. This category includes local gray stone, silicified mudstone, and green chert. Green chert and rhyolite both reflect the overall trends in flake size distribution as seen throughout the sample area, while SAL and the local gray material are both skewed larger. All four materials show similar trends in decline with increasing cortex cover. This rate is somewhat slower than what is observed in other raw materials. Although green chert, local gray stone, and rhyolite have average rates of biface reduction flakes among their assemblages, biface reduction flakes are much higher than expected among the debitage in SAL. The importance of SAL is reflected in its high frequency among the collection of formal tools from the sample area and the site overall, comprising 26.3% and 15.8% of these assemblages, respectively. As a group, the conchoidal regional materials represent 57.9% of the tools from the sample area (n = 9) and 47.3% of Archaic tools from the entire site (n = 18). About half of the biface reduction flakes identified are in local silicified mudstone, indicating that these materials were used most often for biface reduction activities.

Locally sourced, coarse-grained materials were preferred for a range of tasks beyond biface reduction, including ground stone and expedient tool production. The production of expedient tools is particularly interesting, as it is related to the increasingly settled nature of Archaic populations. The very existence of an expedient tool economy relies on the ability to store raw materials in sufficient bulk that usable flake tools can be removed. A core itself is only useful insofar as the flakes removed from it are useful and in the case where a group must move frequently, a few well-designed and reusable tools are a more efficient solution. For a more sedentary group, storage become a viable risk-management option (Wiessner 1982). The use of secondary sources, rather than bedrock sources, is characteristic of the Archaic period (Will 2000; Sanger et al. 2001), and implies that obtaining lithic raw materials likely formed part of an embedded procurement strategy. Because the Gaudreau site inhabitants were able to store large quantities of local mudstone and use it to produce bifaces when necessary, they faced little pressure to send out task groups with the sole focus of procuring toolstone.

The nature of certain raw materials utilised at the Gaudreau site would have led to difficulty in identifying expedient tools made of these types of stone. In particular, local coarse-grained materials and Kineo rhyolite are both heavily affected by post-depositional weathering. Weathering of Kineo rhyolite can obscure striations, while the easily marred surface of the site's local gray stone and silicified mudstone make it difficult to distinguish between evidence of utilisation, weathering, and "trowel retouch." Given these challenges, the strong bias for chert that appears among those utilised and retouched flakes identified on site and recorded in the site catalogue almost certainly resulted from the simple fact that informal tools are easier to identify in some materials than others. Subsequent work on the Gaudreau assemblage has identified expedient tools in a wider range of raw materials than was done on site. Certainly continued work on the collection will only reveal more, especially if particular attention is given to the prodigious quantities of debitage in SAL.

Instead, most utilised flakes identified at the Gaudreau site were made of gray chert. This was one of two major raw materials identified as a fine-grained exotic and reduction in this material would be expected to reflect its high value and cost. This was reflected in the high percentage of tools that were made of gray chert, although gray chert only had an average rate of biface reduction flakes. However, both gray chert and white quartzite had higher rates of pressure flaking than was seen for the sample area as a whole. Any tools that were made of these materials appear to have been retouched and resharpened frequently. This is confirmed by the 100% resharpening rate reported by Gauvin (Gauvin 2016) in his analysis. While biface production and maintenance appear to have been the focus of activity among these materials, and the material was prized to the extent that even the debitage of biface reduction was reused for expedient tools.

5.4.2 – Site Occupant Preferences

The Gaudreau site offers insight into the lithic economy of Archaic peoples in the Eastern Townships and more generally throughout the Far Northeast. First, clearly delineated areas for formal tool production of primarily exotic materials and informal production from primarily local materials indicates that these tool economies were treated as separate (see Figure 41). The former exploited high-quality exotic material, especially cherts and Kineo rhyolite, whenever possible. If not, abundant local mudstone sufficed. For these tools, material was transported in the form of pieces that had already been worked offsite, likely as preforms or blanks. These were further reduced in the northern concentration area, and then finished farther to the south. This activity left behind a debitage in a range of sizes, but which fit the typologies for biface reduction flaking and pressure flaking. These flakes had high rates of platform faceting, especially among exotic materials, when compared to other areas that were considered in this sample.

