An Assessment of the Limitations of Macroscopic Lithic Raw Material Identification and Parent Nodule Assignment within Archaeological Contexts in Minnesota and an Analysis of Lithic Raw Material Utilization at 21LN2

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By

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DEDICATION

To my children; whose warm hugs comfort and enduring love reminds.

ABSTRACT

The objective of this study was twofold; one, test the limitations of macroscopic lithic raw material identification and parent nodule assignment with regard to materials commonly identified within prehistoric contexts in Minnesota (the secondary study); and two, assess the lithic raw material utilization at 21LN2 (the primary study).

The initial results of the secondary study indicate that macroscopic observation can be an effective method with regard to differentiating and identifying lithic raw material types commonly encountered at archaeological sites in Minnesota. The results also suggest that Minimum Analytical Nodule Analysis should be quite applicable to most lithic assemblages identified at archaeological sites in Minnesota.

The results of the primary study demonstrate that the prehistoric inhabitants of 21LN2 operated within a vast sphere of interaction and relied heavily upon local and non-local lithic resources. Indications are that the Law of Least Effort does not adequately describe the procurement pattern found at 21LN2. Non-locally procured raw materials tend to exhibit a higher degree of curation and retooling appears to have been an important aspect of the lithic industry at the site. The results of the study also demonstrate that high quality raw materials of non-local provenience were, in general, reduced more efficiently and retouched with greater intensity than other raw material types identified at the site.

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1.0 INTRODUCTION

1.1 THE IMPORTANCE OF LITHIC RAW MATERIAL STUDIES

Lithic artifacts represent the earliest evidence of human technology and are often the most abundant if not the only form of artifacts found at prehistoric archaeological sites. The manufacture and use of lithic tools was an important human adaptive strategy and the procurement of lithic raw materials was vital to prehistoric life ways. As such, lithic analyses, and more specifically raw material utilization studies, provide an important data set that can be used to interpret prehistoric human behavior.

> *Because lithic raw materials can often be sourced, they provide robust information about circulation of stone, if not people, across the landscape. This fact alone makes lithic raw material an important resource for gaining insight into human land use and mobility patterns, and relating those to lithic technology (Andrefsky 2009:75).*

Sorting a lithic assemblage by raw material is the most fundamental step in any lithic analysis (Baumler and Davis 2004:49). This is obvious when the goal of a lithic analysis is to render interpretations regarding prehistoric interaction spheres, territorial ranges, land use, and lithic procurement strategies. However, it is also important when interpreting technological aspects of a lithic assemblage. A number of studies have shown that patterns of lithic raw material procurement strongly influence the technological organization of stone tool production, maintenance, and discard (Andrefsky 1991, 1994a; Hall 2004; Larson and Kornfeld 1997; Morrow and Jefferies 1989; Parry and Kelly 1986; Rolland and Dibble 1990; Sellet 2004). Additionally, the diagnosis of certain technological aspects, such as heat-treatment, is far more accurately carried out once the raw material composition of the lithic assemblage has been established and an understanding of the natural properties of the identified raw materials is achieved.

The past several decades have witnessed a growing impetus upon lithic raw material analysis, debitage analysis, and aggregate analysis in pursuit of a greater understanding of past human behavior. This trend has focused on different methods of studying a lithic assemblage as a whole, whether mixed or stratified, to interpret the organization of prehistoric lithic technology (Larson 2004). One of these methods is Minimum Analytical Nodule Analysis (MANA). MANA is a technique which allows for raw material types to be further subdivided into more discrete and meaningful analytical units (Hall 2004:141; Larson 2004:15-16). This is accomplished by subdividing heterogeneous raw material groups based on nuances within the raw material types such as color, texture, fossil and crystalline inclusions, cortical texture and color, and other observable characteristics (Larson and Kornfeld 1997:7).

In general, sites tend to exhibit the residue of multiple reduction sequences that become mixed over time through site use and other post-depositional processes. By applying MANA to such complex lithic assemblages, archaeologists can gain a greater ability to assess individual episodes of tool manufacture, maintenance, and discard, allowing for more refined interpretations about the organization of technological activities at a site. In this manner, MANA can provide more refined insight regarding site function and better illuminate decision making processes concerning lithic raw material procurement and production strategies. MANA can also be used to assess the degree to which non-cultural processes of burial or post-depositional movement of lithic materials may have occurred within a site.

1.2 RESEARCH OBJECTIVE

The objective of this study was twofold; one, test the limitations of macroscopic lithic raw material identification and parent nodule assignment with regard to materials commonly identified within prehistoric contexts in Minnesota; and two, assess the lithic raw material utilization at 21LN2.

The pursuit of these research goals was attempted through two separate but connected studies. The primary study sought to integrate MANA into a lithic raw material utilization analysis – something that had not previously been attempted upon a lithic assemblage identified in Minnesota. The secondary study assessed the limitations of traditional macroscopic lithic raw material identification and differentiation as well as parent nodule assignment among materials commonly found within archaeological contexts in Minnesota. The secondary study spawned from the primary study as questions were raised regarding the ambiguity of lithic raw material identification and the designation of minimum analytical nodules. Though the secondary study is presented first in this paper, both studies were carried out simultaneously due to time constraints. A cursory overview of both studies is presented below.

1.3 AN ASSESSMENT OF THE LIMITATIONS OF MACROSCOPIC LITHIC RAW MATERIAL IDENTIFICATION AND PARENT NODULE ASSIGNMENT WITHIN ARCHAEOLOGICAL CONTEXTS IN MINNESOTA

Research regarding lithic raw material utilization relies heavily upon the analyst's ability to differentiate geologically based raw material types of a study region. As a result, this study tests the limitations of macroscopic lithic raw material identification among many of Minnesota's most commonly identified archaeological lithic raw materials as well as the applicability of the MANA technique upon these same material types. To accomplish both of these goals a blind test was organized. The objectives of this test were to quantify the accuracy with which these lithic raw materials can be sorted into geologically based raw material groups and assess which materials work favorably with the MANA technique - validating these analytical approaches with regard to lithic assemblages identified in Minnesota. The test also assessed how accurately the presence or absence of heat-treatment can be diagnosed for each raw material type. The test assessed how well these different aspects of lithic analysis can be carried out using only macroscopic techniques with the aid of a 10x hand lens. Though more sophisticated methods exist by which material types may be differentiated (microscopy, spectroscopy, trace element analysis, etc.); the most accessible, affordable, and utilized method is macroscopic analysis with the aid of a 10x hand lens. As a result, testing the limitations of macroscopic analysis with regard to raw material identification, recognition of thermal alteration, and parent nodule assignment, was justified.

1.4 AN ANALYSIS OF LITHIC RAW MATERIAL UTILIZATION AT 21LN2

Site 21LN2 is perhaps one of the most interesting archaeological sites in the State of Minnesota. Archaeological material representing the full spectrum of known human occupation of this region, Paleo-Indian, Archaic, Woodland, Late Prehistoric (Plains Village/Oneota), proto-historical, and historical periods, have all been identified at this site. The site has been excavated on a number of occasions and analyses have been completed upon the various assemblages; however, little attention has been paid to the lithic assemblages collected from the site, particularly with regard to the lithic raw materials comprising these assemblages.

An analysis of lithic raw material utilization at 21LN2 has the potential to address many interesting questions. For example, what raw materials are present at the site and what does the presence of these raw material types tell us about the prehistoric inhabitants' connections, whether by trade or travel, to surrounding regions? How were differing raw material types utilized at the site, does this usage show a heavy reliance on local materials or non-local materials, and do these observed trends correspond well with Andrefsky's (1994b) predictions regarding high and low quality materials of local and non-local availability? Additionally, how were different materials and/or nodules of material moving through the site, how intensively were the various raw materials being utilized with regard to reduction and tool retouch? Finally, can MANA serve as a tool to better inform lithic raw material utilization behavior at 21LN2?

1.5 THESIS ORGANIZATION AND STRUCTURE

This paper contains four chapters. Chapter 1 is an introduction to the research goals and objectives of this thesis as well as an explanation of the motives behind carrying out such research. Chapter 2 discusses the methods and initial results of a blind test conducted to assess the limitations of macroscopic lithic raw material identification among many of Minnesota’s most commonly identified archaeological lithic raw materials as well as assess the applicability of the MANA technique upon these same raw material types. Chapter 3 presents an analysis of lithic raw material utilization at Site 21LN2. Chapter 4 offers final conclusions and future studies.

2.0 AN ASSESSMENT OF THE LIMITATIONS OF MACROSCOPIC LITHIC RAW MATERIAL IDENTIFICATION AND PARENT NODULE ASSIGNMENT WITHIN ARCHAEOLOGICAL CONTEXTS IN MINNESOTA

2.1 INTRODUCTION

Research regarding lithic raw material utilization relies heavily upon the analyst's ability to differentiate geologically based raw material types of a study region. As a result, this study tests the limitations of macroscopic lithic raw material identification among many of Minnesota's most commonly identified archaeological lithic raw materials as well as the applicability of the MANA technique upon these same material types. To accomplish both of these goals a blind test was carried out. The objectives of this test were to quantify the accuracy with which these lithic raw materials can be sorted into geologically based raw material groups and assess which materials work favorably with the MANA technique - validating these analytical approaches with regard to lithic assemblages identified in Minnesota. The test also assessed how accurately the presence or absence of heat-treatment can be diagnosed for each raw material type. The test was conducted to assess how well these different aspects of lithic analysis can be carried out using only macroscopic techniques with the aid of a 10x hand lens. Though more sophisticated methods exist by which material types may be differentiated (microscopy, spectroscopy, trace element analysis, etc.); the most accessible, affordable, and utilized method is macroscopic analysis with the aid of a 10x hand lens. As a result, testing the limitations of macroscopic analysis with regard to raw material identification, recognition of thermal alteration, and parent nodule assignment, was justified.

It is hoped that the initial results of this study presented in this thesis, can serve as a point of discussion for other lithic analysts who are interested in lithic raw material analysis and the limitations in Minnesota; and that the design of the study can provide a framework within which future data can be collected and tested. This study should be viewed as an initial inquiry. In this manner, the study can also serve as a foundation from which future studies can be developed and refined.

2.2 MINNESOTA'S LITHIC RAW MATERIAL RESOURCE REGIONS

Based on the geological history of Minnesota, Bakken (2011) has divided the state into four lithic raw material resource regions: South Agassiz, West Superior, Pipestone, and Hollandale (Figure 1). The South Agassiz and West Superior resource regions were further delineated into subregions based on variations in the availability of specific raw materials within the region. Based on archaeological and geological data for each region and subregion, Bakken (2011:66) designated raw materials that are commonly available and commonly identified at archaeological sites as 'primary materials' whereas raw materials that are less abundant within the region and less frequently identified at archaeological sites were designated as 'secondary materials'. A third designation, 'other materials or minor materials,' was assigned to raw materials that are not commonly available or not commonly identified as artifacts at archaeological sites. A fourth designation, 'main exotic materials,' was assigned to those materials not found naturally within the region, yet commonly identified at archaeological sites within the region. Table 1 presents Bakken's (2011:67) resource regions and subregions as well as the associated lithic raw materials by level of geological abundance and archaeological utilization (i.e., primary, secondary, minor [other], and main exotic).

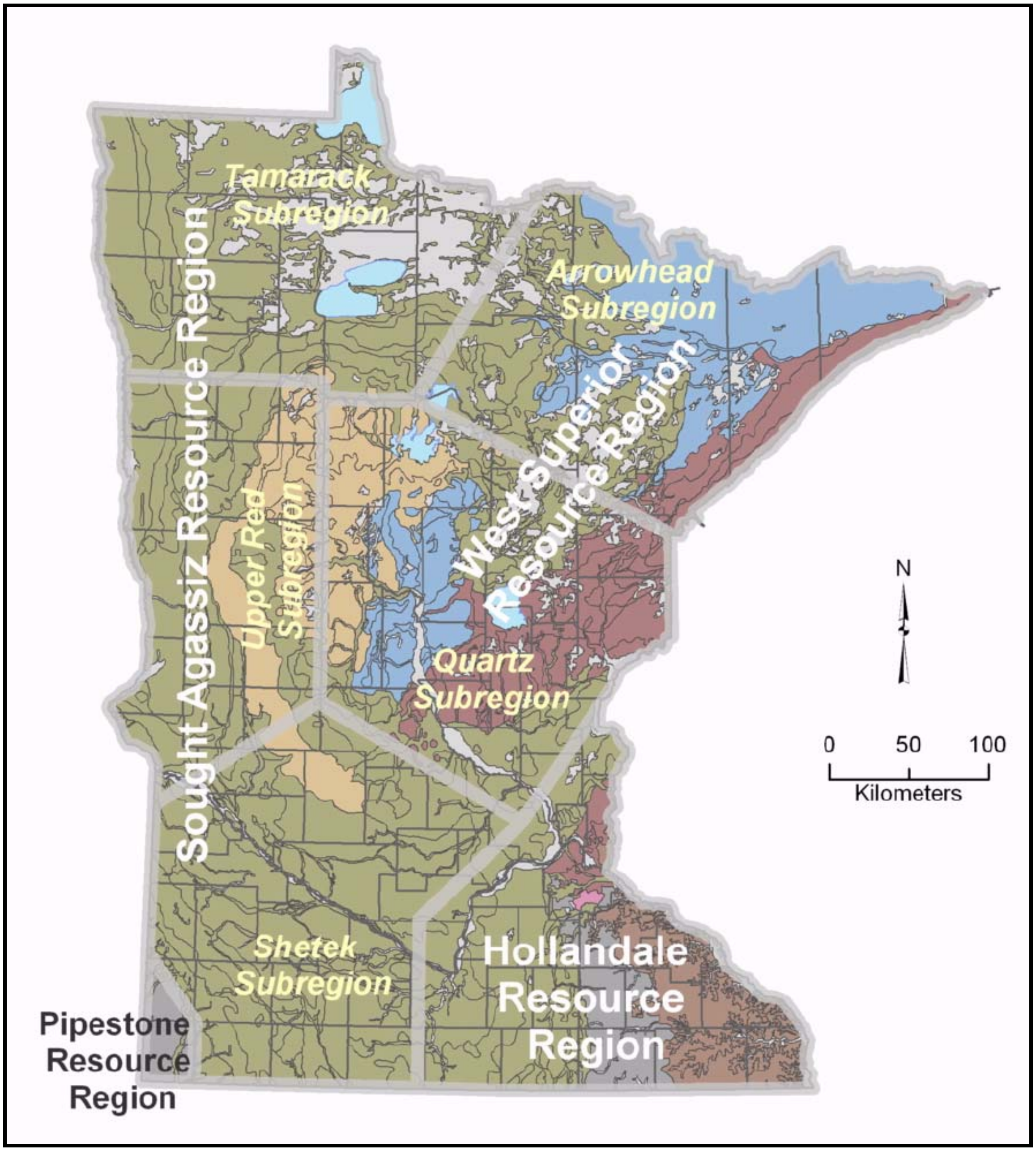
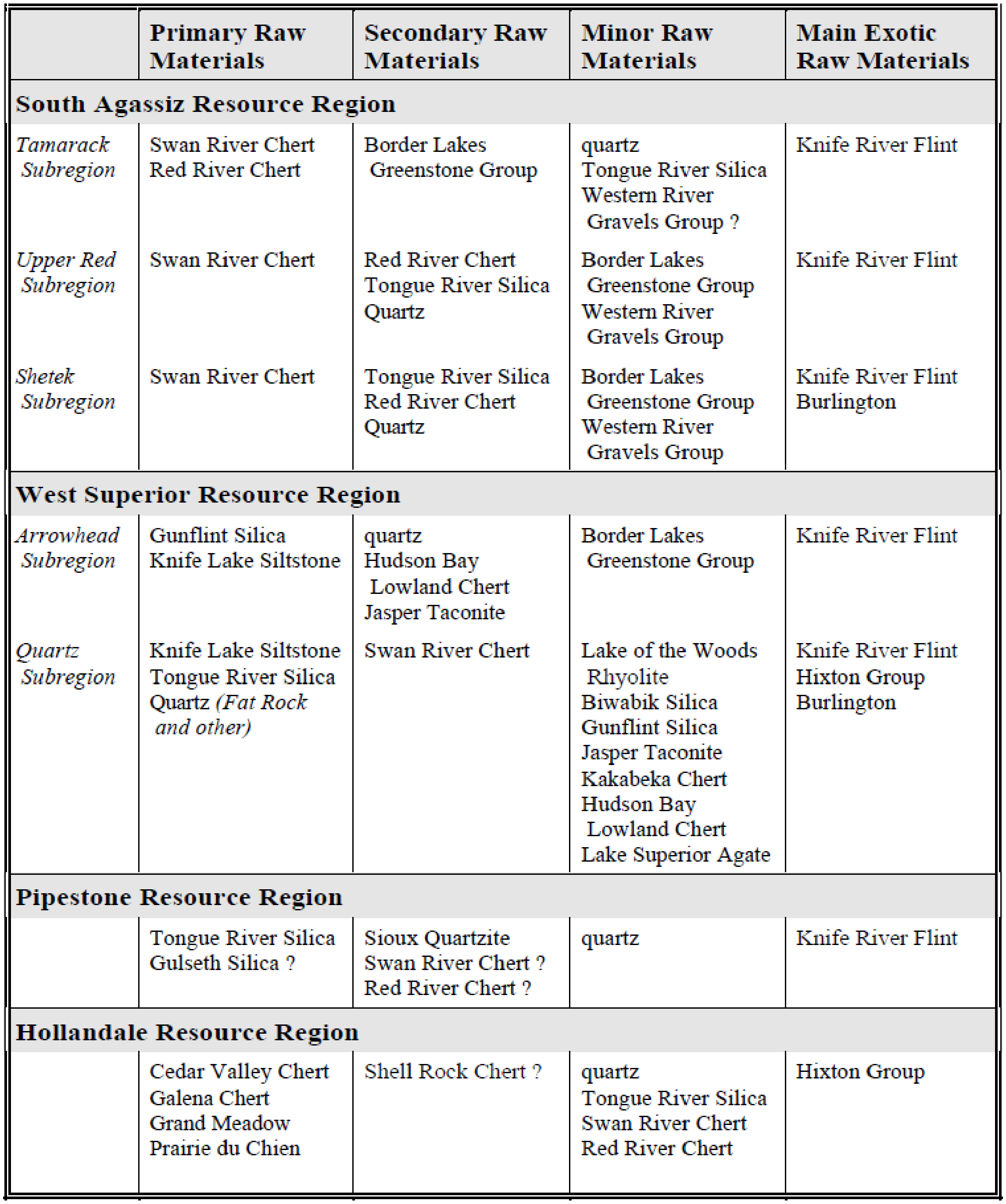


FIGURE 1. LITHIC RAW MATERIAL RESOURCE REGIONS AND GEOLOGICAL DISTRIBUTION OF LITHIC RAW MATERIALS (FROM BAKKEN 2011:38)

TABLE 1. ESTIMATED PRIMARY, SECONDARY, MINOR, AND EXOTIC LITHIC RAW MATERIALS BY REGION AND SUBREGION (FROM BAKKEN 2011:67)



	Primary Raw Materials	**Secondary Raw Materials**	**Minor Raw Materials**	**Main Exotic Raw Materials**
South Agassiz Resource Region				
Tamarack Subregion	Swan River Chert Red River Chert	Border Lakes Greenstone Group	quartz Tongue River Silica Western River Gravels Group ?	Knife River Flint
Upper Red Subregion	Swan River Chert	Red River Chert Tongue River Silica Quartz	Border Lakes Greenstone Group Western River Gravels Group	Knife River Flint
Shetek Subregion	Swan River Chert	Tongue River Silica Red River Chert Quartz	Border Lakes Greenstone Group Western River Gravels Group	Knife River Flint Burlington
West Superior Resource Region				
Arrowhead Subregion	Gunflint Silica Knife Lake Siltstone	quartz Hudson Bay Lowland Chert Jasper Taconite	Border Lakes Greenstone Group	Knife River Flint
Quartz Subregion	Knife Lake Siltstone Tongue River Silica Quartz *(Fat Rock and other)*	Swan River Chert	Lake of the Woods Rhyolite Biwabik Silica Gunflint Silica Jasper Taconite Kakabeka Chert Hudson Bay Lowland Chert Lake Superior Agate	Knife River Flint Hixton Group Burlington
Pipestone Resource Region				
	Tongue River Silica Gulseth Silica ?	Sioux Quartzite Swan River Chert ? Red River Chert ?	quartz	Knife River Flint
Hollandale Resource Region				
	Cedar Valley Chert Galena Chert Grand Meadow Prairie du Chien	Shell Rock Chert ?	quartz Tongue River Silica Swan River Chert Red River Chert	Hixton Group

2.3 METHODS

2.3.1 Raw Material Selection and Test Structure

The initial stage of the blind test was the selection of 18 lithic raw materials commonly identified at archaeological sites in Minnesota. The selection process was informed largely by Bakken's (2011) *Lithic Raw Material Use Patterns in Minnesota*. Additional input regarding the selection process was provided by a number of individuals who are well known for their familiarity with lithic raw material types commonly found at Minnesota's archaeological sites. These acknowledged experts included Dr. Kent Bakken, Dan Wendt, LeRoy Gonsior, and Bruce Koenen.

The 18 lithic raw materials consisted of basaltic rock, Burlington chert, Cedar Valley chert, Cochrane chert, Galena chert, Grand Meadow chert, Hixton Group silicified sandstone, Jasper Taconite, Knife River flint, Lake Superior agate, Maynes Creek chert, Prairie du Chien chert, quartz, quartzite, Red River chert, siltstone, Swan River chert, and Tongue River silica. Several raw material types (i.e., Gunflint silica, Biwabik silica, Gulseth silica, etc.) that are commonly found at archaeological sites in Minnesota were not included in the blind test as adequate sample sizes of these materials were not available at the time of the study.

Once the 18 lithic raw material types were selected, 14 to 28 flakes (size grade: > ½ inch) from each raw material type, representing three to seven randomly selected individual nodules per material type, were selected. The exception to these parameters was Cedar Valley chert, in which case three to seven nodules of each variety (i.e. translucent, opaque, and grainy) were selected making for a total of 71 flakes representing 17 nodules. The number of nodules and flakes of each raw material type were selected randomly. The purpose for the difference in number of nodules and total flakes among differing material types was to prevent deductive reasoning from influencing the test. For example if the examinee knew the exact number of flakes or nodules of each raw material type it is reasonable to assume that the examinee would have an easier time separating out the flakes and nodules than the examinee would assuming the conditions encountered when dealing with an archaeological assemblage where the number of flakes and nodules from each material type is unknown prior to analysis.

A label was applied to each individual flake codifying the raw material type and parent nodule. The label was then covered completely with a small secondary label with a test identifier to prevent the examinee from using the primary label as a sorting aid. The 431 total pieces of debitage were then placed on a large table top and mixed thoroughly prior to being gathered into a mound-like pile. The experimental lithic assemblage was then presented to the examinee who was instructed to sort the lithic debitage first by raw material type and then by nodule. The examinee was instructed to name each raw material type to demonstrate recognition of not only differences between material types but also demonstrate the ability to correctly assign the material to a geological source or source region as defined by the State of Minnesota's lithic raw material comparative collection housed at Fort Snelling State Park. The examinee was also instructed to indicate whether or not each sample had been heat-treated and assign a confidence level to each of their designations. Confidence levels ranged from 1 to 3 (1=very confident, 2=somewhat confident, 3=not very confident).

2.3.2 Assessment Protocol

Each flake which was placed within the correct raw material group was noted and divided by the total number of flakes in that raw material group. The quotient represented the percentage of success for sorting each particular raw material. For example if 24 of the 25 Tongue River silica flakes were correctly assigned to the Tongue River silica group, the percentage of success with regard to correctly sorting Tongue River silica would be 96%. Raw materials incorrectly assigned were recorded and patterns of misidentification were noted in an attempt to determine which of these commonly identified raw material types are most likely to be mistaken for one another during the analysis of archaeological lithic assemblages.

The same process was used when assessing the percentage of success for sorting flakes into the correct nodule. All flakes that were correctly assigned were counted and divided by the total number of flakes in that raw material group. In the case of fairly equally mixed nodule groups, the nodule with the greatest number of flakes within the mixed nodule group became the identity of the mixed nodule. In this manner all flakes from other nodules with less representation were reassigned and counted against the total number of correctly assigned flakes. For example, if the examinee assigned seven flakes of Swan River chert to examinee nodule SRC-A, but in fact four of the flakes were from actual Swan River chert nodule SRC-1 and three were from actual Swan River chert nodule SRC-2, the examinee's mixed nodule, SRC-A, would be correlated with actual Swan River nodule SRC-1 and the three flakes from actual nodule SRC-2 would be reassigned and counted against the total number of correctly assigned flakes within the Swan River chert material group.

Each flake which was correctly diagnosed as heat-treated or not-heat-treated was noted and divided by the total number of flakes in that raw material group. Again, the quotient represented the percentage of success for diagnosing the presence or absence of heat-treatment by raw material. For example if the presence or absence of heat-treatment was correctly diagnosed in 15 of the 25 Grand Meadow chert flakes, the percentage of success with regard to correctly diagnosing the presence or absence of heat-treatment regarding Grand Meadow chert would be 60%.

Finally, the assigned confidence level was cross-checked against correct and incorrect designations to assess how the analysts' confidence levels equate to levels of accuracy. In a real-world situation a lithic analyst has the option of identifying an artifact as indeterminate with regard to material type and heat-treatment and not assigning the artifact to a minimum analytical nodule (MAN) group. However, for the purposes of this blind test the examinees were asked to make such identifications for all 431 samples to assess how well each material type can be recognized and identified and then further divided into MAN and characterized as heat-treated or not heat-treated.

A degree of confidence designation was used to account for the examinee’s confidence level in each of his/her assignments. The degree of confidence designation is based on a three tier confidence rating system (1, 2, and 3). Designation 1 indicates that the examinee had a high level of confidence in his/her identification. Designation 2 indicates that the examinee had a moderate level of confidence in his/her identification. Designation 3 indicates that the examinee had a low level of confidence in his/her identification and in a real-world situation the examinee would normally opt to only identify the sample to a general material type (e.g., chert), not declare if the item was heat-treated or not heat-treated, and/or not attempt to subdivide the material type into MANs. In this manner, all specific material type identifications, heat-treatment designations, and MAN assignments with a corresponding degree of confidence designation of 3 were considered a best guess. Forcing the examinee to make these determinations was essential in generating important data required to demonstrate the degree to which each material type can be recognized, how accurately heat-treatment or lack thereof can be recognized by raw material type, and how accurately each material type can be subdivided by parent nodule.

Alternatively, it is also important to acknowledge that in a real-world scenario the examinee would have been more conservative in his/her material identification, heat-treatment classification, and attempts to subdivide homogeneous material types into nodules. The degree of confidence designation allows those samples which have been given a confidence level designation of 3 to later be excluded or assigned a value equivalent to indeterminate, which then also provides an assessment of how likely the examinee’s identifications are to be correct in a real world situation where an indeterminate assignment is allowed. This also allows the assessment of what percentage of each material type are likely to be assigned to indeterminate categories in a real-world situation.

2.3.3 Test Assemblage and Participants

The test assemblage was assembled by Dan Wendt using a random sampling method and was derived from the extensive lithic raw material type collection housed at Fort Snelling State Park. Over the past thirty years, Mr. Wendt, an avocational archaeologist and master flintknapper, has contributed greatly to this type collection not only through the donation of a vast amount of lithic raw material, but also by lending his expert flintknapping skills to the reduction of many of these geological samples. Mr. Wendt has meticulously saved and labeled the debitage from each reduction sequence providing an excellent resource from which the current test assemblage was derived. Mr. Wendt's knowledge of the type collection made him a good candidate for assembling the test assemblage and also precluded him from participating in the blind test as an examinee.

The author comprised the sole examinee of this initial test. The test results of other lithic analysts, including those of Dr. Kent Bakken (acknowledged expert on the lithic raw materials of Minnesota), will be added once compiled and a synthesis of the results presented in a future paper. The presentation here, of the initial results (those of the author) serves two purposes. First, it provides an initial indication of the potential limitations of macroscopic lithic raw material analysis with regard to lithic assemblages identified in Minnesota, better informing the expectations of raw material analysis such as that presented in Chapter 3. Second, the initial results demonstrate the author's level of ability, informing the accuracy with which the analysis presented in Chapter 3 was carried out.

2.4 RESULTS

Under normal circumstances, lithic raw material analysis should involve the use of a comprehensive type collection and the consultation of colleagues. In the case of this blind test, the use of the State's comprehensive type collection was prohibited due to the fact that the test assemblage was derived from said type collection. Conferring with colleagues was also prohibited as the purpose of the blind test was to assess the individual lithic analyst's ability to recognize and differentiate raw material types as well as designate membership to parent nodules and diagnose thermal alteration. Despite these restrictions, 93.27% of the samples (n=402 of 431) were correctly identified with regard to specific raw material type. The overall percentage of success increased to 95.98% (n=358 of 373) when identifications designated as confidence level 3 (normally assigned an indeterminate status in an actual artifact analysis) were removed. The results of the raw material identification portion of the blind test are summarized and presented by raw material type in Table 2.

It should be noted that Cedar Valley chert and Cochrane chert have similar physical characteristics and procurement provenience (southwest Wisconsin and southeast Minnesota) and attempts are often not made by archaeologists to differentiate the two material types, but rather lump them into one group – the *Cedar Valley Group*. Due to their level of similarity, some archaeologists have argued that the materials are indeed the same material type merely outcropping in different locations. Wisconsin archaeologists generally refer this raw material as Cochrane chert while Minnesota archaeologists generally refer to it as Cedar Valley chert. Glascock (1996) proved through neutron activation analysis that the two materials are indeed distinct raw material types and thus the blind test was set up to assess the limitations of differentiating the two materials macroscopically. Though these results are discussed within the paragraphs covering Cedar Valley Group chert (and presented in Tables 5, 6, and 7), the overall percentage of correct identifications with regard to raw material type was assessed considering the two materials as a group, the Cedar Valley Group, to remain consistent with how a lithic analyst would proceed with an actual archaeological collection. However, the discussion below covering the results of the differentiation of these two material types suggest that certain varieties of Cedar Valley chert can be consistently and accurately differentiated from Cochrane chert through macroscopic means.

The diagnosis of thermal alteration or heat-treatment was not as successful overall as the raw material type identification with only 72.62% (n=313 of 431) of the samples diagnosed correctly. The percentage of success was not improved (72.54% [n=140 of 193]) when diagnoses designated as confidence level 3 (normally assigned an indeterminate status in an actual artifact analysis) were removed. The results of the thermal alteration diagnosis portion of the blind test are presented by raw material type in Table 3.

The assignment of individual samples to parent nodules was far more successful overall than anticipated with 83.29% (n=359 of 431) of the samples assigned to the correct parent nodule. The overall percentage of success increased to 86.29% (n=258 of 299) when assignments designated as confidence level 3 (normally assigned an indeterminate status in an actual artifact analysis) were removed. The results of the parent nodule assignment portion of the blind test are presented by raw material type in Table 4.

It should be noted that four nodules within the test assemblage were comprised of a mix of thermally altered samples and samples not thermally altered. These mixed nodules were included in the study to assess if thermal alteration or lack thereof affected the manner in which the samples were sorted by parent nodule. Assigning these samples into two separate nodules was not considered incorrect, but was noted to better inform how an analyst might classify such an instance during an actual analysis. Mixed nodules were included in four of the raw material test assemblages – Burlington chert, Maynes Creek chert, Red River chert, and Tongue River silica. The presence of this ‘extra nodule’ is noted parenthetically in Table 4 under the column titled *No. of Nodules*.

Detailed results of the blind test are discussed by raw material type within the ensuing paragraphs. The complete blind test results can be found in Appendix A.

Table 2. Blind Test Results: Raw Material Identification and Differentiation

Raw Material Type	Count	Accuracy of Assignment by Raw Material Type					Materials Misidentified As
		No. Correct	Percent Correct	No. of Conf. 1&2	No. Conf. 1&2 Correct	Percent Conf. 1&2 Correct	
Basaltic Rock	22	22	100.00%	22	22	100.00%	None
Burlington Chert	18	15	83.33%	15	15	100.00%	Prairie Du Chien
Cedar Valley Group	97	91	93.81%	61	55	90.16%	Burlington; Hixton (for CVC Grainy)
Galena Chert	28	28	100.00%	28	28	100.00%	None
Grand Meadow Chert	26	22	84.62%	18	18	100.00%	Maynes Creek (for coarse GMC)
Hixton Group Sil. Sand	17	17	100.00%	17	17	100.00%	None
Jasper Taconite	16	16	100.00%	16	16	100.00%	None
Knife River Flint	20	20	100.00%	20	20	100.00%	None
Lake Superior Agate	14	14	100.00%	14	14	100.00%	None
Maynes Creek Chert	23	19	82.61%	19	19	100.00%	Prairie Du Chien; Fusilinid Group
Prairie du Chien Chert	23	19	82.61%	23	19	82.61%	Hixton (for PDC sandy)
Quartz	21	21	100.00%	21	21	100.00%	None
Quartzite	16	16	100.00%	16	16	100.00%	None
Red River Chert	26	18	69.23%	22	17	77.27%	Grand Meadow; Maynes Creek
Siltstone	20	20	100.00%	17	17	100.00%	None
Swan River Chert	22	22	100.00%	22	22	100.00%	None
Tongue River Silica	22	22	100.00%	22	22	100.00%	None
Grand Total	**431**	**402**	**93.27%**	**373**	**358**	**95.98%**	**-----**

TABLE 3. BLIND TEST RESULTS: DIAGNOSIS OF THERMAL ALTERATION

		Accuracy of Designation by Raw Material Type				
Raw Material	**Count**	**No. Correct**	**Percent Correct**	**No. Conf. 1&2**	**No. Conf. 1&2 Correct**	**Percent Conf. 1&2 Correct**
Basaltic Rock	22	22	100.00%	0	0	---
Burlington Chert	18	9	50.00%	6	3	50.00%
Cedar Valley Group	97	42	43.30%	53	26	49.06%
Galena Chert	28	27	96.43%	28	27	96.43%
Grand Meadow Chert	26	14	53.85%	5	5	100.00%
Hixton Group Sil. Sand	17	8	47.06%	16	8	50.00%
Jasper Taconite	16	16	100.00%	0	0	---
Knife River Flint	20	20	100.00%	18	18	100.00%
Lake Superior Agate	14	14	100.00%	0	0	---
Maynes Creek Chert	23	22	95.65%	12	11	91.67%
Prairie du Chien Chert	23	11	47.83%	17	11	64.71%
Quartz	21	21	100.00%	0	0	---
Quartzite	16	16	100.00%	0	0	---
Red River Chert	26	18	69.23%	0	0	---
Siltstone	20	20	100.00%	0	0	---
Swan River Chert	22	14	63.64%	21	14	66.67%
Tongue River Silica	22	19	86.36%	17	17	100.00%
Grand Total	**431**	**313**	**72.62%**	**193**	**140**	**72.54%**

TABLE 4. BLIND TEST RESULTS: PARENT NODULE ASSIGNMENT

Raw Material	No. of Nodules	No. of Samples	Accuracy of Nodule Assignment by Raw Material Type				
			Samples Correct	Percent Correct	No. Conf. 1&2	No. Conf. 1&2 Correct	Percent Conf. 1&2 Correct
Basaltic Rock	4	22	22	100.00%	0	0	---
Burlington Chert	4 (5)	18	18	100.00%	18	18	100.00%
Cedar Valley Group	22	97	79	81.44%	94	77	81.91%
Galena Chert	5	28	19	67.86%	24	18	75.00%
Grand Meadow Chert	5	26	23	88.46%	13	11	84.62%
Hixton Group Sil. Sand	4	17	13	76.47%	16	13	81.25%
Jasper Taconite	4	16	16	100.00%	0	0	---
Knife River Flint	3	20	13	65.00%	0	0	---
Lake Superior Agate	3	14	14	100.00%	14	14	100.00%
Maynes Creek Chert	5 (6)	23	18	78.26%	22	18	81.82%
Prairie du Chien Chert	5	23	23	100.00%	23	23	100.00%
Quartz	4	21	16	76.19%	0	0	---
Quartzite	4	16	16	100.00%	15	15	100.00%
Red River Chert	6 (7)	26	19	73.08%	21	18	85.71%
Siltstone	3	20	11	55.00%	0	0	---
Swan River Chert	6	22	19	86.36%	22	19	86.36%
Tongue River Silica	4 (5)	22	18	81.82%	17	13	76.47%
Grand Total	**91 (95)**	**431**	**357**	**82.83%**	**299**	**257**	**85.95%**

Table 5. Blind Test Results: Cedar Valley Group Identification and Differentiation

Raw Material Type	Nodule	Count	Accuracy of Assignment by Raw Material Type					Materials Misidentified As
			No. Correct	Percent Correct	No. of Conf. 1&2	No. Conf. 1&2 Correct	Percent Conf. 1&2 Correct	
Cedar Valley Chert	**17**	**71**	**45**	**63.38%**	**50**	**40**	**80.00%**	**Cochrane, Hixton, Burlington**
Cedar Valley Chert - opaque	6	26	6	23.08%	5	1	20.00%	Cochrane
Cedar Valley Chert - grainy	4	21	17	80.95%	21	17	80.95%	Hixton Group
Cedar Valley Chert - translucent	7	24	22	91.67%	24	22	91.67%	Burlington
Cochrane Chert	**5**	**26**	**11**	**42.31%**	**11**	**11**	**100.00%**	**Cedar Valley**
Grand Total	**22**	**97**	**56**	**57.73%**	**61**	**51**	**83.61%**	**-----**

Table 6. Blind Test Results: Diagnosis of Thermal Alteration Among Cedar Valley Group

Raw Material	Count	Accuracy of Designation by Raw Material Type				
		No. Correct	Percent Correct	No. Conf. 1&2	No. Conf. 1&2 Correct	Percent Conf. 1&2 Correct
Cedar Valley Chert	**71**	**30**	**42.25%**	**33**	**20**	**60.61%**
Cedar Valley Chert - opaque	26	19	73.08%	11	11	100.00%
Cedar Valley Chert - grainy	21	5	23.81%	9	5	55.56%
Cedar Valley Chert - translucent	24	6	25.00%	13	4	30.77%
Cochrane Chert	**26**	**12**	**46.15%**	**20**	**6**	**30.00%**
Grand Total	**97**	**42**	**43.30%**	**53**	**26**	**49.06%**

TABLE 7. BLIND TEST RESULTS: PARENT NODULE ASSIGNMENT AMONG CEDAR VALLEY GROUP

Raw Material	No. of Nodules	No. of Samples	Accuracy of Nodule Assignment by Raw Material Type					
			Samples Correct	Percent Correct	No. Conf. 1&2	No. Conf. 1&2 Correct	Percent Conf. 1&2 Correct
Cedar Valley Chert	**17**	**71**	**53**	**74.65%**	**68**	**51**	**75.00%**
Cedar Valley Chert – opaque	6	26	23	88.46%	24	21	87.50%
Cedar Valley Chert - grainy	4	21	15	71.43%	21	15	71.43%
Cedar Valley Chert - translucent	7	24	15	62.50%	23	15	65.22%
Cochrane Chert	**5**	**26**	**26**	**100.00%**	**26**	**26**	**100.00%**
Grand Total	**22**	**97**	**79**	**81.44%**	**94**	**77**	**81.91%**

Basaltic Rock

The basaltic rock test assemblage included 22 individual samples representing four nodules. All 22 samples were correctly identified as basaltic rock with a high to moderate degree of confidence. All 22 samples were correctly diagnosed as not thermally altered; however, they were diagnosed with a low level of confidence as heat-treatment of basaltic rock does not appear to alter the stone significantly. All 22 samples of the basaltic rock test assemblage were correctly sorted by parent nodule, though all assignments were made with a low degree of confidence.

Burlington Chert

The Burlington chert test assemblage consisted of 18 individual samples representing four nodules. It should be noted that one of the nodules (BRL-k) consisted of thermally altered samples and samples lacking thermal alteration (BRL-k and BRL-k-TA). Of the 18 samples, 15 (83.33%) were correctly identified as Burlington chert with a high to moderate degree of confidence. The remaining three samples were misidentified as Prairie du Chien chert; however, these were identified with a low degree of confidence indicating that in a real world scenario these three samples would have been classified as indeterminate chert increasing the accuracy of samples designated as Burlington chert to 100% (n=15 of 15). Only 50.00% (n=9 of 18) of the samples were correctly diagnosed with regard to presence or absence of thermal alteration. Only six of the samples were diagnosed with a high to moderate degree of confidence and among these the percentage correctly diagnosed held steady at 50.00%.

The four actual nodules (BRL-a, BRL-j, BRL-k [BRL-k-TA], and BRL-l-TA) of Burlington chert were assigned to four analytical nodules (BRL-A, BRL-B, BRL-C, and PDC-E). All six samples from BRL-j were assigned to BRL-A and no samples from any other actual nodules were assigned to BRL-A. All six samples from BRL-k/BRL-k-TA were assigned to BRL-B and no samples from any other actual nodules were assigned to BRL-B. All three samples from BRL-l-TA were assigned to PDC-E and no samples from any other actual nodules were assigned to PDC-E. All three samples from BRL-a were assigned to BRL-C; however, the two samples from CVT-h (Cedar Valley chert) were also included in BRL-C. Following the designed assessment protocol established in the methods section, 100% (n=18 of 18) of the Burlington chert samples were correctly sorted by parent nodule. All the samples were assigned with a high to moderate degree of confidence. Interestingly, the nodule comprised of thermally altered and non-thermally altered samples was not segregated into two nodules, which further indicates that thermal alteration upon at least some varieties of Burlington chert may not be easily diagnosed.

Cedar Valley Group Chert

The Cedar Valley Group chert test assemblage is comprised of Cochrane chert and Cedar Valley chert. As noted previously, these two materials share similar physical characteristics and somewhat similar procurement provenience (southwest Wisconsin and southeast Minnesota). Attempts are often not made by archaeologists to differentiate the two material types, but rather lump them into one group – the *Cedar Valley Group*. Due to their level of similarity, some archaeologists have argued that the materials are indeed the same material type merely outcropping in different locations. Glascock (1996) proved through neutron activation analysis that the two materials are indeed distinct raw material types and thus the blind test was set up to assess the limitations of differentiating the two materials macroscopically.

The Cochrane chert test assemblage consisted of 26 individual samples representing five nodules. Of the 26 samples, 11 (p=42.31) were correctly identified as Cochrane chert. The remaining 15 samples were misidentified as Cedar Valley chert; however, these samples were identified with a low degree of confidence indicating that in a real world scenario these 15 samples would have been classified as indeterminate chert increasing the accuracy of correctly identifying Cochrane chert as Cochrane chert to 100% (n=11 of 11). It should be noted, however, that 20 samples from the Cedar Valley chert assemblage (all opaque variety) were also identified as Cochrane chert with four of those identifications being made with a high to moderate degree of confidence. Only 46.15% (n=12 of 26) samples of Cochrane chert were correctly diagnosed with regard to presence or absence of thermal alteration. Removal of those samples diagnosed with a low degree of confidence did not improve the success rate (30.00%).

The five actual nodules (CCC-h, CCC-i, CCC-p, CCC-r-TA, and CCC-u) of Cochrane chert were assigned to five analytical nodules (CCC-B, CCC-E, CVC-F, CVC-H, and CVC-J). All six samples from CCC-h were assigned to CVC-J; however, a single sample from actual nodule CVC-g (Cedar Valley chert) was also assigned to CVC-J. All four samples from CCC-i were assigned to CVC-F and no samples from any other actual nodules were assigned to CVC-F. All five samples from CCC-p were assigned to CVC-H and no samples from any other actual nodules were assigned to CVC-H. All six samples from CCC-r-TA were assigned to CCC-E and no samples from any other actual nodules were assigned to CCC-E. All five samples from CCC-u were assigned to CCC-B and no samples from any other actual nodules were assigned to CCC-B. Following the designed assessment protocol established in the methods section, 100% (n=26 of 26) of the Cochrane chert samples were correctly sorted by parent nodule with a high degree of confidence.

The Cedar Valley chert test assemblage was comprised of the three distinct varieties of Cedar Valley chert – opaque, grainy, and translucent. The analyst was not asked to differentiate the three types; as the names themselves suggest, the separation of these three distinct varieties is not challenging (akin to separating blackberries from raspberries). Rather, the three varieties were included to assess if certain varieties of cedar valley are more conducive to MANA as well as if certain varieties are more accurately distinguished from Cochrane chert. The Cedar Valley test assemblage consisted of 71 individual samples representing 17 nodules. Of the 71 samples, 45 (63.38%) were correctly identified as Cedar Valley chert. The remaining 26 samples were misidentified as Cochrane chert, Burlington chert, and Hixton Group silicified sandstone. When the Cedar Valley test assemblage is divided into the three different varieties, distinct differences are noted. Within the translucent variety assemblage, 91.67% (n=22 of 24) of the samples were correctly identified as Cedar Valley chert with a high to moderate degree of confidence. The two remaining samples (nearly pure white in color) were misidentified as Burlington chert with a moderate degree of confidence. Within the grainy variety assemblage, 80.95% (n=17 of 21) of the samples were correctly identified as Cedar Valley chert with a high to moderate degree of confidence. The four remaining samples were misidentified as Hixton Group silicified sandstone with a high to moderate degree of confidence. The four samples were from a single nodule (CVG-e-TA), which upon follow-up macroscopic inspection appears to be quite similar to a fine grained quartzite. It should be noted that a fifth sample from this same nodule was identified correctly as Cedar Valley chert. Within the opaque variety assemblage, 23.08% (n=6 of 26) of the samples were correctly identified as Cedar Valley chert largely with a low degree of confidence. All 20 of the remaining samples were misidentified as Cochrane chert and done so largely (n=15 of 20) with a low degree of confidence.

Only 42.25% (n=30 of 71) samples of Cedar Valley chert were correctly diagnosed with regard to presence or absence of thermal alteration. Removal of those samples diagnosed with a low degree of confidence improved the rate of success slightly to 60.61% (n=20 of 33). Again, when the Cedar Valley test assemblage is divided into the three different varieties, distinct differences are noted. Within the grainy and translucent variety assemblages the success rates for diagnosing thermal alteration were quite low at 23.81% (n=5 of 21) and 25.00% (n=6 of 24), respectively. The removal of diagnoses made with a low degree of confidence improved the rate of success to 55.56% (n=5 of 9) and 30.77% (n=4 of 13), respectively. Within the opaque variety assemblage the rate of success for correctly diagnosing heat alteration was considerably higher at 73.08% (n=19 of 26). The removal of diagnoses made with a low degree of confidence improved the rate of success to 100% (n=11 of 11).

The 17 actual nodules (six opaque [CVC-a, CVC-b, CVC-e, CVC-g, CVC-k-TA, CVC-p-TA], four grainy [CVG-b, CVG-c, CVG-d, CVG-e-TA], seven translucent [CVT-a, CVT-b, CVT-c, CVT-f, CVT-g, CVT-h, CVT-k-TA]) of Cedar Valley chert were assigned to 17 analytical nodules (CVC-A, CVC-B, CVC-C, CVC-D, CVC-E, CVC-G, CVC-I,

CVC-J, CVC-K, CVC-L, CVC-M, CCC-A, CCC-C, CCC-D, CCC-F, BRL-C, and HSS-E). All six samples from CVC-a were assigned to CCC-D and no samples from any other actual nodules were assigned to CCC-D. All four samples from CVC-b were assigned to CCC-A; however, two samples from CVC-g were also assigned to CCC-A. All four samples from CVC-e were assigned to CCC-F and no samples from any other actual nodules were assigned to CCC-F. The four samples from CVC-g were assigned to CCC-A (two samples), CVC-J (one sample), and CVC-M (one sample). No samples from other actual nodules were assigned to CVC-M; however, four samples from CVC-a were assigned to CCC-A and six samples from CCC-h were assigned to CVC-J. All four samples from CVC-k-TA were assigned to CCC-C and no samples from any other actual nodules were assigned to CCC-C. All three samples from CVC-p-TA were assigned to CVC-I and no samples from any other actual nodules were assigned to CVC-I. All eleven samples from CVG-g (n=6) and CVG-c (n=5) were assigned to CVC-D and no samples from any other actual nodules were assigned to CVC-D. All six samples from CVG-d were assigned to CVC-A; however, one sample from CVG-e-TA was also assigned to CVC-A. The samples from CVG-e-TA were assigned to HSS-E (four samples) and CVC-A (one sample). All five samples from CVT-a were assigned to CVC-E and no samples from any other actual nodules were assigned to CVC-E. All five samples from CVT-b were assigned to CVC-C (two samples), CVC-K (two samples), and CVC-L (one sample) and no samples from any other actual nodules were assigned to CVC-C, CVC-K, or CVC-L. All eight samples from CVT-c (n=3), CVT-f (n=1), and CVT-g (n=4) were assigned to CVC-B and no samples from any other actual nodules, beyond these three, were assigned to CVC-B. All two samples from CVT-h were assigned to BRL-C; however, three samples from BRL-a were also assigned to BRL-C. All four samples from CVT-k-TA were assigned to CVC-G and no samples from any other actual nodules were assigned to CVC-G.

Following the designed assessment protocol established in the methods section, 74.65% (n=53 of 71) of the samples were correctly sorted by parent nodule. Removing those samples assigned with a low degree of confidence did not increase the rate of success drastically (75.00% [n=51 of 68]). Again, when the Cedar Valley test assemblage is divided into the three different varieties, somewhat distinct differences are noted. Within the opaque test assemblage, 88.46% (n=23 of 26) of the samples were correctly assigned to a parent nodule and done so largely (n=21 of 23) with a high to moderate degree of confidence. Within the grainy test assemblage, 71.43% (n=15 of 21) of the samples were correctly assigned to a parent nodule. All incorrect assignments were made with a moderate degree of confidence. Within the translucent test assemblage, 62.50% (n=15 of 24) of the samples were correctly assigned to a parent nodule with a high to moderate degree of confidence. The removal of assignments made with a low degree of confidence improves the rate of success to 65.22% (n=15 of 23).

It should be noted that when Cochrane chert and Cedar Valley chert were assessed as one group – the *Cedar Valley Group*, as is most often the case, the rate of success with regard to raw material identification was 93.81% (n=91 of 97). A successful diagnosis of heat alteration was made for 43.30% (n=42 of 92) of the samples and of the 97 samples, 79 (81.44%) were correctly assigned to a parent nodule.

Galena Chert

The Galena chert test assemblage consisted of 28 individual samples representing five nodules. All 28 samples were correctly identified as Galena chert with a high degree of confidence. A successful diagnosis of heat alteration was made for 96.43% (n=27 of 28) of the samples with a high to moderate degree of confidence.

The five actual nodules (GAL-d, GAL-g-TA, GAL-i-TA, GAL-j-TA, and GAL-o-TA) of Galena chert were assigned to four analytical nodules (GAL-A, GAL-B, GAL-C, and GAL-D). Samples from GAL-d were assigned to GAL-C (one sample) and GAL-D (seven samples). No samples from any other actual nodules were assigned to GAL-D; however, nine samples from three other actual nodules (GAL-g-TA, GAL-j-TA, and GAL-o-TA) were also assigned to GAL-C. All three samples from GAL-g-TA were assigned to GAL-C; however, seven samples from three other actual nodules (GAL-d, GAL-j-TA, and GAL-o-TA) were also assigned to GAL-C. All five samples from GAL-i-TA were assigned to GAL-A; however, two samples from actual nodule GAL-j-TA were also assigned to GAL-A. All six samples from GAL-j-TA were assigned to GAL-A (two samples) and GAL-C (four samples); however, five samples from GAL-i-TA were also assigned to GAL-A and six samples from three other nodules (GAL-d, GAL-g-TA, and GAL-o-TA) were also assigned to GAL-C. Samples from GAL-o-TA were assigned to GAL-B (four samples) and GAL-C (two samples). No samples from any other actual nodules were assigned to GAL-B; however, eight samples from three other actual nodules (GAL-d, GAL-g-TA, and GAL-j-TA) were also assigned to GAL-C. Following the designed assessment protocol established in the methods section, 67.86% (n=19 of 28) of the samples were correctly sorted by parent nodule. A majority of the samples (n=24) were assigned with a high to moderate degree of confidence and removing those samples assigned with a low degree of confidence only increase the rate of success to 75.00% (n=18 of 24).

Grand Meadow Chert

The Grand Meadow chert test assemblage consisted of 26 individual samples representing five nodules. Of the 26 samples, 22 (84.62%) were correctly identified as Grand Meadow chert. The remaining four samples were misidentified as Maynes Creek chert; however, these samples were identified with a low degree of confidence indicating that in a real world scenario these four samples would have been classified as indeterminate chert increasing the accuracy of samples designated as Grand Meadow chert to 100%. Only 53.85% (n=14 of 26) samples were correctly diagnosed with regard to presence or absence of thermal alteration. Only five of the samples were diagnosed with a high to moderate degree of confidence and among these the percentage correctly diagnosed increased to 100% (n=5 of 5).

The five actual nodules (GMC-a, GMC-c, GMC-h, GMC-k, and GMC-v-TA) of Grand Meadow chert were assigned to six analytical nodules (GMC-A, GMC-B, GMC-D, GMC-E, GMC-F, and MCC-B). All four samples from GMC-a were assigned to GMC-F and no samples from any other actual nodules were assigned to GMC-F. All four samples from GMC-h were assigned to MCC-B and no samples from any other actual nodules were assigned to MCC-B. All samples from GMC-c were assigned to GMC-A (one sample) and GMC-E (four samples). No samples from any other actual nodules were assigned to GMC-E; however, eight samples from GMC-k were also assigned to GMC-A. All eight samples from GMC-k were assigned to GMC-A; however, one sample from GMC-c was also assigned to GMC-A. All samples from GMC-v-TA were assigned to GMC-B (three samples) and GMC-D (two samples). No samples from any other actual nodules were assigned to GMC-D; however, one sample from RCC-a was assigned to GMC-B. Following the designed assessment protocol established in the methods section, 88.46.% (n=23 of 26) of the samples were correctly sorted by parent nodule. Less of than half the samples (n=13) were assigned with a high to moderate degree of confidence; however, removing those samples assigned with a low degree of confidence did not increase the rate of success (84.62% [n=11 of 13]).

Hixton Group Silicified Sandstone

The Hixton Group silicified sandstone test assemblage consisted of 17 individual samples representing four nodules. All 17 samples were correctly identified as Hixton Group silicified sandstone with a high degree of confidence. A successful diagnosis of heat alteration was made for 47.06% (n=8 of 17) samples. When the singe sample diagnosed with a low degree of confidence is removed (that sample which would normally be deemed indeterminate with regard to diagnosing heat-treatment), the success of accurately diagnosing heat alteration improved to 50.00% (n=8 of 16) within the Hixton Group silicified sandstone test assemblage.

The four actual nodules (HSS-a, HSS-d, HSS-e, and HSS-f) of Hixton Group silicified sandstone were assigned to four analytical nodules (HSS-A, HSS-B, HSS-D, and HSS-F). All four samples from HSS-f were assigned to HSS-D and no other samples from any other actual nodules were assigned to HSS-D. Samples from HSS-d were all assigned to HSS-A (four samples) and HSS-F (one sample) and no other samples from any other actual nodules were assigned to HSS-A or HSS-F. All eight samples from HSS-a and HSS-e were assigned to HSS-B and no other samples from any other actual nodules were assigned to HSS-B. Following the designed assessment protocol established in the methods section, 76.47% (n=13 of 17) of the samples were correctly sorted by parent nodule. All the samples were assigned with a high to moderate degree of confidence with the exception of the single sample from HSS-d assigned to HSS-F. The removal of this one sample improves the rate of successfully assigning samples to parent nodules within the Hixton Group silicified sandstone test assemblage to 81.25% (n=13 of 16).

Jasper Taconite

The Jasper Taconite test assemblage included 16 individual samples representing four nodules. All 16 samples were correctly identified as Jasper Taconite with a high to moderate degree of confidence. All 16 samples were correctly diagnosed as not thermally altered; however, they were diagnosed with a low level of confidence as heat-treatment of Jasper Taconite does not appear to alter the stone significantly. All 16 samples were correctly sorted by parent nodule, though all assignments were made with a low degree of confidence.

Knife River Flint

The Knife River flint test assemblage included 20 individual samples representing three nodules. All 20 samples were correctly identified as Knife River flint with a high to moderate degree of confidence. All 20 samples were correctly diagnosed as not thermally altered with 18 of those designations made with a high to moderate degree of confidence.

The three actual nodules (KRF-h, KRF-i, and KRF-j) of Knife River flint were assigned to two analytical nodules (KRF-A and KRF-B). KRF-A contained all seven samples from KRF-j with the exception of one sample assigned to KRF-B. KRF-B contained all 13 samples from KRF-h and KRF-i as well as the one remaining sample from KRF-j. Following the designed assessment protocol established in the methods section, 65.00% (n=13 of 20) of the samples were correctly sorted by parent nodule, though all assignments were made with a low degree of confidence indicating such an attempt would not be made in a real artifact analysis.

Lake Superior Agate

The Lake Superior agate test assemblage included 14 individual samples representing three nodules. All 14 samples were correctly identified as Lake Superior agate with a high degree of confidence. All 14 samples were correctly diagnosed as not thermally altered; however, they were diagnosed with a low level of confidence as heat-treatment of Lake Superior agate does not appear to alter the stone significantly. All 14 samples of the Lake Superior agate test assemblage were correctly sorted by parent nodule with a high to moderate degree of confidence.

Maynes Creek Chert

The Maynes Creek chert test assemblage consisted of 23 individual samples representing five nodules. It should be noted that one of the nodules (MCC-c) consisted of thermally altered samples and samples lacking thermal alteration (MCC-c and MCC-c-TA). Of the 23 samples, 19 (82.61%) were correctly identified as Maynes Creek chert with a high to moderate degree of confidence. The remaining four samples were misidentified as Prairie du Chien chert and Fusilinid Group chert; however, these were identified with a low degree of confidence indicating that in a real world scenario these four samples would have been classified as indeterminate chert increasing the accuracy of samples designated as Maynes Creek chert to 100% (n=19 of 19). A successful diagnosis of heat alteration was made for 95.65% (n=22 of 23) of the samples with a moderate to low degree of confidence.

The five actual nodules (MCC-b, MCC-c [MCC-c-TA], MCC-d, MCC-e-TA, and MCC-f-TA) of Maynes Creek chert were assigned to five analytical nodules (MCC-A, MCC-C, MCC-D, PDC-F, and FGC-A). All six samples from MCC-b were assigned to MCC-A and no samples from any other actual nodules were assigned to MCC-A. All four samples from MCC-e-TA were assigned to MCC-D and no samples from any other actual nodules were assigned to MCC-D. All nine samples from MCC-c/MCC-c-TA and MCC-f-TA were assigned to MCC-C and no samples from any other actual nodules were assigned to MCC-C. The four samples from MCC-d were assigned to PDC-F (three samples) and FGC-A (one sample); however, no samples from any other actual nodules were assigned to PDC-F or FGC-A. Following the designed assessment protocol established in the methods section, 78.26% (n=18 of 23) of the samples were correctly sorted by parent nodule. A majority of the samples (n=22) were assigned with a high to moderate degree of confidence and removing those samples assigned with a low degree of confidence only slightly increases the rate of success (81.82% [n=18 of 12]). Interestingly, the nodule comprised of thermally altered and non-thermally altered samples was not segregated into two nodules. This is somewhat unexpected due to the high success with regard to diagnosing thermal alteration among the Maynes Creek chert test assemblage. In fact, the single non-thermally altered piece within nodule MCC-c was the single sample within the Maynes Creek test assemblage to have been incorrectly diagnosed with regard to thermal alteration. Perhaps the sample's association with the parent nodule biased the diagnosis of the single non-heat-treated sample of the nodule.

Prairie du Chien Chert

The Prairie du Chien chert test assemblage consisted of 23 individual samples representing five nodules. Of the 23 samples, 19 (82.61%) were correctly identified as Prairie du Chien chert with a high to moderate degree of confidence. The remaining four samples were misidentified as Hixton Group silicified sand. These four samples represent a nodule of the sandy variety of Prairie du Chien chert. Two nodules (PDC-h and PDC-s) of the sandy variety were included in the blind test. One nodule (PDC-h) was correctly identified as Prairie du Chien chert as it exhibited several properties including oolites that helped distinguish it from Hixton Group silicified sand. The other nodule (PDC-s) is for all intents and purposes silicified sandstone and upon follow-up macroscopic inspection appears to be quite indistinguishable from Hixton Group silicified sandstone. All samples were identified with a high to moderate degree of confidence.

Only 47.83% (n=11 of 23) samples were correctly diagnosed with regard to presence or absence of thermal alteration. Seventeen of the samples were diagnosed with a high to moderate degree of confidence and among these the percentage correctly diagnosed increased slightly to 64.71% (n=11 of 17). It should be noted that all four samples diagnosed with a high degree of confidence were diagnosed correctly. All 23 samples of the Prairie du Chien chert test assemblage were correctly sorted by parent nodule with a high to moderate degree of confidence.

Quartz

The quartz test assemblage included 21 individual samples representing four nodules. All 21 samples were correctly identified as quartz with a high degree of confidence. All 21 samples were correctly diagnosed as not thermally altered; however, they were diagnosed with a low level of confidence as heat-treatment of quartz does not appear to alter the stone significantly.

The four actual nodules (QTZ-j, QTZ-k, QTZ-m, and QTZ-n) of quartz were assigned to four analytical nodules (QTZ-A, QTZ-B, QTZ-C, and QTZ-D). The five samples from QTZ-j were fairly evenly assigned to QTZ-B and QTZ-D. All six samples from QTZ-k were all assigned to QTZ-A with exception to one sample assigned to QTZ-D. All four samples from QTZ-m were assigned to QTZ-C and no other samples from any other actual nodules were assigned to QTZ-C. All six samples from QTZ-n were assigned to QTZ-A and QTZ-D at a one to two ratio, respectively. Following the designed assessment protocol established in the methods section, 76.19% (n=16 of 21) of the samples were correctly sorted by parent nodule, though all assignments were made with a low degree of confidence.

Quartzite

The quartzite test assemblage included 16 individual samples representing four nodules. All 16 samples were correctly identified as quartzite with a high degree of confidence. All 16 samples were correctly diagnosed as not thermally altered; however, they were diagnosed with a low level of confidence as heat-treatment of quartzite does not appear to alter the stone significantly. All 16 samples of the quartzite test assemblage were correctly sorted by parent nodule and all were designated as such with a high to moderate degree of confidence with the exception of one sample which was designated correctly, but with a low degree of confidence.

Red River Chert

The Red River chert test assemblage consisted of 26 individual samples representing six nodules. It should be noted that one of the nodules (RRC-g) consisted of thermally altered samples and samples lacking thermal alteration (RRC-g and RRC-g-TA). Of the 26 samples, 18 (69.23%) were correctly identified as Red River chert with a high to moderate degree of confidence for the most part (n=17 of 18). The remaining eight samples were misidentified as Grand Meadow chert (n=7) and Maynes Creek chert (n=1). Of the eight samples that were misidentified, three identifications were made with a low degree of confidence and five were made with a moderate degree of confidence. Removing those samples identified with a low degree of confidence increases the percentage of correct identification to 77.27% (n=17 of 22) among the Red River chert test assemblage. Only 69.23% (n=18 of 26) samples were correctly diagnosed with regard to presence or absence of thermal alteration and were diagnosed with a low degree of confidence as Red River chert tends not to have a significantly visible response to heat-treatment.

The five actual nodules (RRC-a, RRC-g [RRC-g-TA], RRC-h, RRC-m, RRC-o, and RRC-p) of Red River chert were assigned to nine analytical nodules (RRC-A, RRC-B, RRC-C, RRC-D, RRC-E, RRC-F, GMC-B, GMC-C and MCC-E). All four samples from RRC-o were assigned to RRC-D (three samples) and GMC-C (one sample). No samples from any other actual nodules were assigned to RRC-D; however, five samples from actual nodules RRC-p were also assigned to GMC-C. All five samples from RRC-p were assigned to GMC-C and only one sample from another actual nodule (RRC-o) was also assigned to GMC-C. All six samples from RRC-g and RRC-m-TA were assigned to

RRC-A and no samples from other actual nodules were assigned to RRC-A. All three samples from RRC-g-TA were assigned to RRC-C and no samples from any other actual nodules were assigned to RRC-C. All four samples from RCC-h-TA were assigned to RRC-B and no samples from any other actual nodules were assigned to RRC-B. The four samples from RRC-a were assigned to four separate analytical nodules (RRC-E, RRC-F, GMC-B, and MCC-E). No samples from any other actual nodules were assigned to RRC-E, RRC-F, and MCC-E; however, three samples from nodule GMC-v-TA were also assigned to GMC-B. Following the designed assessment protocol established in the methods section, 73.08% (n=19 of 26) of the samples were correctly sorted by parent nodule. A majority of the samples (n=21) were assigned with a high to moderate degree of confidence; however, removing those samples assigned with a low degree of confidence did increase the rate of success to 85.71% (n=18 of 21), which reflects how the analysts would have performed given an *indeterminate* option. Interestingly, the nodule comprised of thermally altered and non-thermally altered samples was segregated into two nodules, which indicates that thermal alteration can be diagnosed with some varieties of Red River chert.

Siltstone

The siltstone test assemblage included 20 individual samples representing three nodules. All 20 samples were correctly identified as siltstone with a high degree of confidence. All 20 samples were correctly diagnosed as not thermally altered; however, they were diagnosed with a low level of confidence as heat-treatment of siltstone does not appear to alter the stone significantly. The three actual nodules (SLT-c, SLT-y, and SLT-z) of siltstone were assigned to three analytical nodules (SLT-A, SLT-B, and SLT-C). All 15 samples from SLT-c and SLT-z were assigned to SLT-B and no sampled from any other actual nodules were assigned to SLT-B. All five samples from SLT-y assigned to SLT-A (two samples) and SLT-C (three samples) and no samples from any other actual nodules were assigned to SLT-A or SLT-C. Following the designed assessment protocol established in the methods section, 55.00% (n=11 of 20) of the samples were correctly sorted by parent nodule, though all assignments were made with a low degree of confidence.

Swan River Chert

The Swan River chert test assemblage consisted of 22 individual samples representing six nodules. All 22 samples were correctly identified as Swan River chert with a high to moderate degree of confidence. A successful diagnosis of heat alteration was made for 63.64% (n=14 of 22) samples. When the singe sample diagnosed with a low degree of confidence is removed (that sample which would normally be deemed indeterminate with regard to diagnosing heat-treatment), the success of accurately diagnosing heat alteration improved to 66.67% (n=14 of 21) within the Swan River chert test assemblage.

The six actual nodules (SRC-b-TA, SRC-f-TA, SRC-g-TA, SRC-i-TA, SRC-l, and SRC-m) of Swan River chert were assigned to five analytical nodules (SRC-A, SRC-B, SRC-C, SRC-D, and SRC-E). All three samples from SRC-b-TA were assigned to SRC-A and no samples from any other actual nodules were assigned to SRC-A. All four samples from SRC-i-TA were all assigned to SRC-C and no samples from any other actual nodules were assigned to SRC-C. All four samples from SRC-l were all assigned to SRC-D and no samples from any other actual nodules were assigned to SRC-D. All four samples from SRC-m were assigned to SRC-B and no samples from any other actual nodules were assigned to SRC-B. All seven samples from SRC-f-TA and SRC-g-TA were assigned to SRC-E and no samples from any other actual nodules were assigned to SRC-E. The combining of SRC-f-TA and SRC-g-TA represents the only incorrectly assigned analytical nodule within the Swan River chert test assemblage. Following the designed assessment protocol established in the methods section, 86.36% (n=19 of 22) of the samples were correctly sorted by parent nodule. All the samples were assigned with a high to moderate degree of confidence.

Tongue River Silica

The Tongue River silica test assemblage consisted of 22 individual samples representing four nodules. It should be noted that one of the nodules (TRS-i) consisted of thermally altered samples and samples lacking thermal alteration (TRS-i and TRS-i-TA). All 22 samples were correctly identified as Tongue River silica with a high degree of confidence. A successful diagnosis of heat alteration was made for 86.36% (n=19 of 22) samples. When the five samples diagnosed with a low degree of confidence are removed (those samples which would normally be deemed indeterminate with regard to diagnosing heat-treatment), the success of accurately diagnosing heat alteration improved to 100% (n=17 of 17) within the Tongue River silica test assemblage.

The four actual nodules (TRS-i [TRS-i-TA], TRS-j-TA, TRS-l-TA, TRS-m-TA) of Tongue River silica were assigned to four analytical nodules (TRS-A, TRS-B, TRS-C, and TRS-D). All four samples from TRS-i were assigned to TRS-D and no samples from any other actual nodules were assigned to TRS-D. All five samples from TRS-i-TA were assigned to TRS-A and no samples from any other actual nodules were assigned to TRS-A. All four samples from TRS-l-TA were assigned to TRS-B and no samples from any other actual nodules were assigned to TRS-B. All eight samples from TRS-j-TA and TRS-m-TA were assigned to TRS-C and no samples from any other nodules were assigned to TRS-C. The combining of TRS-j-TA and TRS-m-TA represents the only incorrectly assigned analytical nodule. Following the designed assessment protocol established in the methods section, 81.82% (n=18 of 22) of the samples were correctly sorted by parent nodule. A majority of the samples (n=17) were assigned with a high to moderate degree of confidence and removing those samples assigned with a low degree of confidence did not increase the rate of success (76.47% [n=13 of 17]). Interestingly, the nodule comprised of thermally altered and non-thermally altered samples was segregated into two nodules, which further indicates that thermal alteration upon Tongue River silica can be diagnosed with a fair degree of accuracy and inflicts significant alteration of the stone.

2.5 DISCUSSION

2.5.1 Raw Material Differentiation and Identification

The initial results of this study indicate that most of the lithic raw material types commonly encountered at archaeological sites in Minnesota can be differentiated and identified macroscopically with a fairly high degree of success. In fact, 93.27% of the samples (n=402 of 431) were correctly identified with regard to specific raw material type and the overall rate of success increased to 95.98% (n=358 of 373) when identifications designated as confidence level 3 were removed. However, it should be noted that overlap in material qualities among several raw material types, or more specifically, certain varieties of several raw material types, appear to make accurate identification and consistent differentiation more difficult. An examination of the misidentified samples (n=29) found below demonstrates where such overlap occurs and where lithic analysts should exercise caution. It should be noted that 14 of these 29 samples were misidentified with a low degree of confidence.

Gray Area

It was within the test assemblages comprised of gray-colored stone of a somewhat similar material property that the clear majority of misidentifications can be found in the blind test results (65.52% [n=19 of 29]). The material types included in this category are Grand Meadow chert and Maynes Creek chert as well as varieties of Prairie du Chien chert, Red River chert and Burlington chert. The manifestation of these 19 misidentifications is discussed in the following paragraph.

Four samples of course-grained Grand Meadow chert from the same nodule were misidentified as Maynes Creek chert with a low degree of confidence. Seven samples of fine-grained, gray-colored Red River chert were misidentified as Grand Meadow chert; five with a moderate degree of confidence and two with a low degree of confidence. Five of these samples were from a single nodule. One sample of Red River chert was misidentified as Maynes Creek chert with a low degree of confidence. Four samples of

Maynes Creek chert from the same nodule were misidentified as Prairie du Chien chert (n=3) and Fusilinid Group chert (n=1) with a low degree of confidence. Three samples of Burlington chert from the same nodule were misidentified as Prairie du Chien chert with a low degree of confidence.

A majority of the samples representing each of these five raw material types were correctly identified and differentiated when considering decisions made with a high to moderate degree of confidence (90.07% [n=88 of 97]); however, despite that fact, there does seem to be a fair amount of ambiguity when differentiating and identifying gray-colored tool stone exhibiting similar material properties. When one includes the decisions made with a low degree of confidence the success rate with regard to correctly differentiating and identifying these five material types drops to 80.17% (n=93 of 116) and accounts for 79.31% (n=23 of 29) of the raw material identification errors encountered in the blind test results. However, four of these misidentifications (within the Prairie du Chien chert test assemblage) are not related to the ambiguity of differentiating gray-colored tool stone and are discussed in the next section which addresses the ambiguity of differentiating and identifying sandy and grainy materials. As a result, the ambiguity found in differentiating and identifying gray-colored tool stone of a somewhat similar material property accounted for 65.52% (n=19 of 29) of the raw material identification errors encountered in the blind test results.

Sandy, Grainy, Quartzite?

A somewhat surprising observation noted in the blind test results was the misidentification of several Prairie du Chien chert and Cedar Valley chert samples as Hixton Group silicified sandstone.

Four samples of grainy variety Cedar Valley chert were misidentified as Hixton Group silicified sandstone with a high to moderate degree of confidence. These four samples are from a single nodule (CVG-e-TA), which upon follow-up macroscopic inspection appears to be quite similar to a uniformly-grained quartzite with excellent conchoidal fracture properties such as those found within the Hixton Group. It should be noted that a fifth sample from this same nodule as well as the other 17 grainy variety Cedar Valley samples included in the blind test were identified correctly as Cedar Valley chert.

Four samples of Prairie du Chien chert were also misidentified as Hixton Group silicified sandstone with a high degree of confidence. These four samples represent a nodule of sandy variety Prairie du Chien chert. Two nodules (PDC-h and PDC-s) of the sandy variety were included in the blind test. One nodule (PDC-h) was correctly identified as Prairie du Chien chert as it exhibited several properties including oolites that helped distinguish it from Hixton Group silicified sand. The other nodule (PDC-s) is for all intents and purposes silicified sandstone and upon follow-up macroscopic inspection appears to be quite indistinguishable from Hixton Group silicified sandstone.

This is very interesting and may have serious implications regarding assumptions that silicified sandstone (or uniformly-grained quartzite) identified at archaeological sites should be attributed to the Hixton Group. Further examination of the misidentified specimens appears to indicate that the use of microscopy will allow the materials to be differentiated quite accurately and consistently (Personal Communication, Dan Wendt, March 5, 2013). Under intense magnification, the matrices of Hixton Group silicified sandstone resemble equally spaced spheres with the space between the spheres filled with a milky chalcedony. The matrices of grainy variety Cedar Valley chert appear as sharp heterogeneous crystals while the matrices of sandy variety Prairie du Chien chert appear as sand grains interspersed with oolites or ghosts of oolites, and the occasional presence of fortification agate filling voids (Personal Communication, Dan Wendt, March 5, 2013). Based on these observations, collections reported as containing large amounts of Hixton Group silicified sandstone, particularly those not collected immediately adjacent to Hixton Group silicified sandstone quarries, should be reevaluated under high magnification.

Odd Couple

Two samples of translucent variety Cedar Valley chert were misidentified as Burlington chert. The two samples are white in color and resemble a variety of Burlington chert; however, the misidentification may also represent a momentary lapse on the part of the analyst as fossil inclusions and transmitted light, observable at a macroscopic level, appear to adequately allow the differentiation of these two material types.

Other Ambiguities: Cedar Valley Group chert

Cedar Valley Group chert is comprised of Cochrane chert and Cedar Valley chert. Due to similar material properties and somewhat similar geological provenience, attempts are often not made by archaeologists to differentiate the two material types, but rather lump them into one group – the *Cedar Valley Group*. However, the results of the blind test indicate that two varieties of Cedar Valley chert, the translucent and grainy varieties, can be accurately and consistently differentiated from Cochrane chert. In fact none of the translucent (n=24) or grainy (n=21) variety Cedar Valley chert samples were misidentified as Cochrane chert. It should also be noted that the blind test results also provide good reason for not attempting to differentiate the opaque variety of Cedar Valley chert and Cochrane chert using only macroscopic analysis methods. The rate of success for differentiating the opaque variety of Cedar Valley chert and Cochrane chert was only 32.69% (n=17 of 52).

2.5.2 Diagnosis of Heat Alteration

The diagnosis of thermal alteration or heat-treatment was not as successful overall as the raw material differentiation and identification with only 72.62% (n=313 of 431) of the samples diagnosed correctly. The percentage of success was not improved (72.54% [n=140 of 193]) when diagnoses designated as confidence level 3 were removed. The blind test results further confirm sentiments shared by many archaeologists - that the diagnosis of thermal alteration is largely a guessing game with exception to several material types that show pronounced, observable changes when heat-treated such as

Galena chert and Tongue River silica. Furthermore, particular varieties of some raw material types appear to show a significant response to thermal alteration while other varieties of the same material type do not. A brief synthesis and discussion of the results is presented below.

Four raw material types lent themselves well to correct diagnoses with regard to thermal alteration with a majority of samples diagnosed with a high to moderate degree of confidence. These four materials include: Galena chert (96.43% [n=27 of 28]), Knife River flint (100% [n=18 of 18]), Maynes Creek chert (91.67% [n=11 of 12]), and Tongue River silica (100% [n=17 of 17]). However, it should be noted that with regard to the Knife River flint test assemblage 12 of the 18 samples diagnosed with a high to moderate degree of confidence contained cortex which aided in the diagnosis. Without cortex, it is unlikely that Knife River flint can be diagnosed with such a high degree of accuracy as the matrix of the stone incurs little to no macroscopically observable change. Additionally, none of the samples incurred thermal alteration and the high percentage of correct guesses is largely the result of the fact that that Knife River flint is rarely suspected of having incurred thermal alteration both in archaeological and modern flint-knapping contexts.

Other materials with high success rates regarding the correct diagnosis of heat-treatment were basaltic rock (100% [n=22 of 22]), Jasper Taconite (100% [n=16 of 16]), Lake Superior agate (100% [n=14 of 14]), quartz (100% [n=21 of 21]), quartzite (100% [n=16 of 16]), and siltstone (100% [n=20 of 20]). However, diagnoses for these six materials (none of the samples incurred thermal alteration) could only be made with a low degree of confidence and as such the results equate to good guesses. This low level of confidence is largely due to the lack of significant macroscopically observable change in these materials as a result of thermal alteration. The high percentage of correct guesses is largely the result of the fact that these material types are rarely suspected of having incurred thermal alteration both in archaeological and modern flint-knapping contexts.

The success rate for diagnosing thermal alteration with a high to moderate degree of confidence within the Swan River chert (66.67% [n=14 of 21]), Prairie du Chien chert (64.71% [n=11 of 17]), Hixton Group silicified sandstone (50.00% [n=8 of 16]), and Burlington chert (50.00% [n=3 of 6]) assemblages was much poorer than expected. Conversely, the results for Red River chert and Grand Meadow chert were much as expected and demonstrate a high degree of ambiguity with regard to diagnosing thermal alteration. Within the Cedar Valley Group chert assemblage, the opaque variety of Cedar Valley chert was diagnosed with 73.08% (n=19 of 26) success while the other varieties of Cedar Valley chert and Cochrane chert were diagnosed with less than 50% success.

Overall, the initial results indicate that diagnosis of heat-treatment remains an ambiguous venture and additional studies are likely needed to ascertain additional defining factors that might aid in the correct diagnosis of thermal alteration.

2.5.3 Parent Nodule Assignment

Cedar Valley Group chert, Galena chert, Lake Superior agate, Maynes Creek chert, Prairie du Chien chert, Red River chert, and Swan River chert are considered to be relatively heterogeneous raw material types. As a result, these material types were expected to exhibit a relatively high rate of success with regard to correctly sorting samples by parent nodule. Conversely, basaltic rock, Grand Meadow chert, Knife River flint, quartz, siltstone, and Tongue River silica are considered to be relatively homogenous in nature and a relatively low rate of success was expected with regard to correctly sorting their associated samples by parent nodule. The remaining tested material types – Burlington chert, Hixton Group silicified sandstone, Jasper Taconite, and quartzite lie somewhere in the middle of heterogeneous and homogenous; and therefore, were expected to exhibit a somewhat moderate rate of success with regard to correct parent nodule assignment.

The blind test results pertaining to several of the material types were quite unexpected with relatively high rates of success for some of the material types considered to be excessively homogenous in nature and relatively low rates of success for some of the material types considered to be adequately heterogeneous in nature (see Table 4).

Better Than Expected

A surprising rate of success was found within the basaltic rock test assemblage where 100% (n=22 of 22) of the samples were correctly sorted by parent nodule. This result was unexpected as basaltic rock is considered to be quite homogenous, which explains why all designations were made with a low degree of confidence. However, under closer inspection there appear to be small differences in texture and color and/or tint from nodule to nodule which adequately differentiate and characterize each nodule allowing samples to be correctly discriminated by parent nodule.

Other materials types which exceeded expectations were Burlington chert (100% [n=18 of 18]), Grand Meadow chert (88.46% [n=23 of 26]), Jasper Taconite (100% [n=16 of 16]), quartzite (100% [n=16 of 16]), Tongue River silica (81.82% [n=18 of 22]) and quartz (76.19% [n=16 of 21]). The most interesting of these lies in the success with which the Tongue River silica test assemblage was sorted by parent nodule. Tongue River silica is quite homogenous in nature from nodule to nodule; however, the intensity and duration with which this material is heat-treated creates highly varied thermal alteration. The thermal alteration is adequately varied to the extent that it becomes a diagnostic tool allowing samples to be correctly discriminated by parent nodule. In fact, the combining of samples from two actual nodules (TRS-j-TA and TRS-m-TA) represents the only incorrectly assigned analytical nodule within the Tongue River silica test assemblage. It is important to note that a large percentage of all Tongue River silica found within archaeological contexts is thermally altered.

The quartz assemblage results were also quite intriguing. Though at first glance all the samples within the quartz test assemblage appear the same, closer inspection reveals that samples from the same nodule seem to share similar and somewhat diagnostic characteristics, whether it be degree of translucency, inclusions, or cortical features.

In the case of Burlington chert, several varieties of this material type (all very high quality) were included in the test assemblage. It should be noted that it is generally the white-colored variety that is most often noted at archaeological sites (though this information may be skewed by the fact that other varieties are not adequately recognized at sites in Minnesota). If only the white-colored variety was presented in the test, the rate of success for the Burlington chert test assemblage may not have been quite as high.

Just As Expected

Material types sorted within the anticipated rate of success included Hixton Group silicified sandstone (76.47 [n=13 of 17]), Knife River flint (65.00% [n=13 of 20]), Lake Superior agate (100% [n=14 of 14]), Prairie du Chien chert (100% [n=23 of 23]), siltstone (55.00% [n=11 of 20]), and Swan River chert (86.36% [n=19 of 22]). Of particular interest were the results pertaining to Swan River chert, a highly heterogeneous material type expected to be highly conducive to MANA. The combining of samples from two actual nodules (SRC-f-TA and SRC-g-TA) represents the only incorrectly assigned analytical nodule within the Swan River chert test assemblage. All designations within the Swan River chert test assemblage were made with a high to moderate degree of confidence.

As expected, the rates of success for Prairie du Chien chert and Lake Superior agate were also high and these designations were made a with high to moderate degree of confidence. Samples within the siltstone and Knife River flint test assemblages could not be assigned to parent nodules with a high degree of accuracy as was anticipated and decisions were made with a low degree of confidence. Also as expected, the rate of success was moderately high within the Hixton Group silicified sandstone test assemblage.

