IROQUOIAN CHERT ACQUISITION:

CHANGING PATTERNS IN THE LATE WOODLAND OF

SOUTHWESTERN ONTARIO

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Abstract

This thesis examines the organization of Iroquoian chert acquisition technology by comparing a number of sites in the southwestern Ontario. The relative amount of cherts from various sources is examined through time and space and across various types of sites looking for patterns both between sites and within sites. During Glen Meyer times a direct embedded acquisition pattern of Kettle Point chert is evident. Groups from the east of the study area could pass freely through intervening groups to acquire chert with distance being the only factor determining the quantity used. A transition to a down-the-line exchange pattern controlled by lineages takes place with the advent of the Middle Ontario Iroquoian (MOI) stage coincident with other significant changes in social organization indicative of increasing complexity. Also, at that time, there is a general constriction in the accessibility of Kettle Point chert. Use of this chert rebounds through time to an almost obsessive use at the late prehistoric Lawson site.

Keywords

Archaeology, Southwestern Ontario, Chert, Acquisition, Iroquoian, Down-the-line, Lineage control

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List of Abbreviations

The following abbreviations, used in the text and appendices.

CSP	Controlled Surface Pick-up
EOI	Early Ontario Iroquoian (Substage)
GIS	Geographical Information System
LOI	Late Ontario Iroquoian (Substage)
MOI	Middle Ontario Iroquoian (Substage)
OAS	Ontario Archaeological Society

Abbreviation are used in Appendix C

SE	This is the "Sampling Error" of the confidence interval at the 95% confidence level. For example, if the confidence interval was expressed as 35.2 +/- 4.1%, the SE is 4.1. For the formulas used to derive these numbers see Appendix B.
FREQ	The frequency of the particular item calculated by dividing the number of that type by the total of all types.
PERCENT	The frequency multiplied by 100.
DIFF FREQ	The frequency calcualted by subtracting one frequency being compared from the other being compared. See Appendix B for the formula.
SE of DIFF	The sampling error of the difference between the two confidence intervals being compared. The formula is in Appendix B.
Total N	The total number of all items of all types found in that area of the site.

The following abbreviations are used in the tables in Appendices D and F these are the various chert source types.

KP	Kettle Point chert
On	Onondaga chert
LTC	Local till chert
Oth	Other chert
UID	Unidentifiable chert

The following abbreviations are used in the tables Appendices D and F for the various flake types.

DC	Decortication flake
CT	Core trimming flake
BP	Bipolar flake
BFR	Bifacial retouch flake
UR	Normal unifacial retouch flake
UR-V	unifacial retouch flake removed from the ventral surface
Sh	Shatter
F	Flake fragment

Chapter 1: Introduction

This thesis is concerned with documenting and explaining patterns of chipped stone source use on Ontario Iroquoian sites (ca. A.D. 1000 to A.D. 1500) in southwestern Ontario focusing on sites in the area of London, Ontario. The aim is to gain insights into changing patterns of social interaction over time and into how chipped stone acquisition and chipped stone tool production was organized. The study area selected is shown in Figure 1.

The genesis of this thesis lies within earlier work (Keron 1986) where the percentage of Kettle Point chert, originating to the northwest on the Lake Huron shoreline, was compared between a number of Iroquoian sites in southeast Middlesex County. While a distance decay pattern (least effort) was evident as distance increased from the source, there were some unusual variations in it that were interpreted as being culturally influenced. These conclusions form the underlying hypotheses to this thesis. Briefly summarized these are as follows. Locations, towns, and sites are shown in Figures 2 and 3.

1. In one site, Harrietsville (AfHf-10), there were significantly different frequencies of Kettle Point chert between the two midden samples (25.2% vs 3.7%). This was interpreted as reflective of the historically documented pattern of trade where lineages controlled trade routes. The logic behind this was that people living in lineage specific longhouses tended to deposit garbage into nearby middens.
2. There was an distinctive drop in frequency of Kettle Point chert between the Lambeth cluster and sites in the Pond Mills cluster further to the east (see Figure 3). The frequency at Lambeth tends to be around 60% while at Pond Mills and areas to the east it drops to 20%. The drop from Lambeth to Pond Mills is startling and almost step-wise given that the distance is 68 km from the source versus 75km from the source respectively. From Pond Mills east to Dorchester, the frequency stayed about 20% over the next 6 km and then drops abruptly again to the Whittaker Lake area where it is 5% at a distance of 90-95 km. There were several conclusions drawn from this.

a. First, the difference between Lambeth and Pond Mills was interpreted as being reflective of two distinct groups with Kettle Point chert passed from the west to the east on a trade route in a down-the-line exchange pattern (Renfrew et al. 1968). The hypothetical trade route was defined as being from the Lawson (or London) community to the Lambeth community to the Pond Mills community to the Whittaker community (see Figure 3 for community locations and site names).

b. Further, as the 20% ratio was consistent from Glen Meyer times to late prehistoric Neutral, this was interpreted to mean exchange patterns had developed at least during the Early Ontario Iroquois stage (EOI) and had remained in place for some time. A further implication of this conclusion would be that the percentage frequency of Kettle Point chert would be a marker of individual groups through time. One site, the Dorchester Village site (AfHg-24) seemed anomalous in that the frequency of Kettle Point chert was only 3%. However, the sample was small and it was not a controlled recovery.

3. As all sites contain all stages of reduction, the hypothesized trade material would be in Kettle Point chert nodules rather than a more reduced form. Cortex bearing flakes and debris and cores occur at all sites, even the most easterly.

4. There appears to be a difference in chert usage and source types by site type and especially between seasonally occupied agricultural cabin sites and larger more permanent village sites.

There were enough interesting trends in the material that was analyzed at that time to warrant an expanded investigation conducting a detailed comparison amongst a number of Iroquoian sites in Middlesex County to determine if additional data would support or disprove these hypotheses.

The objective of this study is to examine the technological organization (Nelson 1991) of Iroquoian chipped lithic technology through time as clues to the underlying social and economic changes through this time period. The primary focus of this will be as it relates to chert acquisition. This approach will inevitably lead into a second related objective: to review Iroquoian culture history from the perspective of lithic technology. Iroquoian technological organization will be approached by examining Iroquoian sites in the London area, controlling for time, site cluster and site type. Information to be sought includes scheduling of activities across various site types, the effects of more reliance on horticulture and consequently, more sedentary lifestyle, and the effects of increasing social complexity, population growth and population aggregation into larger villages. The major focus of the study will be on strategies for raw material acquisition, whether trade or direct procurement (Binford 1979), and the relationships with adjacent groups either Iroquoian to the east or Algonkian to the west. In the immediate London area, there are no primary sources of chert and only low quality chert cobbles in secondary deposits. Obtaining higher grade outcrop chert necessitated access to deposits either 50-80 km to the northwest or 80-100 km to the east requiring either specialized acquisition trips or trade, both of which would mean interaction with intervening groups.

Iroquoian culture history is heavily based on changes in the pottery decoration following MacNeish (1952) and Wright (1966). More recently a focus on settlement patterns has been evident (Pearce 1996; Williamson 1985). An auxiliary objective of this study is to look at the development of Iroquoian culture through time from the perspective of the lithic technology, to examine to what degree it supports or contradicts the existing culture historical models (see Figure 5 for a depiction of the various stages in Wright's [1966] model). Some of the questions to be examined include the following: How does the technological organization relate to the transition from the Early Ontario Iroquoian Stage (EOI) to the Middle Ontario Iroquoian (MOI) Stage? What does the organization of lithic technology say about the social organization of the Glen Meyer peoples? To what extent does the lithic technology support assumptions of increasing warfare particularly through the later periods?

The London vicinity is aptly suited for this analysis for a number of reasons. First, the sites cover all three stages of Wright's *Ontario Iroquois Tradition* (1966) from early Glen Meyer through to late prehistoric Neutral. Second, research has also indicated that there are a number of distinct clusters of sites in the area. Third, a number of different types of sites have been excavated varying from large villages to smaller hamlets and special purpose cabin sites. Finally, as it is to be expected that the chert acquisitions are quite complex, selection of Middlesex County helps reduce the complexity since it represents the most northerly extension of Iroquoian culture in southwestern Ontario. Choosing the most northerly sites will reduce the complexity somewhat as there are no Iroquoian groups to the north from which chert can be obtained, although, it does not preclude the presence of non-Iroquoian groups.

On the issue of terminology, it should be noted that the terms “trade” and “exchange” will be used interchangeably in this thesis. Given the nature of the societies involved “exchange” would be the better term to use from the anthropological perspective as opposed to "trade" following Sahlins (1965) and Flannery and Marcus (1972:287). However, the ethnographic work on the Huron (Tooker 1991; Trigger 1987) uses the terms “trade” and “trade routes” to refer to the exchange of goods. This term most likely derives from the use of the term “fur trade” in the historical writing on 17th century Canada. In deference to Trigger’s use of the term, it will be retained here but most often will be used when discussing ownership and/or existence of “trade routes” as this thesis attempts to identify the same phenomena discussed by Trigger in the prehistoric period in the London area. At other times, the more proper term “exchange” will be used. Similarly, the terms “acquisition” and “procurement” are both used. “Acquisition” is used as the general term for the act of obtaining chert while “Procurement” is used in the sense defined by Binford (1979) for acquiring necessary goods, in this case chert, through different organizational strategies such as “embedded procurement” or “direct procurement”.

History of Research

Iroquoian archaeological research in the province extends back over a century with some of the early pioneers such a David Boyle (e.g. 1896) and W.J Wintemberg (e.g. 1939) locating, excavating and publishing reports on a number of sites including some within the current study area. In the mid-20th century, when a significant number of sites had been located and documented, Iroquoian archaeology moved into a synthetic phase with attempts to pull together the broad picture of what happened during prehistory. With the establishment of the "in situ" hypothesis by Richard MacNeish (1952), some antiquity to the tradition was established and further refinements culminated in the publication of J.V. Wright's *The Ontario Iroquois Tradition* in 1966. Wright established a framework that has remained largely intact ever since as a broad organizing paradigm for Ontario Iroquoian research. The work of J. Norman Emerson in this period should also be noted (e.g. Emerson 1956, 1968) as well as Frank Ridley (e.g. 1952, 1961). The focus of attention of much of this work was the ceramic styles that were abundantly evident in the archaeological record and which were used to develop the relative chronologies and spatial relationships of sites. In general, other than simply noting and providing brief descriptions of lithic material in site reports, the lithics were largely ignored.

The earliest substantive work on Iroquoian lithic research was done by William Fox who around 1970 applied his interest in lithics to Iroquoian research. For example, see the lithic analysis paper (Fox 1971) on the Maurice Village Site. The approach he took, as described in Fox (1990), was to execute a long term study of Iroquoian lithics focusing on building a database from a broad focus of sites with comparable data on formal artefacts especially projectile points and scrapers. However, at the time there was little information on chert sources being used by the native peoples of southern Ontario so an ancillary project was necessary to locate and identify those chert sources. His contributions here, along with those of others, put us in the position now where chert sources for the area are well understood and documented (Eley and von Bitter 1989; Fox 1979e; Janusas 1984). Fox documented and published reports on the lithic assemblages from a number of sites of Petun and Huron provenience (see Fox 1979a, 1979b, 1979c, 1979d, 1980a, 1981a, 1984). He also provided definitions for a number of projectile point styles (Fox 1981b, 1981c, 1981d, 1982a, 1982b) and identified the foliate biface as a distinctive Iroquoian artefact form (Fox 1981e, 1982c). Of special note were two papers that bear directly on this study. In "Of Projectile Points and Politics" (Fox 1980b), he compared projectile points from several western Neutral sites with those from Western Basin tradition sites, noting that certain notched triangular projectile points found on Western Basin sites are best explained as being derived from Neutral sites further to the east. More importantly to this thesis, he clearly established (Fox 1990) a lithic acquisition pattern for the Odawa, that involved exchange of chert with the Petun. The chert was acquired by the Odawa, during regular movements along lake shores, carried to the Collingwood area and then exchanged to the local Iroquoian groups. While chert is never mentioned per se by the 17th century European writers, they do confirm the exchange system operating between the Odawa and the Petun in other goods that have been identified archaeologically. The importance to this immediate study is the clear demonstration that chert was exchanged in the early historic period and that the same pattern can be observed on prehistoric sites.

For the last twenty-five years inclusion of lithic analysis has been standard for site reports of Iroquoian archaeological sites. Notable here was Paul Lennox with the publication of his MA thesis (Lennox 1981) and many subsequent reports (e.g. Lennox 1982, 1986). The debitage analysis he introduced has been adopted by several cultural resource management firms. A very detailed lithic analysis was included with the Calvert site (Timmins 1997) and also of note is work performed by Poulton (e.g. 1985a). An interesting internal analysis of debitage was included in the Myers Road report (Ramsden et al. 1998) that indicated some of the taphonomic/ formation processes taking place with regards to that material.

Despite the growing body of information contained within site reports, not much synthetic analysis has been performed. Both Janusas (1984) and Reid (1986) include information with respect to distance decay in Late Woodland assemblages of Kettle Point chert within the broader studies. The single major synthetic work on Iroquoian lithics is that of Jamieson (1984) who examined chert acquisition and use through time amongst the proto-historic and historic Neutral by comparing both debitage and tool types from seven large sites from three different spatial clusters. Her study links changes in Neutral lithic reduction and acquisition to the larger social environment, both internal to the

Neutral peoples and their relations with other adjacent cultural groups. Of particular note is her claim that a down-the-line exchange system existed within the Neutral confederacy for distribution of Onondaga chert and the occurrence of exotic chert such as Kettle Point chert and Collingwood chert in the northerly cluster on Spencer and Bronte Creeks (Jamieson 1984:381) which she concluded occurred as a result of contact with the Petun to the north.

Chapter 2: The Study Area: Physiography, Culture History and Site Sample

The primary study area (See Figures 1, 2 and 3) covered by this analysis is the southern and central portions of the County of Middlesex, in the Province of Ontario. The sites are located in the Townships of North Dorchester, Westminster, London, Lobo and Caradoc. One site, the Gravel Pit site (AfHf-7) is in South Dorchester Township in Elgin County. What follows is a brief overview of the physical and natural characteristics of the study area. For more detailed descriptions, the reader is referred to Williamson (1985), Pearce (1996) and Timmins (1997).

The main drainage system in the study area is the Thames River which roughly runs from east to west through the whole study area and thence to the west to Lake St. Clair. The extreme southeast portion of the study area, in the vicinity of Whittaker Lake, drains to the west and south through Kettle Creek to Lake Erie. The extreme northwest drains to the west via the Sydenham River which also flows south and west to Lake St. Clair. There are also numerous creeks draining to the Thames throughout the area.

Physiography

The area includes three different regions as defined by Chapman and Putnam (1984): the Stratford till plain, the Caradoc sand plain and the Mount Elgin ridges (see Figure 4 for approximate locations of these regions). The Mount Elgin ridges region is found south of the Thames River and is characterized by a series of parallel recessional moraines formed by the Lake Erie ice lobe. The moraines run east-west starting west of Lambeth and continuing into Oxford county to the east. The Ingersoll moraine starts in the Byron area and runs to the east into Oxford County to a point south of Ingersoll. Running parallel to this and several kilometres to the south is the Westminster moraine. The land between these two moraines drains to the west via Dingman Creek from a point south of Dorchester. To the east it drains via Reynolds Creek which cuts through the Ingersoll moraine at Putnam. The land south of the Westminster moraine is drained by Kettle Creek which flows into Lake Erie from a point in the extreme southeast of the study area. The land on the moraines is generally rolling and there are a number of small kettle lakes, such as Whittaker Lake, Pond Mills and the Westminster Ponds. The soils on the moraines are predominantly silty clay or calcareous clay while the valleys between can vary from clay to sand and gravel. In the Dingman Creek drainage the soil is predominantly clay although numerous swampy areas of black muck are found, mostly in the center of the valley.

The second physiographic region is the Caradoc sand plain. The major portion of this plain occupies the western end of the study area in the township of Caradoc. However, a portion of it extends along the Thames River in the study area right to the edge of Oxford County and the sandy soils in the Dorchester area are part of this same plain. This eastwards extension is called the London annex by Chapman and Putnam (1984). The London annex is a narrow belt sandwiched between the Mount Elgin ridges and the Stratford till plain. The main part of the Caradoc sand plain lies to the west and was formed at the end of the last glaciation when water levels receded to Lake Whittlesey (ca. 13,500 BP) and the Thames spillway deposited a layer of sand in a broad delta over this area. The land there is generally flat with a few rolling hills composed of old dunes in the Mount Bridges area. The London annex was formed earlier as the glaciers receded and layers of sand and gravel were deposited in small plains and terraces along the Thames River spillway. In Caradoc township the soils are of three types, Fox sandy loam, Berrien sandy loam and Oshtemo sand. Along the London annex, the soils are London loam, Fox sandy loam and Burford gravelly loam. In the Dorchester area there is a large area of black muck known as the Dorchester swamp that is found between the Ingersoll moraine and the Thames River. A small creek drains this area to the northwest into the Thames River. In Caradoc township, several small creeks, including the Mill Stream and Komoka Creek, drain the area west of Delaware to the Thames River while the western part of the township drains to the west via several small creeks into the Sydenham River in the Strathroy vicinity.

The third major physiographic region is the Stratford till plain. This area extends some distance to the northeast and only the extreme southwestern portion lies within the study area. This area is predominantly till plain. However, in the portion within this study area there are several recessional moraines which make the topography similar to the Mount Elgin ridges (Chapman and Putnam, 1984). The soils are predominantly a calcareous clay till and sand and gravel are rare. This portion of the study area is bounded on the west by the Lucan moraine. There are two other smaller unnamed moraines between this moraine and London. The area east of the Lucan moraine is drained by Oxbow Creek which drains southward into the Thames River near Komoka and occupies a glacial spillway. Further east in northwest London, the Medway Creek drains land to the north into the Thames River between the two unnamed moraines.

The entire area is found within the Niagara region of the Deciduous Forest Region (Rowe 1972). At the time the land was first surveyed for European settlement (Finlay 1978), the higher ground was mostly maple-beech climax forest. Stands of white pine are frequently found as well, particularly in the Caradoc sand plain, where large tracts are found in the area west of Delaware and from there in a discontinuous belt towards Strathroy. Tamarack swamps are also found in the less well-drained land as is a mix of black willow, silver maple, red maple, bur oak and black ash. The northern boundary of the Carolinian Forest Region is found along the southern boundary of the study area and numerous Carolinian forest species are found as sub-species within the area. (e.g. hickory, sycamore, and black walnut).

Iroquoian Culture History

The study area has been occupied throughout the Late Woodland period by Iroquoian groups. Using Wright’s (1966) definitions, the Early Ontario Iroquoian Stage (EOI) is represented by Glen Meyer branch peoples who are present around AD 1000. This development is succeeded by the Middle Ontario Iroquoian stage (MOI) around AD 1300. The MOI is divided into two substages, the Uren substage that is followed by the Middleport substage. Around AD 1400, the Late Ontario Iroquoian Stage (LOI) commences and continues until the Neutral groups leave the region in late prehistoric times (see Figure 5 for a schematic depiction of the various stages, sub-stages and cultural groups). It should be noted that Wright’s scheme, while still largely intact and used as the taxonomic basis for Ontario Iroquoian research, has been challenged on several fronts.

There are two issues here which are germane to the current study. First, the hypothesis by Wright (1966), that a conquest of the southwestern Glen Meyer people by the southeastern Ontario Pickering people occurred around the year AD 1300 has been largely rejected by the archaeological community. Further debate on this topic appears in Wright (1990, 1992) and Finlayson (1998). A number of other authors conclude that there is a continuous sequence in the area with no evidence for a disruptive conquest (Pearce 1984; Timmins 1997; Williamson 1990). If one were to assume as did Wright (1966) that the Glen Meyer people are Iroquoian, then the presence or absence of a conquest is not a factor that will affect this study since the focus is Iroquoian people in the London area. A possible risk comes with the as yet tentative suggestion by Finlayson (1998) that the Glen Meyer people were Algonkian. The first point here is that this is far from being substantiated and indeed, the evidence for and Algonkian affiliation is not really made clear. Moreover, that argument must face the problem that there are clear stylistic boundaries with the Western Basin people to the west which most do regard as Algonkian (Murphy and Ferris 1990) while there do not appear to be clear boundaries between the Pickering and Glen Meyer to the east. In fact, the similarity between early Pickering and Glen Meyer has led Bursey (1994) to conclude that the so-called Pickering sites in the Crawford lake area are really Glen Meyer based on stylistic similarities. Others dismiss a clear distinction between Glen Meyer and Pickering out of hand (e.g. Warrick 2001). This argument was answered by Finlayson (1998) but the differentiation shifts to a finer level where the distinction is based on the presence of certain ceramic features such as gaming discs. In any event, there is a much clearer and recognizable boundary to the west than there is to the east. Secondly, the current study, in adopting Wright's original formulation, is partially insulated from the problems a conquest would introduce. The boundaries chosen here to control for time are identical to the boundaries that are in dispute. Thus, if in the future incontrovertible proof that the Glen Meyer branch peoples are Algonkian arises, then the worst case is that the word "Iroquoian" might have to be changed to "Late Woodland".

The second issue relevant to this study concerns Wright's (1966) chronology that has been challenged with respect to the absolute dating of the various sequences. Over the years there have been numerous attempts to adjust the chronological scheme. Early on, this involved an attempt to push back the dates on the Pickering sequence sometimes as early as AD 700 (e.g. Kapches 1982). These were largely discredited by Fox (1980c) who noted that if you looked at the dates as given and ignored the rejection by the authors as being "too late", the dates largely fell within Wright's A.D. 1000-1300 original time scale. Other jiggling with the dates involves tinkering with the boundaries and making minor adjustments (see Dodd et al. 1990 and Williamson 1990). More recently, William Finlayson (1998) has proposed significant date changes based on varved sediments in Crawford Lake and the village sequences identified in that area. Briefly in the Crawford Lake area, he puts the Uren substage at A.D. 1330-1420 and the Middleport substage at A.D. 1420 to 1504, thus elongating the Middle Ontario Iroquoian Stage considerably. This major shift in timing has been challenged by Warrick (2000) who noted the difficulty in matching corn pollen to specific sites as well as the fact that it contradicts most of the radio-carbon dates that have accumulated. In the London area, an elongated Middleport substage would make sense since there seem to be more Middleport villages than Neutral villages. But there are not many Uren villages known, so increasing the duration of this substage from 50 - 90 years would not seem to accord with the data. In any event, again as the boundaries used here are the traditional cultural historical boundaries of Ontario Iroquoian Tradition rather than the more preferable absolute dating, this study will largely be impervious to shifts in the dating of these time periods.

The Site Sample

Initial recognition that there were a number of Iroquoian sites in the London region dates back to Wintemberg who added a foot note to his Lawson site report (1939: 2) stating that

> The Lawson site is one of several sites of the same culture in London Township (one on lot 17 and another on lot 18 con. IV, one on lot 26, con. III, one on the Norton farm on Pipeline road, and another at the corner of Edward and Tecumseh Sts., London) as well as Westminster township (on Park's lot and McArthur farm London South), on the Thomas farm near Lambeth,

> on the E. Hodgetts farm north of Talbot road, on the Nixon farm near Pond Mills (Lot 18, con. I), and on Lot 33, con. B, known as the Bogue farm.

In subsequent research and Cultural Resource Management (CRM) work that will not be summarized here (see Pearce 1996 for an overview), a significant number of Iroquoian sites were located and identified. In the course of work on his PhD dissertation, Robert Pearce, traced the developmental sequence of a number of sites north and west of London in a manner not unlike that employed by Tuck (1971) for the Onondaga in New York State. The main focus of his thesis was that three Glen Meyer clusters, Byron, Caradoc and Arkona had coalesced and relocated to the Oxbow Creek area and that this community through time evolved through the Middleport sequence on Oxbow Creek and gradually moved east to the Lawson site. He also looked into the adjoining areas and identified several other clusters in the region that he interpreted as communities beyond the immediate focus of his thesis. These are the Dingman Creek community, the Whittaker Lake community, both within the present study area, and the Catfish Creek community and the Talbot Creek community to the south of it in Elgin County (see Figure 3 for communities and sites).

As the validity of this identification is tentative, for the purposes of this study, links between and within the various communities will be considered only after examining the lithic evidence. While the base unit for this study will be the individual site, the evident existence of localized geographic clusters of sites is readily observable and the assumption that at least the sites of the same cluster form a community sequence through time is not unreasonable. The main problem in substantiating a sequence from early to late is that the movement from the Glen Meyer branch clusters with their associated Uren substage sites to the Middleport substage sites is problematic in the absence of a great deal of comparative data. An alternative developmental sequence was proposed by the author (Keron 1986) where the integrity of the Dingman community was questioned on the basis of lithic evidence. Based on these differences, Pearce's Dingman community was divided in two producing the Pond Mills community in the east and the Lambeth community in the west. It was proposed that only the Caradoc and Arkona

Glen Meyer clusters coalesced into the Middleport sites on the Oxbow and then relocated through time to the Lawson Site. The Glen Meyer cluster in Byron remained autonomous much longer, evolving through Middleport sites such as Norton into the Neutral sites in the Lambeth area. In the east, one or more Glen Meyer groups in the Dorchester area coalesced to form the large Uren substage village, Dorchester (AfHg-24), and thence commenced a series of westward movements through Nilestown to the Brian Site near Pond Mills. The Whittaker Lake sites were derived not from the Dorchester area but through movement from Glen Meyer sites to the south on Catfish Creek or from the east on the Norfolk sand plain. Fox (1976:172) notes the movement out of the Norfolk sand plain at the Middleport Substage.

During the Early Ontario Iroquoian Stage, three distinct clusters of Glen Meyer sites have been identified. All three of these are located on the Caradoc sand plain. The Dorchester cluster is the easternmost and is found on the London Annex of the Caradoc sand plain in the area near Dorchester south of the Thames River and north of the Ingersoll moraine. Samples exist for three sites in the area. One site, the Calvert site (AfHg-1) has been excavated and intensively analyzed by Timmins (1997). Another nearby is the Mustos site (AfHg-2) which has had a controlled surface pick up performed (Keron 1986). The third site is a large Uren substage site: the Dorchester Village Site (Keron 2000a, 2000b). Several other sites are known to exist but none of these have been documented and no artefactual collections exist for these sites.

The Byron cluster is located in southwest London on a series of sandy knolls that are part of the Caradoc sand plain. These sites are largely known through CRM work that was carried out as the City of London expanded into the area. While large and well documented collections exist, they are very large, being the results of rescue excavation. Thus, the collections had to be sampled for purposes of this study. Sites included here are the Ski Club (AfHi-78), the Preying Mantis site (AfHi-178), McGrath (AfHi-62) and several Middle Ontario Iroquoian sites including Willcock (AfHi-52) and Sosad (AfHi-120) and TGIF/Crop Circle site (AfHi-198) which Pearce (personal communication 2002) considers to be a single village site.

Further west in Caradoc Township is the Caradoc cluster which was the subject of a regional study (Williamson 1985) that provided a number of well-documented collections from various Glen Meyer sites. Oddly, while the other two clusters terminate temporally with Uren substage sites, this is not the case with this cluster, although the probability of an undiscovered or destroyed site is very high. Sites included in this analysis are MiV18 (AfHj-19), Roeland (AfHj-14), and Caradoc -13 (AfHj-26) that Williamson (1985) interprets as villages, and Kelly (AfHi-20), Caradoc-3 (AfHj-105), Komoka-3 (AfHi-31) and Melbourne-7 (AfHj-17) that are interpreted as cabin sites as defined by Finlayson and Pearce (1989).

The later clusters include both Middleport substage sites and Neutral sites. In general, after the Uren substage in the London area there is a very clear and well documented movement from the sandy soils of the Caradoc sand plain to the clay soils located in the Mount Elgin ridges and the Stratford till plain. In the farthest southeast of the study area is the Whittaker Lake cluster, located such that it straddles the top of the Westminster moraine in the area south of Dorchester, Ontario. This cluster includes both Middleport and prehistoric Neutral sites. The Messenger site is a large Middleport site located just north of Whittaker Lake. While there is a large analyzed (Smith 1983) ceramic sample from the site, there are very few lithic artefacts. This cluster developed through time in an as yet uncertain sequence up to the Harrietsville site (Keron 1986) or possibly the Pine Tree site (AfHf-4). Samples included here are from Pine Tree, Harrietsville, Gravel Pit (AfHf-7) and Dyjack (AfHf-5). These sites have all been identified as village sites, excepting Dyjack that is most likely a cabin site.

In the Dingman Creek drainage south of the Thames River in the Mount Elgin Ridges, Pearce (1996) has identified the Dingman community. Following previous work (Keron 1986), this community will be treated as two separate communities as they are spatially distinct. The Pond Mills cluster is found in the area south of the Thames River and east of the developed area of London. Most of the sites are in the immediate vicinity of Pond Mills where there is at least one large village site, Brian (AfHh-10), and several other sites that are most likely cabin sites which are also included in this study: the

Skinner site (AfHg-13), the Bradley Ave. site (AfHh-160) and Pond Mills (AfHh-2). The Laidlaw site (AfHh-1) is included and has frequently been identified as a village site but this remains as yet unproven. Further to the east are two cabin sites: the Lone Duck site (AfHg-37) and the Paraducks site (AfHg-38). These sites are most likely associated with a now destroyed village site on the Thames River north of Nilestown (Keron 1986).

The Lambeth cluster is located further east and north of the village of Lambeth. Most of the sites are located on minor tributaries of Dingman Creek that flow from the Ingersoll moraine south into Dingman Creek. Two village sites, Thomas Powerline (AfHh-3) and Pincombe (AfHh-27), have been identified here but neither has had anything more than a controlled surface pick up done to document it. Several cabin sites near the Pincombe site have been excavated through contract work. The Cassandra site (AfHh-65), included in the analysis, was originally interpreted as a cabin site but subsequent investigations and a CSP revealed three middens over a one hectare area so the possibility that it is a small village or hamlet can not be ruled out. Only detailed excavation to examine the settlement patterns will decide its classification. Two cabin sites, Mathew William (AfHh-66) and Marna (AfHh-69) are included. The final site, the Norton site (AfHh-86), is a Middleport village site but it is spatially somewhat distinct from the rest of the Lambeth cluster being located north of Commissioners Rd. and south of the Thames River. This site is one of those referred to by Wintemberg (1939) quoted above. As noted in the same quote there are at least two other sites which were located in nearby areas of the city which have now been developed. These sites could conceivably form a cluster distinct from Lambeth but are herein lumped with that group for descriptive purposes.

The final cluster of sites considered here is Pearce's (1996) London community. This cluster is generally accepted to be the movement of a single community that starts with the Middleport substage sites on Oxbow Creek and moves through a series of village movements through time to the Lawson Site (AgHh-1). Site samples included in the current study include Edwards (AfHi-23), Drumholm (AfHi-22) and Alway (AfHi-2) on the western end of the sequence. In the central part of the sequence are the Sackrider

(AfHh-320) and Sifton (AfHh-85) sites. The Lawson site (AgHh-1) is the last village in the sequence. Also in the vicinity of the Lawson site are a large number of agricultural cabin sites which are interpreted as belonging to the Lawson site but some of which could be associated with earlier sites in the sequence.

Chapter 3: Research Design

This chapter documents the research design used in this study which is loosely based on Clark (1982). This methodology provides a structured process for developing and executing a research project. The starting point for this methodology is what Clark (1982) termed a set of “behaviourial hypotheses”. These hypotheses are drawn from general anthropological knowledge and problem and area specific background research. The next stage in the design process is to identify and define a set of implications of the behaviourial hypotheses that can be operationalized and tested against the data. In the case of the current study, there are two primary sources for these hypotheses. First, is a methodological or possibly theoretical orientation termed “Organization of Technology” and second, a body of work developed around distance decay processes and their relationship to inter-group exchange. A short review of each of these areas follows.

Organization of technology is best described as an approach that relates strategies for organizing technology to environmental and social variables that influence them. In the past, lithic analysis was primarily focused on reduction techniques and definition of types which were reflective of function based on morphological characteristics and time period based on stylistic patterns. The articulation of such materials with the overall cultural sphere was ignored or minimized. More recently, analysts following Binford (e.g. 1979) have developed a body of theory known as technological organization (e.g. Torrence 1989a; Carr 1994). As defined by Nelson (1991: 57), organization of technology studies focus on the

> selection and integration of strategies for making, using, transporting, and discarding tools and the materials needed for their manufacture and maintenance. Studies of technological organization consider the economic and social variables that influence those strategies.

This focus provides a methodological vehicle to move beyond typological studies on artefact form and function by considering these in a larger context where form and design are seen as the result of technological strategies that implement social and economic strategies within an environmental context.

To date, these studies have focused strongly on environmental factors which impact technology. Nelson (1991) noted that the environment creates adaptive problems for humans which necessitate economic strategies for dealing with the environment. Examples of these problems are " time stress..., energy costs..., mobility requirements..., scheduling, risk management..., social aggregation requirements..., and raw material availability" (Nelson 1991:60). There are fewer studies dealing with social strategies but the trend is towards seeing style as of adaptive value in signaling social information. This trend is more pronounced within complex agricultural based societies (e.g. Gero 1989) but others have argued for its validity in less complex foraging societies (e.g. Ellis 1989; Weisner 1982).

Several postulates in this literature bear directly on the situation encountered with local Iroquoian sites. For example, Nelson (1991), following Parry and Kelly (1987), noted that increased sedentism leads to more expedient use of lithics and a less complex/structured lithic industry. Torrence (1989b) also notes a similar trend in the European Mesolithic and attributes this to decreased risk in terms of encountering and capturing game. Both of these are relevant to this study in that the current understanding of the Iroquoian peoples is one of increasing sedentism and reliance on agriculture with a decreasing dependency on hunting beginning in Middle Woodland times and extending through to the historic period. Another example is an assumption that the cost of material acquired through trade will be higher than material procured directly leading to different usage patterns either through greater curation (Morrow and Jefferies 1989) or for use as prestige items (Gero 1989). This argument holds that the cost in terms of energy and time expended will be higher for traded goods than those acquired directly and that more expensive chert will be treated differently than less expensive chert. In terms of different chert acquisition possibilities, it is generally expected that chert acquired through trade would have the highest cost. Chert acquired through specialized acquisition trips would be lower and embedded procurement (e.g. obtained incidentally to other activities) would be the least expensive cost. As groups become more sedentary as is the case with Iroquoian peoples, if raw material is not local, the cost to acquire it will be higher.

Intervening groups may block access. The cost of time and energy to travel to the chert source specifically also drives up the cost. If you can not get chert while food gathering or within an area visited for other purposes (embedded procurement), the cost is higher (Jeske 1989).

The other source of postulates that link the archaeological data back to the behaviourial hypotheses comes from a number of sources that essentially link distance decay functions to cultural processes. Distance decay is a concept borrowed from geographers (for example see Taylor 1975) and proceeds basically by plotting the occurrence of specific source material against the distance from the source. Most often what is plotted is the amount of the material derived from a specific source measured as the percentage of the total such material, against the distance from the source of the sites under consideration. In general, the farther away from the source the lower the percentage becomes or decays. A linear regression is then run against the plot of all points under consideration. Through a process of trial and error several forms of the regression equation are attempted until the best fit is achieved. Serious work in this area extends back 35 years with the definition by Renfrew et al. (1968) of down-the-line exchange based on studies of Near Eastern obsidian source distributions. The postulate is that there is a supply zone in which there is general access to the source but that outward from the supply zone, the material is passed from one group to the next with each group retaining a portion of the material and then trading the rest on to the next group down-the-line. Subsequent to that work, various archaeologists have added to the discussion, introducing linear regression and other methodologies such as trend surface analysis (see Hodder and Orton 1976) as statistical means to describe the observed patterns. Work with the distance decay and linear regression led to an attempt to link different regression curves to specific forms of exchange. For example, a linear equation (straight line) was linked to direct acquisition, a single log equation was linked to down-the-line exchange and a double log equation was linked to infrequent exchange of high value goods between groups by Reid (1986). However, actual attempts to operationalize these postulates has led to problematic results. Janusas (1984) found that a double log model best fit the data for distance decay of Kettle Point chert when plotting the archaic and woodland time in the regression, a situation that would imply infrequent exchange of high value goods. This result hardly seems likely and Janusas wisely declined to make such an interpretation. Reid (1986) also attempted a series of regression analyses on Ontario and Michigan material and after applying the general inferences, concluded that “the results of archaeological studies of trade and interaction” should be treated with a “measured scepticism.” Another factor undermining the utility of the models is identified by Hodder (1982) who claims that different forms of exchange could actually create the same regression curve making a simple link between types of equation and variation in equation parameters to different exchange mechanisms suspect. However, Findlow and Bolognese (1982) used differing curves to good effect in a study within a limited area with clear cultural continuity. The difference seems to be in applying the interpretations to too broad a time span or region. Also, simplistic application across a set of data can create problems. Hodder and Orton (1976) noted problematic results even in a limited region where there were in fact two different decay curves: one where transport over land occurred and a different one where transport along water courses occurred. Once these were separated the pattern became evident. In general, the use of distance decay should best be taken as only one line of evidence whose interpretation should be corroborated/evaluated along with other lines of reasoning.

Behavioural Hypothesis

Three primary sources of chert account for well over 95% of all chert artefacts in London area Iroquoian assemblages. These are Kettle Point chert, which outcrops in Lake Huron just off Kettle Point, Onondaga which outcrops along Lake Erie from Port Dover to the Niagra river and an assortment of local varieties (local till chert) which is found in the glacial till deposited by the Lake Erie lobe in the area south of London. Any given group had access to all three types and the chert acquisition pattern is not a simple case of either trade or direct procurement but was almost certainly a combination of both. A further distinction that needs to be made here is that direct procurement could occur in two ways mentioned earlier: either embedded procurement or by a special trip for the purpose of acquiring the chert (Binford 1979, 1980). Any given site would probably acquire chert in a combination of the three forms.

Returning to Clark's (1982) methodology, the first stage is to identify a set of behavioural hypotheses that are to be tested with the research project. These hypotheses to be examined here are derived from previous work (Keron 1986) described above as well as ethnographic sources (Tooker 1991). They are as follows.

1. Onondaga and Kettle Point chert were the preferred chert but not all groups had unrestricted access to these sources.
2. A down-the-line exchange existed during the Iroquoian occupation of the area.
3. Kettle Point chert was passed from west to east through the study area.
4. Onondaga chert was passed from east to west.
5. Trade routes were controlled by lineages as was documented among the Huron (Tooker 1991; Trigger 1969, 1987).
6. The down-the-line exchange pattern has considerable time depth extending back to the EOI. Documenting this pattern raises the possibility of distinguishing distinct groups in time and space by the percentage of Kettle Point chert.
7. The medium of exchange was raw cores. While this hypothesis was the conclusion in earlier work that led to this study (Keron 1986), as will be shown below in the discussion of the implications of down-the-line exchange, all groups receiving raw cores would contradict many of the results determined in other studies of exchange. In effect, it would argue against down-the-line exchange. Nonetheless, this conclusion was based on the evidence and real results do not always conform to what the theories dictate. In any event, this hypothesis will be retained and evaluated despite the fact that it may be contradictory to some of the hypotheses regarding down-the-line exchange.
8. There are differences in chert use in different site types, for example, a village versus an agricultural cabin site.

9. As the cost of acquiring chert through trade was high, in order to reduce costs for total chert acquisition, groups in the central and east parts of the study area made extensive use of local till chert to supplement their chert supplies. Local till chert was acquired through embedded procurement.

Test Implications of the Behavioural Hypotheses

The next stage in Clark's (1982) research design method is to develop a set of implications from the behavioural hypotheses and then to operationalize them by developing a set of statistical hypotheses that will measure the implications. Normally, this procedure is done as two separate steps. However, they have been combined in the following discussion. Clark notes that it is frequently possible that some implications may not be able to be turned into testable statistical hypotheses. In the following these were eliminated so that only implications that are testable appear.

Down-the-Line Exchange Implications

Much of the work on organization of technology has certainly focussed on lithics and also on the relative costs of various options for acquisition. Essentially there are three primary forms of chert acquisition: embedded procurement, direct acquisition and exchange with another group. A number of papers have explored the relationship between the use of chert that was readily accessible and that which was acquired from some distance. The general assertion is that chert that is difficult to acquire, or requires expenditure of considerable energy to procure, or that is exchanged with neighbouring groups, will be more expensive and thus, will be treated differently than chert that is readily available. The following discussion lists a number of generalizations that have been identified by various authors as to how the organization of technology will vary depending on the ease of obtaining chert. As much of this work has focussed on hunters and gatherers, it is uncertain that all of the following will be applicable to sedentary horticulturalists. However, a number of the principles will tend to hold true regardless of the mobility of the group. The intent of the following set of implications is to develop a set of measures that can be used to distinguish possibly traded chert from locally or inexpensively obtained chert. In each case the source is cited and the relevant statistical hypothesis follows. Numbering of the implications is sequential to facilitate reference later. Definitions of the different types of debris referenced in this discussion can be found in Chapter 4.

1. Non-local chert should be brought to the site in a more reduced state (Morrow and Jeffries, 1989). For debitage, all sites should show a lower percentage of cortex and earlier stage debris like shatter for non-local chert over locally obtainable chert. Import of finished artefacts as Fox (1981a) has suggested for the Huron would also demonstrate this implication.
2. Non-local chert will be employed in the manufacture of formal tools that require time to make and can be rejuvenated or recycled (Jeske 1989; Morrow and Jeffries 1989). Onondaga and Kettle Point chert should be preferred for these tools excepting possibly western groups with direct access to Kettle Point since it would be local chert in that area. More tools will be made of non-local chert and there should be more flakes of bifacial retouch and flake fragments on non-local chert.
3. Non-local chert will be discarded largely as exhausted and or broken tools (Morrow and Jeffries 1989). Again this might be more applicable to mobile hunter-gatherers. However, at sites distant from the source there should be more broken projectile points than at sites close to the source.
4. If long distance chert is more expensive, then Kettle Point chert should get differential treatment in easterly sites and Onondaga in the west for the manufacture of bifaces, scrapers and other formal artefacts. The distance decay of Kettle Point chert should be from west to east and that of Onondaga chert the opposite.
5. Trade in both raw material and finished artefacts could have occurred. Finished artefacts should be found more distant than raw blocks from lithic sources. For imported chert, the ratio of artefacts to flakes should be higher for the more distant sites reflecting a greater emphasis on use as reduced forms rather than manufacture.

6. Traded material will be smaller (Hofman, 1987). While most of the chert would have been used to exhaustion making size difficult to detect, another indicator would be that the traded chert should be more reduced. There should be less early stage debris such as shatter and decortication flakes.
7. Down-the-line exchange should result in a regression line that is single log (Reid 1986). Direct acquisition of should result in a linear equation that falls gradually with distance as the cost of acquisition varies directly with distance.

Lineage Control Implications

5. If lineages controlled trade routes and chert was traded then there should be differential distribution of chert within other villages besides that documented at Harrietsville in the earlier study (Keron 1986).
6. Establishment of a down-the-line pattern of exchange implies ownership and control of the source. It can be taken as indirect evidence of lineage control of a trade route.

Time Depth Implications

7. Trade patterns between groups are stable through time. Groups in the same clusters should show the same relative percentages of chert source in all time periods. If this is true, then during the shift in the Middle Ontario Iroquoian stage from sandy soils to clay soils occurs, it should be possible to link the groups based on chert source percentage. The pattern previously observed in Pond Mills and Dorchester (Keron 1986) should be repeated elsewhere.
8. If the pattern of exchange has a considerable time depth and all other factors are equal, then it would be reasonable to expect that the pattern of use would be consistent through time. There should not be dramatic changes in the frequencies of the various flake types. A sharp break in a pattern of use would suggest that the time depth hypothesis does not hold true.

Exchange Medium Implications

As discussed above, the hypothesis that the exchange medium was raw cores may be contradictory to some of the other hypotheses so in some sense this hypothesis is more exploratory. The following would be the measure of the possibility.

9. If cores are the primary medium of exchange, then there should be exhausted cores of all chert types in all sites. These exhausted cores should be at the same ratio as the debitage for the various chert types in each site.
10. Furthermore, the relative percentage of flake types within each chert type should stay the same regardless of the distance from the source. (i.e. The percentage of shatter and decortication should be similar in all sites).

Site Type Differences

Especially in the late Iroquoian stage there are various types of sites varying from large villages to small agricultural cabin sites. It is presumed that different activities were carried out at these sites and that they were occupied for varying durations/seasons. Therefore this should be reflected in the lithic detritus.

11. Embedded acquisition of local till chert at the cabin sites is a good probability since agricultural activities would result in a close scrutiny of much of the soil. There should be higher percentages of local till chert and more indications of core reduction such as higher amounts of decortication flakes and shatter.
12. As different activities occurred at these sites it could be hypothesized that the chert industry would also be different. Some trends were noted in the previous study but the results were equivocal so it is not possible to generate specific implications, so this would be best considered strictly an exploratory strategy.

Embedded Procurement of Local Till Chert Implications

13. Locally obtainable chert should be used in more expedient manners (Andrefsky 1994; Morrow and Jeffries 1989). Local till chert will be used for more expedient flake tools and Onondaga and Kettle Point preferred for formal artefacts. For local till chert there should be more core trimming flakes and fewer bifacial retouch flakes and flake fragments.

This completes the list of implications and measures that could help establish the behavioural hypotheses outlined above. The data collected to evaluate these implications will be documented in the next chapter.

Confounding Hypotheses

It would be wise to pay some attention to alternate hypotheses or factors that might invalidate the study, provide alternate explanations of the observed data or could indeed be considered alternative behavioural hypotheses. In some cases, it may be necessary to ensure that supportive data is collected during the study. The succeeding paragraphs consider some of these and the approach taken with each.

The dramatic difference between Lambeth and Pond Mills where the percentage of Kettle Point chert drops from over 60% to around 20% could be the result of some other factor besides inter-group exchange such as seasonality of occupation. At this point the best argument that can be made would be that there are permanent villages in each cluster as well as agricultural cabin sites so it is not unreasonable to expect that the differences in chert usage are a result of the acquisition options and distance. If one of the clusters was demonstrated to be lacking permanent villages then this argument might apply.

Hostile groups or other factors could disrupt the orderly flow of raw materials. One of the anomalies noted in the earlier study was the Uren Substage village in Dorchester that stood out in that it had a very low percentage of Kettle Point chert. At the time, potential explanations such as warfare with Western Basin people or potentially high lake levels were suggested as potential explanations. As the evidence was extremely weak, there was no point in attempting to determine causes. The intention of the comparison here is to determine if the trend noted at Dorchester is more widespread. The data to be collected will be capable of answering this question. If such a trend is established then determining the cause will be difficult, as the cause could well lie outside of the study area. As it relates to warfare, the number of projectile points on Iroquoian sites has been used as an inference of increased warfare (Finlayson 1998).

Water travel could mean that all costs are nearly identical since much larger quantities of chert could be returned than by land travel. Canoes make remote acquisition trips more profitable. This method would, in effect, lower the cost of chert acquisition resulting in more expedient use of the chert so acquired. If down-the-line exchange is suggested instead, this method of acquisition would mean that the communities downstream from the community acquiring chert through water transport would be excluded from water transport as a means of acquisition so this is not a significant concern. If this was a factor, then the anticipated impact on distance decay curves would be to flatten them out as Janusas (1984) has demonstrated with sites to the northeast of Kettle Point.

One of the implications of continuity through time is that it may be possible to trace individual groups through time based on their relative access to Kettle Point chert. Of course, this hypothesis assumes that the groups in the area remained stable through time. Group migrations occurred particularly in the MOI stage and these could confound the model as the groups may relocate into areas previously occupied by other groups. Such movements could result in changes in chert usage percentage or the migrants could also develop alternate access to a common supplier so that the intrusive group would appear no different than the indigenous group. There is however, no way to plan for this possibility but it will need to be considered in the final discussion.

Another factor to be considered is that spurious indications of inter-group exchange might be created based on the physical properties of the different varieties of chert. Kettle Point and Onondaga chert are both of higher quality and so could be used in either a curated or expedient fashion. Local till chert on the other hand is frequently not amenable to biface manufacture as the glacial action that deposited it quite frequently damaged the crystalline structure so that fracture planes and shatter are a frequent result of attempted reduction. Also some of it tends to be much coarser than the high grade sources and have non-siliceous content or flaws. Thus, a situation where it appeared that Kettle Point or Onondaga chert were preferred for bifaces could result from the physical nature of the stone not a cultural preference based on cost of acquisition as the theory might suggest. Although this generally low grade chert was largely ignored by earlier inhabitants (e.g. Late Archaic, see Ellis and Spence 1997) specifically because of the poor quality, it became a viable source with sedentary groups who seemed to adopt a greater use of expedient flake technology (Parry and Kelly 1987). The impact of this factor is that the demonstration of trade would be best identified through varying uses of the high grade sources rather than a comparison with the low grade sources.

There is some indication from the Lawson site (Pearce 1994) that, while the debitage is very high in Kettle Point chert, the projectile points are much more likely to be made from Onondaga chert. This pattern could be a result of the cost of obtaining Onondaga chert as described below, but it also could be derived from the basic properties of the chert itself. Flint knappers have described it as a “tough” chert (Dan Long, personal communication). The data being collected should be able to distinguish between these two possibilities. If cost is the determining factor, then the corollary to high Onondaga in the west is high Kettle Point in the east. If this pattern holds up, then the selection is based on using high cost material as per the implications. If it does not hold up, then it may be more likely that the characteristics of the Onondaga chert made it more preferable for projectile points.

