LITHIC SOURCE ANALYSIS AND INTERPRETATION IN NORTHEASTERN WYOMING AND SOUTHEASTERN MONTANA

by

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CHAPTER I

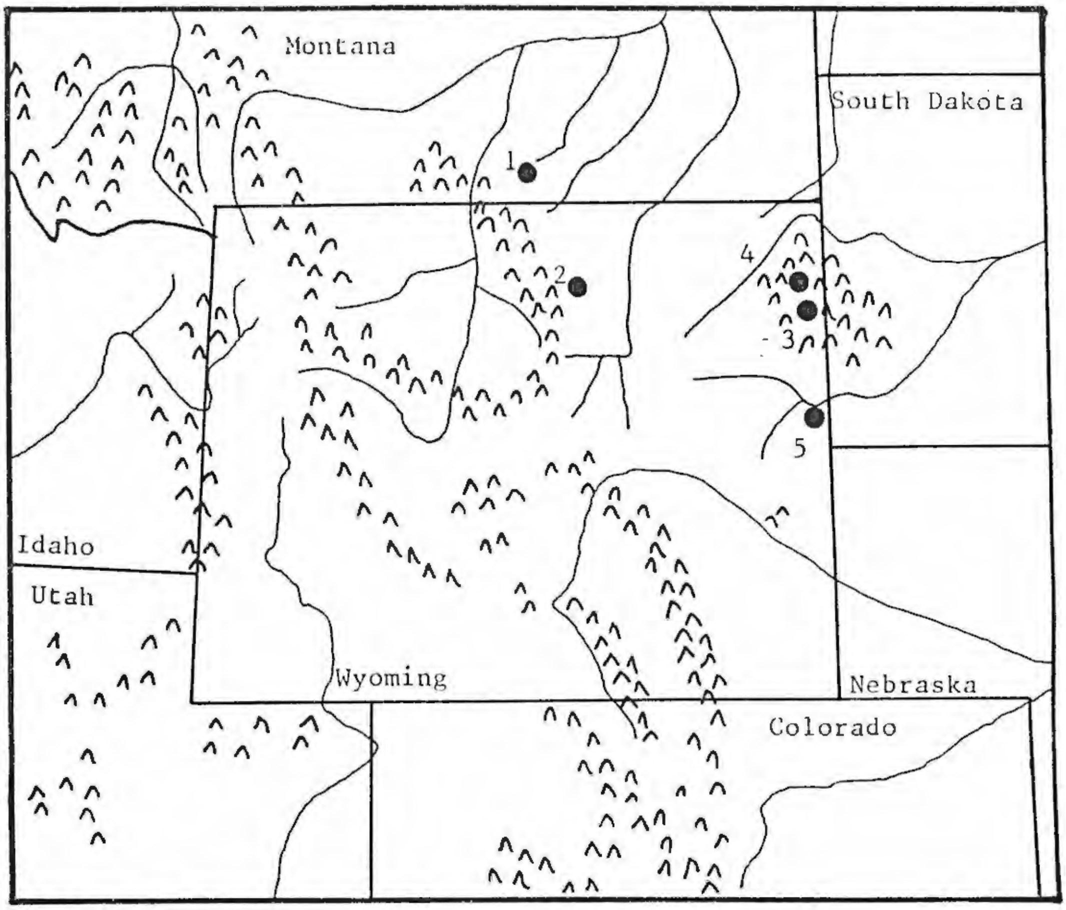
INTRODUCTION

In archeological sites lithic material types may be informative of the areas exploited by prehistoric occupants. Chapman (1977:327) states that the technological behavior of a hunting and gathering group is an adaptive response to two factors: The distribution of suitable raw materials for tool manufacture, and the distribution and seasonal availability of food resources within that region. It seems reasonable that raw materials would primarily be acquired from within or adjacent to the areas exploited by a group for food resources, or that food would be acquired from areas where raw materials were available. In either case, the lithic material types would reflect areas exploited by the inhabitants of a site, or indicate contacts with other areas.

This thesis research has a twofold purpose: to investigate various factors that may influence the types of lithic materials represented in a site; and to examine the raw material types in several artifact assemblages as possible indicators of the home range or areas of exploitation. Site type, duration and season of occupation, material preference and distance to source are believed to be among the primary factors which influence the acquisition, use, and discard of raw materials and thus their representation in a site. Archeologists frequently assume that the types of activities represented in a site and the duration of occupation influence the number and types of raw materials present. Further, the relative frequency of materials in a site is sometimes considered indicative of the duration of occupation or the intensity of utilization of an area. However, the frequency of materials might actually be influenced more by material preference or distance to source. This thesis seeks to examine such assumptions.

Analysis of raw material types in terms of the geographical areas which they represent requires that material types be identified and source areas located and described. Our present knowledge of lithic resources is far from complete. However, the geologic sources of several materials are known. In addition, it is possible to determine the distribution of potential sources of raw materials from geologic maps of a region. A description of material types and potential geologic sources from the study area is presented in Chapter V.

Five sites have been selected for analysis, four from northeastern Wyoming and one from southeastern Montana. (Site locations are illustrated in Figure 1). The region is dominated by rolling sage and grassland, with distinct geologically uplifted areas which are important as potential raw material sources. Temporal affiliation of the five archeological sites ranges from PaleoIndian to the Late Prehistoric period (Site information is summarized in Table I). The different time periods represented allow for the study of change in raw material utilization. With some exceptions, the functions of the sites analyzed are similar. They are all primarily



1 Kobold Site
2 Piney Creek Site
3 Vore Site
4 Hawken Site
5 Agate Basin Site

Figure 1. Location of sites analyzed.

TABLE I

SITE INFORMATION SUMMARY

Site	Site #	Activities	Age	Reference
Agate Basin	48NO201	kill/camp	Folsom	Frison and
		kill	Agate Basin	Stanford
		kill	*Hell Gap	1982a
Piney Creek	48JO311	camp	*Late Prehistoric	Frison 1967
	48JO312	kill	Late Prehistoric	
Kobold	24BH406	camp	Early Archaic	Frison 1970
		kill	Middle Archaic	
		kill	Late Archaic	
		kill/camp	Late Prehistoric	
Hawken	48CK303	kill	Early Archaic	Frison, Wilson and Wilson 1976
Vore	48CK302	kill	Late Prehistoric	Reher and Frison 1980

* Not analyzed

oriented toward bison kill and butchering activities. In addition, the Folsom component of the Agate Basin site and Late Prehistoric component of the Kobold site reflect post-kill occupation of the site and thus provide comparative data relating to site function. The Early Archaic component of the Kobold site represents a small camp site and is included for comparative purposes.

It is apparent that the same factors do not account for the frequency of raw materials at all sites. The analysis and conclusions presented are, in part, intended to point out the importance of caution and careful consideration in the interpretation of raw material frequencies. As the study of raw material types in archeological sites becomes more common, the necessity of understanding the factors that are involved increases.

CHAPTER II

RELATED RESEARCH IN SOURCE ANALYSIS

Lithic source analysis in archeology deals with the examination of lithic material types and the sources of these raw materials. The objectives of such studies are varied and include attempts to understand procurement processes at different raw material quarries (Francis 1981; Gramly 1980; Luedtke 1976), determination of settlement patterns in an area (Loendorf 1973), the delineation of exchange networks (Earle and Ericson 1977), and the study of territoriality (Hester and Grady 1977; Reher and Frison 1980; Wilmsen 1973). The research reported here has developed from these previous studies and seeks to understand more completely the other factors which may be important regarding material types found at a site.

Among the first to consider a relationship between artifacts and raw materials was W. H. Holmes (1893). He noticed that the availability and the form of a raw material influenced the type and size of artifacts produced from it, and that the distribution of certain raw materials correlated with the distribution of certain artifact types. In addition, Holmes noted that there were more broken items and manufacture rejects in areas which produced the material, and also that sites close to a particular raw material source had more tools of that material. Holmes pointed out that tools were frequently made of exotic materials, while rejects rarely appeared to have been manufactured from such materials. Generally, he noted a relationship between the site location for obtaining raw material, the nature of the site, and the kinds of items (tools, rejects, etc.) found. He summarized these relationships as follows:

1) Quarry and manufacture	no dwelling	roughouts, crude preforms
2) Quarry and manufacture	limited dwelling	roughouts, specialized tools, some exotic material
3) Quarry and manufacture	extensive dwelling	all variety of forms and refuse, finished tools, exotic and local material
4) Only small pebbles available	village	lots of rejects and tools made from small pebbles, lots of finished tools of exotic materials averaging small in size

Holmes's interpretations are not much different from some of the assumptions made today in source analysis interpretation.

S. A. C. Keller (1971) examined and compared the assemblages of the Patten Creek site and the upper levels of the Hell Gap site, both campsites in the Hartville Uplift of Wyoming. Keller's study demonstrates the significance of distance to a lithic source for interpreting assemblage composition. The Patten Creek site is located at a raw material source and exhibits a high ratio of waste flakes and cores to artifacts, with many unfinished or broken items and relatively few complete artifacts. In contrast, the Hell Gap site has fewer flakes and cores, but more artifacts, more retouch on tools, and a greater diversity of material types.

In order to describe the settlement pattern represented by approximately 100 sites, Loendorf (1973) analyzed the frequency of certain raw material types in site assemblages in relation to the distribution of their geologic sources in the Pryor Mountains of Montana. He suggested that the relative frequency of lithic material types might indicate the season of occupation of a site. Loendorf noted that distinctive lithic material types outcrop at different elevations. Given the assumption that different elevations are exploited seasonally, he suggested that the relative frequency of raw materials in a site might indicate the direction of movement in the seasonal round, up or down the mountain.

Luedtke (1976) was interested in the distribution of different lithic materials in archeological sites as criteria of exchange and interaction. She stated that the method of procurement of lithic materials (direct or indirect) influences their quantity and form in an archeological site (see Luedtke 1976:25-27, 318-319). Briefly, she defined direct procurement as the removal of materials from a primary or secondary source where access is unrestricted. It may be casual, where materials are obtained during performance of other tasks, or deliberate, where a special trip to the source is made to obtain material. As a result of direct procurement a large quantity of material may be obtained and the debitage to artifact ratio should be high. In contrast, indirect procurement involves acquisition of material through mediation with some other individual or group, therefore access to the source is restricted. According to Luedtke (1976:319), this results in a rapid fall-off in the frequency of material as distance increases and as social boundaries are crossed. She further noted that a material might ultimately be found over greater distances since exchange networks can extend almost indefinitely. Luedtke suggests that factors such as curation and expedient tool use may influence the relationships between proportions of different materials found. She also cites Schiffer (1972:156-165) who noted that the context of discard is not always the same as the context of use, and what is found at a site is not always a complete record of what went on there.

Hester and Grady (1977) studied raw materials as indicators of band range. They assumed that the "total distance exploited by a particular band may be estimated by plotting distances from a specific site to identifiable quarries from which stone utilized at the site was obtained" (Hester and Grady 1977:90). Using material from Blackwater Draw #1, Jones-Miller, Jurgens, and Olsen-Chubbuck sites, they noted that there was considerable variation in the utilization of sources over time but that the major sources were represented in all periods.

D. Keller (1982) examined the relative frequency of different raw material types found in sites on Cedar Mesa in southeastern Utah and the geographic distribution of the geologic sources. He found distinct differences in the frequency of certain raw material types between sites representing Basketmaker II, Basketmaker III, and Pueblo period occupations. According to Keller the raw material representation indicated marked differences in lithic source exploitation patterns between the three occupation periods. Basketmaker II sites suggest a more localized exploitation range lacking ties with the Mesa Verde area to the east. In addition, Keller indicated that the differences in frequency of certain raw materials suggest population or adaptational discontinities between the three periods on Cedar Mesa, thus supporting radiocarbon, dendrochronological, and ceramic evidence for breaks of several hundred years between occupations. He suggested that the knowledge of differing material type frequencies could be useful in dating sites on Cedar Mesa which lack ceramic, architectural or organic remains.

Chapman (1977:433) states that "the variability of materials and the spatial distribution of those materials across the landscape constitute parameters which human adaptive systems must cope with technologically." He examined the lithic resources of the region and the suitability of materials for tool manufacture. He was also interested in the reduction of materials and examined the relationship between distance to source and the selection, manufacture and use of materials.

Huckell (1978) analyzed the lithic tools and debitage of the Hudson-Meng site, 25SX115, in western Nebraska. Included in the analysis was a determination of raw material type and identification of the source area when possible. Several materials and source areas were identified including Knife River flint from North Dakota and quartzites from the Spanish Diggings (Hartville Uplift) area and the

Black Hills. Huckell also identified a red jasper similar to that available in the vicinity of the town of Shell, Wyoming in the Bighorn Mountains. No definitive conclusions were made by Huckell on the significance of the materials.

Reher and Frison (1980) analyzed the raw material composition of several kill site lithic assemblages. They identified the source areas of the materials as possibly reflecting such aspects of regional population movement including the degree of mobility and residential dispersion. The number of sources represented and the distance from source area to site were used as approximate measures of residential dispersion prior to the kill event, and of relative mobility of groups. Data from the Vore site, a Late Prehistoric stratified kill site in northeastern Wyoming, was compared with data from several other kill sites in northeastern Wyoming representing PaleoIndian to Late Prehistoric Periods. The analysis indicated differences in mobility and dispersion for different time periods. The PaleoIndian assemblages indicated a relatively high amount of dispersion and mobility; slightly less mobility and dispersion was indicated by the Late Prehistoric assemblages. Middle and Late Plains Archaic sites suggested a low degree of mobility and dispersion while the Early Plains Archaic Hawken site indicated a high degree of dispersion and low mobility.

Reher and Frison (1980:121) also suggested that research should be directed to clarify the causes of the varying percentages of material types in an assemblage and noted the potential importance of factors such as site type, the kinds of artifacts and debitage analyzed, the suitability and availability of local lithic sources, and the representativeness of the sample. This goal has influenced the direction of the data collection and analysis presented here.

CHAPTER III

METHODOLOGY

Introduction

Raw material types are commonly utilized as evidence of the area exploited by a group. However, questions may be raised concerning how directly material types reflect a home range, and the other variables which might be involved. Chapman (1977:439) notes that:

> The logistical strategy of a systems technological component is the overall strategy through which raw materials are selected, transported, and reduced to tools at site locations of tool-use need. A logistical strategy of this sort must cope with several variables related to seasonal and diurnal movement of the human population across the landscape: relative physical suitability of materials for tool reduction and use, activity specific tool use needs at specific site locations and the distance between such site locations and source locations of raw materials from which tools can be manufactured.

Specifically, site type, duration of occupation, season of occupation, material preference, and distance to source have been selected for analysis. These are not mutually exclusive categories, nor are they the only factors which may affect the types of lithic materials at a site. However, these five are considered to be among the most important variables influencing prehistoric procurement and utilization of raw materials and thus are significant to the study of raw material representation at a site.