Worse Than Expected

Material types for which rates of success were below expectations included Cedar Valley Group chert (81.44% [n=79 of 97]), Galena chert (67.86% [n=19 of 28]), Maynes Creek chert (78.26% [n=n=18 of 23]), and Red River chert (73.08% [n=19 of 26]). Though these materials rendered success rates lower than anticipated, the rates of success still indicate that they are largely conducive to MANA. Interestingly, within the Cedar Valley Group chert test assemblage, both Cochrane chert (100% [n=26 of 26]) and the opaque variety of Cedar Valley chert (88.46% [n=23 of 26]) were sorted with relatively high rates of success; however, the translucent (62.50% [n=15 of 24]) and grainy (71.43% [n=15 of 21]) varieties of Cedar Valley chert were sorted with relatively moderate to low rates of success.

The Whole Picture

Overall, the correct assignment of individual samples to parent nodules was far more successful than anticipated with 83.29% (n=359 of 431) of the samples assigned to the correct parent nodule. The overall percentage of success increased to 86.29% (n=258 of 299) when assignments designated as confidence level 3 were removed. On the whole, these initial results suggest that MANA should be quite applicable to most lithic assemblages identified at archaeological sites in Minnesota. The results also provide an initial indication as to which material types should be excluded when conducting such analysis.

3.0 AN ANALYSIS OF LITHIC RAW MATERIAL UTILIZATION AT 21LN2

3.1 INTRODUCTION

3.1.1 Research Objective

The two objectives of this study were to analyze a lithic assemblage to generate interpretations regarding lithic raw material utilization and explore a method (MANA) not previously applied to lithic assemblages in Minnesota. Assuming that MANA can be successfully applied to lithic assemblages found at Minnesota sites, it could potentially render more refined interpretations regarding the organization of lithic technological activities and past human behavior within Minnesota.

3.1.2 Assemblage Selection

The lithic assemblage selected for this study was required to offer a high proportion of lithic materials conducive to MANA, contain a minimum of 1,000 lithic artifacts, not have undergone a previous lithic raw material analysis, and be readily available for research within an acceptable time frame and under acceptable conditions.

The State of Minnesota possesses archaeological resources from many sites that were excavated in the past. Due to a lack of funding and/or time, some of these collections were not fully cataloged or analyzed. The state is supportive in allowing researchers the opportunity to catalog and analyze such collections in return for the data rendered.

Many of these sites contain lithic assemblages; however, not all of the lithic assemblages are ideal for MANA. MANA is most effective for internally heterogeneous categories of lithic raw materials. In other words raw material types that exhibit variability in color, texture, inclusions, etc., provide the most reliable proxy data for actual production episodes (Andrefsky 2009; Ingbar et al. 1989; Larson 2004).

Lithic Raw Material Use Patterns in Minnesota (Bakken 2011:68), personal communications with Kent Bakken, and my own familiarity with the lithic raw materials of Minnesota suggested that sites located in the South Agassiz Resource Region should contain lithic assemblages highly conducive to MANA (see Figure 1 for Bakken's Resource Regions). Swan River chert is the most abundant lithic raw material in most lithic assemblages at sites within the South Agassiz Resource Region (Bakken 2011:67). Swan River chert was expected to work very well for MANA based on the criteria discussed above (Personal Communication, Kent Bakken, October 14, 2011; Personal Communication, Dan Wendt, October 18, 2011). Many of the less common lithic raw materials found at South Agassiz Resource Region sites were also expected to lend themselves well to MANA.

Sites located in the Hollandale Resource Region (see Figure 1) were expected to present fairly favorable lithic assemblages with regard to MANA as well. Bakken (2011:91) suggests the most abundant lithic raw materials in most lithic assemblages at sites within the Hollandale Resource Region are Prairie du Chien chert, Cedar Valley chert, Grand Meadow chert and Galena chert. All but the Grand Meadow chert were expected to present adequate variation for successful MANA (Personal Communication, Kent Bakken, October 14, 2011; Personal Communication, Dan Wendt, October 18, 2011).

Lithic assemblages at sites located within the West Superior Resource Region (see Figure 1) tend to be dominated by Gunflint silica, Knife Lake siltstone, Tongue River silica, and quartz (Bakken 2011:80). These materials tend to be homogeneous in color and texture and for that reason are not ideal for MANA. However, geospatial provenience and association with features and concentrations may potentially allow successful MANA with such assemblage types.

Based on the information and conditions presented above, the lithic assemblage from Wilford's 1956 University of Minnesota collection at 21LN2 was selected for this study. During the time frame within which this research was to be conducted, Wilford's 1956

University of Minnesota collection from 21LN2 was readily available and easily accessible to the author. The site is located within Bakken's (2011:68) South Agassiz Resource Region and as a result, was expected to contain a high percentage of Swan River chert. A lithic raw material analysis had never been completed for 21LN2 and a majority of the 1956 lithic assemblage had not been inventoried prior to the current analysis. The collection was found to contain of a large number of lithic artifacts (i.e., greater than 1,000) and upon initial inspection appeared to be comprised of a great diversity of raw material types, many of which appeared to be conducive to MANA. The collection offered the author an easily accessible and interesting collection with which lithic raw material analysis could generate new and interesting information. Additionally, Site 21LN2 is a significant type site in Minnesota (Anfinson 1997:51). That Wilford's 1956 University of Minnesota collection is the original collection from such a site and that a lithic raw material utilization study had not previously been conducted for 21LN2, made the site and the collection all the more intriguing.

The Science Museum of Minnesota also conducted excavations at 21LN2 in the early to middle 1970s. Though those collections were also explored, they were not highly accessible and were only available for data collection during normal business hours, which conflicted with the author's professional obligations. As a result, materials from these collections are not included in the analysis presented here.

3.1.3 Research Potential

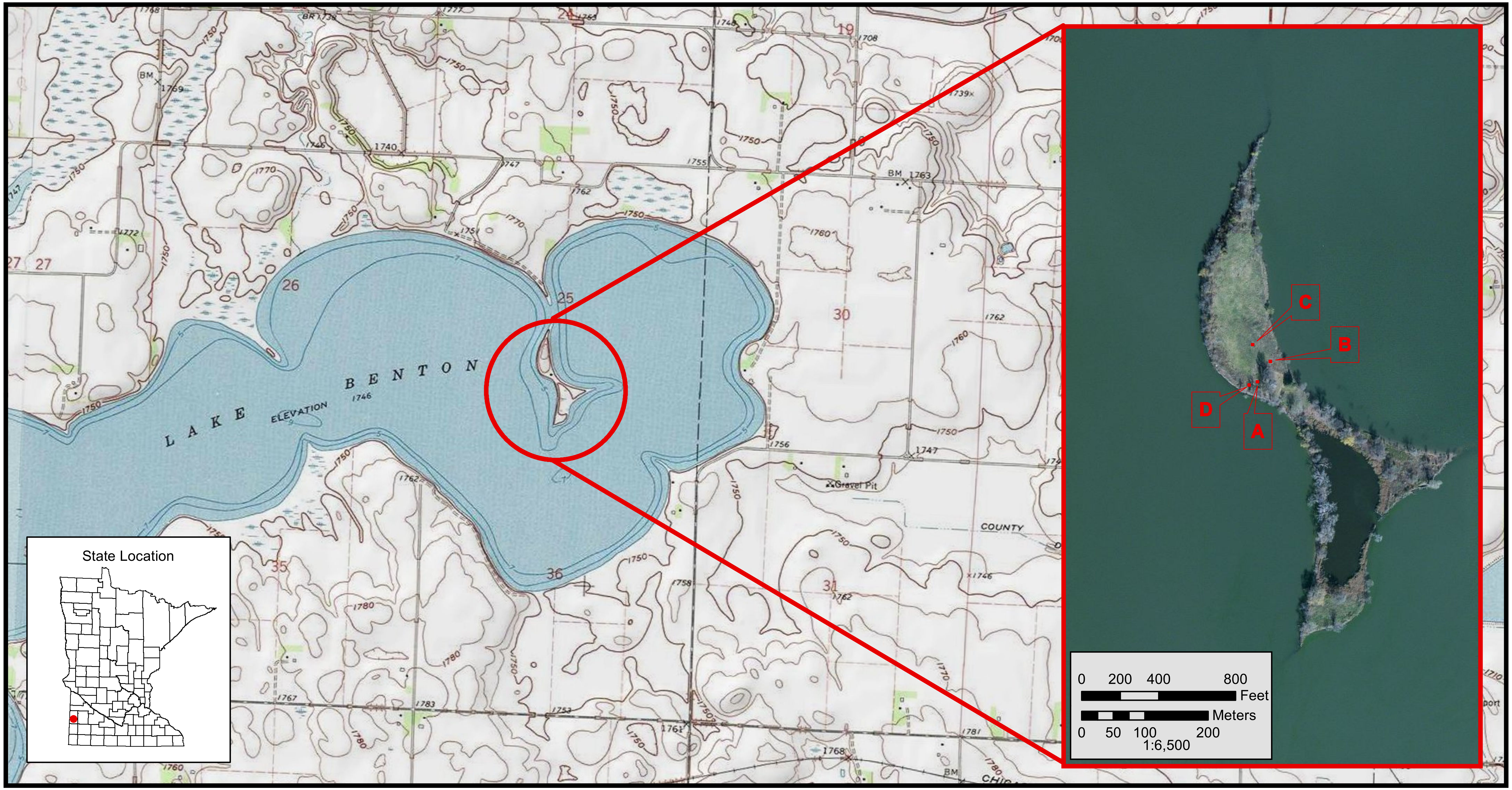
Site 21LN2 is perhaps one of the most interesting archaeological sites in the State of Minnesota. Archaeological material representing the full spectrum of known human occupation of this region, Paleo-Indian, Archaic, Woodland, Late Prehistoric (Plains Village/Oneota), proto-historical, and historical periods, have all been identified at this site.

The site has been excavated on a number of occasions and analyses have been completed upon the various assemblages; however, little attention has been paid to the lithic assemblages collected from the site, particularly with regard to the lithic raw materials comprising these assemblages.

An analysis of lithic raw material utilization at 21LN2 has the potential to address many interesting questions. For example, what raw materials are present at the site and what does the presence of these raw material types tell us about the prehistoric inhabitants' connections, whether by trade or travel, to surrounding regions? How were differing raw material types utilized at the site, does this usage show a heavy reliance on local materials or non-local materials, and do these observed trends correspond well with Andrefsky's (1994b) predictions regarding high and low quality materials of local and non-local availability? Additionally, how were different materials and/or nodules of material moving through the site, how intensively were the various raw materials being utilized with regard to reduction and tool retouch? Finally, can MANA serve as a tool to better inform lithic raw material utilization behavior at 21LN2?

3.2 SITE HISTORY AND SETTING

Site 21LN2 is located on a small 10-acre island in the northeast portion of Lake Benton (Figure 2). Lake Benton is one of the largest lakes in southwestern Minnesota and is located in south-central Lincoln County. The site is situated in the center of Section 25, Township 110 North, Range 45 West. The island is approximately twice as long as it is wide - running lengthwise north to south (Wilford 1956:1). During times of low water a natural causeway spans the short distance between the island and the northern shoreline of Lake Benton (Wilford 1956:1). The northern end of the island exhibits a relatively high elevation compared to the southern end, which rests just above the water level of the lake and exhibits wetland-like characteristics (Wilford 1956:1).



Source: USA Topo Maps, Bing Maps Aerial, Minnesota Counties

M_Doperalski 3/19/2013

Lake Benton, Lincoln County, Minnesota

0 0.25 0.5 0.75 1 Miles
Kilometers
0 0.25 0.5 1
1:24,000

N

Figure 2 Site Location: 21LN2

A Excavation Locations
10 ft x 10 ft

3.2.1 Excavation History and Previous Analysis

The island had been known to contain evidence of prehistoric occupation for many years prior to Wilford's first visit to the site in 1940 (Wilford 1956:1; Winchell 1919:119). During that first visit Wilford noted human remains weathering out of a wagon track along the northern end of the island. In 1947, State Senator Hans Pedersen, the owner of the island at that time, constructed a cottage on the island. During the construction, he identified large amounts of prehistoric artifacts, most notably ceramic sherds. His son Clyde subsequently began digging in an area behind the cottage, uncovering large amounts of bison bone, ceramic sherds, and other artifacts (Wilford 1956:1).

Wilford returned to the site in 1955; however, he was unable to find any evidence of the human remains he had noted in 1940. The following summer in 1956, Wilford surveyed the northern portion of the island recording elevations at 25 foot intervals within a rectangular area measuring 325 feet north-south by 250 feet east-west (Bonney 1965:10; Wilford 1956:2). That same summer Wilford excavated four 10 foot by 10 foot excavation blocks (Squares A through D) on the northern part of the island using six-inch (circa 15 centimeters [cm]) arbitrary levels (Anfinson 1997:51; Wilford 1956:1-2). The location of each square was noted based on the relationship in feet of the square's southeast corner to the site datum (A=80S,20W; B=10S,30E; C=90N,40W; D=100S,70W). The base of each level was made absolute and level relative to the site datum and not the ground surface (Bonney1965:10; Wilford 1956:2). Five complete levels were excavated within each excavation square. All excavated matrices were screened using a ½-inch hardware mesh. In general, the first level of each square consisted of a sod and humus layer. Levels 2 and 3 consisted of loose dry earth. Level 4 contained somewhat higher clay content and Level 5 consisted of soils exhibiting very high clay content. Levels 2, 3, and 4 contained the richest deposits of archaeological material while Levels 1 and 5 contained much less material. A full sixth level was excavated in Square A as well as a seventh level in the northeast quadrant; however, a marked decrease in archaeological material was noted. Level 6 was excavated to the subsoil in Square B. As very little archaeological material was encountered in level five of Square C, Levels 6, 7, 8, and 9 were excavated only in the northeast quadrant to reach subsoil. These four levels rendered very little archaeological material. The excavation of Levels 6 and 7 were confined to the northeast quadrant of Square D to reach subsoil. These two levels demonstrated a marked decrease in archaeological material. No features were noted during the excavation; however, two rock concentrations were identified, one in levels 3 and 4 of Square A and another in levels 3 and 4 of Square D. Wilford (1956:3-4) notes that there was no definite arrangement to the rocks and there was no indication of ash. Wilford also noted that such rocks were exceedingly abundant along the lakeshore and that rocks of all sizes were found throughout the top 24 inches of the excavated squares. The excavation produced large amounts of pottery, lithics, and bone. The bone consisted largely of bison humeri, radii-ulnae, and scapulae (Bonney 1965:12; Wilford 1956:4).

Subsequently, in 1973 and 1974 Hudak conducted further excavation of the site (Anfinson 1997:51; Hudak 1974). The 1973 excavation consisted of 11 units measuring 1 meter by 2 meters and two block excavations measuring approximately 5 meters by 8 meters. These excavations were all on the north half of the island, the majority within the immediate vicinity of Wilford's 1956 excavations (Anfinson 1997:51). Excavation notes housed at the Science Museum of Minnesota indicate that the 1974 excavation consisted of three additional units measuring 1 meter by 2 meters and three block excavations measuring 5 meters by 5 meters. For the most part the excavations were conducted at 5 cm increments. All excavated matrices were screened through ½-inch hardware mesh with exception to the excavated matrices from excavation blocks 17 and 31, which were water-screened through ¼-inch hardware mesh.

Portions of the 1956 and 1970s excavated collections as well as avocational finds have been analyzed and demonstrate the presence of prehistoric archaeological material associated with Paleo-Indian, Archaic, Woodland, and Late Prehistoric (Plains Village/Oneota) cultural periods (Anfinson 1997:51; Bonney 1965:38-39; Hudak 1974:6-

7; Wilford 1956:33-35). Wilford (1956:34) found the site to be predominately a Late Woodland site whereas Hudak (1974:7) found the site to predominately a Middle to Late Woodland site with the major features of the site to be affiliated with the Middle Woodland period. Both Wilford and Hudak found that the large amount of hunting and hide processing tools (i.e., projectile points and scrapers) and copious amounts of non-articulated bison bone as well as aquatic and bog animal remains suggested the site functioned largely as a maintenance and food preparation area. The presence of bison bone throughout the entire vertical column of the cultural deposit was thought to demonstrate a heavy reliance upon bison over a substantial period of time. Hudak (1973) noted that the

> *shallow rock-lined fire hearths, ceramics, lithics, and bone debris, support the conclusion that the Pedersen site [21LN2] is primarily the camp or seasonal habitation site of people of the Woodland cultural pattern.*

There is, however, some debate as to the presence of cultural stratigraphy at 21LN2. Bonney (1965:38-39) and Wilford (1956:25) found no cultural stratification at the site. Bonney (1965:41) noted that the Woodland period materials are mixed together with the Mississippian (Late Prehistoric) period materials at 21LN2 as well as at other similarly positioned sites in southwestern Minnesota. The mixture of shell-tempered pottery and grit-tempered pottery throughout nearly every level of the 1956 excavation suggests a great deal of post-depositional mixing. Wilford (1956:34) went on to note that,

> *The finding of a rifle shell at a very low level [Square A; Level 6] suggests that the stratigraphy is badly blurred by disturbances due to human activities or those of burrowing mammals.*

Hudak (1974:6-7), however, stated that the site exhibited cultural stratification noting that the top 0 to 10 cm contained Mississippian (Late Prehistoric) period pottery, 10 to 35 cm contained Late Woodland period pottery, 35 to 60 cm contained Middle Woodland period pottery, lithics, and bone debris, and below 60 cm to a depth of 150 cm no ceramics were recovered, but bone debris and lithic artifacts of the Archaic period persisted. Hudak's statement is somewhat peculiar. Since, the 1973 excavations were conducted within the immediate vicinity of the 1956 excavations (Anfinson 1997:51), it is expected that the vertical distribution of artifacts would be somewhat similar. Though Hudak maintained better vertical control, having used 5 cm increment levels as opposed to Wilford's 6-inch (circa 15 cm) increment levels, the fact still remains that Wilford's 1956 excavation found shell-tempered pottery in nearly every level and at depths of 24 inches (61 cm) to 36 inches (91 cm) depending upon the excavation square (Wilford 1956:5). In Wilford's Square D, the highest occurrence of shell-tempered sherds occurred in Level 3 (12-18 inches [30-46 cm] below the surface). Hudak's assertion (1974:7) that no pottery was identified below 60 cm also contradicts Wilford's findings and seems somewhat unrealistic. Given the nature and ubiquity of bioturbation in southern Minnesota, particularly at sites along waterways and lakes where burrowing mammals and tree root growth are known to thoroughly mix archaeological deposits, it is highly likely that the site deposits have experienced a good deal of post-depositional movement. Even had the archaeological deposits escaped the bioturbation inflicted by tree root growth and burrowing animals, the fact that the site was so intensively utilized suggests that the human activity alone could be responsible for significantly mixing the archaeological deposit and disrupting features (see Chatters 1987:346).

3.2.2 Environmental Setting

3.2.2.1 Landscape and Soils

The topography and hydrology of the region is largely the result of glaciation. The Des Moines Lobe was the last glacier to cover southwestern Minnesota (Ojakangas and Matsch 1982:225). The end moraines, ground moraines, and meltwater features which characterize the landscape of southwestern Minnesota are largely the result of this final glacial excursion (Ojakangas and Matsch 1982:226).

The site is situated on the eastern fringe of the Coteau Des Prairies (Wright 1972:573). Perched between lowlands associated with the Minnesota and James rivers, this region consists of an upland exhibiting a straight and steep eastern escarpment trending southeast, marked by numerous gullies housing patches of deciduous woodland. The upland and its escarpment bear the appearance of a structurally controlled plateau; however, exposures of bedrock along the escarpment have not been noted and borings within the region have extended several hundred feet through glacial deposits without encountering bedrock (Wright 1972:573).

The many lake basins in the region, including that of Lake Benton, were created directly or indirectly through glacial activity (Schwartz and Thiel 1973:35). The majority of these basins are shallow and were formed by the irregular deposition of glacial till while the deeper basins were formed when ice blocks, deposited in the till, melted.

The till and other glacially derived sediments have been modified by freezing, thawing, chemical weathering, and by the buildup of organic material left by plants and animals. The soils that are present today are the result of this process (Tester 1995:21-22). The Unites States Department of Agriculture-Natural Resources Conservation Service (USDA-NRCS) Soil Survey recognizes two soil series within the established site boundary. The Svea series consists of very deep, well or moderately well drained soils that formed in calcareous till and local alluvium from the till (USDA-NRCS 2012). These soils are found on concave positions on till plains and exhibit slopes ranging from 0 to 25%. The Barnes series consists of very deep, well drained soils that formed in loamy till (USDA-NRCS 2012). These soils are typically found on till plains and moraines and exhibit slopes ranging from 0 to 25%.

3.2.2.2 Climate, Flora, and Fauna

During the early to middle Holocene, strong Pacific air masses became increasingly dominant during the summer months as the Laurenide ice sheet began to retreat northward. The dry Pacific air prevented the intrusion of polar and tropical air masses into the region. The vegetation regime of the region changed over time in response to these climatic conditions (Knox 1983:34). The late-glacial boreal forest which had dominated the region began rapidly deteriorating at approximately 12,000 B.C. It was at this time that spruce forests gave way to deciduous woodlands which in turn gave way to grasslands by approximately 6,000 B.C. (Knox 1983:34).

Due to these climatic conditions, tallgrass prairie interspersed with wet prairie and stands of deciduous trees along waterways and around lakes characterized the vegetative regime of the region during a majority of the site's prehistoric occupation (Tester 1995:134). The vegetative regime exhibited a variety of flora and fauna species which were integral to prehistoric subsistence strategies.

Plants were commonly used by prehistoric peoples as food resources and textiles as well as for medicinal purposes. Species that would have been found within the tallgrass prairie include big and little bluestem, Indian grass, prairie dropseed, porcupine grass sideoats grama, panic grasses, muhly grass, switchgrass, prairie turnip, ground plum, leadplant, pasque flowers, golden alexanders, lousewort, prairie phlox, Philadelphia lily, purple coneflower, goldenrod, sunflowers, blazing star, and asters. In wetland and wet prairie areas the vegetation regime tended to be slightly taller and consisted of prairie-cord grass, switchgrass, mat muhly, bluejoint, northern reed grass, sedges, cattail, bulrush, arrowhead, wild licorice, lady white slipper, New England aster, golden alexander, gayfeather, and several species of mint (Tester 1995:137). Drier areas such as the gravel beach ridges commonly exhibited little bluestem, sideoats grama, prairie dropseed, plains muhly, blue grama, hairy grama, sand reed, June grass, needle grass, pasque flower, prairie smoke, narrow-leaved puccoon, white-flowered beard-tongue, compass plant, purple coneflower, and silky aster (Tester 1995:137). Oak forests would have been common within the river bottoms and along water bodies such as Lake Benton (Gibbon and Anfinson 2008). These woodlands would have provided important subsistence resources in the form of wood and tree fruits such as acorns.

Prior to European contact elk and bison were common throughout southwestern Minnesota. Bison were a staple resource of prehistoric peoples who inhabited this region. Smaller mammals including gophers, badgers, ground squirrels, white-tailed jackrabbits, red foxes, coyotes, skunks, raccoons, muskrats, weasels, meadow voles, short-tailed shrews, meadow jumping mice, and deer mice also occupied the prairie (Tester 1995:141-146). Many of these species were also likely utilized to some extent for subsistence purposes.

Common bird species would have been marbled godwits, upland sandpipers, meadowlarks, bobolinks, savannah sparrows, grasshopper sparrows, clay-colored sparrows, red-tailed hawks, great-horned owls, short-eared owls, burrowing owls, and various waterfowl. Leopard frogs and western chorus frogs as well salamanders would have been frequently found within and around wet prairie vegetation and deciduous woodland habitat along the rivers, lakes, and ponds of the region. Several fish species were also commonly found in the rivers and lakes of the region. Several varieties of snakes, including the common garter snake, plains garter snake, redbelly snake, and smooth green snake also lived in the region. Prairie skinks would have been found on the drier more elevated gravel beach ridges of Glacial Lake Agassiz. Important insects of this ecosystem included moths, butterflies, bees, grasshoppers, crickets, and beetles (Tester 1995:146- 158). The various fish and waterfowl species as well as frogs, snakes, and a number of insect species were likely considered important subsistence resources.

3.2.2.3 Lithic Resources

Lithic materials were also an important natural resource upon which human subsistence depended. The manufacture and use of lithic tools was an important human adaptive strategy and the procurement of lithic raw materials was vital to prehistoric life ways. Based on the geological history of Minnesota, Bakken (2011:63) has divided the state into four lithic raw material resource regions: South Agassiz, West Superior, Pipestone, and Hollandale (see Figure 1). The South Agassiz and West Superior resource regions were further delineated into subregions based on variations in the availability of specific raw materials within the region. Based on archaeological and geological data for each region and subregion, Bakken (2011:66) designated raw materials that are commonly available and commonly identified at archaeological sites as ‘primary materials’ whereas raw materials that are less abundant within the region and less frequently identified at archaeological sites were designated as ‘secondary materials’. A third designation, ‘other materials or minor materials,’ was assigned to raw materials that are not commonly available or not commonly identified as artifacts at archaeological sites. A fourth designation, ‘main exotic materials,’ was assigned to those materials not found naturally within the region, yet commonly identified at archaeological sites within the region. Table 1 presents Bakken’s (2011:67) resource regions and subregions as well as the associated lithic raw materials by level of geological abundance and archaeological utilization (i.e., primary, secondary, minor [other], and main exotic).

Site 21LN2 falls within the Shetek Subregion of the South Agassiz Resource Region which is predominantly characterized by the presence of materials found in secondary contexts, as most of them have been brought in through glacial drift from the west and the northwest. The primary and secondary tool stone materials of the Shetek subregion are Swan River chert, Tongue River silica, Red River chert, and quartz, all of which can be found within local glacial deposits. Minor materials consist of Sioux quartzite as well as the border lakes greenstone group materials and the western river gravels group materials. Raw material types not found naturally within the subregion, but commonly identified at archaeological sites within the subregion consist of Knife River flint, Burlington chert, and Prairie du Chien chert.

3.2.3 Cultural Setting

The cultural traditions of Minnesota’s prehistoric period are divided into generalized sequences or periods. Analysis of material culture in combination with ethnographic data and oral tradition allow for interpretations regarding prehistoric period technological development and subsistence adaptation. These interpretations form the framework within which these generalized cultural periods have been developed and continue to evolve. The generalized cultural periods for the region housing 21LN2 consist of Paleoindian, Archaic, Woodland, Plains Village, and Oneota.

Paleoindian	10,000 to 6,500 B.C.
Archaic	6,500 to 1,000 B.C.
Woodland	1,000 B.C. to A.D. 1000
Plains Village	A.D. 1000 to 1650
Oneota	A.D. 1000 to 1650

3.2.3.1 Paleoindian Period (10,000 to 6,500 B.C.)

Approximately 12,000 years ago, conditions became warmer and drier causing a full glacial retreat within the region. Flora and fauna species slowly repopulated the newly emerging landscape. Human populations in the form of small nomadic hunting bands moved into the region in pursuit of large game species such as mastodon and Pleistocene bison. The earliest complexes of this period, such as Clovis and Folsom, are characterized by fluted lanceolate projectile points, while the later complexes, such as Dalton, are characterized by unfluted lanceolate projectile points (Dobbs 1989:50-53, 64-67). Other “defining characteristics of the Paleoindian period include distinctive butchering tools, extensive use of exotic chert types, and specialized lithic technologies” (Schermer et al. 1995).

Paleoindian sites are scarce in the region and those sites that have been identified often consist of isolated projectile points. It is not known whether the lack of material culture relating to the Paleoindian period is due to the impacts of glaciation or if the environmental conditions of the region during this period were unfavorable for human habitation (Anfinson 1997:121-122).

3.2.3.2 Archaic Period (6,500 to 1,000 B.C.)

As the Midwest continued to experience warmer and drier climatic conditions, deciduous forests continued to replace coniferous forests, prairie grasses expanded in areas, and big-game animals either migrated north or became extinct. The Archaic period (ca. 6,500 to

1,000 B.C.) represents human adaptation to these changing climatic conditions – most notably the change to a broad-spectrum hunting and gathering subsistence base after the demise of the Pleistocene megafauna. The Archaic tradition found within this region is characterized by the presence of a variety of side-notched projectile points, ground stone tools, and an economic focus on the exploitation of bison (Anfinson 1997:35).

The Archaic period can be divided into three developmental parts, the Early, Middle, and Late Archaic. The Early Archaic period (ca. 6,500 to 5,500 B.C.) is characterized by the transition from hunting megafauna to a dependence on bison along with hunting smaller game and gathering wild plant foods. Early Archaic technologies included "medium to large spear points, often with serrated and beveled blade edges" (Schermer et al. 1995). Little is known about the Middle Archaic period (5,500 to 2,500 B.C.) in the region, mainly because this period marked a movement toward the occupation of river valleys; and sites from this period, therefore, are frequently deeply buried in alluvial sediments (Schermer et al. 1995). The Late Archaic period (2,500 to 1,000 B.C.) is characterized by substantial population increases that led to "increased territoriality, local differentiation in artifact styles, and development of intergroup trading networks," (Schermer et al. 1995). Communal cemeteries and other indicators of a more sedentary lifestyle are encountered in the archaeological record of the Late Archaic.

3.2.3.3 Woodland Period (1,000 B.C. to A.D. 1000)

Arzigian (2008:3) sums up the Woodland period (1,000 B.C. to A.D. 1000) as including components that have pottery but lack intensive maize agriculture, which distinguish it from the preceding Archaic period and the later Plains Village pattern and Oneota culture. The basic hunting and gathering strategy continued on from the Archaic period, but was augmented with fishing and plant cultivation (Arzigian 2008:10-11). Arzigian (2008:11) also notes that "earthen mounds were constructed in large numbers and became prominent in parts of the landscape."

The Woodland period can be organized into Early, Middle, and Late Woodland periods.

The Early Woodland period (1,000 to 100 B.C.) is characterized by seasonal occupation of small sites. Food resources were varied and included large and small mammals, birds, and aquatic animals. Burial mounds and trade networks were also characteristic of this period. Early Woodland archaeological resources include stemmed spear points; earlier, thick, flat-bottomed pottery; and later, thin, bag-shaped pottery “often decorated with incised lines in geometric patterns” (Schermer et al. 1995). The Middle Woodland period (100 B.C. to A.D. 300) is characterized by the Hopewell culture, manifested in extensive trade networks, elaboration of mortuary practices, social stratification, and refined art. This period is represented in the archaeological record by broad, corner-notched spear points; finely made, thin blades; marine shell, copper, mica, Knife River flint, obsidian, and pipestone artifacts; and high quality ceramic vessels (Schermer et al. 1995). The Late Woodland period (A.D. 300 to 1000), like the Late Archaic saw substantial population increases and the beginnings of large settlements and the introduction of corn. This period also witnessed the introduction of the bow and arrow to the region as represented archaeologically by small arrow points.

3.2.3.4 Late Prehistoric Period (A.D. 1000 to 1650)

The Late Prehistoric period (A.D. 1000-1650) witnessed the establishment of large villages and the increased development of corn as a staple food resource. Two cultural traditions, Plains Village and Oneota, are apparent within the region during the Late Prehistoric period.

3.2.3.4.1 Plains Village Pattern

The Plains Village pattern (1,000 to 1,650 A.D.) is characterized by “improved corn varieties, garden surpluses, new storage methods, earthlodge houses, and a complex social organization” (Schermer et al. 1995). Habitation sites were semi-permanent and often fortified. They were generally located on river terraces with adjacent river-bottom gardens (Anfinson 1997:89). Plains Village cultures were heavily reliant on bison, not only for food, but for clothing, components of lodging, and tools. This cultural tradition is represented in the archaeological record by varying elements, depending on its regional location. These elements include hearths, storage/trash pits, large semi-subterranean house structures, triangular un-notched and side-notched projectile points, bone tools, and well-made globular jars exhibiting both Woodland and Mississippian traits with rounded bottoms and shoulders, constricted necks, and out-flaring decorated rims (Anderson 1998; Anfinson 1997:89; Fishel 1996a).

3.2.3.4.2 Oneota Culture

The Oneota culture (1,000 A.D. to 1650) represents a widespread manifestation with Late Woodland antecedents infused with Mississippian traits (Benn 1995). Oneota peoples lived in either single-family houses or longhouses in large permanent or semi-permanent villages, which in some cases were fortified. They constructed burial mounds and subsisted on a wide variety of resources obtained through fishing, hunting, gathering, and agriculture. Archaeologically, the Oneota culture is represented by shell-tempered, globular jars with straight rims and wide-trailed line decoration (Anfinson 1997:90) as well as “bone tools, most noticeably the bison scapula hoe and deer mandible sickle; small, unnotched triangular arrow points; end scrapers; sandstone abraders; mauls; catlinite disc and elbow pipes; and village areas marked by an abundance of storage pits” (Fischel 1996b).

3.3 METHODS

3.3.1 Lithic Assemblage

The subject of this study consisted of 1,250 chipped stone artifacts collected in 1956 by Wilford at Site 21LN2. The artifacts were collected from four 10 foot by 10 foot excavation squares. See Section 3.2.1 for detailed information regarding the 1956 excavation. Several additional chipped stone artifacts collected by Wilford as part of this same collection could not be included in this study as the artifact labels, which were written directly on the artifact surface in marker, had rubbed off to the extent that they were no longer legible. These artifacts did not favor one raw material type or another and as such their exclusion was not considered detrimental to the current lithic raw material utilization study. Several other artifacts that were noted in Wilford’s original tool inventory had been pulled from the collection, likely for display or teaching purposes, and not replaced. There is no indication that the missing tools were pulled based on a preference for one raw material type or another, and therefore their exclusion was again not considered detrimental to the current lithic raw material utilization study.

3.3.2 Data Collection

A unique identifier, printed on acid free paper, was applied to each of the 1,250 chipped stone artifacts using a mixture of acetone and B-72. The lithic assemblage was then sorted into groups based on raw material type as defined by the State of Minnesota lithic comparative collection housed at Fort Snelling State Park. Internally heterogeneous raw material type groups were further subdivided into minimum analytical nodules based on nuances within the raw material types (i.e., color, texture, inclusions, cortical texture, transmitted light, and other observable characteristics). Correct assessment of each lithic artifact with regard to lithic raw material type as well as an understanding of the variation that can occur within a single ‘nodule’ of each material type was critical. Therefore, the assessment of these attributes was conducted using the extensive lithic raw material comparative collection housed at Fort Snelling State Park. The process also involved consultation with two colleagues, Dr. Kent Bakken and Mr. Dan Wendt; both recognized experts on lithic raw materials identified at archaeological sites in Minnesota. The presence or absence of heat-treatment was also noted during the raw material assessment, but not summarized or synthesized due to the ambiguity of such designations. If an artifact appeared to have been burnt this fact was noted and a raw material designation of ‘indeterminate’ was assigned when the material characteristics of the stone were too extensively altered.

Each artifact was then assigned to an artifact class based loosely on Andrefsky's (2005:76) morphological typology. Artifacts lacking secondary retouch were categorized as debitage and were designated as a complete flake, proximal flake, medial flake, distal flake, split flake, or shatter based on the morphological characteristics of the artifact. Artifacts exhibiting secondary retouch and modification were categorized as tools and were divided into three initial categories – flake tools, bifaces, and core tools. Flake tools consisted of any tool manufactured from what remained a recognizable flake and were placed into the following artifact classes: complete flake tool, proximal flake tool fragment, medial flake tool fragment, distal flake tool fragment, and split flake tool fragment. These tool types were then further categorized based on morphological characteristics and assumed tool function (e.g., side scraper, end scraper, backed knife, etc.). Bifaces consisted of those tools where flakes were removed across the entire or nearly entire surface area of the artifact (Andrefsky 2005:79) and were placed into the following artifact classes: biface (complete), biface not complete (recognizable portion of a biface), and biface fragment (unrecognizable biface tool fragment or unfinished fragment). These tool types were also further categorized based on morphological characteristics and assumed tool function (e.g., projectile point, knife, etc.). Core tools consisted of bifaces as defined above that exhibited two or more flake scars greater than two cm in length. There was a single artifact class within the core tool category (core tool). This tool type was also further categorized based on morphological characteristics and assumed tool function. Other artifact class categories included: core, core fragment, tested cobble, and heat spall.

The percentage of cortex present was noted for all complete flakes and complete flake tools. The percentage of the dorsal surface exhibiting cortex was designated using the following categories: 0%, 1-10%, 11-40%, 41-60%, 61-90%, and 91-99%, and 100% per Dibble (1995). The percent circumference retouched was assessed for all complete flake tools, complete bifaces, and complete core tools. The percent circumference retouched was designated using the same categories described above for percent cortex. The weight of each artifact was recorded in grams (g). Standard metrics (maximum length, maximum width, and maximum thickness) were recorded in millimeters for all complete tools and all complete flakes as well as complete dimensions of tool fragments (i.e., the recording of max width for a projectile point missing a tip). For complete flakes and complete flake tools, midpoint width, midpoint thickness, and the maximum length from the proximal to distal ends of the flake along a line perpendicular to the striking platform were also recorded. Additional metrics collected for projectile points included minimum neck width, maximum base width, and maximum haft thickness. Additional metrics and notes were also recorded for flake tools to facilitate Kuhn's (1990) Index of Reduction and Clarkson's (2002) Index of Invasiveness as described and discussed below. Flake initiation (i.e., hertizian, bending, wedging), flake termination (i.e., feathered, hinged, abrupt, overshot), debitage type (i.e., flake, bifacial thinning flake, bipolar flake, etc.) flake tool margin (unimarginal, bimarginal), and tool formality (i.e., formal vs. expedient) were also recorded when appropriate.

All data were entered into a Microsoft Access database using the E4 program developed by Harold Dibble and Shannon McPherron at Old Stone Age. The E4 program is a flexible data entry program designed to make data entry faster and reduce errors.

3.3.3 Assessing the Data

3.3.3.1 Lithic Raw Material Procurement

The source location or region of each lithic raw material type identified at 21LN2 was assessed in relation to the site location. Material types that were likely procured within the general site region were considered to be of local origin whereas those materials that could only be procured beyond the general site region were considered to be of non-local origin. As the site area falls within a glaciated area, those materials commonly found within the glacial till of the site region, regardless of the original geological origin of the material, were considered local (e.g., Swan River chert, Red River chert, Lake of the Woods rhyolite, etc.). The count and mass of lithic raw material types were used to quantify the amount of each material present at the site. These data were then used to infer the relative level of dependence prehistoric inhabitants of 21LN2 placed on each material type and their reliance upon local vs. non-local raw materials. These data were also used to infer the prehistoric inhabitants' connections, whether by trade or travel, to surrounding regions.

Andrefsky (1994b:29-30) predicts that a relationship exists between quality and abundance of lithic raw material and the kinds of tools produced of those materials. Essentially, high quality locally available materials are predicted to be used for both formal and expedient tool production. High quality non-locally available materials are predicted to be used primarily for formal tool production. Low quality materials, whether locally or non-locally available are predicted to be used primarily for expedient tool production. Many factors can be used to assess the quality of lithic raw materials; however, in keeping with Andrefsky's (1994b:29-30) logic, for the purposes of this study the material quality was equated to the overall ease with which the raw material can be formed into tools. Designations of material quality were made in consultation with Dan Wendt, a master flintknapper who has experience working all the lithic raw material types identified at the 21LN2 (with the exception of Gulseth silica). Tools were grouped by their tool formality designation (i.e., formal, expedient, unknown). The designation was assigned based on Andrefsky's (1994b:22) distinction between expedient tools or tools with little effort expended in their production and formal tools or tools exhibiting higher levels of effort expended in their production. Tools considered to be formal consisted of bifaces such as projectile points and knives as well as more formally worked flake tools such as well-formed end scrapers and side scrapers. Expedient tools consisted of lightly retouched flake tools and utilized flakes. All tools with an unknown designation (n=26) were removed from consideration. Formal tools (n=100 [n=76 with assigned procurement origin]) and expedient tools (n=121 [n=106 with assigned procurement origin]) were separated into their respective groups and the raw material makeup of the two groups analyzed to assess if the observed trends corresponded well with Andrefsky's (1994b) predictions regarding high and low quality materials of local and non-local availability.

The degree of corticality by raw material was used to evaluate the degree to which differing lithic raw material types had been reduced prior their introduction onto 21LN2. Large amounts of highly cortical flakes indicate that the material type in question tended not to be reduced prior to its introduction onto the site, which is indicative of a low degree of curation (Conard and Adler 1997:155). Little to no highly cortical flakes suggest the raw material type in question tended to be brought on site in a partially reduced state indicative of a moderate to high degree of curation (Conard and Adler 1997:155). Data reflecting the percent cortex of complete flakes and complete flake tools was cross-checked against raw material type. Other factors such a presence and absence of cores, core tools, and shatter by lithic raw material type were also considered when making inferences regarding the state in which the differing raw material types tended to be introduced to the site. These data were then cross-checked against tools by raw material to assess how the differing lithic raw materials tended to move through the site.

3.3.3.2 Reduction Efficiency, Reduction Type, and Tool Production Intensity

Two methods were used to assess the reduction intensity by raw material at 21LN2. The first simply consisted of calculating the frequency of complete flake tools and complete bifaces manufactured from flake blanks against complete flakes by raw material type. The second followed a method proposed by Henry (1989:141) in which dimensional data are used to establish production ratios. Henry (1989:141) states,

> *The dimensions of tools, identified through the presence of secondary retouch, are compared to the dimensions of the other specimens in an assemblage. Those specimens with dimensions less than those of the smallest tool are not considered to have had the potential of being made into tools and are commonly labeled 'debris.' In contrast, specimens with dimensions equal to or greater than tools are considered to have had the potential of being made into tools and are commonly labeled 'debitage.' Comparisons of the ratios between the categories of tools,*

> *debitage, and debris provide insights into the overall production efficiency of an assemblage.*

The current study took Henry's (1989:141) method one step further and subdivided the lithic assemblage into raw material type groups prior to the application of the described method. The dimensional data pertaining to complete flakes, complete flake tools, and complete bifaces manufactured from flake blanks were presented in a scatter plot for each lithic raw material type. These data were then used to make inferences regarding trends in reduction intensity and production efficiency by raw material at 21LN2.

Patterns in reduction type by lithic raw material were assessed by observing frequencies of flake types (e.g., bifacial thinning flake, bipolar flake, etc.) across the different raw material groups at 21LN2. These data allowed for inferences regarding trends in reduction techniques by raw material.

3.3.3.3 Assessment of Tool Retouch Intensity by Raw Material

Kuhn's (1990) Index of Reduction and Clarkson's (2002) Index of Invasiveness were used to assess tool retouch intensity by raw material. Kuhn's (1990) Index of Reduction was applied to all unifacially worked tools exhibiting a retouched edge on the dorsal surface running parallel to a distinct dorsal ridge or medial thickening. Most side scrapers fell into this category. Kuhn's (1990:584) Index of Reduction is based on the premise that

> *the cross-section of a 'typical' flake approximates a triangle, with the thickest point at or near the longitudinal center of the piece (Figure 3). As a unifacial tool is reduced, the terminations of the retouch scars approach the centerline [dorsal ridge] of the flake. The vertical thickness of the flake at the termination of the line of retouch scars ('t' in Figure 3) also increases, achieving the same value as the maximum thickness ('T') when the retouch scars cross the centerline [dorsal ridge] of the flake (Figure 3 a-c). The ratio of t/T increases from 0.0*

(unretouched) to 1.0 (retouched to the point of maximum thickness) as resharpening progresses. If retouch crosses the midpoint of the blank, the ratio will remain at 1.0 since the measurable maximum thickness will also decrease as more and more of the flake is removed.

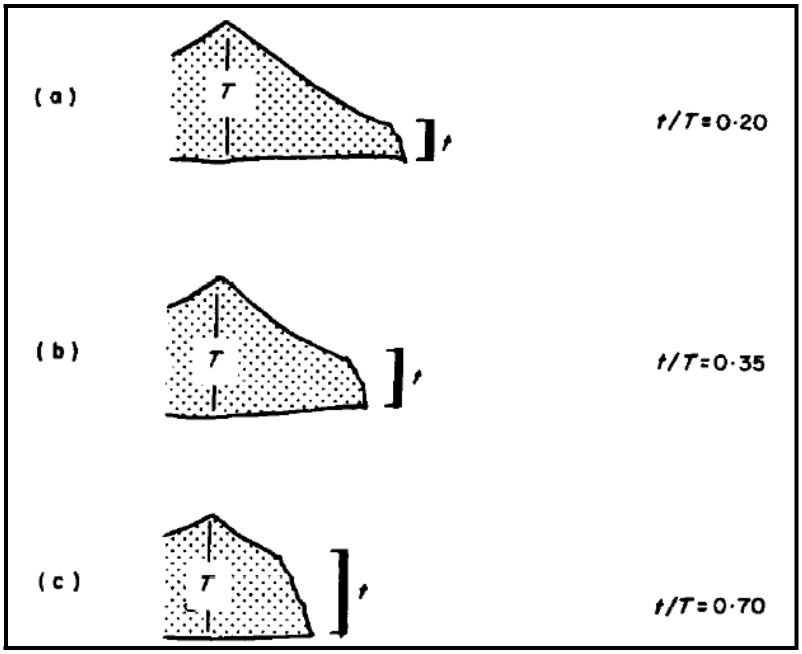


FIGURE 3. SCHEMATIC DIAGRAM SHOWING INCREASE IN RATIO OF THICKNESS AT TERMINATION OF RETOUCHED SCARS (T) TO MEDIAL THICKNESS (T) WITH PROGRESSIVE REDUCTION (FROM KUHN 1990:585)

The Index of Reduction was calculated by taking the Sine of the angle (a) of the retouched margin multiplied by the extension of retouch (D) at that same point divided by the maximum thickness of the flake at that same point (Figure 4). This calculation was performed at three distinct locations along the retouched edge of each applicable tool. The mean of the three individual values was recorded as the Index of Reduction for each artifact. These data were compared across raw material groups allowing inferences regarding tool retouch intensity by raw material.

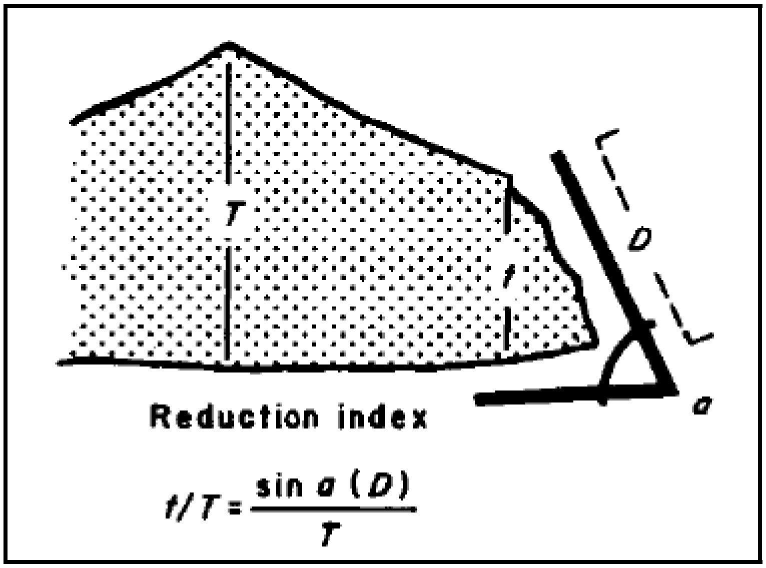


FIGURE 4. DIAGRAM ILLUSTRATING MEASUREMENTS NEEDED TO CALCULATE KUHN'S INDEX OF REDUCTION (FROM KUHN 1990:585)

Clarkson's (2002:72) Index of Invasiveness is best suited for unimarginal and bimarginal flake tools. For this reason, the Index of Invasiveness was used to assess the tool retouch intensity for all complete, non-biface tools. The Index of Invasiveness was calculated by dividing the ventral and dorsal surfaces of the complete flake tools into eight analytical segments on each side for a total of 16 analytical segments (Figure 5(a)). Each surface was also divided into an inner zone and outer or marginal zone.

> *Each zone is ascribed an invasiveness score, representing the maximum degree of encroachment of retouch scars onto the artifact's surface (Figure 5(b)). The outerzone, or marginal zone, is ascribed a score of 0.5, indicating penetration of flake scars not more than halfway to the central point of the flake. The inner zone, or invasive zone, is given a score of 1, indicating that retouch scars terminate more than halfway from the lateral margin and are approaching the medial point of the flake. Scores are attributed on the basis of the maximum encroachment of flake scars in each segment (Figure 6). These scores may then be summed to give a total figure for the invasiveness of each artifact. Dividing this total by the*

> *number of segments (i.e., 16) gives a result ranging between ‘0’ (no retouch) and ‘1’ (completely retouched) (Clarkson 2002:67-68).*

The mean Index of Invasiveness values for each raw material group were compared across raw material groups allowing inferences regarding tool retouch intensity by raw material.

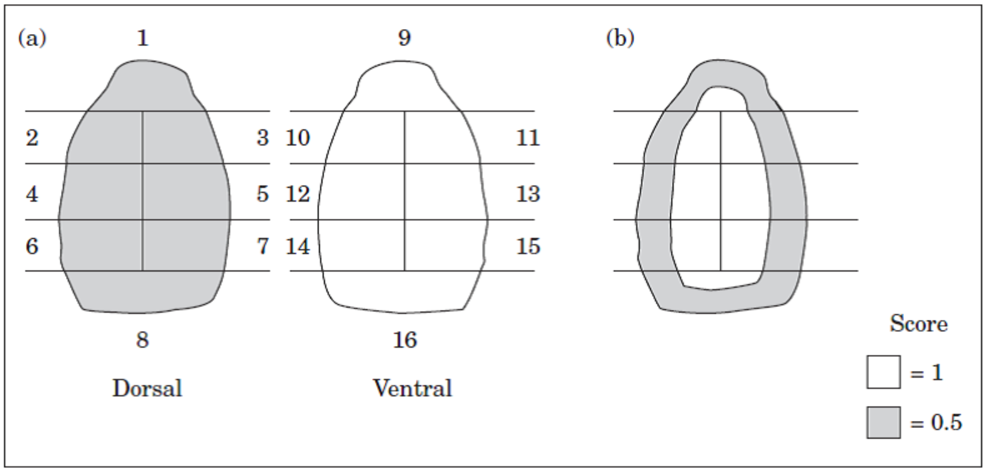


Figure 5. Method for Dividing Dorsal and Ventral Surfaces of Artifact into Analytical Segments and Zones (from Clarkson 2002:67)

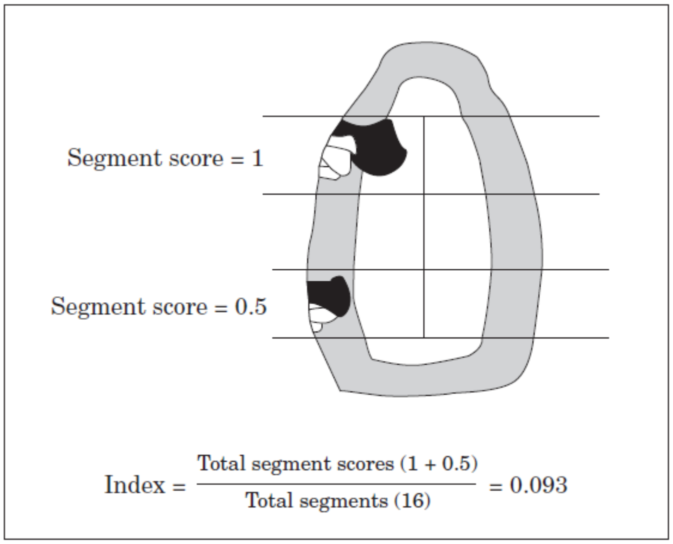


Figure 6. Diagram Illustrating the Application of the Index of Invasiveness (from Clarkson 2002:68)

3.3.3.4 Application and Assessment of Minimum Analytical Nodules (MANA)

MANA was explored here as a way to refine inferences made with regard to the lithic raw material procurement and utilization behavior exhibited at 21LN2. Once, the internally heterogeneous raw material type groups were further subdivided into minimum analytical nodules based on nuances within the raw material types (i.e., color, texture, inclusions, cortical texture, transmitted light, and other observable characteristics) the total number of nodules per lithic raw material type were noted. These data were then used to enhance the earlier interpretations regarding lithic raw material procurement patterns at 21LN2. In this manner, the study was able to go beyond simply using artifact count and mass to describe the amount of each heterogeneous material arriving on site and add an additional behavioral dimension – a proxy for how many nodules of each heterogeneous material arrived on site.

Additionally, each MAN was assigned a behavioral interpretation based on the nodule constituents. Hall (2004:144) proposes four MAN group types within his constituent-based approach to MANA. Type 1 consists solely of a tool(s) and represents before-site curation and on-site discard. Type 2 consists of debitage and a tool(s) and represents before-site curation and on-site maintenance and discard. Type 3 consists of debitage, a core(s), and a tool(s) and represents before-site provisioning and on-site manufacture, maintenance, and discard. Type 4 consists solely of debitage and represents on-site production and off-site provisioning.

Hall (2004:148), citing Larson and Kornfeld (1997:7), notes that sorting debitage into MANs becomes somewhat questionable with small-sized debitage and for that reason he used pieces 2 cm or larger in his study evaluating prehistoric hunter and gatherer mobility. Baumler and Davis (2004:50); however, argue that small-sized debitage (between 1/4" and 1/16") can be affectively assigned to MANs and they demonstrate that a large amount of debitage and data, particularly regarding tool maintenance activities, is lost when not taking small-sized debitage into account. Baulmer and Davis (2004:50) do concede that MAN assignments become more tenuous in the case of multicolored, variegated stones. The assemblage used in the current study contains artifacts roughly 1.5 cm and larger and as such was expected to be well suited, size-wise, for the application of MANA. However, per Baumler and Davis (2004:54), it is noted here that certain reduction sequences are likely not captured in the data set (i.e., tool maintenance). For this reason, when assigning MANs to a type group per Hall (2004:144), types 1 and 2 (1=before-site curation and on-site discard; 2=before-site curation, on-site maintenance, and on-site discard) were combined as the differentiating aspect (maintenance debris) between the two defined types was not collected. This is something that Hall (2004) failed to account for in his study as he freely assigned MANs to types 1 and 2 without analyzing debitage smaller than 2 cm. Additionally, nodules containing a tool(s) and debitage of 1.5 cm or larger in size likely represent on-site production and on-site discard rather than on-site maintenance and discard – again, maintenance generally produces smaller sized debitage than that measuring 1.5 cm or larger. Similarly, nodules comprised solely of such debitage, measuring 1.5 cm or larger in size, likely represent on-site production and off-site curation of the produced tool.

Based on the above discussion and the fact that core elements (i.e., cores, core fragments, core tools, and core tool fragments) were not well represented at the site, three constituent-based MAN types were assigned in this study. Type A nodules consist solely of a tool(s) and represent before-site curation, potential on-site maintenance, and on-site discard. Type B nodules consist of debitage and a tool(s) and represent on-site manufacture, potential on-site maintenance, and on-site discard. Type C nodules consist solely of debitage and represent on-site production and off-site discard.

This data set was used to further infer how the lithic raw materials likely arrived at and move through the site. The nodules were also placed into two categories - locally available and non-locally available - to further assess procurement and utilization patterns at 21LN2.

3.4 RESULTS

No clear cultural stratigraphy was observed within the collection due to the apparent high degree of post-depositional movement of cultural materials. Previous ceramic analysis (Bonney 1965; Wilford 1956) as well as previous (Bonney 1965; Wilford 1956) and current projectile point analysis of this collection further confirm that the cultural material excavated in 1956 experienced a high degree of vertical (and likely horizontal) post-depositional movement. This post-depositional movement is likely the result of extensive bioturbation due largely to burrowing animals and tree root growth; both of which are very common in the region – particularly near lakes and streams. Additionally, the site appears to have been used by prehistoric peoples for several thousand years. Chatters (1987:346) indicates that highly utilized sites will often incur a high degree of disturbance due to each subsequent intrusive human activity.

Due to the nature and extent of the mixing of cultural material a conservative approach was taken here where the lithic assemblage was analyzed as a whole. That is to say, as tempting as it was, the assemblage was not subdivided into cultural horizons as there was no sound basis for doing so. The lithic assemblage appears to largely reflect patterns of the Woodland and Late Prehistoric (Plains Village/Oneota) periods; though it should be noted that Archaic and Paleo-Indian materials are also present, but to a much lesser extent. As a result, the patterns observed during the current analysis largely reflect lithic raw material utilization at the site during the Woodland and Late Prehistoric periods with the acknowledgment that influences and trends from earlier periods are also present in the data.

3.4.1 Raw Material Representation and Implications

The 21LN2 chipped stone assemblage (n=1250/m=4253.27g) is quite diverse with regard to raw material constituency. A total of 11 general raw material groups subdivided into 28 identifiable lithic raw material types were identified at the site (excludes indeterminate chert, indeterminate agate, etc.). Table 8 provides the observed artifact count and mass by raw material group and type and Figure 7 illustrates the lithic raw material representation at 21LN2 by percent count and mass.

The 21LN2 chipped stone assemblage is dominated by Swan River chert artifacts (n=357; m=1404.79g) both by count and mass. Swan River chert can be procured locally from within the region's glacial till. However, four of the next five best represented lithic raw materials by count and mass consist of non-local raw material types: Knife River flint (n=130/m=325.21g), Burlington chert (n=83/m=164.6g), Grand Meadow chert (n=77/m=223.51g), and Prairie du Chien chert (n=64/m=228.88g); with Red River chert (n=50/m=199.74) being the only local raw material type of these five. These data demonstrate a dependence upon both local and non-local lithic raw materials by the prehistoric inhabitants of the site.

The locally and non-locally procured assemblages were observed to better understand procurement patterns and assess the prehistoric inhabitants' connections, whether by trade or travel, to surrounding regions. Table 9 presents the local and non-local lithic raw material type representation by count and mass while Figures 8 and 9 illustrate the general procurement origin of the overall chipped stone assemblage by count and mass respectively. Figures 10 and 11 illustrate the lithic raw material type representation of the local and non-local assemblages.

Locally procured raw materials represent 42.56% of the overall chipped-stone assemblage by artifact count and 52.90% by mass. Non-locally procured raw materials represent a slightly smaller percentage of the chipped-stone by count (p=36.24) and a considerably smaller percentage by mass (p=30.59). These data suggest that the prehistoric inhabitants of 21LN2 depended heavily upon both local and non-local lithic resources. By count, the local and non-local raw material assemblages are nearly equally represented. By mass the local assemblage is considerably larger. This is likely indicative of the degree of reduction with which materials of differing provenience were introduce onto the site as well as how these materials moved through the site. This will be explored in a subsequent portion of this thesis.

The constituent raw materials of the local and non-local lithic raw material assemblages are discussed in detail below. First, however, a discussion regarding the materials omitted from these two assemblages is in order. The raw materials designated as having an unknown or indeterminate procurement origin represented 21.20% of the total chipped-stone assemblage by count and 16.51% by mass (see Table 9). These raw materials fell into two main categories. The first consisted of indeterminate raw material types and the second consisted of three identifiable material types: Hudson Bay Lowland chert, Kakabeka chert, and Lake Superior agate. The indeterminate materials are, by definition, indeterminate and for that reason a procurement origin could not be assessed. The Hudson Bay Lowland chert, Kakabeka chert, and the Lake Superior agate all originate from source areas in northeastern Minnesota and Canada. In the cases of the Kakabeka chert and Lake Superior agate artifacts (n=1 each), both materials may have been procured locally; however, it is more likely that they were procured non-locally from the glacial till of central or eastern Minnesota. It is very unlikely that the material was procured from the respective places of origin given the extremely small amount of material found at the site and regional patterns of raw material utilization noted by Bakken (2011). As a result, these identifiable material types were designated as having an unknown procurement provenience. In the case of the Hudson Bay Lowland chert material (n=6), too little is known regarding the extent of its presence within the glacial till of Minnesota; let alone the exact location of its geologic origin. For that reason, the Hudson Bay Lowland chert was also designated as having an unknown procurement provenience. It should be noted that these three raw material types represent an extremely small percentage (p=0.64 by count and 0.92 by mass) of the overall chipped stone assemblage, which suggests they were likely not considered highly important raw materials by the prehistoric inhabitants of the site. Therefore, the omission of these three raw materials from the local and non-local raw material assemblages was not expected to be a detriment to this study.

TABLE 8. LITHIC RAW MATERIAL TYPE REPRESENTATION BY COUNT AND MASS AT 21LN2

Lithic Raw Material Group/Type	Count	Mass (g)	Percent of Assemblage Count	Percent of Assemblage Mass
AGATE	**9**	**35.2**	**0.72%**	**0.83%**
INDETERMINATE AGATE	1	4.7	0.08%	0.11%
LAKE SUPERIOR AGATE	1	0.8	0.08%	0.02%
LGG - AGATE	7	29.7	0.56%	0.70%
BASALTIC ROCK	**29**	**129.84**	**2.32%**	**3.05%**
BASALTIC ROCK	29	129.84	2.32%	3.05%
CHALCEDONY	**14**	**33.3**	**1.12%**	**0.78%**
INDETERMINATE CHALCEDONY	11	22.8	0.88%	0.54%
LGG - CHALCEDONY	2	5.6	0.16%	0.13%
PLATE CHALCEDONY	1	4.9	0.08%	0.12%
CHERT	**1091**	**3472.42**	**87.28%**	**81.64%**
BURLINGTON CHERT	83	164.6	6.64%	3.87%
CEDAR VALLEY CHERT	10	25.45	0.80%	0.60%
FUSILINID GROUP CHERT	14	26.87	1.12%	0.63%
GALENA CHERT	23	62.36	1.84%	1.47%
GRAND MEADOW CHERT	77	223.51	6.16%	5.26%
GULSETH SILICA	9	20.99	0.72%	0.49%
HARTVILLE UPLIFT CHERT	1	28	0.08%	0.66%
HUDSON BAY LOWLAND CHERT	6	9.55	0.48%	0.22%
INDETERMINATE CHERT	235	624.47	18.80%	14.68%
KAKABEKA CHERT (BR)	1	11.7	0.08%	0.28%
KNIFE RIVER FLINT	130	325.21	10.40%	7.65%
LGG - HARTVILLE UPLIFT (cf.)	1	13.6	0.08%	0.32%
LGG - KNIFE RIVER FLINT	11	46.09	0.88%	1.08%
MAYNES CREEK CHERT	8	38.21	0.64%	0.90%
MOLINE CHERT	6	10.8	0.48%	0.25%
PRAIRIE DU CHIEN CHERT	64	228.88	5.12%	5.38%
RED RIVER CHERT	50	199.74	4.00%	4.70%
SWAN RIVER CHERT	357	1404.79	28.56%	33.03%
WAPSIPINICON CHERT	5	7.6	0.40%	0.18%
GRANITIC ROCK	**1**	**3.44**	**0.08%**	**0.08%**
GRANITIC ROCK	1	3.44	0.08%	0.08%
QUARTZ	**16**	**59.64**	**1.28%**	**1.40%**
QUARTZ	16	59.64	1.28%	1.40%
QUARTZITE	**33**	**166.5**	**2.64%**	**3.91%**
BIJOU HILLS SIL SED	18	116.98	1.44%	2.75%
HIXTON GROUP SIL SANDSTONE	4	16.9	0.32%	0.40%
INDETERMINATE QUARTZITE	10	28.2	0.80%	0.66%
SIOUX QUARTZITE	1	4.42	0.08%	0.10%
RHYOLITE	**14**	**188.25**	**1.12%**	**4.43%**
LAKE OF THE WOODS RHYOLITE	14	188.25	1.12%	4.43%
SILISIFIED SEDIMENT	**33**	**141.83**	**2.64%**	**3.33%**
TONGUE RIVER SILICA	33	141.83	2.64%	3.33%
SILISIFIED WOOD	**5**	**8.77**	**0.40%**	**0.21%**
SILISIFIED WOOD	5	8.77	0.40%	0.21%
SILTSTONE	**5**	**14.08**	**0.40%**	**0.33%**
KNIFE LAKE SILTSTONE	5	14.08	0.40%	0.33%
Grand Total	**1250**	**4253.27**	**100.00%**	**100.00%**

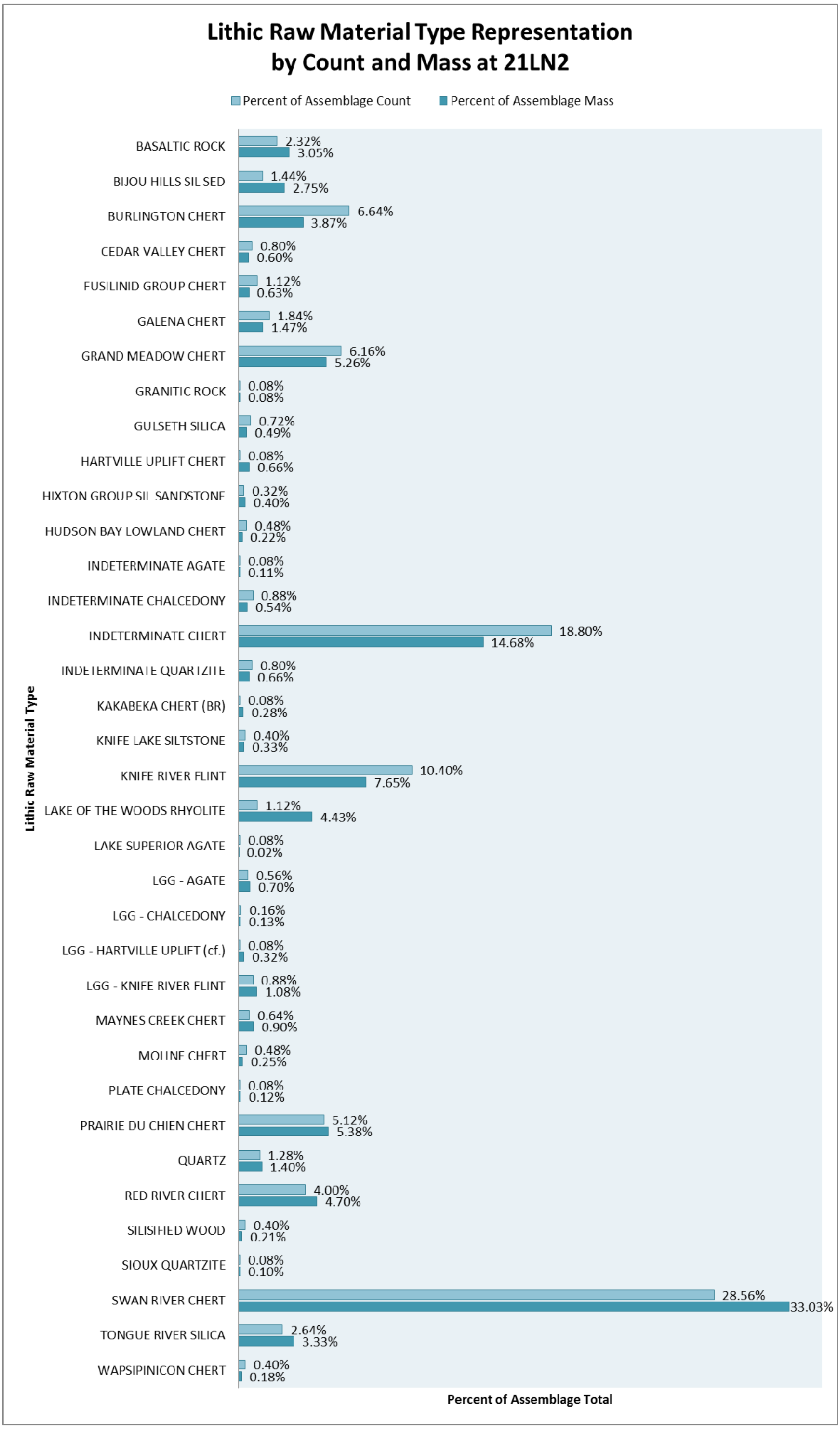


FIGURE 7. LITHIC RAW MATERIAL REPRESENTATION BY PERCENT COUNT AND MASS AT 21LN2

Table 9. Lithic Raw Material Type by Procurement Origin at 21LN2

Procurement Origin and Lithic Raw Material Type	Count	Mass (g)	Percent of Assemblage Count	Percent of Assemblage Mass
Local	**532**	**2249.79**	**42.56%**	**52.90%**
BASALTIC ROCK	29	129.84	2.32%	3.05%
GRANITIC ROCK	1	3.44	0.08%	0.08%
KNIFE LAKE SILTSTONE	5	14.08	0.40%	0.33%
LAKE OF THE WOODS RHYOLITE	14	188.25	1.12%	4.43%
LGG - AGATE	7	29.7	0.56%	0.70%
LGG - CHALCEDONY	2	5.6	0.16%	0.13%
LGG - HARTVILLE UPLIFT (cf.)	1	13.6	0.08%	0.32%
LGG - KNIFE RIVER FLINT	11	46.09	0.88%	1.08%
QUARTZ	16	59.64	1.28%	1.40%
RED RIVER CHERT	50	199.74	4.00%	4.70%
SILISIFIED WOOD	5	8.77	0.40%	0.21%
SIOUX QUARTZITE	1	4.42	0.08%	0.10%
SWAN RIVER CHERT	357	1404.79	28.56%	33.03%
TONGUE RIVER SILICA	33	141.83	2.64%	3.33%
Non-Local	**453**	**1301.26**	**36.24%**	**30.59%**
BIJOU HILLS SIL SED	18	116.98	1.44%	2.75%
BURLINGTON CHERT	83	164.6	6.64%	3.87%
CEDAR VALLEY CHERT	10	25.45	0.80%	0.60%
FUSILINID GROUP CHERT	14	26.87	1.12%	0.63%
GALENA CHERT	23	62.36	1.84%	1.47%
GRAND MEADOW CHERT	77	223.51	6.16%	5.26%
GULSETH SILICA	9	20.99	0.72%	0.49%
HARTVILLE UPLIFT CHERT	1	28	0.08%	0.66%
HIXTON GROUP SIL SANDSTONE	4	16.9	0.32%	0.40%
KNIFE RIVER FLINT	130	325.21	10.40%	7.65%
MAYNES CREEK CHERT	8	38.21	0.64%	0.90%
MOLINE CHERT	6	10.8	0.48%	0.25%
PLATE CHALCEDONY	1	4.9	0.08%	0.12%
PRAIRIE DU CHIEN CHERT	64	228.88	5.12%	5.38%
WAPSIPINICON CHERT	5	7.6	0.40%	0.18%
Unknown	**265**	**702.22**	**21.20%**	**16.51%**
HUDSON BAY LOWLAND CHERT	6	9.55	0.48%	0.22%
INDETERMINATE AGATE	1	4.7	0.08%	0.11%
INDETERMINATE CHALCEDONY	11	22.8	0.88%	0.54%
INDETERMINATE CHERT	235	624.47	18.80%	14.68%
INDETERMINATE QUARTZITE	10	28.2	0.80%	0.66%
KAKABEKA CHERT (BR)	1	11.7	0.08%	0.28%
LAKE SUPERIOR AGATE	1	0.8	0.08%	0.02%
Grand Total	**1250**	**4253.27**	**100.00%**	**100.00%**

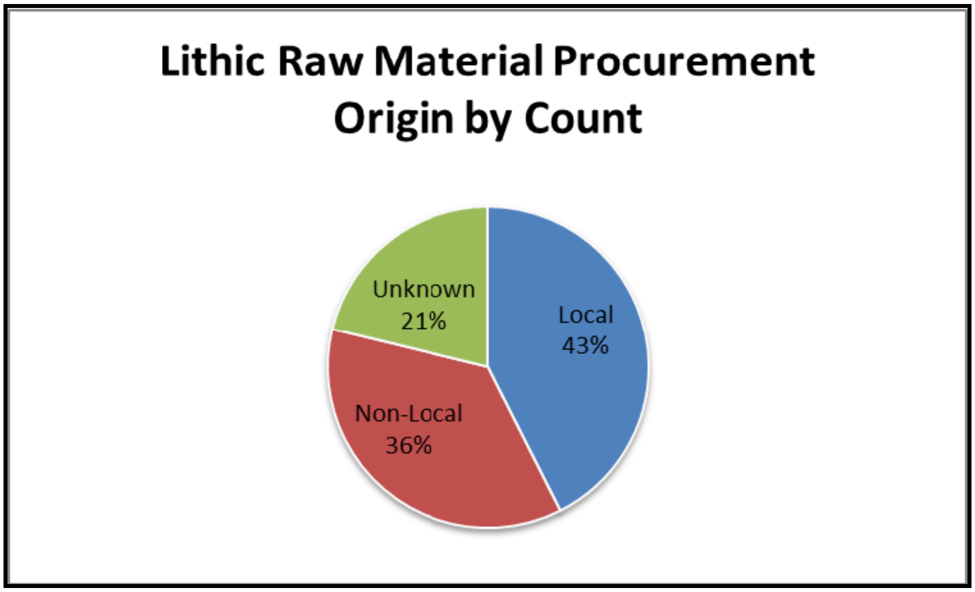


FIGURE 8. LITHIC RAW MATERIAL PROCUREMENT ORIGIN BY COUNT AT 21LN2

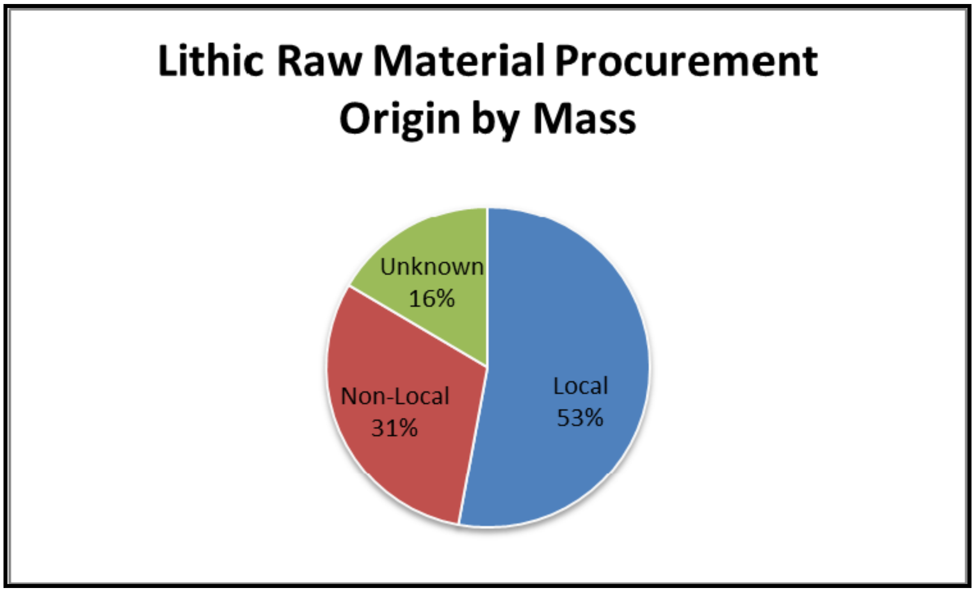


FIGURE 9. LITHIC RAW MATERIAL PROCUREMENT ORIGIN BY MASS AT 21LN2

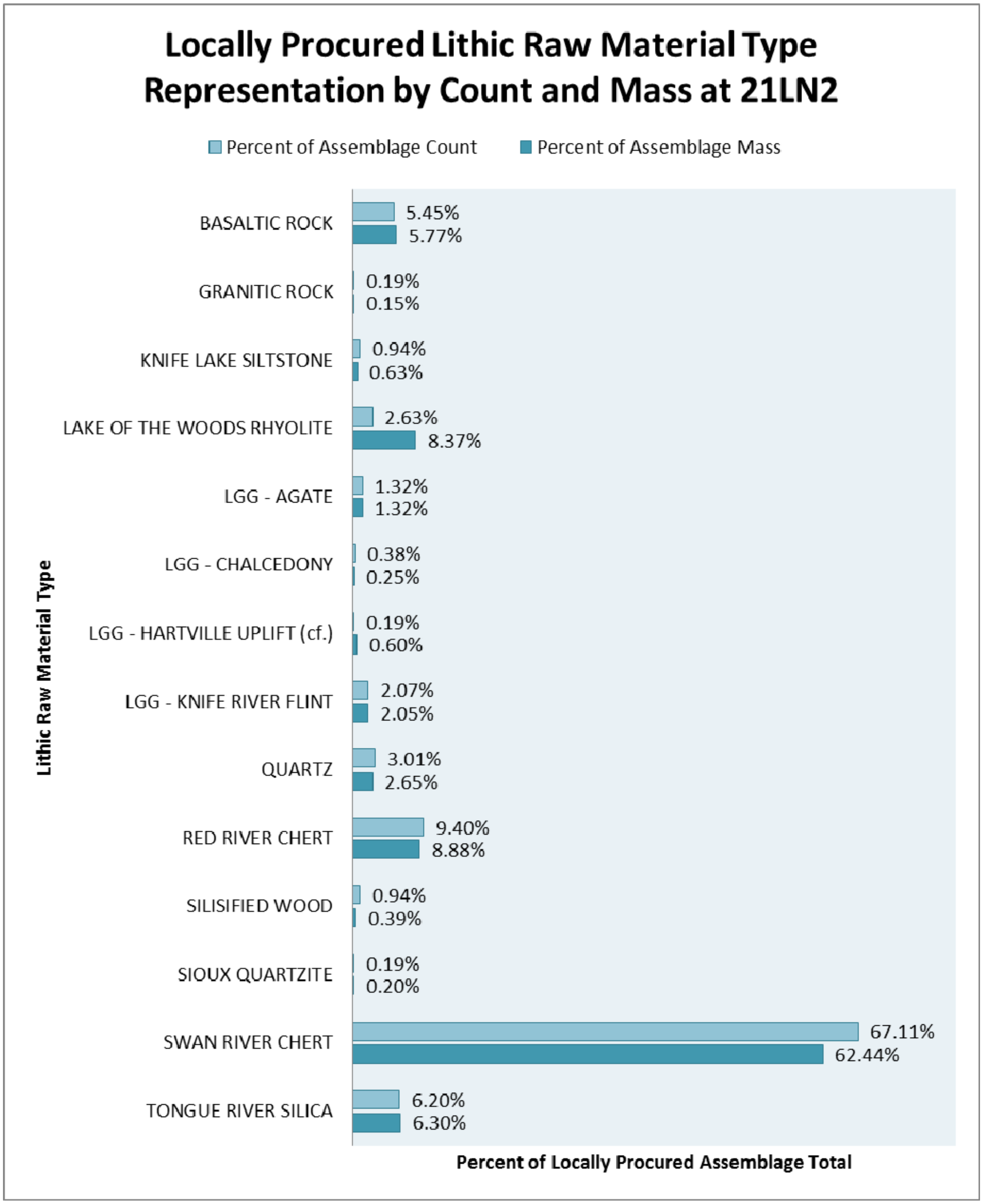


FIGURE 10. LOCALLY PROCURED LITHIC RAW MATERIAL TYPE REPRESENTATION BY PERCENT COUNT AND MASS AT 21LN2

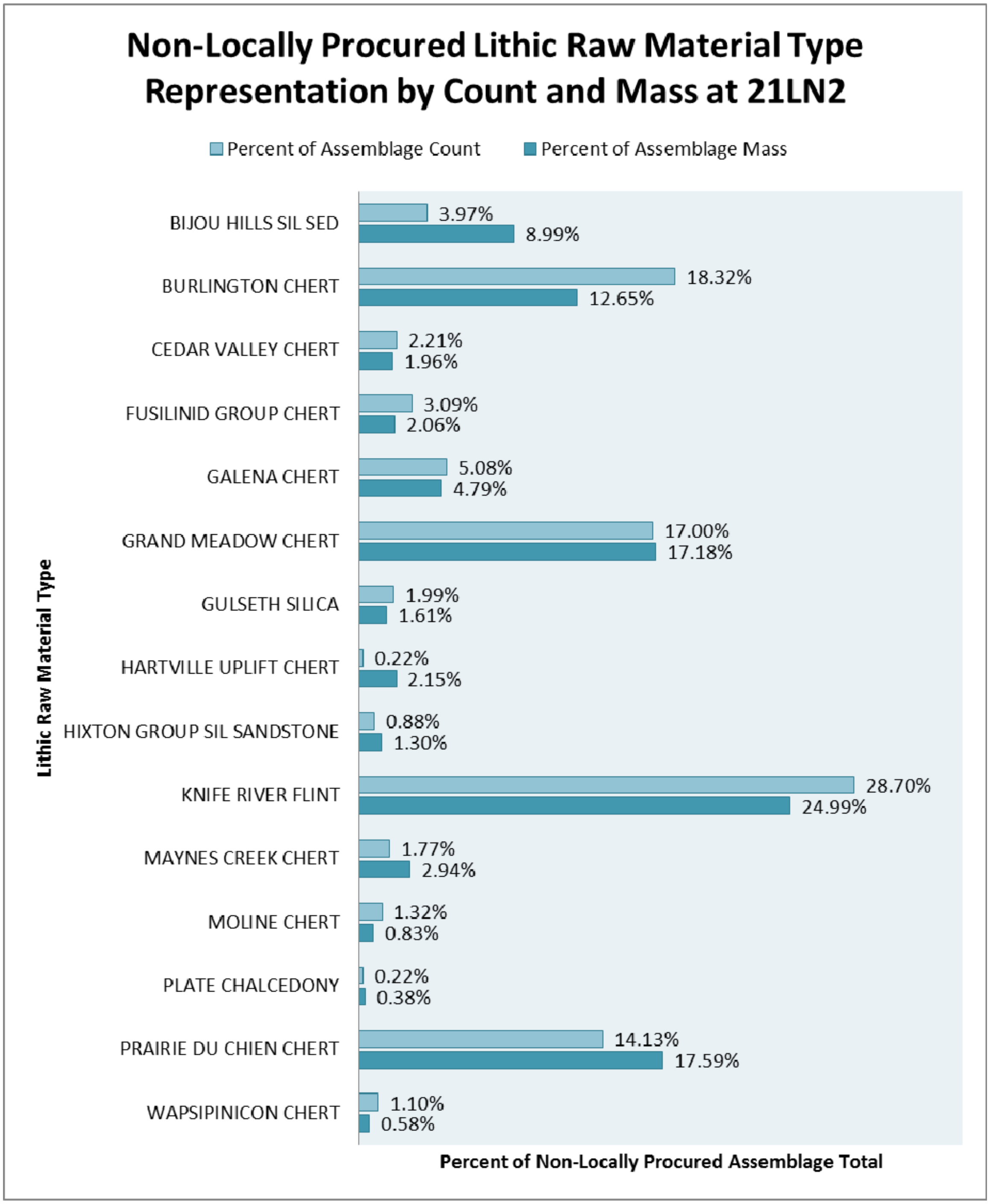


FIGURE 11. NON-LOCALLY PROCURED LITHIC RAW MATERIAL TYPE REPRESENTATION BY PERCENT COUNT AND MASS AT 21LN2

3.4.1.1 Locally Procured Assemblage

The locally procured chipped stone assemblage (n=532/m=2249.79g) consists of 14 raw material types (see Figure 10; Table 9). Many of the materials assigned to the local raw material assemblage have distant geological origins; however, due to glaciation, are commonly identified within local glacial deposits (Anderson 1978:150-151; Bakken 2011:59-92; Low 1996). Though it is possible that these materials were procured at their geological source areas, a conservative approach was taken here, which assumed that if the materials were available locally that they were more likely procured locally than non-locally. These materials include Knife Lake siltstone, Lake of the Woods rhyolite, Red River chert, Swan River chert, and Tongue River silica.