The alternative to down-the-line exchange, is that individual resource acquisition trips by specific individuals or embedded procurement by task groups is responsible for these patterns and no trade can be inferred. The data should be able to support or disprove this alternate hypothesis. If an embedded procurement strategy is used for all chert acquisition, there will be no difference in use between non-local chert and locally obtainable chert, (Morrow and Jeffries 1989) and all flake categories should be similar for each source. Another possible indication of this would be a regression curve with a linear equation as Reid (1986) and others associate this pattern with direct acquisition.

It is universally accepted that the shift from the EOI to the MOI entailed significant cultural changes. Indeed, Kapches (1995) declares that the advent of the MOI stage represents the establishment of the Iroquoian cultural pattern as recorded at the time of contact. While generally discounted by most archaeologists, the Pickering conquest hypothesis (Wright 1966) is still adamantly supported in some quarters (e.g. Finlayson 1998; Wright 1990,1992). Evaluation of the conquest hypothesis is certainly beyond the scope of this study. However, the nature of the study area provides a basis to assess the continuity of the organization of lithic technology over the transition from the EOI to the MOI stage.

Finally, there is always the possibility that some or most of the behaviourial hypotheses will not hold up on wider scrutiny. After all, the pattern was developed based on fewer sites from a smaller study area. So it is entirely possible that the perceived pattern was fortuitous and there is no real substance to it. If that happens then at least some spurious conclusions will have been removed from the literature but there may be opportunity for building an alternate acquisition hypothesis based on the data collected. In any event, that is a risk we all accept by conducting problem-oriented research and the result will at least further our understanding even if it results in disproving certain hypotheses. Obviously, no real data gathering plans can be based on this assumption.

Chapter 4: Data Collection Methodology

This chapter describes the methodology used to collect the data and provides definitions of the various information recorded. The first part of the chapter describes the chert sources, their geological setting, the problems involved in assigning a particular item to its appropriate source and a description of the controls used in attempting to maintain consistency. That is followed by the definitions of the various data collected and then by a discussion of issues surrounding analysis of debitage and various debitage typologies since the debitage typology is critical to this study.

Chert Sources: The Geological Setting

In general, Ontario chert sources are well-known and well-documented both geologically and archaeologically (see Eley and Von Bitter 1989; Fox 1979e; Janusas 1984; Parker 1986b; Parkins 1977). In the study area specifically, there are no surface outcrops due to the thick mantle of secondary glacial deposits. As a result, there are no immediately available primary sources although there is a significant amount of secondary deposits in the glacial till. The closest primary source is Kettle Point chert located at Kettle Point, Ontario, 45 km from the west end of the study area. The other primary source used in measurable quantities is Onondaga chert which outcrops, starting at a point 56 km from the east end of the study area, and swinging southeast to the north shore of Lake Erie east of Long Point. Two other chert sources, Selkirk and Haldimand chert, are located just north of Long Point. These were used sparingly by the Iroquoian peoples in the study area.

The bedrock of southern Ontario is comprised of a series of beds of Devonian and Silurian age that, in general, slope gently downward to the west being the eastern edge of the Michigan Basin (Stokes et al. 1978). Along a line between Kettle Point and Niagara, the older beds occur to the east and these are subsequently covered by younger beds as one moves progressively westward (see Figure 6; Chapman and Putnam 1984). In the west, Kettle Point chert occurs at the interface between the Upper Devonian Ipperwash Formation limestone and the overlying Kettle Point Formation shale (Eley and Von Bitter

1989). Most of this primary chert source is just below water level offshore (Janusas 1984) but there is one outcrop a little to the northeast of the point proper that is right at the current water level. Chert can be obtained from the primary deposits but personal observations indicate that it is also found in the shallow water all around the point in sizes varying from small cobbles to large boulders containing sections of the chert bed. Secondary deposits of Kettle Point chert occur southward into Lambton county at least as far as Shetland. However, the chert pebbles there are fairly small and of little use for knapping. Other secondary deposits can be found in the till at least as far east as the Thedford area (Janusas 1984).

To the east there are a number of chert bearing formations that outcrop along Lake Erie. One source that appears in low frequency on Iroquoian sites in the study area is Selkirk chert from the Dundee Formation which is middle Devonian in age. Primary outcrops of this chert occur between Port Dover and Dunnville, both inland near Selkirk and along the lake shore (Eley and Von Bitter 1989). The Onondaga Formation is also Middle Devonian and grades laterally into the Dundee Formation as one proceeds west from Dunnville. The Dundee Formation outcrops bearing Selkirk chert are slightly younger than the chert bearing portions of the Onondaga Formation. The chert bearing portion of the Onondaga Formation outcrops along Lake Erie from a point south of Selkirk to Fort Erie and on into New York State (Eley and Von Bitter 1989). These outcrops are particularly rich with high quality chert making up a large percentage of chert versus the rock formation as a whole (Parkins 1977). The third chert occurring in this same general area is Haldimand or Bois Blanc chert from the Bois Blanc Formation which is lower Devonian in age (see Parker 1986a, 1986b). These outcrops are found north of the Onondaga outcrops in the Dunnville area. This chert type is also found in small quantities in the study area. It is generally a lower grade chert.

The other major source of chert is secondary deposits of chert that occur in the glacial till throughout the study area. A study by the Department of Highways of Ontario (Ingram and Dunikowska-Koniuszy 1965) provides some quantification of the amount of this occurring in the till by measuring the quantity of chert in gravel deposits within the area and concludes that for most of the western part of the study area chert comprises 5-10% of the aggregate. In the eastern part of the study area in North Dorchester Township, this rises to 10-20% of the aggregate. In the western part of the study area in the Caradoc sand plain, the fine sand obscures much of the chert except in the creek and river beds. The basic problem is that, with any of this chert, it is not possible to identify the original source as there are no outcrops directly in or near the study area. Further, glacial action can move blocks of chert around in a confusing pattern and mix up chert from several different sources. At the end of the last glaciation the ice action left a series of recessional moraines where the ice movement was from south to north out of the Lake Erie basin. However, there are also large erratics of granite that were transported from the Canadian Shield far to the north. Luedke (1976) notes chert tends to break down quickly under glacial action so that it can be assumed that any sizable fragments of chert have not been moved too far from the bed rock from which they were derived.

The look and feel of this till chert can be highly variable. Some of it is quite distinctive and clearly different from any of the primary deposits. Of note is a cream coloured chert occurring through Westminster and North Dorchester Townships. There are also several other distinctive varieties as well. However, some of it is virtually identical to primary source Onondaga chert and short of trace element analysis or thin sectioning, it is impossible to tell the difference. This Onondaga-like till chert could be derived from the Dundee Formation that is Middle Devonian like the Onondaga Formation. Indeed, it is reasonable to assume that the processes that led to the significant chert deposits in the Onondaga Formation were also acting on the contemporary Dundee Formation that underlies the study area and much of southwestern Ontario. However, there are no surface outcrops in this area as the bedrock is buried by Tertiary/Quaternary deposits. Whether this included the colouration or whether the similar colour is an example of different formations producing macroscopically identical chert is a mute point. In any event, there is chert occurring in the till especially to the south of the London area which is virtually identical to primary source Onondaga thus making for great difficulty in macroscopically identifying any given piece. Unfortunately, while the local till chert is readily available it is generally of an inferior quality and frequently shatters with attempts to work it.

In the study area per se this local Onondaga-like chert is generally small and well ground by the glacial action. However, along the Lake Erie shoreline, larger cobbles can be found that are indistinguishable from primary source Onondaga except for the worn cortex. Christopher Ellis (personal communication 2003) has observed such cobbles along the shore line south of the Nettling site. Also William Fox (personal communication 2003) notes the presence of blocks of “Onondaga” chert as far west as Pelee Island. This chert is so much like the primary source material that he hypothesized that it was moved from the primary sources to the east down Lake Erie to its current location that far west. While this is well beyond the range of chert survival in glacial movement suggested by Luedtke (1976), Onondaga chert may be exceptional given the massive amounts of chert in the beds. In effect, there is so much chert in large boulders that some of it survives the distant transportation in blocks large enough to be useful. Alternatively, it could well be derived from Dundee Formation deposits that were subject to glacial action on the bed of Lake Erie and in the far past in the study area itself. On the south side of Lake Erie Onondaga-like chert is found in the glacial tills of Ohio (Christopher Ellis: personal communication 2003). In any event, the actual source of this is a geological problem and need not concern us here. From the archaeological perspective, the chert is identical to primary outcrops of Onondaga and could thus cause problems in identifying it as to source. In conducting the analysis, it was not unusual to find material classified as Onondaga but which has a clearly water rolled cortex suggestive of lake shore action. It is also quite probable that water rolled cobbles were being collected and utilized in the vicinity of the primary outcrops along Lake Erie as well (William Fox personal communication 2003)

Chert Source Identification

This section describes the methodology used in this study to assign various artefacts to a chert source. A systematic approach to this is critical in order to provide consistency to the data to be used in evaluating the behaviourial hypotheses outlined above. In conducting a macroscopic analysis, the specific attributes of the various source types are, to a large extent, entirely visual making it difficult to work from detailed textual descriptions. Chert source identification is more of an oral tradition in the archaeological community where the elders are the keepers of the accumulated knowledge and gradually train the next generation in how to recognize the various source material. The most exact approach is to have a good collection in front of you as you work through assigning source types and thus, gradually knowledge is built that can stand on its own. Therefore, while some characteristics are defined below, it is not expected that the definitions alone are sufficient to facilitate assignment of any given artefact to a particular source. Despite the presence of the oral tradition, there is still a significant variance from one analyst to another in what is identified as to which source and to this end, a comparative analysis was done comparing the typing of 200 flakes amongst six different analysts (Keron 2003). That study showed that there is reasonable agreement on identification of Kettle Point chert but the distinction between Onondaga and local till chert is highly variable from one analyst to the next. This problem arises because primary source Onondaga and local till chert in the London area occur in continuous shades of grey and brown making macroscopic distinction a very error prone activity. Indeed, it has been argued elsewhere (Keron 1986) that this continuum is such that attempting to make the distinction is not worth the effort. This same approach was adopted by Timmins (1997) and Lennox (1995a). In fact, Lennox (1995a:94) claims that local till cherts are indistinguishable from primary source Onondaga and argues the material which resembles Onondaga is derived from local till chert and that easy access to local till chert means Iroquoian groups would not have gone to the trouble of acquiring primary source Onondaga.

Despite the difficulty in macroscopically distinguishing primary source Onondaga from local till chert, the distinction between these two cherts is very important to the social components of Iroquoian chert acquisition. If primary source Onondaga is being acquired, the social component of the acquisition is much different and certainly more complex than that of local till chert. Further, the local groups did go to the trouble of acquiring Kettle Point chert from some distance and most sites also have an low percentage of Selkirk chert which from the author's experience in not easily confused with local till chert. As the source for this is close to the source for Onondaga, there is every reason to believe that the same processes that acquired Selkirk chert could be used to acquire primary source Onondaga. When it comes to comparing material from published reports of different analysts, local till chert should be lumped with Onondaga as there is too much variation between analysts to make any comparison remotely valid. However, given the importance of the distinction, this thesis will attempt to separate the two cherts but only material examined by the author will be used to allow some level of consistency.

The first way of drawing the distinction is if there is a portion of cortex present that was battered indicating it came from a secondary deposit (Keron 1986). However, a second way of making the distinction is to observe the macroscopic characteristics of natural chert cobbles known to be derived from the local till. In fact, the author normally collects samples of this material when doing survey. What has emerged from this is that there is a class of local till chert that is easily identified even when there is no cortex present. That leaves a third class of till chert that is certainly difficult to distinguish from primary source outcrop Onondaga. Distinguishing these two sources is a definite problem. After several false starts, it became apparent that the only way to maintain consistency in sorting was to work from a reference collection. To do this a number of artefacts from earlier time periods (e.g. Archaic) were selected that were derived from primary sources. Then, when doing the data collection, unless a particular piece matched at least one of the sample, it was not counted as Onondaga chert. This method has proved to be workable and while the assignment of a few pieces might be questionable, on the whole, the method is reliable. Finally, as colour hues are sometimes critical to making the distinction, care was taken that the same lighting system was used throughout the entire analysis.

Following is the list of the chert sources identified during data collection as well as a short description of the visual cues used to make the assignment.

Kettle Point This chert can be reddish, greenish or even grey. It tends to be very lustrous and is translucent most of the time. This translucency is a key attribute in making the assignment.

Onondaga As used here, the assignment of a particular artefact as Onondaga chert was based on it matching one of a known sample. Onondaga chert varies from grey to a grey/brown mottled appearance. It is usually fine grained and only slightly translucent or not at all. The grey brown mottling varies from light to dark.

Local Till Chert Local till chert can be highly variable in both colour and quality. Some of it can be quite distinctive in colour from Onondaga and the grain is generally coarser. The cortex can be crushed and battered but is frequently composed of conchoidal fractures making easy distinction between natural pebbles and cores difficult except for a slight rounding of the ridges. Indeed, one site examined (intentionally not referenced) in the study lists five cores in a widely published source. On examination all of these “cores” were determined to be natural chert cobbles without any human modification. Another site (also not referenced) analyzed had a large number of “cores” “wedges” “spokeshaves” and even one “biface” cataloged that were all natural chert pebbles. Colours can vary from a cream brown through to a grey that is almost identical to that found in primary source Onondaga chert. While some of the material can be fine-grained most is generally coarse leading to irregular fractures if one attempts to work it. Despite this coarse nature some of it is fine enough to permit bifacial working, most likely pieces that have not been as badly battered during the glaciation process that led to their deposition.

Other Chert This category includes all chert sources other than those named above. Selkirk chert is included here as are any other chert sources that are clearly foreign to the area (e.g. Flint Ridge, Collingwood, Bayport chert). These sources are a very small percent of the total in all sites. Included in this category are any flakes which are clearly not one of the above but where the source in not known.

Unidentified Included in this category are all pieces that could not be identified as to source due to, generally, two reasons. Frequently debitage has been burned. making identification problematic. In some cases after working with enough material a source assignment might be made, for example the coloration of burned Kettle Point chert might be consistent enough to be identified. However, in order to maintain consistency this material is placed into the unidentified category as the distinction only became evident half-way through the analysis. The other reason to classify a piece as unidentified is when the flake is too small to allow reliable identification.

Site Information

With respect to gathering data for the study about the specific sites, the first step was to build an inventory of Iroquoian sites in the study area. This inventory was developed using a number of sources. The first draft was assembled using published material (Keron 1986; Pearce 1996; Williamson 1985). These data were then augmented through a request for information from the database of the Ministry of Culture, Heritage Branch. Unfortunately, due to other time constraints within the Heritage Planning Branch, it was not possible to get a complete list of all Iroquoian sites in the study area. Out of this inventory, a number of sites were selected for analysis.

The following information was kept for each site in the site inventory. Appendix A details all of the sites used in the analysis and also contains the specific publication references for each site.

1. Site name
2. Borden Number
3. Location (UTM coordinates)
4. Cultural affiliation
5. Site Type
6. Cluster assignment
7. Comments on the nature of the sample and its representativeness.
8. References

The cultural affiliation of the site was normally that assigned by the investigator. Categories used here were Glen Meyer, Uren, Middleport and Neutral, basically following Wright's (1966) stages. While actual dates would have been preferable, this would have meant using radio carbon dates and that would have severely limited the number of sites that could be used. Dates assigned using artefact styles are normally just derived from Wright's (1966) stages anyway and, at the level of analysis used here, the stages are a good ordering device and have proved to be reasonable over the years.

With respect to site types, research in the area has demonstrated that there is a variety of site types throughout the Late Woodland period in southwestern Ontario. Williamson's work (1985) in Caradoc has demonstrated that this pattern arose early. Similarly, Pearce (1996) has demonstrated the same pattern in the Neutral period in the vicinity of the Lawson site as has the author (Keron 1986) in the Pond Mills and Lambeth vicinity. Terms such as villages, hamlets, special function sites and cabin sites have been used but unfortunately not with any kind of consistency. For quite a while the term "hamlet" was applied to any small site and "village" was applied to the larger sites (c.f. Pearce 1996; Williamson 1985). More recently the term "cabin" has been used for the small special function sites that are frequently assumed to be for horticultural purposes. Pearce (1996) in the addendum to his thesis reviews the definitions of village, satellite, hamlet and cabin that were given in Finlayson and Pearce (1989) and modifies that of cabin to include one or two long houses. Those definitions will be adopted here. In operationalizing these definitions it should be noted that they depend to a large extent on classifying a site which has been extensively excavated exposing the patterns of longhouses. Here again, restricting the study to excavated sites would severely limit the number of sites that could be analyzed. In practice, the terms defined by Finlayson and Pearce (1989) will be used but the assignment to the terms will be based primarily on the site size and density of artefacts. While this practice will introduce an element of error into the results, in general the extremes of the large/small dichotomy are almost certainly accurately assigned. The potential errors occur with sites in the middle. These could well be satellites in the sense used by Finlayson and Pearce (1989) or possible hamlets or small villages. Nonetheless, accepting this risk greatly increases the number of sites that can be included.

For cluster, the assignment of sites to a cluster generally follows those used by Pearce (1996; see Figure 3). However, Pearce's Dingman community is divided into two groups labeled Pond Mills and Lambeth. Clusters are assumed to be reflective of a single community occupying a territory through time where successive villages were built as the group relocates through time in the classic Iroquoian pattern as has been demonstrated for some areas (e.g. Tuck [1971] for the Onondaga and Pearce [1984] for the London community of the prehistoric Neutral). In reality, group movements can be quite complex so that heavy dependence on the cluster assumption without detailed inter-site comparisons can be somewhat risky. However, the concept of cluster has been retained more as a descriptive device and, to a large extent, the cluster assignment does not figure heavily in the analysis. What is difficult, as noted earlier, is to connect the Glen Meyer clusters with the succeeding Middleport sites. Pearce (1984) theorizes that the Arkona, Caradoc, and Byron clusters coalesced to form the Middleport sites on Oxbow Creek and that the Dorchester cluster was antecedent to the Lake Whitaker cluster. However, another equally valid interpretation would link the Byron cluster and its associated community with the Lambeth community while the Dorchester cluster could be antecedent to the Pond Mills cluster. Then, of course, there is the conquest theory (Finlayson 1998; Wright 1966, 1992) where the Uren Substage is a cultural replacement of Glen Meyer so any attempt to connect Glen Myer with later sites is a non-issue. In any event, the cluster construct will be retained but does not figure in the analysis and care should be used in reading too much into it.

Finally, the nature of the lithic sample from each site is of utmost importance. In order to establish the validity of the conclusions here, it is necessary that the material used be reflective of the real percentages of various artefact types and chert sources used at the site. The only sure way of doing this would be to excavate the entire site (including screening all the topsoil) and then to analyze all the material or at least a statistically representative sample of it. This procedure is not possible as few sites in the study area have been completely excavated. Thus, it is necessary to consider to what extent the sample from a given site would be representative. The best sample would be a CSP of the entire site as it would be representative, lend itself to spatial analysis, and not be too time consuming. Excavated samples run the risk of not being representative unless the excavation covered a large part of the site or covered most areas of the site. Comments as to the representativeness of a site are included in Appendix A.

Artefact Information

The data from each site were entered into a Microsoft Excel spreadsheet. This spreadsheet contained the debitage data in the form of totals for all combinations of chert source and flake type in both raw counts and in percentages for the dominant five flake types. Further a summary of all the artefact types broken out by chert source was also included. These data are presented in Appendix F. In addition, various qualitative comments on the assemblage were kept in this spreadsheet.

For the sites selected to conduct intra-site spatial analysis, a second Excel spreadsheet was created that had one row per individual artefact. This included the following information.

1. Site
2. Chert Source
3. Artefact Type
4. Artefact SubType
5. Provenience (internal location in Cartesian Co-ordinate form)

Frequently, it was necessary to convert transit and compass readings into Cartesian Coordinates. These were all done using the spreadsheet formula from the London Chapter, OAS, web site (Keron and Prowse 2001). The data in the appendices are in Cartesian Coordinate format.

The artefact types and associated codes used in Appendix F are those defined by the London Museum of Archaeology (again available on the London Chapter OAS web site). However, some additional types were added or the meaning was used differently as follows.

Foliate Biface These bifaces are assumed to be knives. See Fox (1981e, 1982d) for a detailed description.

Preform This is a type of biface in a state that was antecedent to creating a projectile point. To be put in this type, it must be clearly intended for a projectile point.

Used Cobble Given the amount of local till chert available to the Iroquoian people, it is not surprising that occasionally an unmodified piece of till chert would be put to use. To be included in this category the use must be clearly evident and purposeful. A scratch with a plough does not qualify as use.

Additionally, subtypes were kept for projectile points. It should be noted here that projectile points from earlier sites are frequently found on Iroquoian sites. While some of these could be the result of a multiple occupations they are frequently interpreted as resulting from Iroquoian collection on earlier sites. In this analysis these earlier points are ignored.

Notched This classification indicates a notched Iroquoian projectile point. The classic type for this would be Nanticoke Notched (Fox 1981d). Another term sometimes used is Middleport Notched but this has never been formally defined and is best considered an earlier form of Nanticoke Notched.

Triangular During the late period, this category would be termed Nanticoke Triangular (Fox 1981c). There are also triangular forms during Glen Meyer times. These tend to be larger and more variable. Some fit the description of Levanna (Ritchie 1971) while a variant called Glen Meyer Tanged Triangular has been identified by Fox (1982a).

Tip and Mid-section These are broken fragments where the base is missing prohibiting further typing.

Scrapers were broken down into four types as follows.

SCR This is a classic end scraper but lacks ventral retouch,

Side SCR This is a scraper where the working edge is on a lateral margin.

SCR-VR This is a classic end scraper but possesses ventral retouch

SCR-flake The line between what would normally be called a utilized flake and this category is somewhat blurred. These are flakes with retouch along one or more margins. The artefact has not been purposely shaped and the retouch might very well be through use. It is however, quite definite and not problematic as are some of the artefacts that are frequently cataloged as utilized flakes.

Ventral retouch is an interesting treatment frequently applied to end scrapers by Iroquoian people. It is found on a number of late prehistoric Neutral sites and even into the historic period (Lennox 1981:242). It varies from a few flakes purposefully removed from the ventral surface to the point where the entire ventral surface of the flake has been removed, in effect, turning it into a biface. These are referred to as bifacial snub nosed scrapers by Lennox (1981). In this analysis, an artefact is assigned to this type if it possesses ventral retouch. No attempt is made to differentiate types based on the amount of retouch.

Finally a commentary should be made regarding utilized flakes. In this analysis, this so-called type has been excluded. The initial concern was that it would be better to assign the flake to one of the defined flake types rather than to a unique type simply because it has been used, as this would obscure the reduction data. In practice, while working through the various collections cataloged by other researchers, a very healthy scepticism developed as to how consistently this category was applied. Some flakes were cataloged as “utilized” when there was no use-wear evident. Some flakes were cataloged as “utilized” that had damage to one edge that, at least to the author, appeared most likely to have been plough induced. And some flakes did, indeed, appear to be used. These three tend to occur in about equal frequency. Yet another kind of “utilized flake” was a natural chert cobble with some form of plough damage. Further, in working through the debitage or “unutilized flakes”, it was common to encounter flakes that clearly looked “used” but for some reason had not been recognized as such. In general, for the author at least, any future archaeological report that discusses “utilized flakes” will be greeted with a high degree of scepticism. I agree fully with Shen (1999) who concluded that the term "utilized flake" should be completely abandoned as a type. Use-wear analysis is still a very viable tool in our repertoire but as Shen (1999) notes, needs to be conducted with a microscope by a qualified use-wear analyst. Including a "utilized flake" type without this level of analysis is highly problematic.

Approaches to Debitage Typologies

Critical to development of this thesis is the comparison of debitage from a number of sites in the study area. While the post-processual mantra that "data are laden with theory" has been used to justify chaos in archaeological analysis, the criticisms inherent in this perspective have some justification so it is necessary to give some thought to the analytical procedures used to create the comparative data.

Archaeologists have approached the subject of debitage analysis in many ways depending on the particular analytical problem at hand as well as their own predilections. One of the earliest rigorous analysis of debitage from North American sites was that done by Anta White (1963). In this work, she describes a series of flake types which result from the stages of reduction and artefact finishing. Since then, numerous variants of this type approach have been used and other alternative techniques developed. For purposes here, these are classified into three different methodological approaches: lithic reduction stage typologies, Sullivan and Rozen's (1985) typology (SRT), and mass analysis.

The stage typology method, following White_s (1963) analysis, is used most often and involves defining a series of types deemed to be diagnostic of the reduction sequence based on clusters of flake attributes. There are a number of different typologies that have been used over the years and these vary from only a few types (e.g. Lennox 1986) up to a much larger number (e.g. Ellis 1984). White (1963) identifies two types associated with decortication, six types associated with core reduction and four with artefact production. The types associated with artefact production are not as clearly defined, being limited to the method of removal (e.g. percussion, pressure flaking or steep marginal retouch). In general, all these typologies share the same basic assumption, that flake types can be associated with the stages of stone working varying from the initial flakes struck from a nodule through various core preparation and reduction, to bifacial and unifacial tool finishing, and finally to tool resharpening and reworking and that these types are recognizable. Thus, it is possible by looking at the frequencies of the various types, to determine some of the activities that were conducted at the site and even make inferences about the mobility patterns of the inhabitants. For instance a high degree of bifacial thinning and a low frequency of core reduction is indicative of Binford_s (1980) pattern of curation associated with the collector strategy and when used with chert source identification leads to inferences regarding group mobility. (e.g. Andrefsky 1994; Ingbar, 1994; Morrow and Jeffries 1989).

Critics of the lithic reduction stage methodology have noted several problems with the method and experimental replication of the types. Shott (1994: 77) notes three problems. First, while the attribute configuration of the flake is used to assign it to the particular type, it is only inferred that the flake derived from that stage of reduction. Experimental results have shown that such assignation is not unproblematic (Ahler 1989: 88). Second, Shott (1994) criticizes the method because everyone uses a different typology making comparison of assemblages (or more properly comparison of published reports of assemblages from different authors) impossible. This criticism is not of the method per se but symptomatic of most published reports in archaeology where archaeologists assert their individuality (or maybe ethnicity) by using different analytical structures even if none are required. He does go on to include in this criticism the fact that different people will categorize a flake differently even with the same typology which is a major problem with the comparability of analyses (see Keron 2003 for an experimental demonstration). Third, he notes that the typologies based on this approach do not take size into account (Ellis 1984 being an exception). Sullivan and Rozen (1985: 756) expand on Shott_s second criticism noting that typologies which might seem comparable are often not since, while the same _types_ or more properly names of types are used, the definitions are different. For example, while the “names” primary, secondary and tertiary decortication flakes are used, the definitions of the percentage of cortex required to distinguish one from the other vary. Also words such as “primary” and "secondary" have different meanings in different typologies. Further, they introduce another criticism that the reduction process is best viewed as a continuum and not a series of discrete stages.

Stage typologies dominated until the mid 1980s when new approaches were defined and published. One of these, which has generated significant interest and controversy over the years, was that of Sullivan and Rozen (1985). Here they noted problems with stage typologies similar to those of Shott (1994) and, building on the point that the assigned types may in fact not be diagnostic of the particular reduction stage, proposed defining a series of four types that were not at all linked to stages but were "interpretation free". The four types were defined by a simple set of attributes, basically, the presence or absence of a single interior surface, the presence or absence of a point of applied force and whether or not those flakes with a point of applied force were broken or not. The four types are called "debris" (no interior surface), "flake fragment" (no point of applied force), "broken flake" (point of applied force but not complete) and "complete flake" (point of applied force and unbroken). It is necessary to analyze the assemblage at a site and then relate the frequencies of the various types to activities that were conducted at the site. In general, high frequencies of complete flakes and debris are taken to be indicative of core reduction while high frequencies of broken flakes and flake fragments are indicative of tool manufacture. This generalization is derived through a factor analysis of a series of sites where the two pairs of types tended to co-vary and more cores were present with high frequencies of complete flakes and debris.

The method has attracted considerable interest and criticism in the literature in what can best be described as a mixed reaction. The most obvious criticism is that their assignment of type frequencies to various reduction activities is just as arbitrary as the assignment of types in stage typology (Amick and Mauldin 1989a). They also argue that inferring activities directly from the archaeological record is circular and that experimental studies are required to validate the assumptions thus building Binford_s (1981) middle range theory. Amick and Mauldin (1989b) published an edited volume of experimental studies several of which focused on Sullivan and Rozen's typology. Of these, Mauldin and Amick (1989b), Baumler and Downum (1989), Tompka (1989) and Prentiss and Romanski (1989) reported results contradictory to Sullivan and Rozen_s analytical construct while Ingbar et al. (1989) found that it was useful in their study. On the theoretical level Ensor and Roemer (1989) challenge the nature of the "interpretation free" categories and then go on to reject Sullivan and Rozen_s criticisms of stage typology as unfounded and also their claim that the reduction sequence is a continuum, noting that knappers will go through a number of stages from hard hammer percussion to soft hammer percussion and pressure flaking. Most importantly, they note that the assignment of one flake to a reduction stage is not incontrovertible proof that that stage was executed but that there is a probabilistic relationship between the assignment and the actual stage occurring at the site in question. More recently, Prentiss (1998) developed an experimental design which showed the SRT to be reliable in that it could be replicated but that its validity was poor with highly vitreous raw materials. With the exception of use by the authors themselves (e.g. Sullivan 1987), the SRT method has attracted much more attention from a methodological and theoretical perspective than it has been used in practical applications.

The final methodological approach to debitage analysis is known as mass analysis (Ahler 1989) and is very different from the preceding two approaches which both require an analyst to examine each individual flake and assign it to a type. With mass analysis this labour intensive process is replaced by size grading an entire assemblage using a series of nested screens of progressively finer gradation varying from one inch through .5, .25 and .125 inch screens. A group of flakes is deposited in the uppermost layer and a consistent shaking process is applied allowing the flakes to settle down to a screen where they are too large to drop further. From this point the count of flakes and the total weight of the flakes in each layer is recorded. The theory behind this approach is that knapping is essentially a reductive process so that the further progressed the activity, the smaller will be the flakes. Further this can also be related to various techniques of knapping in that percussion techniques generate larger flakes than does pressure flaking. The technique has several advantages not the least of which is the rapidity of performing the analysis when compared to the tedious one-at-a-time approach used by the other methods. Furthermore, smaller flakes resulting from pressure flaking can be included in the analysis as these are normally not even recovered with other methods. The method is consistent in that results can be replicated with a good degree of accuracy. Problems with the method include, similar to the other methods, the concern that the particular pattern recorded may be difficult to link to the behaviours that are being sought. A second unique problem is the difficulty of working with mixed samples. The method works reasonably well in experimental contexts in discriminating core reduction from tool manufacture but is much more difficult to apply when these are mixed as occurs on most archaeological assemblages. In general Ahler_s method, while allowing mass processing of assemblages has not attracted much attention. Further, while it can measure flakes smaller than .025 inches, this assumes that these flakes have been recovered. However, screens that small are rarely used in Iroquoian archaeological excavation and, of course, not at all in a CSP which will be biased against smaller items.

All three approaches provide a way to get at the underlying cultural processes but for further work it is necessary to select a general approach. Both SRT and mass analysis attempt to introduce greater rigor into the process by focusing on better replicability of the analysis. Despite this advantage, it is felt that it would be best to use a stage typology given the shortcomings of the other methods. The criticisms of stage typology must be considered so that more is not read into the data than can reasonably be assumed. Besides, the stage typology approach is very much ingrained in current research in Ontario so that there is an attraction to staying with this approach as long as it can be shown to provide consistent results.

One of the critical areas to be determined was the extent to which published sources could or could not be used in the comparison phase. Use of published information would be attractive as a broader range of sites could be included but could potentially inject spurious results because of subtle differences in classification. Accordingly, an experiment was designed whereby the author and other analysts classified the same set of 200 flakes taken from London area Iroquoian sites according to chert source and two different stage typologies. The details and results of this are published elsewhere (Keron 2003) but the conclusions were as follows as they relate to flake types:

- An error factor between analysts of up to plus or minus 7% would need to be applied to analyses of different authors.
- It might be possible to translate one typology to another as long as the second had fewer types and there is a one-to-one mapping from the first typology to the second.
- The assignment of any given flake to a type is not generally agreed upon by the analysts. Generally agreement was achieved between any two analysts on only 60% of the sample.
- More complex typologies lead to less agreement between analysts.

Given these facts, it became a choice between using a simpler typology such as that of Lennox which would allow some comparison but with a degree of error or to move to a more complex typology that would permit a deeper understanding of the reduction sequence but require all collections to be personally examined. The decision was made in favour of the latter.

One of the very real criticisms of various stage typologies is that a number of those being used are not at all well-defined. Thus, in moving into this exercise, it was deemed critical to be very clear as to the definition of the attributes of the types to be used. This presentation will induce greater reliability into the process and hopefully might allow the typology to be used elsewhere with some success. The detailed definitions of the various subtypes of debitage follow.

Debitage Subtypes

In defining the typology to be used here, the first decision was whether or not to use one of the established typologies most likely that of Paul Lennox given its status as de facto standard. While that idea had some appeal, there were several open questions as to exactly what went in any given category. Furthermore, there were other variables that seemed important that would be lost by using a "lumper" typology such as decortication flakes or unifacial retouch flakes. Thus, it was decided to proceed with yet another typology but, in doing so, to provide a detailed definition of the attributes of each defined type.

The following defines the flake types used in this thesis.

1. Decortication Flake

This is the initial stage in core reduction involving the removal of the cortex from the initial block of chert. The category as used here includes White's (1963) primary and secondary decortication flakes. Cortex as defined includes the original interface to the surrounding source matrix, or weathered surfaces or surfaces with patina. Weathered could include both crushing from action in the glacial till or smoothing through being water rolled.

Attributes

- Presence of substantial (>20%) cortex located other than on the striking platform
- Striking platform has very few facets (<3)
- Striking platform at approximately 90^0 to ventral surface
- Pronounced bulb of percussion
- Dorsal surface has low number of scars
- Generally, on average it is a larger size but there is a considerable range of variation
- Ventral surface is usually straight lacking much curvature

2. Core Trimming Flake

These flakes are produced during core reduction. They can be flake blanks or attempted flake blanks where the purpose is to obtain a flake for either expedient use or manufacture into a more formal tool. They also include generally smaller flakes which were removed in the process of preparing the core for the removal of a flake blank. Flakes in this category are generally indicative of the later stages of core reduction as they lack cortex.

Attributes

- No cortex on surfaces other than the striking platform or less than 20% of the dorsal surface
- Striking platform has few facets (<3)
- Striking platform at approximately right angles to ventral surface
- Bulb of percussion present
- Dorsal surface has relatively low number of scars
- Variable sizes. Larger flakes may be blanks, smaller are preparation flakes

3. Bipolar

These are flakes produced during bipolar reduction when a core either becomes too small to work with freehand percussion or is relatively small to begin with. The core is placed on an anvil stone and then is stuck with a hammer. For a detailed discussion see Ahler (1989) or Hayden (1980).

Attributes

- Shattered or pointed platforms with little or no surface area
- Evidence of force at both ends of the flake (These first two are key in distinguishing this from Shatter discussed below)
- Angular polyhedral cross section
- Steep lateral edge angles
- Lack of definite positive bulb of force
- Pronounced ripple marks
- Lack of distinction between dorsal and ventral flake surfaces

4. Bifacial Retouch Flake

This type results from flake removal during biface reduction. As Iroquoian bifaces are generally small these flakes are also small, being around 1 cm in size. In earlier times, bifacial cores were used but these are not found on Iroquoian sites. For a description see Deller and Ellis (1992) and Frison (1968).

Attributes

- Thin and flat transverse cross section lacking pronounced dorsal ridges
- Thin longitudinal cross section
- Frequently curved so the flake is concave on the ventral surface
- Feathered edges both laterally and distally
- High number of dorsal flake scars
- Striking platform faceted, narrow, lipped, sometimes ground
- Little or no cortex on dorsal face
- Expanding flake shape
- Small or subdued bulb of force.
- Obtuse platform to ventral surface angle
- Acute platform to dorsal angle

5. Normal Unifacial Retouch

The flake results from finishing and resharpening a scraper by detaching a flake with a blow to the ventral surface of the working edge. These flakes result from scraper manufacture and resharpening. See also Deller and Ellis (1992) and Frison (1968). While this flake type was defined and included in the analysis here, few were identified in the collections probably because they were too small for normal recovery practices to capture.

Attributes

- Almost always complete flake
- Platform approximates the ventral surface of a uniface and is right angled. Small, circular to irregular in outline with a pronounced bulb of force
- Parallel scars on dorsal surface (old working edge)
- Use wear on working edge adjacent to platform
- Pronounced curvature
- Usually feathered termination

6. Ventral Unifacial Retouch

Scrapers with ventral retouch are common on Iroquoian sites in the London area. These flakes are removed by a blow to the working edge perpendicular to the ventral surface of the scraper so that a flake is detached from the ventral surface of the scraper (see Deller and Ellis [1992] and Frison [1968]). In practice only the first few flakes detached in this process will be identified to this category. Any subsequent flakes detached will be very difficult to distinguish from flakes of bifacial retouch.

Attributes

- Dorsal surface is flat (approximating the old ventral surface of the uniface)
- Platforms are right angled to the dorsal surface, faceted, show old use wear as approximate the old working edge of the scraper prior to flakes removal
- pronounced bulb of percussion and undulations as struck into a flat surface
- Flakes are markedly expanding
- Terminate in hinges or steps
- Lack curvature

7. Shatter

This category derives from core reduction when fracture planes are encountered in reducing a core. Instead of producing a classic core reduction flake, portions of the core will break off along pre-existing lines of weakness encountered in the core creating blocky chert fragments. In some sites in the study area where natural chert is common in the till, distinguishing culturally created shatter from shatter produced by modern farming practices can be problematic. For a more detailed discussion see Ahler (1989) and Binford and Quimby (1963).

Attributes

- No clear ventral or dorsal surface
- No visible negative bulbs of percussion
- No systematic alignment of cleavage scars

- No orientation - distal or proximal, dorsally or ventrally
- Blocky fragments

8. Fragmentary Flakes

This type is the distal portion of a broken flake.

Attributes

- No striking platform
- Clear dorsal and ventral surfaces
- Break termination proximally

Chapter 5: Intra-Site Spatial Analysis

This chapter provides an initial exploration into the intra-site patterning of the chipped lithic material in five sites. It tests the hypothesis, identified above, that, if the pattern of different Kettle Point frequencies in different middens at the Harrietsville site (Keron 1986) was evidence of the historically observed cultural trait where Iroquoian lineages controlled trade routes (Tooker 1991; Trigger 1987), then the pattern should be repeated at other Iroquoian sites.

In approaching this analysis, the simplest approach would be to do an analysis of chert frequencies from midden deposits from other sites similar to what was done at Harrietsville. However, while a number of middens have been excavated in the London area, there are not really any large scale excavations, so the sample would be very spotty. There are however, a number of Controlled Surface Pickups (CSP) where surface material from the entire site is collected and the horizontal provenience carefully recorded primarily to determine the extent of the site. Given that lithic detritus occurs in large numbers and that the location of each piece is known, then an analysis of the chert source and flake type is capable of providing a great deal of information on internal patterning of activities within a site. Consequently, five sites that have had a CSP conducted on them were selected for internal analysis. These consist of two LOI sites, Brian (AfHf-10) and Cassandra (AfHh-65), two MOI sites, Drumholm (AfHi-22) and Dorchester Village (AfHg-24), and one EOI site, Mustos (AfHg-2).

In conducting the analysis, each flake was typed for the chert source and the flake type. This information and the catalog number of each was recorded in a spread sheet on an item by item basis. The horizontal provenience data occurred in two main forms, one where a transit had been used to record the location so that a distance and direction was recorded and the other where a compass had been used so that two directions were recorded from two known points. Both of these were turned into Cartesian co-ordinates using spreadsheet calculations available on the web site of the London Chapter of the OAS (Keron and Prowse 2001). Using spreadsheet look up functions, each flake was then matched to the appropriate find spot and the Cartesian co-ordinates added to it giving a spreadsheet that has the catalog number, the chert source, the flake type and the X-Y coordinates of the location. Further analysis was based on this file.

The next stage of the analysis examines the differences in the frequency of various flake and chert source types between different areas within the site looking for differences that are statistically significant. To conduct this analysis a Geographical Information System (GIS) was used to both map the site and perform the statistical calculations for each sub-area of the site using the file containing containing the types and location information. This procedure has the enormous advantage of greatly facilitating conducting many iterative “what-if” analyses.

While the details of how this analysis was accomplished and the statistical calculations are included in Appendix B, a brief description follows. First, several GIS “maps” were produced showing the location of each flake of a specific chert or flake type. For example, one map would plot all Kettle Point chert flakes and another would plot all bifacial retouch flakes. While it would have been informative to be able to drive the analysis down to the point where chert source and flake type were combined for example, all Kettle Point chert flakes of bifacial retouch, the samples were not large enough to permit this kind of analysis.

The next step in the analysis and the point around which a number of iterations occurred for each site was to develop a map of the site that would divide it up into various zones that could then be tested for differential distribution of chert source type and flake type. Ideally, this division of the site into analytical units of area should be done using culturally defined areas such as middens or longhouses. However, as we are dealing with CSP collections, the longhouse locations are not known. A general process was developed where the site was divided up into midden areas and non-midden areas. The non-midden areas were created by grouping all points within the site together that were closest to each midden. Thus, for the Brian site, there are seven defined middens and seven interior site areas, one interior area for each of the closest middens. See Figure 7 for an example. In other cases, where there were no defined midden areas the analysis had to proceed by trial and error. In the subsequent analysis, division into cultural areas is described for each site.

Once the cultural areas have been defined for a particular iteration, a GIS script was used to process the data. For the particular attribute under consideration (e.g. Kettle Point chert flakes), this script calculated, for each individual cultural area, the frequency of occurrence (number of occurrences of the specific type divided by the total occurrences of all types), the total occurrences of all types, the range of a confidence interval based on the sample size, and a map of the various areas with the analyzed flakes plotted. The calculated data are found in the legend. Where the confidence intervals do not overlap, there is a statistically significant difference in the particular attribute being considered in its distribution over the site. Where the confidence intervals do overlap, it was necessary to take the frequency and total of all types for the area to a spreadsheet for more detailed calculations to determine statistically significant differences. The differences that were significant were then shaded on the map using a feature of the GIS. Thus, in analyzing chert source types, for example, four maps resulted, one looking at the distribution of unidentifiable or burned chert and three for each of Kettle Point chert, Onondaga chert and local till chert. "Other" chert was examined initially but as the numbers are very small, no statistically significant differences arose so this was subsequently abandoned. For flake types, five maps were created, one for each of the predominant flake types (decortication, core trimming, bifacial retouch, fragment and shatter). Again, for a detailed description of the GIS methodology see Appendix B.

The analysis of distribution was applied to the detritus only and proceeded in two stages: 1) the distribution by chert source type was considered, 2) the distribution by flake type was considered. Initially, it had been intended to do the same analysis with the formal artefacts/tools but the samples were too small to develop any statistically significant trends in the data. A map of the analytical units is included for each site. All observations are statistically significant unless otherwise noted. Each observation is numbered for later reference, primarily in the table in Appendix E.

The tables of the calculated results comparing the differences between each pair of areas in each site are included in Appendix C and the areas that have frequencies that are different with statistical significance are shaded in the table. The observations are based primarily on these tables.

Brian Site Observations

The Brian site (AfHh-10) is a late prehistoric Neutral village of approximately 2.5 ha. A detailed CSP was conducted on the site in 1988 by Peter Timmins for the London Museum of Archaeology. While earlier and later work was done on the site, this sample forms the basis of the following analysis. As there are well-defined middens, these were used to define the cultural areas as described above. There are seven middens and consequently seven interior areas defined by their proximity to the nearest midden. The cultural areas were assigned numbers as show in Figure 7. The midden numbers are those defined by Timmins (personal communication 2002). The data used to develop this analysis is presented in Appendix C: Tables C1 through C5.

<u>Chert Type observations</u>

During the initial part of the analysis, it appeared as though burned chert and larger pieces of debitage like shatter and cores were more common in the middens. Accordingly, an analysis was done whereby the site was separated into two areas, one the midden areas, and the other, all non-midden areas. The chert types and flake types were run through this analysis to the effect that there was little patterning that was statistically significant with the following single exception,

1. Local till chert was more often found in the middens than other areas of the site.

However, as this leaves open the possibility that different middens were used in different fashions so that one might be high in burned chert but another not, the second analysis was done using all the fourteen cultural areas as defined above. This analysis failed to show any differences. Most of the frequencies of burned chert were in the same general range.

2. The single exception was that Area 3 has a lower frequency of unidentified chert than did Midden 4.

For the remaining analysis unidentified chert was excluded from the calculations as it does not represent a real type in the sense that Kettle Point or Onondaga chert would be. Consequently, it was not included in calculations since inclusion would distort the actual frequencies of identifiable chert. For example, two sites with identical chert use would have different percentages of identified source cherts if one site had more of the total burned than did the other. This assumes, of course, that there was no differential burning of chert. In proceeding with the analysis of chert source type using the fourteen cultural areas, the following observations were made.

3. With respect to Onondaga Chert, Midden 1 has a lower frequency than the adjacent Area 1 as well as Area 2 and 3 and their middens. Midden 1 is outside the palisade. Within the palisade Areas 1, 2 and 3 have higher frequencies but the differences to the rest of the interior are not significant.
4. The highest concentrations of Kettle Point chert are in Areas 2 and 3 and their associated middens. The areas they differ from significantly are Areas 1 and 6.
5. In general, local till chert has high frequencies over most of the site with the exception of Area 7 which had a very low frequency. Unfortunately, this area has few flakes but even with a small sample the difference to the entire rest of the site is significant.
6. As to the internal distribution of local till chert, excluding Area 7 there are two other sets of areas which differ significantly from each other. Area 2 and 3 and Midden 2 have a lower frequency than Areas 1 and 6 and Middens 1, 2, 4 and 7.

<u>Flake Type Observations</u>

In general, there is much less variation in flake types over the surface of the site than there is for chert source types. There are only a few significant differences and these involve one area of the site being different from a couple of others. Following are the significant differences.

7. Looking at the flake types both bifacial retouch flakes and shatter showed no significant differential distributions over the site.

8. Looking at decortication flakes, Midden 1 has a frequency that is significantly lower than Midden 4 and Area 6.

9. Flake fragments are lower in Midden 3 than the immediately adjacent Area 3.

10. For core trimming flakes, Midden 2 is significantly lower than Areas 1 and 3 and Midden 4.

General Comments

In considering the distribution of chert types in general, examining all of the observations for chert source type, a number of generalizations can be made. The first point is that the western portions of the site have lower densities of detritus and therefore do not show up as statistically significant for a number of categories. This includes areas 4, 5, and 7 in particular. Second, it is clear that Kettle Point chert occurs with a higher frequency in Areas 2 and 3 and their middens. Third, on the other hand, Onondaga chert seems to be evenly distributed except that it tends to not occur in Midden 1 outside the palisade. And fourth, in some of the other areas of the site the lack of Kettle Point chert seems to be compensated for by increased use of local till chert.

In order to look closer at these generalizations, a further analysis was done where the site was divided into two regions, one a combination of Middens 2 and 3 and their associated areas and the other with everything else. This analysis clearly indicated that the frequency of Kettle Point chert in these areas is higher than the rest of the site and that the results are statistically significant. Also, local till chert has a higher frequency in the rest of the site and the differences are statistically significant. Using the same split of the site, the difference in the frequency of Onondaga chert was not significant.

11. Dividing the site into two areas the various chert percentages are as follows

- In the Midden 2-3 area the percentage of Kettle Point chert is 22.2 +/- 4.7% while the rest of the site has 11.9 +/- 4%. The differences are statistically significant

- In the Midden 2-3 area the percentage of Onondaga chert is 20.2 +/- 4.6% while the rest of the site has 15.9+/- 4.5%. The difference is not significant.
- In the Midden 2-3 area the percentage of local till chert is 56.2 +/- 5.6% while the rest of the site is 69 +/- 5.7%. The differences are significant.

Next, considering the distribution of Onondaga chert, another split of the site was created that also divided the site into two zones. One zone included Midden 1 and the adjoining portion of Area 1 that lies outside the palisade, and the other was the rest of the site assumed to be inside the palisade. This confirmed the earlier observation that Onondaga chert occurs more frequently inside the village than in Midden 1 and the difference is statistically significant.

While that completes the chert source analysis that is statistically significant, mention should be made of Area 7 since the various frequencies are distinctly different from the rest of the site. Unfortunately, the sample is low so there are no statistically significant differences excepting that local till chert is very low compared to the rest of the site. The flakes in this area are the higher quality Kettle Point, Onondaga and other chert. Also, looking at the flake types, most of these are either bifacial retouch (25%) or fragmentary flakes (50%), both of which are suggestive of late stage reduction. While the differences are not significant, it is suggestive that the knapping activity taking place in Area 7 was different than the rest of the site.