Site type is generally defined by the types and distribution of artifacts and debitage present. Sites which represent different types of activities, such as camp sites and kill and butchering sites, should reflect different patterns of lithic material utilization. Camp sites, where generally a wider range of activities are carried out, may be occupied longer than special purpose sites such as kill and butchering locations and therefore, a greater variety of tool types is expected. In addition, because the local environment is exploited for hunting and gathering activities and local raw materials are likely to be collected and utilized, a wide variety of materials are usually represented at a campsite. Furthermore, tool manufacture and reworking is necessary to meet tool use needs as exhausted tools are discarded and others become dulled. These activities produce a large quantity of lithic debris including waste and reduction flakes and manufacture rejects. In contrast, at sites such as kill and butchering locations, which represent task specific activities, the variety of tools represented is likely to be more restricted, and tool working is generally limited to sharpening and reworking existing tools. Acquisition of raw material in preparation for a kill is likely to result in the exploitation of a few sources which contain abundant, high quality materials. Reher and Frison (1980:128) refer to this as "gearing up" and note that kill site assemblages tend to be dominated by a few distinct lithic types representing specific sources.

The nature of the activities carried out at a site influences the procurement and utilization of lithic materials and their deposition across the site. Activity areas may result in an uneven distribution of materials over a site. This will affect the kinds of materials, including lithic and artifact types recovered and their representation when less than 100% of a site is examined. The distribution of materials over the site can be examined for clustering tendencies.

The duration of occupation of a site affects the archeological record left behind. Under some circumstances, increased duration may result in an increased accumulation of material and probably a greater utilization of local materials. Reoccupation of a site before the material from the previous occupations has been buried will also increase the accumulation of material. Frison (1978:12) suggests that groups may have revisited the same campsites or campsite areas from year to year. Such reoccupation of a site might tend to reinforce the representation of lithic materials if the same sources were exploited each year. However, occupation of a site during different seasons or shifts in the types of activities performed there could result in different raw materials being utilized and discarded. Binford (1982) states that multiple occupation of a site greatly increases the complexity of the archeological record. It is likely that this would pertain to raw material representation as well.

The season in which a site is occupied may affect the types of activities performed and also the degree of mobility possible. In the northwest Plains mobility is greatly reduced in winter, probably resulting in an increase in the curation of materials and tools as it becomes more difficult to acquire new lithic materials. The most abundant materials at a site are likely to be from the areas most recently exploited and might indicate direction of movement within the seasonal round (Loendorf 1973), or season of occupation.

Raw material preference might be reflected in significant correlations between material types and tools. It might also result in a high frequency of good quality material from a distant source relative to the amount of material from a closer source. On the other hand, preference for certain raw materials might result in a low frequency of the material, especially in the form of tools, due to curation of high quality materials.

The distance to raw material source areas may be an important factor in the representation of materials at a site. To date, this factor has been most studied in relation to lithic source analysis. Distance to source is likely to provide information on mobility and range size (Reher and Frison 1980; Hester and Grady 1977). Distance to source may influence the amount, type and size of materials in a site. As distance from a source area increases, the amount of material from that source is expected to decrease. This might be indicated by the amount of cortex or the number of manufacture rejects. However, as distance increases the curation of good quality material may increase.

The analysis here assumes that these factors have acted upon the sites. However, the degree to which it is possible to interpret them may vary, as may the importance of each. This research is largely a comparative study of sites. Intra-site and inter-site comparisons of the data are expected to reveal some similarities and differences in the kinds of raw materials represented. Comparisons of different levels within a site may indicate changes through time, while comparison of different activity areas within a site may provide information on the importance of site function in relation to materials represented.

Analysis of Materials and Assemblages

Analysis of the raw material types involved several stages beginning with the analysis of geologic raw material sources, followed by identification of the raw material types in the site assemblages, and finally computation of frequencies and percentages of these material types for artifacts (tools and weaponry) and debitage.

The degree of accuracy and the validity of lithic source analysis depends upon the information available about the raw material sources. Raw material samples from as many areas as possible were assembled, examined, and described for comparative purposes. Any available descriptions or other raw material source accounts were also included. Geologic maps were used to determine the locations and extent of exposures of geologic formations which are known sources of the materials. Raw materials from formations of similar age but from different source locations were examined carefully for similarities and differences, and distinctive features were noted which might make it possible to discern one source area from another.

The second step was to analyze the artifact assemblages of the five sites. The information collected for tools was: catalog number, material type, tool type, completeness, size, weight, and provenience (see Table II: Tool Coding Information Sheet). Material types were identified as accurately as possible. Some could be tentatively assigned to a specific source area, some to a specific formation but not an actual source area, others could only be placed in descriptive categories when all other information was unknown.

The tool type categories employed are: Utilized flake, biface, preform, projectile point, channel flake, scraper, drill or awl, graver, and "other." The types were categorized according to the following definitions. Utilized flakes are flakes which exhibit marginal retouch along one or both surfaces. Chapman (1977:378) defines marginal retouch as retouch scars which extend from the perimeter edge less than 1/3 of the surface. This is a broad category including simple worked flakes and items which might elsewhere have been defined as knives or side scrapers (see Irwin and Wormington 1970). In retrospect it may have been more useful to subdivide the tools within this group. Bifaces, as defined by Chapman (1977:413), are bifacially retouched artifacts which do not exhibit evidence of basal modification. Projectile points are defined as bifacially retouched artifacts which exhibit basal modification (Chapman 1977:413). Preforms are defined as projectile point blanks which were broken in manufacture and which lack evidence for the final stages of manufacture. This tool category was included primarily for analysis of the Folsom level of the Agate Basin site. In the case of Folsom points, the last stage of manufacture is edge grinding (Frison and Bradley 1980). Scrapers are tools which exhibit

TABLE II

TOOL CODING INFORMATION KEY

Column	Information	Code	Description
7-11	Catalog number		
13-14	*Material type	1	Mississippian and Pennsylvanian chert
		2	Lower Cretaceous quartzite
		3	Knife River Flint
		4	Miscellaneous chert - brown speckeled
		7	Porcellanite
		8	Moss agate
		9	Upper Jurassic Age quartzite
		10	Miscellaneous quartzite-coarse
		11	Miscellaneous quartzite-fine
		12	Miscellaneous chert-other
		13	Miscellaneous chert-heated
		15	Miscellaneous quartzite-very fine grained green
		17	Miscellaneous quartzite-red speckeled grey quartzite
		18	Knife River Flint
		21	Miscellaneous quartzite-fine to medium grained white
		20,22 26	Petrified wood
		23	Flattop-Kimball chert
		24	Miscellaneous chert-brown, translucent, round inclusions
		25	Permian Age chert
		28	Miscellaneous chert-opaque white
		30	Plate chalcedony
		31	Miscellaneous chert-translucent, dull white
		32	Obsidian
		33	Non-volcanic glass
		34	Ordovician Age quartzite
		35	Miscellaneous chert-clear, white, chalcedony
		36	Vitrophyre
		37	Miscellaneous chert-clear, yellowish chalcedony

TABLE II(continued)

Column	Information	Code	Description
16-17	Tool type	1	Utilized flake
		2	Biface
		3	Preform
		4	Projectile point
		5	Channel flake
		6	Scraper
		7	Drill/awl
		9	Micro-graver
		10	Other
19	Completeness	1	Fragment
		2	Tip
		3	Base
		4	Midsection
		5	Complete
21	Size	2	1/4" 1/2"
		3	1/2" 1"
		4	1" 2"
		5	2" 3"
		6	3"
22-26	Weight in grams		
28-32	Provenience		

* See Chapter 5 (Geology and Lithic Raw Material of the Study Area) for material descriptions.

steep marginal retouch over the distal end and possibly along the sides. The angle of retouch is generally greater than 25 degrees. Drills and awls are bifacially or unifacially retouched tools which exhibit severely constricted distal ends. Micro-gravers are small flakes which exhibit retouch producing a small, sharp point. The "other" category provided for miscellaneous items which did not meet the criteria of the above tool categories.

The category of completeness recorded whether the tool was a fragment, tip, base, midsection, or complete. All items were size graded. No material less than 1/4 inch in diameter was examined because of the difficulty in determining material types on very small items. The weight in grams of each item was measured and recorded. Provenience information varied somewhat according to the site. North-south designation was recorded when available, as was level. One site, Piney Creek, is a single component site with several areas representing different activities, and this information was recorded.

The information recorded for lithic debitage was catalog number, material type, flake type, platform, size, weight, and provenience (see Table III). Flake type was based on the amount of cortex present and was recorded according to the following guidelines. Primary flakes show 50% or more cortex over the surface. Secondary flakes have some cortex but it covers less than 50% of the surface. Tertiary flakes have no cortex. Cores are classified separately from primary and secondary flakes. Platform was recorded simply for presence or absence, though it was not utilized in analysis.

This information was recorded on computer forms and entered on

TABLE III

DEBITAGE CODING INFORMATION KEY

Column	Information	Code	Description
7-12	Catalog number		
13-14	Material type	(Same as for tools)	
16	Flake type	1	Primary 50% cortex
		2	Secondary 50% cortex
		3	Tertiary 0% cortex
		4	Core
18	Platform	1	Absent
		3	Present
20	Size	2	1/4" 1/2"
		3	1/2" 1"
		4	1" 2"
		5	2" 3"
		6	3"
22-26	Weight in grams		
28-35	Provenience		

the University of Wyoming computer. Several SPSS programs were run to determine frequencies, percentages, and totals of material types, tool types, and debitage. Crosstabulation produced counts and frequencies of material types by level, tool type, provenience, and size. Total raw material weights for tools and debitage were also calculated.

Crosstabulations of material type by tool type were intended to examine material preference in tool manufacture. The information on the kind and amount of raw material used for specific tool types could also be compared. Material type was examined by provenience for clustering tendencies that might indicate activity areas and might also bias the representation of materials recovered from a site. Material type by size was examined to see if the size of debitage correlated with the distance to the source. Frequencies and percentages of materials were calculated in the crosstabulation procedures. This information was compiled for intrasite and intersite comparisons of material type representations and tools. Total weights were calculated as an alternate to numerical frequency for measuring the representation of raw material types.

Area Chosen for Analysis

The area of northeastern Wyoming and southeastern Montana was chosen for analysis (see Figure 1). This basically comprises the Powder River Basin and four separate uplift areas which surround it. Each area is known to contain raw lithic material which was used for tool manufacture by prehistoric peoples. The uplifts are geologically related but geographically separated features. Some work on source analysis has been done within the area (Reher and Frison 1980; Tratebas 1978; S. A. C. Keller 1971; Loendorf 1973; Frison and Stanford 1982a; Frison 1974) thus providing a foundation which could be developed. The author is more familiar with the raw material sources in northeastern Wyoming than with those in other areas and this was a major consideration in the selection of the study area.

Sites Chosen for Analysis

Five sites were selected for analysis. They are Kobold, Piney Creek, Vore, Hawken, and Agate Basin (Figure 2). All are buried sites located in the area of northeastern Wyoming and southeastern Montana. These sites all represent bison kills and/or processing activities. In addition, camp site activities are represented in level 4 of the Kobold site and in the Folsom component of the Agate Basin site. Stratified sites were preferred as they reflect change over time. All five sites have relatively large artifact assemblages. The collections were readily available for study and easily accessible due to their storage in the Department of Anthropology at the University of Wyoming.

CHAPTER IV

PROBLEMS AND LIMITATIONS OF LITHIC SOURCE ANALYSIS

There are several limitations to a study such as this one. They should be mentioned and seriously considered in order to evaluate the analysis and conclusions presented. The primary limitation is the general state of the knowledge of raw materials and their sources. The study of material types and source locations in northeastern Wyoming is in a formative stage since all source areas are not known or understood. This incomplete knowledge leads to problems in several areas of material identification including determination of raw material types and sources. Though some materials can be identified by geological formation and source area, other materials, such as the Mississippian and Pennsylvanian age cherts and some of the Lower Cretaceous age quartzites appear quite similar and at this point the actual source areas cannot always be distinguished. However, it is possible to determine the distribution and location of geologic formations and therefore determine closest potential source areas. Other materials must necessarily go into descriptive, miscellaneous categories as they appear distinctive but are of unknown origin.

Miscellaneous raw materials are also a problem. Most miscellaneous materials are probably from local cobble and stream bed deposits, though some are very fine quality material and may represent distant sources. Tools made of these unidentifiable but high quality materials may have been curated over great distances. The identification of their source could be quite valuable to the delineation of areas which a group has exploited or to the demonstration of groups with whom there has been contact. The inability to identify the source of these materials may be valued as a loss of potentially significant information.

The broad categories of site type used (kill and processing site, campsite) might also be a problem. The variation in activities within each of these types can be great as no site is exactly like another. However, it is assumed that kill sites are more similar to each other than to sites representing other types of activities and therefore should be comparable. Sequential occupation of a site area can increase the complexity of the archeological record. Binford (1978, 1982) has addressed this problem with ethnographic examples of site areas serving various functions at different times by the same or different groups. He notes that site function may differ with each successive occupation and with different seasons of use. It is sometimes possible to recognize sequential occupation within an archeological component as at the Vore and Hawken sites. However, sometimes it is impossible to separate the individual components, such as at the Hawken site, an important consideration for analysis and interpretations of the data.

Curated tools can be useful as they often represent distant sources and thus provide additional information about areas directly utilized or indirect contacts with other areas or groups. However, curation also results in the removal of some tools or items, which were manufactured and/or utilized, as the occupants abandon the site. Tools and materials recovered from a site therefore do not necessarily represent the complete inventory of items used there. The lithic debitage, however, can often provide information about the types and number of tools that were once present on the site (Frison 1967).

Trade may be a problem for interpreting the representation of material types because materials which were acquired through trade could be interpreted as representing part of a home range. Raw material fall-off rates may be useful in identifying trade as demonstrated by Earle and Ericson (1977), Renfrew and Dixon (1966) and Renfrew, Dixon and Cann (1968), among others, but when dealing with a few individual sites, fall-off rates from a source area cannot be determined. However, materials acquired through trade would be those not available within a group's home range and would thus represent distant sources. They would also likely constitute a minor portion of the total assemblage (See Luedtke 1976:319). Additionally, trade is not documented as an important element in Prehistoric Northwest Plains Indian subsistence, though it was well developed in historic times.

A further limitation to this analysis was the degree of comparative similarity of site assemblages analyzed. For various reasons, only the tool assemblages were analyzed for four of the five sites. The debitage, in addition to the tools, from both components of the Agate Basin site were included in this analysis. It was possible, therefore, to examine the significance of raw material representation in the Agate Basin site more completely.

The assemblage sizes of the five sites also differ. The large assemblages are assumed to be more useful to analysis. Relative frequencies are used in the analysis of tool and raw material types to compensate for the discrepancy in assemblage size.