On the other hand, several materials commonly procured non-locally (Knife River flint and Hartville Uplift chert) can be found in trace amounts in the local glacial till of the site vicinity. These locally available versions are somewhat easily differentiated from their non-locally procured counterparts due to differences in fracture quality, package size, and degree of weathering (Bakken 2011: 96). The locally procured Knife River flint and Hartville Uplift chert were designated as being procured from local glacial gravel (LGG). Indeterminate chalcedony and agate, likely originating from western proveniences, which exhibited extremely small package sizes (i.e., small pebbles) as evidenced by cortical features, were also designated as being derived from LGG.

Swan River chert (n=357/m=1404.79g) dominates the local raw materials, representing approximately two-thirds of the assemblage (p=67.11 by count and 62.44 by mass). Red River chert (n=50/m=199.74g) and Tongue River silica (n=33/m=141.83g) were the next best represented local raw materials identified at the site. Basaltic rock (n=29/m=129.84g), Lake of the Woods rhyolite (n=14/m=188.25g), LGG-Knife River flint (n=11/m=46.09g), quartz (n=16/m=59.64g) were represented to a lesser extent. Other locally procured raw materials identified at the site include granitic rock, Knife

Lake siltstone, LGG-agate, LGG-chalcedony, LGG-Hartville Uplift chert, silicified wood, and Sioux quartzite.

3.4.1.2 Non-Locally Procured Assemblage

The non-locally procured chipped-stone assemblage (n=453/m=1301.26g) consists of 15 raw material types (see Figure 11; Table 9). Knife River flint (n=130/m=325.21g) represents the most abundant non-local raw material identified at the site. Burlington chert (n=83/m=164.60g), Grand Meadow chert (n=77/m=223.51g), and Prairie du Chien chert (n=64/m=228.88g) were also well represented at the site. Bijou Hills silicified sediment (n=18/m=116.98g) and Galena chert (n=23/m=62.36g) were moderately well represented. Small amounts of other non-local raw materials were also present at the site and include Cedar Valley chert, Fusilinid Group chert, Gulseth silica, Hartville Uplift chert, Hixton Group silicified sandstone, Maynes Creek chert, Moline chert, Plate chalcedony, and Wapsipinicon chert (see Figure 11; Table 9).

The presence of these materials indicates connections to adjacent regions and allows for interpretations regarding the interaction sphere enjoyed by the prehistoric inhabitants of the site. Table 10 presents the non-local raw material types identified at 21LN2 by the direction of their geological origin. Figures 12 and 13 present summaries of the non-local raw material direction of origin by count and mass respectively. Figure 14 illustrates the generalized movement of the non-local raw material assemblage constituents from their place of geological origin to the site area. This generalized depiction does not account for the many nuances (varied trade routes and corridors of travel) that would have occurred in the movement of the materials from source area to 21LN2. Rather, this illustration is presented to impress upon the reader the magnitude of the interaction sphere within which the prehistoric inhabitants of 21LN2 participated.

TABLE 10. NON-LOCAL RAW MATERIAL TYPE BY DIRECTION OF ORIGIN AT 21LN2

Direction of Origin and Lithic Raw Material Type	Count	Mass (g)	Percent of Assemblage Count	Percent of Assemblage Mass
East	**178**	**557.1**	**39.29%**	**42.81%**
CEDAR VALLEY CHERT	10	25.45	2.21%	1.96%
GALENA CHERT	23	62.36	5.08%	4.79%
GRAND MEADOW CHERT	77	223.51	17.00%	17.18%
HIXTON GROUP SIL SANDSTONE	4	16.9	0.88%	1.30%
PRAIRIE DU CHIEN CHERT	64	228.88	14.13%	17.59%
Northwest	**130**	**325.21**	**28.70%**	**24.99%**
KNIFE RIVER FLINT	130	325.21	28.70%	24.99%
South	**14**	**26.87**	**3.09%**	**2.06%**
FUSILINID GROUP CHERT	14	26.87	3.09%	2.06%
Southeast	**102**	**221.21**	**22.52%**	**17.00%**
BURLINGTON CHERT	83	164.6	18.32%	12.65%
MAYNES CREEK CHERT	8	38.21	1.77%	2.94%
MOLINE CHERT	6	10.8	1.32%	0.83%
WAPSIPINICON CHERT	5	7.6	1.10%	0.58%
Southwest	**28**	**165.97**	**6.18%**	**12.75%**
BIJOU HILLS SIL SED	18	116.98	3.97%	8.99%
GULSETH SILICA	9	20.99	1.99%	1.61%
HARTVILLE UPLIFT CHERT	1	28	0.22%	2.15%
West	**1**	**4.9**	**0.22%**	**0.38%**
PLATE CHALCEDONY	1	4.9	0.22%	0.38%
Grand Total	**453**	**1301.26**	**100.00%**	**100.00%**

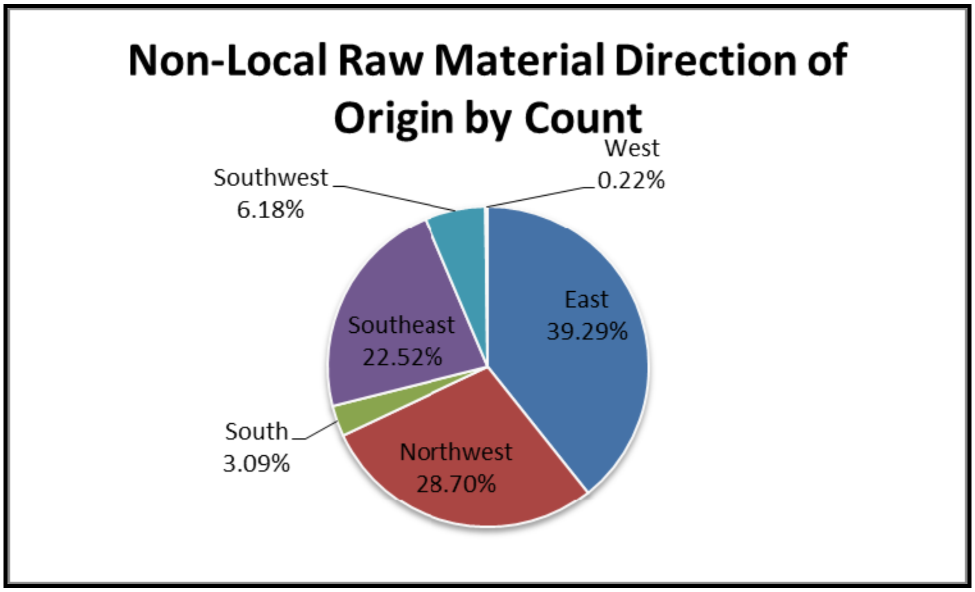


FIGURE 12. NON-LOCAL LITHIC RAW MATERIAL DIRECTION OF ORIGIN BY COUNT AT 21LN2

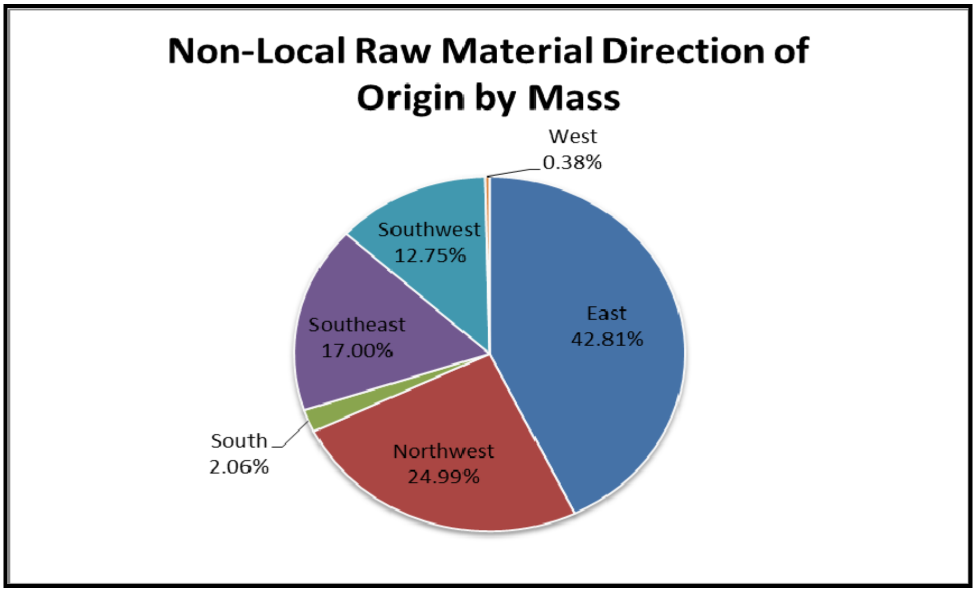
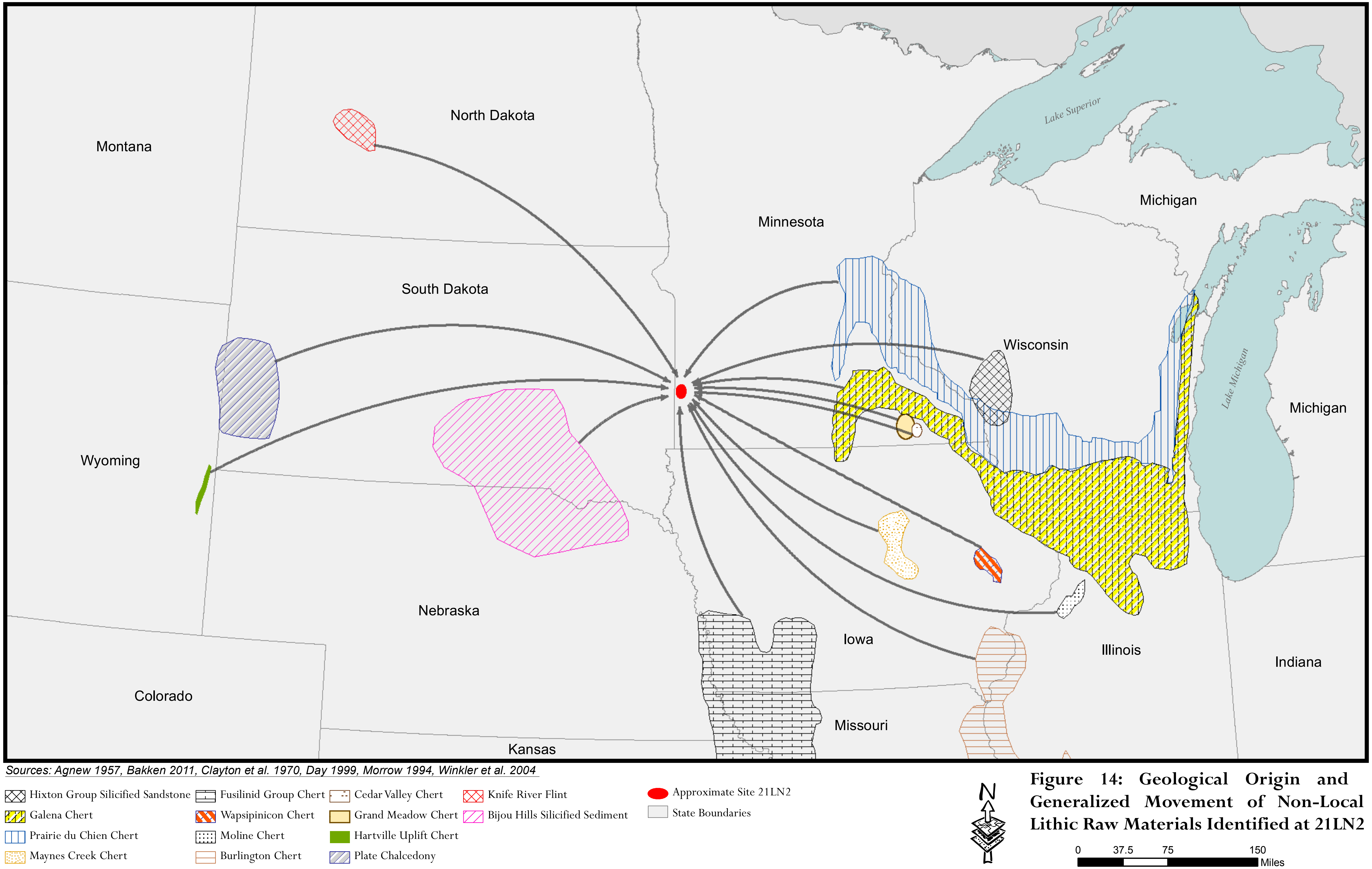


FIGURE 13. NON-LOCAL LITHIC RAW MATERIAL DIRECTION OF ORIGIN BY MASS AT 21LN2



Sources: Agnew 1957, Bakken 2011, Clayton et al. 1970, Day 1999, Morrow 1994, Winkler et al. 2004

Figure 14: Geological Origin and Generalized Movement of Non-Local Lithic Raw Materials Identified at 21LN2

Distance and Direction of Origin

Cedar Valley chert, Galena chert, Grand Meadow chert, and Prairie du Chien chert can all be procured in southeastern Minnesota and are located approximately 190 miles (305 kilometers[km]), 125 miles (200 km), 180 miles (290 km), and 125 miles (200 km) east of 21LN2 respectively (Bakken 2011:105-110; Morrow 1994:118). It should be noted, in light of the fact that Cedar Valley chert and Cochrane chert are difficult to distinguish macroscopically, that 80% (n=8 of 10) of the artifacts identified as Cedar Valley chert were of the translucent variety. As presented in Chapter 2, the blind test results indicate that the translucent variety of Cedar Valley chert can be accurately and consistently differentiated from Cochrane chert through macroscopic means. As a result, these 10 artifacts are referred to as Cedar Valley chert with a high degree of confidence. In the cases of Grand Meadow chert and Cedar Valley chert, the source areas area quite concise; however, Prairie du Chien chert and Galena chert source areas cover extensive areas in southeastern Minnesota, northeastern Iowa, southern Wisconsin, and northern Illinois. For that reason, it was assumed, in an attempt to take a conservative approach, that these latter two material types were procured from the portion of their source area closest to 21LN2. This conservative approach regarding procurement distance was used in all similar scenarios.

Hixton Group silicified sandstone can be procured in southwestern Wisconsin approximately 235 miles (380 km) to the east of 21LN2 (Bakken 2011:130-133; Winkler et al. 2004:36). It should be noted that use of the term *Hixton Group* refers to a family of nearly indistinguishable silicified sandstones found within southwestern Wisconsin (Bakken 2011:135-136). The Knife River flint source area is located in western North Dakota approximately 330 miles (530 km) northwest of 21LN2 (Bakken 2011:128-130; Clayton et al. 1970:283). Fusilinid Group chert can be found over a vast area; however, the closest source area for Fusilinid Group chert lies approximately 190 miles (305 km) to the south of 21LN2 in southwestern Iowa (Bakken 2011:135-136; Morrow 1994:118). It should be noted that use of the term *Fusilinid Group* refers to a family Pennsylvanianaged cherts that are similar in appearance and origin and contain fossils known as fusilinids (Bakken 2011:135-136).

The source areas for Burlington chert, Maynes Creek chert, Moline chert, and Wapsipinicon chert lie to the southeast of 21LN2 (Bakken 2011: 133-136; Birmingham and Van Dyke 1981; Morrow 1994: 118). Maynes Creek chert can be procured in central Iowa approximately 200 miles (320 km) to the southeast. The Moline chert source area lies approximately 360 miles (580 km) to the southeast of the site in northwestern Illinois. Wapsipinicon chert can be procured in east-central Iowa approximately 280 miles (450 km) to the southeast of the site. The Burlington chert source area, like those of Prairie du Chien chert, Galena chert, and Fusilinid Group chert, encompasses a large area covering southeastern Iowa, western Illinois, and northeastern Missouri. The closest extent of the Burlington chert source area lies 325 miles (525 km) to the southeast of 21LN2.

The source areas for Bijou Hills silicified sediment, Gulseth silica, and Hartville Uplift chert lie to the southwest of 21LN2. Bijou Hills silicified sediment can be encountered as close as 110 miles (175 km) to the southwest of the site in southeastern South Dakota and northeastern Nebraska (Agnew 1957:130; Morrow 1994:118,128). The Hartville Uplift chert source area is located in southeastern Wyoming approximately 410 miles (660 km) to the southwest of 21LN2 (Day et al. 1999:1). Though no specific source location has been identified for Gulseth silica, based on its archaeological distribution and material similarity to Bijou Hills silicified sediment, it is likely associated with the Oligocene formation located in southeastern South Dakota and northeastern Nebraska. The closest procurement source for Gulseth silica should be comparable to that of Bijou Hills silicified sediment. Plate chalcedony can be procured in western South Dakota within the vicinity of the Black Hills approximately 345 miles (555 km) to the west of 21LN2 (Personal Communication, Dan Wendt, November, 8, 2012).

Interaction Sphere

Considering the data presented above, the prehistoric inhabitants of 21LN2 were operating within a sphere of interaction measuring nearly 700 miles (1,125 km) from northwest to southeast, over 600 miles (965 km) from west to east, and approximately 200 miles (320 km) north to south (see Figure 14). The data also indicate that a larger amount of lithic raw materials were coming from eastern and southeastern sources (p=61.81 by count and 59.81 by mass) than western, southwestern, and northwestern sources (p=35.10 by count and 38.12 by mass).

The data suggest that the prehistoric inhabitants of 21LN2 had stronger connections to the east or that the inhabitants had greater accessibility to these resources through trade or travel compared to those hailing from the west. The fact that several of the eastern hailing source areas are closer than those to the west may also have played a factor. These data may also reflect the fact that there were simply more known resources to be exploited to the east or that the manner in which the eastern materials presented themselves were more favorable for exploitation. In other words, many eastern materials can be found concentrated within bedded formations or concentrated in nearby secondary deposits associated with drainages. Whereas many western materials are scattered, sometimes quite sparsely, within drainages and over the landscape (i.e., silicified wood, agate, and chalcedony). This could have influenced the procurement strategies of the prehistoric inhabitants of 21LN2 resulting in the data presented. It should also be noted that the manner in which western raw materials present themselves suggests higher material diversity and variability. As a result, more lithic raw materials coming from western procurement proveniences may not be as recognizable to archaeologists as their eastern counterparts; and therefore, are more likely to be designated as indeterminate raw materials types, thus skewing the data.

Regardless, the prehistoric inhabitants of 21LN2 appear to have had strong connections to the east and west and to a lesser extent, the south. Unfortunately, due to glaciation, connections to the north are difficult to assess in southern Minnesota with regard to lithic raw materials. As discussed in the local raw material assemblage section, materials with primary geological origins to the north of the site were identified at 21LN2. However, as noted above, these materials can be procured locally within glacial deposits. It is, however, likely that the inhabitants of 21LN2 had connections to the north as well.

3.4.1.3 Law of Least Effort

In regard to the procurement of raw materials at 21LN2, the Law of Least Effort appears to apply only to a certain degree. Swan River chert, a locally available material is the most heavily represented raw material at the site. This material is quite ubiquitous within the glacial deposits of the site vicinity. That the Swan River chert is the most heavily represented raw material identified at the site complies well with the Law of Least Effort. Yet, if the Law of Least Effort was truly in play it would be expected that count and mass values of the raw material types present at the site would decrease in direct correlation to the distance of the material procurement origin. However, this is not observed in the 21LN2 chipped-stone assemblage. In fact, the second most heavily represented raw material, Knife River flint, has one of the most distant procurement origins of the raw materials represented and the site. Additionally, Burlington chert, Grand Meadow chert, and Prairie du Chien chert are also more heavily represented at the site than the locally procured materials, with exception of course to Swan River chert. The simplest explanation of this divergence from the Law of Least Effort is likely found in the quality, or lack thereof, of the locally available tool stone.

3.4.2 Corticality and Artifact Class

An examination of artifact class by raw material and percent cortex by raw material was conducted. The results for all raw material types are presented in Tables 11 through 14. The results for raw materials representing 5% or more of the total chipped stone assemblage by count and/or mass (Swan River chert, Burlington chert, Grand Meadow chert, Knife River flint, and Prairie du Chien chert), are also discussed in detail below whereas the materials of lesser representation are only briefly summarized.

The data indicate somewhat varying reduction stages and curational values among the five major raw material types identified at 21LN2. All five raw material types are represented across nearly all the artifact class categories. Swan River chert and Prairie du Chien chert exhibit a relatively high degree of shatter (p=40.06 and 29.69, respectively) while Grand Meadow chert, Knife River flint, and Burlington chert exhibit a relatively low degree of shatter (p=12.99, 6.15, and 8.43, respectively). All five material assemblages contain core elements, but in very small numbers. It should be noted that core elements (i.e., cores, core fragments, core tools, and core tool fragments) were not well represented at the site on the whole. The overall corticality of these five major raw materials was assessed based on the percentage of cortex exhibited on each assemblage's complete flakes and complete flake tools. Complete flakes and tools exhibiting cortex on 61% or more of their dorsal surface were considered to be highly cortical. The Swan River chert assemblage exhibited the highest degree of highly cortical artifacts with 16.67%. Burlington chert exhibited the lowest degree of highly cortical artifacts with 0%. Grand Meadow chert, Knife River flint, and Prairie du Chien chert fell in the middle (p=12.50, 9.62, and 5.00, respectively).

Grand Meadow chert and Prairie du Chien chert exhibited the highest percentage of complete flakes (p=29.87 and 28.13, respectively). Swan River chert exhibited the lowest percentage of complete flakes (p=17.37) and Knife River flint and Burlington chert fell in the middle (p=24.62 and 24.62, respectively). All five of these raw material assemblages exhibited discarded tools (numbers based on percentage of assemblage represented by sum of complete bifaces and complete flake tools). Knife River flint and Grand Meadow chert exhibited the highest percentages of complete tools (p=16.92 and 12.99, respectively). The percentage of complete tools within the Swan River chert, Burlington chert, and Prairie du Chien chert assemblages was considerably lower (p=4.20, 4.82, and 4.69, respectively).

These data suggest that Swan River chert was brought onto the site in a relatively unreduced state. The fact that Swan River chert appears to be represented across all the artifact class categories suggests that the material was generally undergoing a complete sequence beginning with transport of an unmodified cobble and terminating with on-site use and to some extent discard – suggesting a low degree of curation according to Conard and Adler (1997). The percentage of cortex exhibited on the complete flakes and tools, which ranges from 0 to 100% and populates all percent increment categories, further confirms the conclusion that a complete sequence of reduction was occurring at the site with regard to the Swan River chert material (Tables 11 through 14). It should be noted that there is a considerably high percentage of complete flakes and tools of Swan River chert material (p=62.12) that do not exhibit cortex; however, this is to be expected concerning a full reduction sequence as there will be many more complete flakes produced during the latter stages of reduction (i.e., soft hammer percussion, indirect percussion, and pressure flaking) with a majority of such flakes lacking cortex. Additionally, complete tools, particularly complete bifacial tools will also generally lack cortex. Similarly, only 8 of these 66 Swan River chert artifacts exhibited 91 to 100% cortex, which is also expected when one considers that initial decortification using hard hammer percussion results in a high degree of shatter and broken flakes, thus leaving very few complete flakes exhibiting a high degree of cortex (see Tables 11 and 12). Despite these considerations, 21.21%, or more than one out of every five of the Swan River chert complete flake and tools contained more than 41% cortex which shows strong evidence for early reduction sequences (see Tables 11 and 12).

The opposite is observed with regard to the Burlington chert assemblage (see Tables 11 - 14). The fact that Burlington chert exhibits a relatively high percentage of complete flakes (p=21.69) and a relatively small amount of shatter (p=8.43) suggests later stage tool manufacture took place at the site with regard to this raw material type – i.e. soft hammer percussion, indirect percussion, and pressure flaking. According to Conard and Adler (1997), this suggests a somewhat high degree of curation. The percentage of cortex exhibited on the complete flakes and tools within the Burlington chert assemblage confirms this observation. Table 12 illustrates that 0% of the Burlington chert complete flakes and tools contain cortex. These data further demonstrate that the Burlington chert material was introduced to the site in a highly reduced state and that the latter stages of lithic reduction were relatively more important site activities with regard to this raw material type. Additionally, the relatively low occurrence (p=4.82) of complete tools suggests transport of completed tools off site prior to discard – again implying a high degree of curation.

The Knife River flint, Grand Meadow Chert, and Prairie du Chien chert assemblages exhibit relatively high percentages of complete flakes (p=24.62, 29.87, and 28.13, respectively). The Knife River flint and Grand Meadow chert exhibit relatively low percentages of shatter (p=6.15 and 12.99) while the Prairie du Chien chert exhibits a relatively high percentage (p=29.69). Though the Prairie du Chien chert exhibits a relatively high percentage of shatter, the high percentages of complete flakes suggest later stage tool manufacture took place at the site with regard to these raw material types – i.e. soft hammer percussion, indirect percussion, and pressure flaking. The higher degree of shatter among the Prairie du Chien may be a reflection of the somewhat poorer flaking quality of the material as compared to Knife River flint and Grand Meadow chert. The Prairie du Chien chert exhibits a relatively low percentage of highly cortical complete flakes and tools with none exhibiting 91 to 100% cortex, which further confirms that later stage reduction was important with regard to this material type and suggests it was introduced to the site in a partially reduced state. The Grand Meadow chert and Knife River flint assemblages exhibit moderate percentages of highly cortical complete flakes and tools with 3.85 and 6.25% of these artifacts exhibiting 91 to 100% cortex, respectively. The percent cortex and percent shatter provide somewhat mixed signals regarding these two raw material types. The Knife River flint and Grand Meadow chert were likely introduced to the site as partially reduced nodules/slabs as well as relatively unmodified nodules/slabs. According to Conard and Adler (1997), these overall data suggest a somewhat moderate degree of curation for these three material types, beginning with transport of partially reduced cobbles or slabs and terminating with on-site use and discard, particularly in the cases of Knife River flint and Grand Meadow chert assemblages as evidenced by the relatively high percentages of discarded complete tools (p=16.92 and 12.99).

Of the raw materials representing less than 5% of the total assemblage, the Red River chert, quartz, basaltic rock, and LGG materials exhibited a low degree of curation based on an examination of artifact class by raw material and percent cortex by raw material (see Tables 11 through 14). The Tongue River silica and Lake of the Woods rhyolite materials exhibited a moderate degree of curation and the Galena chert material exhibited a moderate to high degree of curation. A high degree of curation was exhibited by the Knife Lake siltstone, Bijou Hills silicified sediment, Cedar Valley chert, Fusilinid Group chert, Hixton Group silicified sandstone, Hartville Uplift chert, Gulseth silica, Maynes Creek chert, Wapsipinicon chert, and Moline chert materials.

Overall, the non-locally procured raw materials tend to exhibit a higher degree of curation as defined by Conard and Adler (1997). This is particularly evident in the degree of corticality by raw material type, which appears to be significantly higher among the locally procured materials identified at 21LN2.

TABLE 11. PERCENT CORTEX COUNT BY RAW MATERIAL TYPE AT 21LN2

Lithic Raw Material by Procurement Origin	0%	1-10%	11-40%	41-60%	61-90%	91-99%	100%	Grand Total
Local	**58**	**6**	**14**	**7**	**11**	**12**	**10**	**118**
BASALTIC ROCK	2		1		2	2		7
KNIFE LAKE SILTSTONE	1		1					2
LAKE OF THE WOODS RHYOLITE	1				1	1		3
LGG - AGATE	2						3	5
LGG - CHALCEDONY				1			1	2
LGG - KNIFE RIVER FLINT			1		1			2
QUARTZ	2						2	4
RED RIVER CHERT	3	2	3	2	2	3	1	16
SILISIFIED WOOD	1		1					2
SIOUX QUARTZITE					1			1
SWAN RIVER CHERT	41	4	7	3	3	6	2	66
TONGUE RIVER SILICA	5			1	1		1	8
Non-Local	**99**	**20**	**18**	**4**	**8**	**5**	**1**	**155**
BIJOU HILLS SIL SED	3					1		4
BURLINGTON CHERT	21							21
CEDAR VALLEY CHERT	1	1						2
FUSILINID CHERT	4							4
GALENA CHERT	7				2			9
GRAND MEADOW CHERT	13	8	6	1	2	2		32
GULSETH SILICA	2							2
HARTVILLE UPLIFT CHERT	1							1
HIXTON SIL SANDSTONE	1	1						2
KNIFE RIVER FLINT	31	6	8	2	3	1	1	52
MAYNES CREEK CHERT	1		2					3
MOLINE CHERT						1		1
PRAIRIE DU CHIEN CHERT	12	4	2	1	1			20
WAPSIPINICON CHERT	2							2
Unknown	**42**	**2**	**6**	**2**	**3**	**2**		**57**
HUDSON BAY LOWLAND CHERT	1		1					2
INDETERMINATE CHALCEDONY	5					1		6
INDETERMINATE CHERT	36	2	3	2	3	1		47
INDETERMINATE QUARTZITE			2					2
Grand Total	**199**	**28**	**38**	**13**	**22**	**19**	**11**	**330**

Table 12. Percent Cortex Percent by Raw Material Type at 21LN2

Lithic Raw Material by Procurement Origin	0%	1-10%	11-40%	41-60%	61-90%	91-99%	100%	Grand Total
Local	**49.15%**	**5.08%**	**11.86%**	**5.93%**	**9.32%**	**10.17%**	**8.47%**	**100.00%**
BASALTIC ROCK	28.57%	0.00%	14.29%	0.00%	28.57%	28.57%	0.00%	100.00%
KNIFE LAKE SILTSTONE	50.00%	0.00%	50.00%	0.00%	0.00%	0.00%	0.00%	100.00%
LAKE OF THE WOODS RHYOLITE	33.33%	0.00%	0.00%	0.00%	33.33%	33.33%	0.00%	100.00%
LGG - AGATE	40.00%	0.00%	0.00%	0.00%	0.00%	0.00%	60.00%	100.00%
LGG - CHALCEDONY	0.00%	0.00%	0.00%	50.00%	0.00%	0.00%	50.00%	100.00%
LGG - KNIFE RIVER FLINT	0.00%	0.00%	50.00%	0.00%	50.00%	0.00%	0.00%	100.00%
QUARTZ	50.00%	0.00%	0.00%	0.00%	0.00%	0.00%	50.00%	100.00%
RED RIVER CHERT	18.75%	12.50%	18.75%	12.50%	12.50%	18.75%	6.25%	100.00%
SILISIFIED WOOD	50.00%	0.00%	50.00%	0.00%	0.00%	0.00%	0.00%	100.00%
SIOUX QUARTZITE	0.00%	0.00%	0.00%	0.00%	100.00%	0.00%	0.00%	100.00%
SWAN RIVER CHERT	62.12%	6.06%	10.61%	4.55%	4.55%	9.09%	3.03%	100.00%
TONGUE RIVER SILICA	62.50%	0.00%	0.00%	12.50%	12.50%	0.00%	12.50%	100.00%
Non-Local	**63.87%**	**12.90%**	**11.61%**	**2.58%**	**5.16%**	**3.23%**	**0.65%**	**100.00%**
BIJOU HILLS SIL SED	75.00%	0.00%	0.00%	0.00%	0.00%	25.00%	0.00%	100.00%
BURLINGTON CHERT	100.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	100.00%
CEDAR VALLEY CHERT	50.00%	50.00%	0.00%	0.00%	0.00%	0.00%	0.00%	100.00%
FUSILINID CHERT	100.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	100.00%
GALENA CHERT	77.78%	0.00%	0.00%	0.00%	22.22%	0.00%	0.00%	100.00%
GRAND MEADOW CHERT	40.63%	25.00%	18.75%	3.13%	6.25%	6.25%	0.00%	100.00%
GULSETH SILICA	100.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	100.00%
HARTVILLE UPLIFT CHERT	100.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	100.00%
HIXTON SIL SANDSTONE	50.00%	50.00%	0.00%	0.00%	0.00%	0.00%	0.00%	100.00%
KNIFE RIVER FLINT	59.62%	11.54%	15.38%	3.85%	5.77%	1.92%	1.92%	100.00%
MAYNES CREEK CHERT	33.33%	0.00%	66.67%	0.00%	0.00%	0.00%	0.00%	100.00%
MOLINE CHERT	0.00%	0.00%	0.00%	0.00%	0.00%	100.00%	0.00%	100.00%
PRAIRIE DU CHIEN CHERT	60.00%	20.00%	10.00%	5.00%	5.00%	0.00%	0.00%	100.00%
WAPSIPINICON CHERT	100.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	100.00%
Unknown	**73.68%**	**3.51%**	**10.53%**	**3.51%**	**5.26%**	**3.51%**	**0.00%**	**100.00%**
HUDSON BAY LOWLAND CHERT	50.00%	0.00%	50.00%	0.00%	0.00%	0.00%	0.00%	100.00%
INDETERMINATE CHALCEDONY	83.33%	0.00%	0.00%	0.00%	0.00%	16.67%	0.00%	100.00%
INDETERMINATE CHERT	76.60%	4.26%	6.38%	4.26%	6.38%	2.13%	0.00%	100.00%
INDETERMINATE QUARTZITE	0.00%	0.00%	100.00%	0.00%	0.00%	0.00%	0.00%	100.00%
Grand Total	**60.30%**	**8.48%**	**11.52%**	**3.94%**	**6.67%**	**5.76%**	**3.33%**	**100.00%**

TABLE 13. ARTIFACT CLASS COUNTY BY RAW MATERIAL AT 21LN2

Procurement Provenience & Lithic Raw Material Type	BIFACE	BIFACEFRAG	BIFACENOTCOMP	COMPFLAKE	CORE	COREFRAG	CORETOOL	DISTFLAKE	FLAKETOOLCOMP	FLAKETOOLDIST	FLAKETOOLMED	FLAKETOOLPROX	FLAKETOOLSHAT	FLAKETOOLSPLIT	HEATSPALL	MEDFLAKE	PROXFLAKE	SHATTER	SPLITFLAKE	TESTEDCOBBLE	UNIFACEFRAG	Grand Total
Local	**13**	**11**	**11**	**107**	**2**	**1**	**2**	**34**	**11**	**5**	**5**	**6**	**1**		**1**	**29**	**68**	**219**	**3**	**3**		**532**
BASALTIC ROCK				7				1									1	19	1			29
GRANITIC ROCK																	1					1
KNIFE LAKE SILTSTONE				2				1									1	1				5
LAKE OF THE WOODS RHYOLITE				1				1	2								5	5				14
LGG - AGATE				5				1										1				7
LGG - CHALCEDONY				2																		2
LGG - HARTVILLE UPLIFT (cf.)																		1				1
LGG - KNIFE RIVER FLINT				1	1			1	1									7				11
QUARTZ				4														12				16
RED RIVER CHERT		1		12					4	1						2	4	23		3		50
SILISIFIED WOOD				2								1					1	1				5
SIOUX QUARTZITE				1																		1
SWAN RIVER CHERT	11	9	8	62	1	1	1	25	4	3	5	5	1		1	27	48	143	2			357
TONGUE RIVER SILICA	2	1	3	8			1	4		1							7	6				33
Non-Local	**7**	**12**	**18**	**116**	**1**	**3**	**3**	**39**	**39**	**12**	**16**	**19**	**5**	**1**	**2**	**28**	**71**	**58**	**2**		**1**	**453**
BIJOU HILLS SIL SED		2		2			1		2	1	1					1	7	1				18
BURLINGTON CHERT	1	3		18	1		1	13	3		2	1	1			11	20	7	1			83
CEDAR VALLEY CHERT				2							2					1	2	3				10
FUSILINID CHERT		1	1	3				1	1			1				1	3	1			1	14
GALENA CHERT		1	2	9				1								1	3	6				23
GRAND MEADOW CHERT	1		5	23		1		6	9	4	2	3	1	1		3	8	10				77
GULSETH SILICA				2									1				4	2				9
HARTVILLE UPLIFT CHERT									1													1
HIXTON SIL SANDSTONE			1	2						1												4
KNIFE RIVER FLINT	2	5	6	32		2		12	20	4	8	13				4	13	8	1			130
MAYNES CREEK CHERT				2				1	1							1	2	1				8
MOLINE CHERT	2			1				2									1					6
PLATE CHALCEDONY			1																			1
PRAIRIE DU CHIEN CHERT	1		2	18			1	3	2	2	1		1		2	4	8	19				64
WAPSIPINICON CHERT				2								1	1			1						5

Procurement Provenience & Lithic Raw Material Type	BIFACE	BIFACEFRAG	BIFACENOTCOMP	COMPFLAKE	CORE	COREFRAG	CORETOOL	DISTFLAKE	FLAKETOOLCOMP	FLAKETOOLDIST	FLAKETOOLMED	FLAKETOOLPROX	FLAKETOOLSHAT	FLAKETOOLSPLIT	HEATSPALL	MEDFLAKE	PROXFLAKE	SHATTER	SPLITFLAKE	TESTEDCOBBLE	UNIFACEFRAG	Grand Total
Unknown	**5**	**13**	**6**	**51**		**1**		**17**	**7**	**3**	**4**	**7**	**4**		**24**	**13**	**35**	**74**	**1**			**265**
HUDSON BAY LOWLAND CHERT				2								2				2						6
INDETERMINATE AGATE																		1				1
INDETERMINATE CHALCEDONY				5					1							1	1	3				11
INDETERMINATE CHERT	4	13	6	42		1		17	6	3	4	5	4		24	10	31	64	1			235
INDETERMINATE QUARTZITE				2													3	5				10
KAKABEKA CHERT (BR)																		1				1
LAKE SUPERIOR AGATE	1																					1
Grand Total	**25**	**36**	**35**	**274**	**3**	**5**	**5**	**90**	**57**	**20**	**25**	**32**	**10**	**1**	**27**	**70**	**174**	**351**	**6**	**3**	**1**	**1250**

TABLE 14. ARTIFACT CLASS PERCENT BY RAW MATERIAL AT 21LN2

Procurement Provenience & Lithic Raw Material Type	BIFACE	BIFACEFRAG	BIFACENOTCOMP	COMPFLAKE	CORE	COREFRAG	CORETOOL	DISTFLAKE	FLAKETOOLCOMP	FLAKETOOLDIST	FLAKETOOLMED	FLAKETOOLPROX	FLAKETOOLSHAT	FLAKETOOLSPLIT	HEATSPALL	MEDFLAKE	PROXFLAKE	SHATTER	SPLITFLAKE	TESTEDCOBBLE	UNIFACEFRAG	Grand Total
Local	**2.44%**	**2.07%**	**2.07%**	**20.11%**	**0.38%**	**0.19%**	**0.38%**	**6.39%**	**2.07%**	**0.94%**	**0.94%**	**1.13%**	**0.19%**	**0.00%**	**0.19%**	**5.45%**	**12.78%**	**41.17%**	**0.56%**	**0.56%**	**0.00%**	**100.00%**
BASALTIC ROCK	0.00%	0.00%	0.00%	24.14%	0.00%	0.00%	0.00%	3.45%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	3.45%	65.52%	3.45%	0.00%	0.00%	100.00%
GRANITIC ROCK	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	100.00%	0.00%	0.00%	0.00%	0.00%	100.00%
KNIFE LAKE SILTSTONE	0.00%	0.00%	0.00%	40.00%	0.00%	0.00%	0.00%	20.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	20.00%	20.00%	0.00%	0.00%	0.00%	100.00%
LAKE OF THE WOODS RHYOLITE	0.00%	0.00%	0.00%	7.14%	0.00%	0.00%	0.00%	7.14%	14.29%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	35.71%	35.71%	0.00%	0.00%	0.00%	100.00%
LGG - AGATE	0.00%	0.00%	0.00%	71.43%	0.00%	0.00%	0.00%	14.29%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	14.29%	0.00%	0.00%	0.00%	100.00%
LGG - CHALCEDONY	0.00%	0.00%	0.00%	100.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	100.00%
LGG - HARTVILLE UPLIFT (cf.)	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	100.00%	0.00%	0.00%	0.00%	100.00%
LGG - KNIFE RIVER FLINT	0.00%	0.00%	0.00%	9.09%	9.09%	0.00%	0.00%	9.09%	9.09%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	63.64%	0.00%	0.00%	0.00%	100.00%
QUARTZ	0.00%	0.00%	0.00%	25.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	75.00%	0.00%	0.00%	0.00%	100.00%
RED RIVER CHERT	0.00%	2.00%	0.00%	24.00%	0.00%	0.00%	0.00%	0.00%	8.00%	2.00%	0.00%	0.00%	0.00%	0.00%	0.00%	4.00%	8.00%	46.00%	0.00%	6.00%	0.00%	100.00%
SILISIFIED WOOD	0.00%	0.00%	0.00%	40.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	20.00%	0.00%	0.00%	0.00%	0.00%	20.00%	20.00%	0.00%	0.00%	0.00%	100.00%
SIOUX QUARTZITE	0.00%	0.00%	0.00%	100.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	100.00%
SWAN RIVER CHERT	3.08%	2.52%	2.24%	17.37%	0.28%	0.28%	0.28%	7.00%	1.12%	0.84%	1.40%	1.40%	0.28%	0.00%	0.28%	7.56%	13.45%	40.06%	0.56%	0.00%	0.00%	100.00%
TONGUE RIVER SILICA	6.06%	3.03%	9.09%	24.24%	0.00%	0.00%	3.03%	12.12%	0.00%	3.03%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	21.21%	18.18%	0.00%	0.00%	0.00%	100.00%

Procurement Provenience & Lithic Raw Material Type	BIFACE	BIFACEFRAG	BIFACENOTCOMP	COMPFLAKE	CORE	COREFRAG	CORETOOL	DISTFLAKE	FLAKETOOLCOMP	FLAKETOOLDIST	FLAKETOOLMED	FLAKETOOLPROX	FLAKETOOLSHAT	FLAKETOOLSPLIT	HEATSPALL	MEDFLAKE	PROXFLAKE	SHATTER	SPLITFLAKE	TESTEDCOBBLE	UNIFACEFRAG	Grand Total
Non-Local	**1.55%**	**2.65%**	**3.97%**	**25.61%**	**0.22%**	**0.66%**	**0.66%**	**8.61%**	**8.61%**	**2.65%**	**3.53%**	**4.19%**	**1.10%**	**0.22%**	**0.44%**	**6.18%**	**15.67%**	**12.80%**	**0.44%**	**0.00%**	**0.22%**	**100.00%**
BIJOU HILLS SIL SED	0.00%	11.11%	0.00%	11.11%	0.00%	0.00%	5.56%	0.00%	11.11%	5.56%	5.56%	0.00%	0.00%	0.00%	0.00%	5.56%	38.89%	5.56%	0.00%	0.00%	0.00%	100.00%
BURLINGTON CHERT	1.20%	3.61%	0.00%	21.69%	1.20%	0.00%	1.20%	15.66%	3.61%	0.00%	2.41%	1.20%	1.20%	0.00%	0.00%	13.25%	24.10%	8.43%	1.20%	0.00%	0.00%	100.00%
CEDAR VALLEY CHERT	0.00%	0.00%	0.00%	20.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	20.00%	0.00%	0.00%	0.00%	0.00%	10.00%	20.00%	30.00%	0.00%	0.00%	0.00%	100.00%
FUSILINID CHERT	0.00%	7.14%	7.14%	21.43%	0.00%	0.00%	0.00%	7.14%	7.14%	0.00%	0.00%	7.14%	0.00%	0.00%	0.00%	7.14%	21.43%	7.14%	0.00%	0.00%	7.14%	100.00%
GALENA CHERT	0.00%	4.35%	8.70%	39.13%	0.00%	0.00%	0.00%	4.35%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	4.35%	13.04%	26.09%	0.00%	0.00%	0.00%	100.00%
GRAND MEADOW CHERT	1.30%	0.00%	6.49%	29.87%	0.00%	1.30%	0.00%	7.79%	11.69%	5.19%	2.60%	3.90%	1.30%	1.30%	0.00%	3.90%	10.39%	12.99%	0.00%	0.00%	0.00%	100.00%
GULSETH SILICA	0.00%	0.00%	0.00%	22.22%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	11.11%	0.00%	0.00%	0.00%	44.44%	22.22%	0.00%	0.00%	0.00%	100.00%
HARTVILLE UPLIFT CHERT	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	100.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	100.00%
HIXTON SIL SANDSTONE	0.00%	0.00%	25.00%	50.00%	0.00%	0.00%	0.00%	0.00%	0.00%	25.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	100.00%
KNIFE RIVER FLINT	1.54%	3.85%	4.62%	24.62%	0.00%	1.54%	0.00%	9.23%	15.38%	3.08%	6.15%	10.00%	0.00%	0.00%	0.00%	3.08%	10.00%	6.15%	0.77%	0.00%	0.00%	100.00%
MAYNES CREEK CHERT	0.00%	0.00%	0.00%	25.00%	0.00%	0.00%	0.00%	12.50%	12.50%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	12.50%	25.00%	12.50%	0.00%	0.00%	0.00%	100.00%
MOLINE CHERT	33.33%	0.00%	0.00%	16.67%	0.00%	0.00%	0.00%	33.33%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	16.67%	0.00%	0.00%	0.00%	0.00%	100.00%
PLATE CHALCEDONY	0.00%	0.00%	100.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	100.00%
PRAIRIE DU CHIEN CHERT	1.56%	0.00%	3.13%	28.13%	0.00%	0.00%	1.56%	4.69%	3.13%	3.13%	1.56%	0.00%	1.56%	0.00%	3.13%	6.25%	12.50%	29.69%	0.00%	0.00%	0.00%	100.00%
WAPSIPINICON CHERT	0.00%	0.00%	0.00%	40.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	20.00%	20.00%	0.00%	0.00%	20.00%	0.00%	0.00%	0.00%	0.00%	0.00%	100.00%
Unknown	**1.89%**	**4.91%**	**2.26%**	**19.25%**	**0.00%**	**0.38%**	**0.00%**	**6.42%**	**2.64%**	**1.13%**	**1.51%**	**2.64%**	**1.51%**	**0.00%**	**9.06%**	**4.91%**	**13.21%**	**27.92%**	**0.38%**	**0.00%**	**0.00%**	**100.00%**
HUDSON BAY LOWLAND CHERT	0.00%	0.00%	0.00%	33.33%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	33.33%	0.00%	0.00%	0.00%	33.33%	0.00%	0.00%	0.00%	0.00%	0.00%	100.00%
INDETERMINATE AGATE	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	100.00%	0.00%	0.00%	0.00%	100.00%
INDETERMINATE CHALCEDONY	0.00%	0.00%	0.00%	45.45%	0.00%	0.00%	0.00%	0.00%	9.09%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	9.09%	9.09%	27.27%	0.00%	0.00%	0.00%	100.00%
INDETERMINATE CHERT	1.70%	5.53%	2.55%	17.87%	0.00%	0.43%	0.00%	7.23%	2.55%	1.28%	1.70%	2.13%	1.70%	0.00%	10.21%	4.26%	13.19%	27.23%	0.43%	0.00%	0.00%	100.00%
INDETERMINATE QUARTZITE	0.00%	0.00%	0.00%	20.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	30.00%	50.00%	0.00%	0.00%	0.00%	100.00%
KAKABEKA CHERT (BR)	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	100.00%	0.00%	0.00%	0.00%	100.00%
LAKE SUPERIOR AGATE	100.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	100.00%
Grand Total	**2.00%**	**2.88%**	**2.80%**	**21.92%**	**0.24%**	**0.40%**	**0.40%**	**7.20%**	**4.56%**	**1.60%**	**2.00%**	**2.56%**	**0.80%**	**0.08%**	**2.16%**	**5.60%**	**13.92%**	**28.08%**	**0.48%**	**0.24%**	**0.08%**	**100.00%**

3.4.2.1 A Comparison in Corticality among Non-Local and Local Materials

A chi-square test was performed to assess if the differences observed with regard to high-corticality (> 61% cortex) vs. low-corticality (< 61% cortex) complete flakes and tools among the locally and non-locally procured assemblages differed enough statistically to indicate differences in corticality among the two assemblages. The null hypothesis stated that that any differences with regard to the degree of corticality exhibited in complete flakes and tools of the local and non-local raw material assemblages was merely a chance occurrence and that there is, in fact, no statistical difference. In other words, the null hypothesis states that the data sets are statistically the same with regard to the degree of corticality between the two assemblages. A chi-square test was performed on the data in Table 15 rendering a value of 16.85 (Table 16). With a degree of freedom of 1, the probability of getting this strength of association between the variables tested when there is actually no true statistical difference is essentially 0% (Table 16). As a result, the null hypothesis can be rejected indicating there is a statistical difference in the degree of corticality (high vs. low) with regard to complete flakes and tools between the two assemblages. Essentially this statistically confirms that the complete flakes and tools within the local raw material assemblage exhibit a statistically significant higher degree of corticality than those of the non-local raw material assemblage.

TABLE 15. HIGH CORTICALITY VS. LOW CORTICALITY COMPLETE FLAKES AND COMPLETE TOOLS OF LOCAL AND NON-LOCAL PROCUREMENT PROVENIENCE AT 21LN2

Actual Values	**<61%**	**>61%**	**Grand Total**
Local	85	33	**118**
Non-Local	141	14	**155**
Grand Total	**226**	**47**	**273**
Expected Values	**<61%**	**>61%**	**Grand Total**
Local	97.68498168	20.31501832	**118**
Non-Local	128.3150183	26.68498168	**155**
Grand Total	**226**	**47**	**273**

TABLE 16. CHI-SQUARE TEST RESULTS OF HIGH CORTICALITY VS. LOW-CORTICALITY COMPLETE FLAKES AND COMPLETE TOOLS OF LOCAL VS. NON-LOCAL PROCUREMENT PROVENIENCE AT 21LN2

Probability	4.04139E-05
Chi Square Value	16.85185166
Degree of Freedom	1
Critical Value	5.024

3.4.3 Minimum Analytical Nodule Analysis

MANA was explored here as a way to refine inferences with regard to the lithic raw material procurement and utilization behavior exhibited at 21LN2. The first two results sections (3.4.1 and 3.4.2) used artifact count by raw material, artifact mass by raw material, origin of raw material, degree of artifact corticality by raw material, and artifact class by raw material to make interpretations regarding the movement of lithic raw materials onto and through 21LN2. MANA allowed for a refinement of those interpretations with regard to the heterogeneous raw material types identified at the site. Raw materials identified at 21LN2 which were considered to be heterogeneous in nature, that is exhibit sufficient differences from nodule to nodule to allow for discrimination, were Cedar Valley chert, Fusilinid Group chert, Galena chert, Lake Superior agate, Prairie du Chien chert, Red River chert, and Swan River chert. Other materials which were included in this analysis were Hixton Group silicified sandstone and Hartville Uplift chert due to the small amount of these raw materials present at the site and obvious distinguishing characteristics among the examples present allowing for further discrimination.

These raw material type groups were subdivided into minimum analytical nodules based on nuances within the raw material types (i.e., color, texture, inclusions, cortical texture, transmitted light, and other observable characteristics). It should be noted that geospatial provenience can also be used to further subdivide such analytical nodules; however, the degree of bioturbation evident at the site prevented the use of geospatial provenience as a refining factor. This fact was further confirmed by an analysis of the Swan River chert nodules exhibiting five or more artifacts. Swan River chert is an extremely heterogeneous material type and as such is likely to be over divided as opposed to under divided. These Swan River chert nodules were found to be dispersed vertically within excavation squares and in approximately half the cases were dispersed horizontally between two or more excavation squares (squares were separated by 14 to 59 meters [45 feet to 192 feet]).

Once the minimum analytical nodules were defined the total number of nodules per lithic raw material type was noted. These data were then used to enhance the earlier interpretations regarding lithic raw material procurement patterns at 21LN2. In this manner, the study was able to go beyond simply assessing artifact count and mass to describe the amount of each heterogeneous material arriving on site and add an additional behavioral dimension – a proxy for how many nodules of each heterogeneous material arrived on site.

Additionally, each MAN was assigned a behavioral interpretation based on the nodule constituents. Hall (2004:144) proposes four MAN group types within his constituent-based approach to MANA. Type 1 consists solely of a tool(s) and represents before-site curation and on-site discard. Type 2 consists of debitage and a tool(s) and represents before-site curation and on-site maintenance and discard. Type 3 consists of debitage, a core(s), and a tool(s) and represents before-site provisioning and on-site manufacture, maintenance, and discard. Type 4 consists solely of debitage and represents on-site production and off-site provisioning.

Hall (2004:148), citing Larson and Kornfeld (1997:7), notes that sorting debitage into MANs becomes somewhat questionable with small-sized debitage and for that reason he used pieces two cm or larger in his study evaluating prehistoric hunter and gatherer mobility. Baumler and Davis (2004:50); however, argue that small-sized debitage (between 1/4” and 1/16”) can be affectively assigned to MANs and they demonstrate that a large amount of debitage and data, particularly regarding tool maintenance activities, is lost when not taking small sized debitage into account. Baulmer and Davis (2004:50) do concede that MAN assignments become more tenuous in the case of multicolored, variegated stones. The assemblage used in the current study contains artifacts roughly 1.5

cm and larger and as such was expected to be well suited, size wise, for the application of MANA. However, per Baumler and Davis (2004:54), it is noted here that certain reduction sequences are likely not captured in the data set (i.e., tool maintenance). For this reason, when assigning MANs to a type group per Hall (2004:144), types 1 and 2 (1=before-site curation and on-site discard; 2=before-site curation, on-site maintenance, and on-site discard) were combined as the differentiating aspect (maintenance debris) between the two defined types was not collected. This is something that Hall (2004) failed to account for in his study as he freely assigned MANs to types 1 and 2 without analyzing debitage smaller than 2 cm. Additionally, nodules containing a tool(s) and debitage of 1.5 cm or larger in size likely represent on-site production and on-site discard rather than on-site maintenance and discard – again, maintenance generally produces smaller sized debitage than that measuring 1.5 cm. Similarly, nodules comprised solely of such debitage, measuring 1.5 cm or larger in size, likely represent on-site production and off-site curation of the produced tool.

Based on the above discussion and the fact that core elements (i.e., cores, core fragments, core tools, and core tool fragments) were not well represented at the site, three constituent-based MAN types were assigned in this study. Type A nodules consist solely of a tool(s) and represent before-site curation, potential on-site maintenance, and on-site discard. Type B nodules consist of debitage and a tool(s) and represent on-site manufacture, potential on-site maintenance, and on-site discard. Type C nodules consist solely of debitage and represent on-site production and off-site discard. Types A and C are indicative of a higher level of curation whereas Type B is indicative of a lower level of curation. Type A nodules represent the curation of a completed tool onto the site and its subsequent on-site discard. Type C nodules represent on-site tool manufacture and curation off-site prior to discard. Type B is indicative of a lower level of curation in that the nodule represents on-site tool manufacture as well as on-site tool discard. Table 17 summarizes the number of nodules and provides a breakdown of the nodule types by raw material and material origin. Table 18 provides the percentage of nodule types by raw material type and material origin.

TABLE 17. MINIMUM ANALYTICAL NODULES AND TYPES BY RAW MATERIAL AND MATERIAL ORIGIN

Lithic Raw Material	Artifacts	Nodules	Type A (Tools)	Type B (Debitage and Tools)	Type C (Debitage)
Local	**407**	**195**	**36**	**13**	**146**
RED RIVER CHERT	50	29	2	3	24
SWAN RIVER CHERT	357	166	34	10	122
Non-Local	**116**	**80**	**15**	**8**	**57**
CEDAR VALLEY CHERT	10	7	2	0	5
FUSILINID GROUP CHERT	14	10	4	1	5
GALENA CHERT	23	11	0	3	8
HARTVILLE UPLIFT CHERT	1	1	1	0	0
HIXTON GROUP SIL SAND	4	2	1	1	0
PRAIRIE DU CHIEN CHERT	64	49	7	3	39
Unknown	**1**	**1**	**1**	**0**	**0**
LAKE SUPERIOR AGATE	1	1	1	0	0
Grand Total	**524**	**276**	**52**	**21**	**203**

TABLE 18. PERCENT OF MINIMUM ANALYTICAL NODULE TYPES BY RAW MATERIAL AND MATERIAL ORIGIN

Lithic Raw Material Type	Type A (Tools)	Type B (Debitage and Tools)	Type C (Debitage)
Local	**18.5%**	**6.7%**	**74.9%**
RED RIVER CHERT	6.9%	10.3%	82.8%
SWAN RIVER CHERT	20.5%	6.0%	73.5%
Non-Local	**18.8%**	**10.0%**	**71.3%**
CEDAR VALLEY CHERT	28.6%	0.0%	71.4%
FUSILINID GROUP CHERT	40.0%	10.0%	50.0%
GALENA CHERT	0.0%	27.3%	72.7%
HARTVILLE UPLIFT CHERT	100.0%	0.0%	0.0%
HIXTON GROUP SIL SAND	50.0%	50.0%	0.0%
PRAIRIE DU CHIEN CHERT	14.3%	6.1%	79.6%
Unknown	**100.0%**	**0.0%**	**0.0%**
LAKE SUPERIOR AGATE	100.0%	0.0%	0.0%
Grand Total	**18.8%**	**7.6%**	**73.6%**

Prior to discussing the MANA results, it is worth acknowledging several factors. First, as with all archaeological interpretations, those presented here are based only on the sample of the site which was analyzed. That is to say, a Type C nodule (debitage only) may actually be a Type B nodule (debitage and tools) if a projectile point associated with that nodule lies undiscovered in an unexcavated portion of the site. This is, of course, the curse endured by all archaeologists – making interpretations based on parts of the whole. This dilemma of archaeology becomes all the more apparent when conducting constituent-based MANA.

Second, several of the more well represented raw materials present at 21LN2 are homogenous in nature, thus precluding them from the MANA. These materials include Knife River flint, Burlington chert, and Grand Meadow chert. It is worth noting that all three of these materials represent the non-locally procured assemblage, and for that reason may skew conclusions derived by comparing MANA data regarding locally and non-locally procured material assemblages.

Though MANA was never intended to provide the exact number of number of nodules to pass through a site, it does provide a competent proxy. Analysis presented in Section 3.4.1 indicated that Swan River chert was the most well represented raw material type present at 21LN2. The MANA indicates that there are 166 analytical nodules of Swan River chert within the analyzed assemblage. A majority of these nodules (p=73.5; n=122) represent on-site tool manufacture followed by curation off-site. Only 6% (n=10) represent on-site tool manufacture and discard meanwhile 20.5% (n=34) represent the curation of a completed tool onto the site and its subsequent on-site discard. MANA resulted in the designation of 29 analytical nodules of Red River chert, the only other heterogeneous locally procured material at the site. Similar to Swan River chert, a majority of the Red River chert nodules represent on-site tool manufacture and discard. Unlike the Swan River chert, however, a much smaller amount, only 6.9% (n=2), of the Red River chert analytical nodules represent the curation of a completed tool onto the site and its subsequent on-site discard.

Forty-nine analytical nodules were identified within the Prairie du Chien chert assemblage, the best represented of the non-locally procured heterogeneous raw materials. A majority of these 49 nodules (p=79.6; n=39) represent on-site tool manufacture followed by curation off-site. Only 6.1% (n=3) represent on-site tool manufacture and discard meanwhile 14.3% (n=7) represent the curation of a completed tool onto the site and its subsequent on-site discard. The designated analytical nodules of the next best represented non-locally heterogeneous materials, Galena chert (n=11) and Fusilinid Group chert (n=10), differed from those of Prairie du Chien chert. Similar to Praire du Chien chert, the majority of analytical nodules of both Galena chert and Fusilinid Group chert represent on-site tool manufacture followed by curation off-site (p=72.7 and 50.0; n=8 and 5, respectively). However, as compared to Prairie du Chien chert the Galena chert assemblage exhibited a much higher percentage (p=27.3, n=3) of nodules representing on-site tool manufacture and discard and the Fusilinid Group chert assemblage exhibited a much higher percentage (p=40.0, n=4) of nodules representing the curation of a completed tool onto the site and its subsequent on-site discard.

Seven analytical nodules were identified within the Cedar Valley chert assemblage. A majority of these 7 nodules (p=71.4; n=5) represent on-site tool manufacture followed by curation off-site. None of the analytical nodules represent on-site tool manufacture and discard; however, a relatively high percentage (p=28.6, n=2) represent the curation of a completed tool onto the site and its subsequent on-site discard. One analytical nodule each was identified within the Hartville Uplift chert and Lake Superior agate assemblages. Both represented the curation of a completed tool onto the site and its subsequent on-site discard. The Hixton Group silicified sandstone assemblage was found to contain two analytical nodules. One represents the curation of a completed tool onto the site and its subsequent on-site discard and the other represents on-site tool manufacture and discard.

In general, the heterogeneous raw material assemblage, consisting of those materials included in the MANA, was separated into 276 analytical nodules. A majority of these

276 nodules (p=73.6; n=203) represent on-site tool manufacture followed by curation off-site. Only 7.6% (n=21) represent on-site tool manufacture and discard while 18.8% (n=52) represent the curation of a completed tool onto the site and its subsequent on-site discard. These data appear to indicate that 21LN2 was largely being used as a retooling location. The majority of nodules represent on-site manufacture followed by curation off-site which suggests lithic reduction occurring at 21LN2 concentrated on the manufacture of lithic tools for curation off-site. Nearly one out of five nodules represent the curation of a completed tool onto the site and its subsequent on-site discard, further suggesting that that the manufacture and curation of new tools off-site was part of a retooling strategy. There is no significant difference in the analytical nodule representation by raw material origin (X^2=0.929; df=2; p=.629 [Tables 19 and 20]). However, as stated above this result may be skewed as three of the best represented non-locally procured raw materials (Knife River flint, Burlington chert, and Grand Meadow chert) identified at the site are homogenous in nature, thus precluding them from the MANA.

Table 19. Cross-Tabulation Table of Analytical Nodule Type by Raw Material Origin at 21LN2

Actual Values	**Analytical Nodule Type**			
Material Origin	**Type A**	**Type B**	**Type C**	**Grand Total**
Local	36	13	146	**195**
Non-Local	15	8	57	**80**
Grand Total	**51**	**21**	**203**	**275**
Expected Values	**Analytical Nodule Type**			
Material Origin	**Type A**	**Type B**	**Type C**	**Grand Total**
High Quality	36.16363636	14.89090909	143.9454545	**195**
Low Quality	14.83636364	6.109090909	59.05454545	**80**
Grand Total	**51**	**21**	**203**	**275**

TABLE 20. CHI-SQUARE TEST RESULTS OF ANALYTICAL NODULE TYPE BY RAW MATERIAL ORIGIN AT 21LN2

Probability	0.628529156
Chi Square Value	0.928745725
Degree of Freedom	2
Critical Value	5.024

3.4.4 A Test of Andrefsky's (1994b) Predictions

Andrefsky (1994b:29-30) predicts that a relationship exists between quality and abundance of lithic raw material and the kinds of tools produced of those materials. Figure 15 is a contingency table illustrating those predictions (Andrefsky 1994b:30). Many factors can be used to assess the quality of lithic raw materials; however, in keeping with Andrefsky's (1994b:29-30) logic, for the purposes of this study the material quality was equated to the overall ease with which the raw material can be formed into tools. Designations of material quality were made in consultation with Dan Wendt, a master flintknapper who has experience working all the lithic raw material types identified at 21LN2, with the exception of Gulseth silica. Mr. Wendt designated each of these materials as being of low, medium, or high quality (see Table 21). The high quality category was reserved for only the highest quality materials (Knife River flint, Burlington chert, and Hartville Uplift chert) and it is important to note that these materials appear to have been especially prized by prehistoric populations of the region.

A test of Andrefsky's (1994b) prediction required that the raw materials be separated into two quality classes – high and low. For the purposes of this study, all raw materials rated medium and high quality by Mr. Wendt were categorized as high quality materials. All raw materials rated low quality by Mr. Wendt were categorized as low quality materials (see Table 21). Tools were grouped by their tool formality designation (i.e., formal, expedient, unknown) as discussed in the methods section. Tools considered to be formal consisted of bifaces such as projectile points and knives as well as more formally worked flake tools such as well-formed end scrapers and side scrapers. Expedient tools consisted of lightly retouched flake tools and utilized flakes. All tools with an 'unknown' designation (n=26) were removed from consideration. Formal tools (n=100 [n=76 with assigned procurement origin]) and expedient tools (n=121 [n=106 with assigned procurement origin]) were separated into their respective groups and the raw material makeup of the two groups analyzed to assess if the observed trends corresponded well with Andrefsky's (1994b) predictions regarding high and low quality materials of local and non-local availability. The results are presented in Table 22 as well as Figures 16 and 17.

The results do not conform to Andrefsky's (1994b) predictions. Non-locally procured materials of high quality are expected to be used primarily for formal tool production. The data indicate that this was not the case at 21LN2. In fact, these materials appear to have been used primarily for expedient tool manufacture as 68.9% (n=71) of the tools manufactured of the high quality non-local materials are expedient. The Knife River Flint and Burlington chert, the highest quality materials present at the site and both of non-local procurement provenience further demonstrate this observation. The data show that 24.5% (n=13) of the Knife River flint tools were formal and 75.5% (n=40) were expedient. Similarly, 33.3% (n=3) of the Burlington chert tools were formal and 66.7% (n=6) were expedient. Other high quality materials of non-local origin that did not conform to Andrefsky's prediction include Cedar Valley chert, Grand Meadow chert, Gulseth silica, Hixton Group silicified sandstone, Maynes Creek chert, and Wapsipinicon chert (see Table 22). High quality materials of non-local origin that did conform to Andrefsky's predictions include Fusilid chert, Galena chert, Hartville Uplift chert, and Moline chert.

High quality materials of local procurement origin are expected to yield both formal and expedient tool forms. The sample size of silicified wood (n=1), the only high quality locally procured raw material type present at the site, was too small to make any conclusive statements regarding Andrefsky's prediction regarding locally procured high quality materials.

TABLE 21. OVERALL MATERIAL QUALITY RATING FOR LITHIC RAW MATERIAL TYPES AT 21LN2

Lithic Raw Material Type	Overall Material Quality Rating by Dan Wendt	High/Low Rating per Andrefsky 1994b
Basaltic Material	Low-	Low
Bijou Hills Silicified Sediment	Low	Low
Burlington Chert	High	High
Cedar Valley Chert	Medium+	High
Fusilinid Group Chert	Medium	High
Galena Chert	Medium	High
Grand Meadow Chert	Medium+	High
Granitic Material	Low-	Low
Gulseth Silica	Medium	High
Hartville Uplift Chert	High	High
Hixton Group Silicified Sandstone	Medium	High
Hudson Bay Lowland Chert	Medium	High
Kakabeka Chert (BR)	Low	Low
Knife Lake Siltstone	Low	Low
Knife River Flint	High	High
Lake of the Woods Rhyolite	Low	Low
Lake Superior Agate	Low	Low
LGG-Agate	Low	Low
LGG-Chalcedony	Low	Low
LGG-Hartville Uplift Chert	Low	Low
LGG-Knife River Flint	Low	Low
Maynes Creek Chert	Medium	High
Moline Chert	Medium+	High
Plate Chalcedony	Low	Low
Prairie du Chien Chert	Low	Low
Quartz	Low	Low
Red River Chert	Low	Low
Silicified Wood	Medium	High
Sioux Quartzite	Low-	Low
Swan River Chert	Low	Low
Tongue River Silica	Low	Low
Wapsipinicon Chert	Medium	High

TABLE 22. RELATIONSHIP BETWEEN QUALITY AND ABUNDANCE OF LITHIC RAW MATERIAL AND THE KINDS OF TOOLS PRODUCED AT 21LN2

Lithic Raw Material Type by Procurement Origin and Quality	EXPEDIENT	FORMAL	Grand Total
Local Procurement Origin	**26**	**36**	**62**
High Quality	**1**	**0**	**1**
SILISIFIED WOOD	1	0	1
Low Quality	**25**	**36**	**61**
LAKE OF THE WOODS RHYOLITE	2	0	2
LGG - KNIFE RIVER FLINT	1	0	1
RED RIVER CHERT	5	1	6
SWAN RIVER CHERT	16	28	44
TONGUE RIVER SILICA	1	7	8
Non-Local Procurement Origin	**80**	**40**	**120**
High Quality	**71**	**32**	**103**
BURLINGTON CHERT	6	3	9
CEDAR VALLEY CHERT	2	0	2
FUSILINID GROUP CHERT	1	3	4
GALENA CHERT	0	2	2
GRAND MEADOW CHERT	18	7	25
GULSETH SILICA	1	0	1
HARTVILLE UPLIFT CHERT	0	1	1
HIXTON GROUP SIL SANDSTONE	1	1	2
KNIFE RIVER FLINT	40	13	53
MAYNES CREEK CHERT	1	0	1
MOLINE CHERT	0	2	2
WAPSIPINICON CHERT	1	0	1
Low Quality	**9**	**8**	**17**
BIJOU HILLS SIL SED	4	2	6
PLATE CHALCEDONY	0	1	1
PRAIRIE DU CHIEN CHERT	5	5	10
Grand Total	**106**	**76**	**182**

		Lithic Quality	
		High	**Low**
Lithic Abundance	**High (Local)**	formal and expedient tool production	primarily expedient tool production
	Low (Non-Local)	primarily formal tool production	primarily expedient tool production

Figure 15. Contingency Table Showing Predicted Relationship Between Quality and Abundance of Lithic Raw Material and the Kinds of Tools Produced (From Andrefsky 1994b:30)

		Lithic Quality	
		High	**Low**
Lithic Abundance	**High (Local)**	Silicified Wood	Lake of the Woods Ryolite, LGG - Knife River Flint, Red River Chert, Swan River Chert, Tongue River Silica
	Low (Non-Local)	Burlington Chert, Cedar Valley Chert, Fusilinid Group Chert, Galena Chert, Grand Meadow Chert, Gulseth Silica, Hartville Uplift Chert, Hixton Group Sil Sandstone, Knife River Flint, Maynes Creek Chert, Moline Chert, Wapsipinicon Chert	Bijou Hills Silicified Sediment, Plate Chalcedony, Prairie du Chien Chert

Figure 16. Designations of Raw Materials Identified at 21LN2

		Lithic Quality	
		High	**Low**
Lithic Abundance	**High (Local)**	1 Formal Tool; 0 Expedient Tools	36 Formal Tools; 25 Expedient Tools
	Low (Non-Local)	32 Formal Tools; 71 Expedient Tools	8 Formal Tools; 9 Expedient Tools

Figure 17. Contingency Table Showing Actual Relationship Between Quality and Abundance of Lithic Raw Material and Tool Types Produced at 21LN2

Low quality materials of non-local procurement origin are expected to be used primarily for the production of expedient tools. The data suggest this was not the case at 21LN2 as approximately half (n=8/p=47.1) of the tools within the non-local low quality raw material assemblage are formal. In fact, the ratio for formal tools to expedient tools is higher for the non-local low quality assemblage (r=88.9) than it is for the non-local high quality assemblage (r=45.1). Of the three raw material types within the non-local low quality material assemblage, only Bijou Hills silicified sediment conforms to Andrefsky's prediction. Prairie du Chien chert and plate chalcedony do not.

Low quality materials of local procurement origin are expected to be used primarily for expedient tool production. The overall locally procured low quality material assemblage does not conform to Andrefsky's prediction as 59.0% (n=36) of the tools are formal and 41.0% (n=25) are expedient (see Table 22). Swan River chert and Tongue River silica, largely dictate these numbers, however, as the other three material types of the locally procured low quality material assemblage, Lake of the Woods rhyolite, LGG-Knife River flint, and Red River chert, seem to conform well to Andrefsky's prediction (see Table 22).

These results should not be interpreted as an indication of tool production intensity per raw material type or groups of material types, which is explored in a subsequent section of this thesis. Rather, these results suggest that for the most part the production of formal and expedient tools at 21LN2 does not conform to the expected relationship between stone quality and availability presented by Andrefsky (1994b:29-30).

A consideration that should be explored concerning non-locally available materials is the fact that extensive trade networks may have provided some or all of these raw materials to such an extent as to make their level of procurement effort and cost nearly equal to that of locally available material. A modern day analogy can be found in the availability and cost of oranges and apples in the Midwest. Though oranges are a non-locally procured fruit type and apples a locally procured fruit type, they are generally of equal accessibility and cost due to the extensive trade networks that are enjoyed by Americans living in the Midwest. Perhaps interaction through trade had become adequately extensive during the Woodland and Late Prehistoric periods to allow for non-locally procured lithic raw materials to be accessible and cost effective to the extent they could be treated as locally procured materials.

Another explanation may lie in the intended reduction and subsequent utilization of these raw materials. For example, a material might be primarily intended for formal bifacial tool production, yet the many waste flakes rendered from the main reduction goal may be utilized as expedient tools.

The many factors used to determine the worth and quality of a raw material must also be considered. One particular material might be of low flaking quality, but of exceptional strength making it an excellent material for extensive scraping activities with little to no need of retouch. Another material might exhibit excellent flaking quality conducive to the bifacial production of projectile points, however is not hard enough to render durable scrapers. Yet another material might not be highly durable or exhibit good flaking quality, but the material’s coloration might be considered unique or significant to the manufacturer. In other words, there are likely more complex factors influencing tool manufacture by raw material than a simple relationship between stone quality and availability.

3.4.5 Reduction Efficiency, Reduction Type, and Tool Production Intensity

3.4.5.1 Reduction Efficiency

The lithic raw materials identified at 21LN2 were assessed for their level of reduction efficiency. The study employed a method developed by Henry (1989:141) in which dimensional data pertaining to complete flakes and complete tools are used to establish reduction efficiency as described in detail in Section 3.3.3.2. Twelve raw material types, Bijou Hills Silicified Sediment, Burlington chert, Grand Meadow chert, Knife River flint, Lake of the Woods Rhyolite, LLG-Knife River flint, Maynes Creek chert, Moline chert, Prairie du Chien chert, Red River chert, Swan River chert, and Tongue River silica, are considered here, as only those raw materials presented both complete tools and complete flakes. The dimensional data are presented in a series of scatter plots by raw material type (see Figures 18 – 29).

These data suggest that Burlington chert and Swan River chert were among the least efficiently reduced raw materials identified at 21LN2 (see Figures 19 and 28). These raw material types exhibited a relatively high number of complete flakes exhibiting larger dimensions than the complete tools within their respective assemblages. The size of the complete tools in comparison to the size of the complete flakes identified at the site indicates these two raw material types were not efficiently reduced. It was somewhat expected to find that Swan River chert was not efficiently reduced as it was a highly available local resource for the prehistoric inhabitants of 21LN2; however, it is rather surprising to see how inefficiently the very high quality, non-locally procured Burlington chert was reduced at the site. This may indicate that Burlington chert was readily available through trade or some other form of interaction. It may also suggest that other materials were more highly prized than Burlington chert despite its extraordinarily high quality. Perhaps the intended use of the desired tools produced at 21LN2 favored a material strength or durability that Burlington chert did not provide.