Another area of the site that is unique is Midden 1. During excavation for the UWO field school (Ellis 1996), it was determined that this midden was outside the palisade. As noted above, the midden has a lower frequency of Onondaga chert. Looking at the flake types we also note that there is a lower frequency of decortication flakes than that found elsewhere in the village. This is especially puzzling as the midden also has a high frequency of local till chert and in general local till chert has a higher percentage of decortication flakes than do the other chert source types over the site. This suggests that the reduction and use cycle leading to deposition of debitage in Midden 1 was different than that for the other middens in the site. Furthermore, while the CSP shows a frequency for Kettle Point chert in the 10% range, personal observation of flake samples from the midden excavation indicate that the actual frequency is much lower than that. However, to support this observation would require a detailed analysis of the debitage.

In considering the flake types, the purpose of the spatial analysis is to understand the general pattern of the reduction sequence in the village. As noted above in the observations, the differences in the frequencies of the various flake types between the various areas is weak. Two types, bifacial retouch flakes and shatter, show no significant differences between the site areas and another, decortication flakes has been discussed above for Midden 1. In looking at flake fragments and core trimming flakes, Area 3 shows differences in both of them. Going back to the chert source types, Area 3 appears to be higher than the rest of the site in both Kettle Point chert (24.1%) and Onondaga chert (27.8%). Taken together this would suggest that the reduction activities taking place in Area 3 and the associated midden were different than that for the rest of the site. The residents had better access to higher quality chert and the reduction processes were different.

Cassandra Site Observations

The Cassandra site is a small late prehistoric Neutral village or hamlet located just north of Lambeth along the same creek on which the Thomas Powerline site is found. A CSP was conducted by the author in 1998 (Keron 2000) that clearly identified the site boundaries and three middens within the site. As there are clearly defined middens, the cultural areas defined for the site were based on these three middens and as before, the rest of the site was divided into three other areas based on proximity to the nearest midden. The cultural areas are identified in Figure 8. The data used to develop this analysis are presented in Appendix C: Tables C6 through C8.

Chert Source Type Analysis

The initial analysis was conducted to examine the distribution of unidentified chert yielding the following observation.

1. There is no statistically significant spatial patterning of unidentified chert.

The next spatial analysis was conducted on Kettle Point chert, Onondaga chert and local till chert as measured against the six cultural areas shown in Figure 8. The analysis was not attempted on “other” chert as the numbers were too small. The following are the observations.

2. The difference in percentages of local till chert between Midden 2 and Midden 3 is different with statistical significance.
3. Kettle Point chert is the most commonly used chert, forming over half the sample in each area. The frequencies across the site are similar in the 50-60% range.
4. Midden 3 has the highest percentage of Onondaga chert but the differences from other areas are not quite statistically significant.
5. Middens 1 and 2 do not have the same access to Onondaga and compensate with increased use of local till chert.

Given the distribution of patterning of Onondaga and local till chert, a second round of analysis was conducted where the number of areas was collapsed from six to three by combining the associated middens and areas. The analysis in this manner yielded the following observations.

6. The differences between Area 2 and Area 3 are significant for local till chert.
7. The differences between the same areas for Onondaga are significant at about the 90% (rather than the normally used 95%) level.

Flake Type Analysis.

The analysis of the distribution of the various flake types was conducted with both the six areas and the three areas with the following result.

8. None of the flake types have any significant distribution. Midden 2 has a higher frequency of core trimming flakes but the difference is not significant.

General Comments

In general at the Cassandra site, the most commonly used chert is Kettle Point chert and all areas of the site have equal access to it. One area around Midden 3 has preferred access to Onondaga and the rest of the site does not have the same access to this chert. The rest of the site compensates for this lack by use of local till chert. All reduction activities take place throughout the entire site.

Dorchester Site Observations

The Dorchester Village (AfHg-24) is a MOI village belonging to the Uren Substage. It is located within two kilometres of the Calvert Site (AfHg-1) and the Mustos Site (AfHg-2). In 1998, the author with the help of Shari Prowse conducted a CSP on the site that indicated that the site is 1.5 hectares in size. It is the latest known village within the Dorchester cluster of sites. Unfortunately, no obvious middens or cultural areas were defined by the CSP. Perhaps refuse disposal was still handled in the Glen Meyer fashion or perhaps it was thrown over the edge of the steep slope to the north creating as yet unlocated hillside middens. In any event the interior spatial analysis was forced to proceed by trial and error, primarily by dividing the site into thirds and halves as described in the following analysis. Figure 9 shows the various areas discussed in the analysis. The data used to develop this analysis is presented in Appendix C: Tables C9 through C12.

Chert Source Type Analysis

In lieu of any visible middens around which to define cultural areas, the first round of the analysis was done using the three arbitrarily defined areas shown in Figure 9. While this is certainly much less than desirable, an approach like this would have eventually discovered the major trends in Brian and Cassandra. The observations are as follows.

1. Local till chert is evenly distributed over the site.
2. Onondaga and Kettle Point cherts are evenly distributed in the central and eastern areas.
3. In the western area, Kettle Point chert occurs with a higher frequency and the frequency of Onondaga chert is less frequent.
4. However none of these trends is statistically significant.

A second analysis was run where the central and eastern areas were combined and compared to the western area. However, while the same trends were apparent, none were statistically significant. The map of the distribution of Kettle Point chert was then examined and there appeared to be some patterning to it. First, there was a background distribution of Kettle Point chert over the site that was fairly even. However, there was one spot where half of the Kettle Point chert flakes grouped together in a fairly tight cluster. Accordingly, this area was circled (Figure 9) and another two-area map produced that contained the cluster in one area and everything else in the other. This definition of cultural areas was then run through the analysis with the following results.

5. Local Till chert is identical between the two areas.
6. In the small area to the west, the frequency of Kettle Point chert is much higher than the rest of the site, 31.6% versus 5%.
7. Onondaga is significantly lower in that same area with statistical significance.

<u>Flake Type Analysis</u>

The flake types analysis was run through several different cultural areas.

8. There were no statistically significant differences in the distribution of the various flake types.

<u>General Comments</u>

The patterning within the Dorchester Village site is similar to that observed for the earlier sites with the exception that the various chert types have reversed their position. The chert type that is evenly distributed is local till chert. There is differential but restricted access to Kettle Point chert within one small zone of the site. In the other zones where access to Kettle Point chert is severely restricted, lack of access is compensated for by a greater use of Onondaga chert.

Mustos Site Observations

The Mustos Site (AfHg-2) is a Glen Meyer Branch village located in the Dorchester cluster. It is approximately 2 km southwest of the Dorchester Village site (AfHg-24). The Calvert Village (Timmins 1997), also a Glen Meyer Branch village, is about 400 m to the northeast of Mustos. A CSP was conducted by the author (Keron 1986) with the aid of Peter Timmins and this material forms the basis of the following analysis. Again, there are no clearly defined middens that could be used as the basis for defining cultural areas within the site so, as with the previous analysis, it was necessary to again proceed by trial and error. The cultural areas used in the analysis are illustrated in Figure 10. The data used to develop this analysis is presented in Appendix C: Tables C13 through C17.

<u>Chert Source Type Analysis</u>

1. Using the east-west division of the site there are no differences that are significant.
2. Using a north-south division, Kettle Point chert frequency is higher in the middle band and lower in the south band. Local till chert is the reverse but the differences are not significant.
3. There is no Kettle Point chert in the little cluster to the north.

<u>Flake Type Analysis</u>

4. Using the east-west division, shatter is more apt to be found in the eastern side of the site (17.2% versus 6.3%).

5. Bifacial retouch flakes are more apt to be found on the western side of the site but the differences are not significant.
6. Using the north-south division, bifacial retouch flakes are more apt to be found in the middle section of the site than in the southern section (10.7% vs 2.7%) but the difference is not statistically significant.

General Comments

Despite trying several divisions of the site there do not appear to be any significant differences in the distribution of chert source types over the site. Looking at the debitage types there is a tendency for shatter to occur towards the southeast corner of the site. This last trend is especially puzzling since, in theory, shatter and decortication flakes should tend to co-vary especially where local till chert is involved. Unfortunately, with the Mustos sample, much of the shatter is unidentifiable as to source. The local till chert debitage that was either shatter or decortication was plotted but this did not follow the same clustering to the southeast pattern.

In both the east-west and north-south analysis there was some patterning of bifacial retouch flakes. In fact, looking at their distribution there appears to be two loci where they are located, one in the west central portion of the site and another represented by two flakes in the southeast corner.

Drumholm Site Observations

The Drumholm site is a large Middleport Substage village located west of London on Oxbow Creek. It has been investigated several times by Robert Pearce (1996) and is known entirely through surface collection. Pearce recognized eleven middens on the site in his thesis and conducted a CSP on the site in 1994. This CSP includes the entire site area. At earlier times, material was recovered and was cataloged by midden number. This material was added to the CSP for the purposes of this analysis. This procedure has one unfortunate drawback in that the samples from the non-midden areas are too small for statistical analysis. Consequently, the areas around Middens 3, 10, 5, 7, 8, and 11 had to be ignored. Further the samples from Middens 3, 8 and 10 were also too small. Samples from Areas 1, 6 and 9 and Midden 11 were also small but have been included in the discussion. Figure 11 shows the defined cultural areas. The data giving rise to these observations can be found in Appendix C: Tables C-19 through C-23.

Chert Type Observations

In considering the distribution of burned or unidentifiable chert, the percentage of burned chert on the site does vary between areas. In looking at the midden areas, the amount of burned chert varies from 3.7 % to 43%, a much wider variation than that observed for the Brian Site. The statistically significant difference is as follows.

1. Middens 1 and 2 have a higher percentage of burned chert than Middens 4, 5 and 6.

   Analysis of the distribution of the various chert types against the cultural areas yields the following observations.

2. Area 6 and Middens 5, 6 and 7 have low values for Kettle Point chert while Middens 1, 2, 4 and 9 have percentages of Kettle Point chert that are higher with statistical significance.
3. Areas 2 and 4 have higher percentage of Kettle Point chert than Middens 6 and 7 with statistical significance.
4. Areas 1 and 9 have high percentages of Kettle Point chert but the samples from both areas are small.
5. Middens 5, 6 and 7 and Area 6 have higher percentages of Onondaga chert than Middens 1, 2, 4 and 9 and Area 2 with statistical significance.
6. Areas 1 and 9 have no Onondaga chert but the samples are small.
7. Area 4 is an anomaly. It ranked in the group of areas that have high Kettle Point chert but it also has a high percentage of Onondaga chert. It has a higher percentage of Onondaga than Middens 1, 2, 4,and 9 and Area 2 with statistical significance.

8. Area 4 and Midden 7 have lower percentages of local till chert than many other areas with statistical significance.

Flake Type Analysis

An analysis was run looking at the distribution of the various flake types against the cultural areas with the following result.

9. There are no statistically significant differences across any of the cultural areas.

General Comments

In considering the observations on the Drumholm site, it is evident that differences between the same groups of areas can be found in both the analysis of the distribution of Kettle Point chert and Onondaga chert. Area 6 and Middens 5, 6 and 7 are different from Middens 1, 2, 4, and 9. In addition, Areas 1, 2 and 9 are high in Kettle Point and low in Onondaga. In looking at these trends as a whole, it became obvious that the areas with high Kettle Point and low Onondaga chert were to the north while the areas with the reverse were to the south. Consequently, a new definition of cultural areas that split the site into two halves, north and south, was developed. Middens 1, 2, 3, 10, and 11 and their associated areas are in the north unit. Middens 5, 7 and 8 and their associated areas are in the south unit. Middens 4, 6 and 9 and their associated areas have been divided between the two units. The boundary between these two units is marked on Figure 11. All of the following differences are statistically significant.

10. When the spatial analysis was run the following confidence intervals result.
    - Kettle Point chert was 38.7 +/- 8.2% in the north and 9.1 +/- 5.7% in the south half.
    - Onondaga chert was 19 +/- 6.6% in the north and 64.3 +/- 9.4% in the south half.
    - Local Till chert was 40.9 +/- 8.2% in the north and 25.3 +/- 8.6% in the south half.

Clearly the north half of the site had more use of Kettle Point chert than did the south half and the south half had better access to Onondaga chert than did the north half. Again it appears that a shortfall in access to high quality chert was compensated for with greater use of local till chert in both areas of the site.

One area of the site that does not fit this generalization well is the area around Midden 4. This area is high in both Onondaga and Kettle Point chert (and consequently very low for local till chert). This area may represent a special zone within the site that was used preferentially for high quality chert working but it should also be noted that this area was split to create the north/south site division just described. In fact, Onondaga chert tends occur in the south half of the area while Kettle Point tends to be found more in the north half. However, neither of these distributions is statistically significant. While it might be unwise to assign any special significance to Area 4 without more evidence, it should be noted that a similar area was found at the Brian site above and it was near the centre of the site.

Chapter 6: Inter-Site Spatial Analysis

This chapter provides an inter-site comparison of the data regarding lithic acquisition across the analyzed sites. Appendix F includes a one page summary of the basic lithic data for each site. In this Appendix, each site has three tables. The first table is the raw counts of the breakdown of the eight flake types by the five chert types. During the analysis of the debitage, it quickly became evident that very few unifacial retouch flakes or bipolar flakes were being identified. Consequently, the second table shows the percentages of the five predominant flake types against the five chert types. The third table breaks down the various formal artefact types against the five chert types and calculates some summary percentages. Given the desire to include more sites that are represented by only surface collections or smaller samples, the number of artefacts analyzed is frequently very low, making detailed analysis problematic. The other data used in the analysis concerns the specific sites. Appendix A lists site specific information including the cultural period and the type of site. Data regarding the distance from the respective sources and the percentage of each chert type used in the regression analysis is found in Appendix D, Table D-1. The location of the site was also carried as part of the original spreadsheet in this table, but Ministry of Culture regulations do not permit disclosure of this information so it has been intentionally left out of the Appendix. As in the previous chapter the percentage of any given chert source type for a given site is calculated by dividing the number of flakes of that type against the total of all flakes of identifiable chert types exclusive of unidentified chert (UID in the tables). All flakes including unidentified are included when comparisons are being done with respect to the morphology.

The following analysis is broken down into several discrete steps. First, for the debitage, the distance decay of the two imported chert types, Kettle Point and Onondaga, is examined. Second, morphological variation both in total and by chert type is considered. Third, a comparison is made of Neutral villages versus Cabin sites. Fourth, variation in formal and informal artefacts is examined. And finally, five individual sites are examined that vary significantly from the norm.

Kettle Point Chert Distance Decay

The analysis of the use of Kettle Point chert involved creating Table D-1 as shown in Appendix D that gives the percentage of Kettle Point chert and the distance from the source. The percentage is drawn from the data in Appendix F and the distance was calculated from the UTM grid reference for each site to the UTM grid reference for Kettle Point (4,785,300 north, 417,400 east). Next, the information was plotted as a scatter plot with the distance as the X-axis and the percentage as the Y-axis. Each of the three periods was plotted as a distinct set of points so that changes over time would be apparent. Also for reasons discussed later, the LOI sites are broken down by villages and cabin sites. Finally, regression lines were run on each of the four groups of sites. The results are shown in Figures 12 through 16. In adding the regression lines four different equation forms were tested using Microsoft Excel - 97. These were linear, logarithmic, power and exponential. Each line was added and the parameters of the resulting equation determined and the R-Squared value calculated determining goodness of fit. This statistic (Wonnacott and Wonnacott 1990:486) varies from 0 to 1 with higher numbers representing a better fit to the data. A value of zero would represent absolutely no correlation between the line and the data and a value of 1 would be a perfect fit. While residuals could have been compared, it was felt that, as the samples used were not large, this would be extending the analysis beyond what the data could reasonably support.

The first general observation that can be made is that the site locations are not absolutely ideal in that they do not occur evenly over the entire study area. The Glen Meyer sites have perhaps the widest distribution occurring across the entire area. Neutral sites are well-distributed but do not occur in the westerly portion of the area. The MOI sites occur across the area but when broken down by Uren versus Middleport substage, there are not many Uren sites and all of the Middleport sites tend to occur in a narrow belt in the centre of the area causing some difficulty for the analysis. There are Middleport substage sites in the Whittaker Lake cluster at the eastern edge of the study area, for example, the Messenger Site (AfHf-3). However, there are no reasonable samples from this site as it has never had any archaeological work done on it. There may also be Middleport substage sites in the area between London and Dorchester. However, samples from this area are meager and at least one large village site in the Waubuno area has been destroyed by gravel pit operations (Keron 1986). There may be additional sites in this area but it has received little survey attention. Certainly, the addition of more easterly Middleport substage sites would greatly enhance this analysis.

Considering all the sites as a whole, the plot of the various percentages against distance, at first, seemed to have no evident patterning. However, once the sites were separated out by time period, it became evident there were very significant changes from one period to the next that obscured each other when lumped together.

First, while there appeared to be a very obvious linear decay to the Glen Meyer sites, the interpolated line was flat showing no decay with space. It quickly became evident that this was caused by three outliers; sites that had percentages of chert source types that were widely different from the obvious norm (see Figure 12). After careful consideration described below, these were excluded and the regression line produced a high R-Squared value.

Upon completion of analysis described later in this chapter, it became evident that the Neutral sites would need to be broken down by villages and cabin sites for the distance decay analysis. This improved the fit of the regression line for the villages but the cabin sites were more problematic as the iteration that included all of the cabin sites produced very low R-squared values. Next, a second iteration was attempted excluding two outliers. This produced better R-Squared values but, unlike the reasoning used to exclude the Glen Myer outliers, there is no evident reason for excluding these two. In fact, results of other analysis described below indicate that consistency is not to be expected in cabin sites. In all cases, four different trend-lines were examined for goodness of fit, measured by the R-Squared statistic. The equations forms were linear, logarithmic, exponential and power. The results of this analysis are presented in Appendix D, Table D-2. The following observations can be made.

1. Glen Meyer use of Kettle Point chert starts at around 40% in the west and declines gradually to 30% in the east. A number of sites also tend to create a very obvious line of slowly declining chert usage (Figure 12).
2. There are three Glen Meyer sites that are greatly divergent from this line. One, the McGrath Site, has nearly 100% Kettle Point chert in the debitage and is interpreted as a temporary camp site. The two other divergent sites with almost no Kettle Point chert are cabin sites along the south edge of the cluster of sites in the Caradoc sand plain (Figure 12).
3. Use of Kettle Point chert drops sharply in the Uren Substage being consistently under 10%, suggesting restricted access to the source. See the Uren sites in Table D-1 in Appendix D.
4. During the Middleport substage there seems to be increased access to Kettle Point chert although most sites are still restricted in comparison to Glen Meyer (Figure 13).
5. During Neutral times, looking at the villages, access is not only restored but it seems to become the preferred chert source especially in the western sites in the London area. For example the Lawson site debitage at 85% is almost exclusively Kettle Point chert (Figure 14).
6. Neutral sites in the Lambeth area, while at a similar distance from the source as the Lawson Site, have lower percentages generally in the 50-60% range (Figure 14).
7. Neutral sites in the Pond Mills area have percentages in the 20-30% range (Figure 14).
8. Neutral sites in the Whittaker Lake area have the lowest percentage usually around 10% Kettle Point chert (Figure 14).
9. Looking at the Neutral cabin sites, the two trend lines presented both lie to the left of the trend line of the Neutral villages indicating a lower use of Kettle Point chert (Figure 15).
10. The Glen Meyer trend line is best approximated by a linear equation (Figure 12,

Table D-2). The R-Squared value is high at .809.

11. The MOI trend line is best approximated by a power equation. The R-Squared values are low for all equation types indicating a lot of variability that is not directly related to distance (Figure 13, Table D-2).
12. The Neutral village trend line is best approximated by a logarithmic equation. The R-Squared value is high at .7857 (Figure 14, Table D-2).
13. The trend line of all the Neutral cabins is more problematic. The R-Square numbers for all equation types are low indicating variability in the data that is not a simple function of the distance (Table D-2).
14. The R-Squared values for Neutral cabin sites are higher if the two outliers are removed. However, there is no good reason to eliminate these.
15. There is a very distinctive difference between the regression line for the Glen Meyer period and that of the Neutral villages. These have been plotted together in Figure 16.

Onondaga Chert Distance Decay

The analysis of the use of Onondaga is somewhat more problematic. The analysis, proceeding similarly to that of Kettle Point chert, involved creating a table that has the percentage of Onondaga chert and the distance from the source (Appendix D, Table D-1). The percentage is drawn from the data in Appendix F. Locating the source of Onondaga is not so easy as it outcrops in various locations along many miles of Lake Erie shoreline. As all of these outcrop locations are in the same general direction from the study area, the initial analysis selected a point on the shoreline east of Port Dover. The UTM for this point was 4,740,000 north and 570,000 east. The distance to each site was calculated as the distance between this point and the UTM grid reference for each site. This information was then plotted as a scatter plot with the distance as the X-axis and the percentage as the Y-axis. Again, each of the four time periods was plotted as a distinct set of points so that changes over time would be apparent. The results of this analysis is shown in Figure 17.

This diagram, however, shows no obvious distance decay in any of the periods which, at least in theory, presents a problem. It is unreasonable not to expect some form of distance decay thereby suggesting either a problem with the data or some other confounding factor. One of the factors which has been shown to distort distance decay functions in the past has been ready access to water transport (Hodder and Orton 1976; Luedtke 1976). Janusas (1984) in her analysis of the distribution of Kettle Point chert actually used the seeming anomaly of high percentages of Kettle Point chert on Petun sites to infer that water transport was a factor. With the Onondaga chert sources located along Lake Erie it is not out of the question that chert was transported in bulk along the lake shore by canoe. Also, Ellis (personal communication 2003) reports that there are secondary deposits of Onondaga chert along the Lake Erie shoreline and Kenyon (1980) actually maps out secondary deposits of Onondaga-like material along the Lake Erie shoreline and inland.

Consequently, in an attempt to locate a distance decay function, the “source” was arbitrarily moved to Port Stanley with UTM coordinates of 4,723,000 north and 482,500 east producing Figure 18. Again there is no obvious distance decay function. However, it should be noted that the orientation of the study area while ideal from the perspective of sources to the east and west is not very good for a source to the north or south. The study area has a long east west orientation but is shallow in a north-south direction leaving little room for even observing a distance decay function. Most of the sites occur within a range of 27-40 km of Port Stanley making identification of a southern distance decay function problematic. Furthermore, there is an implicit assumption in conducting distance decay that the source is localized. If the source is more dispersed, distance decay can be problematic.

Morphological Variation

This next phase of the analysis examines the morphological flake types across the various chert sources and through time looking for patterns. In order to facilitate the analysis, all of the raw flake counts from Appendix F were brought together in a single spreadsheet along with the information on cultural period and site type from Appendix A. The raw flake counts were combined by cultural period giving three tables (Appendix D Tables D-3, D-4 and D-5). These tables break down the five common flake types against the four chert sources plus unidentified chert. The vertical columns are the percentages of all flakes types for that particular chert source. As the uncommon flake types (bipolar, unifacial retouch and ventral unifacial retouch) are not included, the columns will sum to something slightly under 100%. Also, given that there were only three Uren sites in the sample, these were combined with the Middleport substage sites to create one table for the MOI. Across the top of the table the total percentage of all flakes identifiable as to chert source for that time period are shown. As discussed earlier, unidentified flakes are excluded for that calculation. The flake type percentage column includes all flakes including unidentified. One other issue encountered during this analysis was that it seemed, especially for the Brian site, that the numbers being used here were out of synchronization with the data being used in the intra-site spatial analysis in the preceding chapter. Upon closer analysis it was found that the earlier surface collection from Brian differed from the CSP sample. As it seems reasonable that the CSP collection representing one intensive systematic collection of the site would be the most representative of the site as a whole, it was decided to exclude the earlier material from this analysis for the Brian, Cassandra, Drumholm and Dorchester sites. The CSP sample from Mustos constitutes the entire collection from that site. In the case of Brian this reduced the percentage of Onondaga chert by about 5% as it was more common in the original sample. This result again underscores the issues around how representative a given sample can be of each site. Anything short of a systematic surface collection of the entire site will be somewhat suspect.

Examining these Tables D-3 through D-5 leads to the following observations.

1. All forms of chert can arrive as nodules from any chert source. Each chert source in each period shows the presence of decortication flakes and shatter.

2. Onondaga arrives in a more reduced state than Kettle Point which in turn arrives in a more reduced state than local till chert in all periods. The percentage of decortication flakes and shatter is lowest for Onondaga and highest for local till chert. Kettle Point is always in the middle. There is always the risk that the differences between Onondaga and Kettle Point chert result from the nature and size of the nodules being imported. If the Onondaga nodules were larger there would be proportionately less decortication and given the propensity for Kettle Point chert to shatter more often there could be relatively less Onondaga shatter. On the other hand what the analysis did not capture was the relative quality of the knapping of each of the source chert types. From a qualitative perspective, Onondaga debitage is generally of greater workmanship than Kettle Point. So this observation is still reasonable albeit a little weakened by the possibility of different size nodules being imported. Also, while the Onondaga beds are relatively much thicker, if secondary sources along the lakeshore were being exploited, it would be reasonable to expect that these would be reduced in size from what originated in the original bed.
3. Onondaga chert is preferred for biface production. Local till chert is least preferred and Kettle Point is in the middle. The percentage of flakes of bifacial retouch on Onondaga is higher than Kettle Point which is higher than local till chert. Also, the percentage of fragmentary flakes shows the same pattern.
4. The percentage of unidentified flakes is relatively high for fragments. At this point this result could be an analytical anomaly. As explained earlier there are two reasons for a flake to be assigned to the unidentified category, if it was burned or if it was too small to permit identification. In conducting the analysis, it was observed that in most cases there were a lot of unidentified fragments. This result could simply be a product of the fact that, when a flake breaks, there may be several small fragments produced that are difficult to identify.
5. The amount of unidentified shatter is higher than the other chert source types.
6. In all time periods, it can be inferred that Kettle Point chert is more preferred for

creating expedient tools as the core trimming type has a higher percentage for Kettle Point than the other chert sources indicative of more of the resource being used to create flake tools as opposed to more formal tools.

7. While the regression analysis looked at Onondaga and Kettle Point chert individually, summing both of these together, the Glen Meyer peoples have the best access to high quality chert, and the MOI has the most restricted access. Given the strong distance decay function that occurs in Neutral times it is difficult to compare to earlier times. Westerly sites like Lawson have an almost obsessive access to Kettle Point chert whereas the more easterly sites do not have good access.
8. The use of local till chert is lowest for Glen Meyer and increases in the middle stage. As with the preceding observation, the Neutral use of local till chert depends greatly on site location.
9. Through time there is a tendency for chert to arrive at the sites in a less reduced state. The percentages of decortication flakes and shatter increase with time.
10. Onondaga chert fragments decline steadily through time.
11. Use of local till chert for bifacial retouch peaks during the MOI when access to higher quality chert is constrained.
12. “Other” chert is low in total counts and as a percentage of the entire sample so that sampling error makes any significant observations impossible. However, it should be noted that the percentage of bifacial retouch flakes is in the same range as Onondaga and Kettle Point chert.
13. The percentage of each of Onondaga chert and Kettle Point chert devoted to biface production increases dramatically over time doubling from Glen Meyer times to the MOI and Neutral periods. Part of this increase may be due to the fact that high quality chert is less accessible than in other times and with the need for production of bifaces for arrow points, more of the high quality chert is directed to this necessary activity as local till chert is usually inadequate to fill that need.

There are some limitations with respect to the data in these tables. First, the use of percentage as a means of comparison creates some problems. For example, if a new reduction technique is added to an existing industry increasing the number of flakes in one category, then the other categories will show a reduction in their percentage when in fact no change in the activity producing those ratios occurred. However, there is no easy way around this problem and the important thing is that such a shift in reduction strategy would create change in the data and will not go unnoticed. The above observations have all been reviewed with this problem in mind and are not unduly impacted by it.

A second issue involves site locations. For the specific tables to be comparable, ideally all sites so compared should be with in a few kilometres of each other. For example comparing the use of Kettle Point chert from Glen Meyer times in the Caradoc sand plain to the use of Kettle Point chert at the Uren site on the Norfolk sand plain would be nonsensical. The difference in distance from the source would be the single dominating factor rather than any underlying cultural factors. However, the only chert where this would be problematic is Kettle Point as no decay factor could be found for Onondaga and local till chert is accessible everywhere. In general, Glen Meyer is distributed throughout the study area and the middle stage sites tend to congregate in the central area and have a good overlap with Glen Meyer sites so these numbers will be generally meaningful ones. However, the Neutral sites are mostly concentrated in the eastern half of the study area and are subject to a rapid distance decay. Thus, the average Neutral period statistics for Kettle Point chert use are not very meaningful since it will fluctuate with the size and location of the samples included in the calculation. However, the only line affected by this concern will be the one showing the average chert usage per period (Total % at the top of each table). The other percentages in that line will also be impacted by the change in this percentage as discussed above. The observations have been examined and are not dependant on this situation.

Given the way that the tables were calculated, there was a risk that one or two sites that had the highest number of flakes would outweigh other sites with much fewer flakes. For example, a site with 1000 flakes would have five times the weight of another with 200 flakes. Accordingly the site counts were recalculated prorating all sites to 1000 flakes and the tables recalculated effectively averaging the averages and reexamined. The result is that a few of the observations were impacted and were adjusted accordingly despite the fact that only the first set of tables are included herein.

Villages vs Cabins

One of the areas of interest in understanding Iroquoian chert acquisition is the differences between the various types of site. As has been demonstrated in the vicinity of the Lawson site, there are a number of smaller sites nearby that have been interpreted as agricultural cabin sites (Pearce 1996). The expectation would be that the different activities conducted at these sites would at least involve different chert use and possibly acquisition patterns. In order to evaluate this influence, it should be necessary to simply compare the collected data for cabin sites and villages. However, there are some problems. First, there is a problem with the Glen Meyer sites in that the definition used by Williamson (1985) to separate cabin sites from villages was based on size and density of scatter. Anything under one hectare was called a cabin site and anything over this amount was a village. This determination was the best possible, short of excavation, but was arbitrary and based on what was then known about later period cabin sites and villages. Further, the Calvert village (AfHg-1) would be called a cabin site by this definition although Timmins refers to it as a village. Given the Glen Meyer propensity to reuse site locations, what was once a village at one point could be rebuilt later as a cabin site as happened at Calvert. Looking at the MOI sites in the analyzed sample these are all villages with one exception so cabin sites are not well represented. Given these problems with EOI and MOI sites in the sample it was decided to restrict this analysis to just the Neutral sites where it is much clearer what is and what is not a cabin site by size of the surface distribution and concentration of material.

Tables D-6 and D-7 in Appendix D were produced by sorting the data into time period and then by type of site. Totals of all flakes were produced for Neutral villages and hamlets on one hand and cabin sites on the other. Again, there is a concern that sites with greater numbers of flakes would skew the results. Therefore, the numbers of flakes in all sites was prorated such that they had the same number (in effect averaging the percentages by site). This procedure provided a cross check on the observations and as above, all observations have taken this into account. The second set of tables is not included.

The following observations can be drawn regarding the difference between village sites and cabin sites.

1. There is more local till chert used at cabin sites.
2. There is more Onondaga and Kettle Point chert used in villages.
3. More primary reduction takes place in cabin sites than in villages. Decortication flakes and shatter are higher for cabin sites.
4. Biface reduction is slightly more apt to happen in villages.
5. Core trimming flakes are more often present in villages.

One of the areas of concern with this approach is the impact of the distance decay pattern evident in LOI times. If, in the selected sample, more village sites are found to the west and more cabin sites to the east this could invalidate any observations regarding the relative use of the chert source types. Examining the site locations though shows a mix of sites across the study area. All three clusters used in the analysis have both village sites and cabin sites in the sample used to derive the percentages so this concern should not be a problem.

Formal and Informal Artefact Variation

This discussion focuses on the formal and informal artefacts exclusive of the debitage or waste flakes. In analyzing the tools, it quickly became apparent that a number of the sites had very small samples so any comparison would be problematic. Furthermore, as there were twenty-one classes of artefacts recorded against five chert types, a majority of the classes have no counts at all in any given site. In order to summarize these data for analysis, first, the numbers of artefacts were totaled for all sites and only sites with more than 25 artefacts were used in the following comparison. This procedure left eleven sites for comparison. For each site, two tables were built, one for formal artefacts and one for informal. The informal category included cores (random and bipolar) and wedges. The formal artefacts included everything else. The counts of these two classes were totaled on the site summary spreadsheet and the totals brought to another spreadsheet for the artefact comparisons. The first approach to comparison involved calculating for each chert type and site, the artefact to debitage ratio. While this would have been very informative, it had to be abandoned when it was realized that for most sites this ratio would be meaningless: only a sample of the flakes had been analyzed, while all the artefacts had been. This problem made it necessary to deal with percentages as opposed to actual counts so the next attempt, involved deriving the percentage of the four chert types (excluding unidentified) and then comparing this percentage to that derived from the debitage for the eleven sites. To accomplish this comparison the two Tables D-8 and D-9 in Appendix D were produced by subtracting the percent of the each chert type for both formal and informal artefacts from the percentages derived from the debitage. The leftmost four columns are the percentages of formal artefacts of the various chert source types and the next four columns are the differences from the percentages of the four source types as found in the debitage. The final column calculates the Robinson-Brainerd coefficient of similarity between the class of artefacts and the debitage for each site. Across the bottom under the four columns of differences is the simple sum of the differences. The intent of this procedure is to look for the overall trend within that chert type across all sites.

In the following discussion, the category “other” chert is ignored as the numbers are too small. Looking at the total line in these two tables the following observations can be made.

1. The percentage of Onondaga chert in formal artefacts is higher than the same chert in the debitage.
2. Conversely, the percentage of local till chert in the formal artefacts is generally

lower than in the debitage.

3. Kettle Point chert seems to have similar percentages in both formal artefacts and debitage.
4. For informal artefacts, the situation is reversed. A larger percentage of the informal artefacts are of local till chert than is the case with the debitage.
5. Both Onondaga and Kettle Point chert informal artefacts occur at a percentage less than the debitage.
6. Considering the coefficients of similarity, there is considerable variance by site. In some sites the artefact classes occur in very much the same percentages as the debitage whereas at other sites they are quite different. Sites with the coefficient of similarity less than 150 are highlighted as are the largest differences by chert source type.

To examine any trends through time, two more tables (D-10 and D-11 in Appendix D) were produced that show the average difference for each of the three time periods. The average difference is shown as well as the average coefficient of similarity for the sites shown in these two figures.

Looking at these tables the following observations are evident.

Formal Artefacts

7. During the Glen Meyer period, the percentage of chert types in the formal artefacts is very similar to the same percentage in the debitage.
8. There is a drop in similarity between formal artefacts and debitage frequencies in the MOI and the Neutral period.
9. The shift to the MOI and Neutral period is accompanied by a greater percentage of Onondaga chert being used for formal artefacts and a corresponding drop in the occurrence of formal artefacts of local till chert.
10. Kettle Point chert use is similar across all periods.

Informal Artefacts

11. There is a comparable drop in coefficients of similarity from the EOI to the MOI.

12. Unlike the formal artefacts though, the coefficient of similarity between chert sources of informal artefacts and the debitage rebounds during the Neutral period exceeding what it was during the Glen Meyer period.
13. During the Early and Middle stages, there is a tendency for more informal artefacts to be made on local till chert than occurs in the corresponding debitage.
14. For informal artefacts both Onondaga and Kettle Point chert occur less often than in the debitage.
15. The preceding two trends are exaggerated a little from the EOI to the MOI.
16. During the LOI, informal artefacts occur in similar percentages to the debitage.

Some caution should be attached to the preceding observations. There are not many sites included and the sample sizes are small. However, the observed differences do seem to be plausible.

Change in Lithic Industry Through Time

It is also possible to attempt to quantify the changes over time in the overall lithic industry. Looking at chert source usage a pattern of highly fluctuating use of Kettle Point chert through time has been demonstrated. However, substitution of one chert type for another does not necessarily change the reduction industry per se or the uses to which the end products were put. Ideally, to explore this possibility the comparison should include both formal and informal artefacts as well as the debitage. Given the low artefact counts in most sites, sampling could well drive spurious results so while this would certainly be informative, it is beyond the capability of the data acquired for this study. Use of published material is clearly out of the question given the varying definitions of artefact types, the highly questionable practices used to assign artefacts to a specific type, erroneous assignments to a type and the failure to even recognize some artefacts between various investigators. A good example of spurious conclusions that can arise by comparing published reports was the comparison of the differences between Pickering, Glen Meyer and Uren lithic industries by Wright (1992). While the coefficients of similarity reveal real differences between the three components, the differences are the result of varying archaeological analytical techniques not the underlying cultural units.

Consequently we are left with the debitage broken down by flake types. In order to compare these the coefficient of similarity was calculated for each pair of the three periods based on the percentages shown in Tables D-2, D-3 and D-4 in Appendix D. The results are illustrated in Table D-12 in Appendix D with the following observations.

1. The debitage industry is highly similar for all time periods.
2. There is a slight change through time.

Site Differences from Period Average

While the preceding sections focused on the differences between the averages of several sites both by period and by type of site, this approach fails to take into account the meaning of individual site variation within the same class of sites. The intent of this next section is to identify several sites that are most removed from the normal pattern and to explore how these sites differ from the others. This analysis does not relate directly to any of the behaviourial hypotheses and is best considered as exploratory. To identify deviant sites, three different analytical approaches were taken, and five sites were then selected that consistently ranked high on two or more of the analyses. To some extent the selection criteria and the assumptions used to flag deviant sites are arbitrary and not based on statistical significance. However, the intent was to select five of the most deviant sites and to explore the differences so this approach is warranted.

First, the differences between each site and the average of all sites of the specific period were compared. Any situation where a particular site deviates significantly from the average probably carries information regarding the chert acquisition and use patterns occurring at that site. Accordingly, in the original spreadsheet, a portion of which is shown in Appendix F, containing the summary for each site, the average for the particular time period was added and the differences between the site and the period average computed. One of the problems quickly encountered concerned situations where the actual counts from the specific site were very low. For instance “Other” chert generally has very low counts and consequently the presence or absence of one flake can make a significant shift in the percentage. Consequently it was necessary to discount the differences that occur with respect to “Other” chert. Similarly if the total number of flakes from the site was low, any comparison from that site would not be valid and consequently, a number of sites had to be ignored. For this analysis the number deemed to be worth comparing was set arbitrarily at 100 flakes. The next issue in the comparison was to determine what differences were of sufficient magnitude to be of interest. This magnitude was set arbitrarily at 10% for the total chert source percentages and the total of flake types. In looking at the combinations of chert source and flake types, this limit was increased to 15% since the reduced numbers made sampling error a real problem. With this in mind a set of notes was made recording every area exceeding these levels. For Neutral sites the distance decay of Kettle Point chert creates some significant differences. While noted, these were not considered except where a site was significantly different from others nearby (e.g. Laidlaw and Skinner).

Second, a table was built calculating the Robinson-Brainerd Coefficient of Similarity for the total flake types from the site. Generally there were quite high coefficients of similarity for most sites. This table was examined and any coefficients less than 160 were highlighted. Then any sites that were frequently different were identified. This table is included in Appendix D as Table D-13.

Third, despite some misgivings, another table was produced with the Coefficients of Similarity for the chert source types for all pairs of sites. Again any site with less than 100 pieces of debitage was dropped. The resulting table was then scanned for divergent pairs of sites. A lower value was used here as in general the coefficients were much lower than in the preceding table. Given the distance decay of Kettle Point chert and the dramatic changes between periods the only differences deemed worthy of consideration were between pairs of sites in the same time period and occurring close to each other. This table is included in Appendix D as Table D-14.

At the end of these three analytical procedures, sites identified that recurred frequently in each analysis were identified and are discussed individually here.

Melbourne-7 (AfHj-17)

This Glen Meyer site stands out primarily with respect to chert source use. Use of Onondaga chert at 84% is extremely high and occurs at the expense of both Kettle Point chert and local till chert. The lithic industry as evidenced by the frequency of the various flake types is largely consistent with the other Glen Meyer sites since the coefficients of similarity between this site and the others are in excess of 160 for all but two other Glen Meyer sites. The site is represented by only a surface collection so any interpretations are problematic. However, the fact that it is high in Onondaga and is the most southerly site in the Caradoc cluster, and consequently closest to Lake Erie where it is presumed that Onondaga chert was acquired, would suggest that it may be a way station used by people recently returning from an Onondaga chert acquisition trip. This situation may be similar to the excavated McGrath site which was interpreted by Poulton (1985a) as a small temporary location as opposed to a cabin site or village. McGrath had a very high incidence of Kettle Point chert in the debitage suggestive of a recent acquisition trip.

Dorchester (AfHg-24)

This site is a large Uren village at the eastern end of the study area. The primary difference with this site is again chert source frequencies. This site has a high percentage of Onondaga chert in the debitage at 53.6%. Kettle Point is lower than other MOI sites but it is the furthest MOI site from the source. While, the use of local till chert is also lower than for other period sites there is much more of it with cortex, the percentage is 19.3 higher than the average of all MOI sites. The percentage of shatter is also higher. Both of these occur at the expense of core trimming flakes where the percentage is 15.3 lower than average. This local till chert is not used as frequently as other period sites but the till chert that is used is arriving in a less reduced state. Outside of the differences within local till chert use the overall lithic assemblage from Dorchester is not unusual.

Sifton (AfHh-85)

This site has been fully excavated and has been interpreted by Pearce (1996) as a Uren cabin site. The key difference with this site is that there is a very low percentage of high quality chert. Onondaga is 2.5% and Kettle Point is 13.5%. These low frequencies are offset by much greater use of local till chert. While seemingly anomalous, it should be pointed out that in the sample analyzed, this site is the only MOI identified as an agricultural cabin. As note above, during Neutral times cabin sites show a higher frequency of use of local till chert. Within the Onondaga chert sample there seems to be a higher use of core trimming flakes but the sample is small. The overall chert working is in line with other MOI sites and, where different, varies as a Neutral cabin site would from a village.

Norton (AfHh-86)

This is a village site that was partially excavated during a mitigation of a water main (Cooper and Robertson, 1993). The excavation is thus long and narrow through the village and it transected a number of houses. As it relates to chert sources used it is not substantially different than other MOI sites although use of Kettle Point chert is a bit lower and compensated for by the greater use of Onondaga chert. However, the lithic industry is somewhat different than in other MOI sites showing lower coefficients of similarity with three of the six other sites. In general there seems to be less emphasis on core trimming flakes and more on bifacial retouch and fragmentary flakes. These latter two categories though do not seem to be related. The major differences occur with Kettle Point and local till chert, where there seems to be more fragmentary flakes produced at the expense of core trimming flakes. The increase in bifacial retouch flakes though occurs with Onondaga chert which has a percentage that is 16.3 higher than the period average. The increase in Onondaga bifacial retouch flakes comes at the expense of core trimming flakes again. This difference would seem to imply a shift in the reduction strategy employed at the Norton site but how and why it differs is problematic. Given the internal spatial analysis conducted above, the general conclusion was that no major internal spatial distinctions were observed so it is unlikely that it is due to partial excavation of the site.

<u>Laidlaw (AfHh-1)</u>

This site is interpreted here as a Neutral cabin site. It has been termed a village elsewhere (e.g. Pearce 1996) but this characterization has never been established as the adjacent field was not cultivated until quite recently. Although it had been intended to conduct a CSP on the site as part of the research for this thesis, such did not happen due to a combination crop cover, other time constraints and the inability to contact the owner to get permission. The sample used was taken from a midden only excavation conducted by Dr. Wm. Finlayson in 1974. As with the Norton site, there are some differences in access to chert. The site has a much lower percentage of Kettle Point chert at 5.5% of the total. This amount contrasts sharply with the Skinner site (AfHg-13) less than 200m away on the other side of the creek which has 24.4% Kettle Point chert. However, there are a number of differences in the reduction sequence. In considering the coefficients of similarity with respect to the flake types, it is less than 160 for four of the other eight Neutral sites. The major difference seems to be a lack of fragmentary flakes. This result can be found in the total and severally in each of the chert types excluding Kettle Point which is too rare to consider. Use of local till chert is higher and primary reduction is higher (decortication flakes and shatter) and use of high quality cherts is less. Both of these trends would be typical of a Neutral cabin site.

With the Skinner site nearby, and both samples being from excavated middens, the opportunity for comparing these seems worth following up. Accordingly, the differences were computed in a similar fashion to that used to compare to period averages. The first point here is that the differences in chert source usage do not appear to be out of line with differences to other Neutral sites despite the difference in the use of Kettle Point chert. The second point is that the Skinner sample is much larger than the sample from Laidlaw (total debitage of 806 versus 218) despite the fact that it was taken from only 5 square metres of midden. In looking at these two sites a similar trend in comparison to site average is noted. There is a much lower frequency of fragmentary flakes at Laidlaw but a much higher frequency of core trimming flakes. Other than concluding that there was a difference in functions performed at the two sites despite their close proximity, any further explanation is problematic.

Chapter 7: Evaluation of Hypotheses

A set of behaviourial hypotheses and potential implications of the same was developed in Chapter 3 and the data analysis yielded a number of observations in Chapters 5 and 6. In order to evaluate the success or failure of the hypotheses, the observations were mapped against the implications and hypotheses. These are included in Appendix E. The following discussion addresses each of the hypotheses in turn considering both the evidence obtained here as well as other evidence and trends both in Iroquoian studies and beyond that bear on the various questions. In general there was good support from the data for most of the hypotheses with the notable exception of the time depth of the inferred down-the-line exchange mechanism. This notion was not supported and what emerged from the data was an acquisition pattern during Glen Meyer times that was significantly different from the pattern observed later during Neutral times. The hypotheses are discussed in order.

Hypothesis 1: Kettle Point and Onondaga Were Preferred

In early formulations, this idea was subsumed as part of the down-the-line hypothesis as a result of understanding the knapping properties of the various chert sources used within the study area. Later it was realized that it may well be a behavioural hypothesis on its own. However, as the research design was already established and data collected, it did not seem worthwhile to go back and establish testable implications when the data had already been collected. Nonetheless, in reviewing the observations several of these tended to provide verification of this hypothesis. These appear in Appendix E, Box 1.

Some of these indications derive from distribution of chert types within a village, for example at the Brian site (AfHh-10) the external midden is low in Onondaga chert and while not demonstrable through the data used here, it is also low in Kettle Point chert. Also local till chert is more prone to end up in the middens indicating a lesser value. Some areas within sites also have a very low level of local till chert and a correspondingly higher level of Kettle Point and Onondaga chert indicating that it would receive preferential use if it can be obtained. Another major indicator is the level of use in the late prehistoric Neutral time frame. At Lawson (AgHg-1), and in the cluster in the Lambeth vicinity, there is a very high usage of Kettle Point chert despite the fact that there is a supply of local till chert that seems to have been useful, especially during the MOI time. Finally, during the MOI when access to Kettle Point chert is curtailed, there is an increase in use of local till chert for projectile point manufacture as there is no high quality alternative.

All of this demonstrates that the high quality chert is preferable if it can be obtained. Local till chert is something that is used if nothing else is available.

Hypothesis 2: Down-the-Line Exchange

As noted above, the time depth hypothesis failed to hold up and while it is discussed below in detail, the implications of this fact must be taken into account in this evaluation. The discussion will commence with the early historical records and then proceed back through time considering each the three time periods looking at the evidence from the study area as well as from other sources that bear directly on these questions.

<u>The Antiquty of Exchange</u>

While Iroquoian trade and the control of trade routes by lineages is unequivocal in the early historical records, Trigger (1987: 168) notes there was some controversy at the time of his writing (the first edition was in 1976) both with respect to the antiquity of trading relationships and with lineage control of trade routes. Part of the problem is undoubtably the lack of clearly identifiable exotic goods originating at substantial distances from the point of deposition as is evident during Late Archaic and Middle Woodland times. These items are very rare on Iroquoian sites of any time period. Furthermore, as Trigger notes, in the historic period with the intensification of trade driven by the fur trade and European goods, items from some distance away again become evident in the archaeological record. However, he notes that even in historic time “the bulk of the trade appears to be in perishable goods, such as corn, fish, and skins” (Trigger 1987:169). These items plus other material such as nets and rope are not normally preserved or if they are, it can be difficult to tell whether or not it was as a result of exchange that lead to the final deposition. He then uses the occurrence of Iroquoian pottery throughout much of the Algonkian territory through all periods of the Late Woodland as the basis to conclude that trade was present prehistorically and that the French only tapped into a complete functional system of trade with their demand for furs in exchange for European goods. Throughout much of the rest of the book it is quite evident that the Native Americans were not newcomers to trading but had a complete set of rules of interaction and a strategy of controlling access by one’s downstream partners to ones upstream partners.

Subsequent work has confirmed Trigger’s assessment of the antiquity of exchange patterns. As noted above, Iroquoian lithic analysis (Fox 1990) has shown that exchange of chert nodules and finished artefacts between major tribal groups was occurring in late prehistory. Recently, an edited book (Baugh and Ericson 1994) has been published containing a series of regional syntheses that demonstrate an ongoing system of regional exchange extending back several thousand years in most areas of the continent. Brose (1994) includes the Great Lakes drainage in an area he calls the “Mid West” and describes a pattern where after the collapse of the Middle Woodland exchange systems, there is a period where the amount of exchange drops significantly during the early Late Woodland and the patterns of exchange of raw materials “suggest focused individual or family initiative rather than down-the-line exchange” (Brose 1994: 228). Trade withers to a point where only Lake Superior copper and Atlantic shell products are exchanged through Ontario. Following AD 1400, there is a resurgence in exchange where “limited lineage-controlled, family organized trade in subsistence resources with surrounding groups” occurred (Brose 1994: 230).