Another possible limitation is the validity of the assumption that the lithic materials from each assemblage are representative of the entire assemblage and will accurately reflect the behavior which produced them. None of the assemblages constitute 100% of the material at the site as none were excavated in their entirety. However, large areas of each site were excavated providing what is considered an adequate sample for analysis.

CHAPTER V

GEOLOGY AND LITHIC RAW MATERIAL SOURCES OF THE STUDY AREA

The material presented in this section is summarized in Table IV. This table lists the geologic ages from youngest to oldest, the regional names of the formations which are of concern to this research, and the rock type with a brief description. Discussion of rocks and geologic formations over a large region can become confusing because of the applications of different local names to similar aged formations. Table IV is intended to clarify some of this confusion. The distance from the analyzed sites to the source areas is presented in Table V.

The sites analyzed in this thesis are located in northeastern Wyoming and southeastern Montana. This area consists primarily of the Powder River Basin and surrounding uplifts and will be referred to as the "study area." The Powder River Basin is bounded on the west by the Bighorn and Pryor Mountains, on the south by the Laramie Range and the Hartville Uplift and on the east by the Black Hills (see Figure 2). The area is characterized primarily by the rolling grasslands of the Powder River Basin and the juniper and pine covered slopes of the surrounding uplifts. Each area contains sources of lithic raw materials which were exploited for tool manufacture by prehistoric inhabitants of the region. The geology of each area is discussed so that the formations which potentially contain rocks

TABLE IV

SUMMARY OF FORMATION AGES, REGIONAL NAMES AND RAW MATERIAL TYPES

Era	System	Bighorns Pryor Mts.	Black Hills	Hartville Uplift Laramie Range	Powder River Basin	Material Type	Distinctive Features
Cenozoic	Tertiary				Fort Union	Porcellanite	Opaque, dull to waxy luster, grey, green, black, red, yellow
						Non-volcanic glass	Translucent, glassy, internal gas bubbles, same colors as above
Mesozoic	Lower Cretaceous	Cloverly	Fall River	Cloverly		Quartzite	Medium to fine grain
	Upper Jurassic	Morrison	Morrison	Morrison		Silicified siltsone	Fine grain, grey streaked with dark grey, yellow red, blue
						Quartzite	Medium to fine grain, blue or grey
						Chert	Translucent whitish with white inclusions
Paleozoic	Permian	Phosphoria	Minnekahta	Phosphoria "Goose egg"		Chert	Fine grain, smooth texture, purple, red, maroon; small round green inclusions
	Pennsylvanian	Tensleep Amsden	Minnelusa	Hartville		Chert	Opaque, waxy luster, sometimes banded, wide color range, sometimes dendritic
	Mississippian	Madison	Pahasapa	Guernsey		Chert	Variegated, wide color range, translucent to opaque, dentrites common
	Ordovician	Bighorn	Whitewood	None		Quartzite chert	Coarse to medium grained
	Reference	Francis 1981 Loendorf 1973	Tratebas 1978	Tratebas 1978 Keller 1971	Frison 1974 Fredlund 1976		

TABLE V

THE APPROXIMATE DISTANCE IN KILOMETERS FROM SITES TO SOURCE AREAS

SITE	Big Horns	Black Hills	Hart-ville	Laramie Range	Powder River Basin	NW Powder River Basin	Knife River N.D.
Kobold	21	200-250	400	350	0	0	450
Piney Creek	15-20	180-220	270-330	200	40+	40+	450
Vore	240	0-40	100-230	230	80-110	250	350
Hawken	240	0-40	100-230	230	80-110	250	350
Agate Basin	240	40-60+	90-140	150+	50-130+	300	520

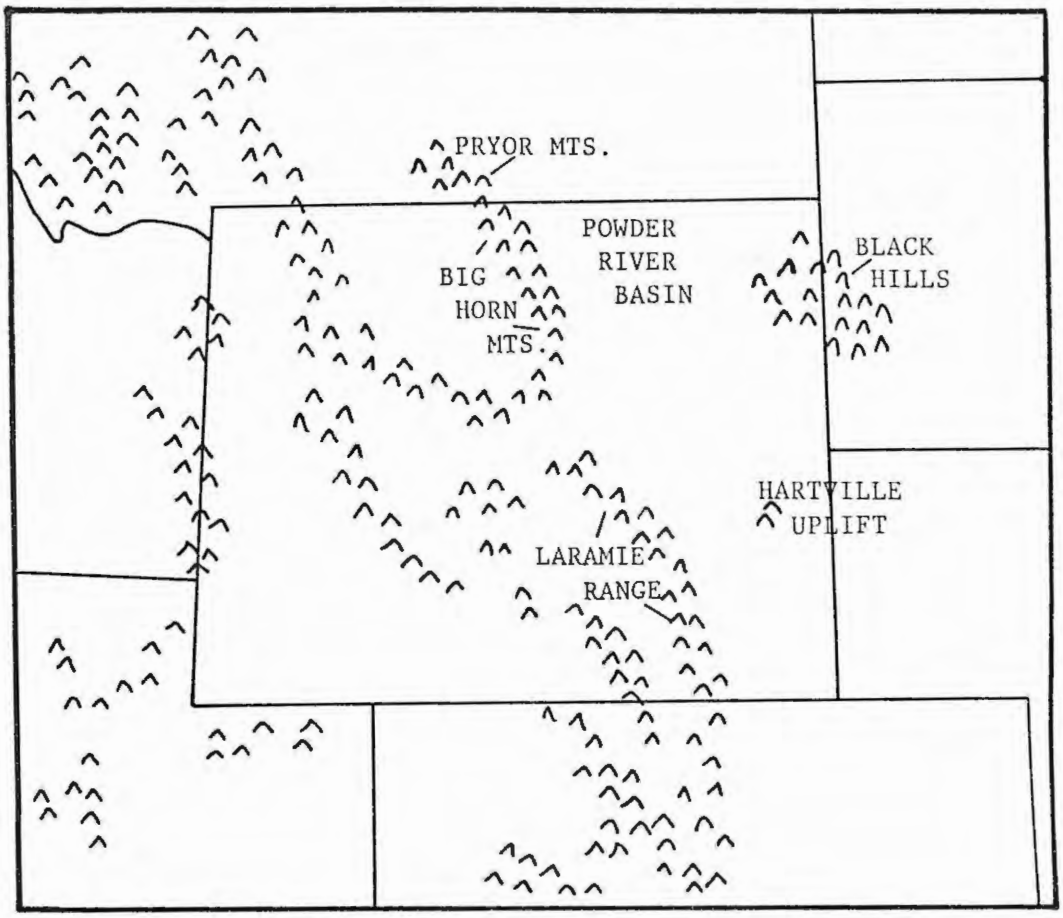


Figure 2. Basin and uplifted areas of the Study Area.

suitable for tool manufacture are indicated. The geographic distribution of the formations is derived from geologic maps of the study area (Love, Weitz and Hose 1955; Renfro and Feray 1972). It should be noted that not all areas where a geologic formation is exposed contain materials of similar quality. Descriptions of each lithic material type are based on visual characteristics of texture, translucence, inclusions present, and color. Munsell color designations are used where pertinent and are given in parentheses following the color referent. The geologic formations are presented from oldest to most recent which is the order in which they occur from high to low elevation in the study area. Descriptions are based on a number of sources including Tratebas (1978), Frison (1974), Frison and Bradley (1980), Francis (1981), Fredlund (1976), Loendorf (1973), the University of Wyoming Lithic Source Collection, and my own analysis of many of the materials.

Raw Material Sources: Geologic Formations of the Study Area

In the higher elevations of uplift areas a number of geologic formations are exposed over a relatively small area. The Black Hills, Hartville Uplift, Laramie Range and Bighorn and Pryor Mountains are related land masses. Therefore, there are many similarities in the formations present with some regional variations. The areas are discussed for each age formation.

Formations of Ordovician Age contain quartzites of variable quality. Generally, they range from coarse to medium grained and vary in color with white, yellow, grey, pink, red, and purple. Due to their generally poor quality for tool manufacture these rocks have not been particularly well studied in lithic source analysis. Sample collections are rare and poorly documented, possibly because the emphasis has been on the finer quality quartzites of the Lower Cretaceous age.

In the Black Hills the Ordovician Age Whitewood limestone is found in the higher elevations and is limited to the northern portions of the Black Hills near Deadwood, South Dakota and the Bear Lodge area north of Sundance, Wyoming. Tratebas (1978) does not mention the Whitewood limestone as a potential raw material source from the Black Hills. Quite possibly it does not provide material of suitable quality for stone tool manufacture.

There are no exposures of Ordovician Age rocks in the Hartville Uplift or the Laramie Range. The Bighorn Mountains, in contrast, have relatively extensive exposures of Ordovician Age rocks. Undivided Cambrian and Ordovician Age rock exposure is extensive, occuring from the northern to the southern end of the Range. Francis (1981) describes these rocks as coarse to medium grained quartzites varying widely in color including white, yellow, grey, pink, red, and purple, often with grain-sized black inclusions. These rocks are generally not of good quality for tool manufacture. A possible quarry is located near Billy Creek (T48N, R84W) on the eastern slope of the Bighorn Mountains.

Loendorf (1973:58) reports quartzites from the higher elevations of the Big Pryor Mountain. The material is known locally as Big Springs Quartzite. Based upon its location and Loendorf's description, the material may be of Ordovician Age. The color range includes light tan, pink, and dark brown, and they are often banded. The material is opaque with dull surface luster.

Loendorf (1973:57) also reports cherts imbedded in the Ordovician Bighorn Dolomite in the Pryor Mountains. They are found between 5000 to 7000 feet in elevation and all have a waxy luster. According to Loendorf some of the cherts vary in color from white, to tan to pink. One variety ranges from lavender to purple and is found in primary quarries on the southwestern slope of the Pryors.

The formations of the Mississippian Age contain good quality cherts which were used extensively by the prehistoric inhabitants of the region. The chert is highly variable in texture and color, including white, yellow, orange, red, pink, purple, green, brown, tan, black and combinations of these. An attempt was made to precisely quantify the colors on a Munsell color chart. However, the range of color variation was so great as to make the information virtually meaningless. These rocks range from dull to high luster, and from translucent to opaque and some have dendritic inclusions.

In the Black Hills these rocks are named the Pahasapa Formation and make up part of the Limestone Plateau. These rocks are similar in appearance to the correlative Madison and Guernsey Formations of the Bighorn Mountains and Hartville Uplift, respectively. However, the raw material in samples of Mississippian and Pennsylvanian age cherts from the Black Hills is of poor quality. It is suggested that sources of good quality cherts are very limited in the Black Hills.

Tratebas (1978) describes the Mississippian and Pennsylvanian Age Formations in the Black Hills but admits to problems in locating actual procurement areas or quarries of good quality material (personal communication 1980). Unfortunately, our incomplete knowledge of these materials presents certain analytic limitations. For the present it will be assumed that the range of variation is similar to that of the Hartville Uplift material and, thus, no distinction will be made between the source areas.

The Guernsey Formation is the name given to these Mississippian Age rocks in the Hartville Uplift. The Hartville Uplift is an anticline exposing areas of the Guernsey Formation on the west slope and along the eastern edge at the contact with the Pre-Cambrian rocks. In addition to the other colors, solid orange colored dendritic cherts are common from this area. These range from translucent to opaque, with luster, ranging from dull to high. Cherts from the Guernsey Formation are sometimes referred to as "Spanish Diggings chert" and as "Hartville chert" in the literature.

Exposures of Mississippian Age Formation are not documented for the Laramie Range. This uplift, then, will not be considered as a source of this material.

The Mississippian Age Madison Formation in the Bighorn Mountains contains good quality cherts which were used extensively by prehistoric populations in the area (Frison and Bradley 1980:13). The best known source of these materials is probably the Spanish Point agate quarry (48BH85) on the west slope of the mountains. Spanish Point agate is very fine grained with very smooth texture.

It is translucent, with color variation including white, light grey and red (10R 5/3) with yellow, grey and black mottling.

Pennsylvanian Age Formations also contain cherts which were utilized by prehistoric peoples for tool manufacture. These, too, vary in color and texture. They may be variegated, solid color or banded. Colors include tan, brown, orange, red, pink, purple, white, yellow, grey and green. These cherts are generally opaque and have a waxy luster. Some of the material has dendritic inclusions.

The Pennsylvanian Age Minnelusa Formation of the Black Hills makes up the outer edges of the Limestone Plateau. Tratebas (1978), notes that some of the banded forms of these cherts are known locally as Tepee Canyon agates.

The Pennsylvanian Age Hartville Formation is exposed over a large area of the Hartville Uplift. Good quality cherts occur primarily in the upper three divisions of the Hartville Formation, particularly in divisions II and III (S. A. C. Keller 1971:16). These cherts have a waxy luster and are opaque with a wide variety of colors. S. A. C. Keller (1971:194) states that color variation is so great and occurs over such short distances that it is not useful as an indicator of specific sources of chert within the uplift.

In the Laramie Range, exposures of the Hartville Formation are restricted in extent. On the west side of the range the rocks outcrop between Marshall and Little Medicine at the contact with the Pre-Cambrian rocks. There are known quarries around Marshall (T27N, R75W). Another exposure of the formation is evident on the east side of the Range from Esterbrook north.

Exposures of the Pennsylvanian Age cherts in the Bighorn Mountains, in contrast to the Laramie Range, are widespread. In the southern end of the Bighorn Mountains, wide bands of the Pennsylvanian Age Tensleep and Amsden Formations are exposed on the east and west slopes. North of Hazelton Peak (T48N, R85W) exposures on the east side are reduced to thin bands, while those on the west side do not reduce in width until north of the town of Shell, north of T56N exposures are scattered.

In the Pryor Mountains exposures of Pennsylvanian rocks are more evenly distributed than in the Bighorns. As previously mentioned Loendorf (1973:57) describes one type of Pryor Mountain chert as varying in color from white to tan to pink. This description fits the Pennsylvanian Age rocks of the Bighorns and it is likely that they are this age.

The Mississippian and Pennsylvanian Age cherts are combined in one category in the lithic analysis of this report. The visual distinction between the rocks is not always clear. In addition, exposures of this material generally co-occur and thus represent similar areas of exploitation.

Cherts occur in the Permian Age Formation. These are opaque and range from dull to shiny luster. Color varies from light to dark purple to red (10R 3/3 to 3/6) and maroon. Small, round light green inclusions may occur in the material. Cortex is a chalky material.

In the Black Hills the Minnekahta Formation contains a dark red, opaque chert, some of which contains the greenish colored inclusions.