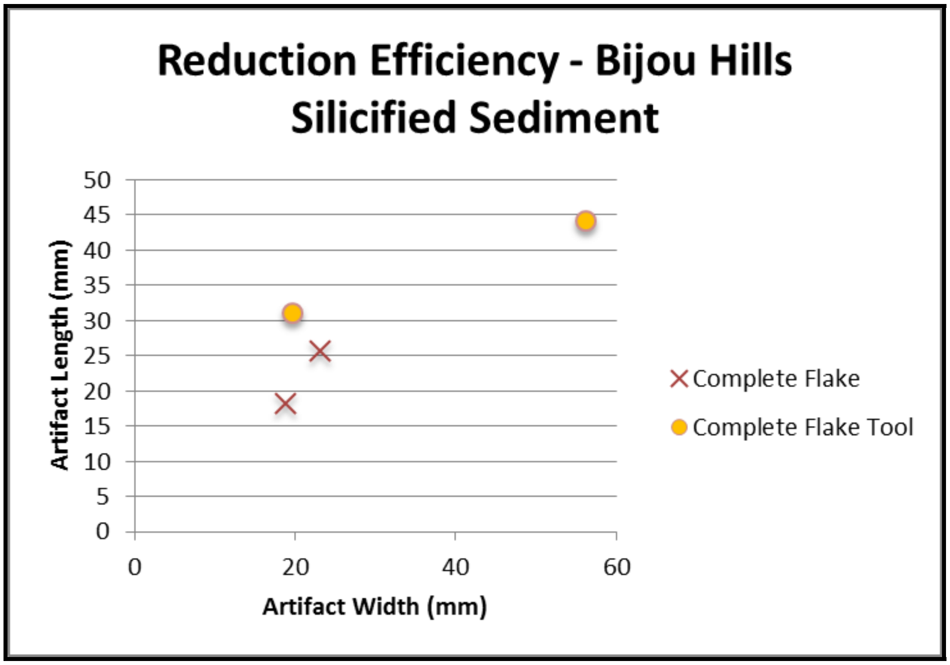


FIGURE 18. REDUCTION EFFICIENCY FOR BIJOU HILLS SILICIFIED SEDIMENT AT 21LN2

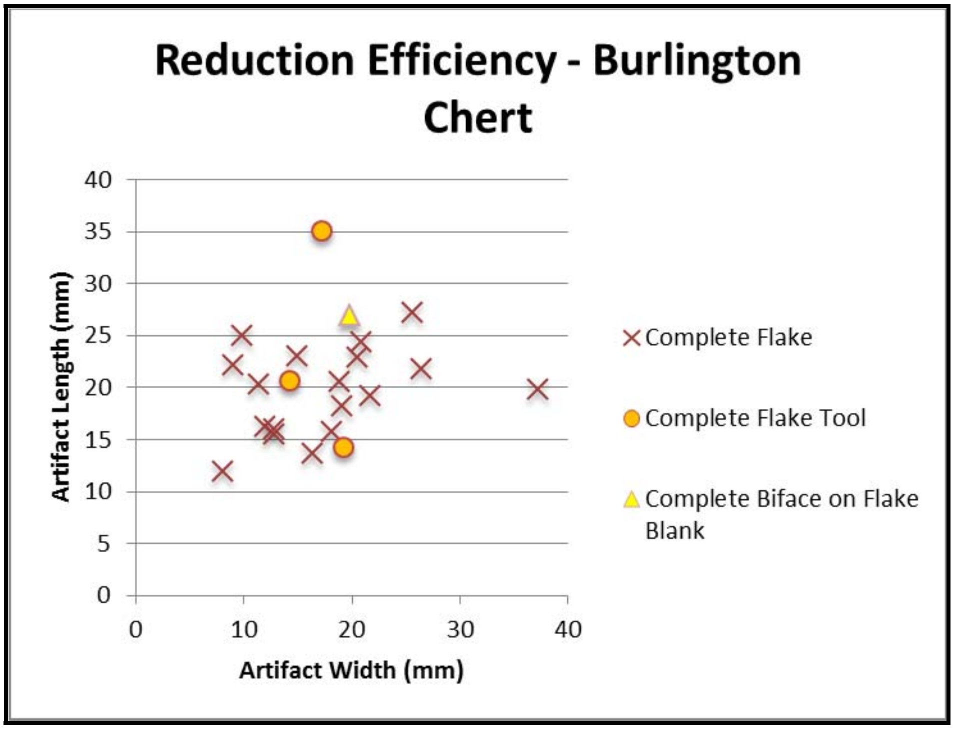


FIGURE 19. REDUCTION EFFICIENCY FOR BURLINGTON CHERT AT 21LN2

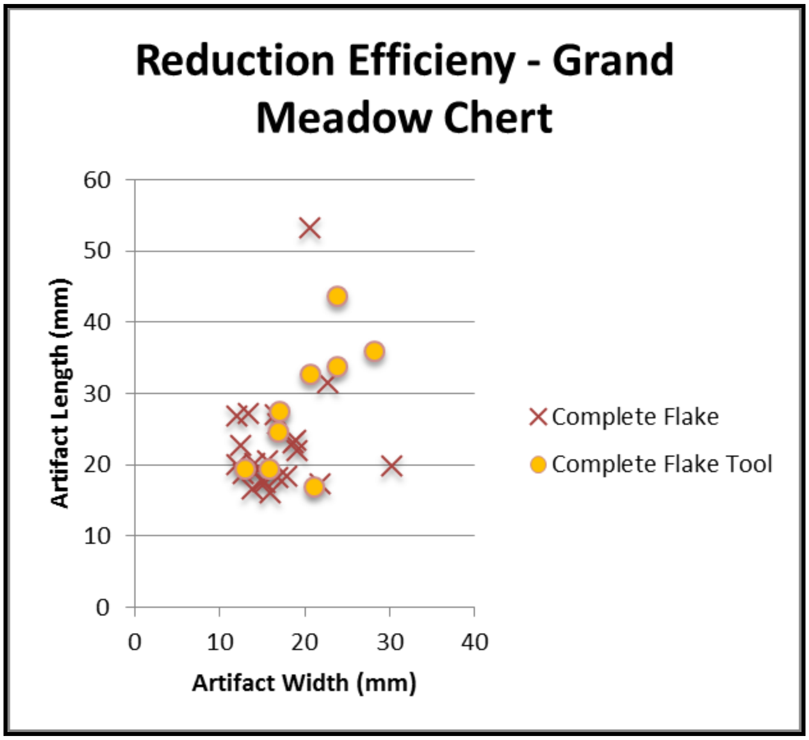


FIGURE 20. REDUCTION EFFICIENCY FOR GRAND MEADOW CHERT AT 21LN2

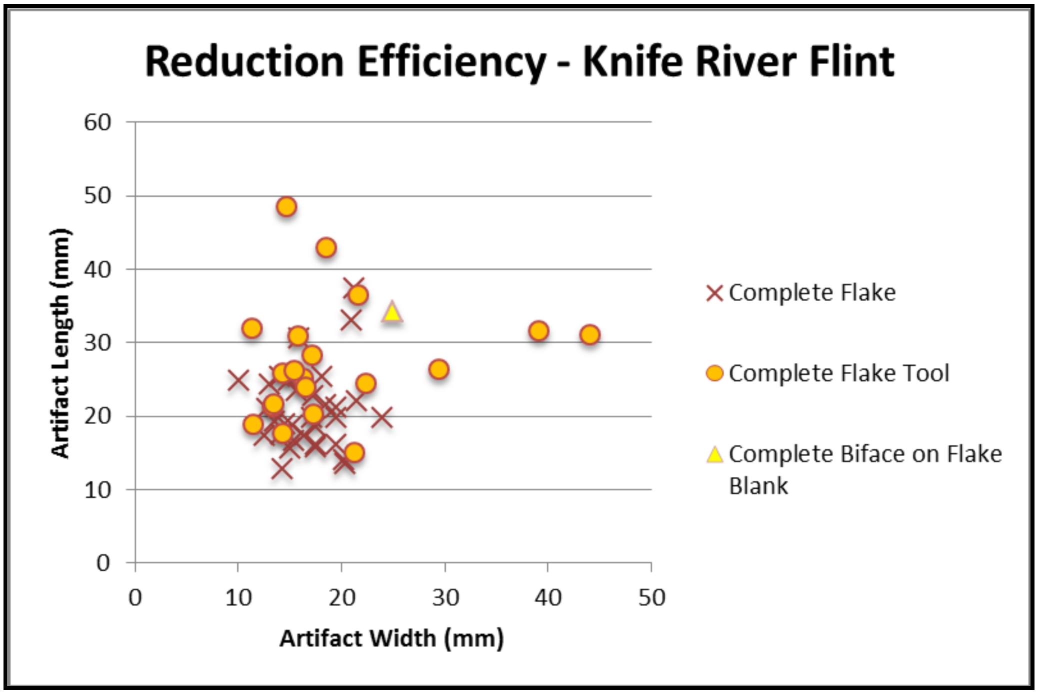


FIGURE 21. REDUCTION EFFICIENCY FOR KNIFE RIVER FLINT AT 21LN2

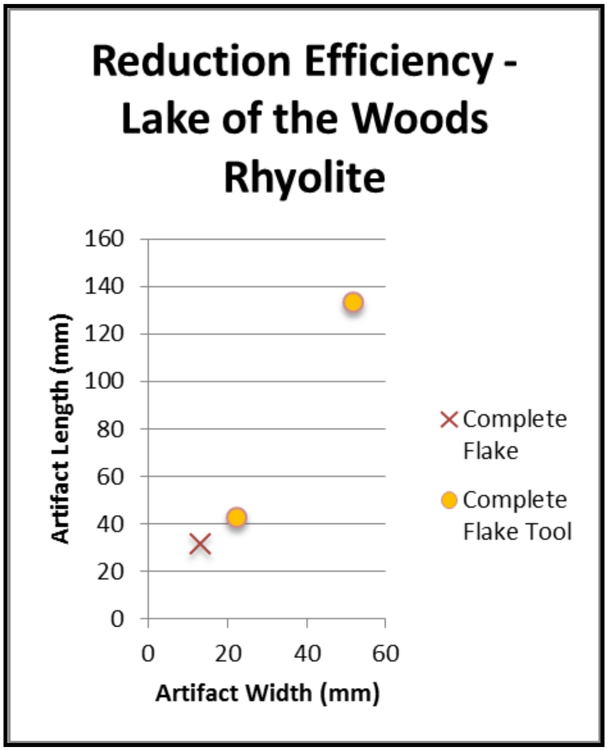


FIGURE 22. REDUCTION EFFICIENCY FOR LAKE OF THE WOODS RHYOLITE AT 21LN2

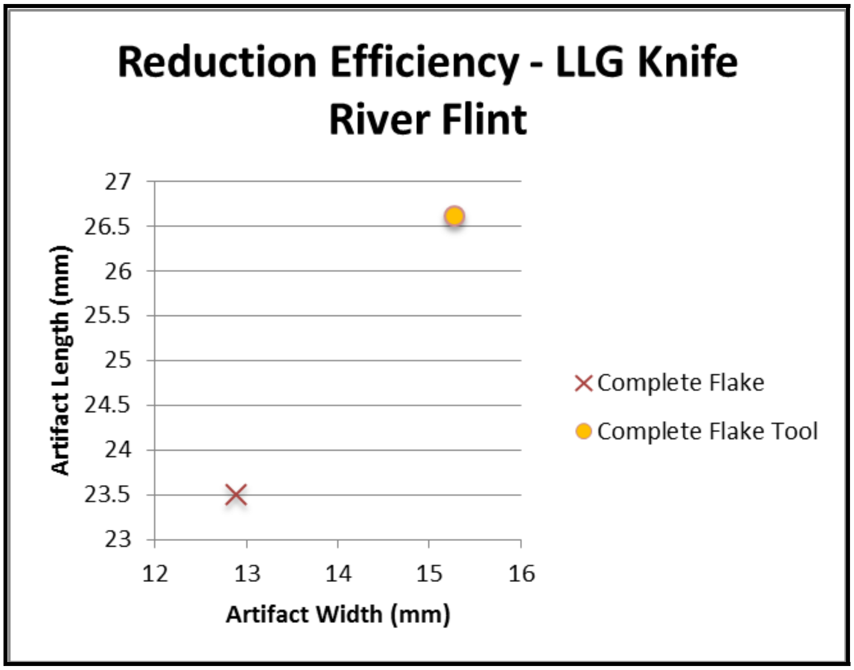


FIGURE 23. REDUCTION EFFICIENCY FOR LLG KNIFE RIVER FLINT AT 21LN2

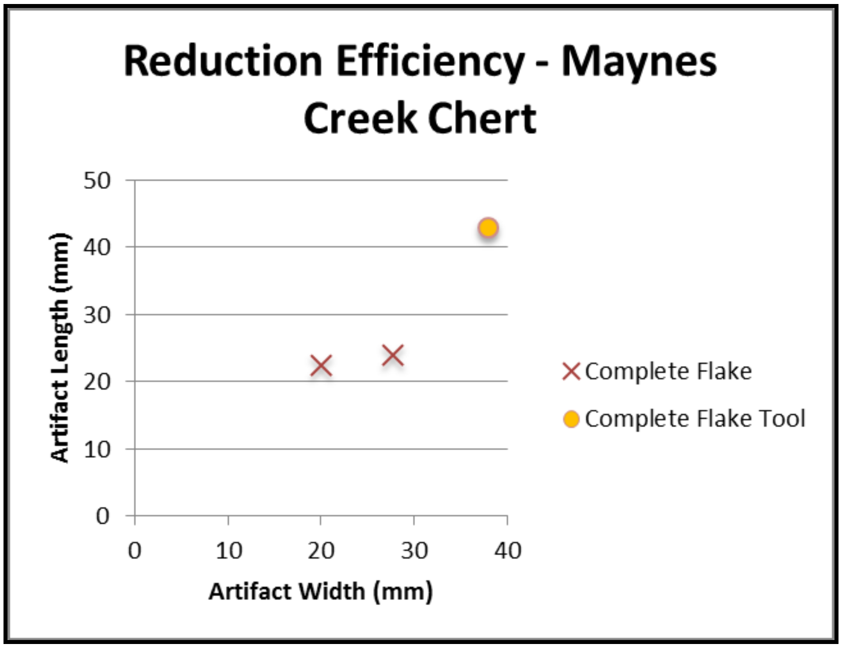


FIGURE 24. REDUCTION EFFICIENCY FOR MAYNES CREEK CHERT AT 21LN2

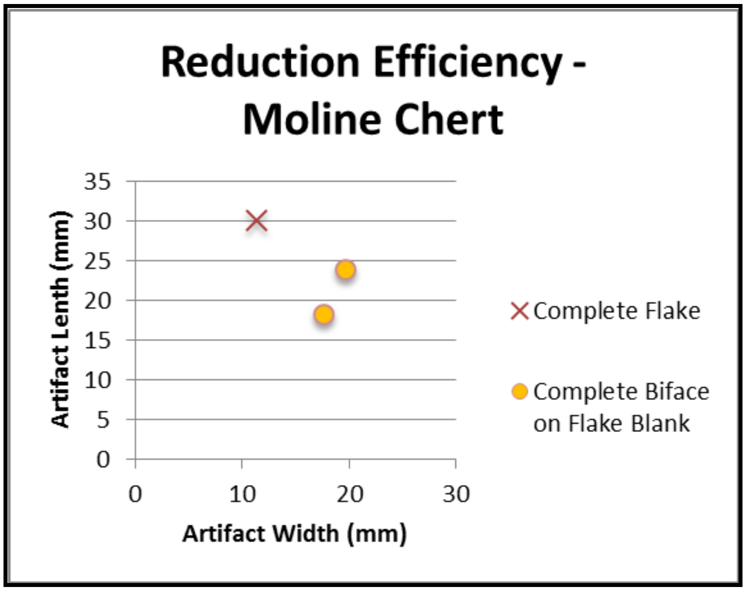


FIGURE 25. REDUCTION EFFICIENCY FOR MOLINE CHERT AT 21LN2

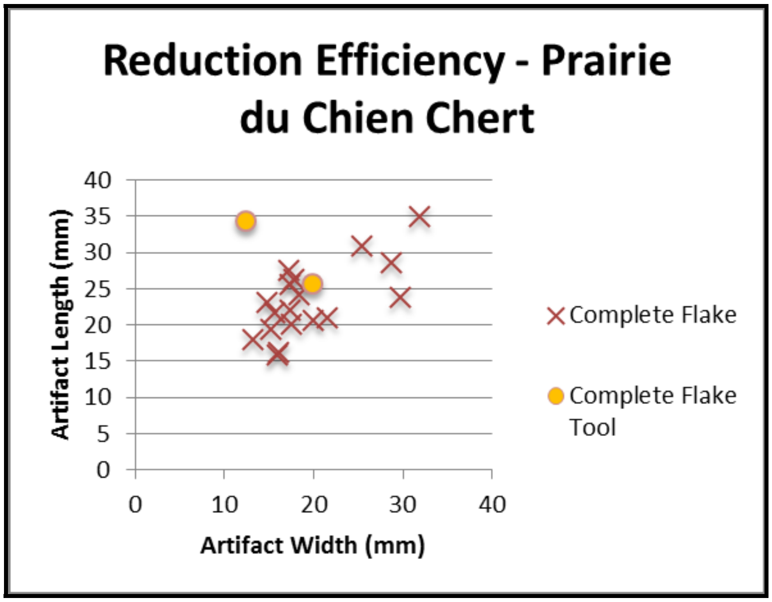


FIGURE 26. REDUCTION EFFICIENCY FOR PRAIRIE DU CHIEN CHERT AT 21LN2

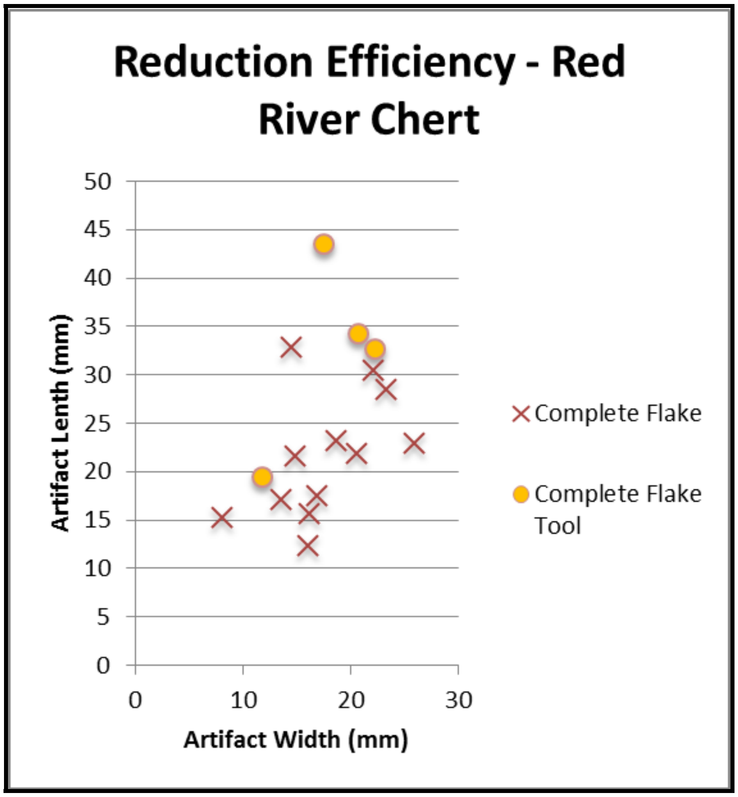


FIGURE 27. REDUCTION EFFICIENCY FOR RED RIVER CHERT AT 21LN2

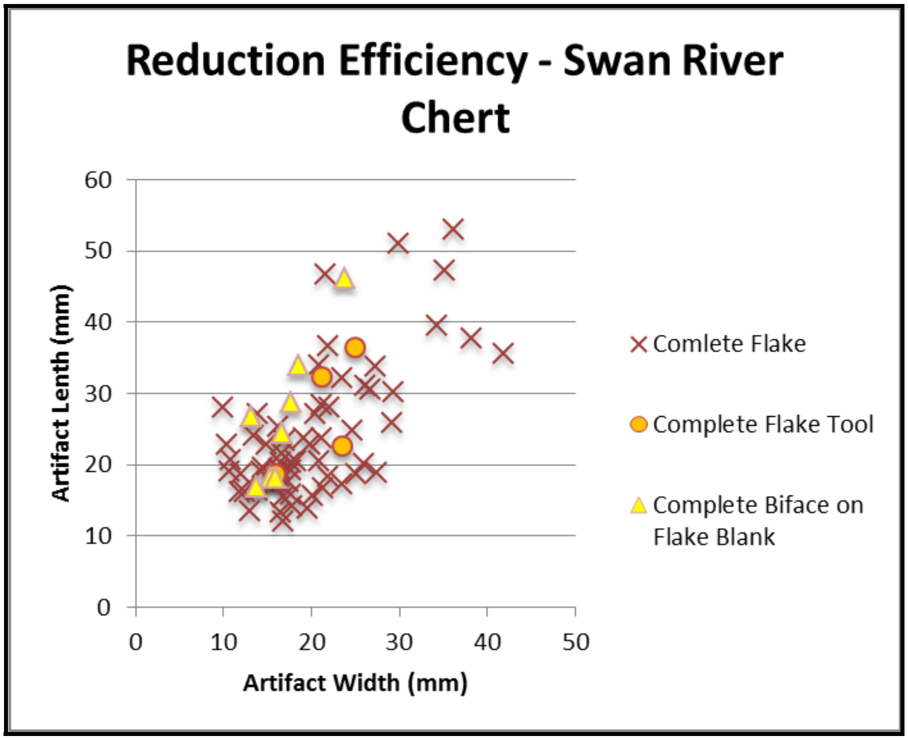


FIGURE 28. REDUCTION EFFICIENCY FOR SWAN RIVER CHERT AT 21LN2

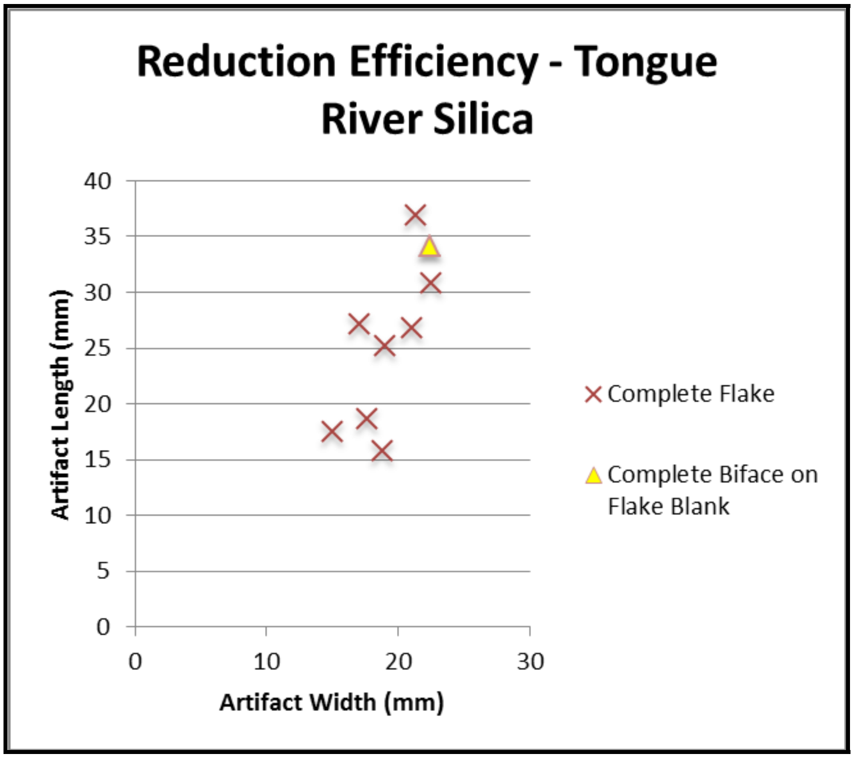


FIGURE 29. REDUCTION EFFICIENCY FOR TONGUE RIVER SILICA AT 21LN2

The data indicate that Bijou Hills Silicified Sediment, Lake of the Woods Rhyolite, LLG-Knife River flint, Maynes Creek chert, Moline chert, and Tongue River silica were the most efficiently reduced raw materials identified at 21LN2 (see Figures 18, 22 – 26, and 29). These raw material types exhibited little to no complete flakes exhibiting larger dimensions than the complete tools within their respective material type assemblage. The size of the complete tools in comparison to the size of the complete flakes identified at the site indicate that most of the unmodified flakes of these raw material types were too small to have had the potential to become tools. In other words, regarding these six raw material types, all the flakes, or nearly all the flakes, with dimensions considered large enough to receive secondary retouch, were modified as such. This demonstrates the high level of reduction efficiency with regard to these six raw materials. This level of reduction efficiency was not unexpected for the non-locally procured raw material types (Bijou Hills Silicified Sediment, Maynes Creek chert, and Moline chert) considering the level of effort involved in their procurement. However, it was unexpected to find this level of reduction efficiency with regard to the lower quality, locally procured materials (Lake of the Woods Rhyolite, LLG-Knife River flint, and Tongue River silica).

Grand Meadow chert and Knife River flint also exhibited a somewhat high level of reduction efficiency (Figures 20 and 21). In the case of both raw material types, relatively few complete flakes exhibited larger dimensions than the complete tools within their respective assemblages; however, a majority of the complete flakes exhibited dimensions comparable to the complete tools within their respective assemblages. In other words, though these two assemblages were fairly efficiently reduced, there was certainly room for the reduction to have been more efficient.

Prairie du Chien chert and Red River chert exhibited a moderately high level of reduction efficiency (see Figures 26 and 27). In the case of the Red River chert assemblage, a majority of the complete tools (n=3 of 4) exhibited larger dimensions than the complete flakes of Red River chert material. Concerning the Prairie du Chien chert assemblage, a great majority of the complete flakes (n=14 of 18) were observed to exhibit smaller dimensions than the complete tools manufactured of Prairie du Chien chert material.

3.4.5.2 Reduction Type

Reduction type was assessed by raw material to better characterize how the different raw materials were being reduced and utilized at 21LN2.

A summary of flake types by raw material is presented in Table 23. It is interesting to note that 77.8% (n=7 of 9) of the identifiable LGG material flakes are bipolar flakes. Bipolar reduction was likely necessary due to the small package size of these glacial pebbles. This type of reduction allowed the prehistoric inhabitants of 21LN2 to generate flakes for expedient tool use or secondary retouch from these small glacial pebbles where other forms of reduction would have failed. Other material types exhibiting bipolar reduction, though to a much lesser extent, include Lake of the Woods rhyolite (p=12.5), Swan River chert (p=0.8), Burlington chert (p=2.4), and Knife River flint (p=1.3). Bipolar reduction does not seem to have been particularly important within other raw material type or group assemblages. It should be noted that the local raw material assemblage exhibited a higher percentage (p=4.6) of bipolar flakes to overall flakes than the non-local assemblage (p=0.8). This is likely tied into procurement effort. It seems logical to assume that if a higher investment of time and energy was put into transporting non-local materials they are likely to be of a higher chipping quality and more appropriate package size. Thus, being of a more appropriate package size bipolar reduction is less likely to be needed and/or employed.

When considering the percentage of bifacial thinning flakes to overall flakes by raw material and number of bifacial thinning flakes by raw material type it appears that bifacial tool production at the site focused on three main materials types: Knife River flint (n=16/p=20.8), Burlington chert (n=7/p=17.1), and Grand Meadow chert (n=6/p=14.6). Other materials that also exhibited a relatively high percentage of bifacial thinning flakes to overall flakes, but relatively small counts of bifacial flakes include: Hixton Group silicified sandstone (n=1/p=50.0), Knife Lake siltstone, (n=1/p=33.0), Cedar Valley chert (n=1/p=25.0), Tongue River silica (n=2/p=13.3), and Lake of the Woods rhyolite (n=1/p=12.5). It should be noted that the non-local raw materials assemblage exhibited a higher percentage (p=14.0) of bifacial thinning flakes to overall flakes than the local assemblage (p=4.1). The data regarding bifacial tool production by raw material conforms to Andrefsky's (1994b:29-30) predictions regarding expedient and formal tool manufacture based on local vs. non-local, low quality vs. high quality raw materials. Bifacial tools are often considered formal tools or tools which require a higher degree of manufacture effort. Bifacial reduction at 21LN2 seemed to focus largely on Knife River flint, Burlington chert, and Grand Meadow chert, which are all considered high quality raw materials of non-local procurement provenience.

TABLE 23. REDUCTION TYPE BY RAW MATERIAL AT 21LN2

Lithic Raw Material Type by Procurement Origin	Bipolar Flake	Bifacial Thinning Flake	Flake	Grand Total	Percent Bipolar	Percent Bifacial Thinning
Local	**9**	**8**	**177**	**194**	**4.6**	**4.1**
BASALTIC ROCK	-	-	8	8	0.0	0.0
GRANITIC ROCK	-	-	1	1	0.0	0.0
KNIFE LAKE SILTSTONE	-	1	2	3	0.0	33.3
LAKE OF THE WOODS RHYOLITE	1	1	6	8	12.5	12.5
LGG - AGATE	5	-	-	5	100.0	0.0
LGG - CHALCEDONY	1	-	1	2	50.0	0.0
LGG - KNIFE RIVER FLINT	1	-	1	2	50.0	0.0
QUARTZ	-	-	4	4	0.0	0.0
RED RIVER CHERT	-	-	20	20	0.0	0.0
SILISIFIED WOOD	-	-	4	4	0.0	0.0
SIOUX QUARTZITE	-	-	1	1	0.0	0.0
SWAN RIVER CHERT	1	4	116	121	0.8	3.3
TONGUE RIVER SILICA	-	2	13	15	0.0	13.3
Non-Local	**2**	**34**	**207**	**243**	**0.8**	**14.0**
BIJOU HILLS SIL SED	-	1	10	11	0.0	9.1
BURLINGTON CHERT	1	7	33	41	2.4	17.1
CEDAR VALLEY CHERT	-	1	3	4	0.0	25.0
FUSILINID GROUP CHERT	-	-	8	8	0.0	0.0
GALENA CHERT	-	-	12	12	0.0	0.0
GRAND MEADOW CHERT	-	6	35	41	0.0	14.6
GULSETH SILICA	-	-	6	6	0.0	0.0
HIXTON GROUP SIL SANDSTONE	-	1	1	2	0.0	50.0
KNIFE RIVER FLINT	1	16	60	77	1.3	20.8
MAYNES CREEK CHERT	-	-	5	5	0.0	0.0
MOLINE CHERT	-	-	3	3	0.0	0.0
PRAIRIE DU CHIEN CHERT	-	2	28	30	0.0	6.7
WAPSIPINICON CHERT	-	-	3	3	0.0	0.0
Unknown	**2**	**4**	**94**	**100**	**2.0**	**4.0**
HUDSON BAY LOWLAND CHERT	-	-	4	4	0.0	0.0
INDETERMINATE CHALCEDONY	-	-	7	7	0.0	0.0
INDETERMINATE CHERT	2	4	78	84	2.4	4.8
INDETERMINATE QUARTZITE	-	-	5	5	0.0	0.0
Grand Total	**13**	**46**	**478**	**537**	**2.4**	**8.6**

3.4.5.3 Retouched Tool Production

The degree to which retouched tools were produced at the site by raw material type was assessed through a comparison of complete flakes to complete tools (complete flake tools and complete bifaces manufactured from flake blanks). The results for each raw material type are presented below; by procurement origin (Table 24) and raw material quality (Table 25).

The non-locally procured assemblage appeared to exhibit a significantly higher complete tool to complete flake ratio (r=0.37) as compared to the locally procured assemblage (r=0.19). To test this observation, a cross-tabulation table was generated based on complete tools against complete flakes by raw material procurement origin (Table 26). A chi-square test was performed to assess if the differences in degree of retouched tool production between the local and non-local raw material assemblages at 21LN2 differed enough statistically to indicate significant differences in degree of retouched tool production between the raw materials of local and non-local procurement origin. The null hypothesis stated that any differences with regard to degree of retouched tool production between the local and non-local raw materials were merely a chance occurrence and that there is, in fact, no statistical difference. In other words, the null hypothesis states that the data sets are statistically the same with regard to degree of retouched tool production. The chi-square test performed on the data presented in Table 26 rendered a value of 5.25 (see Table 27). With a degree of freedom of 1, the probability of getting this strength of association between the variables tested when there is actually no true statistical difference is 2.2% (see Table 27). As a result, we can reject the null hypothesis and state with statistical certainty that sampling error or random chance is not responsible for the pattern observed in the data. These data suggest non-locally procured raw material types tended to be more highly prized by the prehistoric inhabitants of the 21LN2 with regard to retouched tool production than locally procured raw material types.

However, a closer examination of the individual raw materials presents another consideration. Of the well represented non-locally procured raw material types, those with 10 or more artifacts contributing to the complete tool-complete flake ratio, the degree to which retouched tools were produced was the highest for the Knife River flint raw material group with a complete tool to compete flake ratio of 0.66. Other well represented materials within the non-locally procured assemblage were Grand Meadow chert, Burlington chert, and Prairie du Chien chert with complete tool to complete flake ratios of 0.39, 0.22, and 0.11 respectively. Within the locally procured raw material assemblage, among the well represented material types, the degree to which retouched tools were produced was the highest for the Red River chert raw material group with a complete tool to compete flake ratio of 0.33. The only other well represented material, again those with 10 or more artifacts contributing to the complete tool-complete flake ratio, was Swan River chert, which exhibited a complete tool to complete flake ratio of 0.19.

Both of the well represented local raw materials, Swan River chert and Red River chert, were considered to be somewhat lower quality raw material types; as designated and discussed in Section 3.4.4. In contrast, three of the four well represented non-local raw materials, Knife River flint, Grand Meadow chert, and Burlington chert, were considered to be high quality raw material types. This observation provided the impetus to test if the difference in degree of retouched tool production by raw material quality was significant.

As a result, a cross-tabulation table was generated based on complete tools against complete flakes by raw material quality (Table 28). A chi-square test was performed to assess if the differences in degree of retouched tool production between the high and low quality raw material assemblages at 21LN2 differed enough statistically to indicate differences in degree of retouched tool production by raw material quality. The null hypothesis stated that any differences with regard to degree of retouched tool production between the local and non-local raw materials were merely a chance occurrence and that there is, in fact, no statistical difference. In other words, the null hypothesis states that the data sets are statistically the same with regard to degree of retouched tool production. The chi-square test performed on the data presented in Table 28 rendered a value of 5.43 (see Table 29). With a degree of freedom of 1, the probability of getting this strength of association between the variables tested when there is actually no true statistical difference is 2.0% (see Table 29). As a result, we can reject the null hypothesis and state with statistical certainty that sampling error or random chance is not responsible for the pattern observed in the data. The test confirms that the degree of retouched tool production for high quality materials is significantly higher than that of low quality materials.

These results suggest that the quality of the raw material was the major deciding factor affecting the degree of retouched tool production by raw material. However, it is likely not a coincidence that the non-locally procured materials tend to be of a higher quality. In most cases, a higher level of effort is required in the procurement of non-local raw materials. As a result, it should be expected that raw materials procured non-locally will exhibit some quality that exceeds those possessed by the locally available raw materials – whether it be material quality, package size, etc. This expectation is met at 21LN2 as a majority of the non-locally procured raw materials are considered to possess properties more conducive to tool shaping than those procured locally. Therefore, based on these data, it is reasonable to infer that the prehistoric inhabitants of 21LN2 relied more heavily upon the higher quality, non-locally procured raw materials for retouched tool production.

TABLE 24. COMPLETE TOOLS PER COMPLETE FLAKES BY RAW MATERIAL TYPE AND PROCUREMENT ORIGIN AT 21LN2

Lithic Raw Material Type by Origin	Complete Biface on Flake Blank	Complete Flake Tool	Complete Flake	Complete Tool/ Complete Flake
Local	**9**	**11**	**107**	**0.19**
BASALTIC ROCK	0	0	7	0.00
KNIFE LAKE SILTSTONE	0	0	2	0.00
LAKE OF THE WOODS RHYOLITE	0	2	1	2.00
LGG - AGATE	0	0	5	0.00
LGG - CHALCEDONY	0	0	2	0.00
LGG - KNIFE RIVER FLINT	0	1	1	1.00
QUARTZ	0	0	4	0.00
RED RIVER CHERT	0	4	12	0.33
SILISIFIED WOOD	0	0	2	0.00
SIOUX QUARTZITE	0	0	1	0.00
SWAN RIVER CHERT	8	4	62	0.19
TONGUE RIVER SILICA	1	0	8	0.13
Non-Local	**4**	**39**	**116**	**0.37**
BIJOU HILLS SIL SED	0	2	2	1.00
BURLINGTON CHERT	1	3	18	0.22
CEDAR VALLEY CHERT	0	0	2	0.00
FUSILINID GROUP CHERT	0	1	3	0.33
GALENA CHERT	0	0	9	0.00
GRAND MEADOW CHERT	0	9	23	0.39
GULSETH SILICA	0	0	2	0.00
HARTVILLE UPLIFT CHERT	0	1	0	N/A
HIXTON GROUP SIL SANDSTONE	0	0	2	0.00
KNIFE RIVER FLINT	1	20	32	0.66
MAYNES CREEK CHERT	0	1	2	0.50
MOLINE CHERT	2	0	1	2.00
PRAIRIE DU CHIEN CHERT	0	2	18	0.11
WAPSIPINICON CHERT	0	0	2	0.00
Unknown	**4**	**7**	**51**	**0.22**
HUDSON BAY LOWLAND CHERT	0	0	2	0.00
INDETERMINATE CHALCEDONY	0	1	5	0.20
INDETERMINATE CHERT	3	6	42	0.21
INDETERMINATE QUARTZITE	0	0	2	0.00
LAKE SUPERIOR AGATE	1	0	0	N/A
Grand Total	**17**	**57**	**274**	**0.27**

TABLE 25. COMPLETE TOOLS PER COMPLETE FLAKES BY RAW MATERIAL TYPE AND MATERIAL QUALITY AT 21LN2

Lithic Raw Material Type by Quality	Complete Biface on Flake Blank	Complete Flake Tool	Complete Flake	Complete Tool/Complete Flake
High Quality	**4**	**35**	**100**	**0.39**
BURLINGTON CHERT	1	3	18	0.22
CEDAR VALLEY CHERT	0	0	2	0.00
FUSILINID GROUP CHERT	0	1	3	0.33
GALENA CHERT	0	0	9	0.00
GRAND MEADOW CHERT	0	9	23	0.39
GULSETH SILICA	0	0	2	0.00
HARTVILLE UPLIFT CHERT	0	1	0	N/A
HIXTON GROUP SIL SANDSTONE	0	0	2	0.00
HUDSON BAY LOWLAND CHERT	0	0	2	0.00
KNIFE RIVER FLINT	1	20	32	0.66
MAYNES CREEK CHERT	0	1	2	0.50
MOLINE CHERT	2	0	1	2.00
SILISIFIED WOOD	0	0	2	0.00
WAPSIPINICON CHERT	0	0	2	0.00
Low Quality	**10**	**15**	**125**	**0.20**
BASALTIC ROCK	0	0	7	0.00
BIJOU HILLS SIL SED	0	2	2	1.00
KNIFE LAKE SILTSTONE	0	0	2	0.00
LAKE OF THE WOODS RHYOLITE	0	2	1	2.00
LAKE SUPERIOR AGATE	1	0	0	N/A
LGG - AGATE	0	0	5	0.00
LGG - CHALCEDONY	0	0	2	0.00
LGG - KNIFE RIVER FLINT	0	1	1	1.00
PRAIRIE DU CHIEN CHERT	0	2	18	0.11
QUARTZ	0	0	4	0.00
RED RIVER CHERT	0	4	12	0.33
SIOUX QUARTZITE	0	0	1	0.00
SWAN RIVER CHERT	8	4	62	0.19
TONGUE RIVER SILICA	1	0	8	0.13
Indeterminate Quality	**3**	**7**	**49**	**0.20**
INDETERMINATE CHALCEDONY	0	1	5	0.20
INDETERMINATE CHERT	3	6	42	0.21
INDETERMINATE QUARTZITE	0	0	2	0.00
Grand Total	**17**	**57**	**274**	**0.27**

TABLE 26. CROSS-TABULATION TABLE OF COMPLETE TOOLS PER COMPLETE FLAKES BY RAW MATERIAL ORIGIN AT 21LN2

Actual Values	**Complete Tools**	**Complete Flakes**	**Grand Total**
Local Materials	20	107	**127**
Non-Local Materials	43	116	**159**
Grand Total	**63**	**223**	**286**
Expected Values	**Complete Tools**	**Complete Flakes**	**Grand Total**
Local Materials	27.97552448	99.02447552	**127**
Non-Local Materials	35.02447552	123.9755245	**159**
Grand Total	**63**	**223**	**286**

TABLE 27. CHI-SQUARE TEST OF COMPLETE TOOLS PER COMPLETE FLAKES BY RAW MATERIAL ORIGIN AT 21LN2

Probability	0.022006132
Chi Square Value	5.245300164
Degree of Freedom	1
Critical Value	5.024

TABLE 28. CROSS-TABULATION TABLE OF COMPLETE TOOLS PER COMPLETE FLAKES BY RAW MATERIAL QUALITY AT 21LN2

Actual Values	**Complete Tool**	**Complete Flake**	**Grand Total**
High Quality	39	100	**139**
Low Quality	25	125	**150**
Grand Total	**64**	**225**	**289**
Expected Values	**Complete Tool**	**Complete Flake**	**Grand Total**
High Quality	30.78200692	108.2179931	**139**
Low Quality	33.21799308	116.7820069	**150**
Grand Total	**64**	**225**	**289**

TABLE 29. CHI-SQUARE TEST OF COMPLETE TOOLS PER COMPLETE FLAKES BY RAW MATERIAL QUALITY AT 21LN2

Probability	0.019799818
Chi Square Value	5.429458517
Degree of Freedom	1
Critical Value	5.024

3.4.6 Retouch Intensity

Tool retouch intensity by raw material was assessed through the application of the following indices: Kuhn's (1990) Index of Reduction (IR) and Clarkson's (2002) Index of Invasiveness (II). Kuhn's IR is best suited for assessing the degree of exhaustion of worked tool edges. The IR measures the ratio between tool edge and dorsal ridge to quantify the degree to which the edge has been reduced and thus the level of edge exhaustion. This method is best applied to scrapers exhibiting a worked edge on the dorsal side that parallels the dorsal ridge. This method was applied to applicable tools (n=40) of the 21LN2 assemblage. The results are presented in Table 30 by raw material procurement provenience and Table 31 by raw material quality.

TABLE 30. KUHN'S INDEX OF REDUCTION VALUES FOR THE RAW MATERIALS AT 21LN2 BY PROCUREMENT ORIGIN

Lithic Raw Material Type by Procurement Origin	Count	Mean	Standard Deviation
Local	**9**	**0.4535556**	**0.1530842**
LAKE OF THE WOODS RHYOLITE	2	0.4580000	0.1230366
LGG - KNIFE RIVER FLINT	1	0.6510000	N/A
RED RIVER CHERT	1	0.4800000	N/A
SWAN RIVER CHERT	5	0.4070000	0.1744850
Non-Local	**29**	**0.6279401**	**0.2470539**
BIJOU HILLS SIL SED	2	0.4435000	0.0162635
CEDAR VALLEY CHERT	1	0.3480000	N/A
GRAND MEADOW CHERT	9	0.5930000	0.2361890
GULSETH SILICA	1	0.5270000	N/A
HARTVILLE UPLIFT CHERT	1	0.9800000	N/A
KNIFE RIVER FLINT	11	0.7080909	0.2221204
PRAIRIE DU CHIEN CHERT	2	0.5391319	0.4594329
WAPSIPINICON CHERT	2	0.6320000	0.4242641
Unknown	**2**	**0.7335000**	**0.3146625**
HUDSON BAY LOWLAND CHERT	1	0.9560000	N/A
INDETERMINATE CHERT	1	0.5110000	N/A
Grand Total	**40**	**0.5939816**	**0.2399432**

TABLE 31. KUHN'S INDEX OF REDUCTION VALUES FOR THE RAW MATERIALS AT 21LN2 BY MATERIAL QUALITY

Lithic Raw Material Type by Quality	Count	Mean	Standard Deviation
High Quality	**25**	**0.6498000**	**0.2416866**
CEDAR VALLEY CHERT	1	0.3480000	N/A
GRAND MEADOW CHERT	9	0.5930000	0.2361890
GULSETH SILICA	1	0.5270000	N/A
HARTVILLE UPLIFT CHERT	1	0.9800000	N/A
KNIFE RIVER FLINT	11	0.7080909	0.2221204
WAPSIPINICON CHERT	2	0.6320000	0.4242641
Low Quality	**13**	**0.4651741**	**0.1852735**
BIJOU HILLS SIL SED	2	0.4435000	0.0162635
LAKE OF THE WOODS RHYOLITE	2	0.4580000	0.1230366
LGG - KNIFE RIVER FLINT	1	0.6510000	N/A
PRAIRIE DU CHIEN CHERT	2	0.5391319	0.4594329
RED RIVER CHERT	1	0.4800000	N/A
SWAN RIVER CHERT	5	0.4070000	0.1744850
Grand Total	**38**	**0.5866385**	**0.2385397**

Kuhn's IR produces values ranging from zero to one. The greater the value, the greater the degree of edge exhaustion exhibited by the tool. Raw material types with mean values above 0.5 included Grand Meadow chert, Gulseth silica, Hartville Uplift chert, Hudson Bay Lowland chert, Knife River flint, LGG- Prairie du Chien chert, and Wapsinicon chert (Tables 30 and 31). Among material types rendering two or more applicable tools, those exhibiting the highest IR values were Knife River flint (v=0.71), Wapsipinicon chert (v=0.63), and Grand Meadow chert (v=0.59). A majority of these raw material types represent the non-locally procured assemblage. Overall, tools of the non-locally procured raw material assemblage appear to exhibit a greater degree of edge exhaustion (v=0.63) than those of the locally procured raw material assemblage (v=0.45). Similarly, the tools made of high quality raw materials appear to exhibit a greater degree of edge exhaustion (v=0.65) than those made of low quality raw materials (v=0.47).

A t-test was performed to assess if the differences in the Kuhn's IR values between the tools of the locally and non-locally procured raw material assemblages at 21LN2 differed enough statistically to indicate that the edges of the two tool assemblages were exhausted differentially. The null hypothesis stated that that any differences between the IR of the tools of the locally and non-locally procured raw material assemblages were merely a chance occurrence and that there is, in fact, no statistical difference in the two sets of tools with regard to edge exhaustion. In other words, the null hypothesis states that the two tool sets are statistically the same with regard to this measure of retouch intensity.

The mean and standard deviation of the IR for each of the two tool sets are reported in Table 32 below. The t-test produced a value of 1.995 (Table 32). With a degree of freedom of 36, the probability of getting this strength of association between the variables tested when there is actually no true statistical difference is 5.41%. As a result, we cannot reject the null hypothesis and must accept with statistical certainty that sampling error or random chance may be responsible for the pattern observed in the data. Therefore, regarding edge exhaustion exhibited on tools at 21LN2, there is no statistical difference between the tools of the locally procured material assemblage with a mean IR value of 0.45 and a standard deviation of 0.15 and the non-locally procured material assemblage with a mean IR value of 0.63 and a standard deviation of 0.25. In other words, though the data appear to suggest that the tools of the non-locally procured material assemblage exhibit a higher IR value, which would suggest a greater degree of edge exhaustion prior to discard, statistically (at a 95% confidence interval) the two tool groups do not differ in any meaningful manner with regard to edge exhaustion.

A t-test was also performed to assess if the differences in the Kuhn's IR values between the tools of the high and low quality raw material assemblages at 21LN2 differed enough statistically to indicate that the edges of the two tool assemblages were exhausted differentially. The null hypothesis stated that any differences between the IR of the tools of the high and low quality raw material assemblages were merely a chance occurrence and that there is, in fact, no statistical difference in the two sets of tools with regard to edge exhaustion. In other words, the null hypothesis states that the two tool sets are statistically the same with regard to this measure of retouch intensity.

The mean and standard deviation of the IR for each of the two tool sets are reported in Table 33 below. The t-test produced a value of 2.41 (Table 33). With a degree of freedom of 36, the probability of getting this strength of association between the variables tested when there is actually no true statistical difference is 2.14%. As a result, we can reject the null hypothesis and say with statistical certainty that sampling error or random chance is not responsible for the pattern observed in the data.

Therefore, as the data indicates, the tools of the high quality raw material assemblage with a mean IR value of 0.65 and a standard deviation of 0.24 exhibits a greater degree of edge exhaustion than the tools made of the low quality raw material assemblage with a mean IR value of 0.47 and a standard deviation of 0.19. This data suggests that the retouched tools made of high quality raw materials were more extensively exhausted prior to discard.

TABLE 32. T-TEST OF KUHN'S INDEX OF REDUCTION BETWEEN LOCAL AND NON-LOCAL ASSEMBLAGE TOOLS AT 21LN2

T-Test of Kuhn's IR between Local and Non-Local, df=36	
Probability	0.054089884
T-Value	1.995157733
Local (n=9)	
MEAN	0.453555556
STDEV	0.153084218
Non-Local (n=29)	
MEAN	0.627940128
STDEV	0.2470539

TABLE 33. T-TEST OF KUHN'S INDEX OF REDUCTION BETWEEN HIGH QUALITY AND LOW QUALITY RAW MATERIAL ASSEMBLAGE TOOLS AT 21LN2

T-Test of Kuhn's IR between High and Low Quality Materials, df=36	
Probability	0.021415725
T-Value	2.405455875
High Quality (n=25)	
MEAN	0.6498
STDEV	0.241686608
Low Quality (n=13)	
MEAN	0.465174131
STDEV	0.185273514

Clarkson’s II is best suited for assessing the degree of scar invasiveness exhibited on retouched tools. This value can be helpful when assessing gradual increases of retouch over time on a given tool. This method of assessment is unaffected by the original morphology of the blank (i.e., flat or reversal shaped blanks) and is not dependent upon knowing the initial edge morphology or greatest medial thickness of the original blank, but rather assesses the degree of retouch based on the tool’s extant surface area. This method was applied to applicable tools (n=55) of the 21LN2 assemblage. The results are presented in Table 34 by raw material procurement provenience and in Table 35 by raw material quality.

Similar to Kuhn’s IR, Clarkson’s II produces values ranging from zero to one. The greater the value, the greater the degree of scar invasiveness exhibited by the tool. Prairie du Chien chert was the only raw material type to exhibit a mean II value above 0.5. Raw materials with II values of greater than 0.2 included Burlington chert, Fusilinid Group chert, Grand Meadow chert, Hartville Uplift chert, and Knife River flint (Tables 34 and 35). All of these raw material types, including the Prairie du Chien chert, represent the non-locally procured assemblage. Overall, tools of the non-locally procured raw material

TABLE 34. CLARKSON'S INDEX OF INVASIVENESS VALUES FOR THE RAW MATERIALS AT 21LN2 BY PROCUREMENT ORIGIN

Raw Material Type by Procurement Origin	Count	Mean	Standard Deviation
Local	**10**	**0.1040000**	**0.0516828**
LAKE OF THE WOODS RHYOLITE	2	0.1250000	0.0494975
LGG - KNIFE RIVER FLINT	1	0.0600000	N/A
RED RIVER CHERT	3	0.0633333	0.0577350
SWAN RIVER CHERT	4	0.1350000	0.0331662
Non-Local	**38**	**0.2384211**	**0.1640126**
BIJOU HILLS SIL SED	2	0.0600000	0.0424264
BURLINGTON CHERT	3	0.2633333	0.1106044
FUSILINID GROUP CHERT	1	0.4400000	N/A
GRAND MEADOW CHERT	9	0.2122222	0.1551433
HARTVILLE UPLIFT CHERT	1	0.2500000	N/A
KNIFE RIVER FLINT	19	0.2294737	0.1531330
MAYNES CREEK CHERT	1	0.0900000	N/A
PRAIRIE DU CHIEN CHERT	2	0.5500000	0.1555635
Unknown	**7**	**0.4200000**	**0.1842100**
INDETERMINATE CHALCEDONY	1	0.2500000	N/A
INDETERMINATE CHERT	6	0.4483333	0.1843276
Grand Total	**55**	**0.2370909**	**0.1739697**

TABLE 35. CLARKSON'S INDEX OF INVASIVENESS VALUES FOR THE RAW MATERIALS AT 21LN2 BY MATERIAL QUALITY

Lithic Raw Material by Material Quality	Count	Mean	Standard Deviation
High	**34**	**0.2305882**	**0.1466172**
BURLINGTON CHERT	3	0.2633333	0.1106044
FUSILINID GROUP CHERT	1	0.4400000	N/A
GRAND MEADOW CHERT	9	0.2122222	0.1551433
HARTVILLE UPLIFT CHERT	1	0.2500000	N/A
KNIFE RIVER FLINT	19	0.2294737	0.1531330
MAYNES CREEK CHERT	1	0.0900000	N/A
Low	**14**	**0.1614286**	**0.1766290**
BIJOU HILLS SIL SED	2	0.0600000	0.0424264
LAKE OF THE WOODS RHYOLITE	2	0.1250000	0.0494975
LGG - KNIFE RIVER FLINT	1	0.0600000	N/A
PRAIRIE DU CHIEN CHERT	2	0.5500000	0.1555635
RED RIVER CHERT	3	0.0633333	0.0577350
SWAN RIVER CHERT	4	0.1350000	0.0331662
Grand Total	**48**	**0.2104167**	**0.1572633**

assemblage appear to exhibit a greater degree of scar invasiveness (v=0.24) than those of the locally procured raw material assemblage (v=0.10). Similarly, the tools made of high quality raw materials appear to exhibit a greater degree of scar invasiveness (v=0.23) than those made of low quality raw materials (v=0.16).

A t-test was performed to assess if the observed differences in the Clarkson's II values between the tools of the high and low quality raw material assemblages at 21LN2 differed enough statistically to indicate that there is a significant difference in the degree of scar invasiveness between the two tool assemblages. The null hypothesis stated that that any differences between the II of the tools of the high and low quality raw material assemblages were merely a chance occurrence and that there is, in fact, no statistical difference in the two sets of tools with regard to scar invasiveness. In other words, the null hypothesis states that the two tool sets are statistically the same with regard to this measure of retouch intensity.

The mean and standard deviation of the II for each of the two tool sets are reported in Table 36 below. The t-test produced a value of 1.40 (Table 36). With a degree of freedom of 46, the probability of getting this strength of association between the variables tested when there is actually no true statistical difference is 16.86%. As a result, we cannot reject the null hypothesis and must accept with statistical certainty that sampling error or random chance may be responsible for the pattern observed in the data. Therefore, regarding scar invasiveness exhibited on tools at 21LN2, there is no statistical difference between the tools of the high quality raw material assemblage with a mean II value of 0.23 and a standard deviation of 0.15 and the low quality raw material assemblage with a mean II value of 0.16 and a standard deviation of 0.18. In other words, though the data appear to suggest that the tools of the non-locally procured material assemblage exhibit a higher II value, which would suggest a greater degree of retouch prior to discard, statistically (at a 95% confidence interval) the two tool groups do not differ in any meaningful manner with regard to scar invasiveness.

Table 36. T-Test of Clarkson's Index of Invasiveness between High Quality and Low Quality Raw Material Assemblage Tools at 21LN2

T-Test of Clarkson's Ind of Inv between High and Low Quality Material, df=46	
Probability	0.168551202
T-Value	1.398894843
High Quality Material (n=34)	
MEAN	0.230588235
STDEV	0.146617234
Low Quality Material (n=14)	
MEAN	0.161428571
STDEV	0.176628996

Table 37. T-Test of Clarkson's Index of Invasiveness between Local and Non-Local Assemblage Tools at 21LN2

T-Test of Clarkson's II between Local and Non-Local Procurement Origin, df=46	
Probability	0.014501036
T-Value	2.763026511
Locally Procured Materials (n=10)	
MEAN	0.104
STDEV	0.051682793
Non-Locally Procured Materials (n=38)	
MEAN	0.238421053
STDEV	0.164012628

A t-test was performed to assess if the observed differences in the Clarkson’s II values between the tools of the locally and non-locally procured raw material assemblages at 21LN2 differed enough statistically to indicate that there is a significant difference in the degree of scar invasiveness between the two tool assemblages. The null hypothesis stated that any differences between the II of the tools of the locally and non-locally procured raw material assemblages were merely a chance occurrence and that there is, in fact, no statistical difference in the two sets of tools with regard to scar invasiveness. In other words, the null hypothesis states that the two tool sets are statistically the same with regard to this measure of retouch intensity.

The mean and standard deviation of the II for each of the two tool sets are reported in Table 37 below. The t-test produced a value of 2.76 (Table 37). With a degree of freedom of 46, the probability of getting this strength of association between the variables tested when there is actually no true statistical difference is 1.45%. As a result, we can reject the null hypothesis and say with statistical certainty that sampling error or random chance is not responsible for the pattern observed in the data.

Therefore, as the data indicates, the tools of the non-locally procured raw material assemblage with a mean II value of 0.24 and a standard deviation of 0.16 exhibits a greater degree of scar invasiveness than the tools of the locally procured raw material assemblage with a mean II value of 0.10 and a standard deviation of 0.05. This data suggests that the retouched tools made of non-locally procured raw materials were more intensively retouched prior to discard.

3.5 DISCUSSION

The results of the lithic raw material utilization analysis demonstrate that the prehistoric inhabitants of 21LN2 relied heavily upon both local and non-local lithic raw materials. The non-local lithic assemblage indicates that the inhabitants of the site enjoyed a far reaching sphere of interaction with connections through trade, travel, and/or seasonal migration to the west, east, south, and likely also to the north. The data suggest that the prehistoric inhabitants of 21LN2 had stronger connections to the east or that the inhabitants had greater accessibility to these resources through trade or travel compared to those hailing from the west. The fact that several of the eastern hailing source areas are closer than those to the west may also have played a factor. These data may also reflect the fact that there were simply more known resources to be exploited to the east or that the manner in which the eastern materials presented themselves were more favorable for exploitation. In other words, many eastern materials can be found concentrated within bedded formations or concentrated in nearby secondary lag deposits associated with drainages. Whereas many western materials are scattered, sometimes quite sparsely, within drainages and over the landscape (i.e., silicified wood, agate, and chalcedony). This could have influenced the procurement strategies of the prehistoric inhabitants of 21LN2 resulting in the data presented. It should also be noted that the manner in which western raw materials present themselves suggests higher material diversity and variability. As a result, more lithic raw materials coming from western procurement proveniences may not be as recognizable to archaeologists as their eastern counterparts; and therefore, are more likely to be designated as indeterminate raw materials types, thus further skewing the data. Regardless, the prehistoric inhabitants of 21LN2 appear to have had strong connections to the east and west and to a lesser extent, the south. Unfortunately, due to glaciation, connections to the north are difficult to assess in southern Minnesota with regard to lithic raw material procurement patterns.

Swan River chert, a locally procured material, is the most well represented material type at 21LN2, which conforms well to the Law of Least Effort. Yet, if the Law of Least Effort was truly in play it would be expected that count and mass values of the raw material types present at the site would decrease in direct correlation to the distance of the material procurement origin. However, this is not observed in the 21LN2 chipped-stone assemblage. In fact, the second most heavily represented raw material, Knife River flint, has one of the most distant procurement origins of the raw materials represented at the site. Additionally, Burlington chert, Grand Meadow chert, and Prairie du Chien chert are also more heavily represented at the site than the locally procured materials, with exception of course to Swan River chert. The simplest explanation of this divergence from the Law of Least Effort is likely found in the quality, or lack thereof, of the locally available tool stone.

The lithic assemblage also diverges from Andrefsky's (1994b:29-30) predictions regarding a relationship between quality and abundance of lithic raw material and the kinds of tools produced of those materials. Low quality materials of local and non-local procurement origin are expected to be used primarily for expedient tool production. Non-locally procured materials of high quality are expected to be used primarily for formal tool production and high quality materials of local procurement origin are expected yield both formal and expedient tool forms. The data indicate that this was not the case at 21LN2. In fact, the high quality non-locally procured materials appear to have been used primarily for expedient tool manufacture and the ratio for formal tools to expedient tools is higher for the non-local low quality assemblage (r=88.9) than it is for the non-local high quality assemblage (r=45.1). Meanwhile, with regard to low quality materials of local procurement origin, 59.0% (n=36) of the tools are formal and 41.0% (n=25) are expedient.

A consideration that should be explored concerning non-locally available materials is the fact that extensive trade networks may have provided some or all of these raw materials to such an extent as to make their level of procurement effort and cost nearly equal to that of locally available material. A modern day analogy can be found in the availability and cost of oranges and apples in the Midwest. Though oranges are a non-locally procured fruit type and apples a locally procured fruit type, they are generally of equal accessibility and cost due to the extensive trade networks that are enjoyed by Americans living in the Midwest. Perhaps interaction through trade had become adequately extensive during the Woodland and Late Prehistoric Periods to allow for non-locally procured lithic raw materials to be accessible and cost effective to the extent they could be treated as locally procured materials. Another explanation may lie in the intended reduction and subsequent utilization of these raw materials. For example, a material might be primarily intended for formal bifacial tool production, yet the many waste flakes rendered from the main reduction goal may be utilized as expedient tools. This behavior seems reasonable with regard to highly prized material types. The many factors used to determine the worth and quality of a raw material must also be considered. One particular material might be of low flaking quality, but of exceptional strength making it an excellent material for extensive scraping activities with little to no need of retouch. Another material might exhibit excellent flaking quality conducive to the bifacial production of projectile points, however is not hard enough to render durable scrapers. Yet another material might not be highly durable or exhibit good flaking quality, but the material's coloration might be considered unique or significant to the manufacturer. In other words, there are likely more complex factors influencing tool manufacture by raw material than a simple relationship between stone quality and availability.

An examination of artifact class by raw material and percent cortex by raw material indicates that overall the non-locally procured raw materials tend to exhibit a higher degree of curation as defined by Conard and Adler (1997). This is particularly evident in the degree of corticality by raw material type, which appeared to be significantly higher among the locally procured materials identified at 21LN2. A chi-square test confirmed that the complete flakes and tools within the local raw material assemblage exhibit a statistically significant higher degree of corticality ($X^2=16.852$; df=1; $p<0.0001$) than those of the non-local raw material assemblage.

MANA was employed as a way to refine inferences with regard to the lithic raw material procurement and utilization behavior exhibited at 21LN2. Three constituent-based MAN types were assigned in this study. Type A nodules consist solely of a tool(s) and represent before-site curation, potential on-site maintenance, and on-site discard. Type B nodules consist of debitage and a tool(s) and represent on-site manufacture, potential on-site maintenance, and on-site discard. Type C nodules consist solely of debitage and represent on-site production and off-site discard. The heterogeneous raw material assemblage was separated into 276 analytical nodules. A majority of these 276 nodules (p=73.6; n=203) represent on-site tool manufacture followed by curation off-site. Only 7.6% (n=21) represent on-site tool manufacture and discard meanwhile 18.8% (n=52) represent the curation of a completed tool onto the site and its subsequent on-site discard. These data appear to indicate that 21LN2 was largely being used as a retooling location. The majority of nodules represent on-site manufacture followed by curation off-site which suggests lithic reduction occurring at 21LN2 concentrated on the manufacture of lithic tools for curation off-site. Nearly one out of five nodules represent the curation of a completed tool onto the site and its subsequent on-site discard, further suggesting that that the manufacture and subsequent curation of new tools off-site was part of a retooling strategy. There is no significant difference in the analytical nodule representation by raw material procurement origin ($X^2=0.929$; df=2; p=0.629). However, this statistical result may be skewed as three of the best represented non-locally procured raw materials (Knife River flint, Burlington chert, and Grand Meadow chert) identified at the site appeared to be too homogenous in nature to be conducive to MANA. That being said, the initial results of the blind test, presented in Chapter 2, appear to indicate that Grand Meadow chert and some varieties of Burlington chert may be conducive to such analysis.

Henry's (1989:141) method was employed to assess the reduction efficiency of the assemblage by raw material type. The results suggest that Burlington chert and Swan River chert were among the least efficiently reduced raw materials identified at 21LN2. It was somewhat expected to find that Swan River chert was not efficiently reduced as it was a highly available local resource for the prehistoric inhabitants of 21LN2; however, it is rather surprising to see how inefficiently the very high quality, non-locally procured Burlington chert was reduced at the site. This may indicate that Burlington chert was readily available through trade or some other form of interaction. It may also suggest that other materials were more highly prized than Burlington chert despite its extraordinarily high quality. Perhaps the intended use of the desired tools produced at 21LN2 favored a material strength or durability that Burlington chert did not provide. The data indicate that Bijou Hills Silicified Sediment, Lake of the Woods Rhyolite, LLG-Knife River flint, Maynes Creek chert, Moline chert, and Tongue River silica were the most efficiently reduced raw materials identified at 21LN2. This level of reduction efficiency was not unexpected for the non-locally procured raw material types (Bijou Hills Silicified Sediment, Maynes Creek chert, and Moline chert) considering the level of effort involved in their procurement. However, it was unexpected to find this level of reduction efficiency with regard to the lower quality, locally procured materials (Lake of the Woods Rhyolite, LLG-Knife River flint, and Tongue River silica). Grand Meadow chert, Knife River flint, Prairie du Chien chert, and Red River chert also exhibited a high to moderately high level of reduction efficiency.

Reduction type was also assessed for the assemblage by raw material type. The results indicate that a nearly 80% of the LGG materials flakes are bipolar flakes. Bipolar reduction was likely necessary due to the small package size of these glacial pebbles. This type of reduction allowed the prehistoric inhabitants of 21LN2 to generate flakes for expedient tool use or secondary retouch from these small glacial pebbles where other forms of reduction would have failed. Bipolar reduction does not seem to have been particularly important within other raw material type or group assemblages. When considering the percentage of bifacial thinning flakes to overall flakes by raw material and number of bifacial thinning flakes by raw material type it appears that bifacial tool production at the site focused on three main materials types: Knife River flint (n=16/p=20.8), Burlington chert (n=7/p=17.1), and Grand Meadow chert (n=6/p=14.6). Bifacial tools are often considered formal tools or tools which require a higher degree of manufacture effort. Therefore, it seems logical that bifacial reduction at 21LN2 seemed to focus largely on Knife River flint, Burlington chert, and Grand Meadow chert, which are all considered high quality raw materials of non-local origin.

Regarding retouched tool production, the non-locally procured assemblage exhibited a significantly higher (X^2=5.245; df=1; p<0.025) complete tool to complete flake ratio (r=0.37; n=159) as compared to the locally procured assemblage (r=0.19; n=127). Similarly, the high quality material assemblage exhibited a significantly higher (X^2=5.429; df=1; p<0.020) complete tool to complete flake ratio (r=0.39; n=139) as compared to the low quality material assemblage (r=0.20; n=150). These results suggest that the quality of the raw material was the major deciding factor affecting the degree of retouched tool production by raw material. However, it is likely not a coincidence that the non-locally procured materials tend to be of a higher quality. In most cases, a higher level of effort is required in the procurement of non-local raw materials. As a result, it should be expected that raw materials procured non-locally will exhibit some quality that exceeds those possessed by the locally available raw materials – whether it be material quality, package size, etc. This expectation is met at 21LN2 as a majority of the non-locally procured raw materials are considered to possess properties more conducive to tool shaping than those procured locally. Therefore, based on these data, it is reasonable to infer that the prehistoric inhabitants of 21LN2 relied more heavily upon the higher quality, non-locally procured raw materials for retouched tool production.

Among the non-locally procured materials, the highest quality materials are Knife River flint and Burlington chert. It is interesting to note that the complete tool to complete flake ratio exhibited by Knife River flint (r=0.66; n=53) is considerably higher than that of Burlington chert (r=0.22 n=22). This corresponds well with the reduction efficiency data that suggest Knife River flint was more efficiently reduced that Burlington chert. Though both of these materials were highly prized resources during the prehistoric period within this region, this data suggests that Knife River flint was more highly prized by the prehistoric inhabitants of 21LN2 than Burlington chert.

Retouch intensity was assessed for the assemblage by raw material type through the application of Kuhn's (1990) IR and Clarkson's (2002) II. The results of the study demonstrate that the side scrapers (or retouched flake tools exhibiting a worked dorsal edge that parallels the dorsal ridge) within the high quality material assemblage exhibit a significantly higher (*t*=2.405; p=.02) IR value (M=0.650; SD=0.242; n=25) than the retouched tools within the low quality material assemblage (M=0.465; SD=0.185; n=13). These data indicate that the retouched tools of the high quality raw material assemblage incurred a significantly greater amount of edge exhaustion prior to discard than the retouched tools of the low quality raw material assemblage.

Calculations derived from the application of Clarkson's II indicate that the tools of the non-locally procured raw material assemblage (M=0.238; SD=0.164; n=38) exhibit a significantly greater degree of scar invasiveness (*t*=2.763; p=.01) than the tools of the locally procured raw material assemblage (M=0.104; SD=0.052; n=10). This data suggests that the retouched tools made of non-locally procured raw materials were more intensively retouched prior to discard than those of the locally procured raw materials.

4.0 SUMMARY, CONCLUSIONS, AND FUTURE STUDIES

The objective of this study was two-fold; one, test the limitations of macroscopic lithic raw material identification and parent nodule assignment with regard to materials commonly identified within prehistoric contexts in Minnesota; and two, assess the lithic raw material utilization at 21LN2.

The pursuit of these research goals was attempted through two separate but connected studies. The primary study sought to integrate MANA into a lithic raw material utilization analysis – something that had not previously been attempted upon a lithic assemblage identified in Minnesota. The secondary study assessed the limitations of traditional macroscopic lithic raw material identification and differentiation as well as parent nodule assignment among materials commonly found within archaeological contexts in Minnesota. The secondary study spawned from the primary study as questions were raised regarding the ambiguity of lithic raw material identification and the designation of minimum analytical nodules. The two studies were carried out simultaneously due to time constraints.

The initial results of the secondary study indicate that macroscopic observation can be an effective method with regard to differentiating and identifying lithic raw material types commonly encountered at archaeological sites in Minnesota. In fact, 93.27% of the samples (n=402 of 431) were correctly identified with regard to specific raw material type and the overall rate of success increased to 95.98% (n=358 of 373) when identifications designated as confidence level 3 were removed. The diagnosis of thermal alteration or heat-treatment was not as successful overall as the raw material identification, with only 72.62% (n=313 of 431) of the samples diagnosed correctly. The percentage of success was not improved (72.54% [n=140 of 193]) when diagnoses designated as confidence level 3 were removed. The initial results suggest that additional methods for recognizing thermal alteration may need to be cultivated and put to use if interpretations regarding heat-treatment are to be accurately developed. The correct assignment of individual samples to parent nodules was far more successful than anticipated with 83.29% (n=359 of 431) of the samples assigned to the correct parent nodule. The overall percentage of success increased to 86.29% (n=258 of 299) when assignments designated as confidence level 3 were removed. On the whole, the initial results suggest that MANA should be quite applicable to most lithic assemblages identified at archaeological sites in Minnesota. The results also provide an initial indication as to which material types should be excluded when conducting such analysis. Data derived from the results of additional test subjects should be added to these initial results to better inform the limitations of macroscopic analysis with regard to raw material identification, recognition of thermal alteration, and parent nodule assignment.

The results of the primary study demonstrate that the prehistoric inhabitants of 21LN2 relied heavily upon local and non-local lithic resources. These people operated within a sphere of interaction covering a vast area of land approaching a remarkable 700 miles in diameter. The Law of Least Effort does not appear to adequately describe the procurement pattern found at 21LN2, as four of the five best represented material types hale from non-local proveniences. Non-locally procured raw materials tend to exhibit a higher degree of curation. This is particularly evident in the degree of corticality by raw material type, which is significantly higher among the locally procured materials identified at 21LN2. Retooling appears to have been an important aspect of the lithic industry at the site. Nearly 20% of the analytical nodules represent curation of a completed tool onto the site and its subsequent on-site discard, while nearly 75% of the analytical nodules represent the on-site manufacture of a tool and its subsequent curation off-site. High quality raw materials of non-local provenience origin were, in general, reduced more efficiently and retouched with greater intensity than other materials identified at the site.

The results of the lithic raw material utilization study at 21LN2 would have been more powerful had the site assemblage demonstrated evidence of cultural stratigraphy, in which case comparisons between different cultural periods could have been made. Large, multi-component sites such as 21LN2 are often coveted as great databanks for understanding how lithic raw material utilization, and cultural patterns in general, change through time. Unfortunately, it is quite common for archaeological sites in Minnesota to experience moderate to high levels of bioturbation due to large numbers of burrowing species and the growth of tree roots. As a result, it is often difficult to accurately distinguish the differing components of such multi-component sites. In future studies, it may be advantageous for archaeologists to focus on single component sites, selecting several sites from each major cultural period within a specific region. This approach may allow archaeologists to derive more refined interpretations of lithic raw material usage through time in regions where bioturbation is rampant.

Future studies could also focus on the continued quantification of the limits of lithic raw material identification, parent nodule assignment, and recognition of thermal alteration, as well as assessment of capture rates for debitage associated with differing lithic reduction and retouch sequences via standard archaeological collection methods (i.e., 1/4” and 1/8” mesh dry screening, 1/16” mesh water screening, heavy fraction flotation, etc.). To this end, two future studies are proposed. The first proposed study calls for an expansion of the blind test presented in Chapter 2 of this thesis and would be comprised of several different assessments. The second proposed study would seek to accomplish two goals; one, create experimental assemblages providing expected material remains for differing reduction sequences per differing raw material types; and two, assess what portions of each reduction sequence are likely to be omitted from collected lithic assemblages based on the employed collection methods.

Expansion of the Blind Test

The expansion of the blind test should incorporate smaller size grades and additional, less commonly identified, raw materials. It should also explore other methods of differentiating raw materials and nodules of the same materials beyond macroscopic observation, such as microscopy, spectroscopy, and trace element analysis. Finally, the expansion of the blind test should also seek to assess the degree with which different flake types (i.e., bipolar, bifacial thinning, pressure, etc.) can be differentiated and identified correctly. The ability to accurately recognize flake types allows for the presence of associated reduction methods to be correctly diagnosed. It would be helpful to understand how well these flakes types can be differentiated by lithic analysts and where overlap may occur causing incorrect interpretations. The incorporation of different size grades would allow for the blind test to not only assess the archaeologists' ability to differentiate between the differing raw material groups and nodules within the raw material groups, but also to assess how the size of the artifact affects the accuracy of such designations. The inclusion of additional raw materials, particularly those which may not be commonly identified at Minnesota's archaeological sites, but closely resemble commonly identified materials, would be beneficial in assessing how accurately archaeologists can ferret out infrequently identified look-a-likes from their more commonly identified counterparts. The results could indicate that current raw material assessments should be revisited with greater scrutiny concentrated on materials with similar, hard to differentiate, counterparts. This would be especially true if the counterpart materials are within the same geographic range as other materials found at the assessed site. Finally, the use of methods beyond macroscopic observation should be explored to find methods to enhance raw material identification and differentiation by parent nodule.

A Test of Baumler and Davis (2004)

This study would consist of four evolutions, each comprised of lithic samples representing increasingly smaller size grades. Each evolution would be structured in exactly the same manner as discussed in the methods section of Chapter 2. Samples across all four evolutions would be derived from the same parent nodules and would be represented in the same frequencies. The single differentiating factor between the four evolutions would be the size grade of the lithic samples used in each evolution. The size grades utilized in each evolution would relate to different mesh sizes commonly used to assign lithic artifacts to size grades (Table 38). The size grades used in evolutions 1 and 2 (>1/2" [>1.80 cm] and <1/2" to >1/4" [1.80 cm to 0.90 cm]) are representative of the general size grade minimum cutoff (1 cm to 2 cm) most commonly used by lithic analysts when identifying raw material types and applying the MANA technique (Larson and Kornfeld 1997:7; Hall 2004:148). Baumler and Davis (2004:49-54), however, advocate the use of ‘small-sized’ debitage (represented in evolutions 3 and 4 [<1/4” to >1/16”]) when conducting raw material analysis and applying MANA.

TABLE 38. SIZE GRADES BY EVOLUTION

Evolution	Size Grade (mesh size)	Debris Size (based on mesh size hypotenuse)
1	>1/2”	> 1.80 cm
2	<1/2" - > 1/4"	< 1.80 cm - > 0.90 cm
3	<1/4" - > 1/8"	< 0.90 cm - > 0.45 cm
4	<1/8" - > 1/16"	< 0.45 cm - > 0.225 cm

A test such as this would certainly provide informative data regarding the limitations of lithic raw material identification and parent nodule assignment by sample size grade. Such data would certainly enhance the design of future raw material studies in the region.

A Closer Look at Raw Materials Not Commonly Identified in Minnesota

This study would focus on those materials that are somewhat similar to commonly identified raw materials, yet are identified at archaeological sites in Minnesota with much less frequency. Take for instance Hopkinton chert. Hopkinton chert is rarely identified at archaeological sites in Minnesota, yet its material properties and geographic origin are fairly similar to that of Burlington chert, which has been observed at numerous sites within Minnesota. It is certainly possible that both Hopkinton chert and Burlington chert are arriving at archaeological sites within Minnesota at relatively equal frequencies – only that archaeologists are designating both as the more well-known Burlington chert. Another example can be found with the many brown chalcedonic materials that exhibit very similar properties to Knife River flint. Again, it is certainly possible that some of these materials are arriving at archaeological sites in Minnesota and being misidentified as Knife River flint.

This study would test the archaeologist's ability to differentiate similar, look-a-like, raw materials. The objective of the test would seek to assess how well these materials can be identified and differentiated while also identifying key material properties unique to each that can be used as a differentiation tool. The design of this proposed study would mirror that which was discussed in the methods section of Chapter 2 with the exception that this test would focus on sets of raw materials exhibiting great similarity. The tests could also incorporate the four size-grade evolutions discussed in above to ascertain how the size of artifacts effects the differentiation of very similar raw material types.

Differentiating Flake Types and Associated Reduction Methods

This study would focus on assessing the analyst's ability to differentiate flake types (i.e., bipolar, bifacial thinning, etc.) by material quality as well as differentiate debitage produced by direct percussion vs. indirect percussion and pressure flaking. The design of this proposed study would mirror that which was discussed in the methods section of Chapter 2 with the exception that this test would focus on different flake types produced of several raw material types representing differing material qualities. The objective of the test would be to assess how well the analyst can identify the flake types, but to also assess if the accuracy of such identifications differs based on the quality of the material being knapped.

Exploring Methods Beyond Macroscopic Observation

This study would focus on expanding the blind test beyond macroscopic observation. The design of this proposed study would mirror that which was discussed in the methods section of Chapter 2 with the exception that macroscopic observation would be enhanced with other potential techniques of differentiating material types via defining material attributes such as microscopic features and trace elements. It would be interesting to see how much improvement can be made over the macroscopic observation and if the improvements are great enough to warrant the added cost and time of these other methods.

Replicated Reduction Sequence Study

This study would seek to accomplish two goals; one, create experimental assemblages providing expected material remains for differing reduction sequences per differing raw material types; and two, assess what portions of each reduction sequence are likely to be omitted from collected lithic assemblages based on the employed collection method.

The experimental assemblages would represent several reduction sequences commonly observed at archaeological sites in the upper Midwest (Table 39). The same reduction sequences would be rendered using different raw material types commonly found at archaeological sites in the upper Midwest. The raw material types would be selected in an attempt to capture a representative range of tool stone qualities (Table 39). Theoretically, these experimental assemblages would represent the residues of differing technological activities found at archaeological sites accounting for differences in tool stone quality. In this manner, these experimental assemblages would provide a comparative collection to which lithic assemblages or ‘nodules’ identified at archaeological sites could be compared allowing for more accurate interpretations.

Additionally, Baumler and Davis (2004) and Baumler and Downum (1989) have discussed the importance of micro-debitage in aggregate analysis such as MANA. Therefore, the experimental assemblages from each reduction activity would also be screened through a series of progressively smaller mesh screens (1/4”, 1/8”, and 1/16”). This exercise would provide important data regarding what portions of each reduction sequence are expected to be collected or not collected dependent upon raw material quality and screen size. It is important to understand what portion of a reduction sequence(s) may be missing when interpreting an archaeological assemblage. For example, we may find that nearly all of the debitage created during the re-sharpening of a dulled tool falls through a 1/4” mesh. In this case, had re-sharpening sequences taken place at the site, we may not be able to observe such ‘nodules of activity’ if the site was sifted using 1/4” mesh. Since sifting at most sites in the upper Midwest is carried out using the standard 1/4” mesh, this study may show cause for more stringent regulation regarding mesh size.