In general, since Trigger’s (1987) writing in 1976, the proposition that prehistoric groups through the Late Woodland period in southern Ontario engaged in various forms of exchange with neighboring groups has been well established and the only debate now centres on the nature and extent of the exchange.

The Evidence

In attempting to validate the hypothesis that down-the-line trade was the reason for the pattern of rapid distance decay noted earlier (Keron 1986), a number of implications were developed in the research design. In total, there is good support for most of the implications. The chart in Appendix E, Box 2 is the evaluation of the original set of testable implications as confirmed or negated by the observations.

The Neutral Pattern

Morrow and Jeffries (1989) postulated that non-local chert would be more reduced than locally available chert. That postulate has been well borne out in the data here. One observation, however, that there is a slight tendency for chert to arrive in a less reduced state through time, would seem to provide contradictory evidence. However, it should also be noted that this tendency is slight and the main reason for the contradiction is the increased use of local till chert in the later periods.

Both Jeske (1989) and Morrow and Jeffries (1989) assert that non-local chert, if acquired through exchange will be used in the manufacture of formal artefacts. Again, a number of the observations bear this out. Primary among these is the debitage data relating to biface production. Here the ranking is similar to that noted above with respect to the reduction state of the arriving chert. Onondaga is most preferred for biface production followed by Kettle Point which is followed in turn by local till chert. The strength of this conclusion is slightly tempered by the suitability, albeit marginal, of local till chert for biface production. However, during the MOI when access to high quality chert was constrained, local till chert was used in biface production. All of the negative evidence listed in Appendix E, Box 2 seems to be underlain by only two factors. First, accounting for three of the observations is the fact that there seems to be an apparent preference for Kettle Point chert to be cycled into expedient use. This cycling is best interpreted as a function of its suitability for flake tools. However, during the MOI, more

Kettle Point chert was used in biface production. For Onondaga chert however, the evidence is much more straightforward. It is clearly favoured for biface production as is evidenced here and through Pearce's (1994) analysis of Lawson site projectile points. The second source of contradiction relates to the Glen Meyer period where a down-the-line model does not apply so the evidence does not refute the applicability of this explanation in the Neutral period. In any event, while the evidence favours use of both Onondaga and Kettle Point chert for production of formal artefacts, the evidence is not clear cut.

The third implication, that non-local chert will be discarded largely in the form of exhausted and broken tools was originally postulated by Morrow and Jeffries (1989) for Archaic populations of hunter-gatherers. Given the mobile nature of these societies a different technological organization saw the production of bifaces and tools which could be resharpened over the course of their life span. Iroquoian bifaces were typically discarded when broken since they were so small that resharpening in most cases would not be an option. However, as an indirect measure of this postulate's viability one can compare Onondaga and Kettle Point formal and informal artefacts to the percentages of the same chert types in the debitage. This comparison indicates that the non-local cherts were being discarded more in tool form than was the case in the general debitage population.

The test implication that Onondaga was the preferred chert in the west and Kettle Point would be preferred in the east as they are more expensive having passed through more hands depends on the actual movement in the two directions. Evaluation of this requires a detailed comparison of the uses to which both types of chert were used at the extremities of the study area. As Onondaga can not be demonstrated to have moved from east to west, indeed, a southerly access route from secondary sources being more likely, it is impossible to analyse this hypothesis as it was originally formulated.

Hofman (1987) postulates and demonstrates that traded material will be smaller than material that is not traded in, examining the distributions of blades in the Hopewell period. While size was not captured as a measure during this study, an indirect measure of it is the state of reduction of the imported material. Onondaga chert and Kettle Point chert are arriving in a more reduced state and therefore as smaller units than would be available at the source of the high quality material.

A critical piece of evidence supporting the down-the-line exchange model is the distance decay analysis. On the theoretical level, there has been an attempt to relate these distance decay functions to various acquisition styles (Findlow and Bolognese 1982; Hodder and Orton 1976; Reid 1986; Renfrew 1975, 1977). Some of this effort has been productive (Findlow and Bolognese 1982) and some of it has been problematic (Reid 1986). Hodder (1982) cautions against reading too much into the form of the best fit regression equation as different acquisition patterns could lead to the same form of regression curve. Renfrew (1977) actually demonstrates mathematically how different acquisition patterns can lead to the same regression curves. Regression curves can easily be clouded by a number of factors both cultural and geographical. One of the geographical factors confounding the building of meaningful regression curves is the availability of water transport (Hodder and Orton 1976; Janusas 1984; Luedke 1976). The cost of acquisition does not necessarily vary with the physical distance: it varies with how long and how difficult it is to traverse the distance. If the potential of water transport is not recognized the data can appear inconclusive. Another factor is the intervening terrain. Findlow and Bolognese (1982), working in an area with rugged topography, actually factored into the analysis the impact of terrain on the distance to the source. A third factor confounding distance decay analysis is inclusion of too broad a scope in the cultural units being studied. Reid (1986) encounters this problem in the current study area when he tried to develop a distance decay regression curve for Kettle Point chert for the Late Woodland period in southwestern Ontario. As is demonstrated here, dividing this period into EOI, MOI and LOI and restricting the study area to a more limited geographical area, demonstrates that there are several distinctly different regression equations that apply over the three periods. Finally, another factor that could lead to an erroneous conclusion would be population distribution. While direct procurement could have been used, if the population density was distributed in an exponentially decreasing manner, the distribution would be reflective of population density not the exchange mechanism (Renfrew 1977).

In examining the distance decay patterns there is clearly a completely different regression line comparing the Neutral pattern to the Glen Meyer pattern. Figure 16 superimposes the two regression lines. The Glen Meyer pattern is linear, gradually tailing off with distance. During the late Neutral period, the closest Neutral site to the source is the Lawson site. From a high of 85% at the Lawson site, the percentage drops rapidly to around 60% in the Lambeth cluster then again to 20% in the Pond Mills cluster and then off to small percentages in the Lake Whitaker cluster. This drop off for Neutral villages is best approximated by a logarithmic equation and the R-Squared value for this is high demonstrating a good fit. A logarithmic equation is assumed to represent down-the-line exchange (Renfrew 1977).

The shape of the regression curve for Neutral cabin sites is similar to that of the villages but the best fit is a different equation form. As is demonstrated herein, cabin sites tend to access more local till chert in an embedded fashion. Also, when a regression curve is calculated for the cabin sites on their own, it lies to the left of the village curve (Figure 15) indicating that these sites have lower use of Kettle Point chert. Since agricultural fields are owned by lineages (Trigger 1987), implying that the cabin sites are as well, the lineage using the cabin could easily be one that did not have better access to Kettle Point chert. Further, Sidrys (1977), reports a similar pattern for Maya obsidian trade in comparing the amount of imported obsidian between major and minor centres. In effect, there were two distinct regression lines, one for the major centres and one for the minor centres. Renfrew (1977) discusses this factor as well, noting that the flow of goods in an exchange system will flow to the central place first and from there to the minor centres. With the data presented here, the villages and agricultural cabin sites are best seen as special cases of major and minor centres and indeed the plot of the two regression curves is similar to that which he derived. As a side note, Reid (1986) was on the right track in identifying the Lawson site as a major centre that controlled the flow of goods to other Late Woodland sites in the area. His error was in not adopting time controls that were fine enough to identify the pattern.

One of the key arguments towards the down-the-line hypothesis is the sudden and significant drop in accessibility to Kettle Point chert between the Lambeth cluster, that most often has 55–65% Kettle Point chert, and the Pond Mills cluster where 15-25% is the norm. With the Lambeth cluster located between 67 and 69 km from the source and the Pond Mills cluster located at a distance of 74-79 km and local till chert equally available to both, there is clearly some cultural factor that allows access for Lambeth but blocks a similar access to Pond Mills. The 7-12 km difference is simply not nearly great enough to account for the difference. Historic Huron are noted as travelling over 1000 miles on trade expeditions and looking at the distance decay for the Glen Meyer period they clearly did not have the problem. Distance itself is unlikely to have been the causative factor. Furthermore, with the availability of local till chert to both groups, Kettle Point chert was clearly preferred by the Lambeth group possibly due to the superior quality. There is no reason to assume that it would not be equally valued by the Pond Mills group. In fact, other analyses within this study indicate the local till chert was always used as a last resort to satisfy needs that could not be supplied any other way. However, the acquisition mechanism does not allow Pond Mills equal access to the source.

This pattern consisting of a relatively flat decay to a certain point and then a rapid fall off beyond it is almost identical to what Renfrew et al. (1968) found for obsidian in the Near East. The only difference is in the scale of the distances involved. In Renfrew’s study a supply zone was identified that had relatively free access to the source but a point was reached where the fall off was steep and exponential. With the data in this study, the supply zone could be considered to extend to the Lawson Site. From that point east, the percentage of Kettle Point chert drops very rapidly beyond all reasonable explanations if distance was the determining factor. This result is particularly telling given the earlier much shallower decay that was in effect during Glen Meyer times. This logarithmic fall-off model is usually associated with a down-the-line exchange system (e.g. Findlow and Bolognese 1982, Reid 1986, Renfrew 1977) although the mathematical characterization of the curve varies.

Another factor supporting the down-the line model of exchange is the fact that it is generally consistent with the hypothesis about lineage control of trade routes that is discussed below.

Middle Ontario Iroquoian Pattern

The results for this time period are problematic mostly because of the distribution and number of the sites. The Middleport sub-stage sites all tend to cluster close to Byron while there are only three Uren period sites included. Sites further outside of this cluster would have been extremely beneficial. The Messenger site (AfHf-3) is one such site however, a good representative flake sample does not exist. The London Museum of Archaeology does have some formal artefacts from the site but as most of the comparison was done with the debitage, this information, while interesting, would not have been comparable to the debitage data that was used to determine all of the percentages.

However, if all of the sites are taken as a group, the distinct likelihood of a logarithmic curve similar to that observed in the Neutral period is evident in the plot of Kettle Point distance decay (Figure 10). While the best fit for the regression line for the MOI is a power curve, the shapes of this curve are very similar to a logarithmic curve. This viewpoint is strengthened somewhat by the clear differential access to Kettle Point chert that was evident in the internal distribution analysis for the Drumholm site. The other factor confounding the regression curve during the MOI is that access to Kettle Point chert is severely curtailed during the Uren substage and then changes through time as access is improved. Thus, it is not to be expected that this shifting access would lead to a stable distance decay pattern. At this point, the best assumption possible, but one that is by no means certain, is that the MOI pattern closely resembles the LOI pattern with the exception that access to Kettle Point chert is severely curtailed so the total amounts flowing through the system are much less.

<u>Glen Meyer Pattern</u>

The linear nature of the Glen Meyer distance decay was evident looking at the plot of the sites (Figure 12) before even the regression line was added. There are however, three significant outliers that demand examination. The McGrath site (AfHh-61) in the Byron area (Poulton 1985a) is notable for an extremely high percentage of Kettle Point chert in the debitage at 99.1%. The formal artefacts were largely Kettle Point chert at 57.9% but a significant number were either Onondaga and/or local till chert at a combined total of 28.1%. This site was excavated as part of a salvage project and no typical Glen Meyer settlement data (e.g. houses palisades etc.) were evident. Poulton (1985a) interprets the site as a small temporary camp. This observation is important as it implies a very restricted duration of use that is different than Glen Meyer villages sites such as Calvert where Timmins (1997) estimates successive occupations covering 60 or more years. Larger villages are subject to an averaging effect over time whereas the McGrath site is a short time capsule representing one episode in chert acquisition and use. In all probability, this site represents a small temporary camp of a group who had recently visited Kettle Point and were returning with a supply of chert. This pattern, where the debitage has a higher percentage of one chert than the discarded artefacts, has been noted in earlier times (Ellis and Spence 1997) and is there interpreted as indicating that the debitage represents the most recent source to be visited by more mobile groups.

The other two “deviant” EOI sites are exactly the opposite as the percentage of Kettle Point chert is very low. Both of these, Melbourne-7 (AfHj-17) and Caradoc-3 (AfHj-105), are part of the Caradoc cluster of sites and both are known only from small surface collections. However, both are at the small end of the site sizes reported by Williamson (1985) so a briefer occupation is quite possible. Also, it should be noted that Melbourne-7 is the most southerly of the reported Glen Meyer sites in the Caradoc cluster and so could quite likely be a stop on the way back from the Lake Erie shoreline after chert acquisition. While not evident in the site data in Appendix F, one of the qualitative notes from this site indicated that the Onondaga chert debitage was larger and of better quality than that typical of most Iroquoian sites. The larger size could well be the indicative of the recent acquisition.

With respect to the specific chert working industry, Morrow and Jeffries (1989) postulated that there should be differences in chert use if the more distant chert was acquired through embedded procurement as opposed to exchange or special purpose acquisition trips. The observation 7 in the section on artifact variation in chapter 6 notes the fact that all chert types seem to occur in the same percentage as the discarded artefacts suggesting that the more distant cherts were not treated any differently than local chert, thus, implying embedded procurement of both Onondaga and Kettle Point chert.

In examining the regression line, with the exception of the three outliers discussed above, it is clearly best approximated by a linear equation and the R-squared value is high indicating a good fit. It is also very different from the curve that arises later, probably during the MOI. In reviewing the distance decay literature, regression lines where the best fit is linear are always associated with direct procurement (Findlow and Bolognese 1982; Hodder 1974; Renfrew 1977; Torrence 1986). The normal line of reasoning is that the cost of acquisition is driven solely by the cost of the trip to obtain the material. The other point that Renfrew makes is that within the supply zone of a down-the-line exchange system, everyone has access to the material and that the frequency declines only slightly with distance to edge of the supply zone. This edge is usually interpreted as the boundary with a neighbouring corporate group. If this really is the case, then extending this analysis into EOI groups in the Catfish Creek and Norfolk communities could prove interesting.

One final result that is also important to this interpretation is that a similar result has been obtained from the American Southwest. There, Findlow and Bolognese (1982) analysed the movement of obsidian from various sources in New Mexico while controlling for time using various Basketmaker and Pueblo periods. One source, Antelope Wells, shows a similar change from an earlier linear equation to an exponential equation in later periods that is associated with increasing social complexity. They interpret the earlier mode to be direct acquisition, which is replaced by a down-the-line exchange system as the socio-cultural complexity increases, a situation that is matched by the results found here.

Hypothesis 3: Kettle Point Moved West to East

The distance decay analysis of Kettle Point chert indicates that this hypothesis was the case for all time periods although different decay functions were evident. All that changes is the amount and the rate at which it decays with distance.

Hypothesis 4: Onondaga Moved East to West

As was demonstrated in the last chapter, deriving a distance decay pattern for Onondaga chert proved problematic. The original assumption, that the chert was derived from the primary sources located east of Port Dover and passed from group to group overland, was clearly wrong. If this situation was the case, then a distance decay function would have been evident. Reid (1986) notes that a flat distance decay is a possibility but the only potential example was during Early Paleoindian times where Ellis (1989) notes a preference for use of high quality chert from a single source and suggests that the source used served as a band or social marker. It would seem highly unlikely that a flat distance decay function would exist in the Late Woodland period.

Given the difficulty in separating some forms of local till chert from Onondaga as discussed above and elsewhere (Keron 2003), there is still the possibility that the material classified as Onondaga is nothing more than local high quality till chert. There are, however, several arguments against this possibility. First, during fieldwork in the study area, the author has had the opportunity to observe a great deal of till chert both on and off Iroquoian sites. While there are occasionally small pebbles that are close to appearing Onondaga-like, no large nodules have ever been observed that are not in an archaeological context. Second, as was shown in the analysis in the previous chapter, the material classified as Onondaga is arriving in a more reduced form than even Kettle Point chert which in turn arrives on the site in a more reduced form than local till chert. Of the three primary types, Onondaga has less cortex and shatter than the other two chert types. If the material identified as Onondaga chert was really just a variety of local till chert then it should be treated in the same way and one should see only expedient use (Andrefsky 1994). While the entire Iroquoian industry would be characterized as expedient, Onondaga chert is clearly treated differently than local till chert.

The other possibility, and the most probable, is a Lake Erie source for the Onondaga chert observed in the study area. Two explanations can be suggested. First, chert from the primary outcrops east of Port Dover could have been transported along Lake Erie by canoe. Fox (1990) has clearly demonstrated that this transport was occurring in the Lake Huron basin by the Odawa and links the traded material to several outcrops that are at or close to the shoreline. Potentially arguing against this explanation would be the historical observation that the Neutral lacked the means to transport beaver pelts to the French (Trigger 1987). However, the context of that statement is caught up in Native politics where the Huron were striving to maintain their role as middle-men and were actively seeking to discourage direct trade with the French by any of their upstream partners. It seems unreasonable to expect that while the Huron and New York State Iroquois were certainly adept at water transport, the Neutral were not. The second potential source of Onondaga chert from the south would be secondary deposits that can be found there. These have been discussed above with respect to the chert sources.

Looking at the Neutral period where down-the-line exchange has been established there appears to be one community between Neutral sites and the Lake Erie shore so it can be expected that the Neutral sites in the study area would not show any distance decay between each other. They are all one step removed from the source. With the more free ranging Glen Meyer people, again all sites are very close to the same distance from the source so again there would be no distance decay between the study area sites taken as a unit. Finally, unlike the case for Kettle Point chert, there is no single point source and the Onondaga chert could be obtained at a number of locations along the lakeshore.

At this point in time the best explanation would be that Onondaga chert was acquired from the Lake Erie shoreline either directly from secondary deposits or by transport from the primary sources by canoe along the lakeshore. Therefore, no distance decay is evident owing to the orientation of the study area. This possibility should be considered the best explanation for the phenomena at the moment. It is certainly reasonable but testing with a revised research design, the addition of sites from Elgin County and some investigation into the nature of the reported Onondaga chert along the shoreline would be required for validation.

Hypothesis 5: Exchange Routes and Lineage Control

The antiquity of trade has been discussed above so the question that remains is to determine how far back in time this can be demonstrated. Chapter 5 contained the exploratory analysis of distributions of both chert source types and flake types within five Iroquoian sites in the area, one Glen Meyer, one Uren, one Middleport and two Neutral. The results of this analysis mapped against the implications of this hypothesis are shown in Appendix E, Box 5. In general, there was good support for Neutral and Middleport sites, problematic support for the Uren site and no support for the Glen Meyer site.

For both the Brian and Drumholm sites, there were clear indications of internal patterning within the site with one area of the site that had differential access to Kettle Point chert. This conclusion is consistent with the results obtained earlier at the Harrietsville site (Keron 1986). The Cassandra site (AfHh-65) also has internal patterning but it is not as pronounced. However, this site is one of the those like Thomas Powerline (AfHh-3) that has a high percentage of Kettle Point chert that may obscure the overall internal distribution. This site is also best interpreted as a satellite hamlet in the sense given by Pearce (1996), or possibly a small village, so it may have been composed of a single lineage. However, one portion of the site is clearly given over to use of high quality chert.

The case of the Uren sub-stage Dorchester site is more problematic. First, the analysis was complicated by the fact that there were no obvious middens as is normal with Uren period sites (Warrick 2000). Several attempts at analysis by sectioning the site failed to disclose any significant patterning although one end of the site seemed to have a higher percentage of Kettle Point chert. Visual inspection indicated a concentration within one discrete area of the site and when that was singled out it was found to be significant statistically. Given the very low percentage of Kettle Point chert on the site, this could be incipient lineage-controlled exchange or it could also be the result of one individual who distinguished himself by acquiring an unusual and potentially high status chert type given the hypothesized hostile relations with the Western Basin people. Chert acquired under such conditions would reflect on the audacity of the warriors that obtained it.

During the Glen Meyer period, no significant evidence of internal patterning could be found. This result is not unexpected for several reasons. First, it is assumed that the EOI groups occupying individual sites formed the basis of the lineages in later more complex MOI and LOI villages (Timmins 1997). With a single lineage at a site, there should be no evidence of differential access so the absence is not surprising. Indeed, any variance in distribution would have argued against the hypothesis so potentially the failure of the Glen Meyer site to show this may be in the wrong column of Appendix E, Box 5. Second, further complicating the potential to determine spatial patterning from surface collections of Glen Meyer sites is the tendency to rebuild on the same site. This pattern is quite evident at the Calvert site (Timmins 1997) where four distinct overlapping occupations are present. Potentially the only internal spatial analysis that could be done would be similar to Timmins analysis where debitage from each of the occupations was separated out revealing varying access to Kettle Point chert through time. However, the variation between occupations was not widely different. And finally, with a direct access pattern established that shows only a shallow slope in the distance decay line, lineage control of an exchange route is highly unlikely.

Further evidence supportive of the lineage control of trade routes is the variation that occurs in the amount of Kettle Point chert used at cabin sites. The best example is around the Lawson site where three cabin sites vary from 8% to 24% to 65% Kettle Point chert (Pearce 1996). In the Pond Mills cluster two adjacent cabin sites, Skinner (Keron 1989) and Laidlaw (Peace 1996) have different frequencies. The sites could well both be hamlets of the Brian site and the frequencies are not unlike the have and have-not area within the Brian site.

A third confirmatory indication is the consistency with the demonstration of a down-the-line exchange mechanism. Assuming lineage control of trade routes, then a down-the-line exchange system should be evident and thus the results tend to confirm lineage ownership.

A related question that is connected to this discussion concerns ownership of the originating resource. Without such ownership control, one group could in theory just bypass the upstream partner and go and acquire their own chert as was feasible and permissible during the EOI. While the early records are quite clear about ownership of the trade routes, the ownership of the source is not spelled out. Within the study area, the difference in distance between Lawson and Lambeth and the Kettle Point chert source is 5 km, hardly enough difference to account for the drop in percentage. This evidence in itself tends to imply ownership of the source by the Lawson people. It is clear that lineages owned more than just the trade routes. Trigger (1987) notes ownership of agricultural fields. Elsewhere lineages are documented as owning a number of other resources as well (see Dalton (1977) for a short discussion). Relating directly to chert acquisition, source ownership and production is the Slack-Caswell site, an Onondaga chert quarry site with a single longhouse, that was actually set up as a production centre in Middleport times implying corporate ownership of the resource as well as a production centre where the lineage extracted excess chert intended for exchange (Jamieson 1979).

In summary, this hypothesis has been confirmed although demonstration across more sites would certainly be ideal to increase the confidence in the explanation. This study was however, the initial trial and it has demonstrated an effective methodology to conduct the analysis and the results have so far confirmed the hypothesis.

Hypothesis 6: Time-Depth of the Pattern

The evidence against this hypothesis was so overwhelming that its failure became evident even during data collection. Once several EOI and MOI sites had been analysed it became evident that the amount of Kettle Point chert was low compared to later sites.

This outcome was not totally unexpected as the possibility of a curtailment of access to Kettle Point chert had been discussed much earlier (Keron 1986) and the same possibility was reflected in one of the alternate cultural hypotheses in Chapter 3. Pearce (1996), commenting on Southdale (AfHh-35), an Iroquoian site in south London, even used the low percentage of Kettle Point chert in absence of definitive rim sherd data to suggest a Middleport substage placement.

The major feature of this failure is the existence of three distinct distance decay regression lines for Kettle Point chert for each of the three periods. Essentially, an intermediate level of access existed during Glen Meyer times. There is a severe curtailment during MOI times and then use builds rapidly to Neutral times to the point where at the Lawson site there is an almost obsessive use of Kettle Point chert. In examining the regression curves, the reason for proposing the time-depth hypothesis is evident. It derived from the coincidence of the intersection of the two distance decay regression lines for the EOI and LOI directly in the middle of the earlier study area (Keron 1986) between Pond Mills and Dorchester (Figure 13). While frequencies in the 20-30% range were found for all time periods it was not due to conservation through time of the same acquisition pattern. The loss, with the collapse of the hypothesis, is an inability to trace groups through time based on chert usage, especially the potential to link Glen Meyer peoples to their later MOI descendants.

In Appendix E, Box 6 the observations are mapped against the implications of the hypothesis. The evidence is clearly against any time depth to the down-the-line hypothesis. All of this evidence relates to changing frequencies of Kettle Point chert. However, the evidence is mixed with respect to the chert patterns remaining constant. Four of the observations favour gradual change and even some of the observations listed under the “Contradicts” column hardly represent a sharp break in the chert working industry. For example, observations 7, 8 and 9 in section of Chapter 6 titled Formal and Informal Artefact Variation all note that there is a shift between Glen Meyer and later periods where more Onondaga is directed to formal artefacts, hardly a major contradiction given the loss of Kettle Point chert. Highly suggestive of continuity are the observations in the section of Chapter 6 titled Change in Lithic Industry Through Time where the coefficients of similarity were calculated between the three periods for the percentages of the various flake types. This evidence provides a very strong indication of a gradual change through time. Also supporting continuity is observation 10 in section of Chapter 6 titled Formal and Informal Artefact Variation where, in considering formal artefacts, the amount of Kettle Point chert varies, but all periods have about the same relative proportions in both the formal artefacts and the debitage. When access is curtailed during the MOI period, the chert continues to be used in the same way. In general, the split on this hypothesis between the two implications derives from a weakness in the original set of implications. Clearly, the chert industry remains very much the same despite a major curtailment in access to Kettle Point chert. Ultimately, as will be discussed below, it is not the drop in access to Kettle Point chert that invalidates the time-depth of the down-the-line hypothesis but the fact that a down-the-line acquisition is only demonstrable in Neutral times and possibly during the MOI. During Glen Meyer times there is a completely different acquisition pattern and the difference between that and the later pattern is graphically evident in the distance decay regression lines (Figure 13).

The major enigma that has been clearly established with this study is the varying accessibility to Kettle Point chert through time. As this result has implications for how the organization of the technology of chert acquisition articulates with the larger cultural system some consideration of potential causes is germane. Potential causes of this phenomena could be either environmental or social.

One potential environmental source of the curtailment at the time of the transition from Early to MOI times was suggested earlier in that perhaps higher than normal lake levels may be a factor. As the primary sources are offshore at Kettle Point (Janusas 1984) a rise in lake levels could have blocked access to Kettle Point chert or at least made acquisition a much more difficult task. Work on fluctuating lake levels has been conducted by Larsen (1985) that demonstrates a pattern that is exactly opposite to what would be expected if high lake levels made access more difficult. This work demonstrates that lake levels were higher during Glen Meyer times but actually dropped at about the same time as the transition to the MOI stage. Clearly lake levels are not a factor blocking access. Beyond lake levels it is difficult to imagine any strictly environmental factors that would curtail access to the source.

The fact that the drop in access occurs with the advent of the MOI stage is highly suggestive of social factors being the primary cause. The Glen Meyer acquisition pattern had been relatively stable for 200-300 years and the termination of that pattern at the time of the transition combined with the fact that once the Neutral pattern is established it also stays relatively stable for a period of time is almost conclusive proof of social factors impacting the ability of people to obtain Kettle Point chert immediately after the transition. The following discussion explores several potential social factors that could have been instrumental in disrupting the access to Kettle Point chert.

One potential cause that would be raised in some archaeological circles is the Pickering conquest hypothesis proposed by Wright (1966, 1992). This hypothesis claims that the formation to the MOI stage was the result of the conquest of the Glen Meyer branch by the Pickering branch of the EOI with the result being the Uren substage of the MOI was primarily derived from the dominant Pickering culture. Some Glen Meyer traits are thought to have been retained as the result of captive Glen Meyer women being adopted by the Pickering conquerors (Wright 1992). Indeed, the observations developed herein could (and probably will) be taken as evidence of the conquest. If one were predisposed to the conquest hypothesis, one need only look to the Dorchester site (AfHg-24) to see the “evidence”. Access to Kettle Point chert is severely curtailed as Dorchester represents the leading edge of the gradual Pickering displacement of the Glen Meyer people. Access is blocked by hostile Glen Meyer people to the west. There is also a difference in the lithic industry (Keron 2000) in that a new notched projectile point style has replaced the typical triangular Glen Meyer forms like those recovered from the nearby and slightly earlier Calvert site (Timmins 1997). Further there is a heavy reliance on Onondaga chert that is found to the east of the site in territory controlled by Pickering (and presumably friendly) people.

As is normal in the conquest debate the importance of the pros and cons usually correlates well with whether the analyst wants to emphasize differences or similarities in the data. The two key differences in lithic technology are the access to Kettle Point chert and the introduction of a new projectile point style, neither of which is startling given the extent of the social changes occurring at that point in time. Onondaga chert, while it has a higher use at Dorchester is accessible at all time periods. One of the observations recorded here is the difference between the debitage industry calculated for a number of EOI and MOI sites (Chapter 6-Changes in Lithic Industry Through Time) that shows the Coefficient of Similarity between the two stages as being 186.8. The two industries are almost identical. That is doubly significant when Wright (1992), in defending the conquest hypothesis, applies the same statistic to a number of Pickering, Glen Myer and Uren traits and accepts coefficients of similarity of between 100 and 150 as demonstrating the continuity between Pickering and Uren. If a conquest is to explain the drop into the MOI period, how does one explain the significant increase in use of Kettle Point chert into the late period. No one would seriously introduce a second conquest, so the question remains: “why should a conquest explain the earlier drop?” That leaves only the introduction of a new projectile point style which will be discussed below. Given the lack of definitive evidence and the weakness of the arguments for a conquest as is evident in reading Wright (1992), it is highly unlikely that the Pickering conquest hypothesis accounts for the curtailment of access to Kettle Point chert in the MOI stage. As was stated earlier (Keron 1986: 156): “whatever the explanation (for the loss of access to Kettle Point chert) . . . the answer lies towards the (chert) source not to the east”.

Another potential source of the curtailment is related to the rapid cultural changes taking place during the transition. Not all aspects of the classic Iroquoian culture pattern need not have developed at exactly the same time. If the cultural norm where resources were owned by kin groups had been adopted but the down-the-line exchange patterns had not yet been established, then access to high quality chert would have been impeded. In other words, the antecedent mode of direct acquisition was made obsolete by a heightened sense of territoriality and ownership of specific resources. However, an inter-group mechanism to allow exchange of the newly owned resources had not yet evolved. Certainly, access to Kettle Point chert drops off and then gradually rises through the MOI stage. However, forms of exchange are almost universal in human society so that explanation is weak. Further, while access to Kettle Point chert does drop off, access to Onondaga is not affected in the least. In fact, all periods seem to have equal access to it. So if it was a case that the new exchange mechanisms had not yet developed, it should impact all sources equally not just one. Furthermore, if the MOI sites are taken as a whole, the distance decay regression line (Figure 10) is similar to that during the Neutral period (Figure 11) in shape but it is much lower. This evidence, plus the established pattern of internal variation on Middleport sites showing unequal access to Kettle Point chert, would seem to imply that the new cultural pattern involving down-the-line exchange had been quickly adopted, most likely building on earlier exchange relationships.

Yet another potential explanation involves the adoption of more esoteric cultural values that make one chert source predominant. The Early Woodland predilection for use of Onondaga chert is one example (Ellis et al 1988; Granger 1978) while another is the selection by Early Paleoindian groups of a particular source that is frequently used to the exception of all others. Ellis (1989) has suggested that this was used as a group identifier as it became associated with the pooling of risk. However, the groups in question here did continue to use Kettle Point chert, albeit in reduced amounts, as well as Onondaga and local till chert; so the adoption of another source as a signalling mechanism is unlikely with the possible exception of the Lawson site to be discussed below. The opposite situation would be where for higher cultural reasons a particular chert source becomes proscribed. This explanation has been proposed as a potential reason for the post Hopewell aversion to Flint Ridge, Ohio chalcedony (Lepper et al. 2001). However, there is a healthy use of Kettle Point chert by Middleport times in one area of the Drumholm site and even during the Uren period, people at the Willcock site had some form of access (Poulton 1985a); so an aversion to Kettle Point chert does not seem reasonable.

While the possibility of other internal factors can not be discounted, another source of social explanations lies in relations with neighbouring non-Iroquoian groups such as the Western Basin people (Murphy and Ferris 1990) who are generally believed to be Algonkian speakers living west of the study area. A potential explanation of the curtailment of access to Kettle Point chert is that the source was either blocked or very dangerous due to hostilities with Western Basin peoples.

With the advent of the Uren substage, the Iroquoian cultural pattern seems to be in place (Kapches 1995) and one of the aspects of that cultural pattern is endemic warfare with neighbouring groups. Trigger (1987) reports that the warfare up until late historic times was more of a blood feud than full scale warfare. Small groups of warriors would raid other groups, kill a few people and capture a few others to be brought back to the village where torture or adoption awaited them. The raiding would frequently take the form of ambushing small groups of people who could be easily overwhelmed as they went about performing normal subsistence activity. During historic times the Neutral were at war with the Assistaronon (Trigger 1987) who were an Algonkian speaking group living in the southwestern corner of southern Ontario, Michigan and western Ohio. The key question is how far back in time this ongoing raiding pattern can be traced. Normally, archaeological indicators of Iroquoian pattern warfare are taken as the presence of cut and burned human bone in refuse as well as complex palisades and earthworks around villages built in defendable situations. The Lawson site where human bone clearly reflective of torture has been recovered (Pearce: personal communication) would certainly qualify in this respect during late prehistoric Neutral times. Fox (1980b) through comparative data on projectile point styles demonstrated that Kettle Point chert projectile points that are derived from Neutral contexts are arriving on Western Basin sites whereas the same is not true in reverse. Warrick (2000) in a recent synthesis of the Iroquoian occupation of southern Ontario extends the warfare pattern with the central Algonkians back into the 15th and 16th centuries based on village patterns and the presence of osteological data suggestive of Iroquoian torture practices. Moving the warfare pattern back further in time becomes problematic but even at the Uren site

(Wright 1986) there is a complex set of multiple rows of palisades and the suggestion that some human bone may have been derived from torture.

The introduction of the notched triangular projectile point during Uren times is suggestive as well. It seems to be generally accepted, archaeologically at least, that this was to facilitate hafting. However, it should be noted that the notches were not necessary during EOI times nor were they ever adopted by the Five Nations Iroquois in New York State. Ellis (1997) has noted in a study of ethnographically reported peoples that there were frequently at least two styles of stone projectile points with one specifically associated with warfare. Barbed forms, difficult to remove by human targets, are reserved more for warfare. Is it a coincidence that the notched triangular points are introduced about the same time as warfare intensifies? While stemmed points, in addition to triangular points, are found as a minority type on Glen Meyer villages and may or may not have served a similar function, the relative number of notched points increases with the advent of the MOI. Also suggestive of the side-notched projectile point association with warfare is the demonstration that it may have been an innovation that commences on or near the western Iroquoian frontier with the Western Basin peoples and then diffused eastward (Keron 2000).

Further strengthening this idea is the observation 13 in the Chapter 6 Morphological Variation section that there is a jump in production of bifaces right after the transition to the MOI. The more complex social patterns, such as occurred with the advent of the Uren substage, are also coincident with a heightened warfare pattern elsewhere as in the American southwest (Hass 1990); so it is reasonable that warfare started to intensify at the time of the Uren substage and not earlier or later. The other interesting trend with the local Iroquoian population is the abandonment of the Ausable river drainage during or immediately after the Uren substage (Fox personal communication 1986). Pearce (1984) suggests that the Middleport sequence on Oxbow Creek was the result of the fusion into a single community of three antecedent Glen Meyer communities one of which is the Ausable community. Historically, Ontario Iroquoian groups did tend to band togther in the face of external threats (Trigger 1987).

Indeed, Keener (1995) even goes as far as suggesting that endemic warfare was the cultural factor that lead to the increasing socio-cultural integration within the Ontario Iroquoian groups. While this explanation must remain tentative with the evidence available today, it is, at this point in time, the most reasonable explanation for the severe curtailment of access to Kettle Point chert during the MOI. As the Neutral groups gained the upper hand through time and gradually pushed the Western Basin people to the southwest, access to Kettle Point chert then became much safer allowing increased exploitation. By the time of the occupation of the Lawson site there seems to be an almost obsessive use of Kettle Point chert.

In summary, while the failure of the time depth hypothesis of a down-the-line pattern of exchange is best characterized by a curtailment in access to Kettle Point chert, the real reason is that even if that had not happened it appears that there was a significant shift in acquisition pattern from EOI to MOI times where a pattern of direct access is replaced by a down-the-line exchange system.

Hypothesis 7: The Exchange Medium Was Cores

It was originally proposed that the material being exchanged was in the form of raw cores based on the observation that cores of all chert types occurred on all sites. This result is still observed with the broadened sample size in this study but the data should be capable of determining if that was the only media exchanged. The hypothesis and the associated test implications are listed in Appendix E, Box 7.

It is reasonable to suppose that finished artefacts such as finished arrows could be part of the exchange network. One minor indication that more than just cores could be exchanged is the reduction state of the three chert sources. Onondaga is arriving in a more reduced state than Kettle Point chert. This evidence is far from conclusive. Providing better evidence is the fact that the percentage of high quality cherts in the formal artefacts is higher than the percentage of the same cherts in the debitage. This seems indicative of manufacture of the formal artefacts elsewhere so a reasonable assumption, but one that is by no means certain, is that more than just raw cores were being exchanged. This idea requires more testing.

Hypothesis 8: Villages Versus Cabins

This hypothesis asserts the expectation that there should be differences in the lithic reduction between villages and cabin sites. Appendix E, Box 8 maps the observations against the implications of this hypothesis.

This hypothesis is well supported with the data exactly matching expectations. Villages have a higher percentage of Kettle Point chert and Onondaga chert while cabin sites have a higher percentage of local till chert. Furthermore, there are differences in the lithic reduction between the two types of sites. Part of this difference reflects the embedded acquisition of local till chert and the associated initial reduction sequence that produces more decortication flakes and shatter. However, there are other differences as well, clearly indicating different activities. In all probability, local till chert cobbles could have been acquired during subsistence activities in corn fields or as byproducts of procuring other resources. Given the documented tendency (Tooker 1991; Trigger 1987) for women to handle these tasks, the embedded lithic acquisition happening here has a gender component to it (Gero 1991) although Robert Pearce (personal communication 2003) notes that all forms of tools and thus potentially both sexes are present on cabin sites so attributing collection of local till chert to women may be problematic. While local till chert was initially acquired at the cabin site, the high quality cherts occur there as well but in reduced percentages. Given the higher percentage of these cherts in the villages, a reasonable explanation is that the high quality chert was first brought to the village and then transported in reduced quantities to the associated cabin sites. Robert Pearce (personal communication 2003) notes that at the Lawson site finished artefacts made from distance chert sources such as Flint Ridge chalcedony from Ohio and Bayport chert from Michigan are found again suggesting that the villages would be the most frequent destination of artefacts made from imported chert sources.

Additionally Fox (1979:81) notes, as support for the acquisition of local till chert, the description by the Huron of the origin of chert in a fight between two brothers, Iouskeha and Tawiscaron, when Tawiscaron was wounded and fled leaving a trail of blood drops that became chert. There is a similarity between the scatter of pebble cherts in secondary deposits and the scatter of blood drops from the fleeing Tawiscaron. It is not known if the Neutral understanding of the origin as chert was identical but a similar understanding of the distribution of secondary deposits of chert is fairly certain.

Hypothesis 9: Embedded Procurement of Local Chert.

In some ways this hypothesis might be stating the obvious since it would be difficult to imagine someone setting out on an excursion to acquire, or trade for, local till chert. However, it does deserve testing. Appendix E, Box 9 maps the results of the observations to the implication of the hypothesis.

If embedded procurement is the method of acquisition, then a more expedient use of the chert is to be expected (Andrefsky 1994; Morrow and Jeffries 1989). This result is indeed the case as the observations indicate. Informal artefacts are more prone to be fashioned from local till chert whereas Onondaga and Kettle Point are more often cycled into formal artefacts. Additional support for this hypothesis is the fact that there is higher use of local till chert in the locations where embedded procurement is expected to occur: specifically, the agricultural cabin sites.

Chapter 8: Conclusions and Questions

This thesis has demonstrated a changing pattern of chert acquisition through time that starts with a pattern of direct procurement during Glen Meyer times and evolves rather rapidly at the EOI to MOI transition into one of down-the-line exchange with lineage control of the trade routes. The following summary will proceed by a brief description of each acquisition pattern and then proceed to a set of questions as to some of the meanings of the changes and the patterns.

As has been shown, the pattern of chert acquisition during the EOI is best explained by direct procurement through embedded procurement where the acquisition occurs not by a specially planned trip to obtain chert but through procurement embedded in other subsistence activities (Binford 1979). The nature of the distance decay is best explained by direct procurement where the only factor influencing acquisition is distance. In addition, the fact that there does not seem to be any differential treatment of any of the chert sources indicates that the procurement was embedded in the execution of other subsistence activities. Williamson's (1985) description of the broader Glen Meyer settlement pattern within the Caradoc cluster indicates the existence of permanent villages as well as specialized sites where resource acquisition such as deer hunting or nut gathering occurred. The people used the village site as a base camp and the special function sites as a field camp in the sense used by Binford (1980) in his description of site usage by a collector form of organization. Such a pattern is also evident at the Calvert site where Timmins (1997) infers that the site was used as a permanent base camp at one period and as a centre for deer hunting during another occupation.

The implications of direct embedded procurement here provide another aspect to this picture. First, they indicate greater mobility or at least a wider ranging movement of Glen Meyer people than might have been assumed by archaeological focus on specific site clusters. Clearly, people are getting to Kettle Point and the north shore of Lake Erie on a regular basis in their seasonal round. This conclusion is further emphasized by the fact that the Glen Meyer people had the best access of any Iroquoian people in the area to high quality chert. Exactly what they were doing along the lake shores on a regular basis is not a question that can be answered with the data here, but fishing seems a reasonable possibility. Certainly the Glen Meyer occupation of the Reid site (Wright 1978) along Lake Erie was used for fishing. There is a heavy exploitation of fish resources during the Middle Woodland period (Prowse 2003) and the continued use of fish during the Late Woodland period in the area (Fox 1976: 169-172, 175). This focus on a broader range of resources and the need to exploit these from a broader range of localities is evident in the Caradoc Sand Plain (Williamson 1985). Also Spence (1994) notes some mobility in the mortuary programme within the Norfolk Sand Plain where primary burials at or around the inland villages were removed for secondary burial along the lake shore. It could well be that well defined and enforced territorialism does not emerge until the MOI with the greater emphasis on corn agriculture and that during the EOI the social movement and consequently interaction was more akin to earlier time periods than the later. Whether this free-ranging applies to all Glen Meyer people or just within the study area can not be addressed by the data presented here. While potentially intriguing, interaction between the Glen Meyer occupants of the study area and those of the Norfolk Sand Plain or Catfish Creek (Poulton 1985b) must await further research.

The other implication that this situation raises is the issue of group territoriality. Our focus on the specific Glen Meyer clusters contains the assumption that the cluster represents a corporate group occupying that territory through time and naturally leads to the implicit assumption that the archaeological clusters equate to the band's territory. For example, Timmins (1997:227) suggests that EOI village locations and hunting territories may have been "tenaciously protected against incursions by outsiders" and that territoriality may have been a source of tension between EOI communities. While this is a reasonable assumption, there is a natural tendency to equate the group's cluster with a territory that may have been meaningful to the occupants of the site. What is presented here is a picture of people who were ranging widely over the southwest part of the province. That then leads to a third implication regarding the relationships between the various Glen Meyer clusters in the area. If the movement suggested by the lithic acquisition pattern occurred, then there was obviously nothing in the intergroup relationships that restricted movement through the intervening territory. For the group at Dorchester, there would be no less than three distinct clusters between them and Kettle Point that would need to traversed. This being the case, the implication would be that there was very much a common identity perhaps arising from a common ancestral Princess Point group that migrated into the region early in the Glen Meyer sequence and then through population growth fissioned over time into the four communities. This potential common ancestry and significant ongoing interaction would provide a natural grouping when settlement aggregation occurred early in the MOI very likely along the lines proposed by Williamson and Robertson (1994).

At the risk of stressing differences over similarities, it could be stated that the Glen Meyer acquisition pattern had more in common with earlier organization of acquisition technology that it did with the later pattern that emerged during MOI times. The interesting anomaly of the McGrath Site (Poulton 1985a) provides an example that is not unlike that of the Small Point Archaic (Ellis and Spence 1997). It is also interesting in that being a temporary campsite the picture of chert acquisition is fine-grained as opposed to that observed in base village sites which would be coarse-grained (Binford 1980). McGrath, being a short occupation, presents a better snapshot of one point in the acquisition cycle whereas villages would be the average of years of acquisition. There are however, differences in the organization of technology to the Small Point Archaic. Given the shift to increased sedentism, the technology during Glen Meyer times, has shifted to greater use of expedient tools much as Parry and Kelly (1987) indicate was happening broadly across the continent in the Woodland period. So while the organization is changing that portion of it associated with chert acquisition is still similar to earlier times.

While the evidence is not as strong given the site sample available as would be preferred, it appears that with the onset of the MOI significant changes occurred in the social structure of the antecedent Glen Meyer groups. Much has been written regarding changes in settlement patterns and ceramic decoration styles (see Dodd et al. 1990 or Warrick 2000) and all of this indicates substantial socio-cultural changes that need not be summarized here. From the perspective of the organization of lithic technology there is a major shift in the ideology surrounding acquisition of chert. From what would seem an egalitarian system where all people had equal access to the source, there is a radical change that incorporates the concept of ownership into the society. Now certain corporate groups own the source and have the right to trade this to other trade partners who own the trade route to the exclusion of others in their village and other downstream partners in the exchange system. Explanation of why this happened is beyond the scope of this study but, as noted earlier, the same thing has been demonstrated in the American Southwest (Findlow and Bolognese 1982) also in concert with evidence of increasing social complexity so it would seem that a causative explanation might be feasible. The other significant trend at the transition to the MOI is the curtailment of access to Kettle Point chert very likely due to hostile interaction with Western Basin peoples.   This curtailment results in a number of adaptations in the underlying organization of technology as it relates to the use of stone for various artefact classes. The high quality chert that can be obtained is cycled more into formal artefacts and the shortage is taken up with increased use of local till chert.

Despite these differences between the EOI and the MOI, there are not any significant changes in the underlying lithic usage system. This continuity is clearly evidenced by the similarity of the various percentages of flake types in the assemblage. The coefficient of similarity is very high strongly suggesting that while there may have been changes in the acquisition of chert and the chert sources accessible, the underlying uses to which it was put were fundamentally the same.

What emerges during the Neutral period is a picture of chert acquisition graphically depicted in Figure 19 that is drawn from the perspective of one participant in the system identified by the stick person within “My Village”.   He is the member of a lineage that has an upstream trading partner that provides Kettle Point chert and in turn passes a portion of it on to two downstream partners, one in a more easterly village and the other a second lineage in the same village. The Kettle Point chert enters a pool in the home village owned by the lineage with potential percentages indicated by the pie charts.

From the pool owned by "My Lineage" it moves to various local users, to the lineage's cabin sites, and to various downstream partners. In the same village is a second lineage or possibly clan segment that owns a trade route with an upstream partner to the south along Lake Erie who supplies Onondaga chert into a pool owned by that lineage. From here some of it is exchanged with "my lineage" possibly in return for Kettle Point chert. The Onondaga chert is added to "My Lineage's" pool and is disseminated to various uses from there. One additional factor is that some of the chert could have been fashioned into projectile points that may have been exchanged as is or possibly (pure speculation) as a part of a finished arrow similar to that described by Weissner (1982). "My lineage" will also acquire chert in other ways mostly embedded in other activities. One source will be from the lineage's cabin site(s) where local till chert will be gathered during normal agricultural or other extractive activities. This material will be in the form of raw cobbles. Initial reduction would take place in the cabin site or possibly at the original find spot. Some of this would be used in the cabin site location and some potentially returned to the home village. Local till chert could also be obtained in daily activities originating at the home village. A small and frequently ignored source of material is recycling from earlier archaeological sites. Earlier projectile point styles are almost invariably found in Iroquoian contexts with collection by Iroquoian people being a generally accepted explanation. Indeed, Tooker (1991) reports that such items would be regarded as charms or talismans. If earlier projectile points are being recovered it is extremely likely that usable flakes will also be retained from earlier sites. This means of acquisition might explain the odd piece of Flint Ridge chalcedony observed in the analysis.