On the other hand, the expedient tool economy was dispersed across the rest of the sample area, rather than being tightly concentrated in a few locations. This economy made use of the possibility to store bulk quantities of resources and utilised local, lower quality materials. The debitage from this activity exhibited lower rates of platform faceting, as it encompassed a greater range of reduction stages, including the earliest steps of the process. This debitage did not clearly fit into flake typologies and includes the largest flake sizes. This process began, most likely, with direct procurement from nearby sources. These pieces were transported in bulk along the Saint-François River and stored at the site. This allowed flakes to be removed as necessary and, because the material was low-cost, discarded after limited use. Some of this material was also ground into tools after initial shaping by pecking and flaking. Although this class of tools is less common within the sample area, battered platforms of the flakes recovered here suggest that this sort of tool production was common. This activity, however, took place alongside flaked biface production in the concentration areas of formal tool production.

Much of this analysis fits well with prevailing conceptions of the Archaic period. However, descriptions of the Archaic make much of the differences between it and the earlier Paleoindian at the expense of exploring the continuities between these periods of time. Evidence at the Gaudreau site points to a well-developed lithic industry in exotic raw materials, utilised predominantly for biface production, as being one of those points of continuity. This economy functioned somewhat differently to the Paleoindian economy in exotic lithics, but reflects the same preferences for high-quality raw materials for the production of formal tools. Both direct procurement and down-the-line trade continued to fuel the demand for cherty toolstone, but a wider range of sources, including secondary deposits, were used at this time. In the case of the Gaudreau site, this meant that even if materials from primary sources, such as chert from Hathaway, Vermont, do factor into the assemblage, the majority of it comes from diverse and disparate sources. Likely these materials were obtained in the course of procuring other raw materials, embedded into everyday strategies and then traded with other groups as necessary.

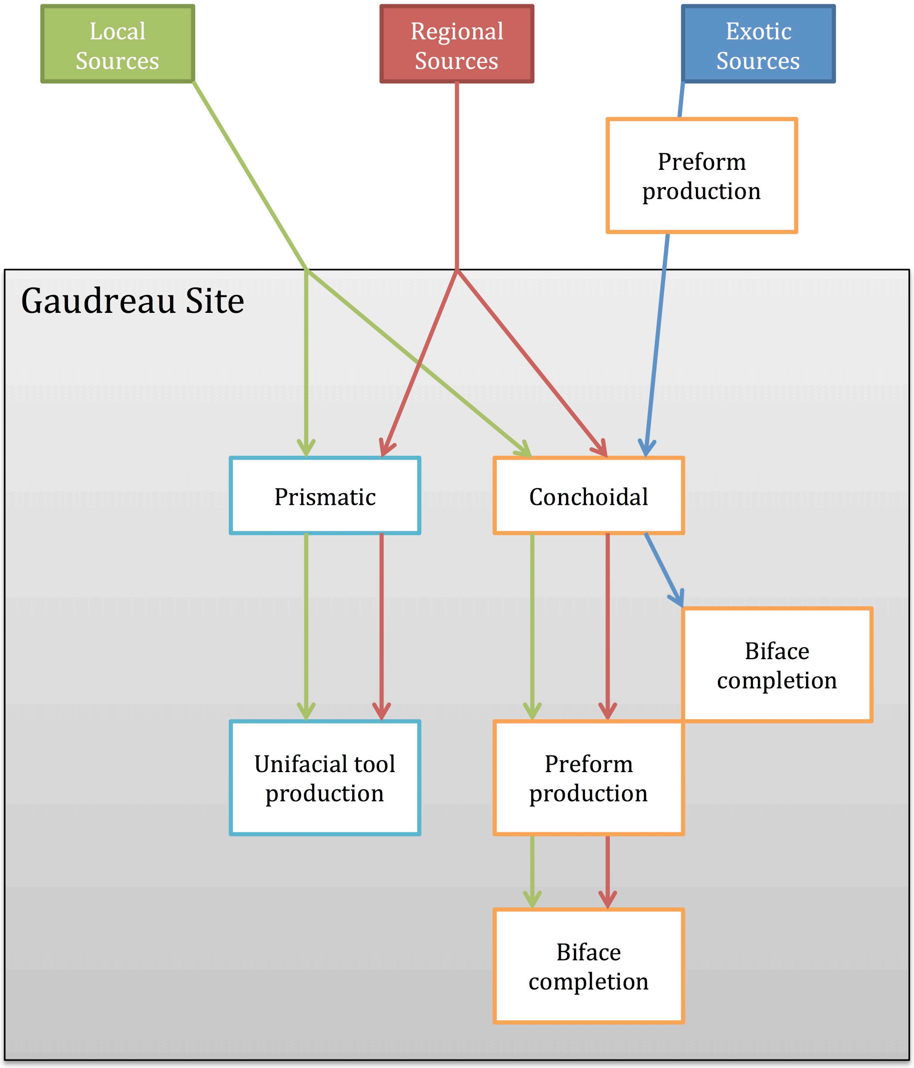


Figure 41. Flow chart showing the use of raw materials from different sources by inhabitants of the Gaudreau site.