TABLE 39. EXPERIMENTAL ASSEMBLAGES

Experimental assemblages	**Raw Materials**			
Reduction Sequences	KRF (highest quality)	GMC (good quality)	SRC (adequate quality)	Poor Quality Quartzite or Quartz (poor quality)
Preparing core from raw cobble	KRF-1	GMC-1	SRC-1	QTZ-1
Manufacture of preform from decorified core	KRF-2	GMC-2	SRC-2	QTZ-2
Final tool shaping of biface from core preform	KRF-3	GMC-3	SRC-3	QTZ-3
Final Tool Shaping of biface from flake blank	KRF-4	GMC-4	SRC-4	QTZ-4
Final tool shaping of uniface from flake blank	KRF-5	GMC-5	SRC-5	QZT-5
Resharpening dulled finished bifacial tool	KRF-6	GMC-6	SRC-6	QZT-6
Resharpening dulled finished unifacial tool	KRF-7	GMC-7	SRC-7	QZT-7

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APPENDIX A: BLIND TEST RESULTS

Sample ID (Marker)	Test ID (Tape)	Analyst	General Material Type	GM Assigned	GM Confidence	GM Match	Specific Material Type	SM Assigned	SM Confidence	SM Match 1	CVG Match 2	TA	TA-Assigned Y/N	TA Confidence	TA Match	MAN Group	MAN Group Assigned	MAN Confidence	Correlation	MAN Match
266a	011	A	Basaltic Rock	Basaltic Rock	1	Y	Basaltic Rock	Basaltic Rock	1	Y	Y	N	N	3	Y	BSR-a	BSR-A	3	BSR-A	Y
266a	021	A	Basaltic Rock	Basaltic Rock	1	Y	Basaltic Rock	Basaltic Rock	1	Y	Y	N	N	3	Y	BSR-a	BSR-A	3	BSR-A	Y
266a	056	A	Basaltic Rock	Basaltic Rock	1	Y	Basaltic Rock	Basaltic Rock	1	Y	Y	N	N	3	Y	BSR-a	BSR-A	3	BSR-A	Y
266a	110	A	Basaltic Rock	Basaltic Rock	1	Y	Basaltic Rock	Basaltic Rock	1	Y	Y	N	N	3	Y	BSR-a	BSR-A	3	BSR-A	Y
266a	116	A	Basaltic Rock	Basaltic Rock	1	Y	Basaltic Rock	Basaltic Rock	1	Y	Y	N	N	3	Y	BSR-a	BSR-A	3	BSR-A	Y
266a	118	A	Basaltic Rock	Basaltic Rock	1	Y	Basaltic Rock	Basaltic Rock	1	Y	Y	N	N	3	Y	BSR-a	BSR-A	3	BSR-A	Y
266b	024	A	Basaltic Rock	Basaltic Rock	1	Y	Basaltic Rock	Basaltic Rock	1	Y	Y	N	N	3	Y	BSR-b	BSR-D	3	BSR-D	Y
266b	034	A	Basaltic Rock	Basaltic Rock	1	Y	Basaltic Rock	Basaltic Rock	1	Y	Y	N	N	3	Y	BSR-b	BSR-D	3	BSR-D	Y
266b	036	A	Basaltic Rock	Basaltic Rock	1	Y	Basaltic Rock	Basaltic Rock	1	Y	Y	N	N	3	Y	BSR-b	BSR-D	3	BSR-D	Y
266b	109	A	Basaltic Rock	Basaltic Rock	1	Y	Basaltic Rock	Basaltic Rock	1	Y	Y	N	N	3	Y	BSR-b	BSR-D	3	BSR-D	Y
266b	208	A	Basaltic Rock	Basaltic Rock	1	Y	Basaltic Rock	Basaltic Rock	1	Y	Y	N	N	3	Y	BSR-b	BSR-D	3	BSR-D	Y
266b	272	A	Basaltic Rock	Basaltic Rock	1	Y	Basaltic Rock	Basaltic Rock	1	Y	Y	N	N	3	Y	BSR-b	BSR-D	3	BSR-D	Y
266c	019	A	Basaltic Rock	Basaltic Rock	1	Y	Basaltic Rock	Basaltic Rock	1	Y	Y	N	N	3	Y	BSR-c	BSR-B	3	BSR-B	Y
266c	031	A	Basaltic Rock	Basaltic Rock	1	Y	Basaltic Rock	Basaltic Rock	1	Y	Y	N	N	3	Y	BSR-c	BSR-B	3	BSR-B	Y
266c	062	A	Basaltic Rock	Basaltic Rock	1	Y	Basaltic Rock	Basaltic Rock	1	Y	Y	N	N	3	Y	BSR-c	BSR-B	3	BSR-B	Y
266c	124	A	Basaltic Rock	Basaltic Rock	1	Y	Basaltic Rock	Basaltic Rock	1	Y	Y	N	N	3	Y	BSR-c	BSR-B	3	BSR-B	Y
266c	275	A	Basaltic Rock	Basaltic Rock	1	Y	Basaltic Rock	Basaltic Rock	1	Y	Y	N	N	3	Y	BSR-c	BSR-B	3	BSR-B	Y
266d	053	A	Basaltic Rock	Basaltic Rock	1	Y	Basaltic Rock	Basaltic Rock	1	Y	Y	N	N	3	Y	BSR-d	BSR-C	3	BSR-C	Y
266d	058	A	Basaltic Rock	Basaltic Rock	1	Y	Basaltic Rock	Basaltic Rock	1	Y	Y	N	N	3	Y	BSR-d	BSR-C	3	BSR-C	Y
266d	198	A	Basaltic Rock	Basaltic Rock	1	Y	Basaltic Rock	Basaltic Rock	1	Y	Y	N	N	3	Y	BSR-d	BSR-C	3	BSR-C	Y
266d	262	A	Basaltic Rock	Basaltic Rock	1	Y	Basaltic Rock	Basaltic Rock	1	Y	Y	N	N	3	Y	BSR-d	BSR-C	3	BSR-C	Y
266d	265	A	Basaltic Rock	Basaltic Rock	1	Y	Basaltic Rock	Basaltic Rock	1	Y	Y	N	N	3	Y	BSR-d	BSR-C	3	BSR-C	Y
36a	117	A	Chert	Chert	1	Y	Burlington Chert	Burlington Chert	1	Y	Y	N	N	3	Y	BRL-a	BRL-C	1	BRL-C	Y
36a	197	A	Chert	Chert	1	Y	Burlington Chert	Burlington Chert	1	Y	Y	N	N	3	Y	BRL-a	BRL-C	1	BRL-C	Y
36a	429	A	Chert	Chert	1	Y	Burlington Chert	Burlington Chert	1	Y	Y	N	N	3	Y	BRL-a	BRL-C	1	BRL-C	Y
36j	084	A	Chert	Chert	1	Y	Burlington Chert	Burlington Chert	1	Y	Y	N	Y	2	N	BRL-j	BRL-A	2	BRL-A	Y
36j	300	A	Chert	Chert	1	Y	Burlington Chert	Burlington Chert	1	Y	Y	N	Y	3	N	BRL-j	BRL-A	2	BRL-A	Y
36j	304	A	Chert	Chert	1	Y	Burlington Chert	Burlington Chert	1	Y	Y	N	Y	3	N	BRL-j	BRL-A	2	BRL-A	Y
36j	333	A	Chert	Chert	1	Y	Burlington Chert	Burlington Chert	1	Y	Y	N	Y	2	N	BRL-j	BRL-A	2	BRL-A	Y
36j	349	A	Chert	Chert	1	Y	Burlington Chert	Burlington Chert	1	Y	Y	N	Y	3	N	BRL-j	BRL-A	2	BRL-A	Y
36j	359	A	Chert	Chert	1	Y	Burlington Chert	Burlington Chert	1	Y	Y	N	Y	2	N	BRL-j	BRL-A	2	BRL-A	Y
36k	089	A	Chert	Chert	1	Y	Burlington Chert	Burlington Chert	1	Y	Y	N	Y	3	N	BRL-k	BRL-B	2	BRL-B	Y
36k	376	A	Chert	Chert	1	Y	Burlington Chert	Burlington Chert	1	Y	Y	N	Y	3	N	BRL-k	BRL-B	2	BRL-B	Y
36k	409	A	Chert	Chert	1	Y	Burlington Chert	Burlington Chert	1	Y	Y	N	Y	3	N	BRL-k	BRL-B	2	BRL-B	Y
36k-TA	132	A	Chert	Chert	1	Y	Burlington Chert	Burlington Chert	1	Y	Y	Y	Y	3	Y	BRL-k-TA	BRL-B	2	BRL-B	Y
36k-TA	260	A	Chert	Chert	1	Y	Burlington Chert	Burlington Chert	1	Y	Y	Y	Y	3	Y	BRL-k-TA	BRL-B	2	BRL-B	Y
36k-TA	360	A	Chert	Chert	1	Y	Burlington Chert	Burlington Chert	1	Y	Y	Y	Y	3	Y	BRL-k-TA	BRL-B	2	BRL-B	Y
36l-TA	129	A	Chert	Chert	1	Y	Burlington Chert	Prairie du Chien Chert	3	N	N	Y	Y	1	Y	BRL-l-TA	PDC-E	1	PDC-E	Y
36l-TA	214	A	Chert	Chert	1	Y	Burlington Chert	Prairie du Chien Chert	3	N	N	Y	Y	1	Y	BRL-l-TA	PDC-E	1	PDC-E	Y
36l-TA	326	A	Chert	Chert	1	Y	Burlington Chert	Prairie du Chien Chert	3	N	N	Y	Y	1	Y	BRL-l-TA	PDC-E	1	PDC-E	Y
1a	095	A	Chert	Chert	1	Y	Cedar Valley Chert	Cochrane Chert	3	N	Y	N	Y	3	N	CVC-a	CCC-D	1	CCC-D	Y
1a	154	A	Chert	Chert	1	Y	Cedar Valley Chert	Cochrane Chert	3	N	Y	N	Y	3	N	CVC-a	CCC-D	1	CCC-D	Y
1a	209	A	Chert	Chert	1	Y	Cedar Valley Chert	Cochrane Chert	3	N	Y	N	Y	3	N	CVC-a	CCC-D	1	CCC-D	Y
1a	227	A	Chert	Chert	1	Y	Cedar Valley Chert	Cochrane Chert	3	N	Y	N	Y	3	N	CVC-a	CCC-D	1	CCC-D	Y
1a	273	A	Chert	Chert	1	Y	Cedar Valley Chert	Cochrane Chert	3	N	Y	N	Y	3	N	CVC-a	CCC-D	1	CCC-D	Y
1a	399	A	Chert	Chert	1	Y	Cedar Valley Chert	Cochrane Chert	3	N	Y	N	Y	3	N	CVC-a	CCC-D	1	CCC-D	Y
1b	023	A	Chert	Chert	1	Y	Cedar Valley Chert	Cochrane Chert	3	N	Y	N	N	3	Y	CVC-b	CCC-A	2	CCC-A	Y
1b	099	A	Chert	Chert	1	Y	Cedar Valley Chert	Cochrane Chert	3	N	Y	N	N	3	Y	CVC-b	CCC-A	2	CCC-A	Y
1b	195	A	Chert	Chert	1	Y	Cedar Valley Chert	Cochrane Chert	3	N	Y	N	N	3	Y	CVC-b	CCC-A	2	CCC-A	Y
1b	288	A	Chert	Chert	1	Y	Cedar Valley Chert	Cochrane Chert	3	N	Y	N	N	3	Y	CVC-b	CCC-A	3	CCC-A	Y
1e	178	A	Chert	Chert	1	Y	Cedar Valley Chert	Cochrane Chert	3	N	Y	N	N	2	Y	CVC-e	CCC-F	1	CCC-F	Y
1e	191	A	Chert	Chert	1	Y	Cedar Valley Chert	Cochrane Chert	3	N	Y	N	N	2	Y	CVC-e	CCC-F	1	CCC-F	Y
1e	368	A	Chert	Chert	1	Y	Cedar Valley Chert	Cochrane Chert	3	N	Y	N	N	2	Y	CVC-e	CCC-F	1	CCC-F	Y
1e	403	A	Chert	Chert	1	Y	Cedar Valley Chert	Cochrane Chert	3	N	Y	N	N	2	Y	CVC-e	CCC-F	1	CCC-F	Y
1g	103	A	Chert	Chert	1	Y	Cedar Valley Chert	Cochrane Chert	3	N	Y	N	N	3	Y	CVC-g	CCC-A	2	CCC-M	N
1g	170	A	Chert	Chert	1	Y	Cedar Valley Chert	Cedar Valley Chert	3	Y	Y	N	N	3	Y	CVC-g	CVC-M	3	CCC-M	Y
1g	216	A	Chert	Chert	1	Y	Cedar Valley Chert	Cedar Valley Chert	3	Y	Y	N	N	3	Y	CVC-g	CVC-J	2	CCC-M	N
1g	309	A	Chert	Chert	1	Y	Cedar Valley Chert	Cochrane Chert	3	N	Y	N	N	3	Y	CVC-g	CCC-A	2	CCC-M	N
1k-TA	037	A	Chert	Chert	1	Y	Cedar Valley Chert	Cochrane Chert	2	N	Y	Y	Y	1	Y	CVC-k-TA	CCC-C	1	CCC-C	Y
1k-TA	070	A	Chert	Chert	1	Y	Cedar Valley Chert	Cochrane Chert	2	N	Y	Y	Y	1	Y	CVC-k-TA	CCC-C	1	CCC-C	Y
1k-TA	286	A	Chert	Chert	1	Y	Cedar Valley Chert	Cochrane Chert	2	N	Y	Y	Y	1	Y	CVC-k-TA	CCC-C	1	CCC-C	Y
1k-TA	345	A	Chert	Chert	1	Y	Cedar Valley Chert	Cochrane Chert	2	N	Y	Y	Y	1	Y	CVC-k-TA	CCC-C	1	CCC-C	Y
1p-TA	125	A	Chert	Chert	1	Y	Cedar Valley Chert	Cedar Valley Chert	3	Y	Y	Y	Y	1	Y	CVC-p-TA	CVC-I	1	CVC-I	Y
1p-TA	222	A	Chert	Chert	1	Y	Cedar Valley Chert	Cedar Valley Chert	3	Y	Y	Y	Y	1	Y	CVC-p-TA	CVC-I	1	CVC-I	Y
1p-TA	370	A	Chert	Chert	1	Y	Cedar Valley Chert	Cedar Valley Chert	3	Y	Y	Y	Y	1	Y	CVC-p-TA	CVC-I	1	CVC-I	Y
207b	172	A	Chert	Chert	2	Y	Cedar Valley Chert	Cedar Valley Chert	2	Y	Y	N	Y	3	N	CVG-b	CVC-D	2	CVC-D	Y
207b	224	A	Chert	Chert	2	Y	Cedar Valley Chert-grainy	Cedar Valley Chert	2	Y	Y	N	Y	3	N	CVG-b	CVC-D	2	CVC-D	Y
207b	330	A	Chert	Chert	2	Y	Cedar Valley Chert-grainy	Cedar Valley Chert	2	Y	Y	N	Y	3	N	CVG-b	CVC-D	2	CVC-D	Y
207b	348	A	Chert	Chert	2	Y	Cedar Valley Chert-grainy	Cedar Valley Chert	2	Y	Y	N	Y	3	N	CVG-b	CVC-D	2	CVC-D	Y
207b	412	A	Chert	Chert	2	Y	Cedar Valley Chert-grainy	Cedar Valley Chert	2	Y	Y	N	Y	3	N	CVG-b	CVC-D	2	CVC-D	Y

Sample ID (Marker)	Test ID (Tape)	Analyst	General Material Type	GM Assigned	GM Confidence	GM Match	Specific Material Type	SM Assigned	SM Confidence	SM Match 1	CVG Match 2	TA	TA-Assigned Y/N	TA Confidence	TA Match	MAN Group	MAN Group Assigned	MAN Confidence	Correlation	MAN Match
207b	415	A	Chert	Chert	2	Y	Cedar Valley Chert-grainy	Cedar Valley Chert	2	Y	Y	N	Y	3	N	CVG-b	CVC-D	2	CVC-D	Y
207c	182	A	Chert	Chert	2	Y	Cedar Valley Chert-grainy	Cedar Valley Chert	2	Y	Y	N	Y	3	N	CVG-c	CVC-D	2	CVC-Z	N
207c	206	A	Chert	Chert	2	Y	Cedar Valley Chert-grainy	Cedar Valley Chert	2	Y	Y	N	Y	3	N	CVG-c	CVC-D	2	CVC-Z	N
207c	231	A	Chert	Chert	2	Y	Cedar Valley Chert-grainy	Cedar Valley Chert	2	Y	Y	N	Y	3	N	CVG-c	CVC-D	2	CVC-Z	N
207c	232	A	Chert	Chert	2	Y	Cedar Valley Chert-grainy	Cedar Valley Chert	2	Y	Y	N	Y	3	N	CVG-c	CVC-D	2	CVC-Z	N
207c	358	A	Chert	Chert	2	Y	Cedar Valley Chert-grainy	Cedar Valley Chert	2	Y	Y	N	Y	3	N	CVG-c	CVC-D	2	CVC-Z	N
207d	067	A	Chert	Chert	2	Y	Cedar Valley Chert-grainy	Cedar Valley Chert	2	Y	Y	N	Y	3	N	CVG-d	CVC-A	2	CVC-A	Y
207d	088	A	Chert	Chert	2	Y	Cedar Valley Chert-grainy	Cedar Valley Chert	2	Y	Y	N	Y	2	N	CVG-d	CVC-A	2	CVC-A	Y
207d	190	A	Chert	Chert	2	Y	Cedar Valley Chert-grainy	Cedar Valley Chert	2	Y	Y	N	Y	2	N	CVG-d	CVC-A	2	CVC-A	Y
207d	194	A	Chert	Chert	2	Y	Cedar Valley Chert-grainy	Cedar Valley Chert	2	Y	Y	N	Y	2	N	CVG-d	CVC-A	2	CVC-A	Y
207d	243	A	Chert	Chert	2	Y	Cedar Valley Chert-grainy	Cedar Valley Chert	2	Y	Y	N	Y	2	N	CVG-d	CVC-A	2	CVC-A	Y
207d	391	A	Chert	Chert	2	Y	Cedar Valley Chert-grainy	Cedar Valley Chert	2	Y	Y	N	Y	3	N	CVG-d	CVC-A	2	CVC-A	Y
207e-TA	014	A	Chert	Quartzite	1	N	Cedar Valley Chert-grainy	Hixton Group Sil. Sand	2	N	N	Y	Y	2	Y	CVG-e-TA	HSS-E	2	HSS-E	Y
207e-TA	086	A	Chert	Chert	2	Y	Cedar Valley Chert-grainy	Cedar Valley Chert	2	Y	Y	Y	Y	2	Y	CVG-e-TA	CVC-A	2	HSS-E	N
207e-TA	091	A	Chert	Quartzite	1	N	Cedar Valley Chert-grainy	Hixton Group Sil. Sand	1	N	N	Y	Y	2	Y	CVG-e-TA	HSS-E	1	HSS-E	Y
207e-TA	153	A	Chert	Quartzite	1	N	Cedar Valley Chert-grainy	Hixton Group Sil. Sand	2	N	N	Y	Y	2	Y	CVG-e-TA	HSS-E	2	HSS-E	Y
207e-TA	355	A	Chert	Quartzite	1	N	Cedar Valley Chert-grainy	Hixton Group Sil. Sand	1	N	N	Y	Y	2	Y	CVG-e-TA	HSS-E	1	HSS-E	Y
2a	074	A	Chert	Chert	1	Y	Cedar Valley Chert-translucent	Cedar Valley Chert	1	Y	Y	N	Y	1	N	CVT-a	CVC-E	1	CVC-E	Y
2a	282	A	Chert	Chert	1	Y	Cedar Valley Chert-translucent	Cedar Valley Chert	1	Y	Y	N	Y	1	N	CVT-a	CVC-E	2	CVC-E	Y
2a	294	A	Chert	Chert	1	Y	Cedar Valley Chert-translucent	Cedar Valley Chert	1	Y	Y	N	Y	1	N	CVT-a	CVC-E	1	CVC-E	Y
2a	389	A	Chert	Chert	1	Y	Cedar Valley Chert-translucent	Cedar Valley Chert	1	Y	Y	N	Y	1	N	CVT-a	CVC-E	1	CVC-E	Y
2a	430	A	Chert	Chert	1	Y	Cedar Valley Chert-translucent	Cedar Valley Chert	1	Y	Y	N	Y	1	N	CVT-a	CVC-E	1	CVC-E	Y
2b	047	A	Chert	Chert	1	Y	Cedar Valley Chert-translucent	Cedar Valley Chert	2	Y	Y	N	Y	2	N	CVT-b	CVC-K	2	CVC-K	Y
2b	049	A	Chert	Chert	1	Y	Cedar Valley Chert-translucent	Cedar Valley Chert	2	Y	Y	N	Y	2	N	CVT-b	CVC-K	2	CVC-K	Y
2b	127	A	Chert	Chert	1	Y	Cedar Valley Chert-translucent	Cedar Valley Chert	1	Y	Y	N	Y	2	N	CVT-b	CVC-C	2	CVC-K	N
2b	144	A	Chert	Chert	1	Y	Cedar Valley Chert-translucent	Cedar Valley Chert	1	Y	Y	N	Y	2	N	CVT-b	CVC-C	2	CVC-K	N
2b	310	A	Chert	Chert	1	Y	Cedar Valley Chert-translucent	Cedar Valley Chert	2	Y	Y	N	Y	3	N	CVT-b	CVC-L	3	CVC-K	N
2c	071	A	Chert	Chert	1	Y	Cedar Valley Chert-translucent	Cedar Valley Chert	1	Y	Y	N	Y	3	N	CVT-c	CVC-B	2	CVC-V	N
2c	264	A	Chert	Chert	1	Y	Cedar Valley Chert-translucent	Cedar Valley Chert	1	Y	Y	N	Y	3	N	CVT-c	CVC-B	2	CVC-V	N
2c	302	A	Chert	Chert	1	Y	Cedar Valley Chert-translucent	Cedar Valley Chert	1	Y	Y	N	Y	3	N	CVT-c	CVC-B	2	CVC-V	N
2f	192	A	Chert	Chert	1	Y	Cedar Valley Chert-translucent	Cedar Valley Chert	1	Y	Y	N	Y	3	N	CVT-f	CVC-B	2	CVC-V	N
2g	087	A	Chert	Chert	1	Y	Cedar Valley Chert-translucent	Cedar Valley Chert	1	Y	Y	N	Y	3	N	CVT-g	CVC-B	2	CVC-B	Y
2g	324	A	Chert	Chert	1	Y	Cedar Valley Chert-translucent	Cedar Valley Chert	1	Y	Y	N	Y	3	N	CVT-g	CVC-B	2	CVC-B	Y
2g	366	A	Chert	Chert	1	Y	Cedar Valley Chert-translucent	Cedar Valley Chert	1	Y	Y	N	Y	3	N	CVT-g	CVC-B	2	CVC-B	Y
2g	405	A	Chert	Chert	1	Y	Cedar Valley Chert-translucent	Cedar Valley Chert	1	Y	Y	N	Y	3	N	CVT-g	CVC-B	2	CVC-B	Y
2h	174	A	Chert	Chert	1	Y	Cedar Valley Chert-translucent	Burlington Chert	2	N	N	N	N	3	Y	CVT-h	BRL-C	2	CVC-P	N
2h	428	A	Chert	Chert	1	Y	Cedar Valley Chert-translucent	Burlington Chert	2	N	N	N	N	3	Y	CVT-h	BRL-C	2	CVC-P	N
2k-TA	022	A	Chert	Chert	1	Y	Cedar Valley Chert-translucent	Cedar Valley Chert	1	Y	Y	Y	Y	1	Y	CVT-k-TA	CVC-G	1	CVC-G	Y
2k-TA	255	A	Chert	Chert	1	Y	Cedar Valley Chert-translucent	Cedar Valley Chert	1	Y	Y	Y	Y	1	Y	CVT-k-TA	CVC-G	1	CVC-G	Y
2k-TA	299	A	Chert	Chert	1	Y	Cedar Valley Chert-translucent	Cedar Valley Chert	1	Y	Y	Y	Y	1	Y	CVT-k-TA	CVC-G	1	CVC-G	Y
2k-TA	394	A	Chert	Chert	1	Y	Cedar Valley Chert-translucent	Cedar Valley Chert	1	Y	Y	Y	Y	1	Y	CVT-k-TA	CVC-G	1	CVC-G	Y
94h	050	A	Chert	Chert	1	Y	Cochrane Chert	Cedar Valley Chert	3	N	Y	N	N	3	Y	CCC-h	CVC-J	1	CVC-J	Y
94h	157	A	Chert	Chert	1	Y	Cochrane Chert	Cedar Valley Chert	3	N	Y	N	N	3	Y	CCC-h	CVC-J	1	CVC-J	Y
94h	341	A	Chert	Chert	1	Y	Cochrane Chert	Cedar Valley Chert	3	N	Y	N	N	3	Y	CCC-h	CVC-J	1	CVC-J	Y
94h	369	A	Chert	Chert	1	Y	Cochrane Chert	Cedar Valley Chert	3	N	Y	N	N	3	Y	CCC-h	CVC-J	1	CVC-J	Y
94h	382	A	Chert	Chert	1	Y	Cochrane Chert	Cedar Valley Chert	3	N	Y	N	N	3	Y	CCC-h	CVC-J	1	CVC-J	Y
94h	398	A	Chert	Chert	1	Y	Cochrane Chert	Cedar Valley Chert	3	N	Y	N	N	3	Y	CCC-h	CVC-J	1	CVC-J	Y
94i	068	A	Chert	Chert	3	Y	Cochrane Chert	Cedar Valley Chert	3	N	Y	N	Y	2	N	CCC-i	CVC-F	1	CVC-F	Y
94i	217	A	Chert	Chert	3	Y	Cochrane Chert	Cedar Valley Chert	3	N	Y	N	Y	2	N	CCC-i	CVC-F	1	CVC-F	Y
94i	317	A	Chert	Chert	3	Y	Cochrane Chert	Cedar Valley Chert	3	N	Y	N	Y	2	N	CCC-i	CVC-F	1	CVC-F	Y
94i	342	A	Chert	Chert	3	Y	Cochrane Chert	Cedar Valley Chert	3	N	Y	N	Y	2	N	CCC-i	CVC-F	1	CVC-F	Y
94p	111	A	Chert	Chert	1	Y	Cochrane Chert	Cedar Valley Chert	3	N	Y	N	Y	2	N	CCC-p	CVC-H	1	CVC-H	Y
94p	160	A	Chert	Chert	1	Y	Cochrane Chert	Cedar Valley Chert	3	N	Y	N	Y	2	N	CCC-p	CVC-H	1	CVC-H	Y
94p	257	A	Chert	Chert	1	Y	Cochrane Chert	Cedar Valley Chert	3	N	Y	N	Y	2	N	CCC-p	CVC-H	1	CVC-H	Y
94p	356	A	Chert	Chert	1	Y	Cochrane Chert	Cedar Valley Chert	3	N	Y	N	Y	2	N	CCC-p	CVC-H	1	CVC-H	Y
94p	408	A	Chert	Chert	1	Y	Cochrane Chert	Cedar Valley Chert	3	N	Y	N	Y	2	N	CCC-p	CVC-H	1	CVC-H	Y
94r-TA	006	A	Chert	Chert	1	Y	Cochrane Chert	Cochrane Chert	2	Y	Y	Y	Y	2	Y	CCC-r-TA	CCC-E	1	CCC-E	Y
94r-TA	094	A	Chert	Chert	1	Y	Cochrane Chert	Cochrane Chert	2	Y	Y	Y	Y	2	Y	CCC-r-TA	CCC-E	1	CCC-E	Y
94r-TA	228	A	Chert	Chert	1	Y	Cochrane Chert	Cochrane Chert	2	Y	Y	Y	Y	2	Y	CCC-r-TA	CCC-E	1	CCC-E	Y
94r-TA	266	A	Chert	Chert	1	Y	Cochrane Chert	Cochrane Chert	2	Y	Y	Y	Y	2	Y	CCC-r-TA	CCC-E	1	CCC-E	Y
94r-TA	279	A	Chert	Chert	1	Y	Cochrane Chert	Cochrane Chert	2	Y	Y	Y	Y	2	Y	CCC-r-TA	CCC-E	1	CCC-E	Y
94r-TA	383	A	Chert	Chert	1	Y	Cochrane Chert	Cochrane Chert	2	Y	Y	Y	Y	2	Y	CCC-r-TA	CCC-E	1	CCC-E	Y
94u	072	A	Chert	Chert	1	Y	Cochrane Chert	Cochrane Chert	2	Y	Y	N	Y	2	N	CCC-u	CCC-B	1	CCC-B	Y
94u	236	A	Chert	Chert	1	Y	Cochrane Chert	Cochrane Chert	2	Y	Y	N	Y	2	N	CCC-u	CCC-B	1	CCC-B	Y
94u	276	A	Chert	Chert	1	Y	Cochrane Chert	Cochrane Chert	2	Y	Y	N	Y	2	N	CCC-u	CCC-B	1	CCC-B	Y
94u	312	A	Chert	Chert	1	Y	Cochrane Chert	Cochrane Chert	2	Y	Y	N	Y	2	N	CCC-u	CCC-B	1	CCC-B	Y
94u	331	A	Chert	Chert	1	Y	Cochrane Chert	Cochrane Chert	2	Y	Y	N	Y	2	N	CCC-u	CCC-B	1	CCC-B	Y
4d	030	A	Chert	Chert	1	Y	Galena Chert	Galena Chert	1	Y	Y	N	N	2	Y	GAL-d	GAL-D	2	GAL-D	Y
4d	075	A	Chert	Chert	1	Y	Galena Chert	Galena Chert	1	Y	Y	N	N	2	Y	GAL-d	GAL-D	2	GAL-D	Y
4d	147	A	Chert	Chert	1	Y	Galena Chert	Galena Chert	1	Y	Y	N	N	2	Y	GAL-d	GAL-D	2	GAL-D	Y

Sample ID (Marker)	Test ID (Tape)	Analyst	General Material Type	GM Assigned	GM Confidence	GM Match	Specific Material Type	SM Assigned	SM Confidence	SM Match 1	CVG Match 2	TA	TA-Assigned Y/N	TA Confidence	TA Match	MAN Group	MAN Group Assigned	MAN Confidence	Correlation	MAN Match
4d	219	A	Chert	Chert	1	Y	Galena Chert	Galena Chert	1	Y	Y	N	N	2	Y	GAL-d	GAL-D	2	GAL-D	Y
4d	252	A	Chert	Chert	1	Y	Galena Chert	Galena Chert	1	Y	Y	N	N	2	Y	GAL-d	GAL-D	2	GAL-D	Y
4d	354	A	Chert	Chert	1	Y	Galena Chert	Galena Chert	1	Y	Y	N	N	2	Y	GAL-d	GAL-D	2	GAL-D	Y
4d	385	A	Chert	Chert	1	Y	Galena Chert	Galena Chert	1	Y	Y	N	N	2	Y	GAL-d	GAL-D	2	GAL-D	Y
4d	423	A	Chert	Chert	1	Y	Galena Chert	Galena Chert	1	Y	Y	N	Y	1	N	GAL-d	GAL-C	3	GAL-D	N
4g-TA	152	A	Chert	Chert	1	Y	Galena Chert	Galena Chert	1	Y	Y	Y	Y	1	Y	GAL-g-TA	GAL-C	2	GAL-C	Y
4g-TA	287	A	Chert	Chert	1	Y	Galena Chert	Galena Chert	1	Y	Y	Y	Y	1	Y	GAL-g-TA	GAL-C	2	GAL-C	Y
4g-TA	315	A	Chert	Chert	1	Y	Galena Chert	Galena Chert	1	Y	Y	Y	Y	1	Y	GAL-g-TA	GAL-C	2	GAL-C	Y
4i-TA	080	A	Chert	Chert	1	Y	Galena Chert	Galena Chert	1	Y	Y	Y	Y	1	Y	GAL-i-TA	GAL-A	2	GAL-A	Y
4i-TA	092	A	Chert	Chert	1	Y	Galena Chert	Galena Chert	1	Y	Y	Y	Y	1	Y	GAL-i-TA	GAL-A	2	GAL-A	Y
4i-TA	135	A	Chert	Chert	1	Y	Galena Chert	Galena Chert	1	Y	Y	Y	Y	1	Y	GAL-i-TA	GAL-A	2	GAL-A	Y
4i-TA	165	A	Chert	Chert	1	Y	Galena Chert	Galena Chert	1	Y	Y	Y	Y	1	Y	GAL-i-TA	GAL-A	2	GAL-A	Y
4i-TA	378	A	Chert	Chert	1	Y	Galena Chert	Galena Chert	1	Y	Y	Y	Y	1	Y	GAL-i-TA	GAL-A	2	GAL-A	Y
4j-TA	005	A	Chert	Chert	1	Y	Galena Chert	Galena Chert	1	Y	Y	Y	Y	1	Y	GAL-j-TA	GAL-A	2	GAL-Z	N
4j-TA	166	A	Chert	Chert	1	Y	Galena Chert	Galena Chert	1	Y	Y	Y	Y	1	Y	GAL-j-TA	GAL-C	3	GAL-Z	N
4j-TA	202	A	Chert	Chert	1	Y	Galena Chert	Galena Chert	1	Y	Y	Y	Y	1	Y	GAL-j-TA	GAL-C	3	GAL-Z	N
4j-TA	204	A	Chert	Chert	1	Y	Galena Chert	Galena Chert	1	Y	Y	Y	Y	1	Y	GAL-j-TA	GAL-A	2	GAL-Z	N
4j-TA	379	A	Chert	Chert	1	Y	Galena Chert	Galena Chert	1	Y	Y	Y	Y	1	Y	GAL-j-TA	GAL-C	2	GAL-Z	N
4j-TA	392	A	Chert	Chert	1	Y	Galena Chert	Galena Chert	1	Y	Y	Y	Y	1	Y	GAL-j-TA	GAL-C	2	GAL-Z	N
4o-TA	077	A	Chert	Chert	1	Y	Galena Chert	Galena Chert	1	Y	Y	Y	Y	1	Y	GAL-o-TA	GAL-B	3	GAL-B	Y
4o-TA	159	A	Chert	Chert	1	Y	Galena Chert	Galena Chert	1	Y	Y	Y	Y	1	Y	GAL-o-TA	GAL-B	2	GAL-B	Y
4o-TA	205	A	Chert	Chert	1	Y	Galena Chert	Galena Chert	1	Y	Y	Y	Y	1	Y	GAL-o-TA	GAL-B	2	GAL-B	Y
4o-TA	311	A	Chert	Chert	1	Y	Galena Chert	Galena Chert	1	Y	Y	Y	Y	1	Y	GAL-o-TA	GAL-B	2	GAL-B	Y
4o-TA	319	A	Chert	Chert	1	Y	Galena Chert	Galena Chert	1	Y	Y	Y	Y	1	Y	GAL-o-TA	GAL-C	2	GAL-B	N
4o-TA	372	A	Chert	Chert	1	Y	Galena Chert	Galena Chert	1	Y	Y	Y	Y	1	Y	GAL-o-TA	GAL-C	2	GAL-B	N
5a	280	A	Chert	Chert	1	Y	Grand Meadow Chert	Grand Meadow Chert	1	Y	Y	N	Y	3	N	GMC-a	GMC-F	3	GMC-F	Y
5a	336	A	Chert	Chert	1	Y	Grand Meadow Chert	Grand Meadow Chert	1	Y	Y	N	Y	3	N	GMC-a	GMC-F	3	GMC-F	Y
5a	365	A	Chert	Chert	1	Y	Grand Meadow Chert	Grand Meadow Chert	1	Y	Y	N	N	3	Y	GMC-a	GMC-F	3	GMC-F	Y
5a	411	A	Chert	Chert	1	Y	Grand Meadow Chert	Grand Meadow Chert	1	Y	Y	N	N	3	Y	GMC-a	GMC-F	3	GMC-F	Y
5c	016	A	Chert	Chert	1	Y	Grand Meadow Chert	Grand Meadow Chert	3	Y	Y	N	Y	3	N	GMC-c	GMC-E	2	GMC-E	Y
5c	098	A	Chert	Chert	1	Y	Grand Meadow Chert	Grand Meadow Chert	3	Y	Y	N	Y	3	N	GMC-c	GMC-E	1	GMC-E	Y
5c	102	A	Chert	Chert	1	Y	Grand Meadow Chert	Grand Meadow Chert	1	Y	Y	N	Y	3	N	GMC-c	GMC-A	3	GMC-E	N
5c	122	A	Chert	Chert	1	Y	Grand Meadow Chert	Grand Meadow Chert	3	Y	Y	N	Y	3	N	GMC-c	GMC-E	2	GMC-E	Y
5c	284	A	Chert	Chert	1	Y	Grand Meadow Chert	Grand Meadow Chert	3	Y	Y	N	Y	3	N	GMC-c	GMC-E	1	GMC-E	Y
5h	101	A	Chert	Chert	1	Y	Grand Meadow Chert	Maynes Creek Chert	3	N	N	N	N	3	Y	GMC-h	MCC-B	2	MCC-B	Y
5h	283	A	Chert	Chert	1	Y	Grand Meadow Chert	Maynes Creek Chert	3	N	N	N	N	3	Y	GMC-h	MCC-B	1	MCC-B	Y
5h	335	A	Chert	Chert	1	Y	Grand Meadow Chert	Maynes Creek Chert	3	N	N	N	N	3	Y	GMC-h	MCC-B	1	MCC-B	Y
5h	374	A	Chert	Chert	1	Y	Grand Meadow Chert	Maynes Creek Chert	3	N	N	N	N	3	Y	GMC-h	MCC-B	1	MCC-B	Y
5k	048	A	Chert	Chert	1	Y	Grand Meadow Chert	Grand Meadow Chert	1	Y	Y	N	Y	3	N	GMC-k	GMC-A	3	GMC-A	Y
5k	193	A	Chert	Chert	1	Y	Grand Meadow Chert	Grand Meadow Chert	1	Y	Y	N	Y	3	N	GMC-k	GMC-A	3	GMC-A	Y
5k	352	A	Chert	Chert	1	Y	Grand Meadow Chert	Grand Meadow Chert	1	Y	Y	N	N	3	Y	GMC-k	GMC-A	3	GMC-A	Y
5k	401	A	Chert	Chert	1	Y	Grand Meadow Chert	Grand Meadow Chert	1	Y	Y	N	Y	3	N	GMC-k	GMC-A	3	GMC-A	Y
5k	413	A	Chert	Chert	1	Y	Grand Meadow Chert	Grand Meadow Chert	1	Y	Y	N	Y	3	N	GMC-k	GMC-A	3	GMC-A	Y
5k	417	A	Chert	Chert	1	Y	Grand Meadow Chert	Grand Meadow Chert	1	Y	Y	N	N	3	Y	GMC-k	GMC-A	3	GMC-A	Y
5k	421	A	Chert	Chert	1	Y	Grand Meadow Chert	Grand Meadow Chert	1	Y	Y	N	Y	3	N	GMC-k	GMC-A	3	GMC-A	Y
5k	425	A	Chert	Chert	1	Y	Grand Meadow Chert	Grand Meadow Chert	1	Y	Y	N	N	3	Y	GMC-k	GMC-A	3	GMC-A	Y
5v-TA	025	A	Chert	Chert	1	Y	Grand Meadow Chert	Grand Meadow Chert	1	Y	Y	Y	Y	2	Y	GMC-v-TA	GMC-B	1	GMC-B	Y
5v-TA	032	A	Chert	Chert	1	Y	Grand Meadow Chert	Grand Meadow Chert	1	Y	Y	Y	Y	2	Y	GMC-v-TA	GMC-B	1	GMC-B	Y
5v-TA	140	A	Chert	Chert	1	Y	Grand Meadow Chert	Grand Meadow Chert	1	Y	Y	Y	Y	2	Y	GMC-v-TA	GMC-D	1	GMC-B	N
5v-TA	239	A	Chert	Chert	1	Y	Grand Meadow Chert	Grand Meadow Chert	1	Y	Y	Y	Y	2	Y	GMC-v-TA	GMC-D	1	GMC-B	N
5v-TA	325	A	Chert	Chert	1	Y	Grand Meadow Chert	Grand Meadow Chert	1	Y	Y	Y	Y	2	Y	GMC-v-TA	GMC-B	1	GMC-B	Y
82a	029	A	Quartzite	Quartzite	1	Y	Hixton Group Sil. Sand	Hixton Group Sil. Sand	1	Y	Y	N	N	2	Y	HSS-a	HSS-B	2	HSS-Z	N
82a	215	A	Quartzite	Quartzite	1	Y	Hixton Group Sil. Sand	Hixton Group Sil. Sand	1	Y	Y	N	N	2	Y	HSS-a	HSS-B	2	HSS-Z	N
82a	254	A	Quartzite	Quartzite	1	Y	Hixton Group Sil. Sand	Hixton Group Sil. Sand	1	Y	Y	N	N	2	Y	HSS-a	HSS-B	2	HSS-Z	N
82d	051	A	Quartzite	Quartzite	1	Y	Hixton Group Sil. Sand	Hixton Group Sil. Sand	1	Y	Y	N	Y	2	N	HSS-d	HSS-A	1	HSS-A	Y
82d	121	A	Quartzite	Quartzite	1	Y	Hixton Group Sil. Sand	Hixton Group Sil. Sand	1	Y	Y	N	Y	3	N	HSS-d	HSS-F	3	HSS-A	N
82d	201	A	Quartzite	Quartzite	1	Y	Hixton Group Sil. Sand	Hixton Group Sil. Sand	1	Y	Y	N	Y	2	N	HSS-d	HSS-A	1	HSS-A	Y
82d	269	A	Quartzite	Quartzite	1	Y	Hixton Group Sil. Sand	Hixton Group Sil. Sand	1	Y	Y	N	Y	2	N	HSS-d	HSS-A	1	HSS-A	Y
82d	322	A	Quartzite	Quartzite	1	Y	Hixton Group Sil. Sand	Hixton Group Sil. Sand	1	Y	Y	N	Y	2	N	HSS-d	HSS-A	1	HSS-A	Y
82e	128	A	Quartzite	Quartzite	1	Y	Hixton Group Sil. Sand	Hixton Group Sil. Sand	1	Y	Y	N	N	2	Y	HSS-e	HSS-B	2	HSS-B	Y
82e	175	A	Quartzite	Quartzite	1	Y	Hixton Group Sil. Sand	Hixton Group Sil. Sand	1	Y	Y	N	N	2	Y	HSS-e	HSS-B	2	HSS-B	Y
82e	380	A	Quartzite	Quartzite	1	Y	Hixton Group Sil. Sand	Hixton Group Sil. Sand	1	Y	Y	N	N	2	Y	HSS-e	HSS-B	2	HSS-B	Y
82e	388	A	Quartzite	Quartzite	1	Y	Hixton Group Sil. Sand	Hixton Group Sil. Sand	1	Y	Y	N	N	2	Y	HSS-e	HSS-B	2	HSS-B	Y
82e	420	A	Quartzite	Quartzite	1	Y	Hixton Group Sil. Sand	Hixton Group Sil. Sand	1	Y	Y	N	N	2	Y	HSS-e	HSS-B	2	HSS-B	Y
82f	038	A	Quartzite	Quartzite	1	Y	Hixton Group Sil. Sand	Hixton Group Sil. Sand	1	Y	Y	N	Y	2	N	HSS-f	HSS-D	1	HSS-D	Y
82f	120	A	Quartzite	Quartzite	1	Y	Hixton Group Sil. Sand	Hixton Group Sil. Sand	1	Y	Y	N	Y	2	N	HSS-f	HSS-D	1	HSS-D	Y
82f	186	A	Quartzite	Quartzite	1	Y	Hixton Group Sil. Sand	Hixton Group Sil. Sand	1	Y	Y	N	Y	2	N	HSS-f	HSS-D	1	HSS-D	Y
82f	424	A	Quartzite	Quartzite	1	Y	Hixton Group Sil. Sand	Hixton Group Sil. Sand	1	Y	Y	N	Y	2	N	HSS-f	HSS-D	1	HSS-D	Y
71c	183	A	Chert	Chert	1	Y	Jasper Taconite	Jasper Taconite	1	Y	Y	N	N	3	Y	JPT-c	JPT-A	3	JPT-A	Y
71c	207	A	Chert	Chert	1	Y	Jasper Taconite	Jasper Taconite	1	Y	Y	N	N	3	Y	JPT-c	JPT-A	3	JPT-A	Y

Sample ID (Marker)	Test ID (Tape)	Analyst	General Material Type	GM Assigned	GM Confidence	GM Match	Specific Material Type	SM Assigned	SM Confidence	SM Match 1	CVG Match 2	TA	TA-Assigned Y/N	TA Confidence	TA Match	MAN Group	MAN Group Assigned	MAN Confidence	Correlation	MAN Match
71c	246	A	Chert	Chert	1	Y	Jasper Taconite	Jasper Taconite	1	Y	Y	N	N	3	Y	JPT-c	JPT-A	3	JPT-A	Y
71c	321	A	Chert	Chert	1	Y	Jasper Taconite	Jasper Taconite	1	Y	Y	N	N	3	Y	JPT-c	JPT-A	3	JPT-A	Y
71g	060	A	Chert	Chert	1	Y	Jasper Taconite	Jasper Taconite	1	Y	Y	N	N	3	Y	JPT-g	JPT-B	3	JPT-B	Y
71g	105	A	Chert	Chert	1	Y	Jasper Taconite	Jasper Taconite	1	Y	Y	N	N	3	Y	JPT-g	JPT-B	3	JPT-B	Y
71g	249	A	Chert	Chert	1	Y	Jasper Taconite	Jasper Taconite	1	Y	Y	N	N	3	Y	JPT-g	JPT-B	3	JPT-B	Y
71g	347	A	Chert	Chert	1	Y	Jasper Taconite	Jasper Taconite	1	Y	Y	N	N	3	Y	JPT-g	JPT-B	3	JPT-B	Y
71g	386	A	Chert	Chert	1	Y	Jasper Taconite	Jasper Taconite	1	Y	Y	N	N	3	Y	JPT-g	JPT-B	3	JPT-B	Y
71h	076	A	Chert	Chert	1	Y	Jasper Taconite	Jasper Taconite	1	Y	Y	N	N	3	Y	JPT-h	JPT-C	3	JPT-C	Y
71h	097	A	Chert	Chert	1	Y	Jasper Taconite	Jasper Taconite	1	Y	Y	N	N	3	Y	JPT-h	JPT-C	3	JPT-C	Y
71h	104	A	Chert	Chert	1	Y	Jasper Taconite	Jasper Taconite	1	Y	Y	N	N	3	Y	JPT-h	JPT-C	3	JPT-C	Y
71h	130	A	Chert	Chert	1	Y	Jasper Taconite	Jasper Taconite	1	Y	Y	N	N	3	Y	JPT-h	JPT-C	3	JPT-C	Y
71h	297	A	Chert	Chert	1	Y	Jasper Taconite	Jasper Taconite	1	Y	Y	N	N	3	Y	JPT-h	JPT-C	3	JPT-C	Y
71h	339	A	Chert	Chert	1	Y	Jasper Taconite	Jasper Taconite	1	Y	Y	N	N	3	Y	JPT-h	JPT-C	3	JPT-C	Y
71h	357	A	Chert	Chert	1	Y	Jasper Taconite	Jasper Taconite	1	Y	Y	N	N	3	Y	JPT-h	JPT-C	3	JPT-C	Y
65h	004	A	Chert	Chert	1	Y	Knife River Flint	Knife River Flint	1	Y	Y	N	N	2	Y	KRF-h	KRF-B	3	KRF-Z	N
65h	035	A	Chert	Chert	1	Y	Knife River Flint	Knife River Flint	1	Y	Y	N	N	2	Y	KRF-h	KRF-B	3	KRF-Z	N
65h	176	A	Chert	Chert	1	Y	Knife River Flint	Knife River Flint	1	Y	Y	N	N	2	Y	KRF-h	KRF-B	3	KRF-Z	N
65h	229	A	Chert	Chert	1	Y	Knife River Flint	Knife River Flint	1	Y	Y	N	N	2	Y	KRF-h	KRF-B	3	KRF-Z	N
65h	308	A	Chert	Chert	1	Y	Knife River Flint	Knife River Flint	1	Y	Y	N	N	3	Y	KRF-h	KRF-B	3	KRF-Z	N
65h	364	A	Chert	Chert	1	Y	Knife River Flint	Knife River Flint	1	Y	Y	N	N	2	Y	KRF-h	KRF-B	3	KRF-Z	N
65i	027	A	Chert	Chert	1	Y	Knife River Flint	Knife River Flint	1	Y	Y	N	N	2	Y	KRF-i	KRF-B	3	KRF-B	Y
65i	115	A	Chert	Chert	1	Y	Knife River Flint	Knife River Flint	1	Y	Y	N	N	2	Y	KRF-i	KRF-B	3	KRF-B	Y
65i	238	A	Chert	Chert	1	Y	Knife River Flint	Knife River Flint	1	Y	Y	N	N	2	Y	KRF-i	KRF-B	3	KRF-B	Y
65i	289	A	Chert	Chert	1	Y	Knife River Flint	Knife River Flint	1	Y	Y	N	N	2	Y	KRF-i	KRF-B	3	KRF-B	Y
65i	318	A	Chert	Chert	1	Y	Knife River Flint	Knife River Flint	1	Y	Y	N	N	2	Y	KRF-i	KRF-B	3	KRF-B	Y
65i	320	A	Chert	Chert	1	Y	Knife River Flint	Knife River Flint	1	Y	Y	N	N	2	Y	KRF-i	KRF-B	3	KRF-B	Y
65i	402	A	Chert	Chert	1	Y	Knife River Flint	Knife River Flint	1	Y	Y	N	N	2	Y	KRF-i	KRF-B	3	KRF-B	Y
65j	107	A	Chert	Chert	1	Y	Knife River Flint	Knife River Flint	1	Y	Y	N	N	2	Y	KRF-j	KRF-A	3	KRF-A	Y
65j	145	A	Chert	Chert	1	Y	Knife River Flint	Knife River Flint	1	Y	Y	N	N	2	Y	KRF-j	KRF-A	3	KRF-A	Y
65j	274	A	Chert	Chert	1	Y	Knife River Flint	Knife River Flint	1	Y	Y	N	N	2	Y	KRF-j	KRF-A	3	KRF-A	Y
65j	290	A	Chert	Chert	1	Y	Knife River Flint	Knife River Flint	1	Y	Y	N	N	3	Y	KRF-j	KRF-A	3	KRF-A	Y
65j	301	A	Chert	Chert	1	Y	Knife River Flint	Knife River Flint	1	Y	Y	N	N	2	Y	KRF-j	KRF-B	3	KRF-A	N
65j	329	A	Chert	Chert	1	Y	Knife River Flint	Knife River Flint	1	Y	Y	N	N	2	Y	KRF-j	KRF-A	3	KRF-A	Y
65j	350	A	Chert	Chert	1	Y	Knife River Flint	Knife River Flint	1	Y	Y	N	N	2	Y	KRF-j	KRF-A	3	KRF-A	Y
12e	040	A	Agate	Agate	1	Y	Lake Superior Agate	Lake Superior Agate	1	Y	Y	N	N	3	Y	LSA-e	LSA-C	2	LSA-C	Y
12e	136	A	Agate	Agate	1	Y	Lake Superior Agate	Lake Superior Agate	1	Y	Y	N	N	3	Y	LSA-e	LSA-C	2	LSA-C	Y
12e	212	A	Agate	Agate	1	Y	Lake Superior Agate	Lake Superior Agate	1	Y	Y	N	N	3	Y	LSA-e	LSA-C	2	LSA-C	Y
12e	303	A	Agate	Agate	1	Y	Lake Superior Agate	Lake Superior Agate	1	Y	Y	N	N	3	Y	LSA-e	LSA-C	2	LSA-C	Y
12e	346	A	Agate	Agate	1	Y	Lake Superior Agate	Lake Superior Agate	1	Y	Y	N	N	3	Y	LSA-e	LSA-C	2	LSA-C	Y
12g	263	A	Agate	Agate	1	Y	Lake Superior Agate	Lake Superior Agate	1	Y	Y	N	N	3	Y	LSA-g	LSA-A	1	LSA-A	Y
12g	363	A	Agate	Agate	1	Y	Lake Superior Agate	Lake Superior Agate	1	Y	Y	N	N	3	Y	LSA-g	LSA-A	1	LSA-A	Y
12g	381	A	Agate	Agate	1	Y	Lake Superior Agate	Lake Superior Agate	1	Y	Y	N	N	3	Y	LSA-g	LSA-A	1	LSA-A	Y
12g	404	A	Agate	Agate	1	Y	Lake Superior Agate	Lake Superior Agate	1	Y	Y	N	N	3	Y	LSA-g	LSA-A	1	LSA-A	Y
12g	418	A	Agate	Agate	1	Y	Lake Superior Agate	Lake Superior Agate	1	Y	Y	N	N	3	Y	LSA-g	LSA-A	1	LSA-A	Y
12h	017	A	Agate	Agate	1	Y	Lake Superior Agate	Lake Superior Agate	1	Y	Y	N	N	3	Y	LSA-h	LSA-B	1	LSA-B	Y
12h	082	A	Agate	Agate	1	Y	Lake Superior Agate	Lake Superior Agate	1	Y	Y	N	N	3	Y	LSA-h	LSA-B	1	LSA-B	Y
12h	221	A	Agate	Agate	1	Y	Lake Superior Agate	Lake Superior Agate	1	Y	Y	N	N	3	Y	LSA-h	LSA-B	1	LSA-B	Y
12h	261	A	Agate	Agate	1	Y	Lake Superior Agate	Lake Superior Agate	1	Y	Y	N	N	3	Y	LSA-h	LSA-B	1	LSA-B	Y
241b	113	A	Chert	Chert	1	Y	Maynes Creek Chert	Maynes Creek Chert	2	Y	Y	N	N	3	Y	MCC-b	MCC-A	1	MCC-A	Y
241b	258	A	Chert	Chert	1	Y	Maynes Creek Chert	Maynes Creek Chert	2	Y	Y	N	N	3	Y	MCC-b	MCC-A	1	MCC-A	Y
241b	268	A	Chert	Chert	1	Y	Maynes Creek Chert	Maynes Creek Chert	2	Y	Y	N	N	3	Y	MCC-b	MCC-A	1	MCC-A	Y
241b	296	A	Chert	Chert	1	Y	Maynes Creek Chert	Maynes Creek Chert	2	Y	Y	N	N	3	Y	MCC-b	MCC-A	1	MCC-A	Y
241b	337	A	Chert	Chert	1	Y	Maynes Creek Chert	Maynes Creek Chert	2	Y	Y	N	N	3	Y	MCC-b	MCC-A	1	MCC-A	Y
241b	362	A	Chert	Chert	1	Y	Maynes Creek Chert	Maynes Creek Chert	2	Y	Y	N	N	3	Y	MCC-b	MCC-A	1	MCC-A	Y
241c	149	A	Chert	Chert	1	Y	Maynes Creek Chert	Maynes Creek Chert	2	Y	Y	N	Y	2	N	MCC-c	MCC-C	2	MCC-Z	N
241c-TA	059	A	Chert	Chert	1	Y	Maynes Creek Chert	Maynes Creek Chert	2	Y	Y	Y	Y	2	Y	MCC-c-TA	MCC-C	2	MCC-Z	N
241c-TA	139	A	Chert	Chert	1	Y	Maynes Creek Chert	Maynes Creek Chert	2	Y	Y	Y	Y	2	Y	MCC-c-TA	MCC-C	2	MCC-Z	N
241c-TA	395	A	Chert	Chert	1	Y	Maynes Creek Chert	Maynes Creek Chert	2	Y	Y	Y	Y	2	Y	MCC-c-TA	MCC-C	2	MCC-Z	N
241d	210	A	Chert	Chert	1	Y	Maynes Creek Chert	Prairie du Chien Chert	3	N	N	N	N	3	Y	MCC-d	PDC-F	2	PDC-F	Y
241d	313	A	Chert	Chert	1	Y	Maynes Creek Chert	Prairie du Chien Chert	3	N	N	N	N	2	Y	MCC-d	PDC-F	1	PDC-F	Y
241d	426	A	Chert	Chert	1	Y	Maynes Creek Chert	Fusilinid Group Chert	3	N	N	N	N	3	Y	MCC-d	FGC-A	3	PDC-F	N
241d	427	A	Chert	Chert	1	Y	Maynes Creek Chert	Prairie du Chien Chert	3	N	N	N	N	2	Y	MCC-d	PDC-F	1	PDC-F	Y
241e-TA	161	A	Chert	Chert	1	Y	Maynes Creek Chert	Maynes Creek Chert	1	Y	Y	Y	Y	3	Y	MCC-e-TA	MCC-D	1	MCC-D	Y
241e-TA	281	A	Chert	Chert	1	Y	Maynes Creek Chert	Maynes Creek Chert	1	Y	Y	Y	Y	3	Y	MCC-e-TA	MCC-D	1	MCC-D	Y
241e-TA	285	A	Chert	Chert	1	Y	Maynes Creek Chert	Maynes Creek Chert	1	Y	Y	Y	Y	2	Y	MCC-e-TA	MCC-D	1	MCC-D	Y
241e-TA	293	A	Chert	Chert	1	Y	Maynes Creek Chert	Maynes Creek Chert	1	Y	Y	Y	Y	3	Y	MCC-e-TA	MCC-D	1	MCC-D	Y
241f-TA	126	A	Chert	Chert	1	Y	Maynes Creek Chert	Maynes Creek Chert	2	Y	Y	Y	Y	2	Y	MCC-f-TA	MCC-C	2	MCC-C	Y
241f-TA	169	A	Chert	Chert	1	Y	Maynes Creek Chert	Maynes Creek Chert	2	Y	Y	Y	Y	2	Y	MCC-f-TA	MCC-C	2	MCC-C	Y
241f-TA	295	A	Chert	Chert	1	Y	Maynes Creek Chert	Maynes Creek Chert	2	Y	Y	Y	Y	2	Y	MCC-f-TA	MCC-C	2	MCC-C	Y
241f-TA	316	A	Chert	Chert	1	Y	Maynes Creek Chert	Maynes Creek Chert	2	Y	Y	Y	Y	2	Y	MCC-f-TA	MCC-C	2	MCC-C	Y

Sample ID (Marker)	Test ID (Tape)	Analyst	General Material Type	GM Assigned	GM Confidence	GM Match	Specific Material Type	SM Assigned	SM Confidence	SM Match 1	CVG Match 2	TA	TA-Assigned Y/N	TA Confidence	TA Match	MAN Group	MAN Group Assigned	MAN Confidence	Correlation	MAN Match
241f-TA	353	A	Chert	Chert	1	Y	Maynes Creek Chert	Maynes Creek Chert	2	Y	Y	Y	Y	2	Y	MCC-f-TA	MCC-C	2	MCC-C	Y
14r	114	A	Chert	Chert	1	Y	Prairie du Chien Chert	Prairie du Chien Chert	2	Y	Y	N	Y	3	N	PDC-r	PDC-B	1	PDC-B	Y
14r	119	A	Chert	Chert	1	Y	Prairie du Chien Chert	Prairie du Chien Chert	2	Y	Y	N	Y	3	N	PDC-r	PDC-B	1	PDC-B	Y
14r	150	A	Chert	Chert	1	Y	Prairie du Chien Chert	Prairie du Chien Chert	2	Y	Y	N	Y	3	N	PDC-r	PDC-B	1	PDC-B	Y
14r	241	A	Chert	Chert	1	Y	Prairie du Chien Chert	Prairie du Chien Chert	2	Y	Y	N	Y	3	N	PDC-r	PDC-B	1	PDC-B	Y
14r	253	A	Chert	Chert	1	Y	Prairie du Chien Chert	Prairie du Chien Chert	2	Y	Y	N	Y	3	N	PDC-r	PDC-B	1	PDC-B	Y
14r	271	A	Chert	Chert	1	Y	Prairie du Chien Chert	Prairie du Chien Chert	2	Y	Y	N	Y	3	N	PDC-r	PDC-B	1	PDC-B	Y
14t	018	A	Chert	Chert	1	Y	Prairie du Chien Chert	Prairie du Chien Chert	1	Y	Y	N	Y	2	N	PDC-t	PDC-C	2	PDC-C	Y
14t	041	A	Chert	Chert	1	Y	Prairie du Chien Chert	Prairie du Chien Chert	1	Y	Y	N	Y	2	N	PDC-t	PDC-C	2	PDC-C	Y
14t	155	A	Chert	Chert	1	Y	Prairie du Chien Chert	Prairie du Chien Chert	1	Y	Y	N	Y	2	N	PDC-t	PDC-C	2	PDC-C	Y
14t	184	A	Chert	Chert	1	Y	Prairie du Chien Chert	Prairie du Chien Chert	1	Y	Y	N	Y	2	N	PDC-t	PDC-C	2	PDC-C	Y
14t	225	A	Chert	Chert	1	Y	Prairie du Chien Chert	Prairie du Chien Chert	1	Y	Y	N	Y	2	N	PDC-t	PDC-C	2	PDC-C	Y
14t	305	A	Chert	Chert	1	Y	Prairie du Chien Chert	Prairie du Chien Chert	1	Y	Y	N	Y	2	N	PDC-t	PDC-C	2	PDC-C	Y
14v-TA	033	A	Chert	Chert	1	Y	Prairie du Chien Chert	Prairie du Chien Chert	1	Y	Y	Y	Y	1	Y	PDC-v-TA	PDC-A	1	PDC-A	Y
14v-TA	112	A	Chert	Chert	1	Y	Prairie du Chien Chert	Prairie du Chien Chert	1	Y	Y	Y	Y	1	Y	PDC-v-TA	PDC-A	1	PDC-A	Y
14v-TA	256	A	Chert	Chert	1	Y	Prairie du Chien Chert	Prairie du Chien Chert	1	Y	Y	Y	Y	1	Y	PDC-v-TA	PDC-A	1	PDC-A	Y
14v-TA	306	A	Chert	Chert	1	Y	Prairie du Chien Chert	Prairie du Chien Chert	1	Y	Y	Y	Y	1	Y	PDC-v-TA	PDC-A	1	PDC-A	Y
14h	007	A	Chert	Chert	1	Y	Prairie du Chien Chert-sandy	Prairie du Chien Chert	1	Y	Y	N	N	2	Y	PDC-h	PDC-D	1	PDC-D	Y
14h	340	A	Chert	Chert	1	Y	Prairie du Chien Chert-sandy	Prairie du Chien Chert	1	Y	Y	N	N	2	Y	PDC-h	PDC-D	1	PDC-D	Y
14h	419	A	Chert	Chert	1	Y	Prairie du Chien Chert-sandy	Prairie du Chien Chert	1	Y	Y	N	N	2	Y	PDC-h	PDC-D	1	PDC-D	Y
14s	065	A	Chert	Quartzite	1	N	Prairie du Chien Chert-sandy	Hixton Group Sil. Sand	1	N	N	N	N	2	Y	PDC-s	HSS-C	2	HSS-C	Y
14s	083	A	Chert	Quartzite	1	N	Prairie du Chien Chert-sandy	Hixton Group Sil. Sand	1	N	N	N	N	2	Y	PDC-s	HSS-C	2	HSS-C	Y
14s	242	A	Chert	Quartzite	1	N	Prairie du Chien Chert-sandy	Hixton Group Sil. Sand	1	N	N	N	N	2	Y	PDC-s	HSS-C	2	HSS-C	Y
14s	307	A	Chert	Quartzite	1	N	Prairie du Chien Chert-sandy	Hixton Group Sil. Sand	1	N	N	N	N	2	Y	PDC-s	HSS-C	2	HSS-C	Y
15j	181	A	Quartz	Quartz	1	Y	Quartz	Quartz	1	Y	Y	N	N	3	Y	QTZ-j	QTZ-D	3	QTZ-B	N
15j	199	A	Quartz	Quartz	1	Y	Quartz	Quartz	1	Y	Y	N	N	3	Y	QTZ-j	QTZ-D	3	QTZ-B	N
15j	233	A	Quartz	Quartz	1	Y	Quartz	Quartz	1	Y	Y	N	N	3	Y	QTZ-j	QTZ-B	3	QTZ-B	Y
15j	245	A	Quartz	Quartz	1	Y	Quartz	Quartz	1	Y	Y	N	N	3	Y	QTZ-j	QTZ-B	3	QTZ-B	Y
15j	384	A	Quartz	Quartz	1	Y	Quartz	Quartz	1	Y	Y	N	N	3	Y	QTZ-j	QTZ-B	3	QTZ-B	Y
15k	054	A	Quartz	Quartz	1	Y	Quartz	Quartz	1	Y	Y	N	N	3	Y	QTZ-k	QTZ-A	3	QTZ-A	Y
15k	061	A	Quartz	Quartz	1	Y	Quartz	Quartz	1	Y	Y	N	N	3	Y	QTZ-k	QTZ-D	3	QTZ-A	N
15k	081	A	Quartz	Quartz	1	Y	Quartz	Quartz	1	Y	Y	N	N	3	Y	QTZ-k	QTZ-A	3	QTZ-A	Y
15k	146	A	Quartz	Quartz	1	Y	Quartz	Quartz	1	Y	Y	N	N	3	Y	QTZ-k	QTZ-A	3	QTZ-A	Y
15k	235	A	Quartz	Quartz	1	Y	Quartz	Quartz	1	Y	Y	N	N	3	Y	QTZ-k	QTZ-A	3	QTZ-A	Y
15k	351	A	Quartz	Quartz	1	Y	Quartz	Quartz	1	Y	Y	N	N	3	Y	QTZ-k	QTZ-A	3	QTZ-A	Y
15m	085	A	Quartz	Quartz	1	Y	Quartz	Quartz	1	Y	Y	N	N	3	Y	QTZ-m	QTZ-C	3	QTZ-C	Y
15m	123	A	Quartz	Quartz	1	Y	Quartz	Quartz	1	Y	Y	N	N	3	Y	QTZ-m	QTZ-C	3	QTZ-C	Y
15m	167	A	Quartz	Quartz	1	Y	Quartz	Quartz	1	Y	Y	N	N	3	Y	QTZ-m	QTZ-C	3	QTZ-C	Y
15m	250	A	Quartz	Quartz	1	Y	Quartz	Quartz	1	Y	Y	N	N	3	Y	QTZ-m	QTZ-C	3	QTZ-C	Y
15n	013	A	Quartz	Quartz	1	Y	Quartz	Quartz	1	Y	Y	N	N	3	Y	QTZ-n	QTZ-D	3	QTZ-D	Y
15n	073	A	Quartz	Quartz	1	Y	Quartz	Quartz	1	Y	Y	N	N	3	Y	QTZ-n	QTZ-D	3	QTZ-D	Y
15n	143	A	Quartz	Quartz	1	Y	Quartz	Quartz	1	Y	Y	N	N	3	Y	QTZ-n	QTZ-D	3	QTZ-D	Y
15n	162	A	Quartz	Quartz	1	Y	Quartz	Quartz	1	Y	Y	N	N	3	Y	QTZ-n	QTZ-D	3	QTZ-D	Y
15n	180	A	Quartz	Quartz	1	Y	Quartz	Quartz	1	Y	Y	N	N	3	Y	QTZ-n	QTZ-A	3	QTZ-D	N
15n	223	A	Quartz	Quartz	1	Y	Quartz	Quartz	1	Y	Y	N	N	3	Y	QTZ-n	QTZ-A	3	QTZ-D	N
16b	001	A	Quartzite	Quartzite	1	Y	Quartzite	Quartzite	1	Y	Y	N	N	3	Y	QZT-b	QZT-B	1	QZT-B	Y
16b	028	A	Quartzite	Quartzite	1	Y	Quartzite	Quartzite	1	Y	Y	N	N	3	Y	QZT-b	QZT-B	1	QZT-B	Y
16b	133	A	Quartzite	Quartzite	1	Y	Quartzite	Quartzite	1	Y	Y	N	N	3	Y	QZT-b	QZT-B	1	QZT-B	Y
16b	189	A	Quartzite	Quartzite	1	Y	Quartzite	Quartzite	1	Y	Y	N	N	3	Y	QZT-b	QZT-B	1	QZT-B	Y
16c	008	A	Quartzite	Quartzite	1	Y	Quartzite	Quartzite	1	Y	Y	N	N	3	Y	QZT-c	QZT-D	3	QZT-D	Y
16c	055	A	Quartzite	Quartzite	1	Y	Quartzite	Quartzite	1	Y	Y	N	N	3	Y	QZT-c	QZT-D	2	QZT-D	Y
16c	131	A	Quartzite	Quartzite	1	Y	Quartzite	Quartzite	1	Y	Y	N	N	3	Y	QZT-c	QZT-D	2	QZT-D	Y
16c	164	A	Quartzite	Quartzite	1	Y	Quartzite	Quartzite	1	Y	Y	N	N	3	Y	QZT-c	QZT-D	2	QZT-D	Y
16d	009	A	Quartzite	Quartzite	1	Y	Quartzite	Quartzite	1	Y	Y	N	N	3	Y	QZT-d	QZT-C	1	QZT-C	Y
16d	010	A	Quartzite	Quartzite	1	Y	Quartzite	Quartzite	1	Y	Y	N	N	3	Y	QZT-d	QZT-C	1	QZT-C	Y
16d	039	A	Quartzite	Quartzite	1	Y	Quartzite	Quartzite	1	Y	Y	N	N	3	Y	QZT-d	QZT-C	1	QZT-C	Y
16d	096	A	Quartzite	Quartzite	1	Y	Quartzite	Quartzite	1	Y	Y	N	N	3	Y	QZT-d	QZT-C	1	QZT-C	Y
16d	377	A	Quartzite	Quartzite	1	Y	Quartzite	Quartzite	1	Y	Y	N	N	3	Y	QZT-d	QZT-C	1	QZT-C	Y
16e	052	A	Quartzite	Quartzite	1	Y	Quartzite	Quartzite	1	Y	Y	N	N	3	Y	QZT-e	QZT-A	1	QZT-A	Y
16e	213	A	Quartzite	Quartzite	1	Y	Quartzite	Quartzite	1	Y	Y	N	N	3	Y	QZT-e	QZT-A	1	QZT-A	Y
16e	248	A	Quartzite	Quartzite	1	Y	Quartzite	Quartzite	1	Y	Y	N	N	3	Y	QZT-e	QZT-A	1	QZT-A	Y
18a	100	A	Chert	Chert	1	Y	Red River Chert	Grand Meadow Chert	3	N	N	N	Y	3	N	RRC-a	GMC-B	3	RRC-E	N
18a	168	A	Chert	Chert	1	Y	Red River Chert	Red River Chert	3	Y	Y	N	N	3	Y	RRC-a	RRC-F	3	RRC-E	Y
18a	218	A	Chert	Chert	1	Y	Red River Chert	Red River Chert	2	Y	Y	N	N	3	Y	RRC-a	RRC-E	3	RRC-E	N
18a	278	A	Chert	Chert	1	Y	Red River Chert	Maynes Creek Chert	3	N	N	N	Y	3	N	RRC-a	MCC-E	3	RRC-E	N
18g	156	A	Chert	Chert	1	Y	Red River Chert	Red River Chert	1	Y	Y	N	N	3	Y	RRC-g	RRC-A	1	RRC-A	Y
18g	244	A	Chert	Chert	1	Y	Red River Chert	Red River Chert	1	Y	Y	N	N	3	Y	RRC-g	RRC-A	1	RRC-A	Y
18g	343	A	Chert	Chert	1	Y	Red River Chert	Red River Chert	1	Y	Y	N	N	3	Y	RRC-g	RRC-A	1	RRC-A	Y
18g-TA	026	A	Chert	Chert	1	Y	Red River Chert	Red River Chert	2	Y	Y	Y	N	3	N	RRC-g-TA	RRC-C	1	RRC-C	Y
18g-TA	093	A	Chert	Chert	1	Y	Red River Chert	Red River Chert	2	Y	Y	Y	N	3	N	RRC-g-TA	RRC-C	1	RRC-C	Y

Sample ID (Marker)	Test ID (Tape)	Analyst	General Material Type	GM Assigned	GM Confidence	GM Match	Specific Material Type	SM Assigned	SM Confidence	SM Match 1	CVG Match 2	TA	TA-Assigned Y/N	TA Confidence	TA Match	MAN Group	MAN Group Assigned	MAN Confidence	Correlation	MAN Match
18g-TA	211	A	Chert	Chert	1	Y	Red River Chert	Red River Chert	2	Y	Y	Y	N	3	N	RRC-g-TA	RRC-C	1	RRC-C	Y
18h-TA	044	A	Chert	Chert	1	Y	Red River Chert	Red River Chert	2	Y	Y	Y	Y	3	Y	RRC-h-TA	RRC-B	1	RRC-B	Y
18h-TA	046	A	Chert	Chert	1	Y	Red River Chert	Red River Chert	2	Y	Y	Y	Y	3	Y	RRC-h-TA	RRC-B	1	RRC-B	Y
18h-TA	163	A	Chert	Chert	1	Y	Red River Chert	Red River Chert	2	Y	Y	Y	Y	3	Y	RRC-h-TA	RRC-B	1	RRC-B	Y
18h-TA	406	A	Chert	Chert	1	Y	Red River Chert	Red River Chert	2	Y	Y	Y	Y	3	Y	RRC-h-TA	RRC-B	1	RRC-B	Y
18m-TA	043	A	Chert	Chert	1	Y	Red River Chert	Red River Chert	1	Y	Y	Y	N	3	N	RRC-m-TA	RRC-A	1	RRC-Z	N
18m-TA	185	A	Chert	Chert	1	Y	Red River Chert	Red River Chert	1	Y	Y	Y	N	3	N	RRC-m-TA	RRC-A	1	RRC-Z	N
18m-TA	400	A	Chert	Chert	1	Y	Red River Chert	Red River Chert	1	Y	Y	Y	N	3	N	RRC-m-TA	RRC-A	1	RRC-Z	N
18o	063	A	Chert	Chert	1	Y	Red River Chert	Red River Chert	2	Y	Y	N	N	3	Y	RRC-o	RRC-D	1	RRC-D	Y
18o	173	A	Chert	Chert	1	Y	Red River Chert	Red River Chert	2	Y	Y	N	N	3	Y	RRC-o	RRC-D	1	RRC-D	Y
18o	203	A	Chert	Chert	1	Y	Red River Chert	Red River Chert	2	Y	Y	N	N	3	Y	RRC-o	RRC-D	1	RRC-D	Y
18o	431	A	Chert	Chert	1	Y	Red River Chert	Grand Meadow Chert	3	N	N	N	N	3	Y	RRC-o	GMC-C	3	RRC-D	N
18p	066	A	Chert	Chert	1	Y	Red River Chert	Grand Meadow Chert	2	N	N	N	N	3	Y	RRC-p	GMC-C	1	GMC-C	Y
18p	148	A	Chert	Chert	1	Y	Red River Chert	Grand Meadow Chert	2	N	N	N	N	3	Y	RRC-p	GMC-C	1	GMC-C	Y
18p	200	A	Chert	Chert	1	Y	Red River Chert	Grand Meadow Chert	2	N	N	N	N	3	Y	RRC-p	GMC-C	1	GMC-C	Y
18p	298	A	Chert	Chert	1	Y	Red River Chert	Grand Meadow Chert	2	N	N	N	N	3	Y	RRC-p	GMC-C	1	GMC-C	Y
18p	414	A	Chert	Chert	1	Y	Red River Chert	Grand Meadow Chert	2	N	N	N	N	3	Y	RRC-p	GMC-C	2	GMC-C	Y
20y	196	A	Siltstone	Siltstone	3	Y	Siltstone	Siltstone	3	Y	Y	N	N	3	Y	SLT-y	SLT-C	3	SLT-C	Y
20y	277	A	Siltstone	Siltstone	1	Y	Siltstone	Siltstone	2	Y	Y	N	N	3	Y	SLT-y	SLT-A	3	SLT-C	N
20y	292	A	Siltstone	Siltstone	3	Y	Siltstone	Siltstone	3	Y	Y	N	N	3	Y	SLT-y	SLT-C	3	SLT-C	Y
20y	323	A	Siltstone	Siltstone	3	Y	Siltstone	Siltstone	3	Y	Y	N	N	3	Y	SLT-y	SLT-C	3	SLT-C	Y
20y	407	A	Siltstone	Siltstone	1	Y	Siltstone	Siltstone	1	Y	Y	N	N	3	Y	SLT-y	SLT-A	3	SLT-C	N
20z	079	A	Siltstone	Siltstone	1	Y	Siltstone	Siltstone	1	Y	Y	N	N	3	Y	SLT-z	SLT-B	3	SLT-Z	N
20z	108	A	Siltstone	Siltstone	1	Y	Siltstone	Siltstone	1	Y	Y	N	N	3	Y	SLT-z	SLT-B	3	SLT-Z	N
20z	137	A	Siltstone	Siltstone	1	Y	Siltstone	Siltstone	1	Y	Y	N	N	3	Y	SLT-z	SLT-B	3	SLT-Z	N
20z	327	A	Siltstone	Siltstone	1	Y	Siltstone	Siltstone	1	Y	Y	N	N	3	Y	SLT-z	SLT-B	3	SLT-Z	N
20z	371	A	Siltstone	Siltstone	1	Y	Siltstone	Siltstone	1	Y	Y	N	N	3	Y	SLT-z	SLT-B	3	SLT-Z	N
20z	375	A	Siltstone	Siltstone	1	Y	Siltstone	Siltstone	1	Y	Y	N	N	3	Y	SLT-z	SLT-B	3	SLT-Z	N
20z	416	A	Siltstone	Siltstone	1	Y	Siltstone	Siltstone	1	Y	Y	N	N	3	Y	SLT-z	SLT-B	3	SLT-Z	N
226c	012	A	Siltstone	Siltstone	1	Y	Siltstone	Siltstone	1	Y	Y	N	N	3	Y	SLT-c	SLT-B	3	SLT-B	Y
226c	015	A	Siltstone	Siltstone	1	Y	Siltstone	Siltstone	1	Y	Y	N	N	3	Y	SLT-c	SLT-B	3	SLT-B	Y
226c	020	A	Siltstone	Siltstone	1	Y	Siltstone	Siltstone	1	Y	Y	N	N	3	Y	SLT-c	SLT-B	3	SLT-B	Y
226c	247	A	Siltstone	Siltstone	1	Y	Siltstone	Siltstone	1	Y	Y	N	N	3	Y	SLT-c	SLT-B	3	SLT-B	Y
226c	251	A	Siltstone	Siltstone	1	Y	Siltstone	Siltstone	1	Y	Y	N	N	3	Y	SLT-c	SLT-B	3	SLT-B	Y
226c	328	A	Siltstone	Siltstone	1	Y	Siltstone	Siltstone	1	Y	Y	N	N	3	Y	SLT-c	SLT-B	3	SLT-B	Y
226c	338	A	Siltstone	Siltstone	1	Y	Siltstone	Siltstone	1	Y	Y	N	N	3	Y	SLT-c	SLT-B	3	SLT-B	Y
226c	397	A	Siltstone	Siltstone	1	Y	Siltstone	Siltstone	1	Y	Y	N	N	3	Y	SLT-c	SLT-B	3	SLT-B	Y
23b-TA	171	A	Chert	Chert	1	Y	Swan River Chert	Swan River Chert	2	Y	Y	Y	Y	2	Y	SRC-b-TA	SRC-A	1	SRC-A	Y
23b-TA	344	A	Chert	Chert	1	Y	Swan River Chert	Swan River Chert	2	Y	Y	Y	Y	2	Y	SRC-b-TA	SRC-A	1	SRC-A	Y
23b-TA	390	A	Chert	Chert	1	Y	Swan River Chert	Swan River Chert	2	Y	Y	Y	Y	2	Y	SRC-b-TA	SRC-A	1	SRC-A	Y
23f-TA	141	A	Chert	Chert	1	Y	Swan River Chert	Swan River Chert	1	Y	Y	Y	Y	1	Y	SRC-f-TA	SRC-E	1	SRC-E	Y
23f-TA	179	A	Chert	Chert	1	Y	Swan River Chert	Swan River Chert	1	Y	Y	Y	Y	1	Y	SRC-f-TA	SRC-E	1	SRC-E	Y
23f-TA	187	A	Chert	Chert	1	Y	Swan River Chert	Swan River Chert	1	Y	Y	Y	Y	1	Y	SRC-f-TA	SRC-E	1	SRC-E	Y
23f-TA	234	A	Chert	Chert	1	Y	Swan River Chert	Swan River Chert	1	Y	Y	Y	Y	1	Y	SRC-f-TA	SRC-E	1	SRC-E	Y
23g-TA	240	A	Chert	Chert	1	Y	Swan River Chert	Swan River Chert	1	Y	Y	Y	Y	1	Y	SRC-g-TA	SRC-E	1	SRC-Z	N
23g-TA	291	A	Chert	Chert	1	Y	Swan River Chert	Swan River Chert	1	Y	Y	Y	Y	1	Y	SRC-g-TA	SRC-E	1	SRC-Z	N
23g-TA	422	A	Chert	Chert	1	Y	Swan River Chert	Swan River Chert	1	Y	Y	Y	Y	1	Y	SRC-g-TA	SRC-E	1	SRC-Z	N
23i-TA	057	A	Chert	Chert	2	Y	Swan River Chert	Swan River Chert	2	Y	Y	Y	Y	2	Y	SRC-i-TA	SRC-C	1	SRC-C	Y
23i-TA	138	A	Chert	Chert	2	Y	Swan River Chert	Swan River Chert	2	Y	Y	Y	Y	2	Y	SRC-i-TA	SRC-C	1	SRC-C	Y
23i-TA	332	A	Chert	Chert	2	Y	Swan River Chert	Swan River Chert	2	Y	Y	Y	Y	2	Y	SRC-i-TA	SRC-C	1	SRC-C	Y
23i-TA	361	A	Chert	Chert	2	Y	Swan River Chert	Swan River Chert	2	Y	Y	Y	Y	2	Y	SRC-i-TA	SRC-C	1	SRC-C	Y
23l	064	A	Chert	Chert	1	Y	Swan River Chert	Swan River Chert	1	Y	Y	N	Y	2	N	SRC-l	SRC-D	2	SRC-D	Y
23l	151	A	Chert	Chert	1	Y	Swan River Chert	Swan River Chert	1	Y	Y	N	Y	2	N	SRC-l	SRC-D	2	SRC-D	Y
23l	267	A	Chert	Chert	1	Y	Swan River Chert	Swan River Chert	1	Y	Y	N	Y	3	N	SRC-l	SRC-D	2	SRC-D	Y
23l	334	A	Chert	Chert	1	Y	Swan River Chert	Swan River Chert	1	Y	Y	N	Y	2	N	SRC-l	SRC-D	2	SRC-D	Y
23m	002	A	Chert	Chert	1	Y	Swan River Chert	Swan River Chert	1	Y	Y	N	Y	2	N	SRC-m	SRC-B	1	SRC-B	Y
23m	003	A	Chert	Chert	1	Y	Swan River Chert	Swan River Chert	1	Y	Y	N	Y	2	N	SRC-m	SRC-B	1	SRC-B	Y
23m	270	A	Chert	Chert	1	Y	Swan River Chert	Swan River Chert	1	Y	Y	N	Y	2	N	SRC-m	SRC-B	1	SRC-B	Y
23m	396	A	Chert	Chert	1	Y	Swan River Chert	Swan River Chert	1	Y	Y	N	Y	2	N	SRC-m	SRC-B	1	SRC-B	Y
24i	042	A	Silicified Sediment	Silicified Sediment	1	Y	Tongue River Silica	Tongue River Silica	1	Y	Y	N	Y	3	N	TRS-i	TRS-D	3	TRS-D	Y
24i	078	A	Silicified Sediment	Silicified Sediment	1	Y	Tongue River Silica	Tongue River Silica	1	Y	Y	N	Y	3	N	TRS-i	TRS-D	3	TRS-D	Y
24i	134	A	Silicified Sediment	Silicified Sediment	1	Y	Tongue River Silica	Tongue River Silica	1	Y	Y	N	N	3	Y	TRS-i	TRS-D	3	TRS-D	Y
24i	220	A	Silicified Sediment	Silicified Sediment	1	Y	Tongue River Silica	Tongue River Silica	1	Y	Y	N	Y	3	N	TRS-i	TRS-D	3	TRS-D	Y
24i	237	A	Silicified Sediment	Silicified Sediment	1	Y	Tongue River Silica	Tongue River Silica	1	Y	Y	N	N	3	Y	TRS-i	TRS-D	3	TRS-D	Y
24i-TA	045	A	Silicified Sediment	Silicified Sediment	1	Y	Tongue River Silica	Tongue River Silica	1	Y	Y	Y	Y	1	Y	TRS-i-TA	TRS-A	1	TRS-A	Y
24i-TA	106	A	Silicified Sediment	Silicified Sediment	1	Y	Tongue River Silica	Tongue River Silica	1	Y	Y	Y	Y	1	Y	TRS-i-TA	TRS-A	1	TRS-A	Y
24i-TA	177	A	Silicified Sediment	Silicified Sediment	1	Y	Tongue River Silica	Tongue River Silica	1	Y	Y	Y	Y	1	Y	TRS-i-TA	TRS-A	1	TRS-A	Y
24i-TA	230	A	Silicified Sediment	Silicified Sediment	1	Y	Tongue River Silica	Tongue River Silica	1	Y	Y	Y	Y	1	Y	TRS-i-TA	TRS-A	1	TRS-A	Y
24i-TA	259	A	Silicified Sediment	Silicified Sediment	1	Y	Tongue River Silica	Tongue River Silica	1	Y	Y	Y	Y	1	Y	TRS-i-TA	TRS-A	1	TRS-A	Y
24j-TA	090	A	Silicified Sediment	Silicified Sediment	1	Y	Tongue River Silica	Tongue River Silica	1	Y	Y	Y	Y	2	Y	TRS-j-TA	TRS-C	2	TRS-C	Y

Sample ID (Marker)	Test ID (Tape)	Analyst	General Material Type	GM Assigned	GM Confidence	GM Match	Specific Material Type	SM Assigned	SM Confidence	SM Match 1	CVG Match 2	TA	TA-Assigned Y/N	TA Confidence	TA Match	MAN Group	MAN Group Assigned	MAN Confidence	Correlation	MAN Match
24j-TA	226	A	Silicified Sediment	Silicified Sediment	1	Y	Tongue River Silica	Tongue River Silica	1	Y	Y	Y	Y	2	Y	TRS-j-TA	TRS-C	2	TRS-C	Y
24j-TA	387	A	Silicified Sediment	Silicified Sediment	1	Y	Tongue River Silica	Tongue River Silica	1	Y	Y	Y	Y	2	Y	TRS-j-TA	TRS-C	2	TRS-C	Y
24j-TA	393	A	Silicified Sediment	Silicified Sediment	1	Y	Tongue River Silica	Tongue River Silica	1	Y	Y	Y	Y	2	Y	TRS-j-TA	TRS-C	2	TRS-C	Y
24l-TA	069	A	Silicified Sediment	Silicified Sediment	1	Y	Tongue River Silica	Tongue River Silica	1	Y	Y	Y	Y	1	Y	TRS-l-TA	TRS-B	1	TRS-B	Y
24l-TA	188	A	Silicified Sediment	Silicified Sediment	1	Y	Tongue River Silica	Tongue River Silica	1	Y	Y	Y	Y	1	Y	TRS-l-TA	TRS-B	1	TRS-B	Y
24l-TA	367	A	Silicified Sediment	Silicified Sediment	1	Y	Tongue River Silica	Tongue River Silica	1	Y	Y	Y	Y	1	Y	TRS-l-TA	TRS-B	1	TRS-B	Y
24l-TA	373	A	Silicified Sediment	Silicified Sediment	1	Y	Tongue River Silica	Tongue River Silica	1	Y	Y	Y	Y	1	Y	TRS-l-TA	TRS-B	1	TRS-B	Y
24m-TA	142	A	Silicified Sediment	Silicified Sediment	1	Y	Tongue River Silica	Tongue River Silica	1	Y	Y	Y	Y	2	Y	TRS-m-TA	TRS-C	2	TRS-Z	N
24m-TA	158	A	Silicified Sediment	Silicified Sediment	1	Y	Tongue River Silica	Tongue River Silica	1	Y	Y	Y	Y	2	Y	TRS-m-TA	TRS-C	2	TRS-Z	N
24m-TA	314	A	Silicified Sediment	Silicified Sediment	1	Y	Tongue River Silica	Tongue River Silica	1	Y	Y	Y	Y	2	Y	TRS-m-TA	TRS-C	2	TRS-Z	N
24m-TA	410	A	Silicified Sediment	Silicified Sediment	1	Y	Tongue River Silica	Tongue River Silica	1	Y	Y	Y	Y	2	Y	TRS-m-TA	TRS-C	2	TRS-Z	N