What is truly puzzling is the almost obsessive use of Kettle Point chert at the Lawson site. This focus seems out of all proportion to what would actually be necessary to satisfy the needs of a lithic technology that was basically expedient. While it has been demonstrated that high quality chert is preferred over local till chert, even this does not explain the almost sole focus on Kettle Point chert. Certainly any of the earlier people were quite capable of living with much lower amounts of Kettle Point chert in their technology. Usually where patterns emerge that differ significantly from what would seem reasonable from the optimal economic perspective that is a sign that there are alternate social explanations that lead to the phenomena. One such explanation that has been demonstrated/suggested elsewhere (Ellis 1989; Weissner 1982) in the past involves signaling group identification. If Western Basin peoples did severely curtail access by the London area Iroquoian people early in the MOI and if the Iroquoian people eventually gained the upper hand and pushed back the Western Basin people opening the source, then use of Kettle Point chert may have become associated with their self-image as a force with which to be reckoned in Iroquoian warfare. Indeed, the preference may even extend into the historic era where Jamieson (1984) notes use of Kettle Point chert amongst the historic Neutral in the group inhabiting the Spencer and Bronte Creek drainages. While her explanation involves trade with the Petun, an equally likely and more probable source for some of the chert observed there is embedded procurement by former western Neutral peoples involved in warfare with the Assistaronon or Fire Nation who are most likely comprised of a number of Algonkian speaking groups (see Heidenreich 1988) to the west. Indeed, Lennox and Fitzgerald (1990: 418) argue that the high percentage of shell-tempered pottery, typical of contemporaneous Western Basin people, found in this same cluster is evidence of the historically documented warfare with the Assistaronon and that the descendants of the western (i.e. London area) Neutral people were resident in this one cluster during the historic period. Another interesting historic site is the Horner Creek site (Lennox 1995b) where 60% of the chert is Kettle Point. This site may well represent a hunting camp occupied by former western Neutral people returning from the west, possibly from a raid on the Assistaronon. Of course, all this speculation goes beyond the capability of the data analyzed in this study but does not seem unreasonable.

Finally, it should be noted that the data collected can undoubtably be used to delve deeper into the organization of Iroquoian lithic technology but that will require more time and analytical space than is available here. In any event, this study has clearly demonstrated the value of wider comparative study of the organization of lithic technology as well as identifying several diachronic trends during the Iroquoian occupation of the London area. It is hoped that subsequent studies will adjust to correct for some of the shortcomings here and move our understanding of the past forward into the ever shifting present.

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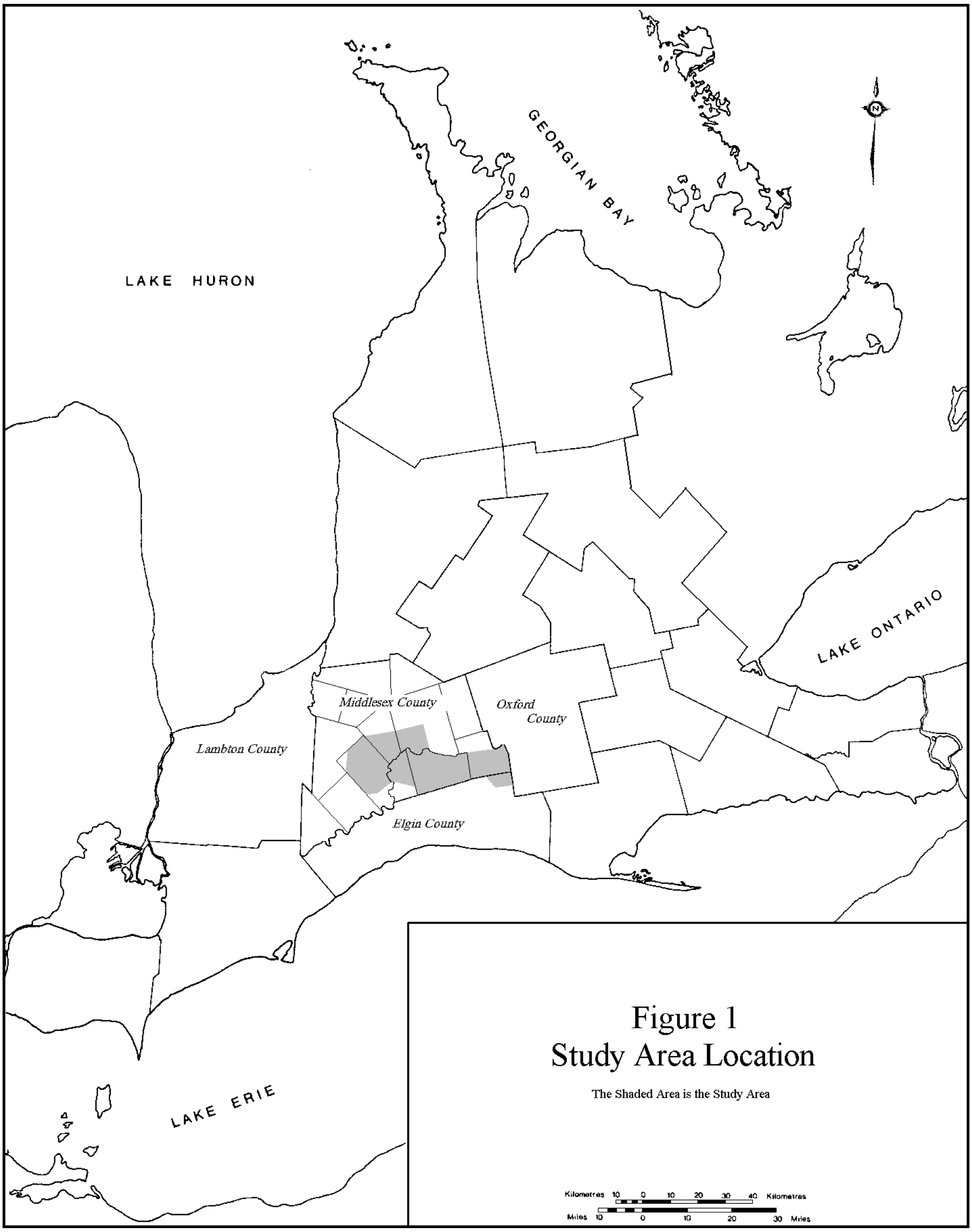


Figure 1
Study Area Location

The Shaded Area is the Study Area

Figure 2: Study Area Landmarks

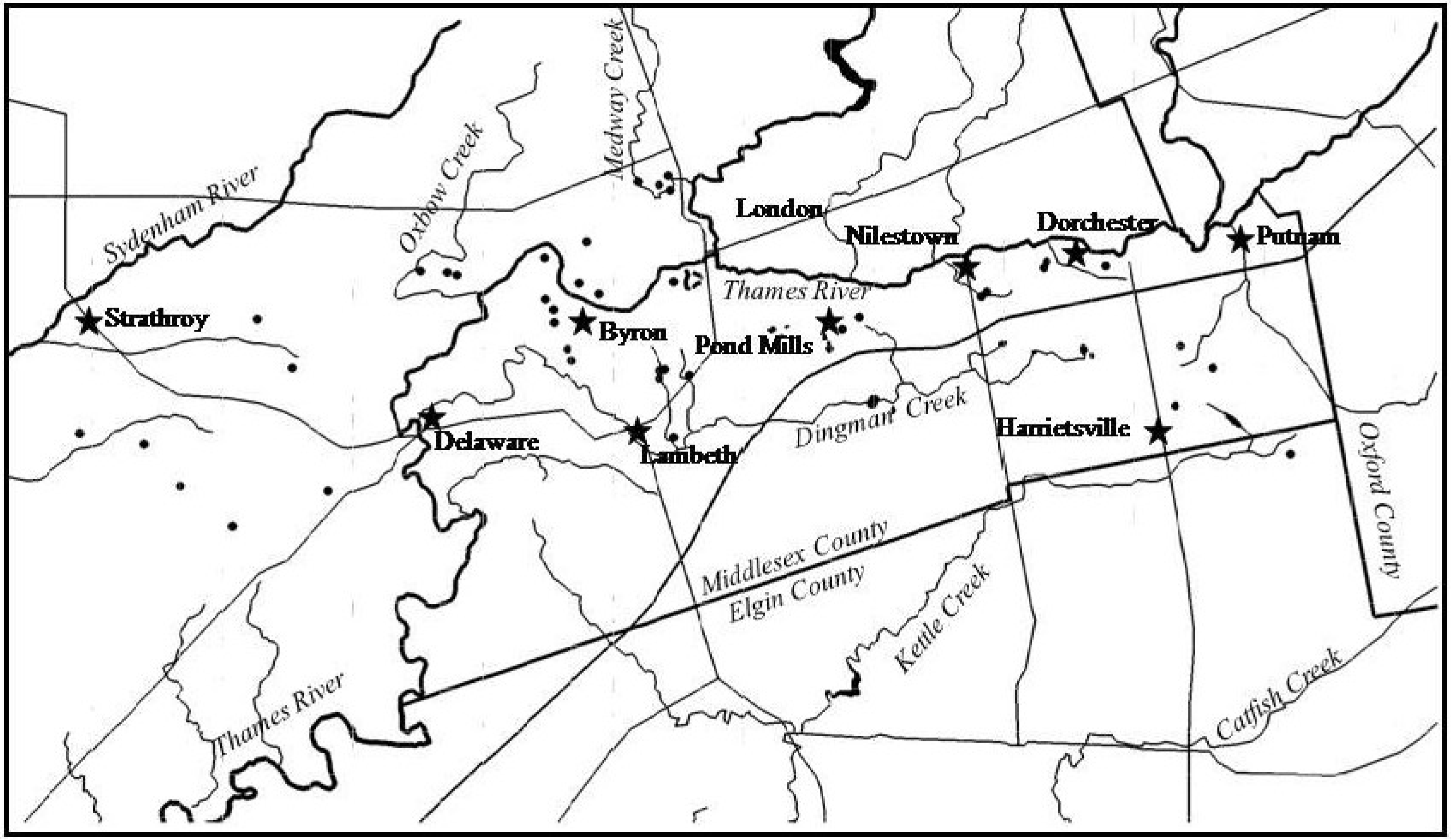


Figure 3: Site Names

1. Caradoc-13
2. MiV18
3. Roeland
4. Melbourne-7
5. Kelly
6. Caradoc-3
7. Komoka-3
8. Always
9. Edwards
10. Drumholm
11. TGIF/Crop Cirlce
12 Magrath
13. Sosad
14. Willcock
15. Ski Club
16. Preying Mantis
17. Thomas Lewis
18. Sackrider
19. Sifton
20. Norton
21. Matthew William
22. Cassandra
23. Mama
24 Thomas Powerline
25. Pincombe 1
26. Lawson
27. Smallman
28. Windermere
29. Ronto
30. Brian
31. Bradley Ave.
32. Pond Mills
33. Laidlaw
34. Skinner
35. Paraducks
36. Lone Duck
37. Mustos
38. Calvert
39. Dorchester Village
40 Harrietsville
41. Dyjack
42. Pine Tree
43. Gravel Pit

Figure 3: Study Area Site Locations

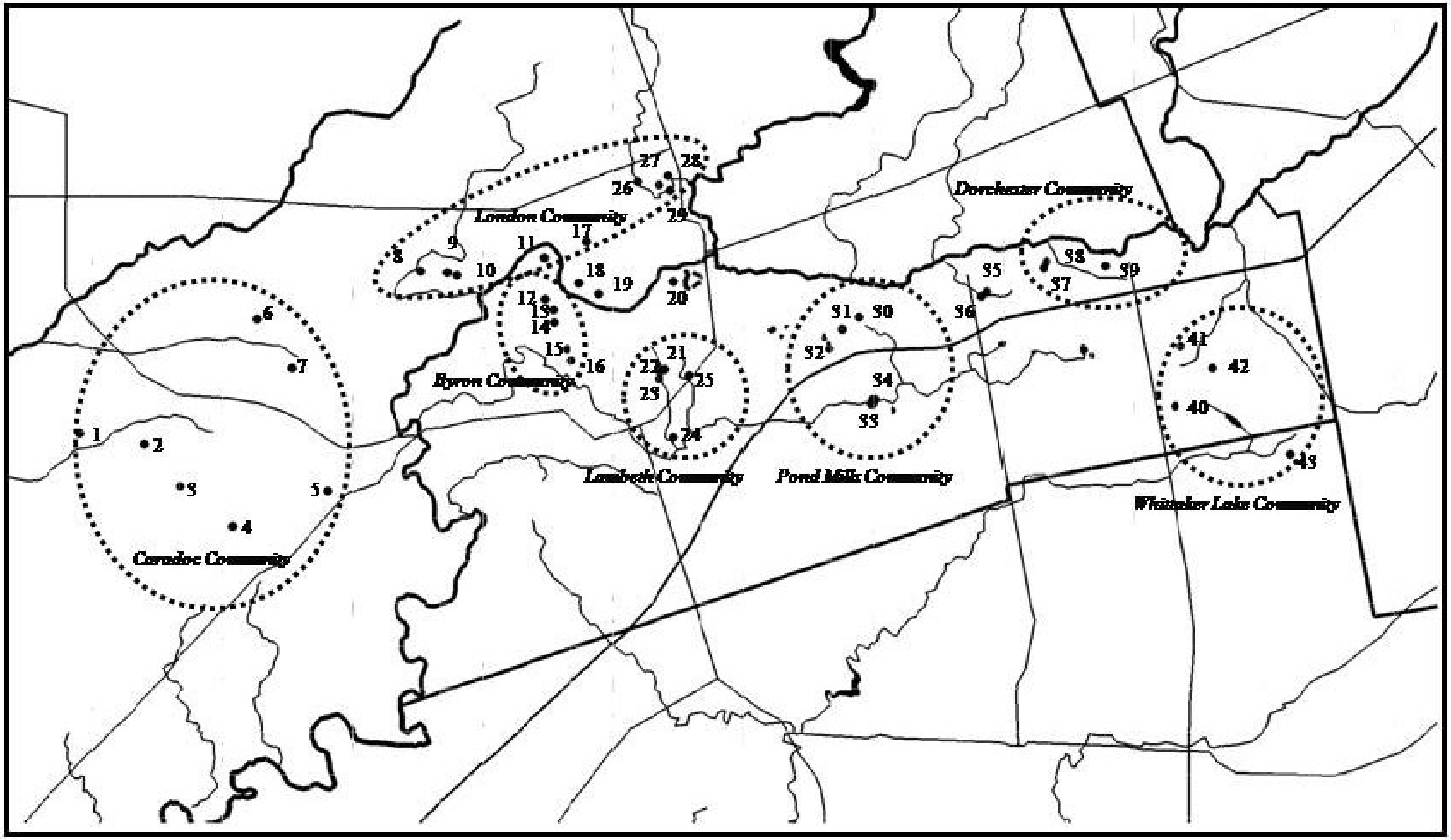


Figure 4: Study Area Physiography

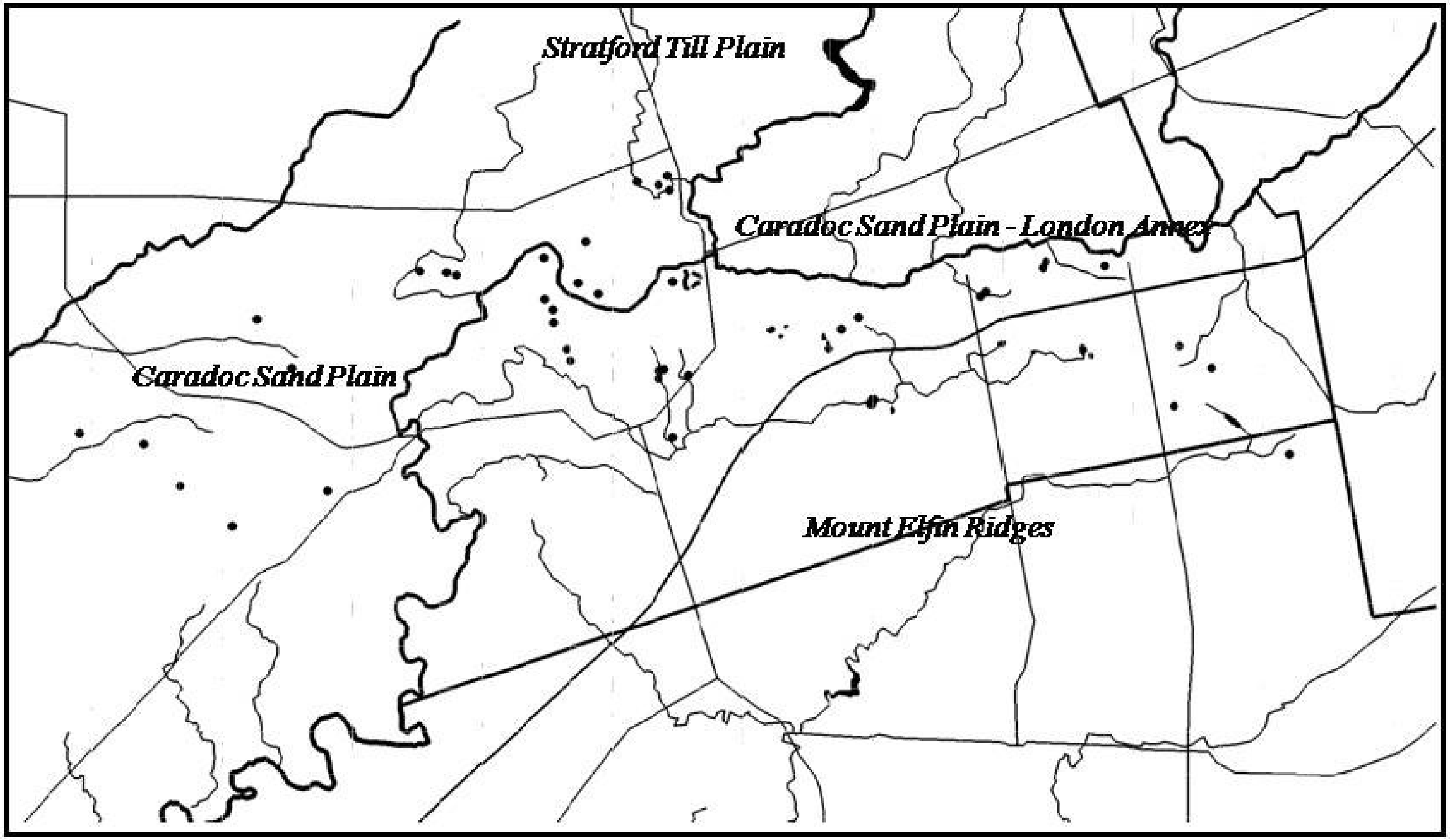


Figure 5: Time Periods and Wright's (1966) Framework

	Stage	Sub-Stage	Cultural Group
AD 1000 Late Woodland Period	Early Ontario Iroquoian Stage		Glen Meyer
	Middle Ontario Iroquoian Stage	Uren Substage Middleport Substage	
AD 1500	Late Ontario Iroquoian Stage		Neutral

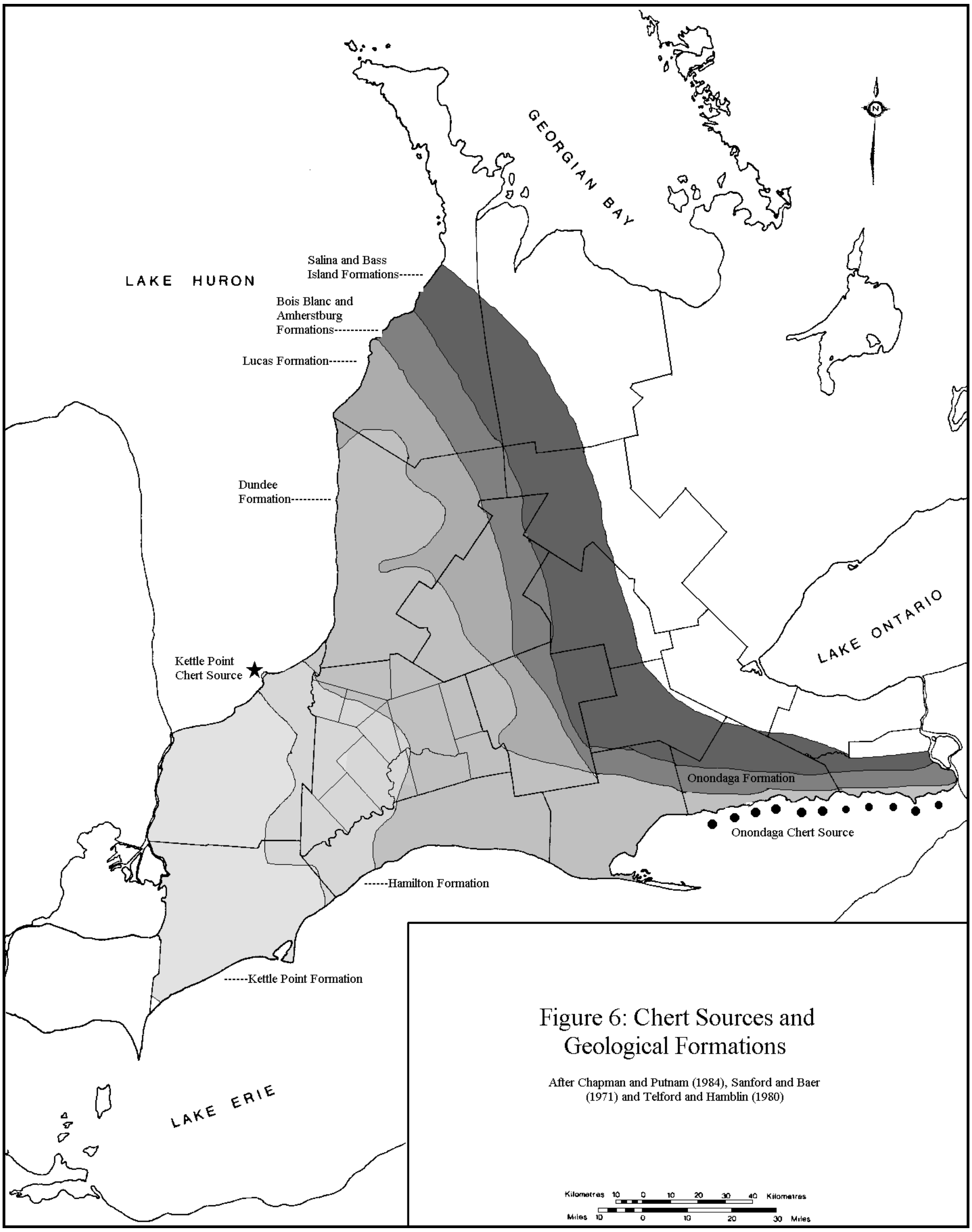


Figure 6: Chert Sources and Geological Formations

After Chapman and Putnam (1984), Sanford and Baer (1971) and Telford and Hamblin (1980)

Figure 7: Brian Site

Cultural Areas

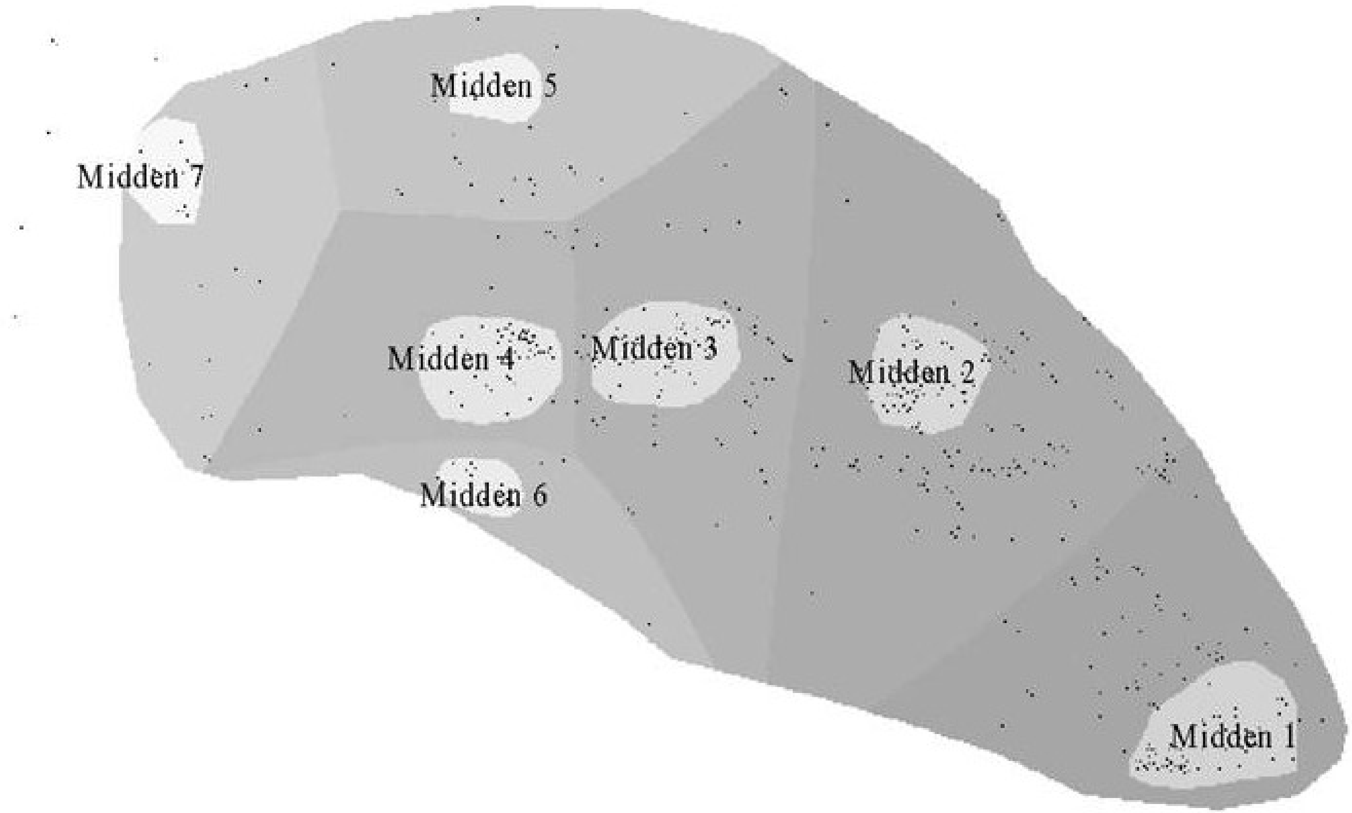


Figure 8: Cassandra Site

Cultural Areas

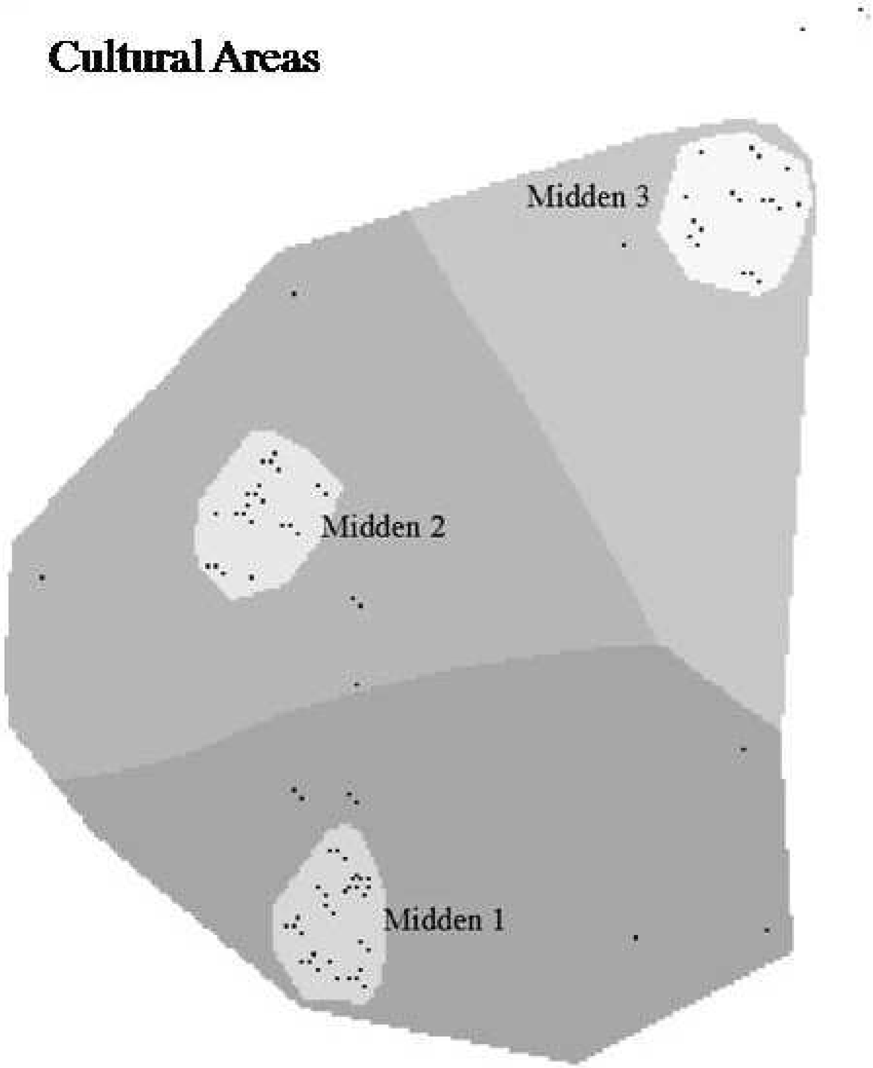


Figure 9: Dorchester Village

Cultural Areas

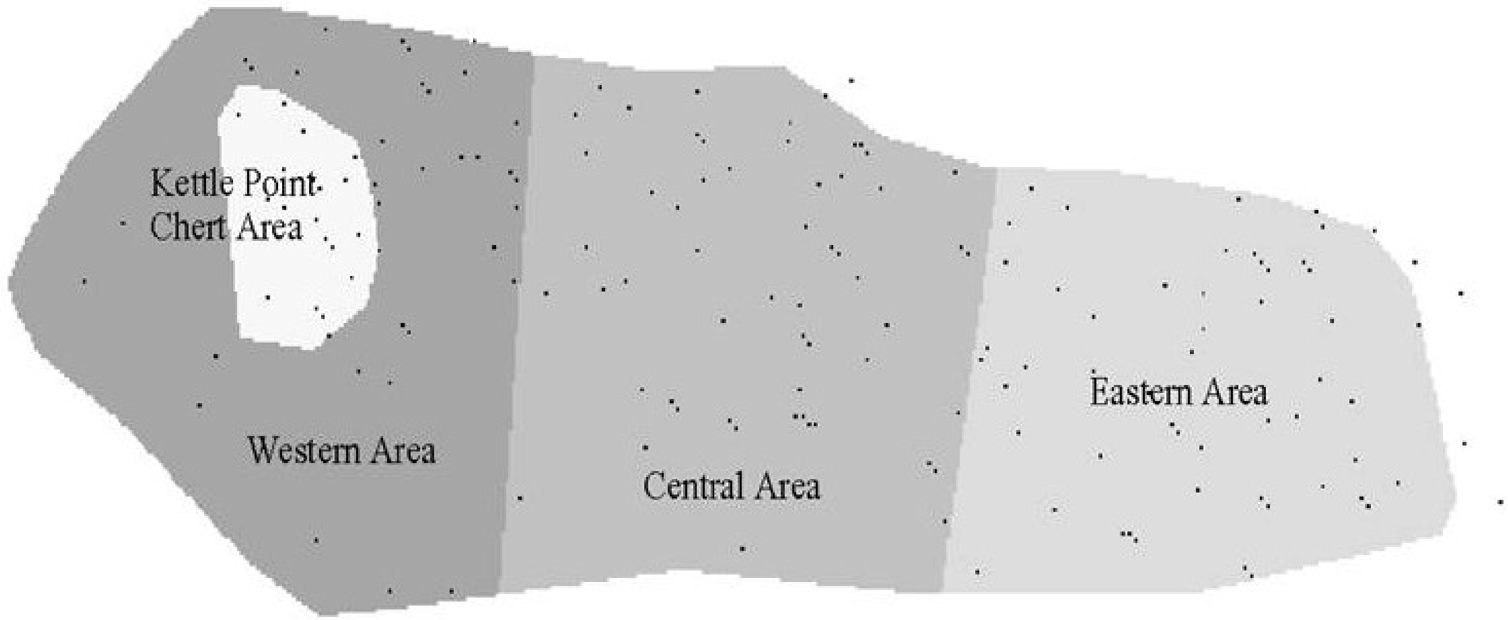
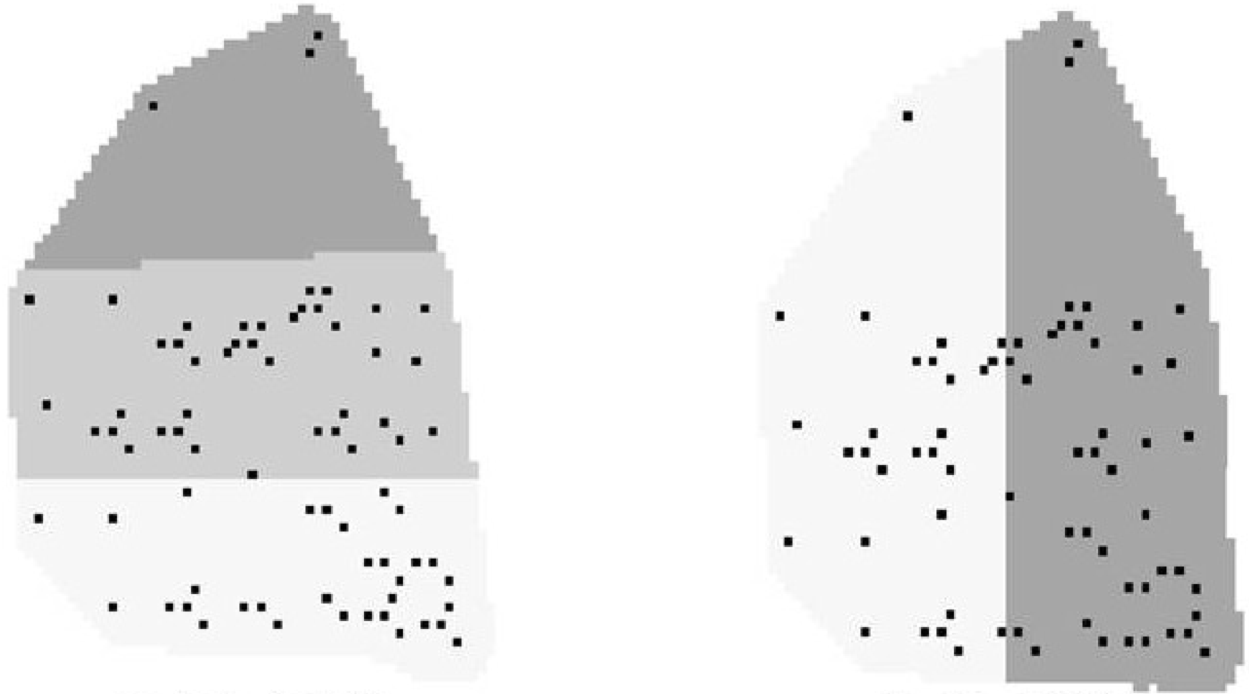


Figure 10: Mustos Site

Cultural Areas



North-South Division East-West Division

Figure 11: Drumholm Site

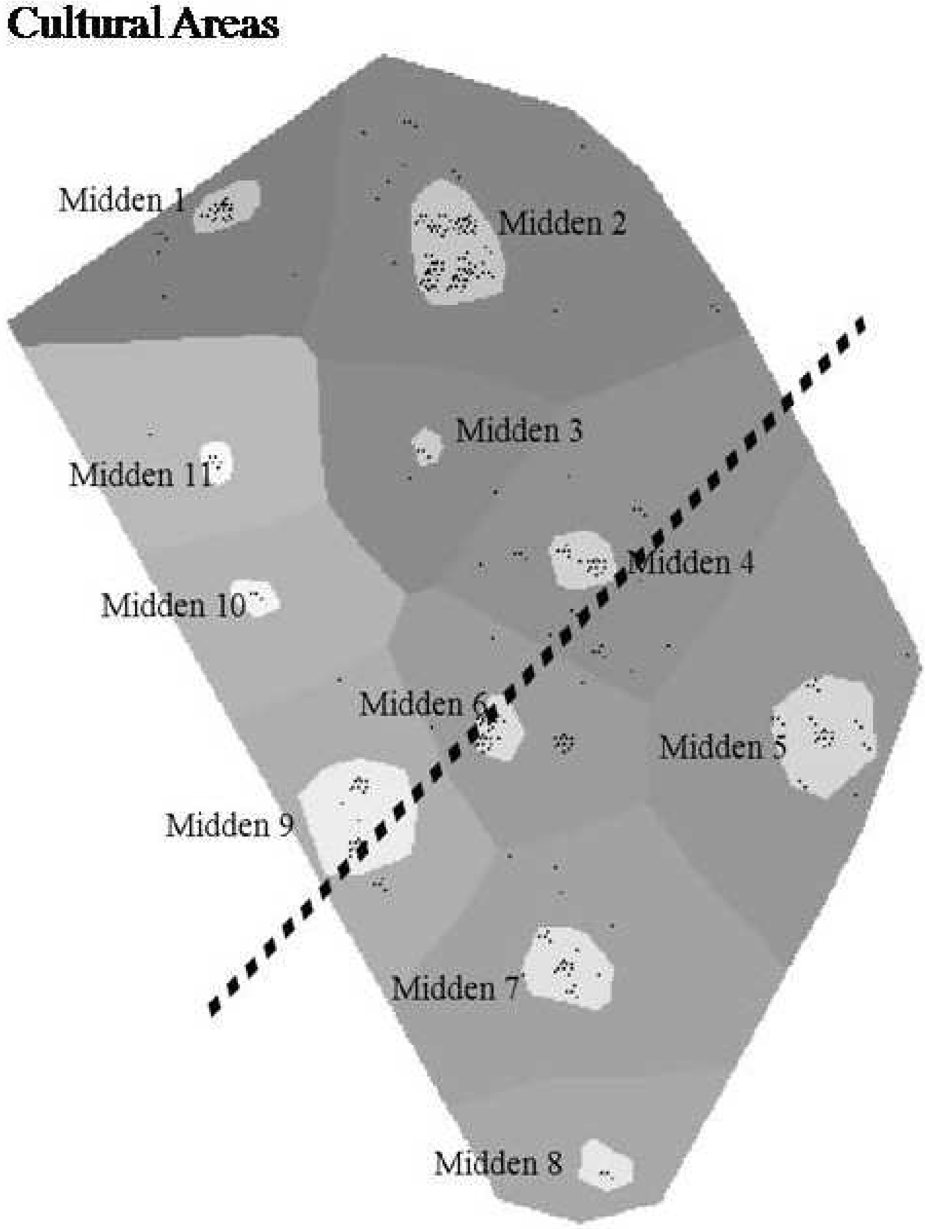


Figure 12: Glen Meyer Distance Decay - Kettle Point Chert

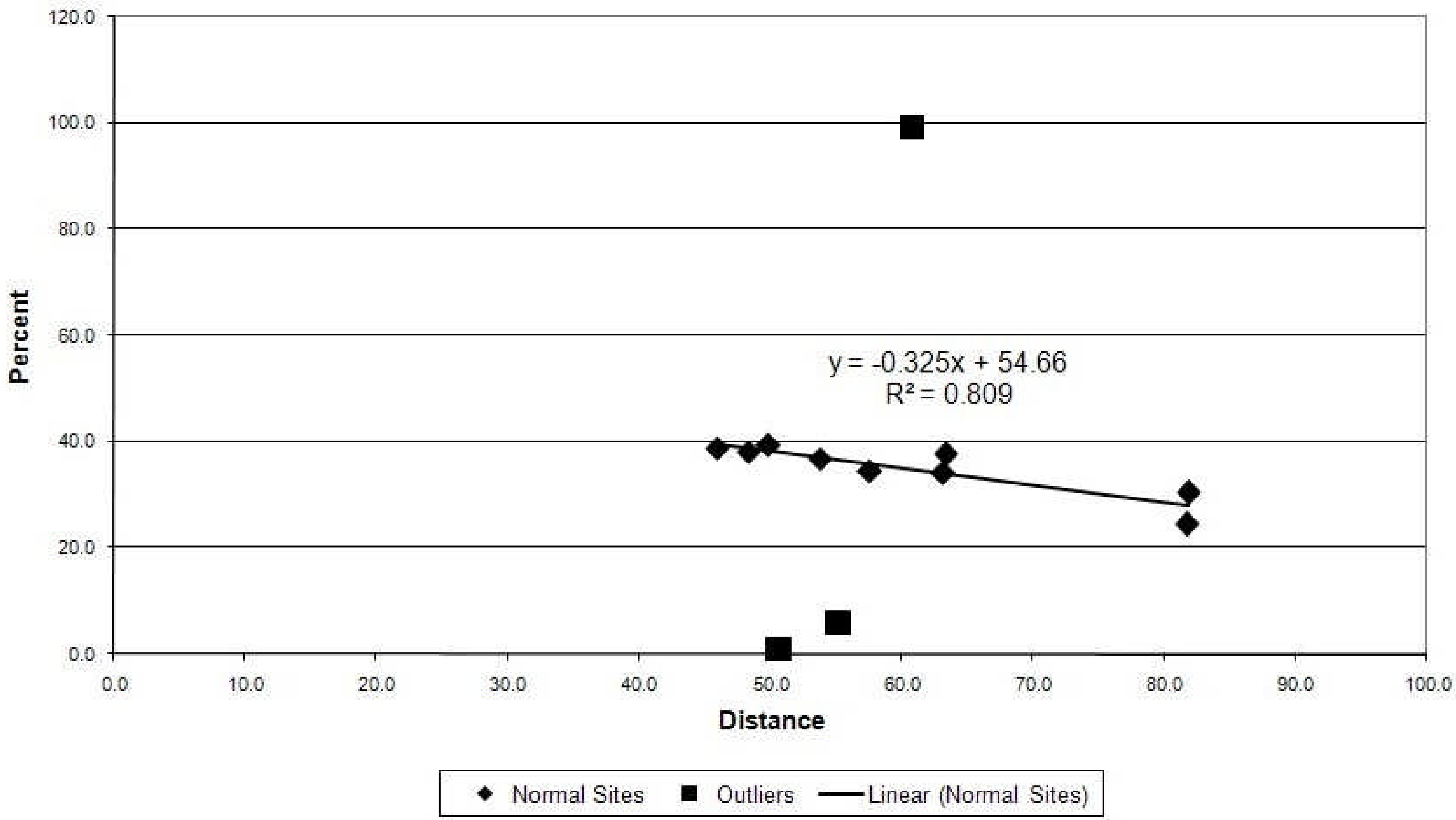


Figure 13: MOI Distance Decay
- Kettle Point Chert

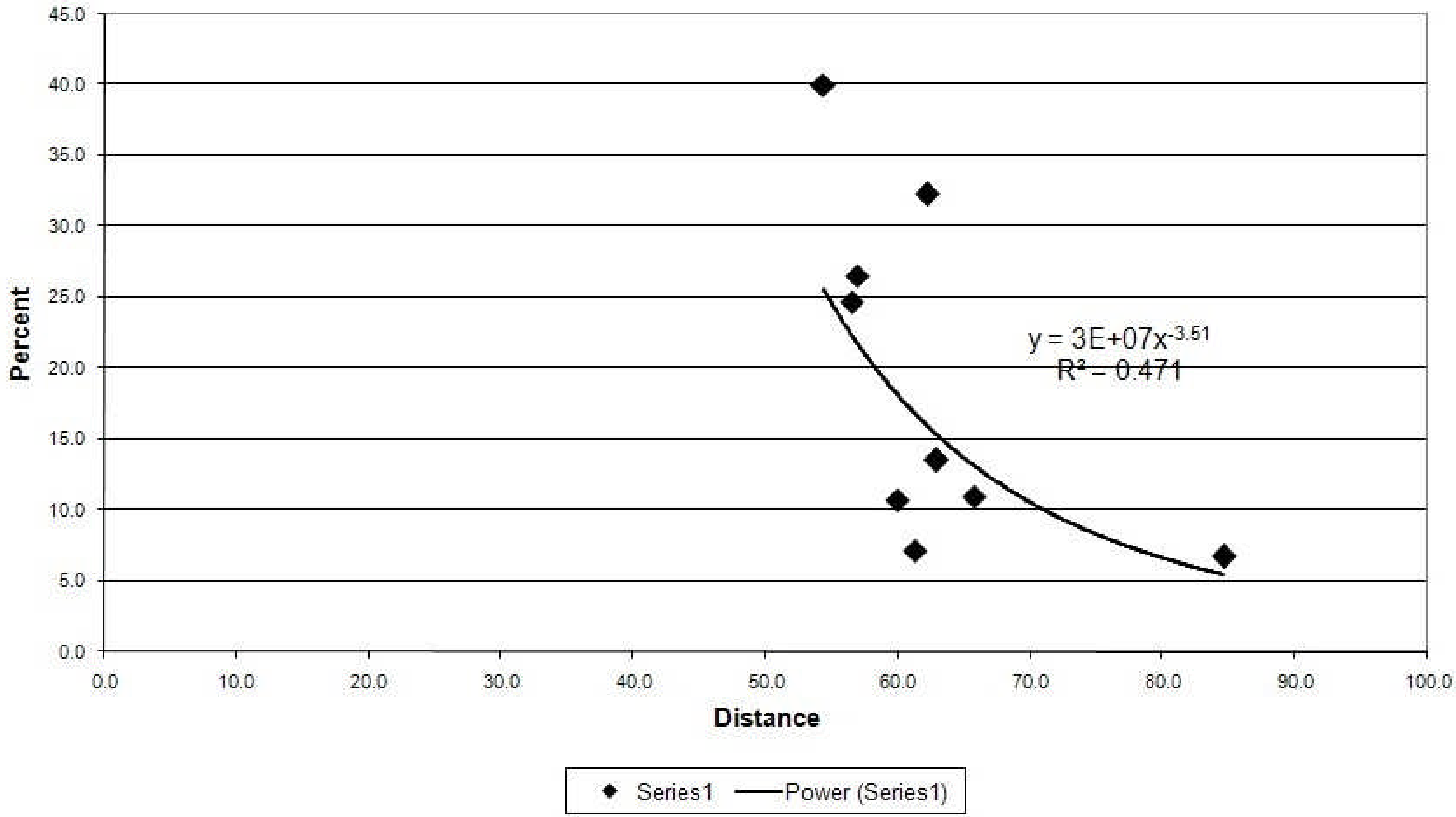


Figure 14: Neutral Villages Distance Decay - Kettle Point Chert

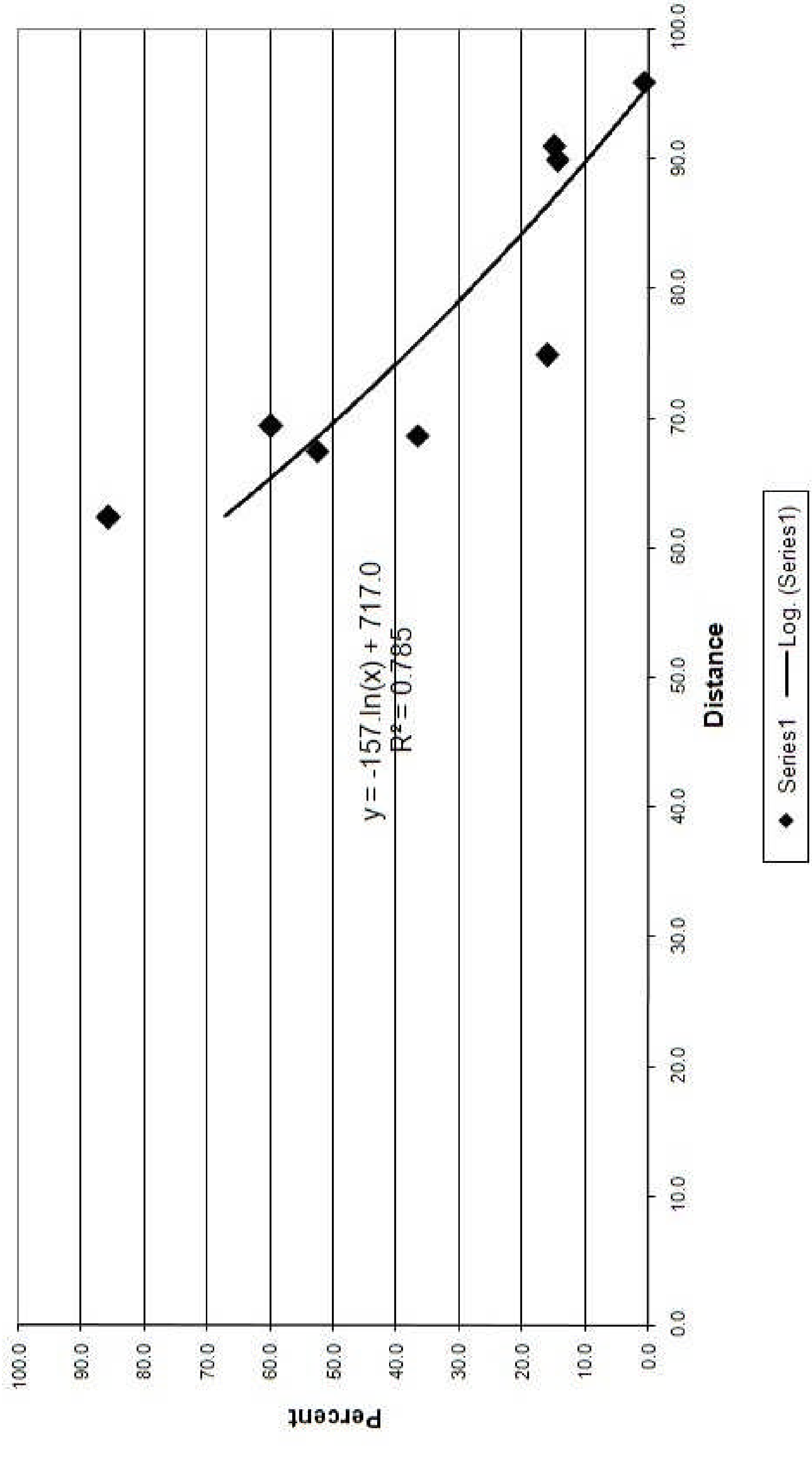
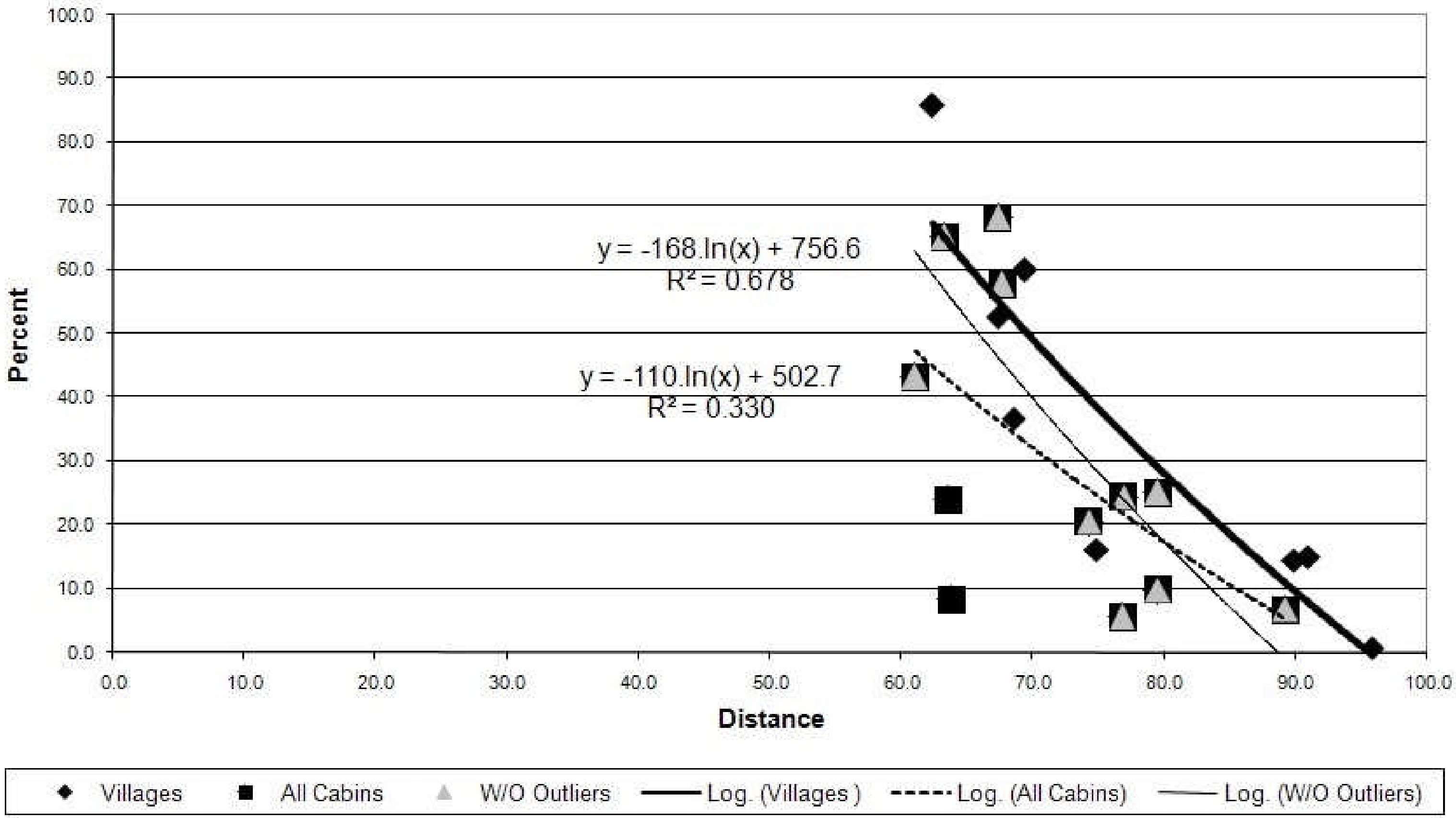