There is some question, however, as to whether these cherts are actually from the Permian Age Minnekahta Formation or the underlying Triassic Age Spearfish Formation. Upon examination of these cherts, Love (personal communication 1981) noted they are more characteristic of the Minnekahta than the Spearfish Formation. No cherts are recorded from other areas where these Triassic Age rocks are exposed (Chugwater Formation). Also, these cherts very closely resemble the Phosphoria cherts of the Bighorn Mountains. Given this information, it is possible that these rocks are from the Minnekahta Formation.

In the Hartville Uplift these rocks occur in what is known as the Phosphoria Formation. Exposures are limited to small areas north and west of Glendo (T29N, R68W) (Condra and Reed 1935).

Exposures of Phosphoria, or Goose Egg Formation, are limited in the Laramie Range to areas at the north end of the Range (T32N, R80W; T30N, R79W; T30N, R76W; and T31N, R72W). The Laramie Range is not known to be a good source of this material.

Exposures of Phosphoria Formation in the Bighorn Mountains are limited to the southern and northern ends. In the south it is exposed south of Nowood (T42N, R88W) east of Badwater (T39N, R88W) and west of Kaycee (T43N, R82W). The material is again exposed between Greybull and Lovell and then west of Sheep Mountain (T57N, R92W). Bighorn Phosphoria chert is generally of very good quality.

In the Pryor Mountains exposures of the Phosphoria Formation are limited to thin bands on the southwest slope of the mountains (T5S, R27W and from T7S, R26W down to T9S, R27W). Loendorf (1973:57) reports that there are four or five known quarries of this material on the southwest slope of the Pryors.

The Upper Jurassic Age Morrison Formation contains three fairly distinct materials that were used for tool manufacture. The most common is a silicified siltstone of very fine grain known generally as "Morrison quartzite." These are most commonly light grey in color though light blue, yellow and rust color are also found. They are streaked with a lighter grey, light blue, yellow or rust color. This material resembles some of the Tongue River silicified siltstone found in lag deposits in westen South Dakota and southwestern Montana (Ahler 1975; Gerald R. Clark, personal communication 1982). The Morrison Formation also contains a medium to fine grained quartzite which is light grey to light blue in color with grain-sized black specks. The third material found in this formation is known as Morrison chert. One variety is a clear or greyish chalcedony, which often contains circular inclusions. Other varieties of chert include deep red, blueish-white, and white, and are often variegated (Frison and Bradley 1980:12). They range from opaque to translucent.

Thin bands of Morrison Formation are exposed on the south, east and west sides of the Black Hills, however, the formation is much more extensive in the northwestern part of the Black Hills in Wyoming from Newcastle north. Tratebas (1978:135) reports that sources of the Morrison silicified siltstone have been located only in the southwestern and northern ends of the Black Hills. The light blue silicified siltstone seems to be more common in the Black Hills than in the other source areas. The fine grained light blue quartzite with black, grain-sized inclusions is also found there.

No Morrison silicified siltstone, quartzites or cherts are known from the Hartville Uplift. While it is possible the material does exist here, based on present knowledge the Hartville Uplift will be eliminated as a possible source of this material.

Exposures of Morrison Formation are limited in the Laramie Range with a distribution similar to the Pennsylvanian Age Hartville Formation. Morrison silicified siltstone is known to occur, though not in great quantity.

The Morrison Formation in the Bighorn Mountains is exposed in a thin band along the east side of the range, though this exposure is somewhat wider from Barnum (T43N, R84W) south. On the west side of the range exposures are narrow from Tensleep (T47N, R88W) south while to the north the formation is slightly more extensive but patchy. A known quarry of this material is located about one mile west of Tensleep along Highway 16. The range of material in this quarry includes the grey and yellow streaked silicified siltstone as well as a medium to fine grained blueish-grey quartzite with black grained size inclusions. A translucent chalcedony is also found here in the Morrison Formation (Francis 1981). In addition to these, Frison and Bradley (1980:12) note an opaque, though sometimes translucent yellow chert from the Morrison Formation.

Loendorf (1973) does not report any Morrison Formation materials from the Pryor Mountains though there are rocks of Upper Jurassic Age exposed. Therefore, for the purpose of this analysis, the assumption will be that this is not a source area for this material.

The Lower Cretaceous Age Formation contains good quality quartzites which vary from medium to fine grain in different areas. The color range includes brown, tan, orange, red, purple, grey, and nearly black. There appears to be some color distinction between the different source areas.

In the Black Hills, the quartzites are medium grained and found in the Fall River sandstone of the Hogback Ridge. Fall River sandstone is exposed all around the Black Hills with the greatest exposure in the southern and northwestern areas (Tratebas 1978:135). The best known quarries are in the southern part of the Black Hills. These are Flint Hill, Parker Peak, and Battle Mountain. The Black Hills quartzites tend to have greenish-brown and grey tones to them.

The Cloverly Formation in the Hartville Uplift contains fine and medium grained quartzites. Similar materials also occur in the Old Woman Anticline which is approximately 50 kilometers to the north. The medium grained quartzites of these two areas are similar in grain size to those of the Black Hills but they generally have more purple and yellowish tones. The distinction is visible in the quarry samples from the two areas but is not always distinguishable in small pieces of debitage. The very fine grained quartzites of the Hartville Uplift and Old Woman Anticline are quite distinctive from the Black Hills quartzites. The Spanish Diggings quarry (48NO50) in the Hartville Uplift is the best known locality (T31N, R67W). Witzel and Hartley (1974) reported a significant difference in grain size and color range in material samples from the Spanish Diggings quarry and samples from Flint Hill quarry in the Black Hills.

In the Laramie Range the Cloverly Formation has the same limited distribution as that described for the Jurassic Age Morrison Formation and the Pennsylvannian Age Hartville Formation. Few sources of good quality quartzites are known from the Laramie Range and it is therefore given less consideration as a potential souce of these quartzites.

Exposures of Cloverly Formation in the Bighorn Mountains have the same distribution as the Morrison Formation discussed previously. The Cloverly Formation in the Bighorns contains medium-grained quartzites.

The Powder River Basin makes up the largest geographic portion of the study area, extending from the central portion of eastern Wyoming into southeastern Montana. The Tertiary Age Fort Union Formation of the Basin contains two related materials that were used for tool manufacture. These are porcellanite and non-volcanic glass (Fredlund 1976; Frison 1974). Both materials are metamorphic rocks formed by the intense heating of clay deposits above burning coal beds. Sources of porcellanite are much more common than sources of non-volcanic glass. Porcellanite is a dull to waxy, opaque material. Color variation includes red and maroon (10R 4/1 through 4/3, 10R 3/1 through 3/3, 104 2.5/1 through 2.5/2), grey-green, black (2.5YR 2.5/0 though 6/0, 10YR 2/1 through 7/1, 5Y 4/1 through 7/1) or grey, usually found in solid colors, though it can be banded. A glassy, opaque porcellanite is known from the Powder River Basin in Montana. It has been referred to as vitreous porcellanite, or vitrophyre, and often contains small, black, dendritic-like inclusions. The quality of materials from the Fort Union Formation varies greatly over the area. The highest quality material seems to be from the northern and western part of the Powder River Basin around Sheridan, Wyoming and Decker, Montana. Sources of non-volcanic glass are relatively rare and tend to be restricted to the northern portions of the Powder River Basin, especially in Montana. This is a glassy material found with the same color range as porcellanite. It can be translucent or opaque, and has tiny gas bubbles which are visible under a 10X hand lense, and often visible to the eye without magnification. Some of the material looks similar to obsidian but can generally be distinguished by the small gas bubbles which often produce a slightly foggy appearance. Most porcellanite and non-volcanic glass is available on ridgetop outcrops, though there is evidence of excavation of pits for material procurement (Carbone 1972).

Other Raw Material Sources

Several other material types are found in sites in the study area but have not been accounted for in the preceeding discussion of the geology. One of these materials is moss agate. The material is generally a clear or translucent whitish chert with dendritic inclusion and usually has a dull luster. This material is known to occur as lag gravel in the arroyos of eastern Wyoming and western South Dakota especially around the area of Lusk and Moorcroft. It is also reported in nodular form along the Yellowstone River Valley north of the Pryor Mountain-Bighorn Canyon area (Loendorf 1973:59). There may be other sources of this material in the study area.

A wide variety of pertrified wood is found in assemblages in the study area. Colors include translucent tans, browns, and a yellowish "chalcedony-like" material as well as opaque browns and black. Translucent tan and brown petrified wood occurs in the Lower Cretaceous Age Dakota Formation of the Black Hills (Tratebas 1978:38). Material of similar appearance also occurs in northwestern South Dakota and northeastern Wyoming, but the geologic source is unknown. Good quality petrified wood is reported along the Powder River in Wyoming (Reher 1979:213).

Plate chalcedony is known to occur in the Badlands of South Dakota (Tratebas 1978:38). This material outcrops in the White River Formation (Ahler 1975). It occurs in thin plates of whitish or grey translucent chalcedony with a rough, white patinated surface or cortex.

Two other materials are known to occur in western South Dakota, east of the Black Hills. One is a translucent dark-brown chert, with dull luster and a rough tan cortex. The material is sometimes compared with, or mistaken for, Knife River Flint. However, unlike Knife River Flint, the color is very blotchy with small dark-brown specks. This may be the "Flat Top chalcedony" from along the White River near Scenic, South Dakota reported by Tratebas (1978:38). The other material from east of the Black Hills is a greyish-brown (5YR 4/2) chert, with dull luster, and a smooth white, chalky cortex.

Both materials are grouped into the category of Knife River Flint-like (KRF-like) material.

Three other material sources were recognized in the assemblages analyzed. These are Knife River Flint, obsidian, and Flattop-Kimball chalcedony. Knife River Flint occurs as pebbles, cobbles, and boulders in secondary deposits of Pleistocene Age in the Knife River Valley of western North Dakota. It is a translucent, dark-brown silicious material which exhibits "internal sedimentary structures consisting of irregular parallel layers and lenses of darker flint about a millimeter thick" (Clayton, Bickley, and Stone 1970:287). A white or light grey patina, sometimes with a yellow stain, often forms over the surface.

Flattop-Kimball chalcedony is a good quality silicious material which occurs in the Pliocene Age Kimball Formation of northeastern Colorado and southwestern Nebraska. One extensive quarry is located on Flattop Butte, northwest of Sterling, Colorado, in Logan County. The material from Flattop Butte includes a homogeneous translucent tan (7.5YR 5/2) material, translucent tan, brown (7.5YR 4/2), or purple (10R 5/2) all with faint red mottling and round inclusions, and an opaque light purple (10R 5/2 through 6/2) some of which is slightly banded and has dark purple irregularly shaped inclusions. Cortex is a smooth, hard, white chert, often pitted.

The closest source of obsidian to the study area is in the northwest corner of Wyoming around Jackson and Yellowstone National Parks. The material is a glassy black, translucent, sometimes banded, igneous material. It is usually distinguishable from non-volcanic glass of the Fort Union Formation by the tiny gas bubbles and sometimes "foggy" appearance of the latter.

Basalt also occurs in primary sources around Yellowstone National Park. Within the study area it is found in secondary deposits along the northern end of the Pryor Mountain-Bighorn Canyon area and in the Wind River Basin of Wyoming. Loendorf (1973:60) reports several basalt quarries along the ancient Shoshoni River bed just north of Warren, Montana. These quarries are below 885 meters in elevation. He describes this material as opaque, black with large grained texture and dull luster.

Miscellaneous Materials

Several raw materials found in the assemblages could not be identified by geologic formation or source area. These were placed in categories of miscellaneous materials (see Table II). Materials which appeared distinctive were provided separate descriptive categories. These include a very fine grained green quartzite, and a grey, medium grained quartzite with rust colored inclusions ("red-speckled grey quartzite"). This grey quartzite has been reported from the southeastern portion of the Bighorn Mountains and from the Hartville Uplift south of Manville, though the geologic source is unknown. Also included in the categories of miscellaneous quartzites are a fine to medium grained white material, and general categories of coarse grained and fine grained quartzites for non-distinctive materials.

There are several categories of miscellaneous cherts. Several materials exhibited a crackled surface indicative of intense heating. Thermal alteration of these cherts often made source identification impossible, and these materials were placed in a separate category. A brown translucent chert with round inclusions was noted. Cortex on the material was indicative of a river cobble, but geologic source is unknown. Several varieties of translucent and opaque white cherts were found. These materials appear to be fairly common in the site assemblages, but the source is as yet unknown. Cherts which were of unknown origin and not distinctive were placed in a miscellaneous category of "other".

CHAPTER VI

SITES SELECTED FOR ANALYSIS

The five sites selected for analysis are buried or stratified sites in the region of northeastern Wyoming and southeastern Montana. These sites range in age from PaleoIndian to Late Prehistoric, thus representing a long time span from which to examine change in material type utilization. Information about each site is summarized in Table VI.

The Kobold Site

The Kobold site, 24BH406 (Frison 1970), is located at the head of Rosebud Creek in the Powder River Basin of southern Montana at an elevation of about 1360 meters. The site contains four components. The early Plains Archaic component (level 1) is a camp with no evidence of kill activities. The Middle Plains Archaic (level 2), Late Plains Archaic (level 3) and Late Prehistoric (level 4) components represent bison jump and butchering activities. The Late Prehistoric component contains evidence of occupation of the rock shelter under the overhang of the jump-off which is believed to be contemporary with the butchering activities. The Early and Middle Plains Archaic components represent single events while the depth of deposits in level 3 and variation in projectile point styles in level 4 suggest a long span of use for these two components (Frison 1970). Season of bison jump events appears to be the fall, determined from

TABLE VI

SUMMARY OF SITE INFORMATION

Site and Reference	Type	Level/Age	Season
Kobold	Camp	1 Early Plains Archaic	Fall
24BH046	kill/butchering	2 Middle Plains Archaic	Fall
Frison 1970	kill/butchering	3 Late Plains Archaic	Fall
	kill/butchering and camp	4 Late Prehistoric	Fall
Piney Creek			
48JO311	camp	Late Prehistoric	Fall
48JO312	kill/butchering	Late Prehistoric	Fall
Frison 1967			
Vore			
48CK302	kill/butchering	1-10 Late Prehistoric	Fall-Summer
Reher and Frison 1980			
Hawken	kill/butchering	Early Plains Archaic	Winter
48CK303			
Frison, Wilson and Wilson 1976			
Agate Basin	kill/butchering and camp	Folsom	Fall/Winter
48NO201			
Frison and Stanford 1982a	kill/butchering	Agate Basin	Fall/Winter

stages of tooth eruption on mandibles (see Frison, Wilson and Wilson 1976 for a complete explanation of seasonal determination from mandible studies).

Piney Creek Site

The Piney Creek sites, 48JO311 and 48JO312 (Frison 1967), are located in the foothills on the east side of the Bighorn Mountains on the south side of Piney Creek about 19 kilometers north of Buffalo, Wyoming. Site 48JO311 consists of 20 stone circles and artifacts on the old river terrace above Piney Creek. This is a surface site with relatively little material and is not dealt with in this analysis.