APPENDIX B: CHIPPED STONE ARTIFACT CATALOG

UNIT	LEVEL	ARTID	DATACLASS	TOOLTYPE1	TOOLTYPE2	DEBTYPE	RAWMAT2	Origin	Direction	Quality	MANGROUP	HEATED	BURNED	CORTEX	WEIGHT (g)	LENGTH1 (mm)	WIDTH1 (mm)	THICK1 (mm)	Clarkson's II	Kuhn's IR	POINTASSOC1
A	1	415-001-01	SHATTER				SWAN RIVER CHERT	Local		Low	CP01	YES	NO		4.67	0	0	0	0	0	
A	1	415-001-02	PROXFLAKE			BTF	SWAN RIVER CHERT	Local		Low	G01	YES	NO		0.74	0	0	0	0	0	
A	1	415-001-03	COMPFLAKE			FLAKE	SWAN RIVER CHERT	Local		Low	CP01	YES	NO	10-40%	8.94	24.83	24.66	7.3	0	0	
A	1	415-001-04	SHATTER				SWAN RIVER CHERT	Local		Low	CP01	YES	NO		8.28	0	0	0	0	0	
A	1	415-001-05	SPLITFLAKE				SWAN RIVER CHERT	Local		Low	CP01	YES	NO		1.8	0	0	0	0	0	
A	1	415-001-06	COMPFLAKE			FLAKE	SWAN RIVER CHERT	Local		Low	CP01	YES	NO	40-60%	1.07	16.41	13.84	3.26	0	0	
A	1	415-001-07	SHATTER				SWAN RIVER CHERT	Local		Low	PG21	YES	NO		1	0	0	0	0	0	
A	1	415-001-08	PROXFLAKE			BTF	SWAN RIVER CHERT	Local		Low	GW01	NO	NO		2.79	0	0	0	0	0	
A	1	415-001-09	COMPFLAKE			FLAKE	SWAN RIVER CHERT	Local		Low	WG01	YES	NO	0%	1.58	17	15.83	5.4	0	0	
A	1	415-001-10	SHATTER				GRAND MEADOW CHERT	Non-Local	East	High		NO	NO		2.97	0	0	0	0	0	
A	1	415-001-11	COMPFLAKE			BTF	GRAND MEADOW CHERT	Non-Local	East	High		UNKNOWN	NO	1-10%	1.47	23.33	19	2.77	0	0	
A	1	415-001-12	BIFACEFRAG	UNFINFRAG	UNKNOWN		KNIFE RIVER FLINT	Non-Local	Northwest	High		UNKNOWN	NO		6.47	0	0	0	0	0	
A	1	415-001-13	FLAKETOOLCOMP	UTILIZEDFLAKE	EXPEDIENT	BTF	KNIFE RIVER FLINT	Non-Local	Northwest	High		UNKNOWN	NO	0%	0.8	18.92	11.4	2.03	0	0	
A	1	415-001-14	COMPFLAKE			BTF	TONGUE RIVER SILICA	Local		Low		NO	NO	0%	2.14	27.16	17.08	5.38	0	0	
A	1	415-001-15	FLAKETOOLDIST	SIDESCRAPER	EXPEDIENT		PRAIRIE DU CHIEN CHERT	Non-Local	East	Low	PG14	YES	NO		1.9	0	0	0	0	0.2142637	
A	1	415-001-16	SHATTER				PRAIRIE DU CHIEN CHERT	Non-Local	East	Low	W01	YES	NO		0.8	0	0	0	0	0	
A	1	415-001-17	PROXFLAKE			FLAKE	TONGUE RIVER SILICA	Local		Low		NO	NO		1.09	0	0	0	0	0	
A	1	415-001-18	HEATSPALL				INDETERMINATE CHERT	Unknown				YES	YES		3.76	0	0	0	0	0	
A	1	415-001-19	SHATTER				BASALTIC ROCK	Local		Low		UNKNOWN	NO		1.17	0	0	0	0	0	
A	1	415-001-20	DISTFLAKE				INDETERMINATE CHERT	Unknown				UNKNOWN	NO		2.38	0	0	0	0	0	
A	1	415-001-21	SHATTER				INDETERMINATE CHERT	Unknown				YES	YES		1.9	0	0	0	0	0	
A	1	415-001-22	SPLITFLAKE				INDETERMINATE CHERT	Unknown				UNKNOWN	NO		0.8	0	0	0	0	0	
A	1	415-001-23	SHATTER				INDETERMINATE CHERT	Unknown				YES	YES		4.2	0	0	0	0	0	
A	1	415-001-24	COMPFLAKE			FLAKE	SIOUX QUARTZITE	Local		Low		NO	NO	60-90%	4.42	19.96	27.55	6.67	0	0	
A	1	415-001-25	SHATTER				SWAN RIVER CHERT	Local		Low	WG02	NO	NO		3.14	0	0	0	0	0	
A	1	415-001-26	COMPFLAKE			FLAKE	INDETERMINATE CHERT	Unknown				UNKNOWN	NO	40-60%	2	24.15	15.42	5.68	0	0	
A	1	415-001-27	PROXFLAKE			FLAKE	INDETERMINATE CHERT	Unknown				UNKNOWN	NO		1.5	0	0	0	0	0	
A	1	415-001-28	HEATSPALL				INDETERMINATE CHERT	Unknown				YES	YES		2.9	0	0	0	0	0	
A	2	415-002-01	SHATTER				SWAN RIVER CHERT	Local		Low	PG01	YES	NO		4.74	0	0	0	0	0	
A	2	415-002-02	FLAKETOOLMED	SIDESCRAPER	EXPEDIENT		SWAN RIVER CHERT	Local		Low	P03	YES	NO		0.9	0	0	0	0	0	
A	2	415-002-03	SHATTER				SWAN RIVER CHERT	Local		Low	CP01	YES	NO		3.05	0	0	0	0	0	
A	2	415-002-04	COMPFLAKE			FLAKE	SWAN RIVER CHERT	Local		Low	R01	YES	NO	90-99%	2.91	18.38	21.87	5.59	0	0	
A	2	415-002-05	COMPFLAKE			FLAKE	SWAN RIVER CHERT	Local		Low	GW02	YES	NO	0%	3.48	18.9	27.49	6.55	0	0	
A	2	415-002-06	SHATTER				SWAN RIVER CHERT	Local		Low	W01	YES	NO		7.66	0	0	0	0	0	
A	2	415-002-07	COMPFLAKE			FLAKE	SWAN RIVER CHERT	Local		Low	CP01	YES	NO	90-99%	2.19	27.06	13.83	3.28	0	0	
A	2	415-002-08	SHATTER				SWAN RIVER CHERT	Local		Low	W02	YES	NO		2.67	0	0	0	0	0	
A	2	415-002-09	FLAKETOOLCOMP	UTILIZEDFLAKE	EXPEDIENT	FLAKE	KNIFE RIVER FLINT	Non-Local	Northwest	High		UNKNOWN	NO	1-10%	1.5	26.14	15.46	2.58	0.03	0	
A	2	415-002-10	PROXFLAKE			FLAKE	GRAND MEADOW CHERT	Non-Local	East	High		NO	NO		8.25	0	0	0	0	0	
A	2	415-002-11	PROXFLAKE			FLAKE	GRAND MEADOW CHERT	Non-Local	East	High		NO	NO		3.02	0	0	0	0	0	
A	2	415-002-12	FLAKETOOLDIST	ENDSCRAPER	EXPEDIENT		GRAND MEADOW CHERT	Non-Local	East	High		NO	NO		1.9	0	0	0	0	0	
A	2	415-002-13	PROXFLAKE			FLAKE	INDETERMINATE CHERT	Unknown				YES	YES		0.59	0	0	0	0	0	
A	2	415-002-14	COMPFLAKE			FLAKE	INDETERMINATE CHERT	Unknown				UNKNOWN	NO	0%	1	16.89	13.48	3.48	0	0	
A	2	415-002-15	HEATSPALL				INDETERMINATE CHERT	Unknown				YES	YES		1.03	0	0	0	0	0	
A	2	415-002-16	COMPFLAKE			FLAKE	BURLINGTON CHERT	Non-Local	Southeast	High		NO	NO	0%	1.02	19.21	21.73	2.06	0	0	
A	2	415-002-17	DISTFLAKE				BURLINGTON CHERT	Non-Local	Southeast	High		NO	NO		0.22	0	0	0	0	0	
A	2	415-002-18	COMPFLAKE			FLAKE	INDETERMINATE CHERT	Unknown				YES	YES	0%	0.7	14.15	17.77	2.11	0	0	
A	2	415-002-19	COMPFLAKE			FLAKE	RED RIVER CHERT	Local		Low	LG15	UNKNOWN	NO	90-99%	3.36	32.8	14.52	6.73	0	0	
A	2	415-002-20	COMPFLAKE			BTF	BURLINGTON CHERT	Non-Local	Southeast	High		YES	NO	0%	0.46	15.46	12.84	1.63	0	0	
A	2	415-002-21	BIFACEFRAG	UNFINFRAG	UNKNOWN		INDETERMINATE CHERT	Unknown				UNKNOWN	NO		3.1	0	0	0	0	0	
A	2	415-002-22	COMPFLAKE			FLAKE	FUSILINID CHERT	Non-Local	South	High	T01	YES	NO	0%	1.8	28.44	12.48	3.28	0	0	
A	2	415-002-23	SHATTER				INDETERMINATE CHERT	Unknown				UNKNOWN	NO		5.5	0	0	0	0	0	
A	2	415-002-24	SHATTER				BASALTIC ROCK	Local		Low		NO	NO		18.77	0	0	0	0	0	
A	2	415-002-26	HEATSPALL				INDETERMINATE CHERT	Unknown				YES	YES		1.2	0	0	0	0	0	
A	2	415-002-27	SHATTER				RED RIVER CHERT	Local		Low	B01	YES	NO		1.68	0	0	0	0	0	
A	2	415-002-28	SHATTER				INDETERMINATE CHERT	Unknown				UNKNOWN	NO		1.5	0	0	0	0	0	
A	2	415-002-29	SHATTER				INDETERMINATE CHERT	Unknown				UNKNOWN	NO		0.4	0	0	0	0	0	
A	2	415-002-30	DISTFLAKE				TONGUE RIVER SILICA	Local		Low		YES	NO		0.3	0	0	0	0	0	
A	2	415-002-31	SHATTER				SWAN RIVER CHERT	Local		Low	W01	YES	NO		4.79	0	0	0	0	0	
A	2	415-002-32	COMPFLAKE			FLAKE	PRAIRIE DU CHIEN CHERT	Non-Local	East	Low	G01	NO	NO	40-60%	1	17.87	13.27	4.62	0	0	
A	2	415-002-33	MEDFLAKE				RED RIVER CHERT	Local		Low	B05	UNKNOWN	NO		2.6	0	0	0	0	0	
A	3	415-003-01	SHATTER				SWAN RIVER CHERT	Local		Low	WG03	YES	NO		10.88	0	0	0	0	0	
A	3	415-003-02	PROXFLAKE			BTF	SWAN RIVER CHERT	Local		Low	WG03	YES	NO		4.11	0	0	0	0	0	
A	3	415-003-03	SHATTER				SWAN RIVER CHERT	Local		Low	W02	YES	NO		4.26	0	0	0	0	0	
A	3	415-003-04	COMPFLAKE			FLAKE	INDETERMINATE CHALCEDONY	Unknown				NO	NO	0%	2.5	25.15	14.25	5.57	0	0	
A	3	415-003-05	SHATTER				SWAN RIVER CHERT	Local		Low	W02	YES	NO		1.32	0	0	0	0	0	
A	3	415-003-06	COMPFLAKE			FLAKE	SWAN RIVER CHERT	Local		Low	WG03	YES	NO	0%	3.36	23.69	19.13	5.06	0	0	
A	3	415-003-07	SHATTER				SWAN RIVER CHERT	Local		Low	CP01	YES	NO		7.08	0	0	0	0	0	
A	3	415-003-08	COMPFLAKE			FLAKE	SWAN RIVER CHERT	Local		Low	PG35	YES	NO	0%	20.66	52.98	36.12	10.32	0	0	
A	3	415-003-09	DISTFLAKE				SWAN RIVER CHERT	Local		Low	CP01	YES	NO		4.33	0	0	0	0	0	
A	3	415-003-10	SHATTER				SWAN RIVER CHERT	Local		Low	CP01	YES	NO		0.86	0	0	0	0	0	
A	3	415-003-11	SHATTER				SWAN RIVER CHERT	Local		Low	B01	YES	NO		1.94	0	0	0	0	0	
A	3	415-003-12	SHATTER				SWAN RIVER CHERT	Local		Low	CP01	YES	NO		1.84	0	0	0	0	0	
A	3	415-003-13	SHATTER				INDETERMINATE CHERT	Unknown				UNKNOWN	NO		0.8	0	0	0	0	0	
A	3	415-003-14	PROXFLAKE			FLAKE	SILISIFIED WOOD	Local		High		UNKNOWN	NO		1.5	0	0	0	0	0	
A	3	415-003-15	BIFACEFRAG	UNFINFRAG	UNKNOWN		KNIFE RIVER FLINT	Non-Local	Northwest	High		UNKNOWN	NO		2.42	0	0	0	0	0	
A	3	415-003-16	COMPFLAKE			FLAKE	GRAND MEADOW CHERT	Non-Local	East	High		NO	NO	10-40%	1.43	26.78	12.09	2.15	0	0	
A	3	415-003-17	COMPFLAKE			FLAKE	INDETERMINATE CHERT	Unknown				YES	YES	0%	0.39	16.49	13.7	1.54	0	0	
A	3	415-003-18	FLAKETOOLPROX	UTILIZEDFLAKE	EXPEDIENT	BTF	INDETERMINATE CHERT	Unknown				UNKNOWN	NO		7.6	0	0	0	0	0	
A	3	415-003-19	COMPFLAKE			FLAKE	HUDSON BAY LOWLAND CHERT	Unknown		High		NO	NO	10-40%	1.75	22.09	21.64	3.37	0	0	
A	3	415-003-20	DISTFLAKE				INDETERMINATE CHERT	Unknown				YES	YES		1.3	0	0	0	0	0	
A	3	415-003-21	COMPFLAKE			FLAKE	GRAND MEADOW CHERT	Non-Local	East	High		NO	NO	10-40%	1.23	18.26	17.91	2.49	0	0	
A	3	415-003-22	PROXFLAKE			BTF	GRAND MEADOW CHERT	Non-Local	East	High		YES	NO		2.8	0	0	0	0	0	
A	3	415-003-23	COMPFLAKE			FLAKE	INDETERMINATE CHERT	Unknown				UNKNOWN	NO	40-60%	6.21	35.44	25.22	7.42	0	0	
A	3	415-003-24	PROXFLAKE			FLAKE	TONGUE RIVER SILICA	Local		Low		YES	NO		2.54	0	0	0	0	0	
A	3	415-003-25	PROXFLAKE			FLAKE	GALENA CHERT	Non-Local	East	High	OG02	UNKNOWN	NO		2.26	0	0	0	0	0	
A	3	415-003-26	SHATTER				INDETERMINATE QUARTZITE	Unknown				NO	NO		1	0	0	0	0	0	
A	3	415-003-27	PROXFLAKE			FLAKE	BIJOU HILLS SIL SED	Non-Local	Southwest	Low		UNKNOWN	NO		0.77	0	0	0	0	0	
A	3	415-003-28	COMPFLAKE			BTF	PRAIRIE DU CHIEN CHERT	Non-Local	East	Low	W01	NO	NO	0%	1.19	27.48	17.26	1.74	0	0	
A	3	415-003-29	SHATTER				RED RIVER CHERT	Local		Low	LG04	UNKNOWN	NO		5	0	0	0	0	0	
A	3	415-003-30	BIFACEFRAG	UNFINFRAG	UNKNOWN		BURLINGTON CHERT	Non-Local	Southeast	High		YES	NO		5	0	0	0	0	0	
A	3	415-003-31	SHATTER				RED RIVER CHERT	Local		Low	LG05	UNKNOWN	NO		3.7	0	0	0	0	0	
A	3	415-003-32	MEDFLAKE				GALENA CHERT	Non-Local	East	High	LG01	YES	NO		0.9	0	0	0	0	0	
A	3	415-003-33	SHATTER				RED RIVER CHERT	Local		Low	LG01	UNKNOWN	NO		5.2	0	0	0	0	0	
A	3	415-003-34	SHATTER				RED RIVER CHERT	Local		Low	LG07	UNKNOWN	NO		1.3	0	0	0	0	0	
A	3	415-003-35	COMPFLAKE			FLAKE	RED RIVER CHERT	Local		Low	DG05	UNKNOWN	NO	100%	1.4	17.12	13.62	4.83	0	0	
A	3	415-003-36	PROXFLAKE			FLAKE	RED RIVER CHERT	Local		Low	LG10	UNKNOWN	NO		0.7	0	0	0	0	0	
A	3	415-003-37	SHATTER				INDETERMINATE CHERT	Unknown				NO	YES		3.5	0	0	0	0	0	
A	3	415-003-38	PROXFLAKE			BTF	BURLINGTON CHERT	Non-Local	Southeast	High		YES	NO		1.7	0	0	0	0	0	
A	3	415-003-39	DISTFLAKE				BURLINGTON CHERT	Non-Local	Southeast	High		YES	NO		0.6	0	0	0	0	0	
A	3	415-003-40	PROXFLAKE			FLAKE	BURLINGTON CHERT	Non-Local	Southeast	High		YES	NO		0.3	0	0	0	0	0	
A	3	415-003-41	COMPFLAKE			FLAKE	KNIFE LAKE SILTSTONE	Local		Low		UNKNOWN	NO	0%	1.44	25.2	17.68	2.94	0	0	
A	3	415-003-42	PROXFLAKE			FLAKE	BURLINGTON CHERT	Non-Local	Southeast	High		NO	NO		0.4	0	0	0	0	0	
A	3	415-003-43	PROXFLAKE			FLAKE	BASALTIC ROCK	Local		Low		UNKNOWN	NO		1.6	0	0	0	0	0	

UNIT	LEVEL	ARTID	DATACLASS	TOOLTYPE1	TOOLTYPE2	DEBTYPE	RAWMAT2	Origin	Direction	Quality	MANGROUP	HEATED	BURNED	CORTEX	WEIGHT (g)	LENGTH1 (mm)	WIDTH1 (mm)	THICK1 (mm)	Clarkson's II	Kuhn's IR	POINTASSOC1
A	3	415-003-44	SHATTER				BASALTIC ROCK	Local		Low		UNKNOWN	NO		0.65	0	0	0	0	0	
A	3	415-003-45	SHATTER				BASALTIC ROCK	Local		Low		UNKNOWN	NO		0.81	0	0	0	0	0	
A	3	415-003-46	HEATSPALL				INDETERMINATE CHERT	Unknown				YES	YES		5.8	0	0	0	0	0	
A	3	415-003-47	SHATTER				INDETERMINATE CHERT	Unknown				UNKNOWN	NO		5.1	0	0	0	0	0	
A	3	415-003-48	PROXFLAKE			FLAKE	INDETERMINATE CHERT	Unknown				YES	YES		1.9	0	0	0	0	0	
A	3	415-003-49	SHATTER				GALENA CHERT	Non-Local	East	High	OG02	UNKNOWN	NO		5.1	0	0	0	0	0	
A	3	415-003-50	SHATTER				INDETERMINATE CHERT	Unknown				UNKNOWN	NO		1.4	0	0	0	0	0	
A	3	415-003-51	PROXFLAKE			FLAKE	SWAN RIVER CHERT	Local		Low	CP01	YES	NO		0.92	0	0	0	0	0	
A	3	415-003-52	PROXFLAKE			FLAKE	INDETERMINATE CHERT	Unknown				YES	YES		1.12	0	0	0	0	0	
A	3	415-003-53	HEATSPALL				INDETERMINATE CHERT	Unknown				YES	YES		3.6	0	0	0	0	0	
A	3	415-003-54	PROXFLAKE			FLAKE	GULSETH SILICA	Non-Local	Southwest	High		UNKNOWN	NO		1.09	0	0	0	0	0	
A	3	415-003-55	COMPFLAKE			FLAKE	KNIFE RIVER FLINT	Non-Local	Northwest	High		UNKNOWN	NO	0%	0.4	12.86	14.34	3.04	0	0	
A	3	415-003-56	HEATSPALL				INDETERMINATE CHERT	Unknown				YES	YES		0.5	0	0	0	0	0	
A	3	415-003-57	COMPFLAKE			FLAKE	SWAN RIVER CHERT	Local		Low	CP01	YES	NO	0%	1.05	22.85	10.46	4.3	0	0	
A	3	415-003-58	DISTFLAKE				INDETERMINATE CHERT	Unknown				YES	YES		0.9	0	0	0	0	0	
A	3	415-003-59	COMPFLAKE			FLAKE	INDETERMINATE CHALCEDONY	Unknown				UNKNOWN	NO	90-99%	3.7	23.07	21.94	6.09	0	0	
A	4	415-004-01	SHATTER				SWAN RIVER CHERT	Local		Low	W03	YES	NO		2.22	0	0	0	0	0	
A	4	415-004-02	SHATTER				SWAN RIVER CHERT	Local		Low	WG02	YES	NO		1.34	0	0	0	0	0	
A	4	415-004-03	COMPFLAKE			FLAKE	SWAN RIVER CHERT	Local		Low	CP01	YES	NO	100%	0.65	18.99	10.72	2.21	0	0	
A	4	415-004-04	DISTFLAKE				SWAN RIVER CHERT	Local		Low	CP01	YES	NO		1.56	0	0	0	0	0	
A	4	415-004-05	SHATTER				SWAN RIVER CHERT	Local		Low	W03	YES	NO		4.68	0	0	0	0	0	
A	4	415-004-06	SHATTER				SWAN RIVER CHERT	Local		Low	CP01	YES	NO		1.58	0	0	0	0	0	
A	4	415-004-07	COMPFLAKE			FLAKE	SWAN RIVER CHERT	Local		Low	CP01	YES	NO	0%	1.99	22.78	14.97	4.24	0	0	
A	4	415-004-08	COMPFLAKE			FLAKE	SWAN RIVER CHERT	Local		Low	CP01	YES	NO	100%	1.53	20.67	10.86	6.51	0	0	
A	4	415-004-09	PROXFLAKE			FLAKE	GRAND MEADOW CHERT	Non-Local	East	High		UNKNOWN	NO		1.5	0	0	0	0	0	
A	4	415-004-10	COMPFLAKE			FLAKE	GRAND MEADOW CHERT	Non-Local	East	High		NO	NO	1-10%	0.73	18.11	16.87	1.49	0	0	
A	4	415-004-11	MEDFLAKE				GRAND MEADOW CHERT	Non-Local	East	High		UNKNOWN	NO		0.99	0	0	0	0	0	
A	4	415-004-12	COREFRAG				GRAND MEADOW CHERT	Non-Local	East	High		UNKNOWN	NO		3.63	0	0	0	0	0	
A	4	415-004-13	DISTFLAKE				GRAND MEADOW CHERT	Non-Local	East	High		UNKNOWN	NO		0.61	0	0	0	0	0	
A	4	415-004-14	COMPFLAKE			FLAKE	GRAND MEADOW CHERT	Non-Local	East	High		UNKNOWN	NO	0%	0.78	18.69	12.83	2.32	0	0	
A	4	415-004-15	DISTFLAKE				GRAND MEADOW CHERT	Non-Local	East	High		UNKNOWN	NO		0.69	0	0	0	0	0	
A	4	415-004-16	PROXFLAKE			FLAKE	GRAND MEADOW CHERT	Non-Local	East	High		NO	NO		1.34	0	0	0	0	0	
A	4	415-004-17	HEATSPALL				INDETERMINATE CHERT	Unknown				YES	YES		0.56	0	0	0	0	0	
A	4	415-004-18	COMPFLAKE			BTF	GRAND MEADOW CHERT	Non-Local	East	High		NO	NO	10-40%	1.84	22.93	18.65	4.26	0	0	
A	4	415-004-19	SHATTER				GRAND MEADOW CHERT	Non-Local	East	High		NO	NO		1.3	0	0	0	0	0	
A	4	415-004-20	SHATTER				GRAND MEADOW CHERT	Non-Local	East	High		UNKNOWN	NO		0.63	0	0	0	0	0	
A	4	415-004-21	PROXFLAKE			BTF	KNIFE RIVER FLINT	Non-Local	Northwest	High		YES	NO		2.08	0	0	0	0	0	
A	4	415-004-22	COMPFLAKE			BTF	KNIFE RIVER FLINT	Non-Local	Northwest	High		NO	NO	0%	0.86	24.84	14.92	1.93	0	0	
A	4	415-004-23	DISTFLAKE				KNIFE RIVER FLINT	Non-Local	Northwest	High		NO	NO		0.77	0	0	0	0	0	
A	4	415-004-24	COMPFLAKE			BTF	KNIFE RIVER FLINT	Non-Local	Northwest	High		YES	NO	10-40%	0.9	24.35	13.02	2.13	0	0	
A	4	415-004-25	COMPFLAKE			FLAKE	KNIFE RIVER FLINT	Non-Local	Northwest	High		NO	NO	60-90%	12.88	13.5	20.42	7.21	0	0	
A	4	415-004-26	COMPFLAKE			FLAKE	LGG - CHALCEDONY	Local		Low		NO	NO	40-60%	2.7	18.4	22.21	5.99	0	0	
A	4	415-004-27	COMPFLAKE			FLAKE	KNIFE RIVER FLINT	Non-Local	Northwest	High		NO	NO	10-40%	0.71	18.94	14.56	2.59	0	0	
A	4	415-004-28	SHATTER				LGG - KNIFE RIVER FLINT	Local		Low		UNKNOWN	NO		1.89	0	0	0	0	0	
A	4	415-004-29	COMPFLAKE			FLAKE	SILISIFIED WOOD	Local		High		NO	NO	10-40%	3.3	17.63	22.89	6.43	0	0	
A	4	415-004-30	PROXFLAKE			BTF	KNIFE RIVER FLINT	Non-Local	Northwest	High		YES	YES		5.11	0	0	0	0	0	
A	4	415-004-31	COMPFLAKE			FLAKE	TONGUE RIVER SILICA	Local		Low		YES	NO	60-90%	3.28	26.79	21.01	5.67	0	0	
A	4	415-004-32	COMPFLAKE			FLAKE	CEDAR VALLEY CHERT	Non-Local	East	High	OW02	YES	NO	0%	1	18.26	19.76	2.01	0	0	
A	4	415-004-33	PROXFLAKE			FLAKE	CEDAR VALLEY CHERT	Non-Local	East	High	OW02	YES	NO		0.94	0	0	0	0	0	
A	4	415-004-34	COMPFLAKE			FLAKE	PRAIRIE DU CHIEN CHERT	Non-Local	East	Low	PG01	YES	NO	0%	3.15	28.42	28.82	3.42	0	0	
A	4	415-004-35	PROXFLAKE			FLAKE	BURLINGTON CHERT	Non-Local	Southeast	High		YES	NO		0.5	0	0	0	0	0	
A	4	415-004-36	SHATTER				RED RIVER CHERT	Local		Low	LG11	UNKNOWN	NO		5.5	0	0	0	0	0	
A	4	415-004-37	PROXFLAKE			FLAKE	INDETERMINATE CHERT	Unknown				UNKNOWN	NO		0.7	0	0	0	0	0	
A	4	415-004-38	SHATTER				RED RIVER CHERT	Local		Low	LG10	UNKNOWN	NO		1.1	0	0	0	0	0	
A	4	415-004-39	MEDFLAKE				INDETERMINATE CHERT	Unknown				UNKNOWN	NO		1.3	0	0	0	0	0	
A	4	415-004-40	SHATTER				GRAND MEADOW CHERT	Non-Local	East	High		YES	NO		2.13	0	0	0	0	0	
A	4	415-004-41	SHATTER				BASALTIC ROCK	Local		Low		UNKNOWN	NO		7.37	0	0	0	0	0	
A	4	415-004-42	PROXFLAKE			FLAKE	SWAN RIVER CHERT	Local		Low	G18	YES	NO		1.9	0	0	0	0	0	
A	4	415-004-43	PROXFLAKE			FLAKE	PRAIRIE DU CHIEN CHERT	Non-Local	East	Low	G02	NO	NO		1.09	0	0	0	0	0	
A	4	415-004-44	HEATSPALL				PRAIRIE DU CHIEN CHERT	Non-Local	East	Low	PG04	YES	YES		0.8	0	0	0	0	0	
A	4	415-004-45	COMPFLAKE			FLAKE	INDETERMINATE CHERT	Unknown				UNKNOWN	NO	60-90%	1	17.4	17.11	3.41	0	0	
A	4	415-004-46	COMPFLAKE			FLAKE	INDETERMINATE CHERT	Unknown				UNKNOWN	NO	60-90%	0.7	20.19	12.76	1.96	0	0	
A	4	415-004-47	COMPFLAKE			FLAKE	INDETERMINATE CHALCEDONY	Unknown				NO	NO	0%	0.5	14.84	15.68	2.15	0	0	
A	4	415-004-48	COMPFLAKE			FLAKE	GALENA CHERT	Non-Local	East	High	GS01	YES	NO	0%	2.5	32.04	18.66	2.72	0	0	
A	4	415-004-49	SHATTER				GULSETH SILICA	Non-Local	Southwest	High		NO	NO		0.5	0	0	0	0	0	
A	4	415-004-50	HEATSPALL				INDETERMINATE CHERT	Unknown				YES	YES		0.6	0	0	0	0	0	
A	4	415-004-51	SHATTER				INDETERMINATE CHERT	Unknown				UNKNOWN	NO		0.5	0	0	0	0	0	
A	4	415-004-52	SHATTER				INDETERMINATE CHERT	Unknown				UNKNOWN	NO		1.2	0	0	0	0	0	
A	4	415-004-53	SHATTER				INDETERMINATE CHERT	Unknown				NO	NO		1.8	0	0	0	0	0	
A	5	415-005-01	COMPFLAKE			FLAKE	SWAN RIVER CHERT	Local		Low	G01	YES	NO	60-90%	14.55	51	29.99	6.4	0	0	
A	5	415-005-02	COMPFLAKE			FLAKE	SWAN RIVER CHERT	Local		Low	PO01	YES	NO	0%	10.18	46.68	21.6	5.24	0	0	
A	5	415-005-03	SHATTER				SWAN RIVER CHERT	Local		Low	G01	YES	NO		1.27	0	0	0	0	0	
A	5	415-005-04	SHATTER				INDETERMINATE CHERT	Unknown				UNKNOWN	NO		2.6	0	0	0	0	0	
A	5	415-005-05	MEDFLAKE				SWAN RIVER CHERT	Local		Low	WG02	YES	NO		3.4	0	0	0	0	0	
A	5	415-005-06	PROXFLAKE			FLAKE	SWAN RIVER CHERT	Local		Low	CP02	YES	NO		1.9	0	0	0	0	0	
A	5	415-005-07	SHATTER				PRAIRIE DU CHIEN CHERT	Non-Local	East	Low	G09	YES	NO		2.7	0	0	0	0	0	
A	5	415-005-08	SHATTER				SWAN RIVER CHERT	Local		Low	WG05	YES	NO		4.07	0	0	0	0	0	
A	5	415-005-09	SHATTER				SWAN RIVER CHERT	Local		Low	W02	YES	NO		2.4	0	0	0	0	0	
A	5	415-005-10	COMPFLAKE			FLAKE	GRAND MEADOW CHERT	Non-Local	East	High		UNKNOWN	NO	0%	0.84	17.67	15.04	2.61	0	0	
A	5	415-005-11	PROXFLAKE			FLAKE	KNIFE RIVER FLINT	Non-Local	Northwest	High		UNKNOWN	NO		1.56	0	0	0	0	0	
A	5	415-005-12	COMPFLAKE			FLAKE	KNIFE RIVER FLINT	Non-Local	Northwest	High		UNKNOWN	NO	0%	1.11	19.67	23.96	3.37	0	0	
A	5	415-005-13	DISTFLAKE				KNIFE RIVER FLINT	Non-Local	Northwest	High		UNKNOWN	NO		0.94	0	0	0	0	0	
A	5	415-005-14	COMPFLAKE			FLAKE	SILISIFIED WOOD	Local		High		UNKNOWN	NO	0%	2.5	30.93	15.7	2.58	0	0	
A	5	415-005-15	SHATTER				KNIFE RIVER FLINT	Non-Local	Northwest	High		UNKNOWN	NO		0.15	0	0	0	0	0	
A	5	415-005-16	DISTFLAKE				KNIFE RIVER FLINT	Non-Local	Northwest	High		UNKNOWN	NO		1.17	0	0	0	0	0	
A	5	415-005-17	PROXFLAKE			FLAKE	TONGUE RIVER SILICA	Local		Low		YES	NO		1.12	0	0	0	0	0	
A	5	415-005-18	SHATTER				CEDAR VALLEY CHERT	Non-Local	East	High	O01	YES	NO		1	0	0	0	0	0	
A	5	415-005-19	PROXFLAKE			BTF	BIJOU HILLS SIL SED	Non-Local	Southwest	Low		UNKNOWN	NO		0.85	0	0	0	0	0	
A	5	415-005-20	COMPFLAKE			FLAKE	BIJOU HILLS SIL SED	Non-Local	Southwest	Low		UNKNOWN	NO	0%	1.19	18.13	18.88	2.76	0	0	
A	5	415-005-21	PROXFLAKE			FLAKE	BIJOU HILLS SIL SED	Non-Local	Southwest	Low		UNKNOWN	NO		0.35	0	0	0	0	0	
A	5	415-005-22	SHATTER				PRAIRIE DU CHIEN CHERT	Non-Local	East	Low	G02	YES	NO		3.06	0	0	0	0	0	
A	5	415-005-23	COMPFLAKE			FLAKE	FUSILINID CHERT	Non-Local	South	High	WG01	YES	NO	0%	0.32	11.59	11.81	1.55	0	0	
A	5	415-005-24	PROXFLAKE			FLAKE	FUSILINID CHERT	Non-Local	South	High	WG01	YES	NO		0.6	0	0	0	0	0	
A	5	415-005-25	PROXFLAKE			FLAKE	FUSILINID CHERT	Non-Local	South	High	WG01	YES	NO		1.55	0	0	0	0	0	
A	5	415-005-26	CORE				BURLINGTON CHERT	Non-Local	Southeast	High		NO	NO		38.4	0	0	0	0	0	
A	5	415-005-27	DISTFLAKE				BURLINGTON CHERT	Non-Local	Southeast	High		YES	NO		1.6	0	0	0	0	0	
A	5	415-005-28	SHATTER				INDETERMINATE CHERT	Unknown				UNKNOWN	NO		3.2	0	0	0	0	0	
A	5	415-005-29	FLAKETOOLMED	UTILIZEDFLAKE	EXPEDIENT		PRAIRIE DU CHIEN CHERT	Non-Local	East	Low	W02	YES	NO		1.2	0	0	0	0	0	
A	5	415-005-30	PROXFLAKE			BTF	BURLINGTON CHERT	Non-Local	Southeast	High		YES	NO		0.5	0	0	0	0	0	
A	5	415-005-31	MEDFLAKE				BURLINGTON CHERT	Non-Local	Southeast	High		YES	NO		0.6	0	0	0	0	0	
A	5	415-005-32	COMPFLAKE			FLAKE	BURLINGTON CHERT	Non-Local	Southeast	High		YES	NO	0%	0.3	16.24	12.04	1.98	0	0	
A	5	415-005-33	MEDFLAKE				BURLINGTON CHERT	Non-Local	Southeast	High		YES	NO		0.5	0	0	0	0	0	
A	5	415-005-34	BIFACEFRAG	UNFINFRAG	UNKNOWN		BURLINGTON CHERT	Non-Local	Southeast	High		YES	NO		4.6	0	0	0	0	0	

UNIT	LEVEL	ARTID	DATACLASS	TOOLTYPE1	TOOLTYPE2	DEBTYPE	RAWMAT2	Origin	Direction	Quality	MANGROUP	HEATED	BURNED	CORTEX	WEIGHT (g)	LENGTH1 (mm)	WIDTH1 (mm)	THICK1 (mm)	Clarkson's II	Kuhn's IR	POINTASSOC1
A	5	415-005-35	COMPFLAKE			FLAKE	RED RIVER CHERT	Local		Low	DG05	UNKNOWN	NO	10-40%	5.5	22.94	25.98	6.86	0	0	
A	5	415-005-36	COMPFLAKE			FLAKE	GALENA CHERT	Non-Local	East	High	OG03	UNKNOWN	NO	0%	1.4	23.03	17.57	3.41	0	0	
A	5	415-005-37	SHATTER				RED RIVER CHERT	Local		Low	DG04	UNKNOWN	NO		2.8	0	0	0	0	0	
A	5	415-005-38	DISTFLAKE				GALENA CHERT	Non-Local	East	High	GS02	YES	NO		1.8	0	0	0	0	0	
A	5	415-005-39	COMPFLAKE			FLAKE	INDETERMINATE CHERT	Unknown				UNKNOWN	NO	0%	0.7	22.76	15.13	2.2	0	0	
A	5	415-005-40	SHATTER				BURLINGTON CHERT	Non-Local	Southeast	High		YES	NO		0.9	0	0	0	0	0	
A	5	415-005-41	COMPFLAKE			FLAKE	GALENA CHERT	Non-Local	East	High	GS01	UNKNOWN	NO	0%	1.2	31.58	11.31	3.27	0	0	
A	5	415-005-42	PROXFLAKE			FLAKE	SWAN RIVER CHERT	Local		Low	G02	YES	NO		1.02	0	0	0	0	0	
A	5	415-005-43	PROXFLAKE			BTF	KNIFE LAKE SILTSTONE	Local		Low		UNKNOWN	NO		1.14	0	0	0	0	0	
A	5	415-005-44	SHATTER				BASALTIC ROCK	Local		Low		NO	NO		4.79	0	0	0	0	0	
A	5	415-005-45	COMPFLAKE			FLAKE	BASALTIC ROCK	Local		Low		NO	NO	60-90%	6.3	40.29	18.19	5.7	0	0	
A	5	415-005-46	SHATTER				LAKE OF THE WOODS RHYOLITE	Local		Low		UNKNOWN	NO		2.22	0	0	0	0	0	
A	5	415-005-47	SHATTER				INDETERMINATE CHERT	Unknown				YES	YES		2.3	0	0	0	0	0	
A	5	415-005-48	SHATTER				GULSETH SILICA	Non-Local	Southwest	High		NO	NO		5.3	0	0	0	0	0	
A	5	415-005-49	SHATTER				INDETERMINATE CHERT	Unknown				UNKNOWN	NO		1.7	0	0	0	0	0	
A	5	415-005-50	PROXFLAKE			FLAKE	INDETERMINATE CHERT	Unknown				YES	YES		1.8	0	0	0	0	0	
A	5	415-005-51	SHATTER				LAKE OF THE WOODS RHYOLITE	Local		Low		UNKNOWN	NO		3.73	0	0	0	0	0	
A	5	415-005-52	PROXFLAKE			FLAKE	INDETERMINATE CHERT	Unknown				UNKNOWN	NO		1.2	0	0	0	0	0	
A	5	415-005-53	COMPFLAKE			FLAKE	GALENA CHERT	Non-Local	East	High	OG02	UNKNOWN	NO	0%	0.6	17.43	16.8	1.96	0	0	
A	5	415-005-54	PROXFLAKE			FLAKE	INDETERMINATE CHERT	Unknown				UNKNOWN	NO		0.7	0	0	0	0	0	
A	5	415-005-55	SHATTER				SILISIFIED WOOD	Local		High		UNKNOWN	NO		0.87	0	0	0	0	0	
A	5	415-005-56	FLAKETOOLCOMP	SIDESCRAPER	EXPEDIENT	FLAKE	LAKE OF THE WOODS RHYOLITE	Local		Low		UNKNOWN	NO	90-99%	140.7	133.41	51.93	13.66	0.09	0.371	
A	6	415-006-01	DISTFLAKE				SWAN RIVER CHERT	Local		Low	PO01	YES	NO		9.48	0	0	0	0	0	
A	6	415-006-02	COMPFLAKE			FLAKE	SWAN RIVER CHERT	Local		Low	PO02	YES	NO	90-99%	1.46	16.65	21.3	2.97	0	0	
A	6	415-006-03	SHATTER				SWAN RIVER CHERT	Local		Low	PO02	YES	NO		1.38	0	0	0	0	0	
A	6	415-006-04	SHATTER				SWAN RIVER CHERT	Local		Low	PG27	YES	NO		1.2	0	0	0	0	0	
A	6	415-006-05	SHATTER				SWAN RIVER CHERT	Local		Low	W18	YES	NO		0.9	0	0	0	0	0	
A	6	415-006-06	SHATTER				SWAN RIVER CHERT	Local		Low	W18	UNKNOWN	NO		0.8	0	0	0	0	0	
A	6	415-006-07	COMPFLAKE			FLAKE	SWAN RIVER CHERT	Local		Low	CP01	YES	NO	0%	0.91	17.59	17.33	2.26	0	0	
A	6	415-006-08	COMPFLAKE			FLAKE	SWAN RIVER CHERT	Local		Low	WG01	YES	NO	0%	1	28.1	10.01	3.78	0	0	
A	6	415-006-09	COMPFLAKE			FLAKE	SWAN RIVER CHERT	Local		Low	G09	NO	NO	90-99%	1.7	23.78	21.17	2.82	0	0	
A	6	415-006-10	SHATTER				SWAN RIVER CHERT	Local		Low	G06	YES	NO		1.1	0	0	0	0	0	
A	6	415-006-11	SHATTER				SWAN RIVER CHERT	Local		Low	PG01	YES	NO		1.2	0	0	0	0	0	
A	6	415-006-12	SHATTER				SWAN RIVER CHERT	Local		Low	PG03	YES	YES		13	0	0	0	0	0	
A	6	415-006-13	DISTFLAKE				SWAN RIVER CHERT	Local		Low	PG01	YES	NO		4.19	0	0	0	0	0	
A	6	415-006-14	DISTFLAKE				SWAN RIVER CHERT	Local		Low	PG01	YES	NO		1.59	0	0	0	0	0	
A	6	415-006-15	COMPFLAKE			FLAKE	SWAN RIVER CHERT	Local		Low	PG01	YES	NO	10-40%	2.33	25.4	16.29	3.5	0	0	
A	6	415-006-16	SHATTER				SWAN RIVER CHERT	Local		Low	W02	YES	NO		3.2	0	0	0	0	0	
A	6	415-006-17	SHATTER				SWAN RIVER CHERT	Local		Low	PG01	YES	NO		1.84	0	0	0	0	0	
A	6	415-006-18	PROXFLAKE			FLAKE	SWAN RIVER CHERT	Local		Low	PG01	YES	NO		3.62	0	0	0	0	0	
A	6	415-006-19	PROXFLAKE			FLAKE	GRAND MEADOW CHERT	Non-Local	East	High		YES	NO		3.23	0	0	0	0	0	
A	6	415-006-20	PROXFLAKE			FLAKE	INDETERMINATE CHERT	Unknown				YES	YES		1.43	0	0	0	0	0	
A	6	415-006-21	COMPFLAKE			FLAKE	INDETERMINATE CHERT	Unknown				UNKNOWN	NO	0%	4	20.94	27.5	5.66	0	0	
A	6	415-006-22	SPLITFLAKE				KNIFE RIVER FLINT	Non-Local	Northwest	High		UNKNOWN	NO		2.51	0	0	0	0	0	
A	6	415-006-23	PROXFLAKE			FLAKE	KNIFE RIVER FLINT	Non-Local	Northwest	High		UNKNOWN	NO		1.92	0	0	0	0	0	
A	6	415-006-24	COREFRAG				KNIFE RIVER FLINT	Non-Local	Northwest	High		UNKNOWN	NO		3.81	0	0	0	0	0	
A	6	415-006-25	COREFRAG				KNIFE RIVER FLINT	Non-Local	Northwest	High		UNKNOWN	NO		5.01	0	0	0	0	0	
A	6	415-006-26	SHATTER				KNIFE RIVER FLINT	Non-Local	Northwest	High		UNKNOWN	NO		8.98	0	0	0	0	0	
A	6	415-006-27	SHATTER				TONGUE RIVER SILICA	Local		Low		YES	NO		0.74	0	0	0	0	0	
A	6	415-006-28	SHATTER				CEDAR VALLEY CHERT	Non-Local	East	High	O02	YES	NO		8.81	0	0	0	0	0	
A	6	415-006-29	PROXFLAKE			FLAKE	TONGUE RIVER SILICA	Local		Low		YES	NO		2.32	0	0	0	0	0	
A	6	415-006-30	SHATTER				BIJOU HILLS SIL SED	Non-Local	Southwest	Low		UNKNOWN	NO		0.52	0	0	0	0	0	
A	6	415-006-31	SHATTER				PRAIRIE DU CHIEN CHERT	Non-Local	East	Low	PG01	YES	NO		4.8	0	0	0	0	0	
A	6	415-006-32	SHATTER				PRAIRIE DU CHIEN CHERT	Non-Local	East	Low	W03	NO	NO		3.65	0	0	0	0	0	
A	6	415-006-33	SHATTER				PRAIRIE DU CHIEN CHERT	Non-Local	East	Low	BG01	YES	NO		0.47	0	0	0	0	0	
A	6	415-006-34	FLAKETOOLMED	SIDESCRAPER	EXPEDIENT		INDETERMINATE CHERT	Unknown				UNKNOWN	NO		5	0	0	0	0	0	
A	6	415-006-35	SHATTER				PRAIRIE DU CHIEN CHERT	Non-Local	East	Low	PG03	YES	NO		4.72	0	0	0	0	0	
A	6	415-006-36	MEDFLAKE				RED RIVER CHERT	Local		Low	DG05	UNKNOWN	NO		1.6	0	0	0	0	0	
A	6	415-006-37	DISTFLAKE				SWAN RIVER CHERT	Local		Low	WG08	YES	NO		0.3	0	0	0	0	0	
A	6	415-006-38	PROXFLAKE			FLAKE	BURLINGTON CHERT	Non-Local	Southeast	High		YES	NO		0.6	0	0	0	0	0	
A	6	415-006-39	DISTFLAKE				BURLINGTON CHERT	Non-Local	Southeast	High		YES	NO		0.9	0	0	0	0	0	
A	6	415-006-40	DISTFLAKE				INDETERMINATE CHERT	Unknown				UNKNOWN	NO		0.5	0	0	0	0	0	
A	6	415-006-41	DISTFLAKE				INDETERMINATE CHERT	Unknown				UNKNOWN	NO		0.7	0	0	0	0	0	
A	6	415-006-42	MEDFLAKE				INDETERMINATE CHERT	Unknown				UNKNOWN	NO		1.9	0	0	0	0	0	
A	6	415-006-43	SHATTER				SWAN RIVER CHERT	Local		Low	W17	YES	NO		1.1	0	0	0	0	0	
A	6	415-006-44	PROXFLAKE			FLAKE	SWAN RIVER CHERT	Local		Low	WG08	YES	NO		0.5	0	0	0	0	0	
A	6	415-006-45	COMPFLAKE			BTF	BURLINGTON CHERT	Non-Local	Southeast	High		YES	NO	0%	0.1	11.89	8.14	1.16	0	0	
A	6	415-006-46	SHATTER				BURLINGTON CHERT	Non-Local	Southeast	High		YES	NO		1	0	0	0	0	0	
A	6	415-006-47	PROXFLAKE			FLAKE	BURLINGTON CHERT	Non-Local	Southeast	High		YES	NO		0.3	0	0	0	0	0	
A	6	415-006-48	COMPFLAKE			FLAKE	BURLINGTON CHERT	Non-Local	Southeast	High		YES	NO	0%	2.8	18.15	19.14	6.35	0	0	
A	6	415-006-49	DISTFLAKE				BURLINGTON CHERT	Non-Local	Southeast	High		YES	NO		2.1	0	0	0	0	0	
A	6	415-006-50	DISTFLAKE				BURLINGTON CHERT	Non-Local	Southeast	High		YES	NO		0.6	0	0	0	0	0	
A	6	415-006-51	COMPFLAKE			FLAKE	RED RIVER CHERT	Local		Low	LG10	UNKNOWN	NO	0%	1	21.49	14.98	3.67	0	0	
A	6	415-006-52	DISTFLAKE				BURLINGTON CHERT	Non-Local	Southeast	High		YES	NO		1.1	0	0	0	0	0	
A	6	415-006-53	COMPFLAKE			FLAKE	BURLINGTON CHERT	Non-Local	Southeast	High		YES	NO	0%	0.5	20.23	11.38	1.34	0	0	
A	6	415-006-54	DISTFLAKE				INDETERMINATE CHERT	Unknown				UNKNOWN	NO		0.7	0	0	0	0	0	
A	6	415-006-55	MEDFLAKE				BURLINGTON CHERT	Non-Local	Southeast	High		YES	NO		0.5	0	0	0	0	0	
A	6	415-006-56	DISTFLAKE				BURLINGTON CHERT	Non-Local	Southeast	High		YES	NO		0.3	0	0	0	0	0	
A	6	415-006-57	PROXFLAKE			FLAKE	BURLINGTON CHERT	Non-Local	Southeast	High		YES	NO		0.3	0	0	0	0	0	
A	6	415-006-58	PROXFLAKE			FLAKE	BURLINGTON CHERT	Non-Local	Southeast	High		YES	NO		0.2	0	0	0	0	0	
A	6	415-006-59	PROXFLAKE			FLAKE	BURLINGTON CHERT	Non-Local	Southeast	High		YES	NO		0.5	0	0	0	0	0	
A	6	415-006-60	PROXFLAKE			FLAKE	MAYNES CREEK CHERT	Non-Local	Southeast	High	WG01	YES	NO		1.81	0	0	0	0	0	
A	6	415-006-61	PROXFLAKE			FLAKE	LAKE OF THE WOODS RHYOLITE	Local		Low		UNKNOWN	NO		7.2	0	0	0	0	0	
A	6	415-006-62	SPLITFLAKE				BASALTIC ROCK	Local		Low		UNKNOWN	NO		1.9	0	0	0	0	0	
A	6	415-006-63	SHATTER				BASALTIC ROCK	Local		Low		UNKNOWN	NO		1.94	0	0	0	0	0	
A	6	415-006-64	SHATTER				BASALTIC ROCK	Local		Low		UNKNOWN	NO		4.84	0	0	0	0	0	
A	6	415-006-65	PROXFLAKE			FLAKE	GRANITIC ROCK	Local		Low		UNKNOWN	NO		3.44	0	0	0	0	0	
A	6	415-006-67	COMPFLAKE			FLAKE	INDETERMINATE CHERT	Unknown				UNKNOWN	NO	0%	9.1	34.13	36.57	7.5	0	0	
A	6	415-006-68	SHATTER				BASALTIC ROCK	Local		Low		UNKNOWN	NO		8.2	0	0	0	0	0	
A	6	415-006-69	COMPFLAKE			FLAKE	INDETERMINATE CHERT	Unknown				UNKNOWN	NO	60-90%	6	34.71	21.19	8.58	0	0	
A	6	415-006-70	PROXFLAKE			FLAKE	INDETERMINATE CHERT	Unknown				UNKNOWN	NO		1.4	0	0	0	0	0	
A	6	415-006-71	SHATTER				INDETERMINATE CHERT	Unknown				YES	YES		7.7	0	0	0	0	0	
A	6	415-006-72	SHATTER				INDETERMINATE CHERT	Unknown				UNKNOWN	NO		2.3	0	0	0	0	0	
A	6	415-006-73	PROXFLAKE			FLAKE	INDETERMINATE CHERT	Unknown				UNKNOWN	NO		1.7	0	0	0	0	0	
A	6	415-006-74	HEATSPALL				INDETERMINATE CHERT	Unknown				YES	YES		3	0	0	0	0	0	
A	6	415-006-75	SHATTER				INDETERMINATE CHERT	Unknown				UNKNOWN	NO		3.7	0	0	0	0	0	
A	6	415-006-76	PROXFLAKE			FLAKE	INDETERMINATE CHERT	Unknown				UNKNOWN	NO		0.9	0	0	0	0	0	
A	6	415-006-77	SHATTER				INDETERMINATE CHERT	Unknown				UNKNOWN	NO		2.2	0	0	0	0	0	
A	6	415-006-78	COMPFLAKE			BIPOLAR	INDETERMINATE CHERT	Unknown				UNKNOWN	NO	0%	1.8	16.67	16.88	5.83	0	0	
A	6	415-006-79	SHATTER				INDETERMINATE CHERT	Unknown				UNKNOWN	NO		1.6	0	0	0	0	0	
A	6	415-006-80	SHATTER				PRAIRIE DU CHIEN CHERT	Non-Local	East	Low	P01	YES	NO		0.58	0	0	0	0	0	
A	6	415-006-81	COMPFLAKE			FLAKE	GALENA CHERT	Non-Local	East	High	OG03	UNKNOWN	NO	0%	1.9	30.56	17.09	3.32	0	0	
A	7	415-007-01	SHATTER				SWAN RIVER CHERT	Local		Low	G22	YES	NO		1.6	0	0	0	0	0	

UNIT	LEVEL	ARTID	DATACLASS	TOOLTYPE1	TOOLTYPE2	DEBTYPE	RAWMAT2	Origin	Direction	Quality	MANGROUP	HEATED	BURNED	CORTEX	WEIGHT (g)	LENGTH1 (mm)	WIDTH1 (mm)	THICK1 (mm)	Clarkson's II	Kuhn's IR	POINTASSOC1
A	7	415-007-02	DISTFLAKE				SWAN RIVER CHERT	Local		Low	WG02	YES	NO		1.34	0	0	0	0	0	
A	7	415-007-03	PROXFLAKE			FLAKE	SWAN RIVER CHERT	Local		Low	W09	YES	NO		4.3	0	0	0	0	0	
A	7	415-007-04	SHATTER				SWAN RIVER CHERT	Local		Low	G22	YES	NO		0.3	0	0	0	0	0	
A	7	415-007-05	SHATTER				PRAIRIE DU CHIEN CHERT	Non-Local	East	Low	PG02	YES	NO		2.28	0	0	0	0	0	
A	7	415-007-06	COMPFLAKE			FLAKE	KNIFE RIVER FLINT	Non-Local	Northwest	High		UNKNOWN	NO	10-40%	1.24	19.8	19.5	2.98	0	0	
A	7	415-007-07	PROXFLAKE			BTF	KNIFE RIVER FLINT	Non-Local	Northwest	High		UNKNOWN	NO		0.93	0	0	0	0	0	
A	7	415-007-08	MEDFLAKE				KNIFE RIVER FLINT	Non-Local	Northwest	High		UNKNOWN	NO		1.03	0	0	0	0	0	
A	7	415-007-09	PROXFLAKE			FLAKE	KNIFE RIVER FLINT	Non-Local	Northwest	High		UNKNOWN	NO		0.51	0	0	0	0	0	
A	7	415-007-10	SHATTER				GALENA CHERT	Non-Local	East	High	OG03	UNKNOWN	NO		0.8	0	0	0	0	0	
A	7	415-007-11	SHATTER				INDETERMINATE CHERT	Unknown				UNKNOWN	NO		1.7	0	0	0	0	0	
A	7	415-007-12	SHATTER				KNIFE RIVER FLINT	Non-Local	Northwest	High		UNKNOWN	NO		35.3	0	0	0	0	0	
A	7	415-007-13	COMPFLAKE			FLAKE	BASALTIC ROCK	Local		Low		UNKNOWN	NO	90-99%	1.1	15.94	16.66	3.93	0	0	
A	7	415-007-14	SHATTER				QUARTZ	Local		Low		UNKNOWN	NO		2.04	0	0	0	0	0	
A	7	415-007-15	COMPFLAKE			FLAKE	PRAIRIE DU CHIEN CHERT	Non-Local	East	Low	BG01	YES	NO	0%	0.79	19.27	15.21	2.94	0	0	
B	1	415-008-01	SHATTER				SWAN RIVER CHERT	Local		Low	PO10	YES	NO		2.4	0	0	0	0	0	
B	1	415-008-02	COMPFLAKE			FLAKE	SWAN RIVER CHERT	Local		Low	PO08	YES	NO	10-40%	16.1	39.48	34.32	9.85	0	0	
B	1	415-008-03	SHATTER				SWAN RIVER CHERT	Local		Low	PO08	YES	NO		2.7	0	0	0	0	0	
B	1	415-008-04	MEDFLAKE				SWAN RIVER CHERT	Local		Low	B02	YES	NO		1	0	0	0	0	0	
B	1	415-008-05	COMPFLAKE			FLAKE	SWAN RIVER CHERT	Local		Low	CP04	YES	NO	0%	7.7	30.59	26.65	8.47	0	0	
B	1	415-008-06	SHATTER				SWAN RIVER CHERT	Local		Low	W04	UNKNOWN	NO		4.1	0	0	0	0	0	
B	1	415-008-07	FLAKETOOLMED	SIDESCRAPER	EXPEDIENT		SWAN RIVER CHERT	Local		Low	W06	YES	NO		2.8	0	0	0	0	0	
B	1	415-008-08	FLAKETOOLPROX	DOUBLESIDESCRAPER	EXPEDIENT	FLAKE	KNIFE RIVER FLINT	Non-Local	Northwest	High		UNKNOWN	NO		2.5	0	0	0	0	0	
B	1	415-008-09	FLAKETOOLPROX	UTILIZEDFLAKE	EXPEDIENT	FLAKE	KNIFE RIVER FLINT	Non-Local	Northwest	High		UNKNOWN	NO		0.7	0	0	0	0	0	
B	1	415-008-10	SHATTER				KNIFE RIVER FLINT	Non-Local	Northwest	High		UNKNOWN	NO		2.1	0	0	0	0	0	
B	1	415-008-11	COMPFLAKE			FLAKE	KNIFE RIVER FLINT	Non-Local	Northwest	High		UNKNOWN	NO	1-10%	0.84	15.51	15.1	2.87	0	0	
B	1	415-008-12	COMPFLAKE			FLAKE	BIJOU HILLS SIL SED	Non-Local	Southwest	Low		UNKNOWN	NO	0%	2.2	25.63	23.19	3.84	0	0	
B	1	415-008-13	COMPFLAKE			FLAKE	PRAIRIE DU CHIEN CHERT	Non-Local	East	Low	G06	NO	NO	10-40%	2.9	20.64	19.96	5.78	0	0	
B	1	415-008-14	DISTFLAKE				TONGUE RIVER SILICA	Local		Low		YES	NO		0.8	0	0	0	0	0	
B	1	415-008-15	SHATTER				PRAIRIE DU CHIEN CHERT	Non-Local	East	Low	PG09	YES	NO		5	0	0	0	0	0	
B	1	415-008-16	FLAKETOOLCOMP	BURIN	EXPEDIENT	FLAKE	RED RIVER CHERT	Local		Low	LG05	UNKNOWN	NO	90-99%	13.2	43.56	17.56	11.38	0	0	
B	1	415-008-17	PROXFLAKE			FLAKE	GALENA CHERT	Non-Local	East	High	LG02	UNKNOWN	NO		1.9	0	0	0	0	0	
B	1	415-008-18	SHATTER				BURLINGTON CHERT	Non-Local	Southeast	High		YES	NO		2	0	0	0	0	0	
B	1	415-008-19	PROXFLAKE			FLAKE	INDETERMINATE QUARTZITE	Unknown				NO	NO		4.4	0	0	0	0	0	
B	1	415-008-20	SHATTER				QUARTZ	Local		Low		UNKNOWN	NO		1.8	0	0	0	0	0	
B	1	415-008-21	SHATTER				INDETERMINATE QUARTZITE	Unknown				NO	NO		1.9	0	0	0	0	0	
B	1	415-008-22	DISTFLAKE				INDETERMINATE CHERT	Unknown				UNKNOWN	NO		5.3	0	0	0	0	0	
B	1	415-008-23	HEATSPALL				INDETERMINATE CHERT	Unknown				YES	YES		0.9	0	0	0	0	0	
B	1	415-008-24	SHATTER				SWAN RIVER CHERT	Local		Low	W15	NO	NO		1.1	0	0	0	0	0	
B	1	415-008-25	COMPFLAKE			FLAKE	INDETERMINATE CHERT	Unknown				YES	YES	0%	1.8	16.19	21.38	4.32	0	0	
B	1	415-008-26	SHATTER				SWAN RIVER CHERT	Local		Low	G10	YES	NO		2.5	0	0	0	0	0	
B	2	415-009-01	SHATTER				SWAN RIVER CHERT	Local		Low	PO04	YES	NO		8.8	0	0	0	0	0	
B	2	415-009-02	COMPFLAKE			FLAKE	SWAN RIVER CHERT	Local		Low	PO04	YES	NO	0%	2.6	21.53	16.73	4.71	0	0	
B	2	415-009-03	COMPFLAKE			FLAKE	SWAN RIVER CHERT	Local		Low	PO03	YES	NO	10-40%	1.3	17.67	15.86	4.3	0	0	
B	2	415-009-04	SHATTER				SWAN RIVER CHERT	Local		Low	PG28	YES	NO		1.2	0	0	0	0	0	
B	2	415-009-05	DISTFLAKE				SWAN RIVER CHERT	Local		Low	CP02	YES	NO		0.6	0	0	0	0	0	
B	2	415-009-06	SHATTER				SWAN RIVER CHERT	Local		Low	PG30	YES	NO		0.6	0	0	0	0	0	
B	2	415-009-07	COMPFLAKE			FLAKE	SWAN RIVER CHERT	Local		Low	G17	YES	NO	0%	4.5	25.87	29.13	4.93	0	0	
B	2	415-009-08	COMPFLAKE			FLAKE	SWAN RIVER CHERT	Local		Low	G31	YES	NO	1-10%	1	19.62	14.41	2.04	0	0	
B	2	415-009-09	SHATTER				INDETERMINATE CHALCEDONY	Unknown				UNKNOWN	NO		2.5	0	0	0	0	0	
B	2	415-009-10	FLAKETOOLCOMP	END&SIDESCRAPER	EXPEDIENT	FLAKE	SWAN RIVER CHERT	Local		Low	CG04	YES	NO	10-40%	1.6	22.65	23.45	3.66	0.16	0	
B	2	415-009-11	SHATTER				SWAN RIVER CHERT	Local		Low	CP01	YES	NO		1.4	0	0	0	0	0	
B	2	415-009-12	SHATTER				SWAN RIVER CHERT	Local		Low	G26	YES	NO		1.7	0	0	0	0	0	
B	2	415-009-13	SHATTER				SWAN RIVER CHERT	Local		Low	G06	YES	NO		2.5	0	0	0	0	0	
B	2	415-009-14	SHATTER				SWAN RIVER CHERT	Local		Low	G27	UNKNOWN	NO		1	0	0	0	0	0	
B	2	415-009-15	COMPFLAKE			FLAKE	SWAN RIVER CHERT	Local		Low	G19	YES	NO	0%	0.9	15.44	16.75	3.94	0	0	
B	2	415-009-16	COMPFLAKE			FLAKE	SWAN RIVER CHERT	Local		Low	G03	UNKNOWN	NO	0%	2.1	22.8	19.85	4.13	0	0	
B	2	415-009-17	DISTFLAKE				SWAN RIVER CHERT	Local		Low	PG31	YES	NO		3.5	0	0	0	0	0	
B	2	415-009-18	SHATTER				INDETERMINATE CHERT	Unknown				UNKNOWN	NO		1.4	0	0	0	0	0	
B	2	415-009-19	SHATTER				SWAN RIVER CHERT	Local		Low	R02	YES	YES		6.4	0	0	0	0	0	
B	2	415-009-20	DISTFLAKE				SWAN RIVER CHERT	Local		Low	PO11	YES	NO		1.5	0	0	0	0	0	
B	2	415-009-21	SHATTER	UNFIN			SWAN RIVER CHERT	Local		Low	G15	YES	NO		10.4	0	0	0	0	0	
B	2	415-009-22	HEATSPALL				SWAN RIVER CHERT	Local		Low	CP02	YES	YES		4	0	0	0	0	0	
B	2	415-009-23	COMPFLAKE			BTF	KNIFE RIVER FLINT	Non-Local	Northwest	High		UNKNOWN	NO	0%	1.3	22.7	17.31	2.95	0	0	
B	2	415-009-24	COMPFLAKE			FLAKE	KNIFE RIVER FLINT	Non-Local	Northwest	High		UNKNOWN	NO	10-40%	1.8	16.03	19.51	4.77	0	0	
B	2	415-009-25	FLAKETOOLCOMP	SIDESCRAPER	EXPEDIENT	FLAKE	KNIFE RIVER FLINT	Non-Local	Northwest	High		UNKNOWN	NO	0%	1.1	23.88	16.53	1.81	0.19	0	
B	2	415-009-26	COMPFLAKE			FLAKE	KNIFE RIVER FLINT	Non-Local	Northwest	High		UNKNOWN	NO	60-90%	0.9	18.56	17.49	2.81	0	0	
B	2	415-009-27	COMPFLAKE			FLAKE	KNIFE RIVER FLINT	Non-Local	Northwest	High		UNKNOWN	NO	0%	0.8	19.25	13.54	2.53	0	0	
B	2	415-009-28	COMPFLAKE			BTF	KNIFE RIVER FLINT	Non-Local	Northwest	High		UNKNOWN	NO	0%	0.9	18.76	15.32	3.21	0	0	
B	2	415-009-29	COMPFLAKE			BIPOLAR	LGG - KNIFE RIVER FLINT	Local		Low		UNKNOWN	NO	10-40%	1.9	23.5	12.89	3.02	0	0	
B	2	415-009-30	COMPFLAKE			FLAKE	KNIFE RIVER FLINT	Non-Local	Northwest	High		UNKNOWN	NO	100%	1.3	17.55	14.19	3.86	0	0	
B	2	415-009-31	COMPFLAKE			FLAKE	KNIFE RIVER FLINT	Non-Local	Northwest	High		UNKNOWN	NO	10-40%	0.8	16.09	17.47	2.14	0	0	
B	2	415-009-32	COMPFLAKE			FLAKE	GRAND MEADOW CHERT	Non-Local	East	High		UNKNOWN	NO	0%	1.7	17.29	21.88	3.5	0	0	
B	2	415-009-33	COMPFLAKE			BTF	GRAND MEADOW CHERT	Non-Local	East	High		UNKNOWN	NO	0%	1	21.92	19.13	2.61	0	0	
B	2	415-009-34	COMPFLAKE			FLAKE	GRAND MEADOW CHERT	Non-Local	East	High		YES	NO	10-40%	1.4	20.17	14.16	3.62	0	0	
B	2	415-009-35	COMPFLAKE			FLAKE	TONGUE RIVER SILICA	Local		Low		YES	NO	40-60%	10	36.85	21.31	9.39	0	0	
B	2	415-009-36	COMPFLAKE			FLAKE	TONGUE RIVER SILICA	Local		Low		YES	NO	100%	3.4	25.16	18.97	7.74	0	0	
B	2	415-009-37	COMPFLAKE			FLAKE	TONGUE RIVER SILICA	Local		Low		YES	NO	0%	3.4	30.85	22.52	4.03	0	0	
B	2	415-009-38	FLAKETOOLDIST	UTILIZEDFLAKE	EXPEDIENT		TONGUE RIVER SILICA	Local		Low		NO	NO		5.7	0	0	0	0	0	
B	2	415-009-39	SHATTER				TONGUE RIVER SILICA	Local		Low		YES	NO		4.3	0	0	0	0	0	
B	2	415-009-40	MEDFLAKE				PRAIRIE DU CHIEN CHERT	Non-Local	East	Low	PG16	YES	NO		2.6	0	0	0	0	0	
B	2	415-009-41	PROXFLAKE			FLAKE	BURLINGTON CHERT	Non-Local	Southeast	High		YES	NO		1.9	0	0	0	0	0	
B	2	415-009-42	MEDFLAKE				BURLINGTON CHERT	Non-Local	Southeast	High		NO	NO		3.1	0	0	0	0	0	
B	2	415-009-43	DISTFLAKE				BURLINGTON CHERT	Non-Local	Southeast	High		YES	NO		0.7	0	0	0	0	0	
B	2	415-009-44	COMPFLAKE			FLAKE	RED RIVER CHERT	Local		Low	LG05	UNKNOWN	NO	1-10%	3.4	21.84	20.61	3.87	0	0	
B	2	415-009-45	COMPFLAKE			FLAKE	RED RIVER CHERT	Local		Low	DG05	UNKNOWN	NO	60-90%	5.9	28.42	23.44	6.27	0	0	
B	2	415-009-46	PROXFLAKE			FLAKE	RED RIVER CHERT	Local		Low	DG05	UNKNOWN	NO		1.7	0	0	0	0	0	
B	2	415-009-47	COMPFLAKE			FLAKE	RED RIVER CHERT	Local		Low	DG05	UNKNOWN	NO	90-99%	0.8	12.23	16.07	4.18	0	0	
B	2	415-009-48	SHATTER				RED RIVER CHERT	Local		Low	DG05	UNKNOWN	NO		0.9	0	0	0	0	0	
B	2	415-009-49	SHATTER				BASALTIC ROCK	Local		Low		UNKNOWN	NO		1.3	0	0	0	0	0	
B	2	415-009-50	SHATTER				INDETERMINATE QUARTZITE	Unknown				NO	NO		1.8	0	0	0	0	0	
B	2	415-009-51	SHATTER				BASALTIC ROCK	Local		Low		UNKNOWN	NO		2	0	0	0	0	0	
B	2	415-009-52	BIFACEFRAG	UNFINFRAG	UNKNOWN		INDETERMINATE CHERT	Unknown				UNKNOWN	NO		6.1	0	0	0	0	0	
B	2	415-009-53	DISTFLAKE				INDETERMINATE CHERT	Unknown				UNKNOWN	NO		0.7	0	0	0	0	0	
B	2	415-009-54	COMPFLAKE			FLAKE	GALENA CHERT	Non-Local	East	High	OG01	UNKNOWN	NO	0%	1.2	30.51	13.14	2.63	0	0	
B	2	415-009-55	COMPFLAKE			FLAKE	INDETERMINATE CHERT	Unknown				UNKNOWN	NO	0%	1.2	23.65	14.55	2.51	0	0	
B	2	415-009-56	HEATSPALL				INDETERMINATE CHERT	Unknown				YES	YES		1.2	0	0	0	0	0	
B	2	415-009-57	DISTFLAKE				LGG - AGATE	Local		Low		NO	NO		2.2	0	0	0	0	0	
B	2	415-009-58	COMPFLAKE			FLAKE	INDETERMINATE CHERT	Unknown				YES	YES	10-40%	1.1	17.38	17.91	3.85	0	0	
B	2	415-009-59	SHATTER				INDETERMINATE CHERT	Unknown				UNKNOWN	NO		1.5	0	0	0	0	0	
B	2	415-009-60	SHATTER				INDETERMINATE CHERT	Unknown				UNKNOWN	NO		1.4	0	0	0	0	0	
B	2	415-009-61	HEATSPALL				INDETERMINATE CHERT	Unknown				YES	YES		3.6	0	0	0	0	0	
B	2	415-009-63	PROXFLAKE			FLAKE	INDETERMINATE CHERT	Unknown				UNKNOWN	NO		1.3	0	0	0	0	0	
B	2	415-009-64	FLAKETOOLPROX	UTILIZEDFLAKE	EXPEDIENT	FLAKE	INDETERMINATE CHERT	Unknown				UNKNOWN	NO		0.5	0	0	0	0	0	

UNIT	LEVEL	ARTID	DATACLASS	TOOLTYPE1	TOOLTYPE2	DEBTYPE	RAWMAT2	Origin	Direction	Quality	MANGROUP	HEATED	BURNED	CORTEX	WEIGHT (g)	LENGTH1 (mm)	WIDTH1 (mm)	THICK1 (mm)	Clarkson's II	Kuhn's IR	POINTASSOC1
B	2	415-009-65	SHATTER				SWAN RIVER CHERT	Local		Low	PO10	YES	NO		2.3	0	0	0	0	0	
B	2	415-009-66	PROXFLAKE			FLAKE	GULSETH SILICA	Non-Local	Southwest	High		NO	NO		1.4	0	0	0	0	0	
B	2	415-009-67	COMPFLAKE			FLAKE	INDETERMINATE CHERT	Unknown				YES	YES	0%	7.4	32.87	27.57	7.82	0	0	
B	2	415-009-68	COMPFLAKE			BIPOLAR	LGG - AGATE	Local		Low		NO	NO	100%	11.5	32.18	22.84	13.86	0	0	
B	3	415-010-01	DISTFLAKE				SWAN RIVER CHERT	Local		Low	G07	YES	NO		6.7	0	0	0	0	0	
B	3	415-010-02	MEDFLAKE				SWAN RIVER CHERT	Local		Low	CG01	YES	NO		3.7	0	0	0	0	0	
B	3	415-010-03	FLAKETOOLMED	SIDESCRAPER	EXPEDIENT		SWAN RIVER CHERT	Local		Low	CG01	YES	NO		2.3	0	0	0	0	0.278	
B	3	415-010-04	MEDFLAKE				SWAN RIVER CHERT	Local		Low	PG07	YES	NO		5.1	0	0	0	0	0	
B	3	415-010-05	SHATTER				SWAN RIVER CHERT	Local		Low	PG31	YES	NO		4.1	0	0	0	0	0	
B	3	415-010-06	PROXFLAKE			FLAKE	SWAN RIVER CHERT	Local		Low	G06	YES	NO		0.9	0	0	0	0	0	
B	3	415-010-07	PROXFLAKE			FLAKE	SWAN RIVER CHERT	Local		Low	PO06	YES	NO		1.3	0	0	0	0	0	
B	3	415-010-08	SHATTER				SWAN RIVER CHERT	Local		Low	PG23	YES	NO		1.5	0	0	0	0	0	
B	3	415-010-09	SHATTER				SWAN RIVER CHERT	Local		Low	W04	UNKNOWN	NO		1.7	0	0	0	0	0	
B	3	415-010-10	DISTFLAKE				SWAN RIVER CHERT	Local		Low	G06	YES	NO		0.5	0	0	0	0	0	
B	3	415-010-11	COMPFLAKE			FLAKE	GRAND MEADOW CHERT	Non-Local	East	High		NO	NO	60-90%	19.7	53.09	20.66	11.21	0	0	
B	3	415-010-12	FLAKETOOLMED	UTILIZEDFLAKE	EXPEDIENT		INDETERMINATE CHERT	Unknown				UNKNOWN	NO		1.8	0	0	0	0	0	
B	3	415-010-13	COMPFLAKE			FLAKE	INDETERMINATE CHERT	Unknown				YES	YES	10-40%	2.7	15.28	24.59	4.6	0	0	
B	3	415-010-14	SHATTER				GRAND MEADOW CHERT	Non-Local	East	High		NO	NO		1.7	0	0	0	0	0	
B	3	415-010-15	COMPFLAKE			FLAKE	GRAND MEADOW CHERT	Non-Local	East	High		UNKNOWN	NO	0%	5.6	31.41	22.75	7.57	0	0	
B	3	415-010-16	COMPFLAKE			BTF	KNIFE RIVER FLINT	Non-Local	Northwest	High		UNKNOWN	NO	0%	1.6	21.95	21.51	3.05	0	0	
B	3	415-010-17	DISTFLAKE				KNIFE RIVER FLINT	Non-Local	Northwest	High		UNKNOWN	NO		0.6	0	0	0	0	0	
B	3	415-010-18	FLAKETOOLMED	DOUBLESIDESCRAPER	EXPEDIENT		KNIFE RIVER FLINT	Non-Local	Northwest	High		UNKNOWN	NO		1.6	0	0	0	0	0	
B	3	415-010-19	BIFACEFRAG	UNFINFRAG	UNKNOWN		KNIFE RIVER FLINT	Non-Local	Northwest	High		UNKNOWN	NO		2.6	0	0	0	0	0	
B	3	415-010-20	PROXFLAKE			FLAKE	TONGUE RIVER SILICA	Local		Low		YES	NO		1.2	0	0	0	0	0	
B	3	415-010-21	COMPFLAKE			BTF	TONGUE RIVER SILICA	Local		Low		YES	NO	0%	0.9	15.77	18.83	3.11	0	0	
B	3	415-010-22	BIFACEFRAG	UNFINFRAG	UNKNOWN		BIJOU HILLS SIL SED	Non-Local	Southwest	Low		UNKNOWN	NO		2.7	0	0	0	0	0	
B	3	415-010-23	COMPFLAKE			FLAKE	PRAIRIE DU CHIEN CHERT	Non-Local	East	Low	PG06	YES	NO	0%	1.4	20.06	17.59	3.2	0	0	
B	3	415-010-24	COMPFLAKE			BIPOLAR	LAKE OF THE WOODS RHYOLITE	Local		Low		UNKNOWN	NO	60-90%	1.9	31.37	13.37	3.81	0	0	
B	3	415-010-25	SHATTER				BASALTIC ROCK	Local		Low		UNKNOWN	NO		0.9	0	0	0	0	0	
B	3	415-010-26	COMPFLAKE			FLAKE	BURLINGTON CHERT	Non-Local	Southeast	High		NO	NO	0%	1.5	22.88	20.58	2.23	0	0	
B	3	415-010-27	SHATTER				RED RIVER CHERT	Local		Low	LG08	UNKNOWN	NO		8.3	0	0	0	0	0	
B	3	415-010-28	SHATTER				INDETERMINATE CHERT	Unknown				YES	YES		1.5	0	0	0	0	0	
B	3	415-010-29	FLAKETOOLMED	DOUBLESIDESCRAPER	EXPEDIENT		INDETERMINATE CHERT	Unknown				UNKNOWN	NO		1	0	0	0	0	0	
B	3	415-010-30	PROXFLAKE			FLAKE	KNIFE RIVER FLINT	Non-Local	Northwest	High		UNKNOWN	NO		0.6	0	0	0	0	0	
B	3	415-010-31	DISTFLAKE				BURLINGTON CHERT	Non-Local	Southeast	High		YES	NO		2.1	0	0	0	0	0	
B	3	415-010-32	PROXFLAKE			FLAKE	FUSILINID CHERT	Non-Local	South	High	G02	YES	NO		2.2	0	0	0	0	0	
B	3	415-010-33	PROXFLAKE			FLAKE	INDETERMINATE CHERT	Unknown				UNKNOWN	NO		8.9	0	0	0	0	0	
B	3	415-010-34	MEDFLAKE				INDETERMINATE CHERT	Unknown				UNKNOWN	NO		0.9	0	0	0	0	0	
B	3	415-010-35	SHATTER				INDETERMINATE CHERT	Unknown				YES	YES		2.5	0	0	0	0	0	
B	3	415-010-36	MEDFLAKE				INDETERMINATE CHERT	Unknown				YES	YES		0.7	0	0	0	0	0	
B	3	415-010-37	PROXFLAKE			FLAKE	INDETERMINATE CHERT	Unknown				UNKNOWN	NO		0.3	0	0	0	0	0	
B	4	415-011-01	SHATTER			FLAKE	SWAN RIVER CHERT	Local		Low	PO10	YES	NO		12.2	0	0	0	0	0	
B	4	415-011-02	PROXFLAKE			FLAKE	SWAN RIVER CHERT	Local		Low	PG05	YES	NO		2	0	0	0	0	0	
B	4	415-011-03	COMPFLAKE			BTF	SWAN RIVER CHERT	Local		Low	W06	YES	NO	1-10%	3.5	30.21	29.31	3.9	0	0	
B	4	415-011-04	COMPFLAKE			FLAKE	SWAN RIVER CHERT	Local		Low	PO04	YES	NO	0%	4.4	27.07	20.46	5.64	0	0	
B	4	415-011-05	COMPFLAKE			FLAKE	SWAN RIVER CHERT	Local		Low	W06	YES	NO	60-90%	3.2	28.37	21.21	3.1	0	0	
B	4	415-011-06	FLAKETOOLMED	UNFINFRAG	UNKNOWN		BURLINGTON CHERT	Non-Local	Southeast	High		YES	NO		4.4	0	0	0	0	0	
B	4	415-011-07	SHATTER				SWAN RIVER CHERT	Local		Low	WG04	YES	NO		0.9	0	0	0	0	0	
B	4	415-011-08	PROXFLAKE			FLAKE	SWAN RIVER CHERT	Local		Low	G06	YES	NO		0.7	0	0	0	0	0	
B	4	415-011-09	DISTFLAKE				SWAN RIVER CHERT	Local		Low	G28	YES	NO		2.3	0	0	0	0	0	
B	4	415-011-10	SHATTER				SWAN RIVER CHERT	Local		Low	PG12	YES	NO		4.7	0	0	0	0	0	
B	4	415-011-11	SPLITFLAKE				SWAN RIVER CHERT	Local		Low	PO10	YES	NO		0.7	0	0	0	0	0	
B	4	415-011-12	SHATTER				SWAN RIVER CHERT	Local		Low	PG23	YES	NO		2.3	0	0	0	0	0	
B	4	415-011-13	MEDFLAKE				SWAN RIVER CHERT	Local		Low	WG07	YES	NO		1.4	0	0	0	0	0	
B	4	415-011-14	SHATTER				SWAN RIVER CHERT	Local		Low	PG12	YES	NO		5.1	0	0	0	0	0	
B	4	415-011-15	PROXFLAKE			FLAKE	SWAN RIVER CHERT	Local		Low	G06	YES	NO		1.6	0	0	0	0	0	
B	4	415-011-16	COMPFLAKE			FLAKE	GRAND MEADOW CHERT	Non-Local	East	High		NO	NO	1-10%	2	20.42	15.64	3.55	0	0	
B	4	415-011-17	SHATTER				GRAND MEADOW CHERT	Non-Local	East	High		NO	NO		1.6	0	0	0	0	0	
B	4	415-011-18	DISTFLAKE				KNIFE RIVER FLINT	Non-Local	Northwest	High		UNKNOWN	NO		1.5	0	0	0	0	0	
B	4	415-011-19	PROXFLAKE			FLAKE	KNIFE RIVER FLINT	Non-Local	Northwest	High		UNKNOWN	NO		5	0	0	0	0	0	
B	4	415-011-20	MEDFLAKE				KNIFE RIVER FLINT	Non-Local	Northwest	High		UNKNOWN	NO		1.1	0	0	0	0	0	
B	4	415-011-21	DISTFLAKE				TONGUE RIVER SILICA	Local		Low		YES	NO		2.3	0	0	0	0	0	
B	4	415-011-22	PROXFLAKE			FLAKE	TONGUE RIVER SILICA	Local		Low		YES	NO		1.2	0	0	0	0	0	
B	4	415-011-23	COMPFLAKE			FLAKE	PRAIRIE DU CHIEN CHERT	Non-Local	East	Low	G10	YES	NO	0%	2.2	20.89	21.64	4.16	0	0	
B	4	415-011-24	COMPFLAKE			FLAKE	PRAIRIE DU CHIEN CHERT	Non-Local	East	Low	G10	YES	NO	0%	1.4	24.16	18.43	2.44	0	0	
B	4	415-011-25	COMPFLAKE			FLAKE	PRAIRIE DU CHIEN CHERT	Non-Local	East	Low	G10	YES	NO	1-10%	1.5	26.16	17.89	2.87	0	0	
B	4	415-011-26	PROXFLAKE			BTF	PRAIRIE DU CHIEN CHERT	Non-Local	East	Low	PG17	YES	NO		1	0	0	0	0	0	
B	4	415-011-27	COMPFLAKE			FLAKE	BURLINGTON CHERT	Non-Local	Southeast	High		YES	NO	0%	2.9	21.78	26.47	3.55	0	0	
B	4	415-011-28	SHATTER				BURLINGTON CHERT	Non-Local	Southeast	High		YES	NO		0.7	0	0	0	0	0	
B	4	415-011-29	PROXFLAKE			FLAKE	INDETERMINATE CHERT	Unknown				UNKNOWN	NO		1	0	0	0	0	0	
B	4	415-011-30	COMPFLAKE			FLAKE	INDETERMINATE CHERT	Unknown				UNKNOWN	NO	0%	0.4	13.23	14.7	2.1	0	0	
B	4	415-011-31	SHATTER				INDETERMINATE CHERT	Unknown				UNKNOWN	NO		3.4	0	0	0	0	0	
B	4	415-011-32	TESTEDCOBBLE				RED RIVER CHERT	Local		Low	DG02	UNKNOWN	NO		7.4	0	0	0	0	0	
B	4	415-011-33	SHATTER				INDETERMINATE CHERT	Unknown				UNKNOWN	NO		4.7	0	0	0	0	0	
B	4	415-011-34	SHATTER				RED RIVER CHERT	Local		Low	PG01	UNKNOWN	NO		1	0	0	0	0	0	
B	4	415-011-35	SHATTER				LAKE OF THE WOODS RHYOLITE	Local		Low		UNKNOWN	NO		6.1	0	0	0	0	0	
B	4	415-011-36	PROXFLAKE			FLAKE	LAKE OF THE WOODS RHYOLITE	Local		Low		UNKNOWN	NO		1.5	0	0	0	0	0	
B	4	415-011-37	SHATTER				BASALTIC ROCK	Local		Low		UNKNOWN	NO		1.5	0	0	0	0	0	
B	4	415-011-38	COMPFLAKE			FLAKE	QUARTZ	Local		Low		UNKNOWN	NO	100%	4	27.66	22.03	4.4	0	0	
B	4	415-011-39	SHATTER				QUARTZ	Local		Low		UNKNOWN	NO		2.4	0	0	0	0	0	
B	4	415-011-40	SHATTER				QUARTZ	Local		Low		UNKNOWN	NO		0.6	0	0	0	0	0	
B	4	415-011-41	HEATSPALL				INDETERMINATE CHERT	Unknown				YES	YES		10.5	0	0	0	0	0	
B	4	415-011-42	COMPFLAKE			FLAKE	INDETERMINATE CHERT	Unknown				UNKNOWN	NO	0%	1.6	18.59	17.35	4.25	0	0	
B	4	415-011-43	COMPFLAKE			FLAKE	MAYNES CREEK CHERT	Non-Local	Southeast	High	G02	NO	NO	10-40%	2.9	23.94	27.82	4.81	0	0	
B	4	415-011-44	SHATTER				INDETERMINATE CHERT	Unknown				UNKNOWN	NO		4.1	0	0	0	0	0	
B	4	415-011-45	PROXFLAKE			FLAKE	GULSETH SILICA	Non-Local	Southwest	High		NO	NO		5.3	0	0	0	0	0	
B	4	415-011-46	DISTFLAKE				INDETERMINATE CHERT	Unknown				YES	YES		1.2	0	0	0	0	0	
B	4	415-011-47	MEDFLAKE				WAPSIPINICON CHERT	Non-Local	Southeast	High		NO	NO		0.6	0	0	0	0	0	
B	4	415-011-48	DISTFLAKE				INDETERMINATE CHERT	Unknown				UNKNOWN	NO		2.7	0	0	0	0	0	
B	4	415-011-49	COMPFLAKE			FLAKE	INDETERMINATE CHERT	Unknown				YES	YES	0%	0.4	20.53	11.68	2.2	0	0	
B	4	415-011-50	DISTFLAKE				INDETERMINATE CHERT	Unknown				YES	YES		0.9	0	0	0	0	0	
B	4	415-011-51	PROXFLAKE			FLAKE	INDETERMINATE CHERT	Unknown				UNKNOWN	NO		1.1	0	0	0	0	0	
B	4	415-011-52	COMPFLAKE			FLAKE	KNIFE RIVER FLINT	Non-Local	Northwest	High		UNKNOWN	NO	0%	5	37.41	21.19	3.75	0	0	
B	4	415-011-53	PROXFLAKE			FLAKE	INDETERMINATE CHERT	Unknown				UNKNOWN	NO		4.2	0	0	0	0	0	
B	4	415-011-54	SHATTER				INDETERMINATE CHERT	Unknown				YES	YES		1.6	0	0	0	0	0	
B	5	415-012-01	COREFRAG				SWAN RIVER CHERT	Local		Low	G06	YES	NO		12.3	0	0	0	0	0	
B	5	415-012-02	SHATTER				SWAN RIVER CHERT	Local		Low	CP02	YES	NO		4.7	0	0	0	0	0	
B	5	415-012-03	PROXFLAKE			FLAKE	SWAN RIVER CHERT	Local		Low	CP02	YES	NO		2.2	0	0	0	0	0	
B	5	415-012-04	SHATTER				SWAN RIVER CHERT	Local		Low	PG22	YES	NO		1	0	0	0	0	0	
B	5	415-012-05	SHATTER				SWAN RIVER CHERT	Local		Low	G25	YES	NO		1.7	0	0	0	0	0	
B	5	415-012-06	COMPFLAKE			FLAKE	SWAN RIVER CHERT	Local		Low	G18	YES	NO	0%	1	13.86	19.61	3.08	0	0	
B	5	415-012-07	COMPFLAKE			FLAKE	INDETERMINATE CHERT	Unknown				UNKNOWN	NO	0%	5.1	25.02	25.64	7.66	0	0	
B	5	415-012-08	MEDFLAKE				SWAN RIVER CHERT	Local		Low	CP03	YES	NO		1.2	0	0	0	0	0	