Figure 15: Neutral Villages and Cabins Disyance Decay - Kettle Point Chert



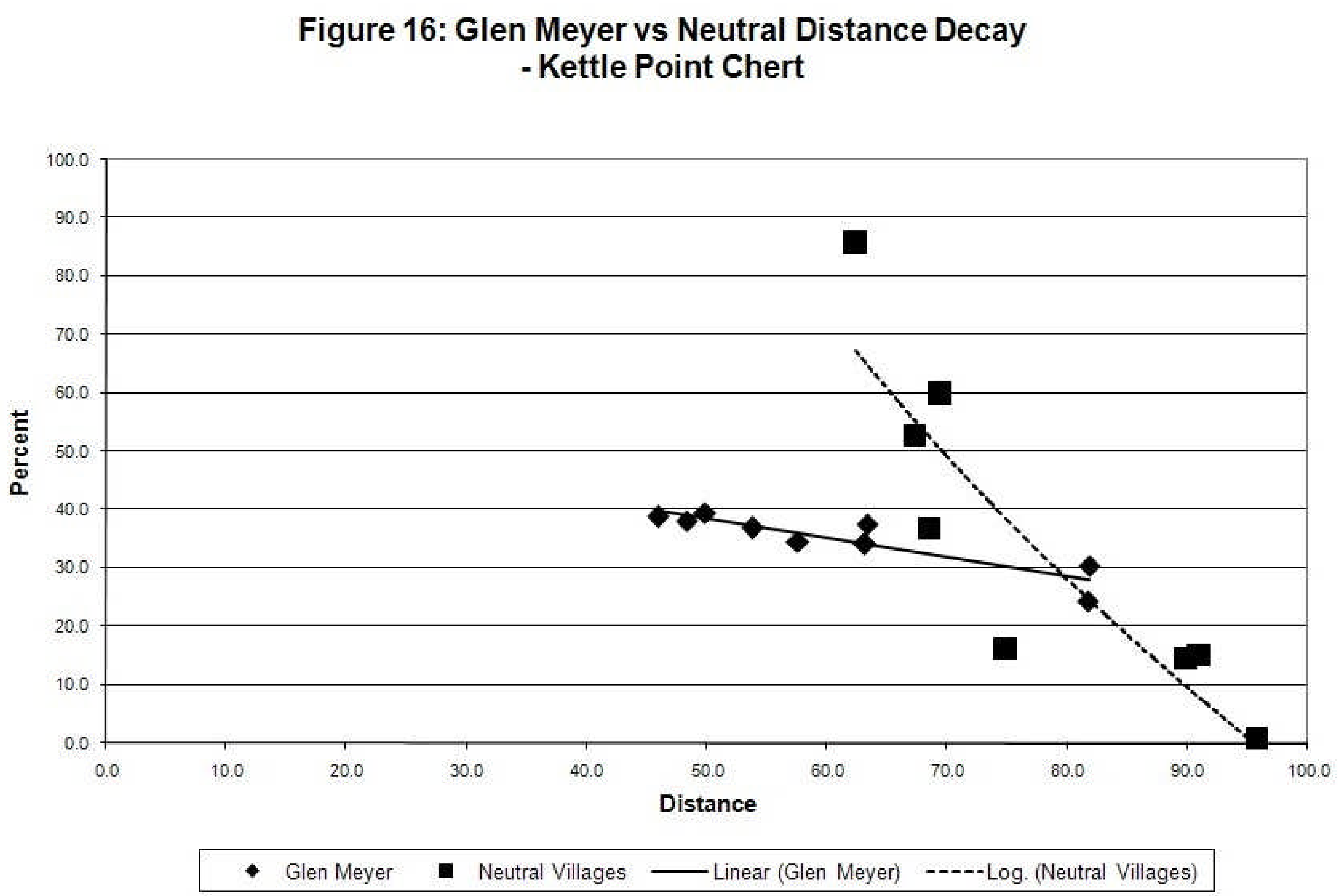


Figure 16: Glen Meyer vs Neutral Distance Decay
- Kettle Point Chert
100.0
90.0
80.0
70.0
60.0
50.0
40.0
30.0
20.0
10.0
0.0
Percent
0.0
10.0
20.0
30.0
40.0
50.0
60.0
70.0
80.0
90.0
100.0
Distance
Glen Meyer
Neutral Villages
Linear (Glen Meyer)
Log. (Neutral Villages)

Figure 17: Onondaga Scatter Plot - Port Dover

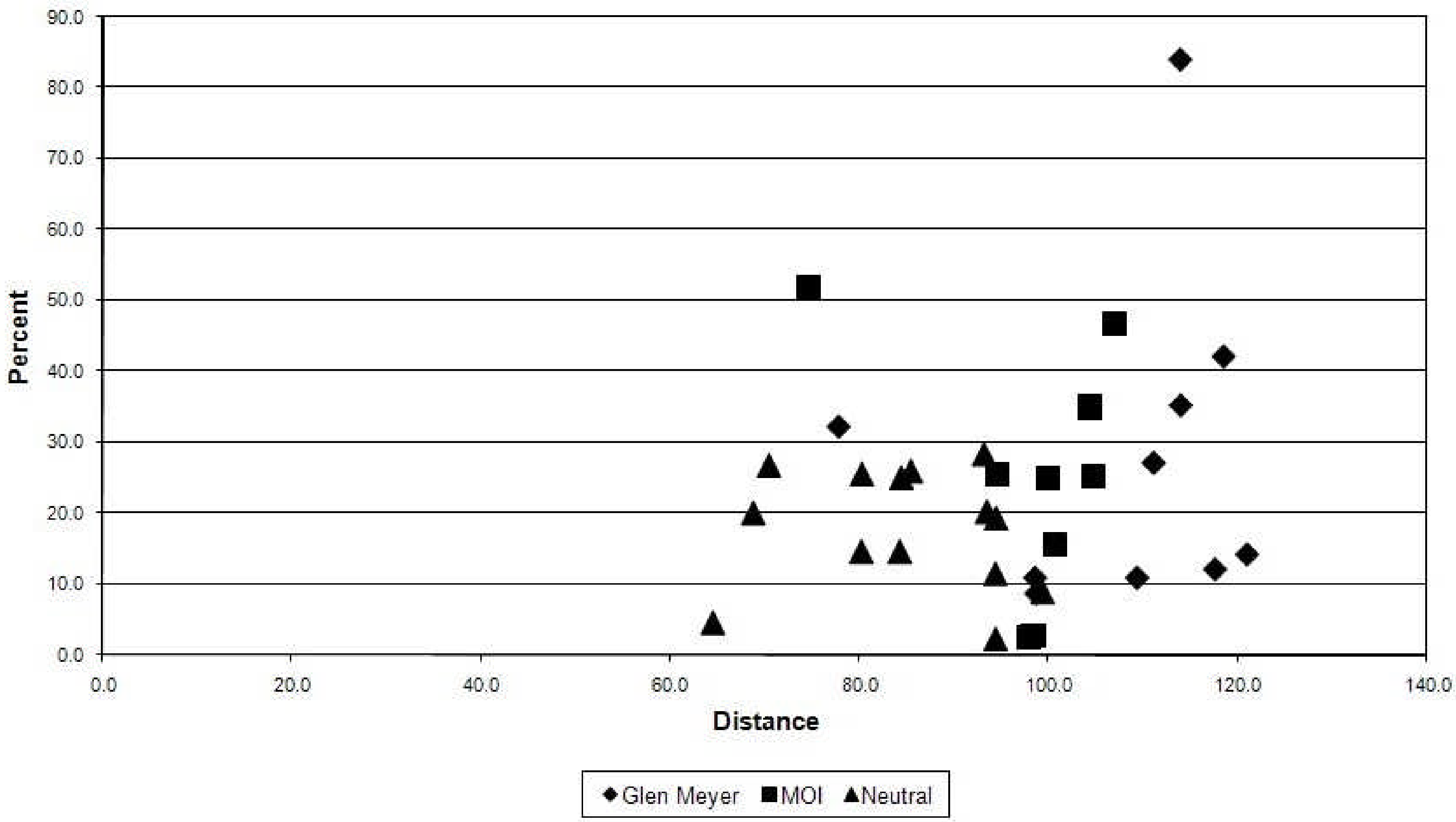
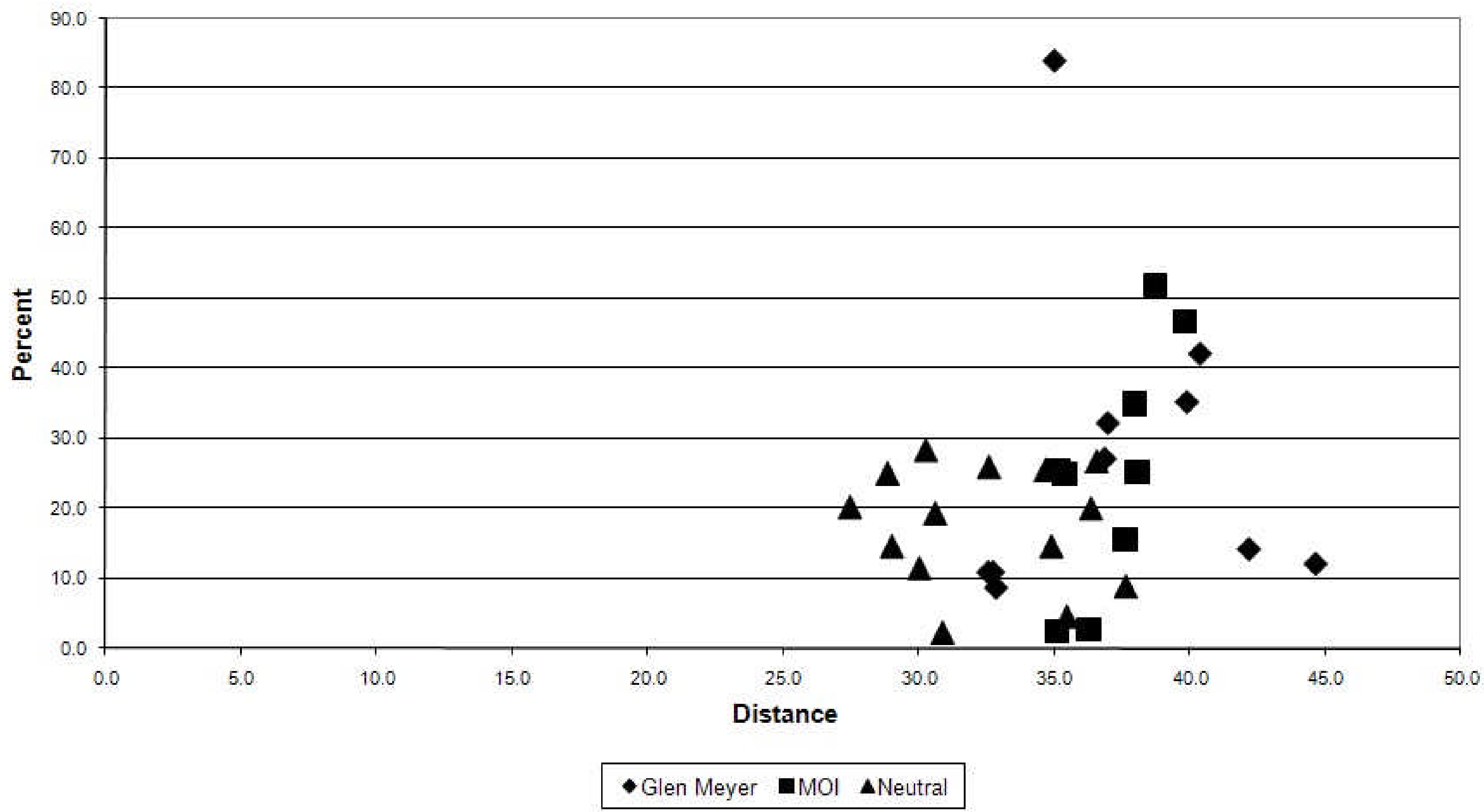


Figure 18: Onondaga Scatter Plot - Port Stanley



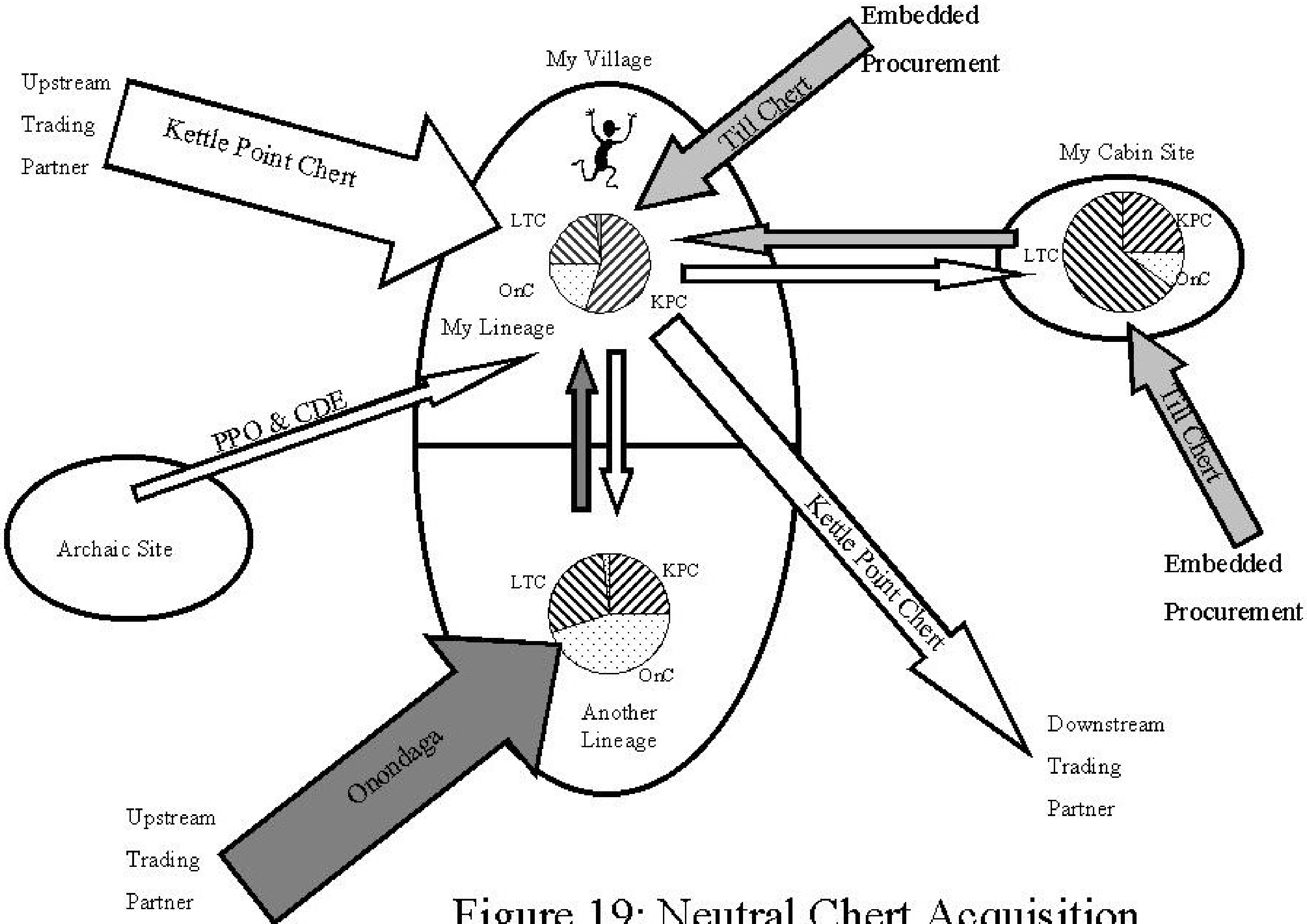


Figure 19: Neutral Chert Acquisition

Appendix A: Site Inventory

Borden	Name	Cluster	Period	Type	Sample and Comments	References
AfHf-4	Pine Tree	Whittaker	Neutral	Village	Surface collection Representative but small	
AfHf-5	Dyjak	Whittaker	Neutral	Cabin	Surface collection Representative but small	Keron 2000a
AfHf-7	Gravel Pit	Whittaker	Neutral	Village	Surface collection Representative	
AfHf-10	Harrietsville	Whittaker	Neutral	Village	Partial excavation Problematic representativeness Note 3 Published KP% only	Keron 1986
AfHg-1	Calvert	Dorchester	Glen Meyer	Village	Excavation, 90% of site Representative Published KP% only	Timmins 1997
AfHg-2	Mustos	Dorchester	Glen Meyer	Village	CSP Representative	Keron 1986
AfHg-13	Skinner	Pond Mills	Neutral	Cabin	Partial excavation Reasonably representative Note1	Keron 1989
AfHg-24	Dorchester Village	Dorchester	Uren	Village	CSP Representative	Keron 2000a, b
AfHg-37	Lone Duck	Pond Mills	Neutral	Cabin	Surface collection Representative but small	Keron 1986
AfHg-38	Paraducks	Pond Mills	Neutral	Cabin	Surface collection Representative but small	Keron 1986
AfHh-1	Laidlaw	Pond Mills	Neutral	Cabin	Partial Excavation Problematic representativeness	Pearce 1996
AfHh-3	Thomas Powerline	Lambeth	Neutral	Village	CSP Representative	Keron 1986
AfHh-10	Brian	Pond Mills	Neutral	Village	CSP Representative	Archaeologix 2001
AfHh-27	Pincombe 1	Lambeth	Neutral	Village	CSP Representative	Timmins 1983
AfHh-65	Cassandra	Lambeth	Neutral	Hamlet	CSP Representative	Keron 1984
AfHh-66	Matthew William	Lambeth	Neutral	Cabin	Surface collection Representative but small	Keron 1984
AfHh-69	Marna	Lambeth	Neutral	Cabin	Surface collection Representative but small	Keron 1984
AfHh-85	Sifton	London	Uren	Cabin	Complete Excavation Representative	Pearce 1996
AfHh-86	Norton	Lambeth	Middleport	Village	Partial Excavation Somewhat representative Note 2	Cooper and Robertson 1993

Borden	Name	Cluster	Period	Type	Sample and Comments	References
AfHh-160	Bradley Ave	Pond Mills	Neutral	Cabin	Complete Excavation Representative Published KP% only	Lennox 1995a
AfHh-320	Sackrider	London	Middleport	Village	Partial Excavation Problematic representativeness	Archaeologix 2002
AfHi-2	Alway	Oxbow	Middleport	Village	Jury Collection small and problematic	Pearce 1996
AfHi-20	Kelly	Caradoc	Glen Meyer	Cabin	Complete Excavation Representative (Note 3)	Williamson 1985, 1986
AfHi-22	Drumholm	Oxbow	Middleport	Village	CSP Representative	Pearce 1996
AfHi-23	Edwards	Oxbow	Middleport	Village	partial Excavation Problematic representativeness	Pearce 1996
AfHi-31	Komoka 3	Caradoc	Glen Meyer	Unk.	Surface Collection Representative but small	Williamson 1985
AfHi-47	Thomas Lewis	London	Neutral	Cabin	Surface Collection Representative	Pearce 1996
AfHi-61	McGrath	Byron	Glen Meyer	Camp	Complete Excavation Representative Published KP% only	Poulton 1985a
AfHi-78	Ski Club	Byron	Glen Meyer	Unk.	Partial Excavation Problematic representativeness	Pearce 1996
AfHi-120	Sosad	Byron	Uren	Unk.	Partial Excavation Problematic representativeness	Pearce 1996
AfHi-178	Preying Mantis	Byron	Glen Meyer	Village	Complete Excavation Representative Note 3	Pearce 1996 Howie-Langs 1998
AfHi-197	TGIF	Byron	Middleport	Village	CSP + Partial Excavation Somewhat problematic	LMA 2001
AfHi-198	Crop Circle	Byron	Middleport	Village	CSP + Partial Excavation Somewhat problematic	LMA 2001
AfHj-14	Roeland	Caradoc	Glen Meyer	Village	Partial Excavation Problematic representativeness Note 3	Williamson 1985
AfHj-17	Melbourne 7	Caradoc	Glen Meyer	Unk.	Surface collection Representative	Williamson 1985
AfHj-19	MiV18	Caradoc	Glen Meyer	Village	Surface Collection Representative Note 3	Williamson 1985
AfHj-26	Caradoc-13	Caradoc	Glen Meyer	Village	Surface collection Representative but small	Williamson 1985
AfHj-105	Caradoc 3	Caradoc	Glen Meyer	Unk.	Surface collection	Williamson

					Representative	1985

Borden	**Site**	**Cluster**	**Period**	**Type**	**Sample and Comments**	**References**
AgHh-1	Lawson	London	Neutral	Village	Partial excavation Problematic representativeness Published KP% only	Pearce 1996
AgHh-10	Ronto	London	Neutral	Cabin	Complete Excavation Representative Published KP% only	Pearce 1983, 1996
AgHh-14	Smallman	London	Neutral	Cabin	Complete Excavation Representative Published KP% only	Pearce 1983, 1996
AgHh-9	Windermere	London	Neutral	Cabin	Complete Excavation Representative Published KP% only	Pearce 1983, 1996

Comments

Problematic Representativeness - This is applied where ever the sample was obtained by only partial excavation of the site since the entire site must be covered to ensure that the sample is representative.

Published KP% Only The collection was not analyzed as part of this study. The only fact taken from the report was the % of Kettle Point chert in the debitage. This percent was then adjusted so that unidentified chert did not count towards the total percentage.

Surface Collection or **CSP** The sample is a complete collection of the surface of the site and so representative. However, some samples are **small** and this is noted.

Note 1: While the sample from Skinner is an excavation from a single midden, it is the only midden on the site and the size has been determined to be similar to that observed for cabins elsewhere.

Note 2: The sample from Norton is from a transect that cuts across the village hitting most houses at right angle. It may still be problematic but is much more likely to be representative than an excavation from a small locus within the site.

Note 3: A randomly selected subset of the debitage was analyzed in this analysis.

Appendix B: Spatial Analysis with GIS

This appendix provides the detailed description of how the intra-site spatial analysis was done using a Geographic Information System (GIS), MFWorks, by Keigan Systems of London, Ontario. The mathematics used and the GIS scripts are included. This discussion assumes some knowledge of MFWorks. There are basically three steps to this analysis.

1. Create a GIS map that divides up the site under consideration into a series of areas to be analyzed. Ideally, the areas so defined should represent units that reflect the cultural use of the space by the inhabitants, for example, longhouses or middens.
2. The flake data must be imported into the GIS creating one map for each type being analyzed. For example, for chert type analysis four maps would be imported, one for each of Kettle Point chert, Onondaga chert, local till chert and "Other" chert.
3. Finally the maps from the above two steps are used to calculate the differences by area and the statistical significance of the differences.

1. Assignment of Village Space

The ideal situation for conducting internal spatial analysis would be where we are dealing with fully excavated sites with complete settlement pattern data. Unfortunately, there is only one fully excavated village site in the London area, the Calvert Site (Timmins 1997). While there are several fully excavated agricultural cabin sites, these are not suitable for the purpose of determining intra-village differential access to chert sources since they usually consist of one or two long houses with an associated midden. Furthermore, these sites would be best interpreted as being occupied by a single lineage. Partial excavations, such as the two midden samples from Harrietsville that initiated this investigation, can be indicative of internal patterning but only tell a partial story and are highly dependent on the areas actually excavated. The only other source of data, then, are the controlled surface pick-ups (CSP) of village sites. While a CSP fails to identify the internal house structure, it defines the site boundaries and can generally define the midden areas. The middens can generally be related to nearby longhouses and consequently to the occupants of those houses. Thus, the midden areas, at least, could be used to define discrete spatial units. The areas between the middens are more problematic with the difficulty coming from not knowing the house orientation. However, if the analysis is restricted to the middens much other information located in the non-midden areas of the site would be discarded. Thus, we are faced with the problem of assigning space within the village but not knowing the underlying settlement patterns.

One possible technique for assigning spatial categories to non-midden areas would be to assign the non-midden area within the site boundary to the nearest midden. With this assignment, various categories of artefacts could then be analyzed using this division of the village as the spatial control. This procedure involves carving up the internal village space and assigning it to the nearest midden by constructing a Voronoi network (Chrisman 1997: 152) around the middens with the MFworks operation _Fence_. Another term for this carving up of space is Theisen polygons (see Hodder and Orton [1976] for another archaeological use of this technique). The script that creates these areas follows.

```
AssignedSpace = Fence NumberedMiddens;
HighMiddens = NumberedMiddens +100;
AAS = Cover AssignedSpace with HighMiddens;
IAA = Cover AAS with Sitemask;
IAA = Cover MapLayer2 with Sitemask;
CA = Recode IAA assigning void to 9999 carryover;
CulturalAreas = Trunc (CA);
```

Briefly, this script breaks all the area within the village into a number of sub-areas. Each midden is a sub-area and all of the interior space within the village is assigned to the nearest midden giving twice as many sub-areas as there are middens. The script requires two input maps, *NumberedMiddens* and *SiteMask*. The first map shows only the midden locations and was created from a map that plots all artefacts recovered with the CSP by tracing out the midden areas. Everything inside the midden boundaries is numbered preferably with the assigned midden numbers (e.g. Midden 1 etc.) and everything else is "void". The second map defines the site boundary and has a value of _1_ outside the village and "void" inside. This map was created by tracing the site boundary as was evident in the original CSP. The result of this process is a map labeled *CulturalAreas*, and it defines the divisions used in this analysis. This map is used as input to the internal spatial analysis.

2. XYZ Input Files

In order to prepare the data required for the analysis, the chert types of the debitage were determined and a spreadsheet constructed showing the artefact type, chert type, and the location in Cartesian Co-ordinates. As normal CSP practices involve recording transit readings (distance and direction from a known point) or compass readings (two directions from each of two known points), it is first necessary to convert the transit or compass readings into Cartesian co-ordinates as most mapping programs require this format to define position and MFworks is no exception. This calculation is done simply using spreadsheets (Keron and Prowse 2001) available on the London Chapter, OAS web site. A sample set of spreadsheet data follows:

Mustos			AfHq-2			
Catno	**Type**	**Subtype**	**Chert**	**East (X)**	**North (Y)**	**Z**
21	cde bfr		ltc	427.568	554.5814	1
76	cde bfr		o	451.9573	517.4861	1
110	cde bfr		uid	414.6886	553.6863	1
12	cde bfr		uid	440.4454	559.5546	1
81	cde bfr		kp	402.1921	539.8409	1
110	cde bfr		kp	414.6886	553.6863	1
81	cde bfr		kp	402.1921	539.8409	1

The data are then imported into the GIS system by importing a "XYZ file". The X and Y are the two Cartesian Co-ordinates from the above spreadsheet and the Y value is the actual count of artefacts at each spot. In the analysis conducted here, there is only one item in each row of the spreadsheet so the value is set to "1".

A second issue arising from CSP field methodology occurs when several items are cataloged at the same pick-up point. While this procedure greatly expedites the time required in the field to collect the original data, it complicates plotting as several items map to the same physical location. The GIS script is capable of dealing with multiple finds at the same point since the “Score” function can accept the totals at each find spot. However, it is desirable visually to see the actual distributions used. In order to break up multiple finds at the same location, a short GIS script was run after each XYZ file was imported into the GIS. This script will take the value of a specific point and create the same number of individual points within a couple of meters (the GIS provides the scaling) of it, thus, creating a visual representation of the original density of recovered material. The script has one minor drawback in that a recurring pattern is created rather than a random pattern that would be visually more appealing.

The script follows:

```
/* CSPMAP SCRIPT
This script is will break up multiple occurrences at the same plot point and create one dot
per artefact. */
AP1 = recode MapLayer1 assigning 0.0 to void, carryover;
AP2 = Filter AP1 Mask ScatterFilter LowPass;
Flakes = recode AP2 assigning 1 to 1...400;
```

Maplayer1 is the default name of the imported XYZ file. It will contain the number of artefacts recorded at each find spot after the import of the XYZ file. The result of the filter operation will be one dot on the map for each artefact recorded at that spot. These dots will be within two metres of the point recorded as the find spot. This scattering is accomplished with a set of calculated values in the filter map that will lead to a series of numbers in the resulting map that vary above and below the value “1" at predefined points as defined in the filter. The script can accommodate up to twenty items at the same point and the result will have exactly the same number points equal to or greater than “1" as is represented at the particular find point. For example, if the value is

“4", there will be four points equal to or greater than “1" and sixteen less than “1". All points less than “1" are dropped and all points greater than or equal to 1 are changed to 1 in the final “Recode” operation. Thus the value of “4" in the example becomes four individual points with the value “1".

The preceding discussion, particularly, assumes a knowledge of MFWorks in general and the “Filter” operation in particular. Without that knowledge, the preceding paragraph will not make sense. It has been included here as documentation for how the script works.

3. Spatial Analysis

With an assignment of the internal space of the site in place and the artefacts being analyzed imported, the next step is to examine the artefact distribution over these areas looking for patterns. This process simply involves counting the number of flakes of each type in each sub-area and then calculating the percentage of each source type by sub-area. As the flakes found within each area can be considered a sample, in the statistical sense, from that area, it is necessary to allow for sampling error to determine whether or not the differences are statistically significant. To do these calculations, more complex statistics are not required and simple confidence intervals can demonstrate non-random variation. The use of confidence intervals brings some assumptions about the nature of the data being used as the confidence interval is a parametric measure. The primary issue from the statistical perspective is that of the randomness of the sample. In the case of a CSP, if the entire site is clearly covered, that is we are not dealing with part of the site being inaccessible due to different crop cover or a bush lot or the use of different methods such as a CSP in a ploughed field combined with test pitting in a bush lot, and the entire CSP has been executed at the same point in time, then it is reasonable to assume that the sample is representative of the entire site. A CSP should meet the requirements of the confidence interval statistic.

The data from the CSP as described above is plotted against the various spatial units as defined in the map *CulturalAreas* by selecting various types and entering it into the GIS as individual maps (i.e. one for each kind of chert). An analysis can then be run showing summaries of total type and percentage by each zone. Once the total of each type has been calculated for each spatial unit, a confidence interval for the percentage of each category, such as Kettle Point chert, is calculated using the following formula

(Wonnacott and Wonnacott (1990: 5):

$$\pi = P \pm \sqrt{\frac{P(1-P)}{n}}$$

Where π is the actual proportion of the total population.
P is the observed proportion in the sample
n is the size of the sample

What the confidence interval means is that the real value of the entire population being measured falls within the range of the specified confidence interval 95% of the time. The calculated range is similar to the range established for a radio-carbon date except that the radio-carbon dates are expressed as one standard deviation and thus the real date lies within the range only 66% of the time. The size of the confidence interval is inversely proportional to the size of the sample. Bigger samples result in a narrower range. Thus, each spatial unit has a confidence interval assigned and it is then necessary to compare the ranges of the intervals against each other. In the simple case, if two middens have confidence intervals that do not overlap, then there is a statistically significant difference in the distributions. For example, if one area of a site has 60 flakes of Onondaga chert out of a total of 396, the confidence interval is 15 +/- 3 %. If another area has 15 flakes out of 617, the confidence interval is 2 +/- 1 %. The two intervals do not overlap and the difference between the middens is statistically significant.

This process is hypothesis testing with H , the null hypothesis, stating that the percentages in each spatial unit are similar to each other. Any observed differences are simply the result of sampling error. The hypothesis being tested H is that there are significant internal differences in the distribution of material over the site.

To implement the calculations in MFWorks requires the use of a number of mathematical functions of the GIS. The site data described above is entered into MFWorks using a "XYZ" file that allows a surface scatter to be plotted. These maps must be aligned properly with the *CulturalAreas* map that allocated the village space. The amount of each chert type is then counted by running a "Score" operation against each area which totals the number of each type per sub-area. These numbers are then used to calculate the confidence interval values for each sub area of the village. The final "Combine" is simply used to create a single legend with all of the pertinent data. The script to do these calculations follows:

```
/* Kettle Point Chert Distribution Analysis Script
Input       - four maps, one for each chert type
            - the CuturalAreas map to be used.
Count the occurrence of each type within each sub-area of the site and calculate the total of
all types */
 KPScore = Score CulturalAreas by KettlePointChert total;
LTCScore = Score CulturalAreas by LTChert total; OnScore =
Score CulturalAreas by OnondagaChert total; OtScore = Score
CulturalAreas by OtherChert total; TotalScore = KPScore +
LTCScore + OnScore + OtScore;
/* Calculate the frequency and the confidence interval of one type for each area and turn the
results into percentages */
 Freq = (KPScore * 1.0) / TotalScore;
StandardError = (1.96 * (Freq * (1-Freq) / TotalScore )^ .5);
Percent = (Trunc (Freq * 1000 + 0.5))/10.0;
 SEPercent = (Trunc (StandardError * 1000 +0.5))/10.0;
 /* Combine the results to create a single legend */
FA1 = Combine CulturalAreas with TotalScore with SEPercent with Percent; /* Plot
the individual points for this execution on the resulting map. */ BA1 = spread
KettlePointChert to 2.5;
 BA2 = recode BA1 assigning 100 to 0...3;
 KPAnalysis = Cover FA1 with BA2;
```

As noted above, when the confidence intervals do not overlap the determination of statistical significance is easy and can be made directly from a review of the legend. However, a problem arises when there is partial overlap. In this case, more statistical calculations are necessary to determine whether or not the differences are statistically significant. It was not possible to implement these calculations in the GIS as it involves comparison of each area of the site with all other areas of the site. In order to calculate whether the differences between areas were statistically significant the data from the legend produced by the preceding script were entered into an Excel spreadsheet that performed the calculations using the following formula to compare each pair of areas. The formula is taken from Wonnacott and Wonnacott (1990):

$$(\pi_1 - \pi_2) = (P_1 - P_2) \pm 1.96\sqrt{\frac{P_1(1-P_1)}{n_1} + \frac{P_2(1-P_2)}{n_2}}$$

Where

P 1 and P2 are the frequency of the particular item (e.g. Kettle Point chert)

each of the two areas being

d n2 are the total number of flakes in each area.

Interpreting the results of this calculation is simply answering the question, "Is zero included within the resulting confidence interval. If the answer is "yes" the differences are not statistically significant. If the answer is "No" the differences are statistically significant. The results of these calculations on the individual sites are included in Appendix C: Chapter Five Tables and the differences that are significant are highlighted.

The result of this analysis is that the differences in percentage of various site areas can be quickly calculated and compared. Once the initial maps of artefact distributions are prepared it is relatively simple to run a number of iterations on the analysis simply by creating different maps defining the cultural areas.

Appendix C: Chapter 5 Tables

Abbreviations Used in Chapter 5 Tables

SE	This is the "Sampling Error" of the confidence interval at the 95% confidence level. For example, if the confidence interval was expressed as 35.2 +/- 4.1%, the SE is 4.1. For the formulas used to derive these numbers see Appendix B.
FREQ	The frequency of the particular item calculated by dividing the number of that type by the total of all types.
PERCENT	The frequency multiplied by 100.
DIFF FREQ	The frequency calcualted by subtracting one frequency being compared from the other being compared. See Appendix B for the formula.
SE of DIFF	The sampling error of the difference between the two confidence intervals being compared. The formula is in Appendix B.
Total N	The total number of all items of all types found in that area of the site.

Table C-1: Brian Site Chert Source Percentages by Area

		Kettle Point Chert		Onondaga Chert		Local Till Chert		UID Chert		
	Total n	Percent	SE	Percent	SE	Percent	SE	Total n	Percent	SE
Area 1	52	9.6	8	23.1	11.5	65.4	12.9	61	14.8	8.9
Area 2	108	25	8.2	16.7	7	57.4	9.3	131	17.6	6.5
Area 3	54	24.1	11.4	27.8	11.9	44.4	13.3	63	14.3	8.6
Area 4	11	18.2	22.7			72.7	26.3	14	21.4	21.5
Area 5	2							3	33.3	53.3
Area 6	23	4.3	8.3	21.7	16.9	73.9	17.9	31	25.8	15.4
Area 7	8	37.5	33.5	37.5	33.5	12.5	22.9	12	33.3	26.7
Midden 1	58	13.8	8.9	6.9	6.5	75.9	11	75	22.7	9.5
Midden 2	72	19.4	9.1	20.8	9.4	58.3	11.4	86	16.3	7.8
Midden 3	63	19	9.7	19	9.7	61.9	12	79	20.3	8.9
Midden 4	58	10.3	7.8	19	10.1	69	11.9	80	27.5	9.8
Midden 5	23	17.4	15.5	17.4	15.5	60.9	19.9	27	14.8	13.4
Midden 6	2							7	71.4	33.5
Midden 7	15	6.7	12.6	6.7	12.6	80	20.2	23	34.8	19.5

Table C-2: Brian Site Flake Type Percentages by Area

		Decortication		Core Trimming		Bifacial Retouch		Shatter		Fragment	
	Total n	Percent	SE	Percent	SE	Percent	SE	Percent	SE	Percent	SE
Area 1	61	14.8	8.9	45.9	12.5	6.6	6.2	4.9	5.4	27.9	11.3
Area 2	131	10.7	5.3	37.4	8.3	8.4	4.7	8.4	4.7	35.1	8.2
Area 3	63	14.3	8.6	44.44	12.3	14.3	8.6	4.8	5.3	22.2	10.3
Area 4	14	14.3	18.3	50	26.2	14.3	18.3			21.4	21.5
Area 5	3			100							
Area 6	30	23.3	15.1	33.3	16.9	10	10.7			33.3	16.9
Area 7	12			16.7	21.1	25	24.5	8.3	15.6	50	28.3
Midden 1	77	6.5	5.5	41.6	11	10.4	6.8	10.4	6.8	31.2	10.3
Midden 2	85	14.1	7.4	28.2	9.6	9.4	6.2	12.9	7.1	35.3	10.2
Midden 3	78	14.1	7.7	33.3	10.5	10.3	6.7	5.1	4.9	37.2	10.7
Midden 4	80	17.5	8.3	45	10	6.3	5.3	5	4.8	26.3	9.6
Midden 5	27	7.4	9.9	44	18.7	7.4	9.9	3.7	7.1	37	18.2
Midden 6	7	14.3	25.9					14.3	25.9	71.4	33.5
Midden 7	22	13.6	14.3	31.8	19.5	18.2	16.1	13.6	14.3	22.7	17.5

Table C-3: Brian Site Kettle Point Chert Differences by Area

Statistically significant differences are highlited.

			Area 1		Area 2		Area 3		Area 4		Area 6		Area 7	
		Total N	52		108		54		11		23		8	
		Freq	0.096		0.25		0.241		0.189		0.043		0.375	
Area	Total N	Freq	Diff Freq	SE of Diff	Diff Freq	SE of Diff	Diff Freq	SE of Diff	Diff Freq	SE of Diff	Diff Freq	SE of Diff	Diff Freq	SE of Diff
Area 1	52	0.096												
Area 2	108	0.25	0.154	0.114371										
Area 3	54	0.241	0.145	0.139371	-0.009	0.140294								
Area 4	11	0.189	0.093	0.24483	-0.061	0.245357	-0.052	0.25796						
Area 5	2	0												
Area 6	23	0.043	-0.053	0.115259	-0.207	0.116373	-0.198	0.141019	-0.146	0.245772				
Area 7	8	0.375	0.279	0.344903	0.125	0.345277	0.134	0.354344	0.186	0.407526	0.332	0.345572		
Midden 1	58	0.138	0.042	0.119542	-0.112	0.120617	-0.103	0.144541	-0.051	0.24781	0.095	0.121459	-0.237	0.347024
Midden 2	72	0.194	0.098	0.121467	-0.056	0.122525	-0.047	0.146137	0.005	0.248744	0.151	0.123354	-0.181	0.347692
Midden 3	63	0.19	0.094	0.125681	-0.06	0.126704	-0.051	0.149658	0.001	0.250829	0.147	0.127506	-0.185	0.349187
Midden 4	58	0.103	0.007	0.111941	-0.147	0.113088	-0.138	0.13832	-0.086	0.244234	0.06	0.113986	-0.272	0.34448
Midden 5	23	0.174	0.078	0.174405	-0.076	0.175143	-0.067	0.192402	-0.015	0.278453	0.131	0.175724	-0.201	0.36953
Midden 6	2	0												
Midden 7	15	0.067	-0.029	0.149736	-0.183	0.150595	-0.174	0.17036	-0.122	0.263705	0.024	0.151271	-0.308	0.358548

			Midden 1		Midden 2		Midden 3		Midden 4		Midden 5		Midden 6	
		Total N	58		72		63		58		23		2	
		Freq	0.138		0.194		0.19		0.103		0.174		0	
Area	TotalN	Freq	Diff Freq	SE of Diff	Diff Freq	SE of Diff	Diff Freq	SE of Diff	Diff Freq	SE of Diff	Diff Freq	SE of Diff	Diff Freq	SE of Diff
Midden 2	72	0.194	0.056	0.127365										
Midden 3	63	0.19	0.052	0.131391	-0.004	0.133144								
Midden 4	58	0.103	-0.035	0.118315	-0.091	0.12026	-0.087	0.124515						
Midden 5	23	0.174	0.036	0.178563	-0.02	0.179857	-0.016	0.18273	0.071	0.173566				
Midden 6	2	0												
Midden 7	15	0.067	-0.071	0.154559	-0.127	0.156052	-0.123	0.159355	-0.036	0.148758	-0.107	0.200038	0.067	0.126529

Table C-4: Brian Site Onondaga Chert Differences by Area

Statistically significant differences are highlited.

			Area 1		Area 2		Area 3		Area 4		Area 6		Area 7	
		Total N	52		108		54		11		23		8	
		Freq	0.231		0.167		0.278		0		0.217		0.375	
Area	**TotalN**	**Freq**	**Diff Freq**	**SE of Diff**	**Diff Freq**	**SE of Diff**	**Diff Freq**	**SE of Diff**	**Diff Freq**	**SE of Diff**	**Diff Freq**	**SE of Diff**	**Diff Freq**	**SE of Diff**
Area 1	52	0.231												
Area 2	108	0.167	-0.064	0.134431										
Area 3	54	0.278	0.047	0.165537	0.111	0.138663								
Area 4	11	0												
Area 5	2	0												
Area 6	23	0.217	-0.014	0.203723	0.05	0.182559	-0.061	0.20654						
Area 7	8	0.375	0.144	0.3545	0.208	0.342776	0.097	0.356126			0.158	0.375402		
Midden 1	58	0.069	-0.162	0.131827	-0.098	0.095933	-0.209	0.136139			-0.148	0.18065	-0.306	0.341763
Midden 2	72	0.208	-0.023	0.14803	0.041	0.117208	-0.07	0.151884			-0.009	0.192793	-0.167	0.348334
Midden 3	63	0.19	-0.041	0.150026	0.023	0.119719	-0.088	0.15383			-0.027	0.19433	-0.185	0.349187
Midden 4	58	0.19	-0.041	0.152699	0.023	0.123052	-0.088	0.156437			-0.027	0.1964	-0.185	0.350343
Midden 5	23	0.174	-0.057	0.192689	0.007	0.170158	-0.104	0.195665			-0.043	0.228878	-0.201	0.36953
Midden 6	2	0												
Midden 7	15	0.067	-0.164	0.170684	-0.1	0.144768	-0.211	0.174036			-0.15	0.210687	-0.308	0.358548

			Midden 1		Midden 2		Midden 3		Midden 4		Midden 5		Midden 6	
		Total N	58		72		63		58		23		2	
		Freq	0.069		0.208		0.19		0.19		0.174		0	
Area	**TotalN**	**Freq**	**Diff Freq**	**SE of Diff**	**Diff Freq**	**SE of Diff**	**Diff Freq**	**SE of Diff**	**Diff Freq**	**SE of Diff**	**Diff Freq**	**SE of Diff**	**Diff Freq**	**SE of Diff**
Midden 2	72	0.208	0.139	0.114212										
Midden 3	63	0.19	0.121	0.116787	-0.018	0.134811								
Midden 4	58	0.19	0.121	0.120201	-0.018	0.137779	0	0.139921						
Midden 5	23	0.174	0.105	0.168109	-0.034	0.181095	-0.016	0.18273	-0.016	0.18493				
Midden 6	2	0												
Midden 7	15	0.067	-0.002	0.142353	-0.141	0.157477	-0.123	0.159355	-0.123	0.161873	-0.107	0.200038	0.067	0.126529

Table C-5: Brian Site Local Till Chert Differences by Area

Statistically significant differences are highlited.