Both sites, 48JO311 and 48JO312, represent the Late Prehistoric Period. Pottery from 48JO311 is attributed to the Crow Indians. The stone circle site may have been the camp used during the bison kill though there is no definite evidence. Location of the camp on an exposed ridge and knowledge of bison behavior suggest that the kill occurred during the fall of the year (Frison 1967).

Vore Site

The Vore site, 48CK312 (Reher and Frison 1980), is located in the Red Valley, an open grassy area of the Black Hills in northeastern Wyoming. The site is a late Prehistoric Period bison jump with evidence of up to 22 separate middens of bison bone. An estimated 15,000 to 25,000 bison were driven into the large pseudokarst sink between A.D. 1500 and 1800 (Reher and Frison 1980:62). Mandible analysis indicates the site was used during the fall or early winter and possibly through the winter with another peak in late spring or early summer. This is a greater range of seasons than is evident at most kill sites in the Plains (Reher and Frison 1980).

Hawken Site

The Hawken site, 48CK303 (Frison, Wilson and Wilson 1976), is located in the Black Hills of northeastern Wyoming about seven miles south of the town of Sundance. The site represents three arroyo trap bison kill events within a short period of time during the Early Plains Archaic. Analysis of bison mandibles to estimate the minimum number of individuals indicates that nearly 100 bison were killed at the site through its period of use. Based on tooth eruption of mandibles, seasonality of the kill event, was determined as winter (December or January). A large proportion of the artifacts from the site were recovered from areas of unauthorized excavation and therefore were not distinguished by level. Therefore, the entire assemblage was analyzed as one unit. Frison, Wilson and Wilson (1976:37) have suggested that the site was utilized repeatedly by a single cultural group.

Agate Basin Site

The Agate Basin site, 48NO201 (Frison and Stanford 1982a), is located in eastern Wyoming between the Black Hills and the Hartville Uplift. The site contains three components: Folsom, Agate Basin, and Hell Gap. The Hell Gap level contained relatively little material and will not be analyzed. The Folsom and Agate Basin components represent arroyo trap bison kill and butchering activities. The exact location of the kill associated with the Agate Basin level material has not been definitely determined. Additionally, the Folsom component exhibits evidence of post kill occupation of undetermined length. Based upon tooth eruption schedules of bison, the season of both kill events is determined to be late fall or early winter.

CHAPTER VII

RESULTS OF ANALYSIS OF RAW MATERIALS AND ARTIFACT ASSEMBLAGES

Introduction

To analyze the various factors (site type, duration of occupation, season of occupation, material preference, and distance to source), raw material and tool type frequencies were calculated. Because the size of the assemblages is extremely variable, the relative frequency of items is considered to be more accurate than actual frequency and, therefore, used for most comparisons.

Frequencies based on weight are used most often in this analysis for reporting and comparing raw material types. Since this research deals primarily with the quantity of materials which have been acquired and transported from various source areas, the bulk of material is the primary concern. The analysis proposes that weight is a more uniform and comparative unit of measure than the number of items, primarily due to differential size of items. For example, a site with 100 small flakes is not necessarily similar to a site with 100 large flakes because more material is represented in the latter. However, in dealing with tool types, the number of items is used instead of weight primarily because the size of the artifacts within a single tool category can vary considerably. The sites selected for analysis exhibit a long time span over which the style and size of projectile points have changed. If weight were used for comparing categories of tools, a Late Prehistoric site with 20 projectile points might appear equal to a PaleoIndian site with only three points due to the difference in projectile point size.

The analysis of the site assemblages deals only with the lithic materials. As used here, therefore, the term artifact refers only to the lithic tools and projectile points of the assemblage and does not include items made of bone, wood, or other materials.

Site Type: Artifact Frequencies and Diversity Indices

As a basis for comparisons of raw material frequencies, the assemblages of the sites were examined to determine the extent to which the sites are similar in function. In addition, artifact (tools and projectile points) and material type diversities were examined with reference to their utility in reflecting site function. All assemblages analyzed exhibit some variability in the relative frequency of artifacts represented, as is illustrated in Figures 3 and 4, but overall they appear similar in the limited range of tool types represented and in assemblages dominated by projectile points and utilized flakes. The cumulative graphs of tool type frequency illustrate these similarities and differences (Figure 5, 6 and 7).

The greatest variability between the assemblages is in the utilized flake and projectile point categories. Hawken, Vore, Kobold, and Piney Creek kill areas have low percentages of utilized flakes and the high frequencies of projectile points. The representation of artifacts for level 1 of the Kobold site appears somewhat distorted considering that the analyzed tool assemblage

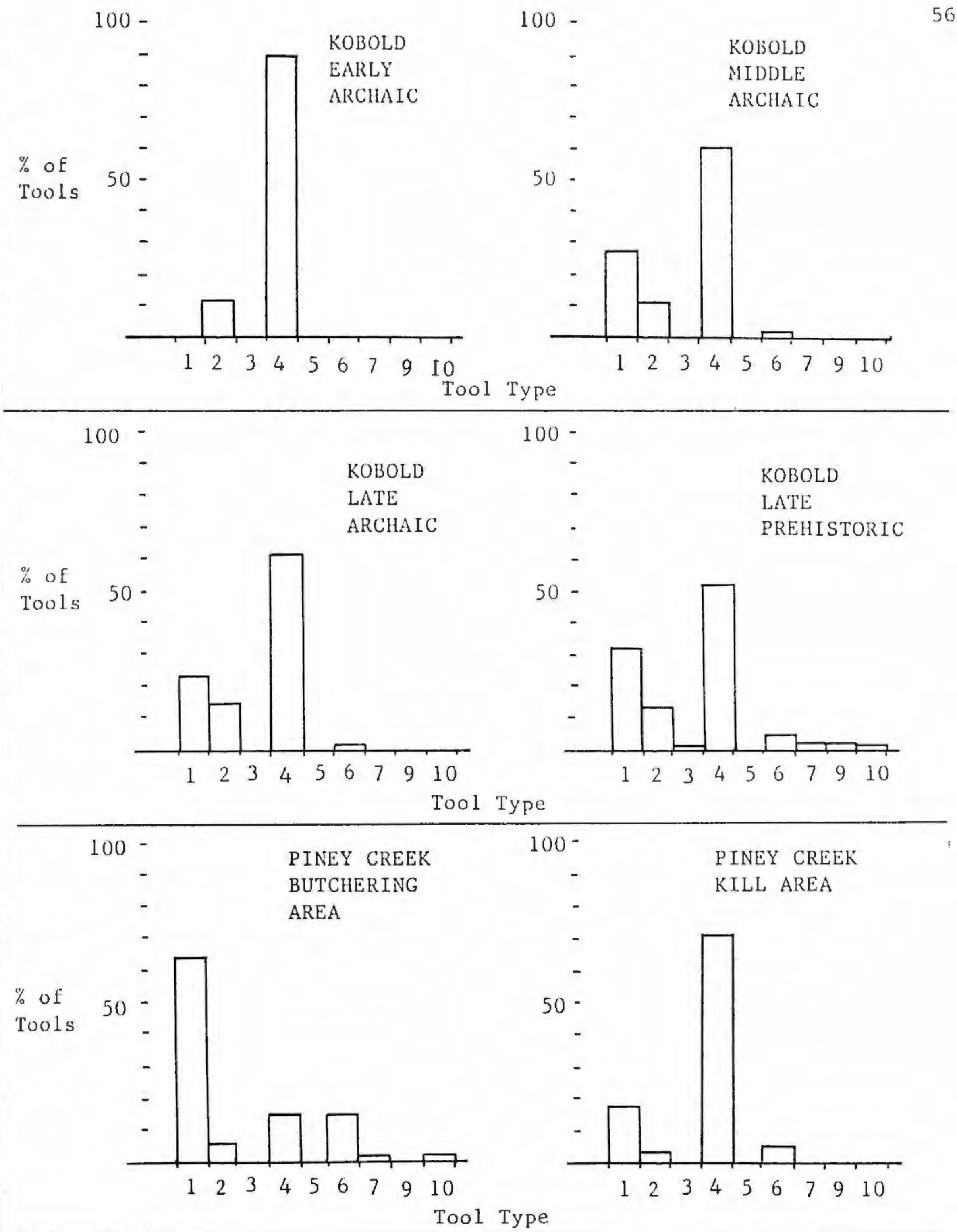


Figure 3. Comparison of the percent of tool types in the Kobold and Piney Creek sites.

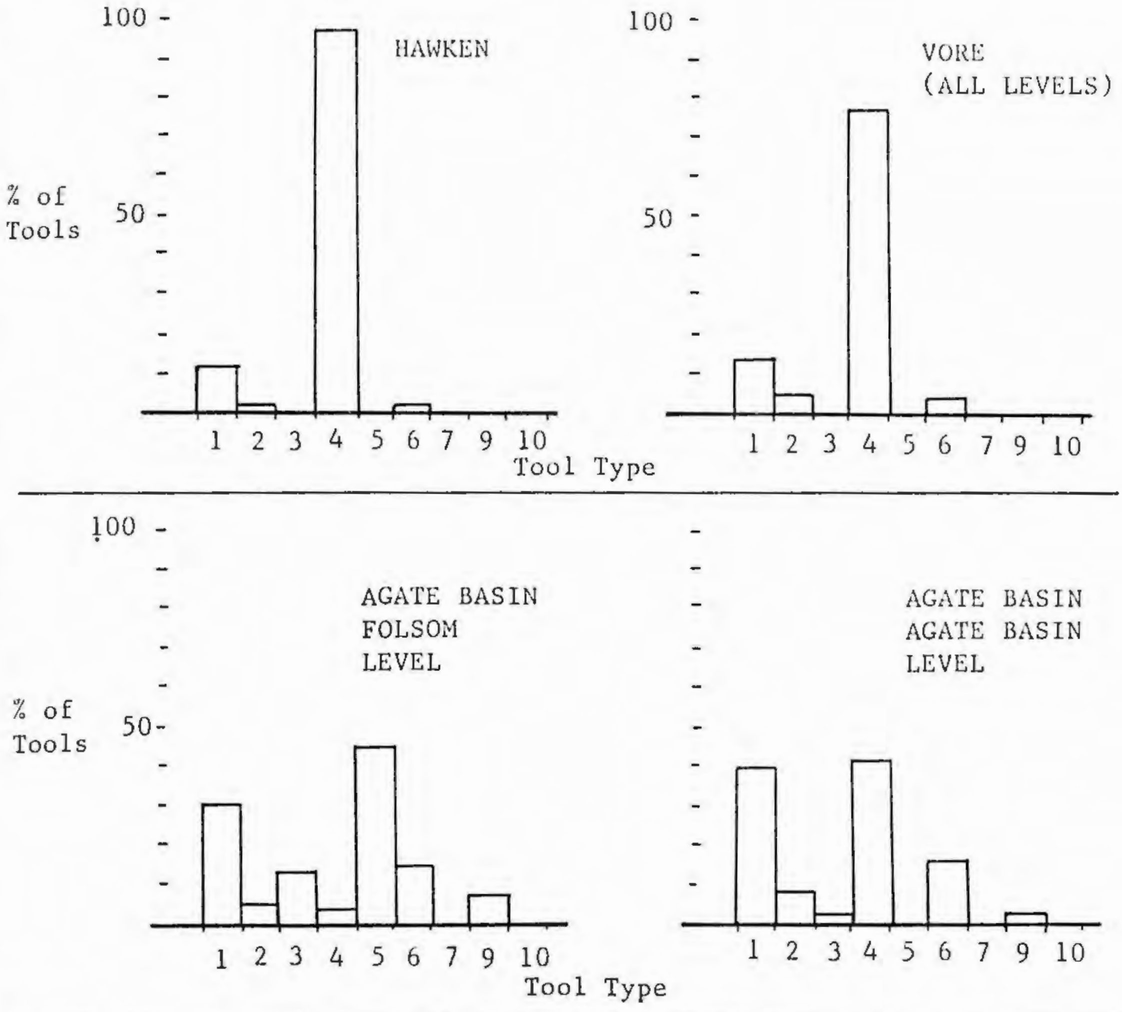


Figure 4. Comparison of the percent of tool types in the Hawken, Vore, and Agate Basin sites.

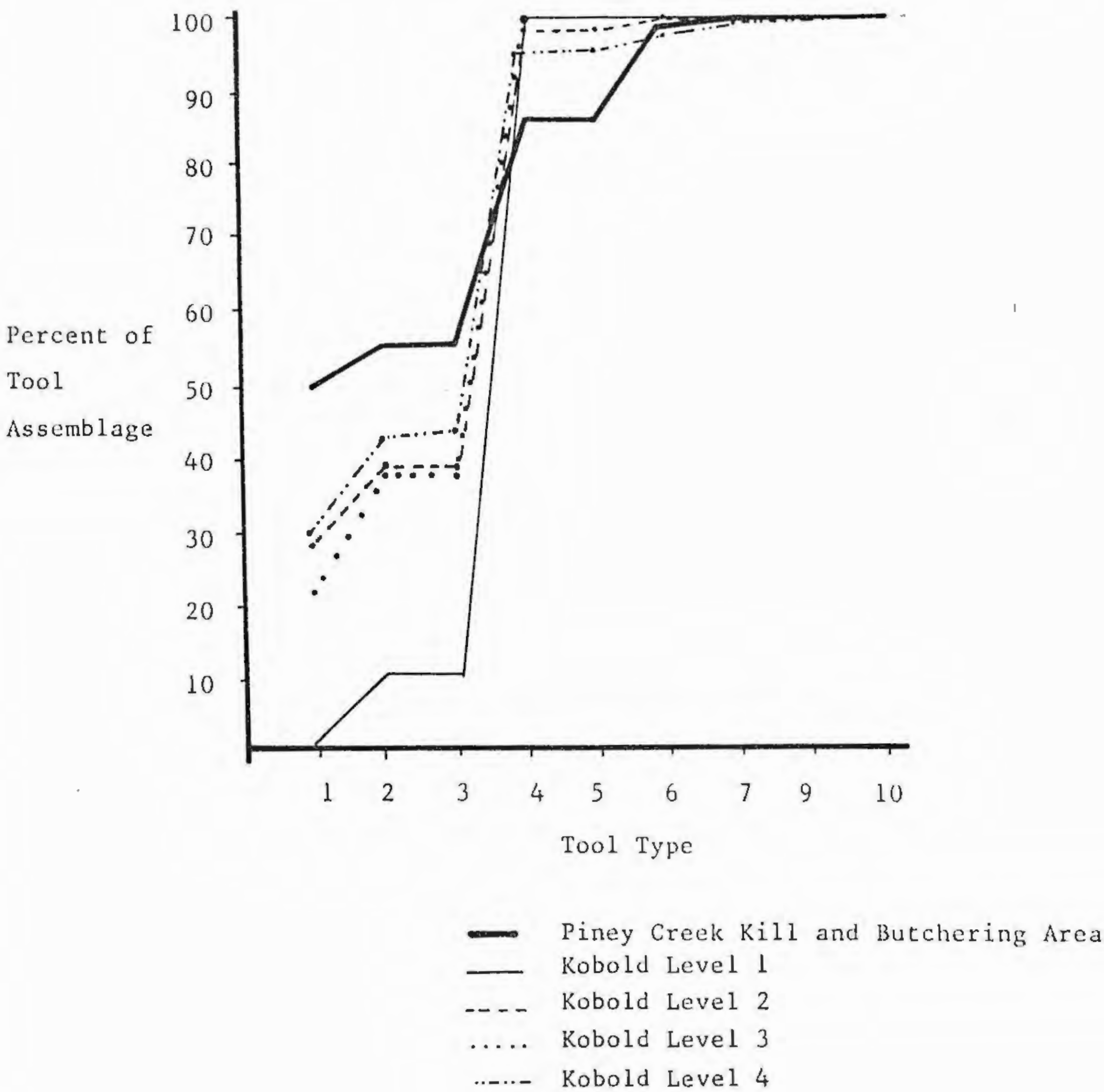


Figure 5. Cumulative graph comparing tool assemblages of Piney Creek and Kobold sites.