UNIT	LEVEL	ARTID	DATACLASS	TOOLTYPE1	TOOLTYPE2	DEBTYPE	RAWMAT2	Origin	Direction	Quality	MANGROUP	HEATED	BURNED	CORTEX	WEIGHT (g)	LENGTH1 (mm)	WIDTH1 (mm)	THICK1 (mm)	Clarkson's II	Kuhn's IR	POINTASSOC1
B	5	415-012-09	MEDFLAKE				SWAN RIVER CHERT	Local		Low	CG01	YES	NO		1.1	0	0	0	0	0	
B	5	415-012-10	MEDFLAKE				SWAN RIVER CHERT	Local		Low	WG16	YES	NO		2.6	0	0	0	0	0	
B	5	415-012-11	MEDFLAKE				SWAN RIVER CHERT	Local		Low	PG14	YES	NO		1.8	0	0	0	0	0	
B	5	415-012-12	SHATTER				SWAN RIVER CHERT	Local		Low	W07	YES	NO		1	0	0	0	0	0	
B	5	415-012-13	MEDFLAKE				SWAN RIVER CHERT	Local		Low	G28	YES	NO		0.7	0	0	0	0	0	
B	5	415-012-14	COMPFLAKE			FLAKE	GRAND MEADOW CHERT	Non-Local	East	High		YES	NO	90-99%	1.6	26.96	16.54	2.81	0	0	
B	5	415-012-15	COMPFLAKE			FLAKE	GRAND MEADOW CHERT	Non-Local	East	High		UNKNOWN	NO	0%	0.8	19.22	14.67	2.01	0	0	
B	5	415-012-16	COMPFLAKE			FLAKE	GRAND MEADOW CHERT	Non-Local	East	High		NO	NO	1-10%	0.6	16.54	13.89	1.81	0	0	
B	5	415-012-17	SHATTER				LGG - KNIFE RIVER FLINT	Local		Low		UNKNOWN	NO		4	0	0	0	0	0	
B	5	415-012-18	SHATTER				LGG - KNIFE RIVER FLINT	Local		Low		UNKNOWN	NO		2.7	0	0	0	0	0	
B	5	415-012-19	PROXFLAKE			FLAKE	KNIFE RIVER FLINT	Non-Local	Northwest	High		UNKNOWN	NO		1.2	0	0	0	0	0	
B	5	415-012-20	COMPFLAKE			FLAKE	KNIFE RIVER FLINT	Non-Local	Northwest	High		UNKNOWN	NO	1-10%	1.1	24.85	10.05	3.24	0	0	
B	5	415-012-21	COMPFLAKE			FLAKE	KNIFE RIVER FLINT	Non-Local	Northwest	High		UNKNOWN	NO	40-60%	1.1	25.39	14.09	2.22	0	0	
B	5	415-012-22	COMPFLAKE			BTF	KNIFE RIVER FLINT	Non-Local	Northwest	High		UNKNOWN	NO	0%	0.8	17.3	12.54	2.33	0	0	
B	5	415-012-23	FLAKETOOLCOMP	UTILIZEDFLAKE	EXPEDIENT	FLAKE	KNIFE RIVER FLINT	Non-Local	Northwest	High		UNKNOWN	NO	0%	1	20.34	17.26	2.39	0.13	0	
B	5	415-012-24	COMPFLAKE			FLAKE	KNIFE RIVER FLINT	Non-Local	Northwest	High		UNKNOWN	NO	10-40%	2.4	33.05	21.01	2.97	0	0	
B	5	415-012-25	SHATTER				TONGUE RIVER SILICA	Local		Low		YES	NO		4	0	0	0	0	0	
B	5	415-012-26	MEDFLAKE				CEDAR VALLEY CHERT	Non-Local	East	High	OW03	UNKNOWN	NO		2.3	0	0	0	0	0	
B	5	415-012-27	COMPFLAKE			BTF	CEDAR VALLEY CHERT	Non-Local	East	High	O03	YES	NO	1-10%	1.3	17.27	20.28	3.23	0	0	
B	5	415-012-28	PROXFLAKE			FLAKE	BIJOU HILLS SIL SED	Non-Local	Southwest	Low		UNKNOWN	NO		1.2	0	0	0	0	0	
B	5	415-012-29	SHATTER			FLAKE	PRAIRIE DU CHIEN CHERT	Non-Local	East	Low	GW01	YES	NO		2.1	27.79	12.84	0	0	0	
B	5	415-012-30	DISTFLAKE				PRAIRIE DU CHIEN CHERT	Non-Local	East	Low	G07	NO	NO		1.1	0	0	0	0	0	
B	5	415-012-31	COMPFLAKE			FLAKE	BURLINGTON CHERT	Non-Local	Southeast	High		YES	NO	0%	2.3	27.2	25.63	2.74	0	0	
B	5	415-012-32	SHATTER				INDETERMINATE CHERT	Unknown				UNKNOWN	NO		0.6	0	0	0	0	0	
B	5	415-012-33	MEDFLAKE				BURLINGTON CHERT	Non-Local	Southeast	High		YES	NO		1.1	0	0	0	0	0	
B	5	415-012-34	PROXFLAKE			FLAKE	BURLINGTON CHERT	Non-Local	Southeast	High		YES	NO		0.7	0	0	0	0	0	
B	5	415-012-35	SHATTER				BURLINGTON CHERT	Non-Local	Southeast	High		YES	NO		1.3	0	0	0	0	0	
B	5	415-012-36	TESTEDCOBBLE				RED RIVER CHERT	Local		Low	LG06	UNKNOWN	NO		42.5	0	0	0	0	0	
B	5	415-012-37	SHATTER				INDETERMINATE CHERT	Unknown				UNKNOWN	NO		3.6	0	0	0	0	0	
B	5	415-012-38	SHATTER				RED RIVER CHERT	Local		Low	LG13	UNKNOWN	NO		4	0	0	0	0	0	
B	5	415-012-39	PROXFLAKE			BTF	BURLINGTON CHERT	Non-Local	Southeast	High		YES	NO		1	0	0	0	0	0	
B	5	415-012-40	SHATTER				KNIFE LAKE SILTSTONE	Local		Low		UNKNOWN	NO		9	0	0	0	0	0	
B	5	415-012-41	COMPFLAKE			FLAKE	BASALTIC ROCK	Local		Low		UNKNOWN	NO	10-40%	1.8	20.37	20.19	3.8	0	0	
B	5	415-012-42	SHATTER				BASALTIC ROCK	Local		Low		UNKNOWN	NO		0.7	0	0	0	0	0	
B	5	415-012-43	COMPFLAKE			BTF	HIXTON SIL SANDSTONE	Non-Local	East	High	PG01	YES	NO	0%	0.6	16.36	14.34	1.41	0	0	
B	5	415-012-44	SHATTER				QUARTZ	Local		Low		UNKNOWN	NO		3.5	0	0	0	0	0	
B	5	415-012-45	BIFACEFRAG	KNIFEFRAG	FORMAL		INDETERMINATE CHERT	Unknown				UNKNOWN	NO		4.9	0	0	0	0	0	
B	5	415-012-46	COMPFLAKE			FLAKE	GULSETH SILICA	Non-Local	Southwest	High		NO	NO	0%	0.8	18.73	15.57	2.19	0	0	
B	5	415-012-47	MEDFLAKE				HUDSON BAY LOWLAND CHERT	Unknown		High		NO	NO		1.9	0	0	0	0	0	
B	5	415-012-48	COMPFLAKE			FLAKE	INDETERMINATE CHALCEDONY	Unknown				NO	NO	0%	0.7	16.18	15.55	3.46	0	0	
B	5	415-012-49	MEDFLAKE				INDETERMINATE CHERT	Unknown				UNKNOWN	NO		2.2	0	0	0	0	0	
B	5	415-012-50	PROXFLAKE			FLAKE	MAYNES CREEK CHERT	Non-Local	Southeast	High	PG03	YES	NO		2.7	0	0	0	0	0	
B	5	415-012-51	COMPFLAKE			FLAKE	WAPSIPINICON CHERT	Non-Local	Southeast	High		NO	NO	0%	1.9	19.48	18.8	4.28	0	0	
B	5	415-012-52	COMPFLAKE			BIPOLAR	LGG - AGATE	Local		Low		UNKNOWN	NO	100%	1.6	27.17	13.07	3.67	0	0	
B	5	415-012-53	HEATSPALL				INDETERMINATE CHERT	Unknown				YES	YES		1.1	0	0	0	0	0	
B	6	415-013-01	SHATTER				SWAN RIVER CHERT	Local		Low	W06	YES	NO		8.6	0	0	0	0	0	
B	6	415-013-02	PROXFLAKE			FLAKE	SWAN RIVER CHERT	Local		Low	CP02	YES	NO		2	0	0	0	0	0	
B	6	415-013-03	COMPFLAKE			FLAKE	SWAN RIVER CHERT	Local		Low	PG22	YES	NO	0%	0.8	18.77	12.01	3.87	0	0	
B	6	415-013-04	SHATTER				SWAN RIVER CHERT	Local		Low	PG04	YES	NO		13.4	0	0	0	0	0	
B	6	415-013-05	DISTFLAKE				SWAN RIVER CHERT	Local		Low	PO03	YES	NO		1.8	0	0	0	0	0	
B	6	415-013-06	PROXFLAKE			FLAKE	SWAN RIVER CHERT	Local		Low	PO09	YES	NO		1.9	0	0	0	0	0	
B	6	415-013-07	DISTFLAKE				SWAN RIVER CHERT	Local		Low	G24	UNKNOWN	NO		1.4	0	0	0	0	0	
B	6	415-013-08	PROXFLAKE			FLAKE	INDETERMINATE CHERT	Unknown				UNKNOWN	NO		1.4	0	0	0	0	0	
B	6	415-013-09	DISTFLAKE				SWAN RIVER CHERT	Local		Low	W06	YES	NO		6	0	0	0	0	0	
B	6	415-013-10	SHATTER				SWAN RIVER CHERT	Local		Low	W06	YES	NO		2.6	0	0	0	0	0	
B	6	415-013-11	SHATTER				SWAN RIVER CHERT	Local		Low	W06	YES	NO		2	0	0	0	0	0	
B	6	415-013-12	SHATTER				SWAN RIVER CHERT	Local		Low	W06	YES	NO		5.4	0	0	0	0	0	
B	6	415-013-13	SHATTER				SWAN RIVER CHERT	Local		Low	W06	YES	NO		1.6	0	0	0	0	0	
B	6	415-013-14	SHATTER				SWAN RIVER CHERT	Local		Low	CP03	YES	NO		1.4	0	0	0	0	0	
B	6	415-013-15	COMPFLAKE			FLAKE	SWAN RIVER CHERT	Local		Low	W06	YES	NO	0%	0.7	11.99	16.88	2.63	0	0	
B	6	415-013-16	COMPFLAKE			FLAKE	SWAN RIVER CHERT	Local		Low	G06	YES	NO	0%	5.2	32.13	23.52	5.01	0	0	
B	6	415-013-17	COMPFLAKE			BIPOLAR	SWAN RIVER CHERT	Local		Low	G06	YES	NO	90-99%	4.5	33.92	20.82	6.62	0	0	
B	6	415-013-18	MEDFLAKE				SWAN RIVER CHERT	Local		Low	G06	YES	NO		1.6	0	0	0	0	0	
B	6	415-013-19	SHATTER				SWAN RIVER CHERT	Local		Low	PG20	YES	NO		8.6	0	0	0	0	0	
B	6	415-013-20	SHATTER				SWAN RIVER CHERT	Local		Low	PO01	YES	NO		5	0	0	0	0	0	
B	6	415-013-21	SHATTER				SWAN RIVER CHERT	Local		Low	PO10	YES	NO		4.7	0	0	0	0	0	
B	6	415-013-22	COMPFLAKE			FLAKE	GRAND MEADOW CHERT	Non-Local	East	High		NO	NO	1-10%	0.5	27.12	13.44	1.04	0	0	
B	6	415-013-23	MEDFLAKE				KNIFE RIVER FLINT	Non-Local	Northwest	High		UNKNOWN	NO		0.9	0	0	0	0	0	
B	6	415-013-24	DISTFLAKE				KNIFE RIVER FLINT	Non-Local	Northwest	High		UNKNOWN	NO		1.4	0	0	0	0	0	
B	6	415-013-25	DISTFLAKE				TONGUE RIVER SILICA	Local		Low		YES	NO		2.1	0	0	0	0	0	
B	6	415-013-26	SHATTER				TONGUE RIVER SILICA	Local		Low		YES	NO		10.4	0	0	0	0	0	
B	6	415-013-27	PROXFLAKE			FLAKE	TONGUE RIVER SILICA	Local		Low		YES	NO		1.1	0	0	0	0	0	
B	6	415-013-28	SHATTER				PRAIRIE DU CHIEN CHERT	Non-Local	East	Low	PG14	YES	NO		3.7	0	0	0	0	0	
B	6	415-013-29	PROXFLAKE			FLAKE	PRAIRIE DU CHIEN CHERT	Non-Local	East	Low	GW01	YES	NO		1.5	0	0	0	0	0	
B	6	415-013-30	PROXFLAKE			FLAKE	PRAIRIE DU CHIEN CHERT	Non-Local	East	Low	GW01	YES	NO		0.5	0	0	0	0	0	
B	6	415-013-31	MEDFLAKE				SWAN RIVER CHERT	Local		Low	G21	YES	NO		1.5	0	0	0	0	0	
B	6	415-013-32	COMPFLAKE			FLAKE	INDETERMINATE CHERT	Unknown				UNKNOWN	NO	0%	1.4	21.84	15.43	4.46	0	0	
B	6	415-013-33	MEDFLAKE				BURLINGTON CHERT	Non-Local	Southeast	High		NO	NO		0.4	0	0	0	0	0	
B	6	415-013-34	PROXFLAKE			FLAKE	INDETERMINATE CHERT	Unknown				UNKNOWN	NO		0.9	0	0	0	0	0	
B	6	415-013-35	MEDFLAKE				MAYNES CREEK CHERT	Non-Local	Southeast	High	WG01	YES	NO		0.5	0	0	0	0	0	
B	6	415-013-36	DISTFLAKE				BASALTIC ROCK	Local		Low		UNKNOWN	NO		2.9	0	0	0	0	0	
B	6	415-013-37	SHATTER				INDETERMINATE QUARTZITE	Unknown				NO	NO		4.2	0	0	0	0	0	
B	6	415-013-38	COMPFLAKE			FLAKE	KNIFE LAKE SILTSTONE	Local		Low		UNKNOWN	NO	10-40%	0.9	24	9.05	1.97	0	0	
B	6	415-013-39	COMPFLAKE			FLAKE	INDETERMINATE CHERT	Unknown				UNKNOWN	NO	0%	7.9	23.76	31	9.24	0	0	
B	6	415-013-40	PROXFLAKE			FLAKE	GALENA CHERT	Non-Local	East	High	OG04	UNKNOWN	NO		4	0	0	0	0	0	
B	6	415-013-41	COREFRAG				INDETERMINATE CHERT	Unknown				UNKNOWN	NO		14.9	0	0	0	0	0	
B	6	415-013-42	COMPFLAKE			FLAKE	INDETERMINATE CHERT	Unknown				UNKNOWN	NO	0%	1	19.27	11.59	3.48	0	0	
B	6	415-013-43	COMPFLAKE			BTF	INDETERMINATE CHERT	Unknown				UNKNOWN	NO	0%	2.1	23.5	16.91	4.65	0	0	
B	6	415-013-44	COMPFLAKE			FLAKE	INDETERMINATE CHERT	Unknown				UNKNOWN	NO	0%	0.5	16.21	12.53	3.09	0	0	
B	6	415-013-45	DISTFLAKE				INDETERMINATE CHERT	Unknown				YES	YES		0.6	0	0	0	0	0	
B	6	415-013-46	COMPFLAKE			FLAKE	WAPSIPINICON CHERT	Non-Local	Southeast	High		NO	NO	0%	0.8	23.74	15.66	1.76	0	0	
B	6	415-013-47	COMPFLAKE			FLAKE	MAYNES CREEK CHERT	Non-Local	Southeast	High	PG02	YES	NO	0%	2.4	22.44	20.09	5.29	0	0	
B	6	415-013-48	COMPFLAKE			FLAKE	HUDSON BAY LOWLAND CHERT	Unknown		High		NO	NO	0%	0.6	19.72	12.8	1.41	0	0	
C	1	415-014-01	COMPFLAKE			FLAKE	SWAN RIVER CHERT	Local		Low	PG26	YES	NO	0%	7	33.87	27.28	7.89	0	0	
C	1	415-014-02	SHATTER				SWAN RIVER CHERT	Local		Low	PG26	YES	NO		5.1	0	0	0	0	0	
C	1	415-014-03	COMPFLAKE			FLAKE	SWAN RIVER CHERT	Local		Low	PG15	YES	NO	40-60%	21.2	47.29	35.11	11.88	0	0	
C	1	415-014-04	PROXFLAKE			FLAKE	SWAN RIVER CHERT	Local		Low	PW03	YES	NO		2.3	0	0	0	0	0	
C	1	415-014-05	SHATTER				SWAN RIVER CHERT	Local		Low	WG10	YES	NO		14.5	0	0	0	0	0	
C	1	415-014-06	COMPFLAKE			FLAKE	SWAN RIVER CHERT	Local		Low	G06	YES	NO	40-60%	9.2	31.03	26.14	12.46	0	0	
C	1	415-014-07	MEDFLAKE				SWAN RIVER CHERT	Local		Low	CP02	YES	NO		0.7	0	0	0	0	0	
C	1	415-014-08	PROXFLAKE			FLAKE	SWAN RIVER CHERT	Local		Low	CG02	YES	NO		0.7	0	0	0	0	0	
C	1	415-014-09	SHATTER				SWAN RIVER CHERT	Local		Low	PG27	YES	NO		1.3	0	0	0	0	0	
C	1	415-014-10	SHATTER				SWAN RIVER CHERT	Local		Low	PG13	YES	NO		8.3	0	0	0	0	0	

UNIT	LEVEL	ARTID	DATACLASS	TOOLTYPE1	TOOLTYPE2	DEBTYPE	RAWMAT2	Origin	Direction	Quality	MANGROUP	HEATED	BURNED	CORTEX	WEIGHT (g)	LENGTH1 (mm)	WIDTH1 (mm)	THICK1 (mm)	Clarkson's II	Kuhn's IR	POINTASSOC1
C	1	415-014-11	PROXFLAKE			FLAKE	SWAN RIVER CHERT	Local		Low	PG27	YES	NO		1.7	0	0	0	0	0	
C	1	415-014-12	PROXFLAKE			FLAKE	SWAN RIVER CHERT	Local		Low	PG26	YES	NO		0.9	0	0	0	0	0	
C	1	415-014-13	FLAKETOOLPROX	UTILIZEDFLAKE	EXPEDIENT	FLAKE	SWAN RIVER CHERT	Local		Low	WG12	YES	NO		3.4	0	0	0	0	0	
C	1	415-014-14	SHATTER				SWAN RIVER CHERT	Local		Low	PG11	YES	NO		1.5	0	0	0	0	0	
C	1	415-014-15	PROXFLAKE			FLAKE	SWAN RIVER CHERT	Local		Low	PG11	YES	NO		3.4	0	0	0	0	0	
C	1	415-014-16	COMPFLAKE			BIPOLAR	LGG - CHALCEDONY	Local		Low		UNKNOWN	NO	100%	2.9	27.32	19.43	4.29	0	0	
C	1	415-014-17	DISTFLAKE				KNIFE RIVER FLINT	Non-Local	Northwest	High		UNKNOWN	NO		1.1	0	0	0	0	0	
C	1	415-014-18	COMPFLAKE			FLAKE	GRAND MEADOW CHERT	Non-Local	East	High		NO	NO	60-90%	0.8	19.93	12.02	2.19	0	0	
C	1	415-014-19	COMPFLAKE			FLAKE	GRAND MEADOW CHERT	Non-Local	East	High		UNKNOWN	NO	0%	0.7	22.65	12.51	2.06	0	0	
C	1	415-014-20	SHATTER				PRAIRIE DU CHIEN CHERT	Non-Local	East	Low	PG15	YES	NO		4.5	0	0	0	0	0	
C	1	415-014-21	HEATSPALL				PRAIRIE DU CHIEN CHERT	Non-Local	East	Low	PG10	YES	YES		5.9	0	0	0	0	0	
C	1	415-014-22	MEDFLAKE				BIJOU HILLS SIL SED	Non-Local	Southwest	Low		UNKNOWN	NO		0.9	0	0	0	0	0	
C	1	415-014-23	PROXFLAKE			FLAKE	BIJOU HILLS SIL SED	Non-Local	Southwest	Low		UNKNOWN	NO		1.1	0	0	0	0	0	
C	1	415-014-24	COMPFLAKE			BTF	BURLINGTON CHERT	Non-Local	Southeast	High		YES	NO	0%	1.6	24.41	20.94	2.49	0	0	
C	1	415-014-25	COMPFLAKE			FLAKE	GALENA CHERT	Non-Local	East	High	P01	YES	NO	60-90%	3.5	24.79	21.9	3.44	0	0	
C	1	415-014-26	SHATTER				RED RIVER CHERT	Local		Low	B05	YES	NO		3.9	0	0	0	0	0	
C	1	415-014-27	FLAKETOOLCOMP	UTILIZEDFLAKE	EXPEDIENT	FLAKE	MAYNES CREEK CHERT	Non-Local	Southeast	High	PG04	YES	NO	10-40%	18.1	42.93	37.94	6.66	0.09	0	
C	1	415-014-28	CORE				LGG - KNIFE RIVER FLINT	Local		Low		UNKNOWN	NO		3.4	0	0	0	0	0	
C	1	415-014-29	COMPFLAKE			FLAKE	INDETERMINATE QUARTZITE	Unknown				NO	NO	10-40%	1.9	22.06	18.35	4.36	0	0	
C	1	415-014-30	COMPFLAKE			FLAKE	INDETERMINATE CHERT	Unknown				UNKNOWN	NO	0%	1.3	14.51	19.49	3.31	0	0	
C	1	415-014-31	DISTFLAKE				INDETERMINATE CHERT	Unknown				UNKNOWN	NO		0.7	0	0	0	0	0	
C	1	415-014-32	SHATTER				MAYNES CREEK CHERT	Non-Local	Southeast	High	PG01	YES	NO		8.2	0	0	0	0	0	
C	1	415-014-33	SHATTER				INDETERMINATE CHERT	Unknown				UNKNOWN	NO		4.7	0	0	0	0	0	
C	1	415-014-34	SHATTER				GALENA CHERT	Non-Local	East	High	OG02	UNKNOWN	NO		6.9	0	0	0	0	0	
C	1	415-014-35	COMPFLAKE			FLAKE	GALENA CHERT	Non-Local	East	High	OG02	UNKNOWN	NO	60-90%	1.6	21.82	15.88	3.76	0	0	
C	1	415-014-36	PROXFLAKE			FLAKE	SWAN RIVER CHERT	Local		Low	W11	UNKNOWN	NO		1.2	0	0	0	0	0	
C	1	415-014-37	COMPFLAKE			FLAKE	FUSILINID CHERT	Non-Local	South	High	WG03	NO	NO	0%	1.4	15.53	16.19	4.07	0	0	
C	1	415-014-38	FLAKETOOLCOMP	UTILIZEDFLAKE	EXPEDIENT	FLAKE	INDETERMINATE CHERT	Unknown				UNKNOWN	NO	0%	0.3	13.12	12.32	1.71	0	0	
C	1	415-014-39	COMPFLAKE			FLAKE	INDETERMINATE CHALCEDONY	Unknown				UNKNOWN	NO	0%	0.5	22.17	9.99	1.68	0	0	
C	1	415-014-40	COMPFLAKE			FLAKE	INDETERMINATE CHERT	Unknown				YES	YES	0%	2.6	25.94	16.12	4.49	0	0	
C	1	415-014-41	DISTFLAKE				INDETERMINATE CHERT	Unknown				UNKNOWN	NO		0.5	0	0	0	0	0	
C	1	415-014-42	SHATTER				INDETERMINATE CHALCEDONY	Unknown				NO	NO		4.6	0	0	0	0	0	
C	1	415-014-43	COMPFLAKE			FLAKE	INDETERMINATE QUARTZITE	Unknown				NO	NO	10-40%	7.4	39.81	20.7	8.32	0	0	
C	1	415-014-44	COMPFLAKE			FLAKE	BURLINGTON CHERT	Non-Local	Southeast	High		YES	NO	0%	0.5	15.99	0	2	0	0	
C	1	415-014-45	COMPFLAKE			FLAKE	QUARTZ	Local		Low		UNKNOWN	NO	0%	1.2	21.64	13.37	3.97	0	0	
C	2	415-015-01	MEDFLAKE				SWAN RIVER CHERT	Local		Low	W12	UNKNOWN	NO		1.2	0	0	0	0	0	
C	2	415-015-02	DISTFLAKE				SWAN RIVER CHERT	Local		Low	W12	YES	NO		1.3	0	0	0	0	0	
C	2	415-015-03	COMPFLAKE			FLAKE	SWAN RIVER CHERT	Local		Low	W12	YES	NO	0%	3.3	18.72	25.15	6.51	0	0	
C	2	415-015-04	COMPFLAKE			FLAKE	SWAN RIVER CHERT	Local		Low	G06	YES	NO	0%	2.3	20.31	16.53	5.5	0	0	
C	2	415-015-05	COMPFLAKE			FLAKE	INDETERMINATE CHERT	Unknown				UNKNOWN	NO	0%	0.8	19.64	14.33	2.94	0	0	
C	2	415-015-06	PROXFLAKE			FLAKE	INDETERMINATE CHERT	Unknown				UNKNOWN	NO		0.6	0	0	0	0	0	
C	2	415-015-07	COMPFLAKE			FLAKE	SWAN RIVER CHERT	Local		Low	PW03	YES	NO	90-99%	0.9	14.15	17.84	3.13	0	0	
C	2	415-015-08	SHATTER				SWAN RIVER CHERT	Local		Low	G16	YES	NO		0.6	0	0	0	0	0	
C	2	415-015-09	SHATTER				SWAN RIVER CHERT	Local		Low	PG16	YES	NO		0.6	0	0	0	0	0	
C	2	415-015-10	COMPFLAKE			FLAKE	SWAN RIVER CHERT	Local		Low	G16	YES	NO	0%	1.2	15.74	20.22	4.26	0	0	
C	2	415-015-11	SHATTER				SWAN RIVER CHERT	Local		Low	W16	YES	NO		4.8	0	0	0	0	0	
C	2	415-015-12	SHATTER				SWAN RIVER CHERT	Local		Low	W07	YES	NO		2.2	0	0	0	0	0	
C	2	415-015-13	PROXFLAKE			FLAKE	SWAN RIVER CHERT	Local		Low	PG13	YES	NO		1.2	0	0	0	0	0	
C	2	415-015-14	COMPFLAKE			BTF	KNIFE RIVER FLINT	Non-Local	Northwest	High		UNKNOWN	NO	0%	1.5	30.63	15.96	2.2	0	0	
C	2	415-015-15	COMPFLAKE			BTF	KNIFE RIVER FLINT	Non-Local	Northwest	High		UNKNOWN	NO	0%	0.7	20.9	12.75	2.2	0	0	
C	2	415-015-16	COMPFLAKE			BTF	KNIFE RIVER FLINT	Non-Local	Northwest	High		UNKNOWN	NO	0%	1.2	23.34	15.6	1.61	0	0	
C	2	415-015-17	DISTFLAKE				GRAND MEADOW CHERT	Non-Local	East	High		UNKNOWN	NO		1.6	0	0	0	0	0	
C	2	415-015-18	MEDFLAKE				INDETERMINATE CHERT	Unknown				UNKNOWN	NO		1.1	0	0	0	0	0	
C	2	415-015-19	DISTFLAKE				GRAND MEADOW CHERT	Non-Local	East	High		YES	NO		1.1	0	0	0	0	0	
C	2	415-015-20	SHATTER				LGG - KNIFE RIVER FLINT	Local		Low		UNKNOWN	NO		1.6	0	0	0	0	0	
C	2	415-015-21	SHATTER				TONGUE RIVER SILICA	Local		Low		YES	NO		2.8	0	0	0	0	0	
C	2	415-015-22	PROXFLAKE			FLAKE	PRAIRIE DU CHIEN CHERT	Non-Local	East	Low	PG05	YES	NO		0.8	0	0	0	0	0	
C	2	415-015-23	COMPFLAKE			FLAKE	PRAIRIE DU CHIEN CHERT	Non-Local	East	Low	G08	UNKNOWN	NO	0%	0.8	15.77	15.92	2.14	0	0	
C	2	415-015-24	SHATTER				GRAND MEADOW CHERT	Non-Local	East	High		NO	NO		3	0	0	0	0	0	
C	2	415-015-25	SPLITFLAKE				BURLINGTON CHERT	Non-Local	Southeast	High		YES	NO		0.9	0	0	0	0	0	
C	2	415-015-26	SHATTER				PRAIRIE DU CHIEN CHERT	Non-Local	East	Low	PG13	YES	NO		3	0	0	0	0	0	
C	2	415-015-27	SHATTER				PRAIRIE DU CHIEN CHERT	Non-Local	East	Low	P02	YES	NO		0.6	0	0	0	0	0	
C	2	415-015-28	COMPFLAKE			BIPOLAR	BURLINGTON CHERT	Non-Local	Southeast	High		YES	NO	0%	0.8	22.12	9.05	2.28	0	0	
C	2	415-015-29	PROXFLAKE			FLAKE	RED RIVER CHERT	Local		Low	DG03	UNKNOWN	NO		0.9	0	0	0	0	0	
C	2	415-015-30	COMPFLAKE			FLAKE	RED RIVER CHERT	Local		Low	B04	UNKNOWN	NO	0%	0.9	17.43	17	2.6	0	0	
C	2	415-015-31	COMPFLAKE			FLAKE	INDETERMINATE CHERT	Unknown				UNKNOWN	NO	90-99%	3.2	30.41	13.79	4.86	0	0	
C	2	415-015-32	SHATTER				GALENA CHERT	Non-Local	East	High	GS04	UNKNOWN	NO		4	0	0	0	0	0	
C	2	415-015-33	DISTFLAKE				KNIFE LAKE SILTSTONE	Local		Low		UNKNOWN	NO		1.6	0	0	0	0	0	
C	2	415-015-34	SHATTER				QUARTZ	Local		Low		UNKNOWN	NO		2.4	0	0	0	0	0	
C	2	415-015-35	SHATTER				INDETERMINATE CHERT	Unknown				UNKNOWN	NO		2.8	0	0	0	0	0	
C	2	415-015-38	COMPFLAKE			BIPOLAR	LGG - AGATE	Local		Low		NO	NO	0%	2.1	27.93	12.07	4.49	0	0	
C	2	415-015-39	COMPFLAKE			BIPOLAR	LGG - AGATE	Local		Low		NO	NO	0%	2.2	31.52	10.62	3.92	0	0	
C	2	415-015-40	PROXFLAKE			FLAKE	LAKE OF THE WOODS RHYOLITE	Local		Low		UNKNOWN	NO		2.1	0	0	0	0	0	
C	2	415-015-41	COMPFLAKE			FLAKE	INDETERMINATE CHERT	Unknown				YES	YES	0%	1.1	23.39	13.77	2.94	0	0	
C	2	415-015-42	MEDFLAKE				INDETERMINATE CHERT	Unknown				UNKNOWN	NO		1.1	0	0	0	0	0	
C	2	415-015-43	SHATTER				INDETERMINATE CHERT	Unknown				UNKNOWN	NO		1.1	0	0	0	0	0	
C	2	415-015-44	PROXFLAKE			FLAKE	BURLINGTON CHERT	Non-Local	Southeast	High		YES	NO		0.6	0	0	0	0	0	
C	2	415-015-45	PROXFLAKE			FLAKE	BIJOU HILLS SIL SED	Non-Local	Southwest	Low		UNKNOWN	NO		1.2	0	0	0	0	0	
C	2	415-015-46	BIFACE	POINT	FORMAL		SWAN RIVER CHERT	Local		Low	G36	YES	NO		1	0	0	0	0	0	crude-unknown
C	3	415-016-01	SHATTER				SWAN RIVER CHERT	Local		Low	CG02	YES	NO		25.6	0	0	0	0	0	
C	3	415-016-02	COMPFLAKE			FLAKE	SWAN RIVER CHERT	Local		Low	WG13	UNKNOWN	NO	0%	0.8	19	14.37	2.74	0	0	
C	3	415-016-03	SHATTER				SWAN RIVER CHERT	Local		Low	W10	UNKNOWN	NO		2.5	0	0	0	0	0	
C	3	415-016-04	SHATTER				SWAN RIVER CHERT	Local		Low	PO01	YES	NO		4.5	0	0	0	0	0	
C	3	415-016-05	SHATTER				SWAN RIVER CHERT	Local		Low	PG13	YES	NO		3	0	0	0	0	0	
C	3	415-016-06	COMPFLAKE			FLAKE	SWAN RIVER CHERT	Local		Low	PW03	YES	NO	0%	2.1	20.08	26.03	2.41	0	0	
C	3	415-016-07	DISTFLAKE				SWAN RIVER CHERT	Local		Low	PW03	YES	NO		1.8	0	0	0	0	0	
C	3	415-016-08	SHATTER				SWAN RIVER CHERT	Local		Low	PG09	YES	NO		3.1	0	0	0	0	0	
C	3	415-016-09	SHATTER			FLAKE	SWAN RIVER CHERT	Local		Low	CP02	YES	NO		4.7	0	0	0	0	0	
C	3	415-016-10	MEDFLAKE				SWAN RIVER CHERT	Local		Low	PG25	YES	NO		1.5	0	0	0	0	0	
C	3	415-016-11	FLAKETOOLMED	SIDESCRAPER	EXPEDIENT		SWAN RIVER CHERT	Local		Low	WG09	YES	NO		1.3	0	0	0	0	0	
C	3	415-016-12	PROXFLAKE			FLAKE	GRAND MEADOW CHERT	Non-Local	East	High		NO	NO		5.5	0	0	0	0	0	
C	3	415-016-13	COMPFLAKE			FLAKE	GRAND MEADOW CHERT	Non-Local	East	High		NO	NO	90-99%	2.2	19.74	30.35	3.37	0	0	
C	3	415-016-14	SHATTER				GRAND MEADOW CHERT	Non-Local	East	High		NO	NO		6	0	0	0	0	0	
C	3	415-016-15	MEDFLAKE				GRAND MEADOW CHERT	Non-Local	East	High		UNKNOWN	NO		0.9	0	0	0	0	0	
C	3	415-016-16	SHATTER				GRAND MEADOW CHERT	Non-Local	East	High		YES	NO		2.3	0	0	0	0	0	
C	3	415-016-17	MEDFLAKE				BURLINGTON CHERT	Non-Local	Southeast	High		YES	NO		1	0	0	0	0	0	
C	3	415-016-18	SHATTER				GALENA CHERT	Non-Local	East	High	LG02	UNKNOWN	NO		3.9	0	0	0	0	0	
C	3	415-016-19	SHATTER				RED RIVER CHERT	Local		Low	LG14	UNKNOWN	NO		6.4	0	0	0	0	0	
C	3	415-016-20	COMPFLAKE			FLAKE	HIXTON SIL SANDSTONE	Non-Local	East	High	PG01	YES	NO	1-10%	3.5	26.23	18.29	6.04	0	0	
C	3	415-016-21	COMPFLAKE			FLAKE	BASALTIC ROCK	Local		Low		UNKNOWN	NO	60-90%	1.2	15.95	17.15	2.89	0	0	
C	3	415-016-22	SHATTER				QUARTZ	Local		Low		UNKNOWN	NO		2.7	0	0	0	0	0	
C	3	415-016-23	SHATTER				QUARTZ	Local		Low		UNKNOWN	NO		4.2	0	0	0	0	0	
C	3	415-016-24	PROXFLAKE			FLAKE	INDETERMINATE QUARTZITE	Unknown				NO	NO		2.4	0	0	0	0	0	

UNIT	LEVEL	ARTID	DATACLASS	TOOLTYPE1	TOOLTYPE2	DEBTYPE	RAWMAT2	Origin	Direction	Quality	MANGROUP	HEATED	BURNED	CORTEX	WEIGHT (g)	LENGTH1 (mm)	WIDTH1 (mm)	THICK1 (mm)	Clarkson's II	Kuhn's IR	POINTASSOC1
C	3	415-016-25	DISTFLAKE				MOLINE CHERT	Non-Local	Southeast	High		NO	NO		4.8	0	0	0	0	0	
C	3	415-016-26	SHATTER				SWAN RIVER CHERT	Local		Low	WG08	YES	YES		1.5	0	0	0	0	0	
C	3	415-016-27	PROXFLAKE			FLAKE	GULSETH SILICA	Non-Local	Southwest	High		NO	NO		1	0	0	0	0	0	
C	3	415-016-28	DISTFLAKE				MAYNES CREEK CHERT	Non-Local	Southeast	High	G01	YES	NO		1.6	0	0	0	0	0	
C	3	415-016-29	DISTFLAKE			FLAKE	MOLINE CHERT	Non-Local	Southeast	High		UNKNOWN	NO		1.1	0	0	0	0	0	
C	3	415-016-30	COMPFLAKE			FLAKE	PRAIRIE DU CHIEN CHERT	Non-Local	East	Low	R02	YES	NO	60-90%	1	22.06	17.4	1.98	0	0	
C	3	415-016-31	MEDFLAKE				INDETERMINATE CHALCEDONY	Unknown				NO	NO		0.9	0	0	0	0	0	
C	3	415-016-32	PROXFLAKE			FLAKE	LAKE OF THE WOODS RHYOLITE	Local		Low		UNKNOWN	NO		2.2	0	0	0	0	0	
C	3	415-016-33	HEATSPALL				INDETERMINATE CHERT	Unknown				YES	YES		0.9	0	0	0	0	0	
C	3	415-016-34	SHATTER				INDETERMINATE CHERT	Unknown				UNKNOWN	NO		2.8	0	0	0	0	0	
C	3	415-016-35	COMPFLAKE			FLAKE	INDETERMINATE CHERT	Unknown				UNKNOWN	NO	0%	2	17.6	23.13	3.17	0	0	
C	3	415-016-36	SHATTER				INDETERMINATE CHERT	Unknown				UNKNOWN	NO		3.4	0	0	0	0	0	
C	3	415-016-37	MEDFLAKE				SWAN RIVER CHERT	Local		Low	G10	YES	NO		1.4	0	0	0	0	0	
C	4	415-017-01	SHATTER				SWAN RIVER CHERT	Local		Low	PG14	YES	NO		33.1	0	0	0	0	0	
C	4	415-017-02	PROXFLAKE			FLAKE	SWAN RIVER CHERT	Local		Low	PG25	YES	NO		8.3	0	0	0	0	0	
C	4	415-017-03	PROXFLAKE			FLAKE	SWAN RIVER CHERT	Local		Low	G05	YES	NO		7.7	0	0	0	0	0	
C	4	415-017-04	SHATTER				SWAN RIVER CHERT	Local		Low	WG06	YES	NO		1.7	0	0	0	0	0	
C	4	415-017-05	PROXFLAKE			FLAKE	SWAN RIVER CHERT	Local		Low	G14	YES	NO		3.2	0	0	0	0	0	
C	4	415-017-06	COMPFLAKE			FLAKE	SWAN RIVER CHERT	Local		Low	CG01	YES	NO	10-40%	2	20.57	18.26	6.07	0	0	
C	4	415-017-07	MEDFLAKE				SWAN RIVER CHERT	Local		Low	CG01	YES	NO		4.7	34.07	17.32	0	0	0	
C	4	415-017-08	DISTFLAKE				SWAN RIVER CHERT	Local		Low	WG10	YES	NO		6.6	0	0	0	0	0	
C	4	415-017-09	DISTFLAKE				SWAN RIVER CHERT	Local		Low	CP02	YES	NO		3.8	0	0	0	0	0	
C	4	415-017-10	COMPFLAKE			FLAKE	SWAN RIVER CHERT	Local		Low	PW03	YES	NO	0%	3.5	28.04	22.11	4.1	0	0	
C	4	415-017-11	COMPFLAKE			FLAKE	SWAN RIVER CHERT	Local		Low	PO13	YES	NO	0%	0.5	13.57	12.96	2.1	0	0	
C	4	415-017-12	PROXFLAKE			FLAKE	GRAND MEADOW CHERT	Non-Local	East	High		UNKNOWN	NO		0.9	0	0	0	0	0	
C	4	415-017-13	COMPFLAKE			FLAKE	GRAND MEADOW CHERT	Non-Local	East	High		UNKNOWN	NO	0%	1.3	25.64	16.85	2.61	0	0	
C	4	415-017-14	MEDFLAKE				GRAND MEADOW CHERT	Non-Local	East	High		UNKNOWN	NO		1.1	0	0	0	0	0	
C	4	415-017-15	DISTFLAKE				GRAND MEADOW CHERT	Non-Local	East	High		UNKNOWN	NO		3.3	0	0	0	0	0	
C	4	415-017-16	PROXFLAKE			FLAKE	INDETERMINATE CHERT	Unknown				UNKNOWN	NO		2.7	0	0	0	0	0	
C	4	415-017-17	DISTFLAKE				KNIFE RIVER FLINT	Non-Local	Northwest	High		UNKNOWN	NO		1	0	0	0	0	0	
C	4	415-017-18	COMPFLAKE			BTF	KNIFE RIVER FLINT	Non-Local	Northwest	High		UNKNOWN	NO	0%	2.4	25.27	18.16	5.22	0	0	
C	4	415-017-19	COMPFLAKE			FLAKE	KNIFE RIVER FLINT	Non-Local	Northwest	High		UNKNOWN	NO	0%	0.7	19.82	17.1	1.78	0	0	
C	4	415-017-20	COMPFLAKE			FLAKE	KNIFE RIVER FLINT	Non-Local	Northwest	High		UNKNOWN	NO	0%	0.4	17.34	16.36	1.42	0	0	
C	4	415-017-21	SHATTER				SWAN RIVER CHERT	Local		Low	PG24	YES	NO		3	0	0	0	0	0	
C	4	415-017-22	PROXFLAKE			FLAKE	CEDAR VALLEY CHERT	Non-Local	East	High	O01	UNKNOWN	NO		0.5	0	0	0	0	0	
C	4	415-017-23	COMPFLAKE			FLAKE	PRAIRIE DU CHIEN CHERT	Non-Local	East	Low	G03	UNKNOWN	NO	0%	1.9	25.55	17.48	3.57	0	0	
C	4	415-017-24	COMPFLAKE			FLAKE	PRAIRIE DU CHIEN CHERT	Non-Local	East	Low	W05	UNKNOWN	NO	0%	0.8	16.18	16.18	2.95	0	0	
C	4	415-017-25	COMPFLAKE			FLAKE	PRAIRIE DU CHIEN CHERT	Non-Local	East	Low	PG15	YES	NO	0%	0.9	21.64	15.73	2.1	0	0	
C	4	415-017-26	MEDFLAKE				SWAN RIVER CHERT	Local		Low	WG08	YES	YES		0.6	0	0	0	0	0	
C	4	415-017-27	FLAKETOOLMED	UTILIZEDFLAKE	EXPEDIENT		BURLINGTON CHERT	Non-Local	Southeast	High		YES	NO		1	0	0	0	0	0	
C	4	415-017-28	SHATTER				RED RIVER CHERT	Local		Low	B03	UNKNOWN	NO		5	0	0	0	0	0	
C	4	415-017-29	DISTFLAKE				BURLINGTON CHERT	Non-Local	Southeast	High		YES	NO		0.8	0	0	0	0	0	
C	4	415-017-30	SHATTER				INDETERMINATE CHERT	Unknown				UNKNOWN	NO		1.9	0	0	0	0	0	
C	4	415-017-31	DISTFLAKE				PRAIRIE DU CHIEN CHERT	Non-Local	East	Low	W02	YES	NO		0.9	0	0	0	0	0	
C	4	415-017-32	COMPFLAKE			FLAKE	BURLINGTON CHERT	Non-Local	Southeast	High		UNKNOWN	NO	0%	1	23.01	15.01	2.65	0	0	
C	4	415-017-33	FLAKETOOLPROX	UTILIZEDFLAKE	EXPEDIENT	FLAKE	INDETERMINATE CHERT	Unknown				UNKNOWN	NO		0.6	0	0	0	0	0	
C	4	415-017-34	PROXFLAKE			FLAKE	SWAN RIVER CHERT	Local		Low	G10	YES	NO		4.3	0	0	0	0	0	
C	4	415-017-35	PROXFLAKE			BTF	LAKE OF THE WOODS RHYOLITE	Local		Low		UNKNOWN	NO		2.6	0	0	0	0	0	
C	4	415-017-36	DISTFLAKE				LAKE OF THE WOODS RHYOLITE	Local		Low		UNKNOWN	NO		1.7	0	0	0	0	0	
C	4	415-017-37	SHATTER				LAKE OF THE WOODS RHYOLITE	Local		Low		UNKNOWN	NO		4	0	0	0	0	0	
C	4	415-017-38	SHATTER				QUARTZ	Local		Low		UNKNOWN	NO		23.3	0	0	0	0	0	
C	4	415-017-39	PROXFLAKE			FLAKE	INDETERMINATE QUARTZITE	Unknown				NO	NO		2.5	0	0	0	0	0	
C	4	415-017-40	COMPFLAKE			FLAKE	BASALTIC ROCK	Local		Low		UNKNOWN	NO	0%	0.9	18.86	11.64	3.19	0	0	
C	4	415-017-41	SHATTER				INDETERMINATE CHERT	Unknown				UNKNOWN	NO		1.8	0	0	0	0	0	
C	4	415-017-42	SHATTER				SWAN RIVER CHERT	Local		Low	PG17	YES	NO		1.9	0	0	0	0	0	
C	4	415-017-43	SHATTER				INDETERMINATE AGATE	Unknown				UNKNOWN	NO		4.7	0	0	0	0	0	
C	4	415-017-44	MEDFLAKE				FUSILINID CHERT	Non-Local	South	High	G02	YES	NO		3	0	0	0	0	0	
C	4	415-017-45	SHATTER				SWAN RIVER CHERT	Local		Low	W08	UNKNOWN	NO		3.4	0	0	0	0	0	
C	4	415-017-46	SHATTER				LGG - HARTVILLE UPLIFT (cf.)	Local		Low		NO	NO		13.6	0	0	0	0	0	
C	4	415-017-47	PROXFLAKE			FLAKE	SWAN RIVER CHERT	Local		Low	WG08	YES	NO		0.9	0	0	0	0	0	
C	4	415-017-48	PROXFLAKE			FLAKE	INDETERMINATE CHERT	Unknown				UNKNOWN	NO		0.5	0	0	0	0	0	
C	4	415-017-49	COMPFLAKE			FLAKE	INDETERMINATE CHERT	Unknown				UNKNOWN	NO	0%	1	20.3	12.42	2.77	0	0	
C	5	415-018-01	PROXFLAKE			FLAKE	SWAN RIVER CHERT	Local		Low	PG05	YES	NO		2.2	0	0	0	0	0	
C	5	415-018-02	SHATTER				SWAN RIVER CHERT	Local		Low	W10	UNKNOWN	NO		4.5	0	0	0	0	0	
C	5	415-018-03	SHATTER				SWAN RIVER CHERT	Local		Low	CG01	UNKNOWN	NO		2.2	0	0	0	0	0	
C	5	415-018-04	FLAKETOOLDIST	UTILIZEDFLAKE	EXPEDIENT		SWAN RIVER CHERT	Local		Low	CG01	YES	NO		2.2	0	0	0	0	0	
C	5	415-018-05	SHATTER				SWAN RIVER CHERT	Local		Low	PG14	YES	NO		4.4	0	0	0	0	0	
C	5	415-018-06	PROXFLAKE			FLAKE	SWAN RIVER CHERT	Local		Low	CP02	YES	NO		3	0	0	0	0	0	
C	5	415-018-07	SHATTER				SWAN RIVER CHERT	Local		Low	R05	YES	NO		1.4	0	0	0	0	0	
C	5	415-018-08	COMPFLAKE			FLAKE	SWAN RIVER CHERT	Local		Low	PW01	YES	NO	1-10%	1.7	19.19	17.75	3.8	0	0	
C	5	415-018-09	COMPFLAKE			FLAKE	SWAN RIVER CHERT	Local		Low	R03	YES	NO	0%	1.1	15.86	17.68	2.27	0	0	
C	5	415-018-10	SHATTER				SWAN RIVER CHERT	Local		Low	PG14	YES	NO		3.9	0	0	0	0	0	
C	5	415-018-11	SHATTER				SWAN RIVER CHERT	Local		Low	PO13	YES	NO		4.6	0	0	0	0	0	
C	5	415-018-12	PROXFLAKE			FLAKE	SWAN RIVER CHERT	Local		Low	PO13	YES	NO		4	0	0	0	0	0	
C	5	415-018-13	SHATTER				INDETERMINATE CHERT	Unknown				UNKNOWN	NO		2.1	0	0	0	0	0	
C	5	415-018-14	SHATTER				SWAN RIVER CHERT	Local		Low	G29	YES	NO		2.6	0	0	0	0	0	
C	5	415-018-15	COMPFLAKE			FLAKE	SWAN RIVER CHERT	Local		Low	W10	UNKNOWN	NO	0%	1.2	24.11	13.52	3.99	0	0	
C	5	415-018-16	MEDFLAKE				SWAN RIVER CHERT	Local		Low	PW03	YES	NO		5.2	0	0	0	0	0	
C	5	415-018-17	COMPFLAKE			FLAKE	SWAN RIVER CHERT	Local		Low	PW03	YES	NO	0%	1.9	20.45	20.85	4.36	0	0	
C	5	415-018-18	SHATTER				SWAN RIVER CHERT	Local		Low	CP03	YES	NO		7.8	0	0	0	0	0	
C	5	415-018-19	COMPFLAKE			FLAKE	SWAN RIVER CHERT	Local		Low	PW03	YES	NO	0%	0.5	16.18	12.48	2.37	0	0	
C	5	415-018-20	COMPFLAKE			FLAKE	SWAN RIVER CHERT	Local		Low	W12	UNKNOWN	NO	0%	1.2	19.43	16.34	3.79	0	0	
C	5	415-018-21	SHATTER				SWAN RIVER CHERT	Local		Low	W10	UNKNOWN	NO		1.6	0	0	0	0	0	
C	5	415-018-22	SHATTER				SWAN RIVER CHERT	Local		Low	CP02	YES	NO		11.9	0	0	0	0	0	
C	5	415-018-23	FLAKETOOLCOMP	SIDESCRAPER	EXPEDIENT	FLAKE	SWAN RIVER CHERT	Local		Low	CP02	YES	NO	0%	9.5	36.42	25.04	7.53	0.09	0	
C	5	415-018-24	DISTFLAKE				SWAN RIVER CHERT	Local		Low	PG05	YES	NO		5.9	0	0	0	0	0	
C	5	415-018-25	SHATTER				SWAN RIVER CHERT	Local		Low	CP02	YES	NO		1.4	0	0	0	0	0	
C	5	415-018-26	PROXFLAKE			FLAKE	SWAN RIVER CHERT	Local		Low	CP03	YES	NO		2.6	0	0	0	0	0	
C	5	415-018-27	PROXFLAKE			FLAKE	KNIFE RIVER FLINT	Non-Local	Northwest	High		UNKNOWN	NO		3.1	0	0	0	0	0	
C	5	415-018-28	DISTFLAKE				LGG - KNIFE RIVER FLINT	Local		Low		UNKNOWN	NO		3	0	0	0	0	0	
C	5	415-018-29	COMPFLAKE			FLAKE	KNIFE RIVER FLINT	Non-Local	Northwest	High		UNKNOWN	NO	1-10%	1.9	13.94	20.19	4.05	0	0	
C	5	415-018-30	COMPFLAKE			FLAKE	KNIFE RIVER FLINT	Non-Local	Northwest	High		UNKNOWN	NO	0%	1	21.12	19.55	2.2	0	0	
C	5	415-018-31	SHATTER				TONGUE RIVER SILICA	Local		Low		YES	NO		1.4	0	0	0	0	0	
C	5	415-018-32	COMPFLAKE			FLAKE	TONGUE RIVER SILICA	Local		Low		YES	NO	0%	1.2	17.51	14.99	3.3	0	0	
C	5	415-018-33	COMPFLAKE			FLAKE	TONGUE RIVER SILICA	Local		Low		YES	NO	0%	1	18.6	17.6	2.22	0	0	
C	5	415-018-34	MEDFLAKE				PRAIRIE DU CHIEN CHERT	Non-Local	East	Low	W06	YES	NO		1.5	0	0	0	0	0	
C	5	415-018-35	SHATTER				PRAIRIE DU CHIEN CHERT	Non-Local	East	Low	PG08	YES	NO		5.5	0	0	0	0	0	
C	5	415-018-36	COMPFLAKE			FLAKE	PRAIRIE DU CHIEN CHERT	Non-Local	East	Low	G05	NO	NO	1-10%	11.9	34.89	31.99	9.95	0	0	
C	5	415-018-37	FLAKETOOLCOMP	UTILIZEDFLAKE	EXPEDIENT	FLAKE	RED RIVER CHERT	Local		Low	LG09	UNKNOWN	NO	10-40%	5.3	34.23	20.71	7.03	0.03	0	
C	5	415-018-38	SHATTER				INDETERMINATE CHERT	Unknown				UNKNOWN	NO		7.4	0	0	0	0	0	
C	5	415-018-39	COMPFLAKE			FLAKE	GALENA CHERT	Non-Local	East	High	GS03	YES	NO	0%	1.8	24.11	17.15	2.93	0	0	
C	5	415-018-40	COMPFLAKE			FLAKE	RED RIVER CHERT	Local		Low	DG05	UNKNOWN	NO	40-60%	3.2	23.19	18.79	7.01	0	0	
C	5	415-018-41	PROXFLAKE			FLAKE	BURLINGTON CHERT	Non-Local	Southeast	High		YES	NO		0.3	0	0	0	0	0	

UNIT	LEVEL	ARTID	DATACLASS	TOOLTYPE1	TOOLTYPE2	DEBTYPE	RAWMAT2	Origin	Direction	Quality	MANGROUP	HEATED	BURNED	CORTEX	WEIGHT (g)	LENGTH1 (mm)	WIDTH1 (mm)	THICK1 (mm)	Clarkson's II	Kuhn's IR	POINTASSOC1
C	5	415-018-42	PROXFLAKE			FLAKE	BURLINGTON CHERT	Non-Local	Southeast	High		NO	NO		1.5	0	0	0	0	0	
C	5	415-018-43	MEDFLAKE				BURLINGTON CHERT	Non-Local	Southeast	High		YES	NO		1.5	0	0	0	0	0	
C	5	415-018-44	DISTFLAKE				PRAIRIE DU CHIEN CHERT	Non-Local	East	Low	W02	YES	NO		0.5	0	0	0	0	0	
C	5	415-018-45	COMPFLAKE			FLAKE	INDETERMINATE CHERT	Unknown				UNKNOWN	NO	0%	0.6	17.52	13.05	2.19	0	0	
C	5	415-018-46	DISTFLAKE				GRAND MEADOW CHERT	Non-Local	East	High		UNKNOWN	NO		0.6	0	0	0	0	0	
C	5	415-018-47	COMPFLAKE			BTF	GRAND MEADOW CHERT	Non-Local	East	High		NO	NO	1-10%	1	17.52	15.33	4.13	0	0	
C	5	415-018-48	SHATTER				RED RIVER CHERT	Local		Low	DG05	UNKNOWN	NO		1	0	0	0	0	0	
C	5	415-018-49	COMPFLAKE			FLAKE	BASALTIC ROCK	Local		Low		UNKNOWN	NO	0%	25.4	37.3	53	9.16	0	0	
C	5	415-018-50	COMPFLAKE			FLAKE	QUARTZ	Local		Low		UNKNOWN	NO	100%	2	27.05	14.4	4.16	0	0	
C	5	415-018-51	COMPFLAKE			FLAKE	QUARTZ	Local		Low		UNKNOWN	NO	0%	0.9	19.44	9.62	4.76	0	0	
C	5	415-018-52	SHATTER				QUARTZ	Local		Low		UNKNOWN	NO		1.8	0	0	0	0	0	
C	5	415-018-53	SHATTER				QUARTZ	Local		Low		UNKNOWN	NO		2.5	0	0	0	0	0	
C	5	415-018-54	SHATTER				INDETERMINATE QUARTZITE	Unknown				YES	NO		0.7	0	0	0	0	0	
C	5	415-018-55	SHATTER				BASALTIC ROCK	Local		Low		UNKNOWN	NO		2.5	0	0	0	0	0	
C	5	415-018-57	COMPFLAKE			BIPOLAR	LGG - AGATE	Local		Low		NO	NO	100%	6.4	29.96	18.92	9.45	0	0	
C	5	415-018-58	FLAKETOOLSHAT	SCRAPER	EXPEDIENT		INDETERMINATE CHERT	Unknown				UNKNOWN	NO		11.5	0	0	0	0	0	
C	5	415-018-59	SHATTER				INDETERMINATE CHERT	Unknown				UNKNOWN	NO		8.1	0	0	0	0	0	
C	5	415-018-60	DISTFLAKE				FUSILINID CHERT	Non-Local	South	High	G01	YES	NO		0.9	0	0	0	0	0	
C	5	415-018-61	COMPFLAKE			FLAKE	INDETERMINATE CHERT	Unknown				UNKNOWN	NO	0%	3.7	26.73	30.02	5.95	0	0	
C	5	415-018-62	SHATTER				SWAN RIVER CHERT	Local		Low	G23	YES	NO		2.1	0	0	0	0	0	
C	5	415-018-63	SHATTER				INDETERMINATE CHERT	Unknown				UNKNOWN	NO		0.3	0	0	0	0	0	
C	5	415-018-64	MEDFLAKE				INDETERMINATE CHERT	Unknown				UNKNOWN	NO		1	0	0	0	0	0	
C	5	415-018-65	SHATTER				INDETERMINATE CHERT	Unknown				UNKNOWN	NO		3.6	0	0	0	0	0	
C	5	415-018-66	PROXFLAKE			FLAKE	INDETERMINATE CHERT	Unknown				UNKNOWN	NO		1	0	0	0	0	0	
C	5	415-018-67	SHATTER				INDETERMINATE CHERT	Unknown				UNKNOWN	NO		3	0	0	0	0	0	
C	5	415-018-68	PROXFLAKE			FLAKE	INDETERMINATE CHALCEDONY	Unknown				NO	NO		2.4	0	0	0	0	0	
C	5	415-018-69	SHATTER				INDETERMINATE CHERT	Unknown				YES	YES		1	0	0	0	0	0	
C	5	415-018-70	PROXFLAKE			FLAKE	MOLINE CHERT	Non-Local	Southeast	High		NO	NO		1.3	0	0	0	0	0	
C	7	415-019-01	PROXFLAKE			FLAKE	SWAN RIVER CHERT	Local		Low	GW03	YES	NO		65.5	0	0	0	0	0	
C	7	415-019-02	SHATTER				SWAN RIVER CHERT	Local		Low	PG13	YES	NO		4.8	0	0	0	0	0	
C	7	415-019-03	MEDFLAKE				SWAN RIVER CHERT	Local		Low	PG13	YES	NO		1.8	0	0	0	0	0	
C	7	415-019-04	SHATTER				SWAN RIVER CHERT	Local		Low	PG34	YES	NO		19	0	0	0	0	0	
C	7	415-019-05	COMPFLAKE			FLAKE	SWAN RIVER CHERT	Local		Low	PG25	YES	NO	1-10%	12.4	35.49	41.86	7.25	0	0	
C	7	415-019-06	PROXFLAKE			FLAKE	SWAN RIVER CHERT	Local		Low	WG10	YES	NO		1.2	0	0	0	0	0	
C	7	415-019-07	SHATTER				SWAN RIVER CHERT	Local		Low	CG03	YES	NO		0.5	0	0	0	0	0	
C	7	415-019-08	PROXFLAKE			FLAKE	SWAN RIVER CHERT	Local		Low	PW03	YES	NO		0.8	0	0	0	0	0	
C	7	415-019-09	COMPFLAKE			FLAKE	KNIFE RIVER FLINT	Non-Local	Northwest	High		UNKNOWN	NO	1-10%	0.9	16.67	15.4	2.07	0	0	
C	7	415-019-10	FLAKETOOLPROX	UTILIZEDFLAKE	EXPEDIENT	FLAKE	KNIFE RIVER FLINT	Non-Local	Northwest	High		UNKNOWN	NO		4.8	0	0	0	0	0	
C	7	415-019-11	COMPFLAKE			FLAKE	KNIFE RIVER FLINT	Non-Local	Northwest	High		UNKNOWN	NO	0%	0.4	15.77	17.5	1.41	0	0	
C	7	415-019-12	SHATTER				PRAIRIE DU CHIEN CHERT	Non-Local	East	Low	PG07	YES	NO		1.4	0	0	0	0	0	
C	7	415-019-13	PROXFLAKE			BTF	INDETERMINATE CHERT	Unknown				UNKNOWN	NO		1	0	0	0	0	0	
C	7	415-019-14	COMPFLAKE			FLAKE	BASALTIC ROCK	Local		Low		UNKNOWN	NO	90-99%	19.6	38.64	42.18	8.6	0	0	
C	7	415-019-15	SHATTER				BURLINGTON CHERT	Non-Local	Southeast	High		NO	NO		6.8	0	0	0	0	0	
C	7	415-019-18	SHATTER				INDETERMINATE CHERT	Unknown				YES	YES		32.6	0	0	0	0	0	
C	7	415-019-19	SHATTER				PRAIRIE DU CHIEN CHERT	Non-Local	East	Low	PG12	YES	NO		5.2	0	0	0	0	0	
C	7	415-019-20	HEATSPALL				INDETERMINATE CHERT	Unknown				YES	YES		3.1	0	0	0	0	0	
C	7	415-019-21	PROXFLAKE			FLAKE	INDETERMINATE CHERT	Unknown				YES	YES		1.2	0	0	0	0	0	
C	7	415-019-22	COMPFLAKE			FLAKE	INDETERMINATE CHERT	Unknown				UNKNOWN	NO	0%	1.9	21.31	15.16	4.62	0	0	
C	7	415-019-23	SHATTER				INDETERMINATE CHALCEDONY	Unknown				NO	NO		2.5	0	0	0	0	0	
C	7	415-019-24	MEDFLAKE				HUDSON BAY LOWLAND CHERT	Unknown		High		NO	NO		1.2	0	0	0	0	0	
C	7	415-019-25	SHATTER				INDETERMINATE CHERT	Unknown				UNKNOWN	NO		0.5	0	0	0	0	0	
C	9	415-020-01	COMPFLAKE			FLAKE	SWAN RIVER CHERT	Local		Low	CG01	YES	NO	0%	1.7	23.42	16.96	3.09	0	0	
C	9	415-020-02	SHATTER				SWAN RIVER CHERT	Local		Low	WG14	YES	NO		0.8	0	0	0	0	0	
C	9	415-020-03	SHATTER				SWAN RIVER CHERT	Local		Low	PW02	YES	NO		1.5	0	0	0	0	0	
C	9	415-020-04	COMPFLAKE			FLAKE	SWAN RIVER CHERT	Local		Low	G16	YES	NO	0%	0.5	16.19	11.82	2	0	0	
C	9	415-020-06	SHATTER				KNIFE RIVER FLINT	Non-Local	Northwest	High		UNKNOWN	NO		1.4	0	0	0	0	0	
C	9	415-020-07	COMPFLAKE			FLAKE	PRAIRIE DU CHIEN CHERT	Non-Local	East	Low	G12	YES	NO	0%	5.9	23.66	29.71	7.82	0	0	
C	9	415-020-08	BIFACEFRAG	UNFINFRAG	UNKNOWN		FUSILINID CHERT	Non-Local	South	High	WG02	YES	NO		5.6	0	0	0	0	0	
C	9	415-020-09	SHATTER				BASALTIC ROCK	Local		Low		UNKNOWN	NO		3	0	0	0	0	0	
C	9	415-020-10	BIFACEFRAG	UNFINFRAG	UNKNOWN		INDETERMINATE CHERT	Unknown				UNKNOWN	NO		2.9	0	0	0	0	0	
C	9	415-020-11	HEATSPALL				INDETERMINATE CHERT	Unknown				YES	YES		0.7	0	0	0	0	0	
C	9	415-020-12	HEATSPALL				INDETERMINATE CHERT	Unknown				YES	YES		0.8	0	0	0	0	0	
C	9	415-020-13	COMPFLAKE			FLAKE	INDETERMINATE CHERT	Unknown				UNKNOWN	NO	0%	0.3	10.2	16.47	1.91	0	0	
D	1	415-021-01	SHATTER				SWAN RIVER CHERT	Local		Low	G04	YES	NO		0.7	0	0	0	0	0	
D	1	415-021-02	COMPFLAKE			FLAKE	SWAN RIVER CHERT	Local		Low	PO05	YES	NO	10-40%	7.9	36.6	21.95	7.37	0	0	
D	2	415-022-01	PROXFLAKE			FLAKE	SWAN RIVER CHERT	Local		Low	CG02	YES	NO		12.4	0	0	0	0	0	
D	2	415-022-02	COMPFLAKE			FLAKE	PRAIRIE DU CHIEN CHERT	Non-Local	East	Low	G04	UNKNOWN	NO	1-10%	3.9	30.8	25.5	3.98	0	0	
D	2	415-022-03	SHATTER				SWAN RIVER CHERT	Local		Low	PO07	YES	NO		3	0	0	0	0	0	
D	2	415-022-04	MEDFLAKE				SWAN RIVER CHERT	Local		Low	G04	YES	NO		1.2	0	0	0	0	0	
D	2	415-022-05	SHATTER				SWAN RIVER CHERT	Local		Low	P04	YES	NO		3.2	0	0	0	0	0	
D	2	415-022-06	SHATTER				SWAN RIVER CHERT	Local		Low	P01	YES	NO		5	0	0	0	0	0	
D	2	415-022-07	SHATTER				SWAN RIVER CHERT	Local		Low	G04	YES	NO		2.4	0	0	0	0	0	
D	2	415-022-08	SHATTER				SWAN RIVER CHERT	Local		Low	PG08	YES	NO		2.5	0	0	0	0	0	
D	2	415-022-09	COMPFLAKE			FLAKE	SWAN RIVER CHERT	Local		Low	G04	YES	NO	0%	1	18.3	16.44	3.79	0	0	
D	2	415-022-10	SHATTER				SWAN RIVER CHERT	Local		Low	WG11	YES	NO		1.4	0	0	0	0	0	
D	2	415-022-11	PROXFLAKE			FLAKE	KNIFE RIVER FLINT	Non-Local	Northwest	High		UNKNOWN	NO		0.3	0	0	0	0	0	
D	2	415-022-12	SHATTER				INDETERMINATE CHERT	Unknown				UNKNOWN	NO		9.2	0	0	0	0	0	
D	2	415-022-13	SHATTER				LGG - KNIFE RIVER FLINT	Local		Low		UNKNOWN	NO		18.2	0	0	0	0	0	
D	2	415-022-14	SHATTER				CEDAR VALLEY CHERT	Non-Local	East	High	OW02	UNKNOWN	NO		0.9	0	0	0	0	0	
D	2	415-022-15	DISTFLAKE				BURLINGTON CHERT	Non-Local	Southeast	High		YES	NO		0.8	0	0	0	0	0	
D	2	415-022-16	PROXFLAKE			FLAKE	BURLINGTON CHERT	Non-Local	Southeast	High		YES	NO		1.4	0	0	0	0	0	
D	2	415-022-17	COMPFLAKE			BTF	BURLINGTON CHERT	Non-Local	Southeast	High		YES	NO	0%	1	24.97	9.91	3	0	0	
D	2	415-022-18	COMPFLAKE			FLAKE	RED RIVER CHERT	Local		Low	B05	UNKNOWN	NO	1-10%	0.7	15.61	16.19	1.85	0	0	
D	2	415-022-19	COMPFLAKE			FLAKE	INDETERMINATE CHERT	Unknown				UNKNOWN	NO	0%	1.1	25.12	11.22	2.71	0	0	
A	6	415-0222	FLAKETOOLPROX	SIDESCRAPER	EXPEDIENT	FLAKE	WAPSIPINICON CHERT	Non-Local	Southeast	High		UNKNOWN	NO		2.6	0	0	0	0	0.332	
D	2	415-022-20	SHATTER				BASALTIC ROCK	Local		Low		YES	YES		2.6	0	0	0	0	0	
D	2	415-022-21	SHATTER				LGG - AGATE	Local		Low		NO	NO		3.7	0	0	0	0	0	
D	2	415-022-22	MEDFLAKE				PRAIRIE DU CHIEN CHERT	Non-Local	East	Low	G02	YES	NO		0.9	0	0	0	0	0	
D	2	415-022-23	MEDFLAKE				INDETERMINATE CHERT	Unknown				UNKNOWN	NO		3.6	0	0	0	0	0	
D	2	415-022-24	COMPFLAKE			FLAKE	INDETERMINATE CHERT	Unknown				YES	YES	N/A	2.1	25.96	15.25	4.05	0	0	
D	2	415-022-25	SHATTER				INDETERMINATE CHERT	Unknown				UNKNOWN	NO		3.1	0	0	0	0	0	
D	2	415-022-26	HEATSPALL				INDETERMINATE CHERT	Unknown				YES	YES		0.9	0	0	0	0	0	
D	2	415-022-27	PROXFLAKE			FLAKE	RED RIVER CHERT	Local		Low	B02	UNKNOWN	NO		2.1	0	0	0	0	0	
D	2	415-022-28	SHATTER				INDETERMINATE CHERT	Unknown				UNKNOWN	NO		2.3	0	0	0	0	0	
D	2	415-022-29	MEDFLAKE				INDETERMINATE CHERT	Unknown				UNKNOWN	NO		1.4	0	0	0	0	0	
D	3	415-023-01	DISTFLAKE				SWAN RIVER CHERT	Local		Low	PG05	YES	NO		0.9	0	0	0	0	0	
D	3	415-023-02	SHATTER				SWAN RIVER CHERT	Local		Low	G13	UNKNOWN	NO		3.1	0	0	0	0	0	
D	3	415-023-03	MEDFLAKE				SWAN RIVER CHERT	Local		Low	G20	YES	NO		1.3	0	0	0	0	0	
D	3	415-023-04	MEDFLAKE				SWAN RIVER CHERT	Local		Low	PG05	YES	NO		2	0	0	0	0	0	
D	3	415-023-05	SHATTER				SWAN RIVER CHERT	Local		Low	PG18	YES	NO		1.4	0	0	0	0	0	
D	3	415-023-06	PROXFLAKE			FLAKE	SWAN RIVER CHERT	Local		Low	CG01	UNKNOWN	NO		6.4	0	0	0	0	0	
D	3	415-023-07	SHATTER				SWAN RIVER CHERT	Local		Low	PG18	YES	NO		2	0	0	0	0	0	
D	3	415-023-08	SHATTER				SWAN RIVER CHERT	Local		Low	PG19	YES	NO		2.3	0	0	0	0	0	

UNIT	LEVEL	ARTID	DATACLASS	TOOLTYPE1	TOOLTYPE2	DEBTYPE	RAWMAT2	Origin	Direction	Quality	MANGROUP	HEATED	BURNED	CORTEX	WEIGHT (g)	LENGTH1 (mm)	WIDTH1 (mm)	THICK1 (mm)	Clarkson's II	Kuhn's IR	POINTASSOC1
D	3	415-023-09	SHATTER				SWAN RIVER CHERT	Local		Low	G07	YES	NO		4.8	0	0	0	0	0	
D	3	415-023-10	SHATTER				SWAN RIVER CHERT	Local		Low	PG29	YES	NO		4.1	0	0	0	0	0	
D	3	415-023-11	SHATTER				SWAN RIVER CHERT	Local		Low	PG33	YES	NO		1.1	0	0	0	0	0	
D	3	415-023-12	PROXFLAKE			FLAKE	SWAN RIVER CHERT	Local		Low	W05	YES	NO		0.9	0	0	0	0	0	
D	3	415-023-13	SHATTER				LGG - KNIFE RIVER FLINT	Local		Low		UNKNOWN	NO		5.2	0	0	0	0	0	
D	3	415-023-14	DISTFLAKE				KNIFE RIVER FLINT	Non-Local	Northwest	High		UNKNOWN	NO		1.5	0	0	0	0	0	
D	3	415-023-15	DISTFLAKE				KNIFE RIVER FLINT	Non-Local	Northwest	High		UNKNOWN	NO		0.7	0	0	0	0	0	
D	3	415-023-16	FLAKETOOLMED	KNIFE	EXPEDIENT		BIJOU HILLS SIL SED	Non-Local	Southwest	Low		UNKNOWN	NO		1.2	0	0	0	0	0	
D	3	415-023-17	PROXFLAKE			FLAKE	BIJOU HILLS SIL SED	Non-Local	Southwest	Low		UNKNOWN	NO		0.4	0	0	0	0	0	
D	3	415-023-18	PROXFLAKE			FLAKE	PRAIRIE DU CHIEN CHERT	Non-Local	East	Low	G10	YES	NO		2.6	0	0	0	0	0	
D	3	415-023-19	FLAKETOOLSHAT	SCRAPER	EXPEDIENT	FLAKE	PRAIRIE DU CHIEN CHERT	Non-Local	East	Low	PG11	YES	NO		1.1	0	0	0	0	0	
D	3	415-023-20	COMPFLAKE			FLAKE	PRAIRIE DU CHIEN CHERT	Non-Local	East	Low	BR01	YES	NO	10-40%	1.2	23.1	14.78	2.63	0	0	
D	3	415-023-21	PROXFLAKE			FLAKE	PRAIRIE DU CHIEN CHERT	Non-Local	East	Low	PG11	YES	NO		1	0	0	0	0	0	
D	3	415-023-22	SHATTER				PRAIRIE DU CHIEN CHERT	Non-Local	East	Low	R01	YES	NO		1.8	0	0	0	0	0	
D	3	415-023-23	SHATTER				FUSILINID CHERT	Non-Local	South	High	PG01	YES	NO		1.4	0	0	0	0	0	
D	3	415-023-24	MEDFLAKE				BURLINGTON CHERT	Non-Local	Southeast	High		YES	NO		1.7	0	0	0	0	0	
D	3	415-023-25	PROXFLAKE			FLAKE	INDETERMINATE CHERT	Unknown				UNKNOWN	NO		1.6	0	0	0	0	0	
D	3	415-023-26	HEATSPALL				INDETERMINATE CHERT	Unknown				YES	YES		2.3	0	0	0	0	0	
D	3	415-023-27	SHATTER				LAKE OF THE WOODS RHYOLITE	Local		Low		UNKNOWN	NO		2.4	0	0	0	0	0	
D	3	415-023-29	SHATTER				QUARTZ	Local		Low		UNKNOWN	NO		4.3	0	0	0	0	0	
D	3	415-023-30	SHATTER				BASALTIC ROCK	Local		Low		UNKNOWN	NO		2.5	0	0	0	0	0	
D	3	415-023-32	SHATTER				INDETERMINATE CHERT	Unknown				UNKNOWN	NO		2.1	0	0	0	0	0	
D	3	415-023-33	SHATTER				INDETERMINATE CHERT	Unknown				UNKNOWN	NO		3.7	0	0	0	0	0	
D	3	415-023-34	DISTFLAKE				INDETERMINATE CHERT	Unknown				UNKNOWN	NO		5.1	0	0	0	0	0	
D	3	415-023-35	COMPFLAKE			BIPOLAR	INDETERMINATE CHERT	Unknown				UNKNOWN	NO	0%	2.6	29.3	18.43	3.14	0	0	
D	3	415-023-36	HEATSPALL				INDETERMINATE CHERT	Unknown				YES	YES		1.1	0	0	0	0	0	
D	3	415-023-37	PROXFLAKE			FLAKE	INDETERMINATE CHERT	Unknown				UNKNOWN	NO		0.8	0	0	0	0	0	
D	3	415-023-39	SHATTER				INDETERMINATE CHERT	Unknown				UNKNOWN	NO		5.7	0	0	0	0	0	
D	3	415-023-40	HEATSPALL				INDETERMINATE CHERT	Unknown				YES	YES		1.5	0	0	0	0	0	
D	4	415-024-01	COMPFLAKE			FLAKE	SWAN RIVER CHERT	Local		Low	PO05	YES	NO	60-90%	14.6	37.71	38.22	6.59	0	0	
D	4	415-024-02	SHATTER				SWAN RIVER CHERT	Local		Low	W14	YES	NO		2	0	0	0	0	0	
D	4	415-024-03	SHATTER				SWAN RIVER CHERT	Local		Low	PG10	YES	NO		2.3	0	0	0	0	0	
D	4	415-024-04	SHATTER				SWAN RIVER CHERT	Local		Low	PG36	YES	NO		6.3	0	0	0	0	0	
D	4	415-024-05	MEDFLAKE				SWAN RIVER CHERT	Local		Low	PG10	YES	NO		1.9	0	0	0	0	0	
D	4	415-024-06	SHATTER				SWAN RIVER CHERT	Local		Low	PO12	YES	NO		0.4	0	0	0	0	0	
D	4	415-024-07	PROXFLAKE			FLAKE	SWAN RIVER CHERT	Local		Low	CG01	YES	NO		1.7	0	0	0	0	0	
D	4	415-024-08	COMPFLAKE			FLAKE	SWAN RIVER CHERT	Local		Low	PG10	YES	NO	0%	1.3	20.32	17.68	2.71	0	0	
D	4	415-024-09	PROXFLAKE			FLAKE	SWAN RIVER CHERT	Local		Low	R04	YES	NO		2.6	0	0	0	0	0	
D	4	415-024-10	SHATTER				SWAN RIVER CHERT	Local		Low	B01	YES	NO		1.1	0	0	0	0	0	
D	4	415-024-11	DISTFLAKE				SWAN RIVER CHERT	Local		Low	PG10	YES	NO		1.5	0	0	0	0	0	
D	4	415-024-12	DISTFLAKE				SWAN RIVER CHERT	Local		Low	PG02	YES	NO		1.2	0	0	0	0	0	
D	4	415-024-13	PROXFLAKE			FLAKE	SWAN RIVER CHERT	Local		Low	WG15	UNKNOWN	NO		1.3	0	0	0	0	0	
D	4	415-024-14	SHATTER				KNIFE RIVER FLINT	Non-Local	Northwest	High		UNKNOWN	NO		5.3	0	0	0	0	0	
D	4	415-024-15	FLAKETOOLDIST	UTILIZEDFLAKE	EXPEDIENT		KNIFE RIVER FLINT	Non-Local	Northwest	High		UNKNOWN	NO		0.4	0	0	0	0	0	
D	4	415-024-16	PROXFLAKE			BTF	KNIFE RIVER FLINT	Non-Local	Northwest	High		UNKNOWN	NO		0.7	0	0	0	0	0	
D	4	415-024-17	MEDFLAKE				KNIFE RIVER FLINT	Non-Local	Northwest	High		UNKNOWN	NO		0.3	0	0	0	0	0	
D	4	415-024-18	DISTFLAKE				KNIFE RIVER FLINT	Non-Local	Northwest	High		UNKNOWN	NO		1	0	0	0	0	0	
D	4	415-024-19	SHATTER				GRAND MEADOW CHERT	Non-Local	East	High		NO	NO		3.3	0	0	0	0	0	
D	4	415-024-20	COMPFLAKE			FLAKE	GRAND MEADOW CHERT	Non-Local	East	High		NO	NO	40-60%	1	15.97	16.05	3.26	0	0	
D	4	415-024-21	PROXFLAKE			FLAKE	PRAIRIE DU CHIEN CHERT	Non-Local	East	Low	G11	YES	NO		0.7	0	0	0	0	0	
D	4	415-024-22	MEDFLAKE				BURLINGTON CHERT	Non-Local	Southeast	High		YES	NO		0.6	0	0	0	0	0	
D	4	415-024-23	PROXFLAKE			FLAKE	BURLINGTON CHERT	Non-Local	Southeast	High		YES	NO		0.7	0	0	0	0	0	
D	4	415-024-24	DISTFLAKE				BURLINGTON CHERT	Non-Local	Southeast	High		YES	NO		0.9	0	0	0	0	0	
D	4	415-024-25	SHATTER				BURLINGTON CHERT	Non-Local	Southeast	High		NO	NO		4.4	0	0	0	0	0	
D	4	415-024-26	SHATTER				RED RIVER CHERT	Local		Low	LG12	UNKNOWN	NO		0.9	0	0	0	0	0	
D	4	415-024-27	HEATSPALL				INDETERMINATE CHERT	Unknown				YES	YES		3.4	0	0	0	0	0	
D	4	415-024-28	PROXFLAKE			FLAKE	INDETERMINATE CHERT	Unknown				UNKNOWN	NO		0.4	0	0	0	0	0	
D	4	415-024-29	DISTFLAKE				INDETERMINATE CHERT	Unknown				UNKNOWN	NO		1.2	0	0	0	0	0	
D	4	415-024-30	SHATTER				INDETERMINATE CHERT	Unknown				UNKNOWN	NO		1.7	0	0	0	0	0	
D	4	415-024-31	SHATTER				INDETERMINATE CHERT	Unknown				UNKNOWN	NO		2.2	0	0	0	0	0	
D	4	415-024-32	DISTFLAKE				KNIFE RIVER FLINT	Non-Local	Northwest	High		UNKNOWN	NO		1.7	0	0	0	0	0	
D	4	415-024-33	SHATTER				INDETERMINATE CHERT	Unknown				UNKNOWN	NO		6.3	0	0	0	0	0	
D	4	415-024-34	SHATTER				INDETERMINATE CHERT	Unknown				YES	YES		2.7	0	0	0	0	0	
D	4	415-024-35	DISTFLAKE				INDETERMINATE CHERT	Unknown				UNKNOWN	NO		0.7	0	0	0	0	0	
D	4	415-024-36	SHATTER				INDETERMINATE CHERT	Unknown				UNKNOWN	NO		2.4	0	0	0	0	0	
D	4	415-024-37	COMPFLAKE			FLAKE	MOLINE CHERT	Non-Local	Southeast	High		NO	NO	90-99%	1.1	30.04	11.39	2.38	0	0	
D	4	415-024-38	SHATTER				INDETERMINATE CHERT	Unknown				YES	YES		0.9	0	0	0	0	0	
D	4	415-024-39	SHATTER				SWAN RIVER CHERT	Local		Low	G30	YES	NO		2.7	0	0	0	0	0	
D	5	415-025-01	PROXFLAKE			FLAKE	SWAN RIVER CHERT	Local		Low	W05	YES	NO		1.9	0	0	0	0	0	
D	5	415-025-02	SHATTER				SWAN RIVER CHERT	Local		Low	PG02	YES	NO		2.1	0	0	0	0	0	
D	5	415-025-03	PROXFLAKE			FLAKE	SWAN RIVER CHERT	Local		Low	CP02	YES	NO		3.6	0	0	0	0	0	
D	5	415-025-04	MEDFLAKE				SWAN RIVER CHERT	Local		Low	PG13	YES	NO		2.3	0	0	0	0	0	
D	5	415-025-05	SHATTER				SWAN RIVER CHERT	Local		Low	G08	YES	NO		3.8	0	0	0	0	0	
D	5	415-025-06	MEDFLAKE				SWAN RIVER CHERT	Local		Low	P02	YES	NO		4.1	0	0	0	0	0	
D	5	415-025-07	SHATTER				SWAN RIVER CHERT	Local		Low	PG31	YES	NO		1.1	0	0	0	0	0	
D	5	415-025-08	SHATTER				SWAN RIVER CHERT	Local		Low	W05	YES	NO		1	0	0	0	0	0	
D	5	415-025-09	SHATTER				SWAN RIVER CHERT	Local		Low	G11	UNKNOWN	NO		2.1	0	0	0	0	0	
D	5	415-025-10	COMPFLAKE			FLAKE	SWAN RIVER CHERT	Local		Low	PG33	YES	NO	0%	1.7	17.32	23.53	4.82	0	0	
D	5	415-025-11	SHATTER				SWAN RIVER CHERT	Local		Low	PG36	YES	NO		36.3	0	0	0	0	0	
D	5	415-025-12	PROXFLAKE			FLAKE	SWAN RIVER CHERT	Local		Low	CP02	YES	NO		7.2	0	0	0	0	0	
D	5	415-025-13	SHATTER				SWAN RIVER CHERT	Local		Low	G18	YES	NO		0.9	0	0	0	0	0	
D	5	415-025-14	PROXFLAKE			FLAKE	SWAN RIVER CHERT	Local		Low	CG02	YES	NO		22	0	0	0	0	0	
D	5	415-025-15	SHATTER				SWAN RIVER CHERT	Local		Low	W05	YES	NO		0.6	0	0	0	0	0	
D	5	415-025-16	MEDFLAKE				PRAIRIE DU CHIEN CHERT	Non-Local	East	Low	W04	YES	NO		0.3	0	0	0	0	0	
D	5	415-025-17	COMPFLAKE			FLAKE	KNIFE RIVER FLINT	Non-Local	Northwest	High		YES	YES	0%	1	21.55	18.54	2.06	0	0	
D	5	415-025-18	BIFACE	UNFIN	UNKNOWN		KNIFE RIVER FLINT	Non-Local	Northwest	High		UNKNOWN	NO		4.2	0	0	0	0	0	
D	5	415-025-19	SHATTER				KNIFE RIVER FLINT	Non-Local	Northwest	High		UNKNOWN	NO		2	0	0	0	0	0	
D	5	415-025-20	SHATTER				LGG - KNIFE RIVER FLINT	Local		Low		UNKNOWN	NO		0.8	0	0	0	0	0	
D	5	415-025-21	COMPFLAKE			FLAKE	BURLINGTON CHERT	Non-Local	Southeast	High		YES	NO	0%	3.8	19.82	37.2	3.62	0	0	
D	5	415-025-22	COMPFLAKE			FLAKE	BURLINGTON CHERT	Non-Local	Southeast	High		YES	NO	0%	1.1	15.72	18.13	3.59	0	0	
D	5	415-025-23	COMPFLAKE			FLAKE	BURLINGTON CHERT	Non-Local	Southeast	High		YES	NO	0%	0.7	13.65	16.37	3.04	0	0	
D	5	415-025-24	PROXFLAKE			FLAKE	BURLINGTON CHERT	Non-Local	Southeast	High		YES	NO		0.7	0	0	0	0	0	
D	5	415-025-25	PROXFLAKE			FLAKE	BURLINGTON CHERT	Non-Local	Southeast	High		YES	NO		0.6	0	0	0	0	0	
D	5	415-025-26	MEDFLAKE				BURLINGTON CHERT	Non-Local	Southeast	High		YES	NO		0.8	0	0	0	0	0	
D	5	415-025-27	SHATTER				INDETERMINATE CHERT	Unknown				UNKNOWN	NO		8.8	0	0	0	0	0	
D	5	415-025-28	SHATTER				RED RIVER CHERT	Local		Low	LG05	UNKNOWN	NO		1.9	0	0	0	0	0	
D	5	415-025-29	SHATTER				RED RIVER CHERT	Local		Low	LG02	UNKNOWN	NO		2.6	0	0	0	0	0	
D	5	415-025-30	COMPFLAKE			FLAKE	RED RIVER CHERT	Local		Low	B05	YES	NO	60-90%	3.7	30.48	22.18	4.12	0	0	
D	5	415-025-31	SHATTER				RED RIVER CHERT	Local		Low	LG17	UNKNOWN	NO		1.3	0	0	0	0	0	
D	5	415-025-32	SHATTER				RED RIVER CHERT	Local		Low	LG03	UNKNOWN	NO		1.3	0	0	0	0	0	
D	5	415-025-34	SHATTER				BASALTIC ROCK	Local		Low		UNKNOWN	NO		1.6	0	0	0	0	0	
D	5	415-025-35	SHATTER				KAKABEKA CHERT (BR)	Unknown		Low		NO	NO		11.7	0	0	0	0	0	
D	5	415-025-37	COMPFLAKE			BTF	INDETERMINATE CHERT	Unknown				UNKNOWN	NO	0%	1.1	20.38	16.15	2.89	0	0	