6 – Conclusion

The Gaudreau site offers a great deal of data, but with limited contextual information to make those data useful. The site hosted many occupations that spanned from the earliest habitation of Quebec to the modern period. A succession of occupations such as this not only offers valuable information about the universal utility of the site's location, but also should afford the opportunity to track the ways changing cultures and circumstances affect coping strategies employed to survive and thrive in the same location. While the site's Paleoindian inhabitants ignored the local source of serviceable lithic raw material in favour of their own imported regional stone, later Archaic peoples used these sources extensively. Although Archaic and Paleoindian peoples lacked the technology to exploit clay sources, later Woodland peoples were able to do so. Each choice and development, in turn, left its mark on the Gaudreau site's assemblage. Unfortunately, these successive occupations also had a strong confounding effect on the site's taphonomy. Modern industry and agriculture have led to extensive mixing of soil levels and make it difficult to draw clear distinctions between time periods based on depth below surface.

Because vertical distribution was unreliable, this study made use of other markers to identify the Archaic occupation so that it could be analysed. First, an area of highly concentrated diagnostic Archaic tools was identified for further exploration. Markers of Paleoindian, Archaic, and Woodland occupation were selected and mapped to ensure that these occupations could be distinguished in the site's spatial organisation. The lithic assemblage as a whole fits those patterns established by the distribution of Archaic occupation markers, and differed from the spatial patterning of ceramics, trachyte, and historical artefacts. Analysis therefore continued and treated the lithic assemblage within the sample area as a result of this particular occupation. It is certainly probable that the total lithic assemblage was also influenced by earlier and later occupations, but its spatial organisation indicates that this influence is minimal. Analysis of the debitage included typological identification, as well as attributes indicative of production stage and reduction technology.

This study was begun with the expectation that trends in reduction technology, such as hard-hammer or soft-hammer reduction, would be the major results. While a slight preference for soft hammer reduction was indicated, certain stronger trends revealed more interesting insights. As expected, the larger flakes tended to be of local materials, while reduction of exotic materials left behind smaller debitage. Exotic materials also had higher rates of platform faceting and dorsal scarring, indicating that minimal early stage reduction was done with these materials at the Gaudreau site. On the other hand, platform battering was more common among local materials, which indicated that these were preferred for the production of ground stone tools. Flakes in exotic materials and those that fit the biface reduction or pressure flaking typologies tended to be concentrated in two main, but separate, areas. Local, unclassified flakes exhibited more diffuse patterning. This indicated the existence of two distinct lithic economies at the Gaudreau site, distinguishable by the type of tool being produced.

The choices made by site inhabitants with regard to the lithic industry indicate important points of continuity from the Paleoindian into the Archaic period, which are often deemphasized in favour of stressing points of change. The changing environment allowed Archaic peoples to settle for longer periods of time, while the growth of forests allowed for diversification of fauna and flora exploited, and possibly the introduction of wooden watercraft. Together, these changes allowed bulk quantities of lithic raw material to be obtained and stored. This did not, however, change the strong preference of prehistoric peoples in the Far Northeast when it came to selecting raw materials for formal tool production. Rather than simply exploiting the material that was easiest to obtain, the Archaic people at the Gaudreau site invested effort in procuring higher quality materials from exotic sources. The benefits of this were not only technological, but also related to cultural relationships with distant and neighbouring groups. Acquiring raw materials may have required maintaining cordial relations, or it could have been a generally helpful benefit of vital trade activities, but in either case, intergroup relations and raw material acquisition are inextricably related for hunter-gatherers. Although more settled than before, the Archaic peoples of the Far Northeast needed more coping strategies than just storage to thrive in the region, and resource-sharing practices continued to thrive.

The results of this study open certain possibilities for further research into the Archaic period, both at the Gaudreau site and throughout southern Quebec and western Maine. First, further study of the debitage assemblage from the Gaudreau collection should be undertaken in order to identify utilised and retouched flake tools. This would confirm the ways that site's lithic economies functioned, and would also help in understanding how this class of tool was used. More broadly, a study of the regional distribution of rhyolite and materials with similar regional distributions should be conducted that encompasses the area from Moosehead Lake in Maine westward to the St. Lawrence River and bordered by the mountain ranges to the north and south. This would allow for a more nuanced understanding the trade networks throughout the region, which is hinted at by the assemblages of its sites. Finally, despite its difficulty, work towards identifying secondary sources of cherts in the Far Northeast should continue in order to better understand the procurement strategies of the region's prehistoric inhabitants.

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