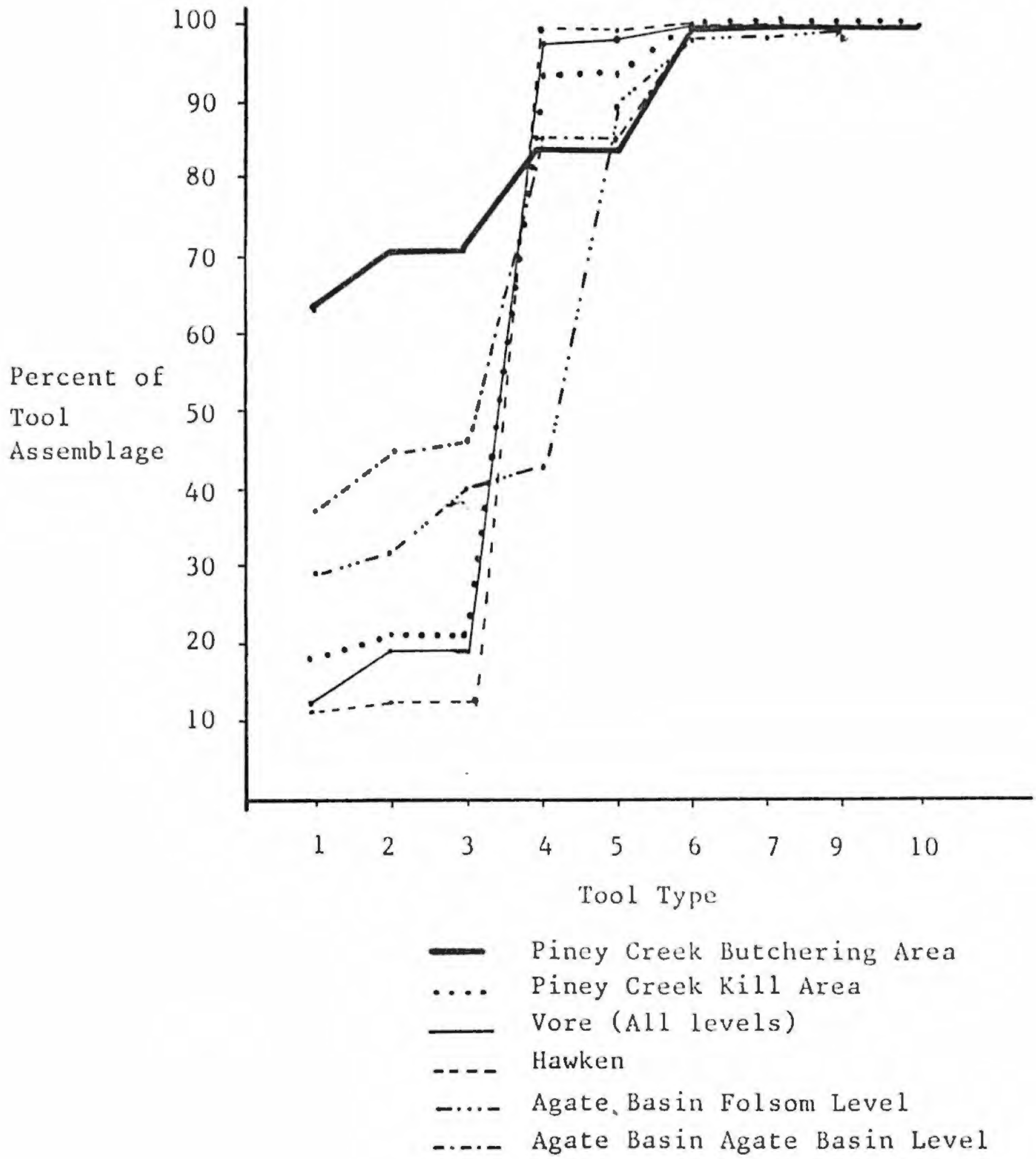


Figure 6. Cumulative graphs comparing tool assemblages of Piney Creek, Vore, Hawken, and Agate Basin sites.

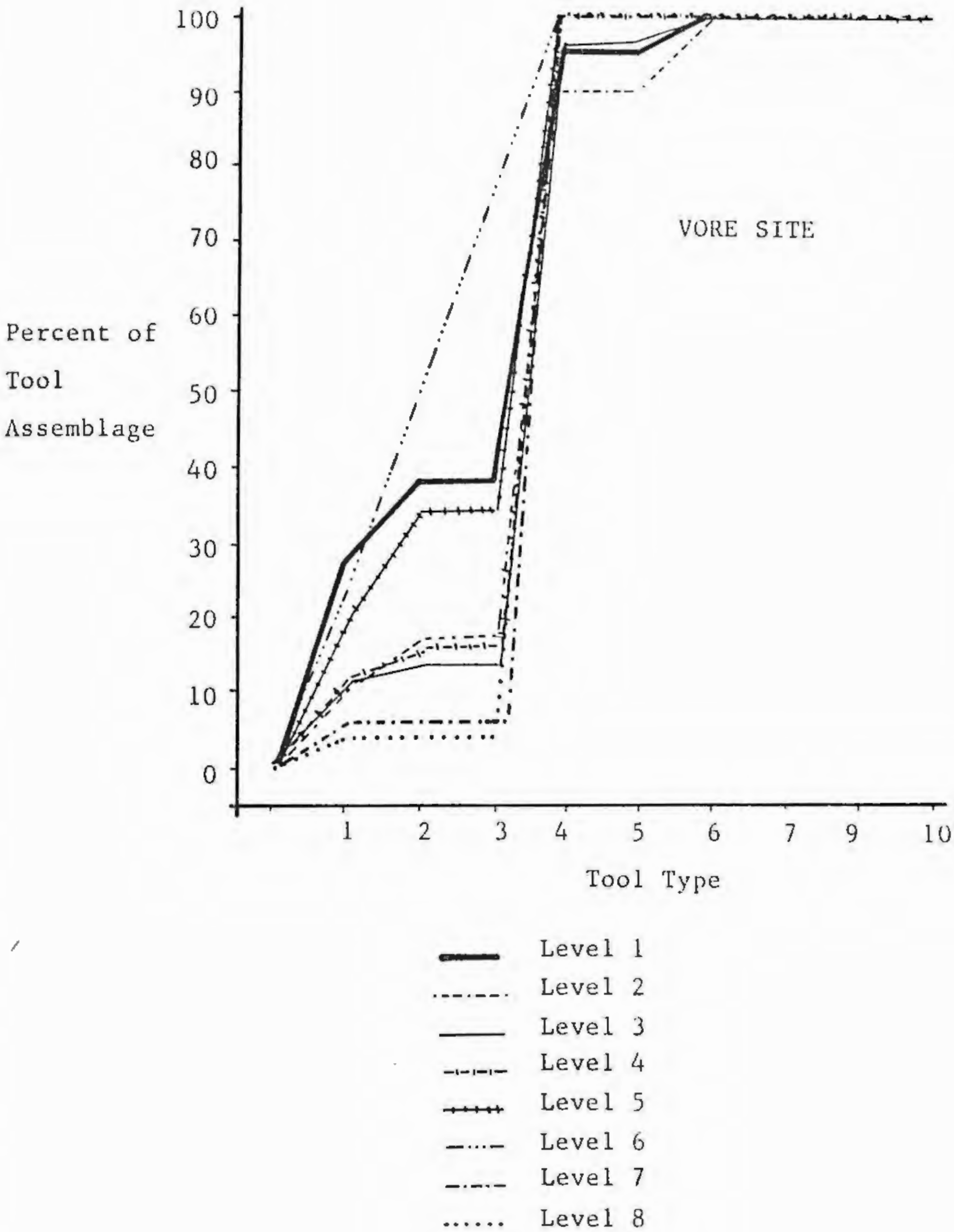


Figure 7. Cumulative graph comparing tool assemblages of levels 1 through 8 of the Vore site.

consists of only one biface and eight projectile points. Frison (1970:9) reports an additional core and 60 flakes in level 1. The lack of utilized flakes and scrapers and relatively high proportion of projectile points is unexpected for a campsite. The camp appears to have been used for a short duration and strongly oriented toward hunting with evidence of few activities at the site itself.

The Agate Basin Folsom level, Kobold level 4 and Piney Creek site represent campsites in addition to the bison kill and butchering activities. Evidence for campsites suggests a greater number of activities and possibly a longer period of occupation than existed with occupations represented in the other site components. The assemblages of the Folsom level of the Agate Basin site, level 4 of Kobold and the Piney Creek site have a greater variety of artifact types than is found in the other assemblages (Figures 5 and 6). This probably reflects additional activities associated with the campsites and possibly also the length of occupation. At Piney Creek the campsite is associated with, but separate from, the kill and butchering areas, while in the Folsom level of the Agate Basin site and level 4 of Kobold there is little or no separation of them.

The assemblage of the Agate Basin level of the Agate Basin site also exhibits a wide range of tool types, though no campsite is known to be associated with it. The range of tool types in this assemblage is much greater than the range exhibited in the other four kill and processing assemblages (Kobold levels 2 and 3, Hawken, Vore). Possibly there was a campsite associated with the Agate Basin site, Agate Basin component; however, the location has not been found or it has been eroded away.

There are differences between the artifact assemblages of the kill area and the butchering area of the Piney Creek site, as might be expected (Figures 3 and 6). The kill area has a very high proportion of points (74%) relative to the other tool types and only four artifact categories are represented (Numbers 1, 2, 4, 6, 7; refer to Table II for key to tool types). The butchering location has relatively few points (14%), but a high frequency of utilized flakes (63% compared to 19% for the kill area) and six tool categories represented (Numbers 1, 2, 4, 6, 7, 10). In addition, more artifacts were recovered from the butchering location (401 items) than from the kill area (169 items). The activities of the two areas would seem to account for these differences because the butchering activities require a wider range of tools than are necessary for the kill.

As might be expected for specialized activity sites where no campsite activities are evident (Figures 3 and 4), the artifact assemblages of the Piney Creek kill area, Kobold level 2, Kobold level 3, Hawken, and Vore sites exhibit a limited range of tool types. In addition, the same four categories of tools are represented in these five assemblages (Numbers 1, 2, 4, 6).

All of the assemblages analyzed demonstrate some unique characteristics, yet they are similar in that they exhibit a relatively narrow range of tool types, and assemblages generally dominated by only one or two artifact types. Sites representing kill plus camp activities have more diverse tool assemblages, while sites representing more specialized or limited activities tend to have fewer tool types. While the range of variation is important, the sites analyzed are considered functionally similar, as bison kill and butchering activities are the dominant activities represented.

Diversity indices for cultural and environmental data have been used in the analysis of site function (Grant 1981; Reher 1979; Larson and Tibesar 1981). Low diversity of tool assemblages is assumed to indicate limited activity sites, while high diversity is interpreted as representing habitation sites. This is based upon the assumption that the number and types of discarded tools increase as the number of activities performed at a site increase. A greater number of activities are assumed to be performed at campsites than at specialized sites including kill sites (although kill sites usually represent more activities than take place at some "limited activity" sites). However, as has been illustrated, there is some variation in the complexity of kill and butchering sites, which is reflected in diversity indices calculated from them. Although the basic assumption upon which interpretation of diversity indices are based may be valid, the factors which are involved in the calculation and interpretation of diversity indices are complex and need to be carefully considered and applied with caution.

Diversity indices were calculated for the assemblages of the five sites analyzed using the Shannon-Wiener Index, H' (Pielou 1978:290) defined as:

$$H' = \sum_{i=1}^{s} p_i \log p_i$$

where: s = number of cases
p_i = probability of occurrence of each case
log = natural log

As a preliminary test, tool type diversity was plotted with assemblage size to see if there was any correlation between them (Figure 8). The sites with large assemblages have high tool diversity and the sites with the smallest assemblages have low diversity indices. However, several sites with small assemblages have relatively high diversity indices. Tool diversity, therefore, does not appear to be directly related to assemblage size, an important consideration due to the wide range of variation in the sizes of the assemblages analyzed.

The tool diversity indices for the assemblages analyzed ranges from 0.00 (only one tool type) to 1.47. The diversity indices for levels 6, 7, and 8 of the Vore site, ranging from .00 to .26, may not be representative due to the small samples of material recovered in these levels. Eliminating these three levels, and level 1 of Kobold because it is a campsite, the diversity indices for the kill and butchering site assemblages analyzed range from .46 to 1.47, indicating there is a definite range in diversity indices for sites which are thought to represent similar functions.