UNIT	LEVEL	ARTID	DATACLASS	TOOLTYPE1	TOOLTYPE2	DEBTYPE	RAWMAT2	Origin	Direction	Quality	MANGROUP	HEATED	BURNED	CORTEX	WEIGHT (g)	LENGTH1 (mm)	WIDTH1 (mm)	THICK1 (mm)	Clarkson's II	Kuhn's IR	POINTASSOC1
D	5	415-025-38	PROXFLAKE			FLAKE	INDETERMINATE CHERT	Unknown				UNKNOWN	NO		1.3	0	0	0	0	0	
D	5	415-025-39	SHATTER				SWAN RIVER CHERT	Local		Low	W13	UNKNOWN	NO		1.1	0	0	0	0	0	
D	5	415-025-40	PROXFLAKE			FLAKE	INDETERMINATE CHERT	Unknown				UNKNOWN	NO		1	0	0	0	0	0	
D	5	415-025-41	COMPFLAKE			FLAKE	SWAN RIVER CHERT	Local		Low	W05	UNKNOWN	NO	0%	0.8	13.24	16.54	2.56	0	0	
D	5	415-025-42	DISTFLAKE				SWAN RIVER CHERT	Local		Low	GW04	UNKNOWN	NO		0.9	0	0	0	0	0	
D	5	415-025-43	COMPFLAKE			FLAKE	GULSETH SILICA	Non-Local	Southwest	High		NO	NO	0%	0.4	14.56	10.35	1.78	0	0	
D	5	415-025-44	SHATTER				INDETERMINATE CHERT	Unknown				UNKNOWN	NO		1.8	0	0	0	0	0	
D	5	415-025-46	SHATTER				SWAN RIVER CHERT	Local		Low	CP02	YES	NO		4.3	0	0	0	0	0	
D	6	415-026-01	SHATTER				SWAN RIVER CHERT	Local		Low	G21	NO	NO		25.5	0	0	0	0	0	
D	6	415-026-02	PROXFLAKE			FLAKE	SWAN RIVER CHERT	Local		Low	GW04	UNKNOWN	NO		2.4	0	0	0	0	0	
D	6	415-026-03	CORE				SWAN RIVER CHERT	Local		Low	CG01	YES	NO		11.3	0	0	0	0	0	
D	6	415-026-04	SHATTER				SWAN RIVER CHERT	Local		Low	P02	YES	NO		4.3	0	0	0	0	0	
D	6	415-026-05	SHATTER				SWAN RIVER CHERT	Local		Low	PG09	YES	NO		2.2	0	0	0	0	0	
D	6	415-026-06	MEDFLAKE				SWAN RIVER CHERT	Local		Low	G08	YES	NO		1.1	0	0	0	0	0	
D	6	415-026-07	SHATTER				KNIFE RIVER FLINT	Non-Local	Northwest	High		UNKNOWN	NO		5.3	0	0	0	0	0	
D	6	415-026-08	COMPFLAKE			FLAKE	BURLINGTON CHERT	Non-Local	Southeast	High		YES	NO	0%	1.1	20.59	18.83	2.96	0	0	
D	6	415-026-09	SHATTER				RED RIVER CHERT	Local		Low	LG16	UNKNOWN	NO		2.3	0	0	0	0	0	
D	6	415-026-10	SHATTER				RED RIVER CHERT	Local		Low	LG03	UNKNOWN	NO		3.6	0	0	0	0	0	
D	6	415-026-11	COMPFLAKE			FLAKE	RED RIVER CHERT	Local		Low	LG12	UNKNOWN	NO	40-60%	0.3	15.14	8.11	2.38	0	0	
D	6	415-026-12	SHATTER				GALENA CHERT	Non-Local	East	High	OG02	UNKNOWN	NO		1.6	0	0	0	0	0	
A	1	415-101	FLAKETOOLPROX	ENDSCRAPER	EXPEDIENT	UNKNOWN	GRAND MEADOW CHERT	Non-Local	East	High		NO	NO		3.3	0	0	0	0	0	
A	1	415-102	FLAKETOOLCOMP	ENDSCRAPER	EXPEDIENT	FLAKE	INDETERMINATE CHERT	Unknown				UNKNOWN	NO	10-40%	1.1	14.1	15.22	2.8	0.31	0	
A	3	415-103	FLAKETOOLPROX	SIDESCRAPER	EXPEDIENT	FLAKE	GRAND MEADOW CHERT	Non-Local	East	High		NO	NO		5.5	0	0	0	0	0.376	
A	1	415-104	BIFACENOTCOMP	POINT	FORMAL		GRAND MEADOW CHERT	Non-Local	East	High		UNKNOWN	NO		0.8	0	0	0	0	0	latewoodland-mississ
A	2	415-105	BIFACE	POINT	FORMAL		BURLINGTON CHERT	Non-Local	Southeast	High		YES	NO		2	0	0	0	0	0	latewoodland
A	2	415-106	BIFACENOTCOMP	POINT	FORMAL		KNIFE RIVER FLINT	Non-Local	Northwest	High		UNKNOWN	NO		0.6	0	0	0	0	0	latewoodland-mississ
A	2	415-107	BIFACENOTCOMP	POINT	FORMAL		PRAIRIE DU CHIEN CHERT	Non-Local	East	Low	G15	YES	NO		3.2	0	0	0	0	0	middlewoodland
A	2	415-109	BIFACENOTCOMP	POINT	FORMAL		INDETERMINATE CHERT	Unknown				UNKNOWN	NO		0.6	0	0	0	0	0	
A	2	415-110	FLAKETOOLMED	SIDESCRAPER	EXPEDIENT		GRAND MEADOW CHERT	Non-Local	East	High		NO	NO		2.2	0	0	0	0	0	
A	2	415-111	FLAKETOOLSHAT	SCRAPER	UNKNOWN		WAPSIPINICON CHERT	Non-Local	Southeast	High		UNKNOWN	NO		1.7	0	0	0	0	0.932	
A	2	415-112	FLAKETOOLMED	SIDESCRAPER	EXPEDIENT		SWAN RIVER CHERT	Local		Low	G06	YES	NO		1.6	0	0	0	0	0.447	
A	2	415-113	FLAKETOOLDIST	UTILIZEDFLAKE	EXPEDIENT		RED RIVER CHERT	Local		Low	LG05	UNKNOWN	NO		1.3	0	0	0	0	0	
A	2	415-114	BIFACEFRAG	KNIFEFRAG	FORMAL		TONGUE RIVER SILICA	Local		Low		NO	NO		6.4	0	0	0	0	0	
A	2	415-115	FLAKETOOLCOMP	ENDSCRAPER	EXPEDIENT	FLAKE	RED RIVER CHERT	Local		Low	LG03	UNKNOWN	NO	0%	1.6	19.48	11.81	4.95	0.03	0	
A	2	415-116	BIFACE	POINT	FORMAL		SWAN RIVER CHERT	Local		Low	PG07	YES	NO		1.4	0	0	0	0	0	latewoodland-mississ
A	2	415-117	BIFACE	POINT	FORMAL		SWAN RIVER CHERT	Local		Low	PG40	YES	NO		1.3	0	0	0	0	0	latewoodland-mississ
A	2	415-118	FLAKETOOLSHAT	SCRAPER	EXPEDIENT		GULSETH SILICA	Non-Local	Southwest	High		UNKNOWN	NO		5.2	0	0	0	0	0.527	
A	2	415-119	FLAKETOOLCOMP	UTILIZEDFLAKE	EXPEDIENT	FLAKE	KNIFE RIVER FLINT	Non-Local	Northwest	High		UNKNOWN	NO	10-40%	1	17.68	14.33	4.63	0.09	0	
A	2	415-120	FLAKETOOLCOMP	DOUBLESIDESCRAPER	EXPEDIENT	FLAKE	KNIFE RIVER FLINT	Non-Local	Northwest	High		UNKNOWN	NO	0%	2	32.01	11.29	3.59	0.22	0.523	
A	2	415-121	BIFACENOTCOMP	POINT	FORMAL		SWAN RIVER CHERT	Local		Low	G33	YES	NO		1.1	0	0	0	0	0	latewoodland-mississ
A	2	415-122	BIFACENOTCOMP	POINT	FORMAL		KNIFE RIVER FLINT	Non-Local	Northwest	High		UNKNOWN	NO		0.6	0	0	0	0	0	latewoodland
A	2	415-123	FLAKETOOLDIST	SIDESCRAPER	UNKNOWN		GRAND MEADOW CHERT	Non-Local	East	High		YES	YES		1.2	0	0	0	0	1	
S	0	415-125	BIFACE	POINT	FORMAL		MOLINE CHERT	Non-Local	Southeast	High		YES	NO		1.7	0	0	0	0	0	latewoodland-mississ
S	0	415-126	BIFACE	POINT	FORMAL		LAKE SUPERIOR AGATE	Unknown		Low	RW01	UNKNOWN	NO		0.8	0	0	0	0	0	latewoodland-mississ
S	0	415-127	BIFACEFRAG	KNIFEBASE	FORMAL		SWAN RIVER CHERT	Local		Low	PG37	YES	NO		11.8	0	0	0	0	0	
S	0	415-128	FLAKETOOLMED	ENDSCRAPER	FORMAL		KNIFE RIVER FLINT	Non-Local	Northwest	High		UNKNOWN	NO		10.8	0	0	0	0	0.65	
S	0	415-129	FLAKETOOLCOMP	SIDESCRAPER	EXPEDIENT	BIPOLAR	KNIFE RIVER FLINT	Non-Local	Northwest	High		UNKNOWN	NO	0%	3.4	48.46	14.73	5.45	0.13	0.339	
S	0	415-130	FLAKETOOLPROX	DOUBLESIDESCRAPER	EXPEDIENT	FLAKE	KNIFE RIVER FLINT	Non-Local	Northwest	High		YES	YES		1.5	0	0	0	0	0	
D	1	415-131	BIFACE	POINT	FORMAL		INDETERMINATE CHERT	Unknown				YES	YES		7.3	0	0	0	0	0	latepaleo-earlyarch
D	1	415-132	BIFACE	POINT	FORMAL		KNIFE RIVER FLINT	Non-Local	Northwest	High		UNKNOWN	NO		3.7	0	0	0	0	0	latewoodland
D	1	415-133	BIFACE	POINT	FORMAL		MOLINE CHERT	Non-Local	Southeast	High		UNKNOWN	NO		0.8	0	0	0	0	0	latewoodland-mississ
D	1	415-134	FLAKETOOLDIST	ENDSCRAPER	EXPEDIENT		KNIFE RIVER FLINT	Non-Local	Northwest	High		UNKNOWN	NO		3	0	0	0	0	0	
D	2	415-135	BIFACE	POINT	FORMAL		SWAN RIVER CHERT	Local		Low	W25	YES	NO		4.5	0	0	0	0	0	latearchaic
D	2	415-136	BIFACEFRAG	BIFACETIP	FORMAL		INDETERMINATE CHERT	Unknown				UNKNOWN	NO		0.6	0	0	0	0	0	
D	2	415-137	FLAKETOOLDIST	END&SIDESCRAPER	EXPEDIENT		BIJOU HILLS SIL SED	Non-Local	Southwest	Low		UNKNOWN	NO		1.3	0	0	0	0	0	
D	2	415-138	FLAKETOOLMED	SIDESCRAPER	EXPEDIENT		CEDAR VALLEY CHERT	Non-Local	East	High	OW01	YES	NO		7	0	0	0	0	0	
D	2	415-139	FLAKETOOLPROX	SIDESCRAPER	EXPEDIENT	FLAKE	FUSILINID CHERT	Non-Local	South	High	G03	YES	NO		1.3	0	0	0	0	0	
D	2	415-140	BIFACE	POINT	FORMAL		INDETERMINATE CHERT	Unknown				UNKNOWN	NO		1.3	0	0	0	0	0	unknown
D	2	415-141	BIFACE	UNFIN	UNKNOWN		INDETERMINATE CHERT	Unknown				UNKNOWN	NO		4.3	0	0	0	0	0	
D	3	415-142	BIFACEFRAG	KNIFEBASE	FORMAL		BURLINGTON CHERT	Non-Local	Southeast	High		YES	NO		3.9	0	0	0	0	0	
D	3	415-143	FLAKETOOLSHAT	ENDSCRAPER	FORMAL	FLAKE	INDETERMINATE CHERT	Unknown				UNKNOWN	NO	0%	2.8	0	0	0	0.66	0	
D	3	415-144	FLAKETOOLPROX	UTILIZEDFLAKE	EXPEDIENT	FLAKE	KNIFE RIVER FLINT	Non-Local	Northwest	High		UNKNOWN	NO		1	0	0	0	0	0	
D	3	415-145	PROXFLAKE			FLAKE	KNIFE RIVER FLINT	Non-Local	Northwest	High		UNKNOWN	NO		2.8	0	0	0	0	0	
D	3	415-147	FLAKETOOLCOMP	SIDESCRAPER	FORMAL	UNKNOWN	HARTVILLE UPLIFT CHERT	Non-Local	Southwest	High		UNKNOWN	NO	0%	28	56.66	41.85	9.38	0.25	0.98	
D	3	415-148	BIFACENOTCOMP	POINT	FORMAL		SWAN RIVER CHERT	Local		Low	WG20	YES	NO		1.5	0	0	0	0	0	latewoodland-mississ
D	3	415-149	FLAKETOOLPROX	UTILIZEDFLAKE	EXPEDIENT	FLAKE	KNIFE RIVER FLINT	Non-Local	Northwest	High		UNKNOWN	NO		0.7	0	0	0	0	0.246	
D	3	415-150	BIFACE	UNFIN	UNKNOWN		SWAN RIVER CHERT	Local		Low	PG19	YES	NO		3.4	0	0	0	0	0	
D	3	415-151	FLAKETOOLPROX	UTILIZEDFLAKE	EXPEDIENT	FLAKE	KNIFE RIVER FLINT	Non-Local	Northwest	High		UNKNOWN	NO		1.4	0	0	0	0	0	
D	3	415-152	FLAKETOOLPROX	UTILIZEDFLAKE	EXPEDIENT	FLAKE	SILISIFIED WOOD	Local		High		UNKNOWN	NO		0.6	0	0	0	0	0	
D	4	415-153	BIFACE	POINT	FORMAL		SWAN RIVER CHERT	Local		Low	W25	UNKNOWN	NO		11.2	0	0	0	0	0	latearchaic
D	4	415-154	FLAKETOOLCOMP	ENDSCRAPER	FORMAL	FLAKE	KNIFE RIVER FLINT	Non-Local	Northwest	High		UNKNOWN	NO	1-10%	5	24.4	22.3	6.14	0.31	0	
D	4	415-155	FLAKETOOLCOMP	ENDSCRAPER	FORMAL	FLAKE	GRAND MEADOW CHERT	Non-Local	East	High		NO	NO	10-40%	4.4	27.46	17.05	7.2	0.41	1	
D	4	415-156	FLAKETOOLPROX	UTILIZEDFLAKE	EXPEDIENT	FLAKE	INDETERMINATE CHERT	Unknown				UNKNOWN	NO		1.2	0	0	0	0	0	
D	4	415-158	FLAKETOOLMED	DOUBLESIDESCRAPER	EXPEDIENT		KNIFE RIVER FLINT	Non-Local	Northwest	High		UNKNOWN	NO		1.8	0	0	0	0	0.734	
D	4	415-159	FLAKETOOLPROX	UNFIN	UNKNOWN	FLAKE	HUDSON BAY LOWLAND CHERT	Unknown		High		UNKNOWN	NO		1.6	0	0	0	0	0	
D	4	415-160	BIFACE	POINT	FORMAL		SWAN RIVER CHERT	Local		Low	G38	YES	NO		0.8	0	0	0	0	0	latewoodland-mississ
D	4	415-161	BIFACENOTCOMP	POINT	FORMAL		INDETERMINATE CHERT	Unknown				UNKNOWN	NO		0.7	0	0	0	0	0	latewoodland-mississ
D	5	415-163	BIFACENOTCOMP	POINT	FORMAL		INDETERMINATE CHERT	Unknown				UNKNOWN	NO		3.3	0	0	0	0	0	paleo
D	5	415-165	BIFACEFRAG	BIFACETIP	FORMAL		INDETERMINATE CHERT	Unknown				UNKNOWN	NO		0.5	0	0	0	0	0	
D	5	415-166	FLAKETOOLDIST	UTILIZEDFLAKE	EXPEDIENT		KNIFE RIVER FLINT	Non-Local	Northwest	High		UNKNOWN	NO		0.4	0	0	0	0	0	
D	5	415-167	FLAKETOOLCOMP	ENDSCRAPER	EXPEDIENT	FLAKE	LGG - KNIFE RIVER FLINT	Local		Low		UNKNOWN	NO	60-90%	3.4	26.61	15.28	8.53	0.06	0.651	
D	5	415-168	BIFACEFRAG	BIFACETIP	FORMAL		RED RIVER CHERT	Local		Low	LG18	YES	NO		2.7	0	0	0	0	0	
D	5	415-169	FLAKETOOLCOMP	ENDSCRAPER	FORMAL	FLAKE	INDETERMINATE CHERT	Unknown				UNKNOWN	NO	1-10%	1.7	17.42	14.11	4.05	0.25	0	
D	6	415-171	BIFACENOTCOMP	POINT	FORMAL		KNIFE RIVER FLINT	Non-Local	Northwest	High		UNKNOWN	NO		0.9	0	0	0	0	0	
D	6	415-172	FLAKETOOLDIST	END&SIDESCRAPER	EXPEDIENT		SWAN RIVER CHERT	Local		Low	W19	YES	NO		29.4	0	0	0	0	0.694	
D	6	415-173	FLAKETOOLCOMP	KNIFE	EXPEDIENT	FLAKE	PRAIRIE DU CHIEN CHERT	Non-Local	East	Low	G13	UNKNOWN	NO	0%	2.6	25.64	19.81	4.28	0.66	0	
A	3	415-174a	BIFACEFRAG	BIFACEBASE	FORMAL		SWAN RIVER CHERT	Local		Low	CP06	YES	NO		3.7	0	0	0	0	0	
D	6	415-174d	BIFACEFRAG	BIFACEBASE	FORMAL		INDETERMINATE CHERT	Unknown				UNKNOWN	NO		1.4	0	0	0	0	0	
A	3	415-176	FLAKETOOLCOMP	KNIFE	EXPEDIENT	UNKNOWN	GRAND MEADOW CHERT	Non-Local	East	High		NO	NO	1-10%	9.5	35.89	28.25	6.81	0.47	0	
A	3	415-177	BIFACEFRAG	BIFACETIP	FORMAL		SWAN RIVER CHERT	Local		Low	WG17	YES	NO		2.2	0	0	0	0	0	
A	3	415-178	FLAKETOOLCOMP	END&SIDESCRAPER	EXPEDIENT	BTF	KNIFE RIVER FLINT	Non-Local	Northwest	High		UNKNOWN	NO	0%	2	28.21	17.12	3.07	0.22	0	
A	3	415-179	BIFACEFRAG	BIFACETIP	FORMAL		INDETERMINATE CHERT	Unknown				UNKNOWN	NO		2.1	0	0	0	0	0	
A	3	415-180	FLAKETOOLPROX	UTILIZEDFLAKE	EXPEDIENT	FLAKE	GRAND MEADOW CHERT	Non-Local	East	High		UNKNOWN	NO		1.2	0	0	0	0	0	
A	3	415-181	FLAKETOOLCOMP	ENDSCRAPER	EXPEDIENT	FLAKE	GRAND MEADOW CHERT	Non-Local	East	High		YES	YES	1-10%	0.8	19.4	13.01	1.58	0.03	0	
A	3	415-182	FLAKETOOLCOMP	ENDSCRAPER	EXPEDIENT	FLAKE	GRAND MEADOW CHERT	Non-Local	East	High		UNKNOWN	NO	0%	0.9	16.94	21.07	3.13	0.03	0	
A	3	415-183	BIFACEFRAG	KNIFEFRAG	UNKNOWN		INDETERMINATE CHERT	Unknown				YES	YES		5.4	0	0	0	0	0	
A	3	415-184	BIFACENOTCOMP	POINT	FORMAL		TONGUE RIVER SILICA	Local		Low		YES	NO		1.4	0	0	0	0	0	
A	3	415-186	BIFACEFRAG	KNIFEFRAG	FORMAL		SWAN RIVER CHERT	Local		Low	WG18	YES	NO		7	0	0	0	0	0	
A	3	415-188	FLAKETOOLPROX	UTILIZEDFLAKE	EXPEDIENT	FLAKE	INDETERMINATE CHERT	Unknown				YES	YES		0.9	0	0	0	0	0	
A	3	415-190	UNIFACEFRAG	POINT	FORMAL		FUSILINID CHERT	Non-Local	South	High	T02	UNKNOWN	NO		2	0	0	0	0	0	archaic
A	4	415-191	BIFACENOTCOMP	POINT	FORMAL		SWAN RIVER CHERT	Local		Low	PG39	YES	NO		1.7	0	0	0	0	0	
A	4	415-192	BIFACENOTCOMP	POINT	FORMAL		INDETERMINATE CHERT	Unknown				UNKNOWN	NO		2.7	0	0	0	0	0	
A	4	415-194	FLAKETOOLCOMP	ENDSCRAPER	EXPEDIENT	BTF	GRAND MEADOW CHERT	Non-Local	East	High		UNKNOWN	NO	0%	1.2	19.35	15.79	3.1	0.25	0	

UNIT	LEVEL	ARTID	DATACLASS	TOOLTYPE1	TOOLTYPE2	DEBTYPE	RAWMAT2	Origin	Direction	Quality	MANGROUP	HEATED	BURNED	CORTEX	WEIGHT (g)	LENGTH1 (mm)	WIDTH1 (mm)	THICK1 (mm)	Clarkson's II	Kuhn's IR	POINTASSOC1
A	4	415-195	FLAKETOOLCOMP	ENDSCRAPER	FORMAL	FLAKE	INDETERMINATE CHERT	Unknown				UNKNOWN	NO	0%	2.1	21.9	16.96	4.72	0.31	0	
A	4	415-196	BIFACENOTCOMP	POINT	FORMAL		GRAND MEADOW CHERT	Non-Local	East	High		UNKNOWN	NO		0.7	0	0	0	0	0	latewoodland-mississ
A	4	415-197	BIFACE	KNIFE	FORMAL		SWAN RIVER CHERT	Local		Low	WG17	YES	NO		10.9	0	0	0	0	0	
A	4	415-198	FLAKETOOLCOMP	ENDSCRAPER	EXPEDIENT	UNKNOWN	BURLINGTON CHERT	Non-Local	Southeast	High		YES	NO	0%	1.8	20.69	14.29	4.36	0.25	0	
A	4	415-199	FLAKETOOLCOMP	SIDESCRAPER	EXPEDIENT	FLAKE	GRAND MEADOW CHERT	Non-Local	East	High		UNKNOWN	NO	0%	4.1	32.71	20.65	4.75	0.16	0.507	
A	4	415-200	FLAKETOOLDIST	END&SIDESCRAPER	EXPEDIENT		KNIFE RIVER FLINT	Non-Local	Northwest	High		YES	YES		1.8	0	0	0	0	0	
A	4	415-201	BIFACENOTCOMP	POINT	FORMAL		KNIFE RIVER FLINT	Non-Local	Northwest	High		UNKNOWN	NO		2	0	0	0	0	0	latewoodland
A	4	415-202	FLAKETOOLCOMP	ENDSCRAPER	EXPEDIENT	FLAKE	BURLINGTON CHERT	Non-Local	Southeast	High		YES	NO	0%	0.6	14.29	19.25	1.69	0.16	0	
A	4	415-204	BIFACENOTCOMP	POINT	FORMAL		PLATE CHALCEDONY	Non-Local	West	Low		UNKNOWN	NO		4.9	0	0	0	0	0	
A	4	415-205	BIFACEFRAG	BIFACETIP	FORMAL		BIJOU HILLS SIL SED	Non-Local	Southwest	Low		UNKNOWN	NO		3.2	0	0	0	0	0	
A	5	415-206	FLAKETOOLDIST	SIDESCRAPER	EXPEDIENT		GRAND MEADOW CHERT	Non-Local	East	High		NO	NO		2.1	0	0	0	0	0.442	
A	5	415-207	FLAKETOOLCOMP	ENDSCRAPER	FORMAL	FLAKE	KNIFE RIVER FLINT	Non-Local	Northwest	High		UNKNOWN	NO	0%	2.1	21.66	13.46	5.72	0.5	1	
A	5	415-208	FLAKETOOLPROX	SIDESCRAPER	EXPEDIENT	FLAKE	KNIFE RIVER FLINT	Non-Local	Northwest	High		UNKNOWN	NO		5.4	0	0	0	0	0.588	
A	5	415-209	BIFACEFRAG	BIFACETIP	FORMAL		SWAN RIVER CHERT	Local		Low	PG32	YES	NO		2.3	0	0	0	0	0	
A	5	415-210	FLAKETOOLCOMP	SIDESCRAPER	EXPEDIENT	FLAKE	BIJOU HILLS SIL SED	Non-Local	Southwest	Low		UNKNOWN	NO	0%	1.9	31.12	19.75	2.99	0.09	0.432	
A	5	415-212	BIFACEFRAG	BIFACETIP	FORMAL		INDETERMINATE CHERT	Unknown				UNKNOWN	NO		1.5	0	0	0	0	0	
A	5	415-213	FLAKETOOLCOMP	SIDESCRAPER	EXPEDIENT	FLAKE	KNIFE RIVER FLINT	Non-Local	Northwest	High		UNKNOWN	NO	0%	2.6	26.29	29.38	2.56	0.06	0	
A	5	415-214	FLAKETOOLMED	DOUBLESIDESCRAPER	EXPEDIENT		GRAND MEADOW CHERT	Non-Local	East	High		UNKNOWN	NO		2.7	0	0	0	0	0.555	
A	5	415-216	FLAKETOOLCOMP	UTILIZEDFLAKE	EXPEDIENT	FLAKE	KNIFE RIVER FLINT	Non-Local	Northwest	High		UNKNOWN	NO	0%	0.8	14.96	21.25	2.9	0.03	0	
A	6	415-218	FLAKETOOLCOMP	DOUBLESIDESCRAPER	EXPEDIENT	FLAKE	BURLINGTON CHERT	Non-Local	Southeast	High		YES	NO	0%	2.6	35.09	17.26	3.15	0.38	0	
A	6	415-219	BIFACENOTCOMP	POINT	FORMAL		TONGUE RIVER SILICA	Local		Low		YES	NO		6.7	0	0	0	0	0	
A	6	415-220	BIFACE	DRILL	FORMAL		SWAN RIVER CHERT	Local		Low	WG10	YES	NO		2.4	0	0	0	0	0	
A	6	415-221	BIFACENOTCOMP	POINT	FORMAL		KNIFE RIVER FLINT	Non-Local	Northwest	High		UNKNOWN	NO		2.3	0	0	0	0	0	latewoodland
A	6	415-223	BIFACE	UNFIN	FORMAL		TONGUE RIVER SILICA	Local		Low		YES	NO		4.6	0	0	0	0	0	
A	6	415-224	FLAKETOOLDIST	SIDESCRAPER	EXPEDIENT		HIXTON SIL SANDSTONE	Non-Local	East	High	PG01	YES	NO		7.9	0	0	0	0	0	
A	6	415-225	FLAKETOOLCOMP	SIDESCRAPER	EXPEDIENT	FLAKE	LAKE OF THE WOODS RHYOLITE	Local		Low		UNKNOWN	NO	0%	9.9	42.84	22.3	7.69	0.16	0.545	
A	7	415-226	BIFACENOTCOMP	POINT	FORMAL		FUSILINID CHERT	Non-Local	South	High	PG02	YES	NO		2.6	0	0	0	0	0	earlytolatewoodland
A	7	415-227	BIFACEFRAG	BIFACEFRAG	FORMAL		INDETERMINATE CHERT	Unknown				UNKNOWN	NO		3.2	0	0	0	0	0	
B	1	415-228	BIFACENOTCOMP	POINT	FORMAL		GRAND MEADOW CHERT	Non-Local	East	High		UNKNOWN	NO		1.1	0	0	0	0	0	latewoodland-mississ
B	1	415-229	BIFACEFRAG	KNIFEFRAG	FORMAL		KNIFE RIVER FLINT	Non-Local	Northwest	High		UNKNOWN	NO		4.2	0	0	0	0	0	
B	1	415-230	BIFACENOTCOMP	POINT	FORMAL		GRAND MEADOW CHERT	Non-Local	East	High		YES	NO		1.5	0	0	0	0	0	
B	1	415-231	FLAKETOOLPROX	DOUBLESIDESCRAPER	EXPEDIENT	FLAKE	SWAN RIVER CHERT	Local		Low	PO04	YES	NO		1.5	0	0	0	0	0	
B	1	415-232	FLAKETOOLCOMP	BURIN	EXPEDIENT	FLAKE	KNIFE RIVER FLINT	Non-Local	Northwest	High		UNKNOWN	NO	60-90%	7	43.01	18.46	5.4	0.28	0	
B	1	415-233	FLAKETOOLCOMP	KNIFE	EXPEDIENT	FLAKE	KNIFE RIVER FLINT	Non-Local	Northwest	High		UNKNOWN	NO	10-40%	6.6	36.55	21.61	7.09	0.5	0	
B	2	415-234	FLAKETOOLCOMP	ENDSCRAPER	EXPEDIENT	FLAKE	KNIFE RIVER FLINT	Non-Local	Northwest	High		UNKNOWN	NO	90-99%	10.4	31.15	44.01	6.22	0.13	0	
B	2	415-235	FLAKETOOLCOMP	ENDSCRAPER	EXPEDIENT	FLAKE	BIJOU HILLS SIL SED	Non-Local	Southwest	Low		UNKNOWN	NO	90-99%	28.4	44.16	56.26	10.4	0.03	0.455	
B	2	415-236	BIFACEFRAG	KNIFEBASE	FORMAL		SWAN RIVER CHERT	Local		Low	W21	YES	NO		6.9	0	0	0	0	0	
B	2	415-237	FLAKETOOLCOMP	ENDSCRAPER	FORMAL	FLAKE	SWAN RIVER CHERT	Local		Low	PO14	YES	NO	0%	5.6	32.37	21.2	6.08	0.16	0	
B	2	415-238	FLAKETOOLSPLIT	UTILIZEDFLAKE	EXPEDIENT		GRAND MEADOW CHERT	Non-Local	East	High		UNKNOWN	NO		3.2	0	0	0	0	0	
B	2	415-239	BIFACE	POINT	FORMAL		INDETERMINATE CHERT	Unknown				UNKNOWN	NO		0.7	0	0	0	0	0	latewoodland-mississ
B	2	415-240	FLAKETOOLMED	KNIFEFRAG	EXPEDIENT		KNIFE RIVER FLINT	Non-Local	Northwest	High		UNKNOWN	NO		1.7	0	0	0	0	0	
B	2	415-242	FLAKETOOLMED	SIDESCRAPER	EXPEDIENT		KNIFE RIVER FLINT	Non-Local	Northwest	High		UNKNOWN	NO		2.4	0	0	0	0	0	
B	2	415-243	BIFACENOTCOMP	POINT	FORMAL		KNIFE RIVER FLINT	Non-Local	Northwest	High		UNKNOWN	NO		2.8	0	0	0	0	0	early-middlewoodland
B	2	415-244	BIFACENOTCOMP	POINT	FORMAL		SWAN RIVER CHERT	Local		Low	W23	YES	NO		1.1	0	0	0	0	0	latewoodland
B	2	415-245	FLAKETOOLCOMP	SIDESCRAPER	EXPEDIENT	FLAKE	GRAND MEADOW CHERT	Non-Local	East	High		UNKNOWN	NO	0%	1.2	24.71	16.9	2.98	0.09	0.483	
B	2	415-246	BIFACENOTCOMP	POINT	FORMAL		GRAND MEADOW CHERT	Non-Local	East	High		YES	NO		1.1	0	0	0	0	0	
B	2	415-247	BIFACENOTCOMP	POINT	FORMAL		INDETERMINATE CHERT	Unknown				YES	YES		1.9	0	0	0	0	0	
B	3	415-250	FLAKETOOLCOMP	END&SIDESCRAPER	FORMAL	FLAKE	KNIFE RIVER FLINT	Non-Local	Northwest	High		UNKNOWN	NO	0%	11.1	31.66	39.14	8.27	0.5	1	
B	3	415-251	BIFACE	POINT	FORMAL		TONGUE RIVER SILICA	Local		Low		YES	NO		4.7	0	0	0	0	0	lateprehistoric
B	3	415-252	FLAKETOOLPROX	SIDESCRAPER	EXPEDIENT	FLAKE	KNIFE RIVER FLINT	Non-Local	Northwest	High		UNKNOWN	NO		1.5	0	0	0	0	0.948	
B	3	415-253	FLAKETOOLSHAT	SCRAPER	EXPEDIENT		SWAN RIVER CHERT	Local		Low	W20	YES	NO		1.6	0	0	0	0	0.336	
B	3	415-254	FLAKETOOLCOMP	DOUBLESIDESCRAPER	EXPEDIENT	FLAKE	KNIFE RIVER FLINT	Non-Local	Northwest	High		UNKNOWN	NO	0%	1.7	25.19	16.32	2.8	0.22	0	
B	3	415-255	BIFACENOTCOMP	POINT	FORMAL		PRAIRIE DU CHIEN CHERT	Non-Local	East	Low	PG21	YES	NO		1	0	0	0	0	0	
B	3	415-256	FLAKETOOLCOMP	END&SIDESCRAPER	EXPEDIENT	FLAKE	KNIFE RIVER FLINT	Non-Local	Northwest	High		UNKNOWN	NO	0%	1.4	25.83	14.32	3.22	0.22	0	
B	3	415-257	FLAKETOOLSHAT	SCRAPER	FORMAL		INDETERMINATE CHERT	Unknown				UNKNOWN	NO		2.2	0	0	0	0	0	
B	3	415-258	FLAKETOOLCOMP	ENDSCRAPER	FORMAL	FLAKE	INDETERMINATE CHERT	Unknown				UNKNOWN	NO	0%	6.7	37.14	18.11	8.23	0.5	0	
B	3	415-260	BIFACENOTCOMP	POINT	FORMAL		GALENA CHERT	Non-Local	East	High	OG04	UNKNOWN	NO		0.7	0	0	0	0	0	latewoodland
B	3	415-261	FLAKETOOLDIST	SCRAPER	UNKNOWN		INDETERMINATE CHERT	Unknown				UNKNOWN	NO		1.8	0	0	0	0	0	
B	3	415-262	BIFACEFRAG	KNIFETIP	FORMAL		INDETERMINATE CHERT	Unknown				UNKNOWN	NO		9.2	0	0	0	0	0	
B	4	415-263	FLAKETOOLPROX	SIDESCRAPER	EXPEDIENT	FLAKE	KNIFE RIVER FLINT	Non-Local	Northwest	High		UNKNOWN	NO		4.6	0	0	0	0	0.477	
B	4	415-264	FLAKETOOLCOMP	END&SIDESCRAPER	EXPEDIENT	FLAKE	GRAND MEADOW CHERT	Non-Local	East	High		UNKNOWN	NO	0%	3.6	33.7	23.91	3.88	0.25	0	
B	4	415-265	FLAKETOOLPROX	DOUBLESIDESCRAPER	EXPEDIENT	FLAKE	SWAN RIVER CHERT	Local		Low	WG19	UNKNOWN	NO		8.2	0	0	0	0	0	
B	4	415-266	FLAKETOOLCOMP	SIDESCRAPER	EXPEDIENT	FLAKE	PRAIRIE DU CHIEN CHERT	Non-Local	East	Low	PG18	YES	NO	1-10%	5	34.36	12.45	7.29	0.44	0.864	
B	4	415-267	BIFACENOTCOMP	POINT	FORMAL		SWAN RIVER CHERT	Local		Low	PG41	YES	NO		1.2	0	0	0	0	0	
B	4	415-268	FLAKETOOLCOMP	DOUBLESIDESCRAPER	EXPEDIENT	FLAKE	INDETERMINATE CHALCEDONY	Unknown				UNKNOWN	NO	0%	2	33.21	13.89	2.21	0.25	0	
B	4	415-269	FLAKETOOLDIST	ENDSCRAPERFRAG	FORMAL		PRAIRIE DU CHIEN CHERT	Non-Local	East	Low	PG19	YES	NO		2.5	0	0	0	0	0	
B	4	415-270	FLAKETOOLMED	DOUBLESIDESCRAPER	EXPEDIENT		KNIFE RIVER FLINT	Non-Local	Northwest	High		UNKNOWN	NO		1.8	0	0	0	0	0	
B	5	415-271	BIFACE	POINT	FORMAL		SWAN RIVER CHERT	Local		Low	CG05	YES	NO		2.6	0	0	0	0	0	latewoodland
B	5	415-272	BIFACENOTCOMP	POINT	FORMAL		HIXTON SIL SANDSTONE	Non-Local	East	High	T01	NO	NO		4.9	0	0	0	0	0	woodland
B	5	415-275	BIFACENOTCOMP	POINT	FORMAL		TONGUE RIVER SILICA	Local		Low		NO	NO		1.5	0	0	0	0	0	latewoodland-mississ
B	5	415-277	FLAKETOOLCOMP	SIDESCRAPER	EXPEDIENT	FLAKE	RED RIVER CHERT	Local		Low	LG17	YES	NO	10-40%	5.3	32.73	22.27	5.87	0.13	0.48	
B	5	415-278	FLAKETOOLSHAT	SCRAPER	EXPEDIENT		INDETERMINATE CHERT	Unknown				YES	YES		1.9	0	0	0	0	0	
B	5	415-279	FLAKETOOLCOMP	DOUBLESIDESCRAPER	EXPEDIENT	FLAKE	KNIFE RIVER FLINT	Non-Local	Northwest	High		UNKNOWN	NO	0%	2.5	30.89	15.75	2.78	0.19	0	
B	5	415-280	FLAKETOOLMED	SIDESCRAPER	EXPEDIENT		CEDAR VALLEY CHERT	Non-Local	East	High	O04	UNKNOWN	NO		1.7	0	0	0	0	0.348	
B	5	415-282	FLAKETOOLPROX	ENDSCRAPER	FORMAL	FLAKE	SWAN RIVER CHERT	Local		Low	PO16	YES	NO		1.2	0	0	0	0	0	
B	5	415-283	BIFACEFRAG	UNFINFRAG	UNKNOWN		KNIFE RIVER FLINT	Non-Local	Northwest	High		UNKNOWN	NO		3.3	0	0	0	0	0	
B	5	415-284	FLAKETOOLSHAT	SCRAPER	EXPEDIENT		BURLINGTON CHERT	Non-Local	Southeast	High		UNKNOWN	NO		1.4	0	0	0	0	0	
B	5	415-285	CORETOOL	KNIFE	FORMAL		BURLINGTON CHERT	Non-Local	Southeast	High		NO	NO		16	0	0	0	0	0	
B	6	415-286	CORETOOL	KNIFE	FORMAL		SWAN RIVER CHERT	Local		Low	PO15	YES	NO		18.5	0	0	0	0	0	
B	6	415-287	FLAKETOOLCOMP	UNKNOWN	UNKNOWN	UNKNOWN	INDETERMINATE CHERT	Unknown				UNKNOWN	NO	N/A	2.4	24.57	0	0	0.66	0	
B	6	415-288	FLAKETOOLDIST	SIDESCRAPER	EXPEDIENT		SWAN RIVER CHERT	Local		Low	PG05	YES	NO		2	0	0	0	0	0	
B	6	415-289	TESTEDCOBBLE				RED RIVER CHERT	Local		Low	B06	UNKNOWN	NO		10	0	0	0	0	0	
B	6	415-291	BIFACEFRAG	BIFACETIP	FORMAL		SWAN RIVER CHERT	Local		Low	G34	UNKNOWN	NO		1.1	0	0	0	0	0	
B	6	415-292	FLAKETOOLPROX	SIDESCRAPER	EXPEDIENT	FLAKE	KNIFE RIVER FLINT	Non-Local	Northwest	High		UNKNOWN	NO		0.9	0	0	0	0	0	
B	6	415-293	BIFACEFRAG	BIFACEFRAG	UNKNOWN		SWAN RIVER CHERT	Local		Low	G32	YES	NO		0.5	0	0	0	0	0	
C	1	415-294	FLAKETOOLMED	SIDESCRAPER	EXPEDIENT		KNIFE RIVER FLINT	Non-Local	Northwest	High		UNKNOWN	NO		1.4	0	0	0	0	0.674	
C	1	415-295	BIFACE	KNIFE	FORMAL		GRAND MEADOW CHERT	Non-Local	East	High		UNKNOWN	NO		11.4	0	0	0	0	0	
C	1	415-297	FLAKETOOLMED	SIDESCRAPER	EXPEDIENT		INDETERMINATE CHERT	Unknown				UNKNOWN	NO		2	0	0	0	0	0.511	
C	1	415-298	BIFACENOTCOMP	POINT	FORMAL		SWAN RIVER CHERT	Local		Low	W24	YES	NO		5.3	0	0	0	0	0	cf.latearch-midwoodl
C	1	415-299	FLAKETOOLSHAT	BACKEDKNIFE	EXPEDIENT		GRAND MEADOW CHERT	Non-Local	East	High		NO	NO		25.5	0	0	0	0	0	
C	1	415-300	FLAKETOOLMED	DOUBLESIDESCRAPER	EXPEDIENT		KNIFE RIVER FLINT	Non-Local	Northwest	High		UNKNOWN	NO		1.7	0	0	0	0	0	
C	1	415-301	FLAKETOOLCOMP	END&SIDESCRAPER	FORMAL	FLAKE	KNIFE RIVER FLINT	Non-Local	Northwest	High		UNKNOWN	NO	40-60%	1.6	21.26	13.25	4.41	0.41	0.856	
C	2	415-302	FLAKETOOLPROX	SIDESCRAPER	UNKNOWN	FLAKE	HUDSON BAY LOWLAND CHERT	Unknown		High		UNKNOWN	NO		2.5	0	0	0	0	0.956	
C	2	415-303	BIFACENOTCOMP	POINT	FORMAL		SWAN RIVER CHERT	Local		Low	W12	YES	NO		1.6	0	0	0	0	0	latewoodland-mississ
C	2	415-304	FLAKETOOLDIST	SIDESCRAPER	EXPEDIENT		INDETERMINATE CHERT	Unknown				UNKNOWN	NO		2	0	0	0	0	0	
C	2	415-306	BIFACE	KNIFE	FORMAL		PRAIRIE DU CHIEN CHERT	Non-Local	East	Low	G14	YES	NO		32.8	0	0	0	0	0	
C	2	415-308	BIFACENOTCOMP	POINT	FORMAL		SWAN RIVER CHERT	Local		Low	G35	YES	NO		2.5	0	0	0	0	0	latewoodland
C	2	415-309	FLAKETOOLCOMP	SIDESCRAPER	EXPEDIENT	FLAKE	GRAND MEADOW CHERT	Non-Local	East	High		NO	NO	10-40%	14.1	43.68	23.89	9.93	0.22	0.458	
C	2	415-310	COMPFLAKE			FLAKE	INDETERMINATE CHERT	Unknown				YES	YES	1-10%	9.4	33.68	32.61	6.14	0	0	
C	2	415-311	FLAKETOOLPROX	SIDESCRAPER	EXPEDIENT		KNIFE RIVER FLINT	Non-Local	Northwest	High		UNKNOWN	NO		1.6	0	0	0	0	0	
C	3	415-312	FLAKETOOLPROX	DOUBLESIDESCRAPER	EXPEDIENT	FLAKE	BURLINGTON CHERT	Non-Local	Southeast	High		UNKNOWN	NO		2.2	0	0	0	0	0	
C	3	415-313	BIFACENOTCOMP	POINT	FORMAL		INDETERMINATE CHERT	Unknown				YES	YES		0.8	0	0	0	0	0	
C	3	415-314	BIFACENOTCOMP	POINT	FORMAL		GALENA CHERT	Non-Local	East	High	OG02	UNKNOWN	NO		1.2	0	0	0	0	0	latewoodland

UNIT	LEVEL	ARTID	DATACLASS	TOOLTYPE1	TOOLTYPE2	DEBTYPE	RAWMAT2	Origin	Direction	Quality	MANGROUP	HEATED	BURNED	CORTEX	WEIGHT (g)	LENGTH1 (mm)	WIDTH1 (mm)	THICK1 (mm)	Clarkson's II	Kuhn's IR	POINTASSOC1
C	3	415-315	SHATTER				INDETERMINATE CHERT	Unknown				YES	YES		16.2	0	0	0	0	0	
C	4	415-316	CORETOOL	KNIFE	FORMAL		BIJOU HILLS SIL SED	Non-Local	Southwest	Low		UNKNOWN	NO		67.6	0	0	0	0	0	
C	4	415-317	FLAKETOOLDIST	DOUBLESIDESCRAPER	EXPEDIENT		GRAND MEADOW CHERT	Non-Local	East	High		UNKNOWN	NO		2.1	0	0	0	0	0.516	
C	4	415-318	FLAKETOOLDIST	ENDSCRAPERFRAG	UNKNOWN		INDETERMINATE CHERT	Unknown				UNKNOWN	NO		1.1	0	0	0	0	0	
C	4	415-319	CORETOOL	KNIFE	FORMAL		TONGUE RIVER SILICA	Local		Low		YES	NO		45.8	0	0	0	0	0	
C	4	415-320	FLAKETOOLPROX	END&SIDESCRAPER	EXPEDIENT	FLAKE	KNIFE RIVER FLINT	Non-Local	Northwest	High		UNKNOWN	NO		2.9	0	0	0	0	0	
C	4	415-322	FLAKETOOLPROX	SIDESCRAPER	EXPEDIENT	FLAKE	SWAN RIVER CHERT	Local		Low	PG38	YES	NO		1.4	0	0	0	0	0	
C	4	415-323	BIFACE	PREFORM	UNKNOWN		SWAN RIVER CHERT	Local		Low	G37	UNKNOWN	NO		6.3	0	0	0	0	0	
C	4	415-324	BIFACEFRAG	BIFACEFRAG	FORMAL		SWAN RIVER CHERT	Local		Low	P05	YES	NO		1.3	0	0	0	0	0	
C	5	415-325	FLAKETOOLCOMP	END&SIDESCRAPER	EXPEDIENT	FLAKE	SWAN RIVER CHERT	Local		Low	W12	YES	NO	0%	1.9	18.68	15.86	4.01	0.13	0.28	
C	5	415-327	FLAKETOOLCOMP	ENDSCRAPER	FORMAL	FLAKE	FUSILINID CHERT	Non-Local	South	High	WG01	YES	NO	0%	2.2	16.92	17.92	5.9	0.44	0	
C	5	415-328	CORETOOL	KNIFEFRAG	FORMAL		PRAIRIE DU CHIEN CHERT	Non-Local	East	Low	PG20	YES	NO		54.2	0	0	0	0	0	
C	5	415-329	BIFACEFRAG	KNIFETIP	FORMAL		INDETERMINATE CHERT	Unknown				UNKNOWN	NO		11.4	0	0	0	0	0	
C	5	415-330	BIFACEFRAG	UNFINFRAG	UNKNOWN		GALENA CHERT	Non-Local	East	High	GS01	YES	NO		11.6	0	0	0	0	0	

APPENDIX C: MINIMUM ANALYTICAL NODULE CLASSIFICATIONS

Cedar Valley Chert

MATERIAL	MAN ID	Munsell	TRANSLUCENCY (O/T)	GRAIN (F, M, C)	FOSSIL INCLUSIONS	OTHER INCLUSIONS	TRANSMITTED LIGHT	HEAT TREATED
CVC	O01	10YR6/6	T	M	None	Vugs	Orange	U
CVC	O02	10YR6/6	O	F	None	None	Orange to Gold	U
CVC	O03	10YR5/4	O	F	None	None	Orange	Y
CVC	O04	10YR5/4	T	M	None	None	Orange	U
CVC	OW01	10YR6/6; N7	T	M-F	None	Vugs	Orange to Clear	Y
CVC	OW02	10YR7/4; 10YR8/2	T	M	None	None	Clear	U
CVC	OW03	10YR6/6; N7	T	M	None	Vugs	Orange	U

Fusilinid Group Chert

MATERIAL	MAN ID	Munsell	TRANSLUCENCY (O/T)	GRAIN (F, M, C)	FOSSIL INCLUSIONS	OTHER INCLUSIONS	TRANSMITTED LIGHT	HEAT TREATED
Fusilinid	G01	5PB5/2	O	M-F	Fusilinids	Fusilinids	Olive	Y
Fusilinid	G02	5Y6/1	O	F	Fusilinids	Fusilinids	Olive	Y
Fusilinid	G03	N6; 5Y8/1	O	F	Fusilinids	Fusilinids	Gray to Gold	Y
Fusilinid	PG01	5YR8/1	O	M	Fusilinids	Fusilinids	Pink to Yellow	Y
Fusilinid	PG02	5Y6/1; 5YR8/1	O	M-F	Fusilinids	Fusilinids	Gold to Olive	Y
Fusilinid	T01	5Y8/1	O	F	Fusilinids	Fusilinids	Pink to Yellow	Y
Fusilinid	T02	10YR6/2	O	M	Fusilinids	Fusilinids	Olive	U
Fusilinid	WG01	5Y8/1	O	F	Fusilinids	Fusilinids	Pink to White	Y
Fusilinid	WG02	5Y8/1	O	M-F	Fusilinids	Fusilinids	Light Yellow	Y
Fusilinid	WG03	N9; N7	O	M-F	Fusilinids	Fusilinids	White to Olive	N

Galena Chert

MATERIAL	MAN ID	Munsell	TRANSLUCENCY (O/T)	GRAIN (F, M, C)	FOSSIL INCLUSIONS	OTHER INCLUSIONS	TRANSMITTED LIGHT	HEAT TREATED
GAL	GS01	5Y8/1	O	M-F	Worm Borings/White Flecks	None	Pink to Gray	Y
GAL	GS02	5Y8/1	O	M-F	Worm Borings/White Flecks	None	Pink to Gold	U
GAL	GS03	5YR8/1	O	M-F	Worm Borings/White Flecks	None	Pink to Gray	Y
GAL	GS04	5Y8/1; 10YR7/4	O	M	None	None	Gray to Orange	U
GAL	LG01	N8; 5YR8/1	O	M-F	None	None	Pink to Gold	Y
GAL	LG02	10YR6/2; 5Y7/2	O	F	None	None	Gold-Olive	U
GAL	OG01	N6; 10YR8/2	T	M-F	None	None	Gray to Orange	U
GAL	OG02	5YR6/4; 10YR10/2	O	F	None	None	Tan	U
GAL	OG03	10YR8/2; N7	O	M-F	None	None	Gray to Orange	U
GAL	OG04	5YR6/4; 10YR10/2	O	F	None	None	Tan	U
GAL	P01	5YR6/4; 10R4/6	O	F	None	None	Pink to Gold	Y

Hixton Group Silicified Sandstone

MATERIAL	MAN ID	Munsell	TRANSLUCENCY (O/T)	GRAIN (F, M, C)	FOSSIL INCLUSIONS	OTHER INCLUSIONS	TRANSMITTED LIGHT	HEAT TREATED
Hixton	PG01	5YR7/2; 5YR6/1	T	C	None	None	Pink	Y
Hixton	T01	10YR5/4	T	C	None	None	Gold	N

Maynes Creek Chert

MATERIAL	MAN ID	Munsell	TRANSLUCENCY (O/T)	GRAIN (F, M, C)	FOSSIL INCLUSIONS	OTHER INCLUSIONS	TRANSMITTED LIGHT	HEAT TREATED
Maynes	G01	N7	O	F	None	White Fragments	Gold to Olive	Y
Maynes	G02	N7	O	F	None	White Fragments	Gold	N
Maynes	PG01	10YR6/2	O	F	None	None	Gold	Y
Maynes	PG02	5YR5/2	O	F	None	None	Gold to Olive	Y
Maynes	PG03	5YR7/2	O	M-F	None	None	Gold to Yellow	Y
Maynes	PG04	5Y8/1	O	M-F	None	None	Light Yellow to Pink	Y
Maynes	WG01	N8; N5	O	F	None	None	Tan	Y

Prairie Du Chien Chert

MATERIAL	MAN ID	Munsell	TRANSLUCENCY (O/T)	GRAIN (F, M, C)	FOSSIL INCLUSIONS	OTHER INCLUSIONS	TRANSMITTED LIGHT	HEAT TREATED
PDC	BG01	N3; 10Y8/2	O/T	F	Oolites	None	Clear to Gold	Y
PDC	BR01	N2; 10R5/4	O	M-F	Oolites	None	Pink	Y
PDC	G01	N7	O	F	Oolites	None	Clear to Gray	N
PDC	G02	N7	O	M-F	Oolites	None	Olive	Y
PDC	G03	N7	O	M-F	Oolites	None	Olive	U
PDC	G04	N7	O	C	Oolites	None	Gray	U
PDC	G05	5Y6/1	O	M-F	Oolites	None	Olive	N
PDC	G06	N7	O	M-F	Oolites	None	Olive	N
PDC	G07	N7	O	M	Oolites	None	White to Olive	N
PDC	G08	N7	O	M-F	Oolites	None	Yellow	U
PDC	G09	N8; N6	O	M-F	None	None	White	Y
PDC	G10	N8	O/T	M-F	Oolites	None	Yellow to White	Y
PDC	G11	5GY6/1	O	M-F	Oolites	None	Clear to Olive	Y

MATERIAL	MAN ID	Munsell	TRANSLUCENCY (O/T)	GRAIN (F, M, C)	FOSSIL INCLUSIONS	OTHER INCLUSIONS	TRANSMITTED LIGHT	HEAT TREATED
PDC	G12	5YR8/1; 5Y8/1	O	M	Oolites	None	Pink	Y
PDC	G13	5Y6/1	O	M	Oolites	None	Gray to Olive	U
PDC	G14	5Y8/1; 5Y6/1	O	M	Oolites	None	Pink to Gray	Y
PDC	G15	5Y8/1; 5Y6/1	O	M	Oolites	None	Pink to Gray	Y
PDC	GW01	N7	O/T	M-F	Oolites	None	Yellow to Olive	Y
PDC	P01	10R7/4	O	M	Oolites (sparse)	None	Red to Pink	Y
PDC	P02	5R5/4	O	M-F	Oolites	None	Pink	Y
PDC	PG01	10R7/4; N6	O	F	Oolites	None	Pink to Orange	Y
PDC	PG02	10R8/2; N6	O	M-C	Oolites	None	None	Y
PDC	PG03	10R8/2; N6	O	F	Oolites	None	Pink	Y
PDC	PG04	N7; 10R5/4	O	M	Oolites	None	None	Y
PDC	PG05	5Y6/1; 10R5/4	O	M-F	Oolites	None	Olive to Yellow	Y
PDC	PG06	N8; 10R8/2	O	F	Oolites	None	Pink	Y
PDC	PG07	5YR8/1	O	M-F	Oolites	None	Pink to Gold	Y
PDC	PG08	N8; 5YR8/1	O	F	Oolites	None	Pink	Y
PDC	PG09	5Y8/1; 10R5/4	O	M-F	Oolites	None	White to Pink	Y
PDC	PG10	5YR8/1	O	M	Oolites	None	Pink	Y
PDC	PG11	5YR8/1	O	M	Oolites	None	Olive to Pink	Y
PDC	PG12	5Y8/1; 5YR8/1	O	M-F	None	None	Pink	Y
PDC	PG13	5YR8/1	O	M-F	Oolites	None	Pink	Y
PDC	PG14	5Y8/1; 5YR8/1	O	M	Oolites	None	Pink	Y
PDC	PG15	5Y8/1;	O	M-F	Oolites	None	Gold to Pink	Y

MATERIAL	MAN ID	Munsell	TRANSLUCENCY (O/T)	GRAIN (F, M, C)	FOSSIL INCLUSIONS	OTHER INCLUSIONS	TRANSMITTED LIGHT	HEAT TREATED
		5YR8/1						
PDC	PG16	5Y6/1; 5YR8/1	O	M-F	Oolites	None	Yellow to Olive	Y
PDC	PG17	5YR8/1	O	M	Oolites	None	Pink to White	Y
PDC	PG18	10YR6/2	O	M-F	Oolites	None	Gold to Olive	Y
PDC	PG19	10YR6/2	O	M-F	Oolites	None	Gold to Olive	Y
PDC	PG20	N6; 10YR5/4;	O	C	Oolites	None	Gold to Gray	Y
PDC	PG21	5YR8/1	O	F	Oolites	None	Pink to Gold	Y
PDC	R01	10R4/6	O	C-M	Oolites	None	Red to Pink	Y
PDC	R02	10R4/6; 10R8/2	O/T	M	Oolites	None	Clear to Pink	Y
PDC	W01	5Y8/1	O	F	Oolites	None	White	N
PDC	W02	N9	O	F	None	None	Yellow	Y
PDC	W03	5Y8/1	O	M-F	Oolites	None	White	N
PDC	W04	5Y8/1	T	M-F	Oolites	None	Yellow	Y
PDC	W05	5Y8/1	O	M-F	Oolites	None	White to Tan	U
PDC	W06	5Y8/1	O	M-F	Oolites	None	White to Pink	Y

Red River Chert

MATERIAL	MAN ID	Munsell	TRANSLUCENCY (O/T)	GRAIN (F, M, C)	FOSSIL INCLUSIONS	OTHER INCLUSIONS	TRANSMITTED LIGHT	HEAT TREATED
RRC	B01	10YR4/2	O	F	None	None	Gold-Brown	Y
RRC	B02	10TR5/4	O	F	Fossil bits	None	Gold-Brown	U
RRC	B03	5YR4/4	O	F	None	None	Gold-Brown	U
RRC	B04	10YR6/2	O	F	None	None	Reddish-Brown	U
RRC	B05	5YR5/2;	O	M-F	None	None	Gold-Brown	Y

MATERIAL	MAN ID	Munsell	TRANSLUCENCY (O/T)	GRAIN (F, M, C)	FOSSIL INCLUSIONS	OTHER INCLUSIONS	TRANSMITTED LIGHT	HEAT TREATED
		10YR6/2						
RRC	B06	5YR5/6	O	M-F	None	None	Gold-Brown	U
RRC	DG01	N7; N5	O	F	Fossil bits	None	Golden	U
RRC	DG02	5YR4/1	O	M-F	None	None	None	U
RRC	DG03	5Y6/1	O	M	Fossil bits	None	Gold-Olive	U
RRC	DG04	N5	O	F	None	Vug	Gray	U
RRC	DG05	5YR4/1	O	M-F	None	None	Olive	U
RRC	LG01	5Y7/2	O	M-C	None	None	Olive	U
RRC	LG02	5Y8/1	O	M	None	None	Gray	U
RRC	LG03	5Y8/1	O	F	None	None	Gold-Gray	U
RRC	LG04	5Y8/1	O	M	None	None	Gold-Gray	U
RRC	LG05	10YR6/2; 5Y8/1	O	M-F	None	None	Olive	U
RRC	LG06	5Y8/1	O	M	None	Vugs	Gold-Olive	U
RRC	LG07	N8	O	F	None	None	Gray	U
RRC	LG08	5Y8/1	O	M	None	None	Gray-Olive	U
RRC	LG09	5Y8/1	O	F	None	None	Gray-Olive	U
RRC	LG10	5Y8/1	O	M-F	Fossil bits	None	Gold-Gray	U
RRC	LG11	5Y8/1; 5YR6/1	O	M-C	None	None	None-Olive	U
RRC	LG12	5Y8/1	T/O	M-F	None	None	Gold-Olive	U
RRC	LG13	10YR6/2	O	F	None	None	None	U
RRC	LG14	10YR6/2	O	C	None	None	Olive	U
RRC	LG15	5Y8/1; N5	O	F-M	Fossil bits	None	None	U
RRC	LG16	10YR8/2	O	M-F	None	None	None	U
RRC	LG17	10YR6/2	O	F	None	None	Gold to Olive	Y

MATERIAL	MAN ID	Munsell	TRANSLUCENCY (O/T)	GRAIN (F, M, C)	FOSSIL INCLUSIONS	OTHER INCLUSIONS	TRANSMITTED LIGHT	HEAT TREATED
RRC	LG18	5Y6/1	O	M	None	None	Gray	Y

Swan River Chert

MATERIAL	MAN ID	Munsell	TRANSLUCENCY (O/T)	GRAIN (F, M, C)	FOSSIL INCLUSIONS	OTHER INCLUSIONS	TRANSMITTED LIGHT	HEAT TREATED
SRC	B01	5YR6/4	T	C	None	Small Vugs	Tan	Y
SRC	B02	10YR5/4	T	M	None	Vugs	Orange to Gold	Y
SRC	CG01	N8	T	M-F	None	None	Clear	U
SRC	CG02	N6; 5Y8/1	T	M-C	None	Vugs	Clear to Gold	Y
SRC	CG03	N6	T	M-F	None	Vugs	Clear to Gray	Y
SRC	CG04	N7	T	F	None	Vugs	Clear to Gold	Y
SRC	CG05	N8; 5YR8/1	T/O	M	None	Vugs	Gray to Gold	Y
SRC	CP01	5Y8/1; 10R8/2; N6	T	F	None	Small to Medium Vugs	Gold	Y
SRC	CP02	5RP5/2; 5Y6/1; N7	T	M-C	None	Vugs	Pink to Clear	Y
SRC	CP03	5YR7/2	T	M	None	Small Vugs	Clear to Gold	Y
SRC	CP04	N8; N5; 5YR8/1	T	M-F	None	Vugs	Clear to Gray	Y
SRC	CP05	5RP5/2; 5Y6/1; N7	T	M-C	None	Vugs	Pink to Clear	Y
SRC	CP06	10YR6/2	T	C	None	Vugs	Gold	Y
SRC	G01	N5; N4	T/O	F-C	None	Small to Medium Vugs	Clear to Gold	Y
SRC	G02	N6	T	M	None	Small Vugs	Clear to Gold	Y
SRC	G03	N8	O	M-C	None	Vugs	White	U
SRC	G04	N7	T	M-C	None	Vugs	Clear to Gray	Y
SRC	G05	5Y8/1	O	M	None	Vugs	Pink	Y
SRC	G06	N7; N6	T	M-F	None	Vugs	Gray to Pink	Y

MATERIAL	MAN ID	Munsell	TRANSLUCENCY (O/T)	GRAIN (F, M, C)	FOSSIL INCLUSIONS	OTHER INCLUSIONS	TRANSMITTED LIGHT	HEAT TREATED
SRC	G07	N7	T	M-C	None	Vugs	Clear to Olive	Y
SRC	G08	5YR4/1	T	C	None	Vugs	Clear to Olive	Y
SRC	G09	N5	T/O	M-C	None	Vugs	Clear to Gray	N
SRC	G10	N4	T/O	M	None	Vugs	Clear to Olive	Y
SRC	G11	N6	T	C	None	Vugs	Gray	U
SRC	G12	N8; N6	O	M	None	Vugs	Gray	U
SRC	G13	N8; N6	T/O	M-F	None	Vugs	Clear to Gray	U
SRC	G14	N7	T	C	None	Vugs	Clear to Olive	Y
SRC	G15	N6	O	F	None	Vugs	Clear to Olive	Y
SRC	G16	N8	T	M-F	None	Vugs	Gray to Gold	Y
SRC	G17	N7	T	C	None	Vugs	Gray	Y
SRC	G18	5Y6/1	T	M-F	None	Vugs	Clear to Gold	Y
SRC	G19	5Y6/1	T	F	None	Vugs	Clear to Olive	Y
SRC	G20	N6; N4	T	M-C	None	None	Gray	Y
SRC	G21	5Y4/1	T	C	None	Vugs	Olive	Y
SRC	G22	5YR6/1	T	C	None	Vugs	Olive	Y
SRC	G23	5Y8/1	O	M-C	None	Vugs	Gray	Y
SRC	G24	N7	T	C	None	Vugs	Gray	U
SRC	G25	5YR6/1	T	M	None	Vugs	Gold to Orange	Y
SRC	G26	N5	T	M	None	Vugs	Gray to Olive	Y
SRC	G27	N7; N5	T	M	None	Vugs	Gray	U
SRC	G28	N6; N8	T	M	None	Vugs	Gray to Pale Pink	Y
SRC	G29	N8	O	M	None	Vugs	Gray to Pink	Y
SRC	G30	N6	O	F	None	Vugs	Pink	Y
SRC	G31	5Y8/1	T	M-C	None	None	Pale Olive	Y

MATERIAL	MAN ID	Munsell	TRANSLUCENCY (O/T)	GRAIN (F, M, C)	FOSSIL INCLUSIONS	OTHER INCLUSIONS	TRANSMITTED LIGHT	HEAT TREATED
SRC	G32	N8	O	M	None	None	Gray to Pink	Y
SRC	G33	5Y8/1; 5R6/6	O	M	None	Vugs	Gold	Y
SRC	G34	N6; N7	T	M	None	Vugs	Gray	U
SRC	G35	5YR4/1	T	M	None	Vugs	Gray to Olive	Y
SRC	G36	N5	T	M-F	None	Vugs	Gray	Y
SRC	G37	5Y8/1	O	C	None	Vugs	Gold	U
SRC	G38	N8; N5	T	M-C	None	Vugs	Gray	Y
SRC	GW01	N4; N8	O	C	None	None	Clear	N
SRC	GW02	N7; N9; 10R4/6	O	M	None	Small Vugs	White to Clear	Y
SRC	GW03	5Y8/1;N7	O	M-C	None	Vugs	Light Olive	Y
SRC	GW04	N9; N5	T	C	None	Vugs	Clear to Gold	U
SRC	P01	10R4/6	O	M-C	None	Vugs	Pink	Y
SRC	P02	5R7/4	T	M	None	Vugs	Pink to Gold	Y
SRC	P03	10R8/2	T	M	None	Vugs	Pink to Clear	Y
SRC	P04	5YR8/1	O	M-F	None	Vugs	Pink	Y
SRC	P05	5R5/4	T/O	M	None	Vugs	Pink	Y
SRC	PG01	5YR8/1; 5Y8/1	O (portions = T)	M	None	Small Vugs	Pink to Clear	Y
SRC	PG02	5YR8/1	T	C	None	Vugs	Pink	Y
SRC	PG03	5YR8/1	O	C	None	Vugs	Pink	Y
SRC	PG04	N6; N9; 5YR8/1	T	M	None	Vugs	Clear to Pink	Y
SRC	PG05	N7; 5YR8/1	T	M-C	None	Vugs	Clear to Pink	Y
SRC	PG06	N7; 5YR8/1	T	C	None	Vugs	Clear to Purple-Gray	Y
SRC	PG07	5YR8/1	T	M-C	None	Vugs	White to Gold	Y
SRC	PG08	5R6/2; N8	T	M	None	Vugs	Gray	Y

MATERIAL	MAN ID	Munsell	TRANSLUCENCY (O/T)	GRAIN (F, M, C)	FOSSIL INCLUSIONS	OTHER INCLUSIONS	TRANSMITTED LIGHT	HEAT TREATED
SRC	PG09	5YR8/1	T	C	None	Vugs	Clear to Gray	Y
SRC	PG10	5YR8/1; 5Y8/1	T	M	None	Vugs	Clear to Gold	Y
SRC	PG11	5YR8/1	T	M-F	None	Vugs	Pinkish Orange	Y
SRC	PG12	N8; N6; 5Y8/1; 10R7/4	O	M-C	None	Vugs	Clear to Gold	Y
SRC	PG13	N8; 5YR4/1; 10Y4/6	T/O	M-C	None	Vugs	Clear to Pinkish Gray	Y
SRC	PG14	5Y8/1	T	M	None	Vugs	Gold to Pink	Y
SRC	PG15	5YR8/1	O	M	None	Vugs	White to Pink	Y
SRC	PG16	5YR8/1	T	C	None	Vugs	Gold	Y
SRC	PG17	N5; 5YR8/1	O	M-F	None	Vugs	Gold	Y
SRC	PG18	5Y6/1	O	M	None	Vugs	Olive to Gray	Y
SRC	PG19	N7; 5YR8/1	O	M	None	Vugs	Yellow to Pink	Y
SRC	PG20	5YR8/1	O	M-C	None	Vugs	Pink	Y
SRC	PG21	N6; 5RP8/2	T	M	None	Vugs	Clear to Gold	Y
SRC	PG22	N7; 5R4/6	T	M	None	Vugs	Clear to Gold	Y
SRC	PG23	5Y8/1; 5YR8/1	T	C	None	Vugs	Yellow to Pink	Y
SRC	PG24	5YR6/1; 5YR8/1	O	M-F	None	Vugs	Pink	Y
SRC	PG25	5YR8/1	T/O	C	None	Vugs	Yellow-Gold	Y
SRC	PG26	N6; 5Y8/1; 5YR8/1	T	M-C	None	Vugs	Pink-Orange-Gold	Y
SRC	PG27	N8; 5RP6/2	T	M-C	None	Vugs	Pink	Y
SRC	PG28	5YR8/1	T	M	None	Vugs	Pink	Y
SRC	PG29	5Y8/1	O	C	None	Vugs	Pink	Y
SRC	PG30	5YR8/1	T	M-F	None	Vugs	Gray to Pink	Y
SRC	PG31	5YR8/1	T	M	None	Vugs	Gray to Pink	Y
SRC	PG32	N8; 5YR8/1;	T/O	M-F	None	Vugs	Gray to Gold	Y

MATERIAL	MAN ID	Munsell	TRANSLUCENCY (O/T)	GRAIN (F, M, C)	FOSSIL INCLUSIONS	OTHER INCLUSIONS	TRANSMITTED LIGHT	HEAT TREATED
SRC	PG33	5YR8/1	T	M	None	Vugs	Pink	Y
SRC	PG34	5YR8/1	O	M	None	Vugs	Pink	Y
SRC	PG35	N8; N6; 5YR6/4	T	M-C	None	Small Vugs	Pink	Y
SRC	PG36	5YR8/1	O	M	None	Vugs	White to Pink	Y
SRC	PG37	5Y6/1; 5YR8/1	O	C	None	Vugs	Gray to Pink	Y
SRC	PG38	N7; 5Y6/1; 10R5/4	T	M	None	Vugs	Gold to Pink	Y
SRC	PG39	10R7/4; N7	O	M-F	None	Vugs	Pink to Gold	Y
SRC	PG40	5Y8/1; 5YR6/4	T	M	None	Vugs	Gold	Y
SRC	PG41	5Y6/1; 5YR7/2	T	M	None	None	Pink to Gray	Y
SRC	PO01	10R7/4; 10YR8/2	T	M-C	None	Small Vugs	Pink to White	Y
SRC	PO02	10R7/4; 10YR8/2	O	F-M	None	Small Vugs	Pink to White	Y
SRC	PO03	10YR8/2; 10R6/2	T	M	None	Vugs	Clear to Gold	y
SRC	PO04	5YR7/2	T	M-F	None	Vugs	Orangish Pink	Y
SRC	PO05	5YR7/2; 10R6/6	T	C	None	Vugs	Pinkish Orange	Y
SRC	PO06	10R6/6	T	M	None	Vugs	Orange	Y
SRC	PO07	10R6/6	T	M	None	Vugs	Red-Orange	Y
SRC	PO08	10R8/2; 10R7/4	T	M-C	None	Vugs	Orangish Pink	Y
SRC	PO09	5YR6/4; 5YR7/2	T	M	None	Vugs	Orange-Gold	Y
SRC	PO10	N8; 5RP6/2; 5Y8/1	T	M-F	None	Vugs	Clear-Pink-Gold	Y
SRC	PO11	5YR7/2	T	F	None	None	Pale Orange	Y
SRC	PO12	5YR7/2	T	M	None	Vugs	Gold	Y
SRC	PO13	N6; 5Y8/1; 5YR8/1	T	M-C	None	Vugs	Pink-Orange-Gold	Y
SRC	PO14	5YR6/4; 10R6/4	T	C	None	Vugs	Orange	Y
SRC	PO15	10YR4/6; 5YR6/4	T	C	None	Vugs	Orange	Y
SRC	PO16	5YR8/1; 5YR5/6	T	M-F	None	None	Clear to Orange	Y

MATERIAL	MAN ID	Munsell	TRANSLUCENCY (O/T)	GRAIN (F, M, C)	FOSSIL INCLUSIONS	OTHER INCLUSIONS	TRANSMITTED LIGHT	HEAT TREATED
SRC	PW01	5R7/4; N8	T	M-F	None	Vugs	Pink to Gold	Y
SRC	PW02	5R6/2; N8	O	C	None	Vugs	Pink to Clear	Y
SRC	PW03	N9; 5YR8/1	T	M-C	None	Vugs	Clear to Pink	Y
SRC	R01	10R5/4	T	M	None	Small Vugs	Light Red	Y
SRC	R02	5R4/3	T/O	M	None	None	Red	Y
SRC	R03	5R4/6	T	M-F	None	Small Vugs	Pink	Y
SRC	R04	5R4/3	T	M	None	None	Red	Y
SRC	R05	5R3/4	O	M-C	None	Vugs	Pink to Clear	Y
SRC	W01	5Y8/1	T	F	None	Small to Medium Vugs	Opaque White	Y
SRC	W02	N8	T	M-C	None	Small Vugs	White	Y
SRC	W03	N9	T	F	None	Small Vugs	White	Y
SRC	W04	N7	T	M	None	Vugs	Clear	U
SRC	W05	N8; 5YR8/1	T/O	M	None	Vugs	Clear to Gray	Y
SRC	W06	N8; 5YR8/1	T	M-F	None	Vugs	Clear to Gold	Y
SRC	W07	5Y8/1	T	M-C	None	Vugs	Yellow	Y
SRC	W08	5Y8/1	O	C	None	Vugs	Yellowish Gold	U
SRC	W09	10YR8/2	O	M	None	Vugs	Orangish Gold	Y
SRC	W10	N8	T	M-F	None	Vugs	White	U
SRC	W11	5Y8/1	T	M-C	None	Vugs	Pale Orangish Pink	U
SRC	W12	N8	T	M-F	None	Vugs	Clear to Gold	Y
SRC	W13	5Y8/1	T	M-C	None	Vugs	Yellowish	U
SRC	W14	5Y8/1	T/O	F	None	Vugs	Gold to Pink	Y
SRC	W15	N8	O	M	None	Vugs	Gray	N
SRC	W16	N8; 5Y8/1	T	F	None	Vugs	Gray to Orange	Y

MATERIAL	MAN ID	Munsell	TRANSLUCENCY (O/T)	GRAIN (F, M, C)	FOSSIL INCLUSIONS	OTHER INCLUSIONS	TRANSMITTED LIGHT	HEAT TREATED
SRC	W17	N8; 5YR8/1	O	F	None	Vugs	Gray to Pink	Y
SRC	W18	N8	T	C	None	Vugs	Pale Gold	U
SRC	W19	5Y8/1	T	M-C	None	Vugs	Gold	Y
SRC	W20	N7	T	M	None	None	Gray to Pink	Y
SRC	W21	5Y8/1; N7	T	C	None	Vugs	Gold	Y
SRC	W23	5Y8/1	T	M-F	None	Vugs	Gray to Gold	Y
SRC	W24	5Y7/2	T/O	M-C	None	Vugs	Gold	Y
SRC	W25	N9-N8	T	M	None	Vugs	Gold	Y
SRC	W25	5Y8/1	T/O	M-C	None	Vugs	Gray	U
SRC	WG01	N8; N5	T	M-C	None	Small to Medium Vugs	Clear	Y
SRC	WG02	N9; N7	O	M	None	Small Vugs	None	N
SRC	WG03	5Y8/1; N7; 5YR6/4	T/O	M	None	Small Vugs	Clear to White	Y
SRC	WG04	N8; N6	T	M-C	None	Vugs	Gray to Light Pink	Y
SRC	WG05	N8; N6; 5YR6/4	O	M	None	Small Vugs	Clear	Y
SRC	WG06	N8; N6	O	F	None	Small Vugs	Clear to Gray	Y
SRC	WG07	N8; N6	T	M	None	Vugs	Clear to Gray	Y
SRC	WG08	5Y8/1; 5B7/1	T/O	M	None	Vugs	White to Gray	Y
SRC	WG09	N8; N4	T	F	None	Vugs	Clear to Gray	Y
SRC	WG10	N8; N6; 5YR8/1	T/O	M-C	None	Vugs	Clear to Gray	Y
SRC	WG11	N6; 5YR8/1	T	F	None	Vugs	White to Gold	Y
SRC	WG12	N9; N7	T	F	None	None	White to Gold	Y
SRC	WG13	N8; N6	T	F	None	None	White	U
SRC	WG14	N8; N6	T	M-F	None	Vugs	Gold	Y
SRC	WG15	N8; N6	O	F	None	Small Vugs	Clear to Gray	U

MATERIAL	MAN ID	Munsell	TRANSLUCENCY (O/T)	GRAIN (F, M, C)	FOSSIL INCLUSIONS	OTHER INCLUSIONS	TRANSMITTED LIGHT	HEAT TREATED
SRC	WG16	N8; N6;	T/O	M	None	Vugs	Gray to Pink	Y
SRC	WG17	N7; 5Y8/1	T	M-F	None	Vugs	Gray	Y
SRC	WG18	5Y8/1; 10R4/2	T/O	C	None	Vugs	Gold	Y
SRC	WG19	5Y8/1; N6	T/O	M	None	Vugs	Gray	U
SRC	WG20	N6; 5YR8/1	O	M-C	None	Vugs	Gray	Y