			Area 1		Area 2		Area 3		Area 4		Area 6		Area 7	
		Total N		52		108		54		11		23		8
		Freq		0.654		0.574		0.444		0.727		0.739		0.125
Area	TotalN	Freq	Diff Freq	SE of Diff	Diff Freq	SE of Diff	Diff Freq	SE of Diff	Diff Freq	SE of Diff	Diff Freq	SE of Diff	Diff Freq	SE of Diff
Area 1	52	0.654												
Area 2	108	0.574	-0.08	0.159421										
Area 3	54	0.444	-0.21	0.185147	-0.13	0.162049								
Area 4	11	0.727	0.073	0.293309	0.153	0.279305	0.283	0.294746						
Area 5	2	0												
Area 6	23	0.739	0.085	0.221208	0.165	0.202271	0.295	0.22311	0.012	0.318636				
Area 7	8	0.125	-0.529	0.263133	-0.449	0.247426	-0.319	0.264734	-0.602	0.349049	-0.614	0.291097		
Midden 1	58	0.759	0.105	0.169802	0.185	0.144268	0.315	0.172272	0.032	0.285357	0.02	0.21055	0.634	0.254239
Midden 2	72	0.583	-0.071	0.172303	0.009	0.147204	0.139	0.174738	-0.144	0.286853	-0.156	0.212573	0.458	0.255916
Midden 3	63	0.619	-0.035	0.176347	0.045	0.151917	0.175	0.178726	-0.108	0.2893	-0.12	0.215863	0.494	0.258656
Midden 4	58	0.69	0.036	0.17574	0.116	0.151213	0.246	0.178128	-0.037	0.288931	-0.049	0.215368	0.565	0.258243
Midden 5	23	0.609	-0.045	0.237675	0.035	0.220159	0.165	0.239446	-0.118	0.330281	-0.13	0.268306	0.484	0.303799
Midden 6	2	0												
Midden 7	15	0.8	0.146	0.240196	0.226	0.222879	0.356	0.241949	0.073	0.3321	0.061	0.270542	0.675	0.305776

			Midden 1		Midden 2		Midden 3		Midden 4		Midden 5		Midden 6	
		Total N		58		72		63		58		23		2
		Freq		0.759		0.583		0.619		0.69		0.609		0
Area	TotalN	Freq	Diff Freq	SE of Diff	Diff Freq	SE of Diff	Diff Freq	SE of Diff	Diff Freq	SE of Diff	Diff Freq	SE of Diff	Diff Freq	SE of Diff
Midden 1	58	0.759												
Midden 2	72	0.583	-0.176	0.158388										
Midden 3	63	0.619	-0.14	0.162777	0.036	0.165385								
Midden 4	58	0.69	-0.069	0.162121	0.107	0.164739	0.071	0.168963						
Midden 5	23	0.609	-0.15	0.227789	0.026	0.229659	-0.01	0.232708	-0.081	0.232249				
Midden 6	2	0												
Midden 7	15	0.8	0.041	0.230418	0.217	0.232268	0.181	0.235283	0.11	0.234829	0.191	0.284164	0.8	0.202428

Table C-6: Cassandra Site Chert Source Percentages by Area

		Kettle Point Chert		Onondaga Chert		Local Till Chert		UID Chert		
	Total n	Percent	SE	Percent	SE	Percent	SE	Total n	Percent	SE
Area 1	6	50	40	16.7	29.8	16.7	29.8	9	33.3	30.8
Area 2	5	20	35.1	40	42.9	40	42.9	6	16.7	29.8
Area 3	4	25	42.4	50	49	25	42.4	4		
Midden 1	47	53.2	14.3	17	10.7	29.8	13.1	57	17.5	9.9
Midden 2	33	60.6	16.7	18.2	13.2	21.2	13.9	36	8.3	9
Midden 3	19	57.9	22.2	36.8	21.7	5.3	10	27	29.6	17.2

Table C-7: Cassandra Site Flake Type Percentages by Area

		Decortication		Core Trimming		Bifacial Retouch		Shatter		Fragment	
	Total n	Percent	SE	Percent	SE	Percent	SE	Percent	SE	Percent	SE
Area 1	9	11.1	20.5	22.2	27.2	11.1	20.5			55.6	32.5
Area 2	6	33.3	37.7	16.7	30.8					50	40
Area 3	4			25	42.4	25	42.4	25	42.4	25	42.4
Midden 1	58	10.3	7.8	36.2	12.4	13.8	8.9	5.2	5.7	34.5	12.2
Midden 2	35	20	13.3	20	13.3	14.3	11.6	8.6	9.3	37.1	16
Midden 3	26	11.5	12.3	30.8	17.7	15.4	13.9	11.5	12.3	30.8	17.7

Table C-8: Cassandra Site Local Till Chert Differences by Area

Statistically significant differences are highlited.

			Area 1		Area 2		Area 3		Midden 1		Midden 2	
		Total N	6		5		4		47		33	
		Freq	0.167		0.4		0.25		0.298		0.212	
	TotalN	Freq	Diff Freq	SE of Diff	Diff Freq	SE of Diff	Diff Freq	SE of Diff	Diff Freq	SE of Diff	Diff Freq	SE of Diff
Area 1	6	0.167										
Area 2	5	0.4	0.233	0.522939								
Area 3	4	0.25	0.083	0.51879	-0.15	0.603715						
Midden 1	47	0.298	0.131	0.325833	-0.102	0.448883	0.048	0.444043				
Midden 2	33	0.212	0.045	0.329417	-0.188	0.451491	-0.038	0.446679	-0.086	0.191171		
Midden 3	19	0.053	-0.114	0.314986	-0.347	0.441072	-0.197	0.436146	-0.245	0.165067	-0.159	0.172033

Table C-9: Dorchester Village Site Chert Source Percentages by Area (Three Areas)

	Total n	Kettle Point Chert		Onondaga Chert		Local Till Chert		UID Chert		
		Percent	SE	Percent	SE	Percent	SE	Total n	Percent	SE
West	55	14.5	9.3	43.6	13.1	34.5	12.6	69	20.3	9.5
Central	59	5.1	5.6	59.3	12.5	28.8	11.6	68	13.2	8.1
East	44	4.5	4.5	59.1	14.5	29.5	13.5	58	24.1	11

Table C-10: Dorchester Village Site Chert Source Percentages by Area (KP Area vs the Rest)

	Total n	Kettle Point Chert		Onondaga Chert		Local Till Chert	
		Percent	SE	Percent	SE	Percent	SE
KP Area	19	31.6	20.9	31.6	20.9	31.6	20.9
The Rest	140	5	3.6	57.1	8.2	30.7	7.6

Table C-11: Dorchester Village Flake Type Percentages by Area

		Decortication		Core Trimming		Bifacial Retouch		Shatter		Fragment	
	Total n	Percent	SE	Percent	SE	Percent	SE	Percent	SE	Percent	SE
West	68	22.1	9.9	33.8	11.2	10.3	7.2	5.9	5.6	27.9	10.7
Central	67	16.4	8.9	32.8	11.2	19.4	9.5	4.5	5	26.9	10.6
East	56	14.3	9.2	28.6	11.8	17.9	10	14.3	9.2	25	11.3

Table C-12: Dorchester Village Site Local Till Chert Differences by Area (KP Area vs the Rest)

Statistically significant differences are highlited.

			KP Area	
		Total N		19
		Freq		0.316
Area	TotalN	Freq	Diff Freq	SE of Diff
KP Area	19	0.316		
The Rest	140	0.05	-0.266	0.212145

Table C-13: Mustos Site Chert Source Percentages by Area (East-West Split)

	Total n	Kettle Point Chert		Onondaga Chert		Local Till Chert		UID Chert		
		Percent	SE	Percent	SE	Percent	SE	Total n	Percent	
East	89	21.3	8.5	27	14.3	39.3	10.1	117	23.9	7.7
West	37	32.4	15.1	33.7	9.8	40.5	15.8	51	27.5	12.2

Table C-14: Mustos Flake Type Percentages by Area (East-West Split)

	Total n	Decortication		Core Trimming		Bifacial Retouch		Shatter		Fragment	
		Percent	SE	Percent	SE	Percent	SE	Percent	SE	Percent	SE
East	48	10.4	8.6	33.6	8.6	12.5	9.4	6.3	6.8	31.3	13.1
West	116	11.2	5.7	39.6	13.8	4.3	3.7	17.2	6.9	33.5	8.6

Table C-15: Mustos Site Debitage Differences by Area (East-West Split) - Shatter

Statistically significant differences are highlited.

				East
		Total N		116
		Freq		0.172
Area	TotalN	Freq	Diff Freq	SE of Diff
East	116	0.172		
West	48	0.063	-0.109	0.097164

Table C-16: Mustos Site Chert Source Percentages by Area (North-South Split)

	Total n	Kettle Point Chert		Onondaga Chert		Local Till Chert		UID Chert		
		Percent	SE	Percent	SE	Percent	SE	Total n	Percent	SE
North	3	0		66.7	53.3	33.3	53.3	5	40	42.9
Central	68	30.9	11	27.9	10.7	35.3	11.4	86	20.9	8.6
South	55	18.2	10.2	34.5	12.6	45.5	13.2	77	28.6	10.1

Table C-17: Mustos Flake Type Percentages by Area (North-South Split)

	Total n	Decortication		Core Trimming		Bifacial Retouch		Shatter		Fragment	
		Percent	SE	Percent	SE	Percent	SE	Percent	SE	Percent	SE
North	5	20	35.1	60	42.9	0		0		20	35.1
Central	84	9.5	6.3	38.1	10.4	10.7	6.6	11.9	6.9	29.8	9.8
South	75	12	7.4	30.7	10.4	2.7	3.6	17.3	8.6	37.3	10.9

Table C-18: Mustos Site Debitage Differences by Area (North-South Split) - Bifacial Retouch Flakes

Statistically significant differences are highlited.

			North		Central	
		Total N	5		84	
		Freq	0		0.107	
Area	TotalN	Freq	Diff Freq	SE of Diff	Diff Freq	SE of Diff
North	5	0				
Central	84	0.107	0.107	0.066105		
South	75	0.027	0.027	0.036683	-0.08	0.075601

Table C-19: Drumholm Site Chert Source Percentages by Area

	Total n	Kettle Point Chert		Onondaga Chert		Local Till Chert		UID Chert			
		Percent	SE	Percent	SE	Percent	SE		Total n	Percent	SE
Midden 1	12	58.3	27.9	8.3	15.6	33.3	26.7		21	42.9	21.2
Area 1	5	60	42.3	0		40	42.9		6	16.7	29.8
Midden 2	54	35.2	12.7	25.9	11.7	37	12.9		90	40	10.1
Area 2	11	36.4	28.4	9.1	17	54.5	29.4		14	21.4	21.5
Midden 4	14	42.9	25.9	7.1	13.5	50	26.2		17	17.6	18.1
Area 4	17	29.4	21.7	52.9	23.7	17.6	18.1		21	19	16.8
Midden 5	23	8.7	11.5	65.2	19.5	26.1	17.9		25	8	10.6
Midden 6	26	3.8	7.4	50	19.2	46.2	19.2		27	3.7	7.1
Area 6	10	10	18.6	60	30.4	30	28.4		14	28.6	23.7
Midden 7	18	0	0	83.3	17.2	16.7	17.2		20	10	13.1
Midden 9	18	38.9	22.5	16.7	17.2	38.9	22.5		23	21.7	16.9
Area 9	5	80	35.1	0		0			6	16.7	29.8
Midden 11	7	14.3	25.9	42.9	36.7	42.9	36.7		7	0	

Table C-20: Drumholm Site Flake Type Percentages by Area

		Decortication		Core Trimming		Bifacial Retouch		Shatter		Fragment	
	Total n	Percent	SE	Percent	SE	Percent	SE	Percent	SE	Percent	SE
Midden 1	21	14.3	15	38.1	20.8	23.8	18.2	0		23.8	18.2
Area 1	6	50	40	16.7	29.8	0		0		33.3	37.7
Midden 2	91	13.2	7	42.9	10.2	12.1	6.7	8.8	5.8	23.1	8.7
Area 2	14	14.3	18.3	42.9	25.9	7.1	13.5	14.3	18.3	21.4	21.5
Midden 4	17	5.9	11.2	47.1	23.7	29.4	21.7	0		17.6	18.1
Area 4	21	4.8	9.1	38.1	20.8	19	16.8	9.5	12.6	28.6	19.3
Midden 5	25	8	10.6	28.6	33.5	12	12.7	0		52	19.6
Midden 6	26	3.8	7.4	46.2	19.2	11.5	12.3	3.8	7.4	34.6	18.3
Area 6	15	0		40	24.8	6.7	12.6	6.7	12.6	46.7	25.2
Midden 7	20	5	9.6	45	21.8	0		15	15.6	35	20.9
Midden 9	23	13	13.8	34.8	19.5	17.4	15.5	13	13.8	21.7	16.9
Area 9	6	0		0		33.3	37.7	0		66.7	37.7
Midden 11	7	57.1	36.7	28.6	33.5	14.3	25.9	0		0	

Table C-21: Drumholm Site Kettle Point Chert Differences

Statistically significant differences are highlited.

			Area 1		Area 2		Area 4		Area 6		Area 9		Midden 1	
	Total N		5		11		17		10		5		12	
	Freq		0.6		0.364		0.294		0.1		0.8		0.582	
Area	TotalN	Freq	Diff Freq	SE of Diff	Diff Freq	SE of Diff	Diff Freq	SE of Diff	Diff Freq	SE of Diff	Diff Freq	SE of Diff	Diff Freq	SE of Diff
Area 1	5	0.6												
Area 2	11	0.364	-0.236	0.515021										
Area 4	17	0.294	-0.306	0.480938	-0.07	0.357427								
Area 6	10	0.1	-0.5	0.467944	-0.264	0.339741	-0.194	0.285445						
Area 9	5	0.8	0.2	0.554372	0.436	0.451421	0.506	0.412111	0.7	0.39687				
Midden 1	12	0.582	-0.018	0.51213	0.218	0.39841	0.288	0.35325	0.482	0.335343	-0.218	0.44812		
Midden 2	54	0.352	-0.248	0.44791	-0.012	0.311571	0.058	0.25126	0.252	0.225391	-0.448	0.373039	-0.23	0.30677
Midden 4	14	0.429	-0.171	0.501611	0.065	0.384794	0.135	0.337818	0.329	0.319047	-0.371	0.43606	-0.153	0.380917
Midden 5	23	0.087	-0.513	0.444594	-0.277	0.306784	-0.207	0.245299	-0.013	0.218727	-0.713	0.36905	-0.495	0.301907
Midden 6	26	0.038	-0.562	0.435658	-0.326	0.293685	-0.256	0.228705	-0.062	0.199939	-0.762	0.358235	-0.544	0.288586
Midden 7	18	0	-0.6	0.429414	-0.364	0.284341	-0.294	0.216575	-0.1	0.185942	-0.8	0.350615	-0.582	0.279071
Midden 9	18	0.389	-0.211	0.484895	0.025	0.362734	0.095	0.312459	0.289	0.292062	-0.411	0.416722	-0.193	0.358618
Midden 11	7	0.143	-0.457	0.50165	-0.221	0.384845	-0.151	0.337877	0.043	0.319109	-0.657	0.436105	-0.439	0.380968

			Midden 2		Midden 4		Midden 5		Midden 6		Midden 7		Midden 9	
	Total N		54		14		23		26		18		18	
	Freq		0.352		0.429		0.087		0.038		0		0.389	
	TotalN	Freq	Diff Freq	SE of Diff	Diff Freq	SE of Diff	Diff Freq	SE of Diff	Diff Freq	SE of Diff	Diff Freq	SE of Diff	Diff Freq	SE of Diff
Midden 4	14	0.429	0.077	0.288866										
Midden 5	23	0.087	-0.265	0.171738	-0.342	0.283697								
Midden 6	26	0.038	-0.314	0.147065	-0.391	0.269477	-0.049	0.136632						
Midden 7	18	0	-0.352	0.127385	-0.429	0.259262	-0.087	0.115183	-0.038	0.073493				
Midden 9	18	0.389	0.037	0.258753	-0.04	0.343428	0.302	0.252968	0.351	0.236912	0.389	0.225224		
Midden 11	7	0.143	-0.209	0.288934	-0.286	0.366705	0.056	0.283766	0.105	0.26955	0.143	0.259338	-0.246	0.343485

Table C-22: Drumholm Site Onondaga Chert Differences

Statistically significant differences are highlited.

			Area 1		Area 2		Area 4		Area 6		Area 9		Midden 1	
		Total N	5		11		17		10		5		12	
		Freq	0		0.091		0.529		0.6		0		0.083	
	TotalN	Freq	Diff Freq	SE of Diff	Diff Freq	SE of Diff	Diff Freq	SE of Diff	Diff Freq	SE of Diff	Diff Freq	SE of Diff	Diff Freq	SE of Diff
Area 1	5	0												
Area 2	11	0.091	0.091	0.169966										
Area 4	17	0.529	0.529	0.237285	0.438	0.291878								
Area 6	10	0.6	0.6	0.303642	0.509	0.347975	0.071	0.38536						
Area 9	5	0	0	0	-0.091	0.169966	-0.529	0.237285	-0.6	0.303642				
Midden 1	12	0.083	0.083	0.156095	-0.008	0.230769	-0.446	0.284024	-0.517	0.341415	0.083	0.156095		
Midden 2	54	0.259	0.259	0.116847	0.168	0.206256	-0.27	0.264494	-0.341	0.325349	0.259	0.116847	0.176	0.194984
Midden 4	14	0.071	0.071	0.134533	-0.02	0.216766	-0.458	0.27277	-0.529	0.332111	0.071	0.134533	-0.012	0.20607
Midden 5	23	0.652	0.652	0.194673	0.561	0.25843	0.123	0.306923	0.052	0.360688	0.652	0.194673	0.569	0.249526
Midden 6	26	0.5	0.5	0.192194	0.409	0.256568	-0.029	0.305356	-0.1	0.359356	0.5	0.192194	0.417	0.247597
Midden 7	18	0.833	0.833	0.172306	0.742	0.242029	0.304	0.293246	0.233	0.349124	0.833	0.172306	0.75	0.232497
Midden 9	18	0.167	0.167	0.172306	0.076	0.242029	-0.362	0.293246	-0.433	0.349124	0.167	0.172306	0.084	0.232497
Midden 11	7	0.429	0.429	0.366652	0.338	0.404131	-0.1	0.436735	-0.171	0.476059	0.429	0.366652	0.346	0.398496

			Midden 2		Midden 4		Midden 5		Midden 6		Midden 7		Midden 9	
		Total N	54		14		23		26		18		18	
		Freq	0.259		0.071		0.652		0.5		0.833		0.167	
	TotalN	Freq	Diff Freq	SE of Diff	Diff Freq	SE of Diff	Diff Freq	SE of Diff	Diff Freq	SE of Diff	Diff Freq	SE of Diff	Diff Freq	SE of Diff
Midden 4	14	0.071	-0.188	0.178192										
Midden 5	23	0.652	0.393	0.227048	0.581	0.236636								
Midden 6	26	0.5	0.241	0.224926	0.429	0.234601	-0.152	0.273562						
Midden 7	18	0.833	0.574	0.208189	0.762	0.218606	0.181	0.259975	0.333	0.258124				
Midden 9	18	0.167	-0.092	0.208189	0.096	0.218606	-0.485	0.259975	-0.333	0.258124	-0.666	0.243678		
Midden 11	7	0.429	0.17	0.38482	0.358	0.390554	-0.223	0.415128	-0.071	0.413971	-0.404	0.405121	0.262	0.405121

Table C-23: Drumholm Site Local Till Chert Differences

Statistically significant differences are highlited.

Area	TotalN	Freq	Area 1 Diff Freq	Area 1 SE of Diff	Area 2 Diff Freq	Area 2 SE of Diff	Area 4 Diff Freq	Area 4 SE of Diff	Area 6 Diff Freq	Area 6 SE of Diff	Area 9 Diff Freq	Area 9 SE of Diff	Midden 1 Diff Freq	Midden 1 SE of Diff
Total N			5		11		17		10		5		12	
Freq			0.4		0.545		0.176		0.3		0		0.333	
Area 1	5	0.4												
Area 2	11	0.545	0.145	0.520575										
Area 4	17	0.176	-0.224	0.466014	**-0.369**	**0.345505**								
Area 6	10	0.3	-0.1	0.51485	-0.245	0.408993	0.124	0.336817						
Area 9	5	0	-0.4	0.429414	**-0.545**	**0.294282**	-0.176	0.18103	**-0.3**	**0.284031**				
Midden 1	12	0.333	-0.067	0.505472	-0.212	0.397123	0.157	0.3223	0.033	0.389588	**0.333**	**0.266655**		
Midden 2	54	0.37	-0.03	0.446308	-0.175	0.321224	0.194	0.22216	0.07	0.31186	**0.37**	**0.128775**	0.037	0.296122
Midden 4	14	0.5	0.1	0.502988	-0.045	0.393957	**0.324**	**0.31839**	0.2	0.386359	**0.5**	**0.261916**	0.167	0.373772
Midden 5	23	0.261	-0.139	0.465417	-0.284	0.344699	0.085	0.254927	-0.039	0.33599	**0.261**	**0.179488**	-0.072	0.321436
Midden 6	26	0.462	0.062	0.470236	-0.083	0.351179	**0.286**	**0.263623**	0.162	0.342635	**0.462**	**0.191638**	0.129	0.328375
Midden 7	18	0.167	-0.233	0.462694	**-0.378**	**0.341015**	-0.009	0.249923	-0.133	0.332209	0.167	0.172306	-0.166	0.317482
Midden 9	18	0.389	-0.011	0.484895	-0.156	0.370578	0.213	0.28896	0.089	0.362491	**0.389**	**0.225224**	0.056	0.349043
Midden 11	7	0.429	0.029	0.564651	-0.116	0.470144	0.253	0.408908	0.129	0.463796	**0.429**	**0.366652**	0.096	0.453364

Area	TotalN	Freq	Midden 2 Diff Freq	Midden 2 SE of Diff	Midden 4 Diff Freq	Midden 4 SE of Diff	Midden 5 Diff Freq	Midden 5 SE of Diff	Midden 6 Diff Freq	Midden 6 SE of Diff	Midden 7 Diff Freq	Midden 7 SE of Diff	Midden 9 Diff Freq	Midden 9 SE of Diff
Total N			54		14		23		26		18		18	
Freq			0.37		0.5		0.261		0.462		0.167		0.389	
Midden 4	14	0.5	0.13	0.291861										
Midden 5	23	0.261	-0.109	0.220904	-0.239	0.317515								
Midden 6	26	0.462	0.092	0.230885	-0.038	0.324538	0.201	0.262566						
Midden 7	18	0.167	-0.203	0.21511	**-0.333**	**0.313511**	-0.094	0.248808	**-0.295**	**0.25771**				
Midden 9	18	0.389	0.019	0.25944	-0.111	0.345436	0.128	0.287996	-0.073	0.295721	0.222	0.283576		
Midden 11	7	0.429	0.059	0.388608	-0.071	0.450592	0.168	0.408227	-0.033	0.413713	0.262	0.405121	0.04	0.430302

Appendix D: Chapter 6 Tables

Table D-1: Site Data for Distance Decay Analysis

Site	Borden	Period	Site Type used in Analysis	Kettle Point Chert		Onondaga Chert		
				Distance	Percent	Distance Pt Stanley	Distance Pt. Dover	Percent
Calvert	AfHg-1	Glen Meyer		81.8	30.4			
McGrath	AfHi-61	Glen Meyer	Outlier	60.9	99.1			
Kelly	AfHi-20	Glen Meyer		57.6	34.6	32.7	109.4	11.0
Komoka 3	AfHi-31	Glen Meyer		53.8	36.9	36.9	111.1	27.2
Caradoc 3	AfHj-105	Glen Meyer	Outlier	50.6	0.9	39.9	114.0	35.3
Melbourne 7	AfHj-17	Glen Meyer	Outlier	55.2	5.9	35.0	114.0	84.0
Roeland	AfHj-14	Glen Meyer		45.9	38.8	44.6	117.6	12.2
Caradoc-13	AfHj-26	Glen Meyer		48.3	38.1	42.2	121.0	14.3
Mustos	AfHg-2	Glen Meyer		81.7	24.4	37.0	77.7	32.3
MiV18	AfHj-19	Glen Meyer		49.9	39.5	40.4	118.6	42.2
Ski Club	AfHi-78	Glen Meyer		63.1	34.1	32.9	98.7	8.8
Preying Mantis	AfHi-178	Glen Meyer		63.3	37.6	32.6	98.6	11.0
Sackrider	AfHh-320	Middleport		62.2	32.3	36.3	98.4	2.7
Crop Circle/TGIF	AfHi-198	Middleport		59.9	10.7	37.6	100.6	15.6
Edwards	AfHi-23	Middleport		56.5	24.7	38.0	104.8	25.2
Norton	AfHh-86	Middleport		65.8	11.0	35.2	94.6	25.5
DrumHolm	AfHi-22	Middleport		56.9	26.5	37.9	104.4	34.9
Alway	AfHi-2	Middleport		54.3	40.0	39.8	106.9	46.7
Sosad	AfHi-120	MOI -Uren		61.2	7.1	35.4	99.9	25.0
Dorchester Village	AfHg-24	MOI -Uren		84.6	6.7	38.7	74.7	51.8
Sifton	AfHh-85	MOI -Uren		62.9	13.5	35.1	97.9	2.5
Matthew William	AfHh-66	Neutral	Cabin	67.3	68.2	30.9	94.3	2.3
Marna	AfHh-69	Neutral	Cabin	67.6	57.7	30.0	94.3	11.5
Skinner	AfHg-13	Neutral	Cabin	76.9	24.4	29.0	84.2	14.6
Paraducks	AfHg-38	Neutral	Cabin	79.5	25.0	34.9	80.2	14.6
Lone Duck	AfHg-37	Neutral	Cabin	79.5	9.8	34.7	80.2	25.5
Bradley Ave	AfHh-160	Neutral	Cabin	74.2	20.6			
Ronto	AgHh-10	Neutral	Cabin	63.8	8.3			
Smallman	AgHh-14	Neutral	Cabin	63.3	65.2			
Windermere	AgHh-9	Neutral	Cabin	63.5	24.0			
Laidlaw	AfHh-1	Neutral	Cabin	76.8	5.5	28.8	84.4	25.0
Thomas Lewis	AfHi-47	Neutral	Cabin	61.0	43.2	37.7	99.3	8.9
Cassandra	AfHh-65	Neutral	Hamlet	67.4	52.6	30.6	94.4	19.3
Gravel Pit	AfHf-7	Neutral	Village	95.8	0.7	35.5	64.5	4.6
Pine Tree	AfHf-4	Neutral	Village	90.9	15.0	36.4	68.8	20.0
Thomas Powerline	AfHh-3	Neutral	Village	69.4	59.9	27.4	93.4	20.2
Brian	AfHh-10	Neutral	Village	74.8	16.2	32.6	85.4	25.9
Dyjak	AfHf-5	Neutral	Village	89.2	6.7	36.6	70.4	26.7
Pincombe	AfHh-27	Neutral	Village	68.5	36.8	30.3	93.1	28.3
Harrietsville	AfHf-10	Neutral	Village	89.9	14.4			
Lawson	AgHh-1	Neutral	Village	62.4	85.8			

Tables D-2: R-Squared Values of Various Regression Lines

Equation Type	EOI	MOI	LOI- villages	LOI-cabins	
				All	w/o outliers
Exponential	0.7815	0.4417	0.7104	0.3303	0.6782
Linear	0.809	0.3575	0.7587	0.3529	0.6647
Power	0.7509	0.4719	0.6965	0.3349	0.6749
Log	0.7828	0.3939	0.7857	0.3445	0.6606

Table D-3: Average Across All Glen Meyer Analyzed Flakes

	O	KP	LTC	Other	UID	Flake
Total %	19.9	33.8	44.1	2.1		
DC	3.4	6.6	18.2	8.2	3.3	9.4
CT	38.8	45.5	39.7	42.6	25.3	38.0
BFR	11.5	9.3	5.3	16.4	4.0	7.2
SH	1.4	7.4	10.4	3.3	13.4	8.7
Frag	44.6	30.6	25.8	29.5	53.8	36.1

Table D-4: Average Across All Middle Iroquoian Analyzed Flakes

	O	KP	LTC	Other	UID	Flake Type %
Total %	16.1	22.6	59.8	1.5		
DC	3.0	8.7	20.0	9.2	5.8	12.2
CT	32.7	42.5	40.8	49.4	28.7	37.0
BFR	20.0	19.4	7.0	23.0	6.8	10.7
SH	1.3	5.3	9.9	2.3	14.0	9.2
Frag	42.3	23.5	21.9	16.1	44.6	30.6

Table D-5: Average Across All Neutral Analyzed Flakes

	O	KP	LTC	Other	UID	Flake Type %
Total %	17.3	27.7	53.0	2.1		
DC	9.5	12.1	24.3	6.1	6.6	14.8
CT	36.3	39.4	36.7	36.7	26.1	34.3
BFR	18.2	14.1	3.7	16.3	5.1	8.2
SH	1.7	5.0	11.5	8.2	16.0	10.2
Frag	33.8	29.0	23.5	32.7	45.5	32.1

Table D-6: Average Neutral Village Sites

	O	KP	LTC	Other	UID	Flake Type %
Total %	18.1	30.4	49.7	1.8		
DC	8.9	11.8	21.0	8.3	3.4	12.8
CT	36.6	44.0	40.4	41.7	27.8	37.6
BFR	19.5	15.7	3.4	25.0	5.4	9.2
SH	0.8	3.9	11.8	4.2	13.3	8.8
Frag	33.7	24.4	23.2	20.8	49.7	31.4

Table D-7: Average Neutral Cabin Sites

	O	KP	LTC	Other	UID	Flake Type %
Total %	16.1	23.8	57.5	2.6		
DC	10.3	12.6	28.3	4.0	9.6	17.4
CT	35.9	31.2	32.3	32.0	24.6	30.0
BFR	16.0	11.3	4.1	8.0	4.8	6.9
SH	3.2	6.9	11.1	12.0	18.6	12.0
Frag	34.0	37.2	23.8	44.0	41.4	33.1

Table D-8: Formal Artefacts vs Debitage Chert Source Percentage

	Formal Artefact Percentages				Difference from Debitage Percentages				
	On	KP	LTC	Oth	On	KP	LTC	Oth	Coeff Sim
Kelly	14.6	33.3	45.8	6.3	3.6	-1.3	-6.3	4.0	184.8
Preying Mantis	12.9	36.6	44.1	6.5	2.0	-1.0	-5.3	4.4	187.3
Sifton	33.3	22.2	44.4	0.0	30.9	8.7	-37.6	-2.0	120.8
Dorchester	53.8	23.1	23.1	0.0	0.2	15.2	-7.6	-7.8	169.0
Sackrider	22.7	27.3	45.5	4.5	20.0	-5.0	-18.2	3.2	153.6
TGIF-CC	25.0	22.5	52.5	0.0	9.4	11.8	-20.1	-1.1	157.7
Drumholme	58.3	16.7	25.0	0.0	25.5	-11.6	-13.0	-0.9	149.0
Edwards	12.2	31.7	48.8	7.3	-13.0	7.0	0.0	6.1	173.9
Cassandra	16.7	58.3	25.0	0.0	-5.7	4.0	2.6	-0.9	186.8
Brian	51.0	10.2	24.5	14.3	30.8	-6.7	-36.1	12.0	114.4
Thomas PWL	38.1	47.6	14.3	0.0	17.9	-12.3	-3.5	-2.0	164.3
				Total Difference	117.8	10.1	-138.9	11.0	

Table D-9: Informal Artefacts vs Debitage Chert Source Percentage

	Informal Artefacts Percentage				Difference from Debitage Percentages				
	On	KP	LTC	Oth	On	KP	LTC	Oth	Coeff Sim
Kelly	3.6	35.7	60.7	0.0	-7.4	1.1	8.6	-2.3	180.6
Preying Mantis	4.3	19.6	71.7	4.3	-6.6	-18.0	22.4	2.3	150.7
Sifton	0.0	2.4	97.6	0.0	-2.5	-11.1	15.6	-2.0	168.8
Dorchester	26.1	0.0	73.9	0.0	-27.5	-7.8	43.2	-7.8	113.6
Sackrider	0.0	0.0	85.7	14.3	-2.7	-32.3	22.0	12.9	130.1
TGIF-CC	1.1	5.7	92.0	1.1	-14.5	-5.0	19.5	0.0	161.0
Drumholme	0.0	12.5	87.5	0.0	-32.9	-15.7	49.5	-0.9	101.1
Edwards	10.9	23.9	65.2	0.0	-14.3	-0.8	16.4	-1.3	167.2
Cassandra	10.0	60.0	30.0	0.0	-12.4	5.7	7.6	-0.9	173.4
Brian	27.3	13.6	54.5	4.5	7.0	-3.3	-6.0	2.3	181.4
Thomas PWL	27.3	45.5	18.2	9.1	7.0	-14.5	0.4	7.1	171.1
			Total		-99.3	-102.9	190.4	11.8	

Table D-10: Formal Artefacts - Average Difference by Period

	On	KP	LTC	Oth	Coeff Sim
Glen Meyer	2.8	-1.2	-5.8	4.2	186.1
Middle OI	12.2	4.4	-16.1	-0.4	154.0
Neutral	14.3	-5.0	-12.3	3.0	155.2

Table D-11: Informal Artefacts - Average Difference by Period

	On	KP	LTC	Oth	Coeff Sim
Glen Meyer	-7.0	-8.5	15.5	0.0	165.7
Middle OI	-15.7	-12.1	27.7	0.2	140.3
Neutral	0.5	-4.0	0.6	2.8	175.3

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Table D-12: Coefficients of Similarity - Flake Types

	Early	Middle
Early		
Middle	186.8	
Late	184.5	189.6

Table D13: Coefficient of Similarity of Flake Types Between Sites

	Kelly	**Caradoc 3**	**Melbourne 7**	**Mustos**	**Praying mantis**	**Ski Club**	**Roeland**	**MiV18**
Caradoc 3	170.0							
Melbourne 7	172.4	172.7						
Mustos	189.6	167.0	162.0					
Praying Mantis	170.0	172.1	155.6	179.4				
Ski Club	169.1	162.4	158.2	173.2	181.4			
Roeland	185.5	175.5	167.6	182.6	179.8	167.3		
MiV18	178.7	186.7	185.9	172.9	169.7	163.1	179.3	
Sifton	166.9	144.4	141.1	174.4	170.4	162.9	157.0	147.3
Dorchester	165.3	146.4	152.6	169.0	173.8	184.0	163.1	153.4
Sackrider	175.4	166.7	164.2	175.4	178.8	171.0	189.1	171.6
Norton	161.3	158.6	160.7	157.5	157.1	171.1	155.4	163.4
Crop Circle	176.9	148.7	154.9	180.6	176.1	176.7	166.3	155.7
Drumholme	175.1	168.3	164.3	181.3	184.0	186.6	180.7	172.0
Edwards	180.3	165.6	167.7	186.3	180.2	186.9	180.4	172.6
Skinner	179.1	159.8	158.2	178.2	168.8	163.3	165.8	164.3
Paraducks	166.5	156.5	152.1	174.1	183.8	177.2	168.3	163.5
Laidlaw	156.5	142.2	136.5	163.0	169.6	161.4	159.7	143.6
Cassandra	176.3	159.9	166.0	173.5	170.4	180.6	171.4	166.9
Thomas Lewis	189.7	172.0	167.5	192.7	180.3	174.7	189.5	178.7
Gravel Pit	171.1	153.6	143.5	180.0	168.4	162.5	162.7	152.9
Brian	177.7	167.8	165.0	184.2	188.3	184.7	182.6	172.1
Thomas PL	172.2	168.8	161.4	176.3	183.3	177.5	184.7	169.7
Pincombe 1	170.8	164.5	160.0	172.9	176.8	194.7	169.3	165.1

Table D-13 Continued.

	Sifton	Dorchester	Sackrider	Norton	Crop Circle	Drumholme	Edwards
Dorchester	175.0						
Sackrider	154.3	165.5					
Norton	142.4	167.4	150.9				
Crop Circle	183.6	188.4	167.8	158.7			
Drumholme	159.3	178.1	183.5	167.4	173.1		
Edwards	163.5	180.8	180.6	170.2	177.3	193.2	
Skinner	169.2	167.4	154.8	173.2	177.9	160.8	167.5
Paraducks	176.8	178.8	167.7	152.4	179.6	175.7	176.7
Laidlaw	171.0	169.3	161.2	136.6	173.2	165.1	163.8
Cassandra	159.2	181.9	166.8	183.2	175.6	181.5	186.2
Thomas Lewis	167.1	170.4	180.4	161.3	176.8	184.9	187.8
Gravel Pit	177.5	161.1	159.9	142.2	172.7	164.9	169.1
Brian	166.8	178.6	185.3	164.6	180.5	192.4	191.9
Thomas PL	156.5	169.6	192.3	157.2	170.3	189.2	183.9
Pincombe 1	157.6	178.7	166.2	172.8	171.4	182.8	185.6

	Skinner	Paraducks	Laidlaw	Cassandra	Thomas Lewis	Gravel Pit	Brian	Thomas PL
Paraducks	162.2							
Laidlaw	151.1	177.4						
Cassandra	179.0	166.9	153.4					
Thomas Lewis	174.5	175.2	164.9	177.3				
Gravel Pit	164.1	164.7	153.7	158.2	172.7			
Brian	168.3	180.7	171.5	181.5	187.5	170.9		
Thomas PL	155.7	173.4	164.5	170.7	181.2	162.1	187.4	
Pincombe 1	164.9	172.1	156.3	182.3	176.6	157.6	180.9	172.6

Table D-14: Coefficient of Similarity of Chert Source Between Sites

	Kelly	Caradoc 3	Melbourne 7	Mustos	Praying mantis	Ski Club	Roeland	MiV18
Caradoc 3	132.7							
Melbourne 7	53.9	93.8						
Mustos	154.1	153.1	96.5					
Praying Mantis	194.0	126.7	53.8	153.6				
Ski Club	193.6	133.8	49.5	153.0	188.6			
Roeland	189.2	124.3	56.4	152.8	195.1	183.7		
MiV18	127.2	109.6	117.0	149.4	133.2	121.8	136.9	
Sifton	140.2	125.9	36.9	114.7	134.7	139.2	130.0	68.0
Dorchester	103.6	146.4	139.2	149.5	103.1	105.7	102.4	136.8
Sackrider	176.9	125.1	37.3	135.7	171.4	175.9	168.0	106.0
Norton	152.7	171.8	82.2	155.5	146.7	147.4	144.4	108.2
Crop Circle	149.9	150.4	63.2	133.6	144.3	144.5	143.9	88.7
Drumholme	156.3	145.4	97.6	191.2	156.2	151.9	157.8	157.9
Edwards	171.6	152.4	82.3	180.5	171.5	167.2	171.9	135.9
Skinner	179.6	153.1	61.1	163.8	173.5	176.8	171.2	114.0
Paraducks	179.0	148.9	61.1	159.5	173.4	173.7	172.4	115.2
Laidlaw	138.8	168.5	81.1	141.2	133.2	133.4	133.4	96.5
Cassandra	137.7	93.3	76.8	140.2	143.7	132.3	147.7	159.5
Thomas Lewis	182.9	115.6	49.7	145.4	188.9	181.6	191.3	130.7
Gravel Pit	117.5	128.3	30.7	91.9	111.9	116.5	108.5	46.6
Brian	164.7	162.0	72.4	157.6	158.7	159.3	156.3	110.4
Thomas PL	130.8	82.0	72.4	129.0	136.8	125.4	138.5	155.5
Pincombe 1	159.9	128.3	88.5	175.2	163.8	155.5	163.0	166.2

Table D-14 Continued.

	Sifton	Dorchester	Sackrider	Norton	Crop Circle	Drumholme	Edwards
Dorchester	86.0						
Sackrider	162.0	85.2					
Norton	154.1	131.9	153.3				
Crop Circle	173.7	110.6	156.4	178.2			
Drumholme	109.8	144.5	139.7	150.0	130.5		
Edwards	132.1	130.0	155.0	172.3	152.5	177.6	
Skinner	150.9	113.4	171.8	170.6	167.7	155.7	178.1
Paraducks	152.8	109.1	176.2	171.9	170.8	157.0	178.8
Laidlaw	154.9	123.9	145.3	185.8	181.3	138.6	160.1
Cassandra	78.5	107.0	116.5	113.3	99.2	147.9	140.8
Thomas Lewis	127.9	94.9	165.8	135.6	135.1	150.4	163.2
Gravel Pit	173.0	74.6	136.7	136.4	157.8	88.3	110.7
Brian	157.0	122.1	163.1	188.1	176.0	152.2	174.5
Thomas PL	71.5	95.8	108.3	102.1	90.5	134.3	128.1
Pincombe 1	100.1	139.4	136.8	140.9	119.0	179.0	166.5

	Skinner	Paraducks	Laidlaw	Cassandra	Thomas lewis	Gravel Pit	Brian	Thomas PL
Paraducks	195.6							
Laidlaw	156.6	159.7						
Cassandra	124.5	125.7	102.2					
Thomas Lewis	162.5	163.7	124.6	148.9				
Gravel Pit	128.1	131.2	149.6	57.1	106.4			
Brian	182.5	183.9	174.1	120.9	147.6	134.3		
Thomas PL	117.6	117.6	88.6	186.5	139.7	48.8	114.0	

Pincombe 1	147.7	146.1	126.7	165.0	155.5	77.3	143.0	153.7

Appendix E: Chapter 7 Tables

This table maps the observations from chapters five and six against the original behaviourial hypotheses from chapter three. The left hand column contains the hypotheses, the centre column contains observations that support the hypotheses and the right hand column contains observations that invalidate the hypotheses as stated.

The observations are referenced through an abbreviation in the form “n-xxxx-m” where “n” is the chapter (5 or 6), “xxxx” is an abbreviation of the appropriate section and “m” is the number of the observation within that section.

Section title abbreviations are as follows.

Chapter 5	Brian	The Brian Site
	Cass	The Cassandra Site
	Dorch	The Dorchester Village Site
	Must	The Mustos Site
	Drum	The Drumholme Site
Chapter 6	KPDD	Kettle Point Distance Decay
	OnDD	Onondaga Distance Decay
	MV	Morphological Variation
	VVC	Villages versus cabin Sites
	ART	Formal and Informal Artefact Variation
	CLITT	Change in Lithic Industry Through Time
	SDPA	Site Differences from Period Averages

Hypotheses / Implications	**Confirming Observations**	**Invalidating Observations**
1. KP and Onondaga were preferred cherts • **LTC was low grade and undesireable** • **LTC was used as background fill**	5-Brian-1,3,5,6 5-Cass-2,4,5,6,7 5-Dorch-6 5-Drum-8 6-KPDD-5, 6 6-MV-3,8, 11	

	6-ART-1,2	
2. Down-the-Line Existed		
• Non-Local chert is more reduced	6-MV-2	6-MV-9
• Non-local chert will be used for formal tools	6-MV- 3,12, 13 6-ART-1, 2, 3, 5 6-ART-8, 9, 13, 14	6-MV-6 6-ART-3, 10 6-ART-7 (EOI)
• Non-local chert will be discarded as exhausted and broken tools	6-ART-1, 5	
• Onondaga will be the most preferred chert in the west and KP in the east of the study area	6-KPDD-5,6	6-ONDD-1
• Artefacts should be found more distant than debitage	6-ART-1	6-ART-3
• Traded material will be smaller	6-MV-2	
• Single log decay implies down-the-line exchange	6-KPDD-5, 6, 7, 8, 12	6-KPDD-1, 10 (EOI) 6-KPDD-11
• Linear distance decay shows individual acquisition • Outliers can be well off the main decay line	6-KPDD-1, 10 (EOI) 6-KPDD-2 (EOI)	
3. KP passed from west to east	6-KPDD-all	
4. Onondaga passed from east to west		6-OnDD-1
5. Lineages controlled the trade routes		
• Differential distribution of non local chert occurs in other sites	5-Brian-4,5,11 5-Cass 2,4,5,6, 7 5-Dorch,6,7 5-Drum-2, 3, 4,	5-Dorch-1,2,3,4 5-Mustos-1,2,3 (EOI)

	5, 6, 7,8,10 6-KPDD-9,13	
• Sites close to the source may be difficult to tell where one chert monopolizes the sample.	5-Cassandra-3	
6. The Pattern has considerable time depth		
• The down-the-line pattern has considerable time depth	6-KPDD-11	6-KPDD-1,3,4 6-KPDD-10,15 6-MV-7, 8 5-Dorch-1,2,3,4 5-Mustos-1,2,3
• Chert patterns remain constant or vary slowly with time	6-ART-10	6-MV-8, 9, 13 6-ART-7, 8, 9
7. Raw cores were the exchange media	6-MV-1	6-MV-2
• Exhausted cores should occur in the same frequency as debitage	6-ART-3	6-ART-1,2
• Debitage percentage should stay the same regardless of the distance from the source		
8. There are differences between villages and agricultural cabins		
• Greater use of local till chert at cabin sites	6-VVC-1 6-KPDD-9,13,14	
• Different chert working patterns at cabin sites	6-VVC-2, 3, 4, 5	
9. Local till chert was acquired through embedded procurement		
• LT chert should be used in a more expedient fashion	6-ART-2, 4, 5 5-Brian-1 6-VVC-3	

Appendix F: Individual Site Data

(Borden number order)

Pine Tree Site **AfHf-4**

	O	KP	LTC	Other	UID
DC	1	0	7	0	0
CT	2	2	4	0	0
BiPolar	0	0	0	0	0
BFR	0	1	0	0	0
UR	0	0	0	0	0
UR-V	0	0	0	0	0
SH	0	0	2	0	1
Frag	1	0	0	0	0
Totals	4	3	13	0	1

	O	KP	LTC	Other	UID	Flake Type %
Total %	20.0	15.0	65.0	0.0		
DC	25.0	0.0	53.8	0.0	0.0	38.1
CT	50.0	66.7	30.8	0.0	0.0	38.1
BFR	0.0	33.3	0.0	0.0	0.0	4.8
SH	0.0	0.0	15.4	0.0	100.0	14.3
Frag	25.0	0.0	0.0	0.0	0.0	4.8

Artefacts

	O	KP	LTC	Other	UID
COR	0	0	3	0	0
BPC	0	0	0	0	0
WED	0	0	2	0	0
bif	0	0	1	0	0
Preform	0	0	0	0	0
PPO-Tri	1	0	0	0	0
PPO-not	0	0	0	0	0
PPO -tip	0	0	0	0	0
PPO- stem	0	0	0	0	0
DRI	0	0	0	0	0
SCR	0	0	0	0	0
SCR- VR	0	0	1	0	0
GRA	0	0	0	0	0
Foliate BF	1	0	0	0	0
KNI	1	0	0	0	0
DRI	0	0	0	0	0

Dyjack Site **AfHf-5**

	O	KP	LTC	Other	UID
DC	0	0	3	0	0
CT	1	0	3	0	0
BiPolar	0	0	0	0	0
BFR	1	0	0	0	0
UR	0	0	0	0	0
UR-V	0	0	0	0	0
SH	0	0	1	0	2
Frag	2	1	2	1	4
Totals	4	1	9	1	6

	O	KP	LTC	Other	UID	Flake Type %
Total %	26.7	6.7	60.0	6.7		
DC	0.0	0.0	33.3	0.0	0.0	14.3
CT	25.0	0.0	33.3	0.0	0.0	19.0
BFR	25.0	0.0	0.0	0.0	0.0	4.8
SH	0.0	0.0	11.1	0.0	33.3	14.3
Frag	50.0	100.0	22.2	100.0	66.7	47.6

Artefacts

	O	KP	LTC	Other	UID
COR	0	0	1	0	0
BPC	0	0	0	0	0
WED	0	0	0	0	0
bif	0	0	0	0	0
Preform	0	0	0	0	0
PPO-Tri	0	0	0	0	0
PPO-not	0	0	0	0	0
PPO -tip	0	0	0	0	0
PPO-frag	0	0	0	0	0
PPO- stem	0	0	0	0	0
DRI	0	0	0	0	0
SCR	0	1	0	0	0
Side scr	0	0	0	0	0
SCR- VR	0	0	0	0	0
SCR-flake	0	0	0	0	0
GRA	0	0	0	0	0
Foliate BF	0	0	0	0	0
KNI	0	0	0	0	0
Used Cobble	0	0	0	0	0
STR	0	0	0	0	0
MCS	0	0	0	0	0

Gravel Pit Site **AfHf-7**

	O	KP	LTC	Other	UID
DC	1	0	24	0	3
CT	3	1	56	0	17
BiPolar	0	0	0	0	0
BFR	1	0	1	0	0
UR	0	0	0	0	0
UR-V	0	0	0	0	0
SH	0	0	33	1	14
Frag	2	0	28	1	33
Totals	7	1	142	2	67

	O	KP	LTC	Other	UID	Flake Type %
Total %	4.6	0.7	93.4	1.3		
DC	14.3	0.0	16.9	0.0	4.5	12.8
CT	42.9	100.0	39.4	0.0	25.4	35.2
BFR	14.3	0.0	0.7	0.0	0.0	0.9
SH	0.0	0.0	23.2	50.0	20.9	21.9
Frag	28.6	0.0	19.7	50.0	49.3	29.2

Artefacts

	O	KP	LTC	Other	UID
COR	0	0	10	0	0
BPC	0	0	0	0	0
WED	0	0	1	0	0
bif	0	0	1	1	0
Preform	0	0	0	0	0
PPO-Tri	0	0	0	0	0
PPO-not	0	1	0	0	0
PPO -tip	0	0	0	0	0
PPO-frag	0	0	0	0	0
PPO- stem	0	0	0	0	0
DRI	0	0	0	0	0
SCR	0	0	1	0	0
Side scr	0	0	0	0	0
SCR- VR	0	0	1	0	0
SCR-flake	0	0	0	0	0
GRA	0	0	0	0	0
Foliate BF	0	0	0	0	0
KNI	0	0	0	0	0
Used Cobble	0	0	0	0	0
STR	0	0	0	0	0
MCS	0	0	0	0	0