Larson and Tibesar (1981:10-11, 166) have suggested that diversities calculated from material types of debitage may be used to determine site function. However, it is proposed here that the

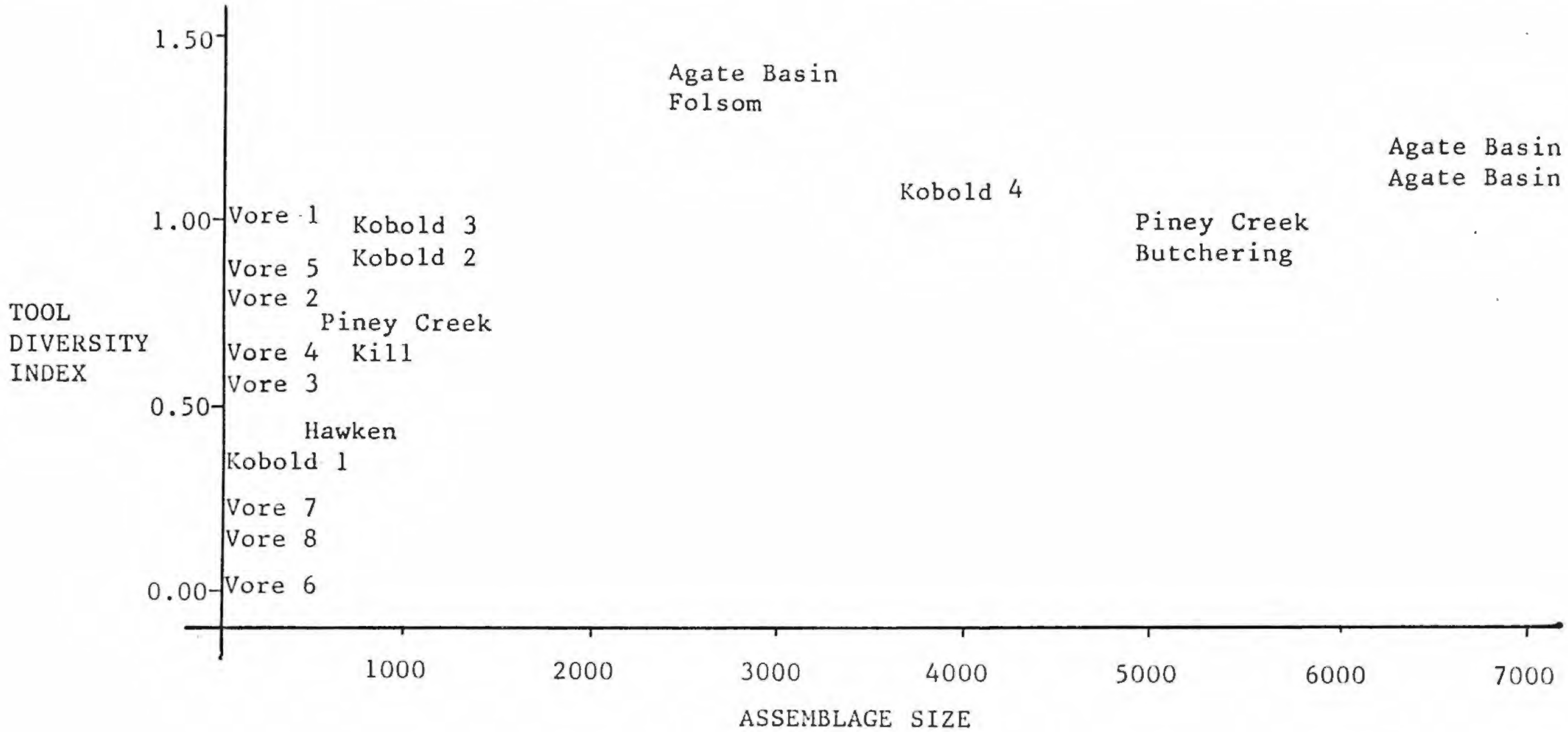


Figure 8. Graph of tool diversity plotted against assemblage size.

diversity of raw material types is not necessarily related to site function and may not always be an accurate indicator of function. Tool type diversity when plotted against tool material type diversity based on weight (illustrated in Figure 9) indicates there is little correlation between the two indices. Tool types represented at a site are related to activities performed there and thus do reflect site function. However, the types of raw materials represented at a site might be influenced by site function but may also be related to the location and availability of lithic materials, season of occupation, material preference, and other factors. Further comparison of tool diversity and tool material type diversity indicates that the two do not reflect the same thing (Figure 10) and are therefore not comparable.

Diversity indices also differ according to the unit of measure from which they are calculated. Diversities were calculated for material types of the debitage at the Agate Basin site using the percent of the total number of flakes of each material and then the percent of the total weight of the flakes by material type. The diversity index for the Folsom debitage based on the number of flakes is 1.61, and based on weight is 1.55. The indices for the Agate Basin debitage are 1.98 by the number of flakes and 1.46 by weight of the materials. The diversity index for weight is consistently less than that for number. The Agate Basin debitage has a higher diversity index than the Folsom debitage when calculated from the total number of flakes, but a lower index when calculated from the weight of the flakes. The unit of measurement, therefore, not only alters

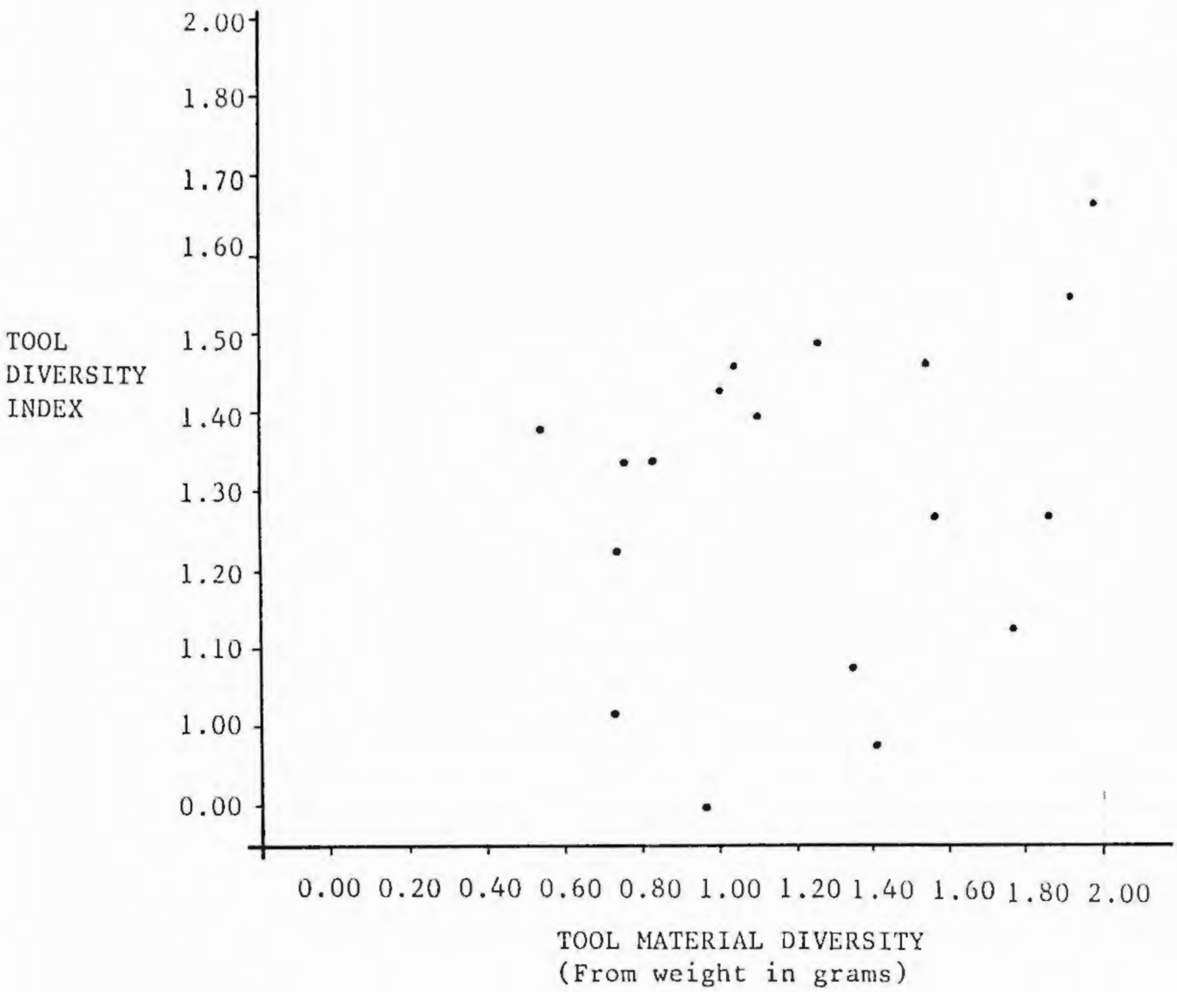


Figure 9. Correlation of tool diversity and tool material type diversity for all assemblages

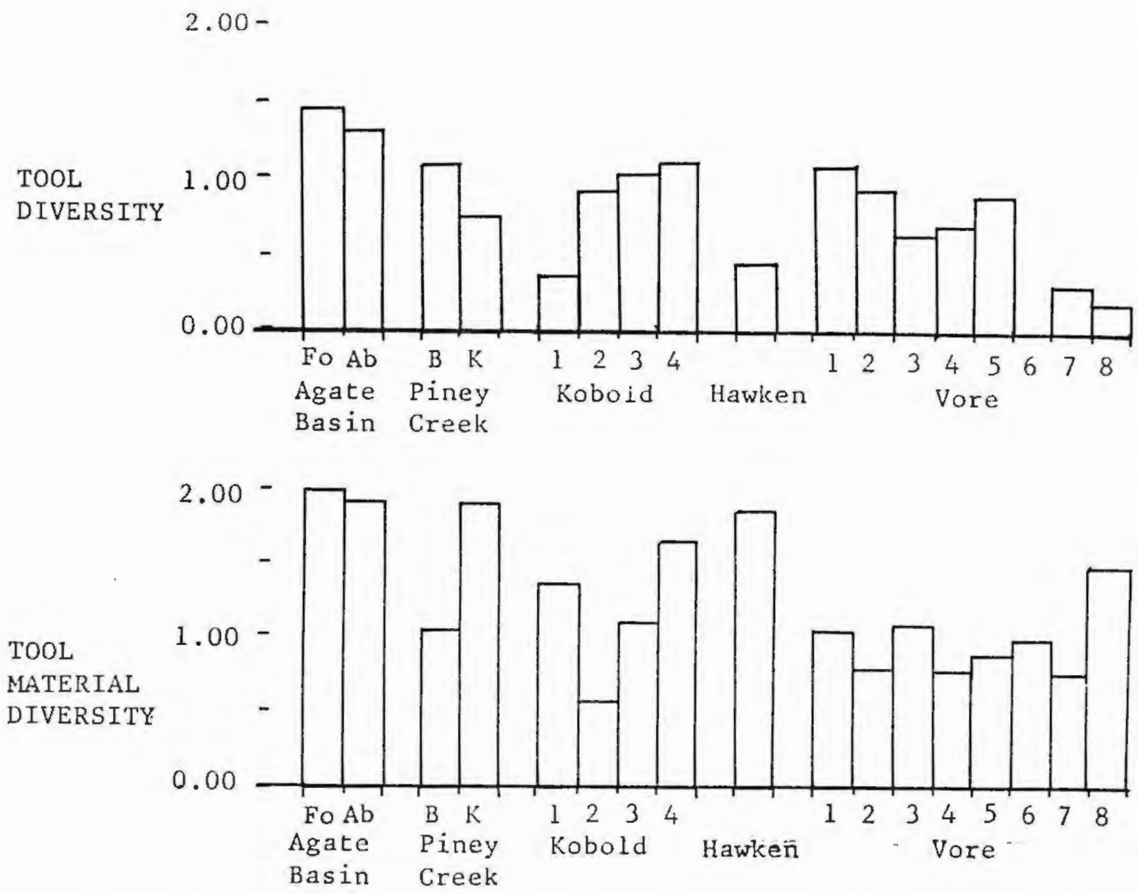


Figure 10. Comparison of tool diversity indicies and tool material type diversity indicies at the five sites anal'zed.

but reverses the ranking of the Agate Basin and Folsom components. Depending upon which of the diversity indices were used for comparing the Folsom and Agate Basin assemblages to each other or to other sites, different conclusions might be drawn.

In summary, there may be a relatively wide range in the tool diversity indices calculated from sites which actually represent similar functions. This should be considered in the application of diversity indices for determining site functions. If the potential range of variation is not understood, inaccuracies in the identification of site type may result, especially when diversity indices are use to determine site types of surface lithic scatters. It is clear that the diversity of raw materials reflects more than site type. Interpretations and corollaries of the basic assumption upon which diversity indices are based must be carefully considered for their validity in interpreting site functions.

Raw Material Frequencies

The major material types for the assemblages were analyzed for their relative frequency in the assemblages. Cumulative graphs reveal similarities and differences in raw material representations within and between sites.

Kobold Site

The most common raw material in the Kobold assemblage is porcellanite which is attributed primarily to the site's proximity to porcellanite sources. The Kobold site is located within the source area of good quality porcellanite. Tools of porcellanite comprise

44% of the assemblage in level 1 and 54% to 73% of the material in levels 2 through 4.

The predominance of tools of porcellanite in all levels suggest intensive exploitation of the Powder River Basin which is the source area of this material. The relative scarcity of raw materials from higher elevations suggests that these areas had not been recently exploited prior to the site events. Had the occupants of the site geared up at higher elevations with lithic materials for tools and weapons for the kill, the dominant materials would probably have been cherts and quartzites. Utilization of these higher elevations is suggested by the presence of artifacts of Mississippian and Pennsylvanian cherts, Morrison quartzite and/or Permian Age Phosphoria chert, though tools of these materials make up only small portions of the assemblages. Lower Cretaceous Age quartzites generally comprise a somewhat larger percent of the material.