Mustos Site **AfHg-2**

	O	KP	LTC	Other	UID
DC	4	3	11	0	1
CT	12	16	23	2	8
BiPolar	0	0	0	0	0
BFR	5	3	1	0	2
UR	0	0	0	0	0
UR-V	0	0	0	0	0
SH	1	0	8	1	13
Frag	19	9	7	2	19
Totals	41	31	50	5	43

	O	KP	LTC	Other	UID	Flake Type %
Total %	32.3	24.4	39.4	3.9		
DC	9.8	9.7	22.0	0.0	2.3	11.2
CT	29.3	51.6	46.0	40.0	18.6	35.9
BFR	12.2	9.7	2.0	0.0	4.7	6.5
SH	2.4	0.0	16.0	20.0	30.2	13.5
Frag	46.3	29.0	14.0	40.0	44.2	32.9

Artefacts

	O	KP	LTC	Other	UID
COR	0	0	2	0	2
BPC	0	0	0	0	0
WED	0	0	1	0	1
bif	2	1	1	0	0
Preform	0	0	1	0	0
PPO-Tri	0	1	0	1	0
PPO-not	0	0	0	0	0
PPO -tip	0	0	0	0	0
PPO-frag	0	0	0	0	0
PPO- stem	0	0	0	0	0
DRI	0	0	0	0	0
SCR	1	0	1	0	0
Side scr	0	0	0	0	0
SCR- VR	0	0	1	0	0
SCR-flake	0	0	0	0	0
GRA	0	0	0	0	0
Foliate BF	0	0	0	0	0
KNI	0	0	0	0	0
Used Cobble	0	0	0	0	0
STR	0	0	0	0	0
MCS	0	0	0	0	0

The Skinner Site **AfHg-13**

	O	KP	LTC	Other	UID
DC	8	16	80	1	20
CT	18	36	108	7	38
BiPolar	0	0	1	0	1
BFR	11	17	12	2	5
UR	1	1	1	0	2
UR-V	0	1	0	0	1
SH	4	9	30	2	59
Frag	40	57	91	8	118
Totals	82	137	323	20	244

	O	KP	LTC	Other	UID	Flake Type %
Total %	14.6	24.4	57.5	3.6		
DC	9.8	11.7	24.8	5.0	8.2	15.5
CT	22.0	26.3	33.4	35.0	15.6	25.7
BFR	13.4	12.4	3.7	10.0	2.0	5.8
SH	4.9	6.6	9.3	10.0	24.2	12.9
Frag	48.8	41.6	28.2	40.0	48.4	39.0

Artefacts

	O	KP	LTC	Other	UID
COR	0	1	9	0	1
BPC	0	0	0	0	0
WED	0	0	1	0	0
bif	0	0	0	0	0
Preform	0	0	0	0	0
PPO-Tri	1	0	0	0	0
PPO-not	2	1	0	0	0
PPO -tip	0	0	0	0	0
PPO-frag	0	0	0	0	0
PPO- stem	0	0	0	0	0
DRI	0	0	0	0	0
SCR	0	0	0	0	0
Side scr	0	0	0	0	0
SCR- VR	0	0	0	0	0
SCR-flake	0	0	0	0	0
GRA	0	0	0	0	0
Foliate BF	0	0	0	0	0
KNI	0	0	0	0	0
Used Cobble	0	0	0	0	0
STR	0	0	0	0	0
MCS	0	0	0	0	0

Dorchester Village Site **AfHg-24**

	O	KP	LTC	Other	UID
DC	11	2	20	2	1
CT	30	6	13	6	8
BiPolar	0	0	1	0	0
BFR	20	1	2	3	4
UR	3	0	0	0	0
UR-V	0	0	0	0	0
SH	2	1	8	0	6
Frag	23	3	7	2	20
Totals	89	13	51	13	39

	O	KP	LTC	Other	UID	Flake Type %
Total %	53.6	7.8	30.7	7.8		
DC	12.4	15.4	39.2	15.4	2.6	17.6
CT	33.7	46.2	25.5	46.2	20.5	30.7
BFR	22.5	7.7	3.9	23.1	10.3	14.6
SH	2.2	7.7	15.7	0.0	15.4	8.3
Frag	25.8	23.1	13.7	15.4	51.3	26.8

Artefacts

	O	KP	LTC	Other	UID
COR	4	0	14	0	9
BPC	1	0	3	0	0
WED	1	0	0	0	0
bif	1	2	0	0	0
Preform	2	0	0	0	1
PPO-Tri	1	0	0	0	0
PPO-not	2	1	2	0	0
PPO -tip	0	0	0	0	0
PPO-frag	0	0	0	0	0
PPO- stem	0	0	0	0	0
DRI	0	0	0	0	0
SCR	1	0	1	0	0
Side scr	0	0	0	0	0
SCR- VR	0	0	0	0	0
SCR-flake	0	0	0	0	0
GRA	0	0	0	0	0
Foliate BF	0	0	0	0	0
KNI	0	0	0	0	0
Used Cobble	0	0	0	0	0
STR	0	0	0	0	0
MCS	0	0	0	0	0

The Lone Duck Site **AfHg-37**

	O	KP	LTC	Other	UID
DC	1	1	5	0	1
CT	6	3	13	0	3
BiPolar	0	0	0	0	0
BFR	2	0	0	0	0
UR	0	0	0	0	0
UR-V	0	0	0	0	0
SH	0	0	11	0	2
Frag	4	1	4	0	8
Totals	13	5	33	0	14

	O	KP	LTC	Other	UID	Flake Type %
Total %	25.5	9.8	64.7	0.0		
DC	7.7	20.0	15.2	0.0	7.1	12.3
CT	46.2	60.0	39.4	0.0	21.4	38.5
BFR	15.4	0.0	0.0	0.0	0.0	3.1
SH	0.0	0.0	33.3	0.0	14.3	20.0
Frag	30.8	20.0	12.1	0.0	57.1	26.2

Artefacts

	O	KP	LTC	Other	UID
COR	0	0	0	0	0
BPC	0	0	0	0	0
WED	0	0	0	0	0
bif	1	0	1	0	0
Preform	0	0	0	0	0
PPO-Tri	0	0	0	0	0
PPO-not	0	0	0	0	0
PPO -tip	0	0	0	0	0
PPO-frag	0	0	0	0	0
PPO- stem	0	0	0	0	0
DRI	0	0	0	0	0
SCR	0	0	0	0	0
Side scr	0	0	0	0	0
SCR- VR	0	0	0	0	0
SCR-flake	0	0	0	0	0
GRA	0	0	0	0	0
Foliate BF	0	0	0	0	0
KNI	0	0	0	0	0
Used Cobble	0	0	0	0	0
STR	0	0	0	0	0
MCS	0	0	0	0	0

The Paradducks Site **AfHg-38**

	O	KP	LTC	Other	UID
DC	2	7	25	0	13
CT	13	14	28	0	18
BiPolar	0	0	0	0	0
BFR	1	4	5	0	5
UR	0	0	0	0	0
UR-V	0	0	0	0	0
SH	1	3	2	0	6
Frag	4	8	25	2	17
Totals	21	36	85	2	59

	O	KP	LTC	Other	UID	Flake Type %
Total %	14.6	25.0	59.0	1.4		
DC	9.5	19.4	29.4	0.0	22.0	23.2
CT	61.9	38.9	32.9	0.0	30.5	36.0
BFR	4.8	11.1	5.9	0.0	8.5	7.4
SH	4.8	8.3	2.4	0.0	10.2	5.9
Frag	19.0	22.2	29.4	100.0	28.8	27.6

Artefacts

	O	KP	LTC	Other	UID
COR	0	1	4	0	0
BPC	0	0	0	0	0
WED	0	0	0	0	0
bif	0	0	0	0	1
Preform	0	0	0	0	0
PPO-Tri	0	1	2	0	0
PPO-not	0	0	0	0	0
PPO -tip	0	0	0	0	0
PPO-frag	0	0	0	0	0
PPO- stem	0	0	0	0	0
DRI	0	0	0	0	0
SCR	0	0	0	0	0
Side scr	0	0	0	0	0
SCR- VR	0	0	0	0	0
SCR-flake	0	0	0	0	0
GRA	0	0	0	0	0
Foliate BF	0	0	0	0	0
KNI	0	0	0	0	0
Used Cobble	0	0	0	0	0
STR	0	0	0	0	0
MCS	0	0	0	0	0

The Laidlaw Site **AfHh-1**

	O	KP	LTC	Other	UID
DC	3	0	37	0	9
CT	16	3	24	1	42
BiPolar	0	0	0	0	0
BFR	10	2	4	0	6
UR	0	0	0	0	0
UR-V	0	0	0	0	0
SH	0	0	15	0	9
Frag	3	2	8	0	24
Totals	32	7	88	1	90

	O	KP	LTC	Other	UID	Flake Type %
Total %	25.0	5.5	68.8	0.8		
DC	9.4	0.0	42.0	0.0	10.0	22.5
CT	50.0	42.9	27.3	100.0	46.7	39.4
BFR	31.3	28.6	4.5	0.0	6.7	10.1
SH	0.0	0.0	17.0	0.0	10.0	11.0
Frag	9.4	28.6	9.1	0.0	26.7	17.0

Artefacts

	O	KP	LTC	Other	UID
COR	0	0	3	0	0
BPC	0	0	0	0	0
WED	1	0	0	0	0
bif	1	0	1	0	0
Preform	0	0	0	0	0
PPO-Tri	0	0	0	0	0
PPO-not	0	0	0	0	0
PPO -tip	0	0	0	0	0
PPO-frag	0	0	0	0	0
PPO- stem	0	0	0	0	0
DRI	0	0	0	0	0
SCR	0	0	1	0	1
Side scr	0	0	0	0	0
SCR- VR	0	0	0	0	0
SCR-flake	0	0	0	0	0
GRA	0	0	0	0	1
Foliate BF	0	0	0	0	0
KNI	0	0	0	0	0
Used Cobble	0	0	0	0	0
STR	0	0	0	0	0
MCS	0	0	0	0	0

The Thomas Powerline Site **AfHh-3**

	O	KP	LTC	Other	UID
DC	2	16	12	1	3
CT	18	79	22	2	29
BiPolar	0	0	0	0	0
BFR	12	15	1	1	7
UR	0	0	0	0	0
UR-V	0	0	0	0	0
SH	0	6	2	0	12
Frag	18	32	7	1	45
Totals	50	148	44	5	96

	O	KP	LTC	Other	UID	Flake Type %
Total %	20.2	59.9	17.8	2.0		
DC	4.0	10.8	27.3	20.0	3.1	9.9
CT	36.0	53.4	50.0	40.0	30.2	43.7
BFR	24.0	10.1	2.3	20.0	7.3	10.5
SH	0.0	4.1	4.5	0.0	12.5	5.8
Frag	36.0	21.6	15.9	20.0	46.9	30.0

Artefacts

	O	KP	LTC	Other	UID
COR	2	3	2	1	0
BPC	1	1	0	0	0
WED	0	1	0	0	0
bif	0	5	0	0	2
Preform	1	2	0	0	1
PPO-Tri	0	0	0	0	0
PPO-not	3	1	0	0	0
PPO -tip	0	0	0	0	0
PPO-frag	0	0	0	0	0
PPO- stem	0	0	0	0	0
DRI	0	0	0	0	0
SCR	3	2	3	0	0
Side scr	0	0	0	0	0
SCR- VR	0	0	0	0	0
SCR-flake	0	0	0	0	0
GRA	0	0	0	0	0
Foliate BF	1	0	0	0	0
KNI	0	0	0	0	0
Used Cobble	0	0	0	0	0
STR	0	0	0	0	0
MCS	0	0	0	0	0

The Brian Site **AfHh-10**

	O	KP	LTC	Other	UID
DC	21	20	85	2	12
CT	80	53	176	10	64
BiPolar	1	0	0	0	0
BFR	32	21	22	4	10
UR	1	0	0	0	0
UR-V	0	0	0	0	1
SH	5	7	36	0	27
Frag	56	22	102	1	108
Totals	196	123	421	17	222

	O	KP	LTC	Other	UID	Flake Type %
Total %	25.9	16.2	55.6	2.2		
DC	10.7	16.3	20.2	11.8	5.4	14.3
CT	40.8	43.1	41.8	58.8	28.8	39.1
BFR	16.3	17.1	5.2	23.5	4.5	9.1
SH	2.6	5.7	8.6	0.0	12.2	7.7
Frag	28.6	17.9	24.2	5.9	48.6	29.5

Artefacts

	O	KP	LTC	Other	UID
COR	4	3	11	1	1
BPC	1	0	0	0	0
WED	1	0	1	0	1
bif	3	1	1	0	2
Preform	10	0	5	4	1
PPO-Tri	4	2	4	1	0
PPO-not	2	0	0	1	1
PPO -tip	2	0	0	0	2
PPO-frag	0	0	0	0	0
PPO- stem	0	0	0	0	0
DRI	0	0	0	0	0
SCR	2	1	0	0	0
Side scr	0	0	0	0	0
SCR- VR	2	1	2	1	1
SCR-flake	0	0	0	0	0
GRA	0	0	0	0	0
Foliate BF	0	0	0	0	0
KNI	0	0	0	0	0
Used Cobble	0	0	0	0	0
STR	0	0	0	0	0
MCS	0	0	0	0	0

The Pincombe Site **AfHh-27**

	O	KP	LTC	Other	UID
DC	2	6	13	0	0
CT	8	19	16	1	4
BiPolar	1	0	0	0	0
BFR	11	6	0	1	2
UR	0	0	0	0	0
UR-V	0	0	0	0	0
SH	0	1	0	0	0
Frag	8	7	5	1	26
Totals	30	39	34	3	32

	O	KP	LTC	Other	UID	Flake Type %
Total %	28.3	36.8	32.1	2.8		
DC	6.7	15.4	38.2	0.0	0.0	15.2
CT	26.7	48.7	47.1	33.3	12.5	34.8
BFR	36.7	15.4	0.0	33.3	6.3	14.5
SH	0.0	2.6	0.0	0.0	0.0	0.7
Frag	26.7	17.9	14.7	33.3	81.3	34.1

Artefacts

	O	KP	LTC	Other	UID
COR	0	2	1	0	0
BPC	0	0	0	0	0
WED	1	1	1	0	0
bif	0	0	0	0	1
Preform	0	0	0	0	0
PPO-Tri	0	0	0	0	0
PPO-not	0	0	0	0	0
PPO -tip	0	0	0	0	0
PPO-frag	0	0	0	0	0
PPO- stem	0	0	0	0	0
DRI	0	0	0	0	0
SCR	0	0	0	0	0
Side scr	0	0	0	0	0
SCR- VR	0	0	0	0	0
SCR-flake	0	0	0	0	0
GRA	0	0	0	0	0
Foliate BF	0	0	0	0	0
KNI	0	0	0	0	0
Used Cobble	0	0	0	0	0
STR	0	0	0	0	0
MCS	0	0	0	0	0

The Cassandra Site **AfHh-65**

	O	KP	LTC	Other	UID
DC	2	6	12	0	3
CT	15	32	11	1	19
BiPolar	0	0	0	0	1
BFR	2	21	1	0	3
UR	0	0	0	0	0
UR-V	0	0	0	0	1
SH	0	5	12	0	9
Frag	14	26	9	2	19
Totals	33	90	45	3	55

	O	KP	LTC	Other	UID	Flake Type %
Total %	19.3	52.6	26.3	1.8		
DC	6.1	6.7	26.7	0.0	5.5	10.2
CT	45.5	35.6	24.4	33.3	34.5	34.5
BFR	6.1	23.3	2.2	0.0	5.5	11.9
SH	0.0	5.6	26.7	0.0	16.4	11.5
Frag	42.4	28.9	20.0	66.7	34.5	31.0

Artefacts

	O	KP	LTC	Other	UID
COR	1	6	3	0	3
BPC	0	0	0	0	1
WED	0	0	0	0	0
bif	0	1	2	0	0
Preform	0	4	0	0	0
PPO-Tri	0	1	0	0	1
PPO-not	0	0	0	0	0
PPO -tip	1	0	0	0	0
PPO-frag	0	0	0	0	0
PPO- stem	0	0	0	0	0
DRI	0	0	0	0	0
SCR	0	0	1	0	0
Side scr	0	0	0	0	0
SCR- VR	0	1	0	0	0
SCR-flake	0	0	0	0	0
GRA	0	0	0	0	0
Foliate BF	1	0	0	0	0
KNI	0	0	0	0	0
Used Cobble	0	0	0	0	0
STR	0	0	0	0	0
MCS	0	0	0	0	0

The Mathew William Site **AfHh-66**

	O	KP	LTC	Other	UID
DC	1	4	4	0	1
CT	0	10	3	0	7
BiPolar	0	0	0	0	0
BFR	0	3	2	0	5
UR	0	0	0	0	0
UR-V	0	0	0	0	0
SH	0	3	2	0	5
Frag	0	10	2	0	18
Totals	1	30	13	0	36

	O	KP	LTC	Other	UID	Flake Type %
Total %	2.3	68.2	29.5	0.0		
DC	100.0	13.3	30.8	0.0	2.8	12.5
CT	0.0	33.3	23.1	0.0	19.4	25.0
BFR	0.0	10.0	15.4	0.0	13.9	12.5
SH	0.0	10.0	15.4	0.0	13.9	12.5
Frag	0.0	33.3	15.4	0.0	50.0	37.5

Artefacts

	O	KP	LTC	Other	UID
COR	0	1	0	0	0
BPC	0	0	0	0	0
WED	2	0	0	0	1
bif	0	0	0	0	0
Preform	0	1	0	0	0
PPO-Tri	0	0	0	0	0
PPO-not	0	0	0	0	0
PPO -tip	0	0	0	0	0
PPO-frag	0	0	0	0	0
PPO- stem	0	0	0	0	0
DRI	0	0	0	0	0
SCR	0	0	0	0	0
Side scr	0	0	0	0	0
SCR- VR	0	1	0	0	0
SCR-flake	0	0	0	0	0
GRA	0	0	0	0	0
Foliate BF	0	0	0	0	0
KNI	0	0	0	0	0
Used Cobble	0	0	0	0	0
STR	0	0	0	0	0
MCS	0	0	0	0	0

The Marna Site **AfHh-69**

	O	KP	LTC	Other	UID
DC	1	1	4	0	0
CT	2	6	1	0	4
BiPolar	0	0	0	0	0
BFR	0	0	0	0	1
UR	0	0	0	0	0
UR-V	0	0	0	0	0
SH	0	1	1	1	2
Frag	0	7	1	0	0
Totals	3	15	7	1	7

	O	KP	LTC	Other	UID	Flake Type %
Total %	11.5	57.7	26.9	3.8		
DC	33.3	6.7	57.1	0.0	0.0	18.2
CT	66.7	40.0	14.3	0.0	57.1	39.4
BFR	0.0	0.0	0.0	0.0	14.3	3.0
SH	0.0	6.7	14.3	100.0	28.6	15.2
Frag	0.0	46.7	14.3	0.0	0.0	24.2

Artefacts

	O	KP	LTC	Other	UID
COR	0	3	0	0	0
BPC	0	0	0	0	0
WED	0	0	0	0	0
bif	0	0	0	0	0
Preform	0	0	0	0	0
PPO-Tri	0	0	0	1	0
PPO-not	1	0	1	0	0
PPO -tip	0	0	0	0	0
PPO-frag	0	0	0	0	0
PPO- stem	0	0	0	0	0
DRI	0	0	0	0	0
SCR	0	0	0	0	0
Side scr	0	0	0	0	0
SCR- VR	0	0	0	0	0
SCR-flake	0	0	0	0	0
GRA	0	0	0	0	0
Foliate BF	0	0	0	0	0
KNI	0	0	0	0	0
Used Cobble	0	0	0	0	0
STR	0	0	0	0	0
MCS	0	0	0	0	0

The Sifton Site **AfHh-85**

	O	KP	LTC	Other	UID
DC	0	9	134	1	17
CT	8	33	172	6	43
BiPolar	0	0	0	0	0
BFR	2	17	13	3	5
UR	0	0	0	0	0
UR-V	0	0	0	0	0
SH	0	2	100	1	38
Frag	5	21	79	1	95
Totals	15	82	498	12	198

	O	KP	LTC	Other	UID	Flake Type %
Total %	2.5	13.5	82.0	2.0		
DC	0.0	11.0	26.9	8.3	8.6	20.0
CT	53.3	40.2	34.5	50.0	21.7	32.5
BFR	13.3	20.7	2.6	25.0	2.5	5.0
SH	0.0	2.4	20.1	8.3	19.2	17.5
Frag	33.3	25.6	15.9	8.3	48.0	25.0

Artefacts

	O	KP	LTC	Other	UID
COR	0	0	37	0	0
BPC	0	0	1	0	0
WED	0	1	3	0	0
bif	0	2	0	0	1
Preform	0	0	0	0	0
PPO-Tri	0	0	0	0	0
PPO-not	1	0	0	0	0
PPO -tip	2	0	1	0	0
PPO-frag	0	0	0	0	0
PPO- stem	0	0	0	0	0
DRI	0	0	1	0	0
SCR	0	0	0	0	0
Side scr	0	0	0	0	0
SCR- VR	0	0	2	0	0
SCR-flake	0	0	0	0	0
GRA	0	0	0	0	0
Foliate BF	0	0	0	0	0
KNI	0	0	0	0	0
Used Cobble	0	0	0	0	0
STR	0	0	0	0	0
MCS	0	0	0	0	0

The Norton Site **AfHh-86**

	O	KP	LTC	Other	UID
DC	1	2	32	0	3
CT	12	6	24	0	24
BiPolar	1	1	2	0	1
BFR	20	5	13	4	7
UR	0	0	0	0	0
UR-V	0	0	1	0	0
SH	0	1	6	0	6
Frag	21	9	57	1	31
Totals	55	24	135	5	72

	O	KP	LTC	Other	UID	Flake Type %
Total %	25.1	11.0	61.6	2.3		
DC	1.8	8.3	23.7	0.0	4.2	13.1
CT	21.8	25.0	17.8	0.0	33.3	22.7
BFR	36.4	20.8	9.6	80.0	9.7	16.8
SH	0.0	4.2	4.4	0.0	8.3	4.5
Frag	38.2	37.5	42.2	20.0	43.1	40.9

Artefacts

	O	KP	LTC	Other	UID
COR	0	1	1	0	0
BPC	0	2	0	0	0
WED	0	1	0	0	0
bif	2	0	2	0	0
Preform	2	0	0	0	0
PPO-Tri	0	0	0	0	0
PPO-not	1	1	0	0	0
PPO -tip	1	0	0	1	0
PPO-frag	0	0	0	0	0
PPO- stem	0	0	0	0	0
DRI	0	0	0	0	0
SCR	0	0	0	0	0
Side scr	0	0	0	0	0
SCR- VR	0	0	0	0	0
SCR-flake	0	0	0	0	0
GRA	0	0	0	0	0
Foliate BF	0	0	0	0	0
KNI	0	0	0	0	0
Used Cobble	0	0	0	0	0
STR	0	0	0	0	0
MCS	0	0	0	0	0

The Sackrider Site **AfHh-320**

	O	KP	LTC	Other	UID
DC	0	33	99	2	22
CT	19	254	519	12	233
BiPolar	0	2	1	0	0
BFR	6	90	90	2	33
UR	0	0	0	0	0
UR-V	0	1	7	0	0
SH	0	31	58	0	88
Frag	19	114	262	6	309
Totals	44	525	1036	22	685

	O	KP	LTC	Other	UID	Flake Type %
Total %	2.7	32.3	63.7	1.4		
DC	0.0	6.3	9.6	9.1	3.2	6.7
CT	43.2	48.4	50.1	54.5	34.0	44.9
BFR	13.6	17.1	8.7	9.1	4.8	9.6
SH	0.0	5.9	5.6	0.0	12.8	7.7
Frag	43.2	21.7	25.3	27.3	45.1	30.7

Artefacts - Total

	O	KP	LTC	Other	UID
COR	0	0	6	1	0
BPC	0	0	0	0	0
WED	0	5	7	1	1
bif	0	5	7	1	0
Preform	2	0	2	0	1
PPO-Tri	1	1	2	0	2
PPO-not	3	3	1	1	1
PPO -tip	2	0	1	0	1
PPO-frag	1	0	0	0	1
PPO- stem	0	0	0	0	0
DRI	0	0	0	0	0
SCR	1	2	2	0	0
SCR- VR	0	1	4	0	1
SCR-flake	0	0	0	0	0
GRA	0	0	0	0	1
Foliate BF	0	0	0	0	0
KNI	0	0	0	0	0
Used Cobble	0	0	0	0	0
STR	0	0	0	0	0
MCS	0	0	1	0	0

The Alway Site **AfHi-2**

	O	KP	LTC	Other	UID
DC	1	2	1	0	0
CT	5	2	0	0	4
BiPolar	0	0	0	0	0
BFR	1	0	0	0	0
UR	0	0	0	0	0
UR-V	0	0	0	0	0
SH	0	0	0	0	0
Frag	0	2	1	0	2
Totals	7	6	2	0	6

	O	KP	LTC	Other	UID	Flake Type %
Total %	46.7	40.0	13.3	0.0		
DC	14.3	33.3	50.0	0.0	0.0	19.0
CT	71.4	33.3	0.0	0.0	66.7	52.4
BFR	14.3	0.0	0.0	0.0	0.0	4.8
SH	0.0	0.0	0.0	0.0	0.0	0.0
Frag	0.0	33.3	50.0	0.0	33.3	23.8

Artefacts

	O	KP	LTC	Other	UID
COR	0	0	0	0	0
BPC	0	0	0	0	0
WED	0	0	0	0	0
bif	0	0	0	0	0
Preform	0	0	0	0	0
PPO-Tri	0	0	0	0	0
PPO-not	1	0	0	0	0
PPO -tip	0	0	0	0	0
PPO-frag	0	0	0	0	0
PPO- stem	0	0	0	0	0
DRI	0	0	0	0	0
SCR	0	0	0	0	0
Side scr	0	0	0	0	0
SCR- VR	0	0	0	1	0
SCR-flake	0	0	0	0	0
GRA	0	0	0	0	0
Foliate BF	1	0	0	0	0
KNI	0	0	0	0	0
Used Cobble	0	0	0	0	0
STR	0	0	0	0	0
MCS	0	0	0	0	0

The Kelly Site **AfHi-20**

	O	KP	LTC	Other	UID
DC	2	16	54	2	4
CT	32	105	161	6	37
BiPolar	0	0	1	0	0
BFR	12	29	24	4	9
UR	0	0	0	0	0
UR-V	0	0	0	0	0
SH	0	23	65	1	40
Frag	41	101	108	5	108
Totals	87	274	413	18	198

	O	KP	LTC	Other	UID	Flake Type %
Total %	11.0	34.6	52.1	2.3		
DC	2.3	5.8	13.1	11.1	2.0	7.9
CT	36.8	38.3	39.0	33.3	18.7	34.4
BFR	13.8	10.6	5.8	22.2	4.5	7.9
SH	0.0	8.4	15.7	5.6	20.2	13.0
Frag	47.1	36.9	26.2	27.8	54.5	36.7

Artefacts

COR	O	KP	LTC	Other	UID	
BPC	0	0	0	0	0	
WED	0	3	3	0	0	
bif	0	2	7	0	2	
Preform	0	0	0	0	0	
PPO-Tri	1	3	3	0	0	
PPO-not	0	0	0	0	0	
PPO -tip	0	1	2	1	1	
PPO-frag	0	0	0	0	0	
PPO- stem	0	0	0	0	0	
DRI	0	1	1	1	0	
SCR	2	1	2	0	0	
Side scr	1	0	2	1	0	
SCR- VR	1	1	1	0	0	
SCR-flake	0	4	3	0	0	
GRA	0	1	0	0	0	
Foliate BF	0	0	0	0	0	
KNI	0	0	0	0	0	
Used Cobble	0	0	0	0	0	
STR	0	0	0	0	0	
MCS	2	2	1	0	1	

The Drumholme Site **AfHi-22**

	O	KP	LTC	Other	UID
DC	2	11	30	0	12
CT	55	40	56	1	40
BiPolar	1	0	0	0	0
BFR	20	23	10	2	12
UR	0	0	0	0	0
UR-V	0	0	0	0	0
SH	2	4	15	0	9
Frag	52	22	32	0	54
Total	132	100	143	3	127

	O	KP	LTC	Other	UID	Flake Type %
Total %	34.9	26.5	37.8	0.8		
DC	1.5	11.0	21.0	0.0	9.4	10.9
CT	41.7	40.0	39.2	33.3	31.5	38.0
BFR	15.2	23.0	7.0	66.7	9.4	13.3
SH	1.5	4.0	10.5	0.0	7.1	5.9
Frag	39.4	22.0	22.4	0.0	42.5	31.7

Artefacts

	O	KP	LTC	Other	UID
COR	0	2	12	0	0
BPC	0	0	2	0	0
WED	0	0	0	0	0
bif	12	0	1	0	0
Preform	0	1	0	0	0
PPO-Tri	0	0	0	0	0
PPO-not	0	0	1	0	0
PPO -tip	2	1	1	0	0
PPO-frag	0	0	0	0	0
PPO- stem	0	0	0	0	0
DRI	0	0	0	0	0
SCR	0	0	0	0	0
Side scr	0	0	0	0	0
SCR- VR	0	0	0	0	2
SCR-flake	0	1	0	0	0
GRA	0	0	0	0	0
Foliate BF	0	0	0	0	0
KNI	0	0	0	0	0
Used Cobble	0	0	1	0	0
STR	0	0	0	0	0
MCS	0	1	2	0	0

The Edwards Site **AfHi-23**

	O	KP	LTC	Other	UID
DC	7	44	184	2	46
CT	126	168	376	12	173
BiPolar	0	1	0	0	0
BFR	79	87	70	3	64
UR	0	0	0	0	0
UR-V	1	2	1	0	0
SH	6	22	63	1	85
Frag	220	107	157	4	291
Totals	439	431	851	22	659

	O	KP	LTC	Other	UID	Flake Type %
Total %	25.2	24.7	48.8	1.3		
DC	1.6	10.2	21.6	9.1	7.0	11.8
CT	28.7	39.0	44.2	54.5	26.3	35.6
BFR	18.0	20.2	8.2	13.6	9.7	12.6
SH	1.4	5.1	7.4	4.5	12.9	7.4
Frag	50.1	24.8	18.4	18.2	44.2	32.4

Artefacts

	O	KP	LTC	Other	UID
COR	3	3	23	0	3
BPC	1	3	1	0	0
WED	1	5	6	0	1
bif	2	3	8	2	3
Preform	0	0	1	0	1
PPO-Tri	0	1	2	1	1
PPO-not	0	0	2	0	2
PPO -tip	1	0	1	0	2
PPO-frag	0	0	1	0	0
PPO- stem	0	0	0	0	0
DRI	0	0	0	0	0
SCR	0	1	1	0	0
Side scr	0	0	0	0	0
SCR- VR	1	1	0	0	0
SCR-flake	1	4	1	0	1
GRA	0	2	0	0	0
Foliate BF	0	0	0	0	0
KNI	0	1	1	0	0
Used Cobble	0	0	1	0	0
STR	0	0	0	0	0
MCS	0	0	1	0	0

The Komoka-3 Site **AfHi-31**

	O	KP	LTC	Other	UID
DC	2	4	4	0	1
CT	9	12	9	2	9
BiPolar	0	0	0	0	0
BFR	1	1	0	1	1
UR	0	0	0	0	0
UR-V	0	0	0	0	0
SH	0	5	4	0	1
Frag	6	2	2	1	19
Totals	18	24	19	4	31

	O	KP	LTC	Other	UID	Flake Type %
Total %	27.7	36.9	29.2	6.2		
DC	11.1	16.7	21.1	0.0	3.2	11.5
CT	50.0	50.0	47.4	50.0	29.0	42.7
BFR	5.6	4.2	0.0	25.0	3.2	4.2
SH	0.0	20.8	21.1	0.0	3.2	10.4
Frag	33.3	8.3	10.5	25.0	61.3	31.3

Artefacts

	O	KP	LTC	Other	UID
COR	0	3	1	0	0
BPC	0	0	0	0	0
WED	0	2	0	0	0
bif	0	0	0	0	0
Preform	0	0	0	0	0
PPO-Tri	0	0	0	0	0
PPO-not	0	0	0	0	0
PPO -tip	0	0	0	0	0
PPO-frag	0	0	0	0	0
PPO- stem	0	0	0	0	0
DRI	0	0	0	0	0
SCR	0	0	0	0	0
SCR- VR	0	0	0	0	0
SCR-flake	0	0	0	0	0
SCR- side					
GRA	0	0	0	0	0
Foliate BF	0	0	0	0	0
KNI	0	0	0	0	0
Used Cobble	0	0	0	0	0
STR	0	0	0	0	0
MCS	0	0	0	0	0

The Thomas Lewis Site **AfHi-47**

	O	KP	LTC	Other	UID
DC	2	9	12	0	0
CT	6	21	33	0	22
BiPolar	0	0	1	0	0
BFR	2	9	0	0	6
UR	0	0	0	0	0
UR-V	0	1	0	0	0
SH	0	2	9	0	12
Frag	3	21	15	0	37
Totals	13	63	70	0	77

	O	KP	LTC	Other	UID	Flake Type %
Total %	8.9	43.2	47.9	0.0		
DC	15.4	14.3	17.1	0.0	0.0	10.3
CT	46.2	33.3	47.1	0.0	28.6	36.8
BFR	15.4	14.3	0.0	0.0	7.8	7.6
SH	0.0	3.2	12.9	0.0	15.6	10.3
Frag	23.1	33.3	21.4	0.0	48.1	34.1

Artefacts

	O	KP	LTC	Other	UID
COR	0	1	1	0	2
BPC	0	1	0	0	0
WED	0	0	2	0	0
bif	0	0	0	0	1
Preform	0	0	1	0	0
PPO-Tri	0	0	0	0	0
PPO-not	0	0	0	0	0
PPO -tip	0	0	0	0	0
PPO-frag	0	0	0	0	0
PPO- stem	0	0	0	0	0
DRI	0	0	0	0	0
SCR	0	0	0	0	0
Side scr	0	0	0	0	0
SCR- VR	0	0	1	0	0
SCR-flake	0	0	0	0	0
GRA	0	0	0	0	0
Foliate BF	0	0	0	0	0
KNI	0	0	0	0	0
Used Cobble	0	0	0	0	0
STR	0	0	0	0	0
MCS	0	0	0	0	0

The Ski Club Site **AfHi-78**

	O	KP	LTC	Other	UID
DC	1	3	12	0	3
CT	4	14	18	2	5
BiPolar	0	2	1	0	0
BFR	3	6	4	2	3
UR	0	0	0	0	0
UR-V	0	0	0	0	0
SH	0	0	1	0	2
Frag	0	6	11	1	20
Totals	8	31	47	5	33

	O	KP	LTC	Other	UID	Flake Type %
Total %	8.8	34.1	51.6	5.5		
DC	12.5	9.7	25.5	0.0	9.1	15.3
CT	50.0	45.2	38.3	40.0	15.2	34.7
BFR	37.5	19.4	8.5	40.0	9.1	14.5
SH	0.0	0.0	2.1	0.0	6.1	2.4
Frag	0.0	19.4	23.4	20.0	60.6	30.6

Artefacts

	O	KP	LTC	Other	UID
COR	0	0	1	0	2
BPC	0	0	0	0	0
wedge	0	0	0	0	1
bif	0	0	0	0	0
Preform	0	0	0	0	0
PPO-Tri	0	0	0	0	0
PPO-not	0	0	0	0	0
PPO -tip	0	0	1	0	0
PPO-frag	0	0	0	0	0
PPO- stem	0	0	0	0	0
DRI	0	0	0	0	1
SCR	1	0	0	0	0
Side scr	0	0	0	0	0
SCR- VR	0	0	0	0	0
SCR-flake	0	0	0	0	0
GRA	0	0	0	0	0
Foliate BF	0	0	0	0	0
KNI	0	0	0	0	0
Used Cobble	0	0	0	0	0
STR	0	0	0	0	0
MCS	0	0	0	0	0
DRI	0	0	0	0	0

The Sosad Site **AfHi-120**

	O	KP	LTC	Other	UID
DC	0	0	4	0	0
CT	0	2	9	0	5
BiPolar	0	0	0	0	0
BFR	3	0	0	0	2
UR	0	0	0	0	0
UR-V	0	0	0	0	0
SH	0	0	0	0	1
Frag	4	0	6	0	7
Total	7	2	19	0	15

	O	KP	LTC	Other	UID	Flake Type %
Total %	25.0	7.1	67.9	0.0		
DC	0.0	0.0	21.1	0.0	0.0	9.3
CT	0.0	100.0	47.4	0.0	33.3	37.2
BFR	42.9	0.0	0.0	0.0	13.3	11.6
SH	0.0	0.0	0.0	0.0	6.7	2.3
Frag	57.1	0.0	31.6	0.0	46.7	39.5

Artefacts

	O	KP	LTC	Other	UID
COR	0	0	1	0	2
BPC	0	0	0	0	0
WED	0	0	0	0	1
bif	0	0	1	0	1
Preform	0	0	0	0	0
PPO-Tri	1	0	0	0	0
PPO-not	0	0	0	0	0
PPO -tip	0	1	0	0	0
PPO-frag	0	0	0	0	0
PPO- stem	0	0	0	0	0
DRI	0	0	0	0	0
SCR	0	0	0	0	0
Side scr	0	0	0	0	0
SCR- VR	0	0	0	0	0
SCR-flake	0	0	0	0	0
GRA	0	0	0	0	0
Foliate BF	0	0	0	0	0
KNI	0	0	0	0	0
Used Cobble	0	0	0	0	0
STR	0	0	0	0	0
MCS	0	0	0	0	0

The Preying Mantis Site AfHi-178

	O	KP	LTC	Other	UID
DC	5	13	78	1	9
CT	25	89	83	6	52
BiPolar	0	2	5	0	2
BFR	6	12	7	1	10
UR	0	0	0	0	0
UR-V	0	1	0	0	0
SH	1	12	8	0	13
Frag	16	53	58	2	68
Totals	53	182	239	10	154

	O	KP	LTC	Other	UID	Flake Type %
Total %	11.0	37.6	49.4	2.1		
DC	9.4	7.1	32.6	10.0	5.8	16.6
CT	47.2	48.9	34.7	60.0	33.8	40.0
BFR	11.3	6.6	2.9	10.0	6.5	5.6
SH	1.9	6.6	3.3	0.0	8.4	5.3
Frag	30.2	29.1	24.3	20.0	44.2	30.9

Artefacts

	O	KP	LTC	Other	UID
COR	1	4	16	0	3
BPC	1	3	5	1	5
WED	0	2	12	1	2
bif	1	6	12	1	5
Preform	1	0	1	1	0
PPO-Tri	2	0	5	1	2
PPO-not	0	0	0	0	0
PPO -tip	0	1	1	1	0
PPO-frag	0	0	0	0	0
PPO- stem	1	2	1	1	0
DRI	1	1	1	0	0
SCR	6	24	20	1	5
SCR Side	0	0	0	0	0
SCR- VR	0	0	0	0	0
SCR -Flake	0	0	0	0	0
GRA	0	0	0	0	0
Foliate BF	0	0	0	0	0
KNI	0	0	0	0	0
Used Cobble	0	0	0	0	0
STR	0	0	0	0	0
MCS	0	0	0	0	0

The Crop Circle and TGIF Site **AfHi-178 & 9**

	O	KP	LTC	Other	UID
DC	5	9	174	1	20
CT	49	33	219	6	67
BiPolar	0	0	0	0	1
BFR	35	25	39	3	14
UR	0	0	1	0	0
UR-V	1	1	1	0	0
SH	2	7	88	0	58
Frag	51	23	142	0	122
Totals	143	98	664	10	282

	O	KP	LTC	Other	UID	Flake Type %
Total %	15.6	10.7	72.6	1.1		
DC	3.5	9.2	26.2	10.0	7.1	17.5
CT	34.3	33.7	33.0	60.0	23.8	31.2
BFR	24.5	25.5	5.9	30.0	5.0	9.7
SH	1.4	7.1	13.3	0.0	20.6	12.9
Frag	35.7	23.5	21.4	0.0	43.3	28.2

Artefacts

	O	KP	LTC	Other	UID
COR	1	1	72	1	2
BPC	0	0	2	0	1
WED	0	4	7	0	2
bif	1	4	7	0	2
Preform	0	0	4	0	2
PPO-Tri	2	1	1	0	0
PPO-not	2	1	2	0	1
PPO -tip	0	1	0	0	2
PPO-frag	0	0	0	0	0
PPO- stem	0	0	1	0	0
DRI	1	0	1	0	0
SCR	1	0	0	0	2
Side scr	0	0	0	0	0
SCR- VR	2	2	2	0	0
SCR-flake	0	0	0	0	0
GRA	0	0	0	0	0
Foliate BF	1	0	0	0	0
KNI	0	0	0	0	0
Used cobble	0	0	2	0	0
STR	0	0	1	0	0
MCS	0	0	0	0	0

The Roeland Site **AfHj-14**

	O	KP	LTC	Other	UID
DC	1	13	48	0	5
CT	40	138	142	3	60
BiPolar	0	0	0	0	0
BFR	11	27	27	0	3
UR	0	0	0	0	0
UR-V	0	0	0	0	0
SH	1	18	33	0	28
Frag	33	77	92	0	117
Totals	86	273	342	3	213

	O	KP	LTC	Other	UID	Flake Type %
Total %	12.2	38.8	48.6	0.4		
DC	1.2	4.8	14.0	0.0	2.3	7.3
CT	46.5	50.5	41.5	100.0	28.2	41.8
BFR	12.8	9.9	7.9	0.0	1.4	7.4
SH	1.2	6.6	9.6	0.0	13.1	8.7
Frag	38.4	28.2	26.9	0.0	54.9	34.8

Artefacts

	O	KP	LTC	Other	UID
COR	0	0	0	1	0
BPC	0	0	0	0	0
WED	0	0	0	0	0
bif	0	0	0	1	0
Preform	0	0	0	0	0
PPO-Tri	0	0	0	0	1
PPO-not	0	0	0	0	0
PPO -tip	0	0	0	0	0
PPO-frag	0	0	0	0	0
PPO- stem	0	0	0	0	0
DRI	0	0	0	0	0
SCR	1	0	0	0	0
SCR- VR	0	0	0	1	0
SCR-side	0	0	0	0	0
SCR-flake	0	0	0	0	0
GRA	0	0	0	0	0
Foliate BF	0	0	0	0	0
KNI	0	0	0	0	0
Used Cobble	0	0	0	0	0
STR	0	0	0	0	0
MCS	0	0	0	0	0

The Melbourne-7 Site **AfHj-17**

	O	KP	LTC	Other	UID
DC	0	0	2	0	0
CT	35	4	5	0	8
BiPolar	0	0	0	0	0
BFR	14	0	1	0	0
UR	1	0	0	0	0
UR-V	0	0	0	0	0
SH	4	0	1	0	5
Frag	46	3	3	0	23
Totals	100	7	12	0	36

	O	KP	LTC	Other	UID	Flake Type %
Total %	84.0	5.9	10.1	0.0		
DC	0.0	0.0	16.7	0.0	0.0	1.3
CT	35.0	57.1	41.7	0.0	22.2	33.5
BFR	14.0	0.0	8.3	0.0	0.0	9.7
SH	4.0	0.0	8.3	0.0	13.9	6.5
Frag	46.0	42.9	25.0	0.0	63.9	48.4

Artefacts

	O	KP	LTC	Other	UID
COR	0	0	0	0	0
BPC	0	0	0	0	0
WED	0	0	0	0	0
bif	2	0	0	0	0
Preform	0	0	0	0	0
PPO-Tri	0	0	0	0	0
PPO-not	0	0	0	0	0
PPO -tip	0	0	0	0	0
PPO-frag	0	0	0	0	0
PPO- stem	0	0	0	0	0
DRI	1	0	0	0	0
SCR	0	0	0	0	1
SCR-Side	0	0	0	0	0
SCR- VR	0	0	0	0	0
SCR-flake	1	0	0	0	1
GRA	0	0	0	0	0
Foliate BF	0	0	0	0	0
KNI	0	0	0	0	0
Used Cobble	0	0	0	0	0
STR	0	0	0	0	0
MCS	0	0	0	0	0

The MiV18 Site **AfHj-19**

	O	KP	LTC	Other	UID
DC	4	7	4	2	2
CT	41	52	21	1	10
BiPolar	0	0	0	0	0
BFR	10	10	1	0	3
UR	0	0	0	0	0
UR-V	0	0	0	0	0
SH	1	11	5	0	2
Frag	69	36	19	0	30
Totals	125	116	50	3	47

	O	KP	LTC	Other	UID	Flake Type %
Total %	42.5	39.5	17.0	1.0		
DC	3.2	6.0	8.0	66.7	4.3	5.6
CT	32.8	44.8	42.0	33.3	21.3	36.7
BFR	8.0	8.6	2.0	0.0	6.4	7.0
SH	0.8	9.5	10.0	0.0	4.3	5.6
Frag	55.2	31.0	38.0	0.0	63.8	45.2

Artefacts

	O	KP	LTC	Other	UID
COR	1	0	1	0	1
BPC	0	0	0	0	0
WED	0	1	0	0	1
bif	0	2	0	0	1
Preform	0	0	0	0	0
PPO-Tri	0	0	0	0	0
PPO-not	0	0	0	0	0
PPO -tip	0	1	0	0	0
PPO-frag	0	0	0	0	0
PPO- stem	0	0	0	0	0
DRI	1	1	0	0	0
SCR	1	1	2	0	0
Side scr	0	0	0	0	0
SCR- VR	1	1	0	0	0
SCR-flake	0	1	0	0	0
GRA	0	0	0	0	0
Foliate BF	0	0	0	0	0
KNI	0	0	0	0	0
Used Cobble	0	0	0	0	0
STR	0	0	0	0	0
MCS	0	0	0	0	0

The Caradoc-13 Site **AfHj-26**

	O	KP	LTC	Other	UID
DC	0	5	5	0	0
CT	4	8	11	2	4
BiPolar	0	0	0	0	0
BFR	1	2	0	2	0
UR	0	0	0	0	0
UR-V	0	0	0	0	0
SH	0	2	3	0	1
Frag	4	7	4	3	4
Totals	9	24	23	7	9

	O	KP	LTC	Other	UID	Flake Type %
Total %	14.3	38.1	36.5	11.1		
DC	0.0	20.8	21.7	0.0	0.0	13.9
CT	44.4	33.3	47.8	28.6	44.4	40.3
BFR	11.1	8.3	0.0	28.6	0.0	6.9
SH	0.0	8.3	13.0	0.0	11.1	8.3
Frag	44.4	29.2	17.4	42.9	44.4	30.6

Artefacts

	O	KP	LTC	Other	UID
COR	0	0	0	1	0
BPC	0	0	0	0	0
WED	0	0	0	0	0
bif	0	0	0	1	0
Preform	0	0	0	0	0
PPO-Tri	0	0	0	0	1
PPO-not	0	0	0	0	0
PPO -tip	0	0	0	0	0
PPO-frag	0	0	0	0	0
PPO- stem	0	0	0	0	0
DRI	0	0	0	0	0
SCR	1	0	0	0	0
SCR-side	0	0	0	0	0
SCR- VR	0	0	0	1	0
SCR-flake	0	0	0	0	0
GRA	0	0	0	0	0
Foliate BF	0	0	0	0	0
KNI	0	0	0	0	0
Used Cobble	0	0	0	0	0
STR	0	0	0	0	0
MCS	0	0	0	0	0

The Caradoc-3 Site **AfHj-105**

	O	KP	LTC	Other	UID
DC	0	0	10	0	1
CT	17	0	26	2	5
BiPolar	1	0	0	0	0
BFR	2	0	2	0	0
UR	0	0	0	0	0
UR-V	0	0	0	0	0
SH	0	0	3	0	0
Frag	18	1	20	4	14
Totals	38	1	61	6	20

	O	KP	LTC	Other	UID	Flake Type %
Total %	35.8	0.9	57.5	5.7		
DC	0.0	0.0	16.4	0.0	5.0	8.7
CT	44.7	0.0	42.6	33.3	25.0	39.7
BFR	5.3	0.0	3.3	0.0	0.0	3.2
SH	0.0	0.0	4.9	0.0	0.0	2.4
Frag	47.4	100.0	32.8	66.7	70.0	45.2

Artefacts

	O	KP	LTC	Other	UID
COR	0	0	0	0	0
BPC	0	0	0	0	0
WED	0	0	0	0	0
bif	0	0	0	0	0
Preform	0	0	0	0	0
PPO-Tri	0	0	0	0	0
PPO-not	0	0	0	0	0
PPO -tip	0	0	0	0	0
PPO-frag	0	0	0	0	0
PPO- stem	0	0	0	0	0
DRI	0	0	0	0	0
SCR	1	0	0	0	0
Side scr	0	0	0	0	0
SCR- VR	0	0	0	0	0
SCR-flake	0	0	0	0	0
GRA	0	0	0	0	0
Foliate BF	0	0	0	0	0
KNI	0	0	0	0	0
Used Cobble	0	0	0	0	0
STR	0	0	0	0	0
MCS	0	0	0	0	0

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1977 License Report
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