The Kobold site exhibits variation between levels in the relative frequency (by weight) of Lower Cretaceous quartzites and porcellanite (Figure 11). There appears to be an inverse relationship between these two materials such that as the amount of Lower Cretaceous quartzite increases, the amount of porcellanite decreases. Lower Cretaceous quartzite represents a mountain foothills source while porcellanite comes from the basin. Both materials are available within 100 kilometers of the site. The relatively low frequency of Lower Cretaceous quartzite and high frequency of porcellanite in levels 2, 3, and 4 might indicate that the basin was the most recently exploited area, while the dominance of Lower Cretaceous

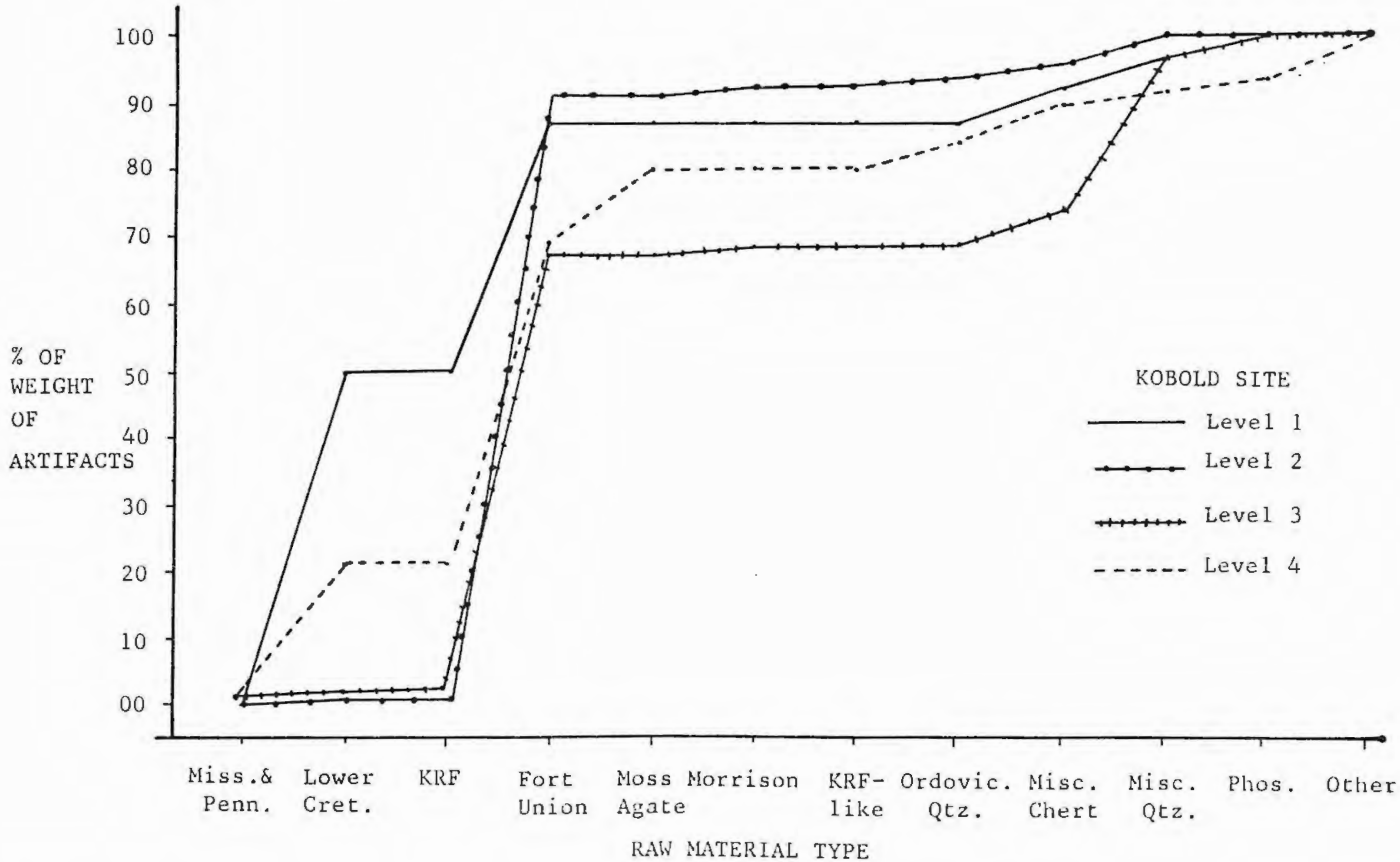


Figure 11. Cumulative graph comparing raw material types by level in the Kobold site.

quartzites in level 1 suggests the mountain foothills area may have been more recently exploited prior to that occupation.

This information may be applied to a model of seasonal settlement (Loendorf 1973). The model of seasonal settlement in Figure 12 illustrates the movement of groups as a response to seasonal availability of food resources in relation to raw material sources. Basin areas, in general, are most productive in spring and fall in terms of food resources. In summer the higher elevations become more productive as plants become available. Figure 13, which is derived from the model in Figure 12 represents the expected raw material frequency based on assumed raw material fall-off rates. The seasonality of all four levels of the Kobold site was determined from tooth eruption schedules of bison to be around September or October (Frison 1970). Based on the models presented in Figures 12 and 13 the frequency of raw material types at Kobold supports a fall occupation for each component. It might be that the occupations of levels 1 and 4 occurred earlier in the fall than the occupations of levels 2 and 3 because the former contain more upland materials suggesting more recent exploitation of that source.

Level 1 of the Kobold site contains only 10 artifacts (Frison 1970:9), nine of which were located for analysis. Eight of these are projectile points and one is a biface. Half of the projectile points are made of porcellanite and one of vitrophyre, a glassy porcellanite. Frison (1970:11) reports that 53 of the total of 60 flakes which comprise the debitage from level 1 are of porcellanite.

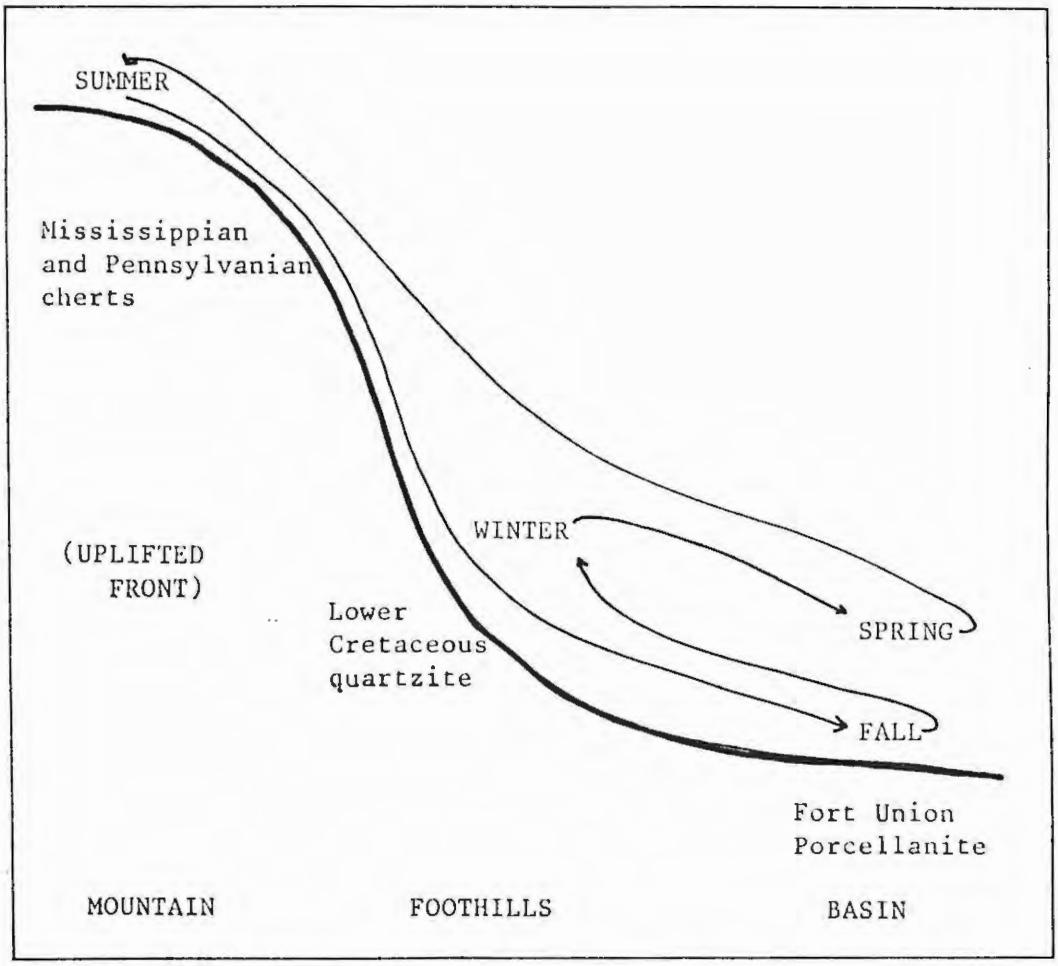


Figure 12. Model of seasonal settlement in relation to raw material sources along an uplifted front.

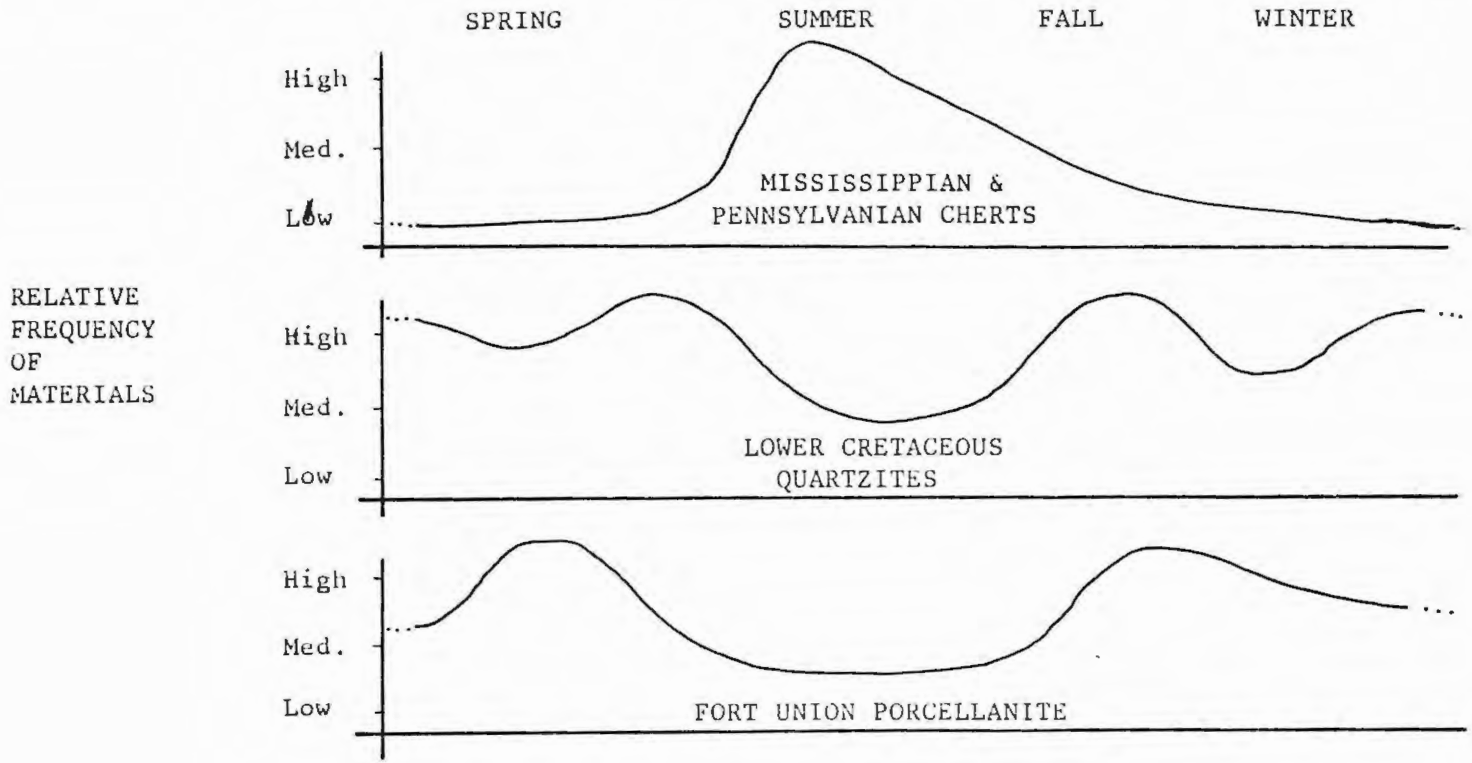


Figure 13. Model of raw material frequencies based on the model of seasonal settlement.

The remaining six flakes are of chert and quartzite.

Level 2 of the Kobold site contains more artifacts (84 items). Tools of porcellanite account for 71.4% of the assemblage (89% of the weight), over half of these are projectile points, and a third are utilized flakes. Frison (1970:13) notes that tool sharpening flakes indicate there were at one time more tools present than were recovered in excavation. These flakes are also dominated by porcellanite. He reports that 707 porcellanite flakes, 70 quartzite flakes, and 34 chert flakes comprise the debitage.

In level 3 of the Kobold site 73% of the 112 tools (65% of the weight) are made of porcellanite. Again projectile points and utilized flakes of porcellanite dominate the assemblage though there is one projectile point of obsidian (Frison 1970:9 reports 2). Frison (1970) notes that in the debitage there were 11 obsidian flakes, 1116 porcellanite flakes, 110 quartzite flakes, and 82 chert flakes.

Level 4 of the Kobold site contains the greatest number of artifacts (460 items) and is the most complex of the four components with nine tool categories represented. Like the other three components, the assemblage is dominated by projectile points (51.8%) and utilized flakes (31.0%). Sixteen material types are represented in level 4, compared to 11 for level 3, 9 for level 2, and 6 for level 1. The greatest range in material types in level 4 is exhibited in projectile points. Porcellanite dominates the entire assemblage, comprising 53.6% of the tools and 58% of the raw material weight. Exploitation of other areas is evident in the presence of Mississippian and Pennsylvanian cherts (2.5% of number, 2% of weight), Lower Cretaceous quartzite (20.6% of number, 19% of weight), and Permian Age Phosphoria chert (3.9% of number, 2% of weight). In addition, there is greater variety of miscellaneous quartzites and cherts than were evident in the other three levels. Frison (1970:11, 20, 24) reports 12 artifacts of obsidian as well as retouch flakes which suggests contacts with areas to the west or utilization of that area.

Level 4 at Kobold is somewhat distinct in composition from the other three levels. The greater number of tool types represented and greater variety of raw materials, including miscellaneous raw materials might be attributed, in part, to the additional activities associated with the post-kill occupation of the site.

The similarities and differences noted between the tool assemblages of level 1 through 4 at Kobold are somewhat paralleled in the material types represented. Level 4 has the most diverse tool assemblage as well as the most diverse raw material representation. Level 1 has the least diverse tool assemblage and few raw material types. Levels 2 and 3 are roughly similar in terms of diversity of tools and also in the number of raw materials represented.

Piney Creek Site

Though there are different frequencies, basically, the same raw materials represented at the Piney Creek site are found at Kobold. This may suggest similarity of adaptation strategies resulting in exploitation of similar raw materials.

Piney Creek kill and butchering areas, in contrast to all levels of Kobold, have a relatively high frequency of Mississippian and Pennsylvanian cherts. Piney Creek site is closer to the source of this material than is Kobold. Since it is also closer to sources of Lower Cretaceous Age quartzites of which there are very few in the site, this might indicate better sources of cherts are available further south. Or, it may indicate that the Piney Creek kill occurred earlier in the fall when the assemblage still contained a relatively high frequency of cherts acquired during summer occupation of the higher elevation (See Figure 12 and 13).

The kill and butchering areas of the Piney Creek site are similar in the major raw material types represented, but the frequencies of the materials differ (Figure 14). There appears to be an inverse relationship in the ratio of Lower Cretaceous quartzites and porcellanite at Piney Creek, as there was at Kobold. The butchering area at Piney Creek site has no Lower Cretaceous quartzites, but a relatively high frequency of porcellanite. The kill area contains some of these quartzites and exhibits a relatively lower frequency of porcellanite. Seasonality is not a factor here as these site areas are contemporaneous. Function of the site areas and material preference may, however, be important functions since the Lower Cretaceous quartzites at the kill location are all projectile points.

Material preference is likely to bias the representation of certain materials in a site. A dominance of certain material types or high correlation between certain tool types and particular materials is generally assumed to indicate a preference for that material. However, the availability of the material may actually be

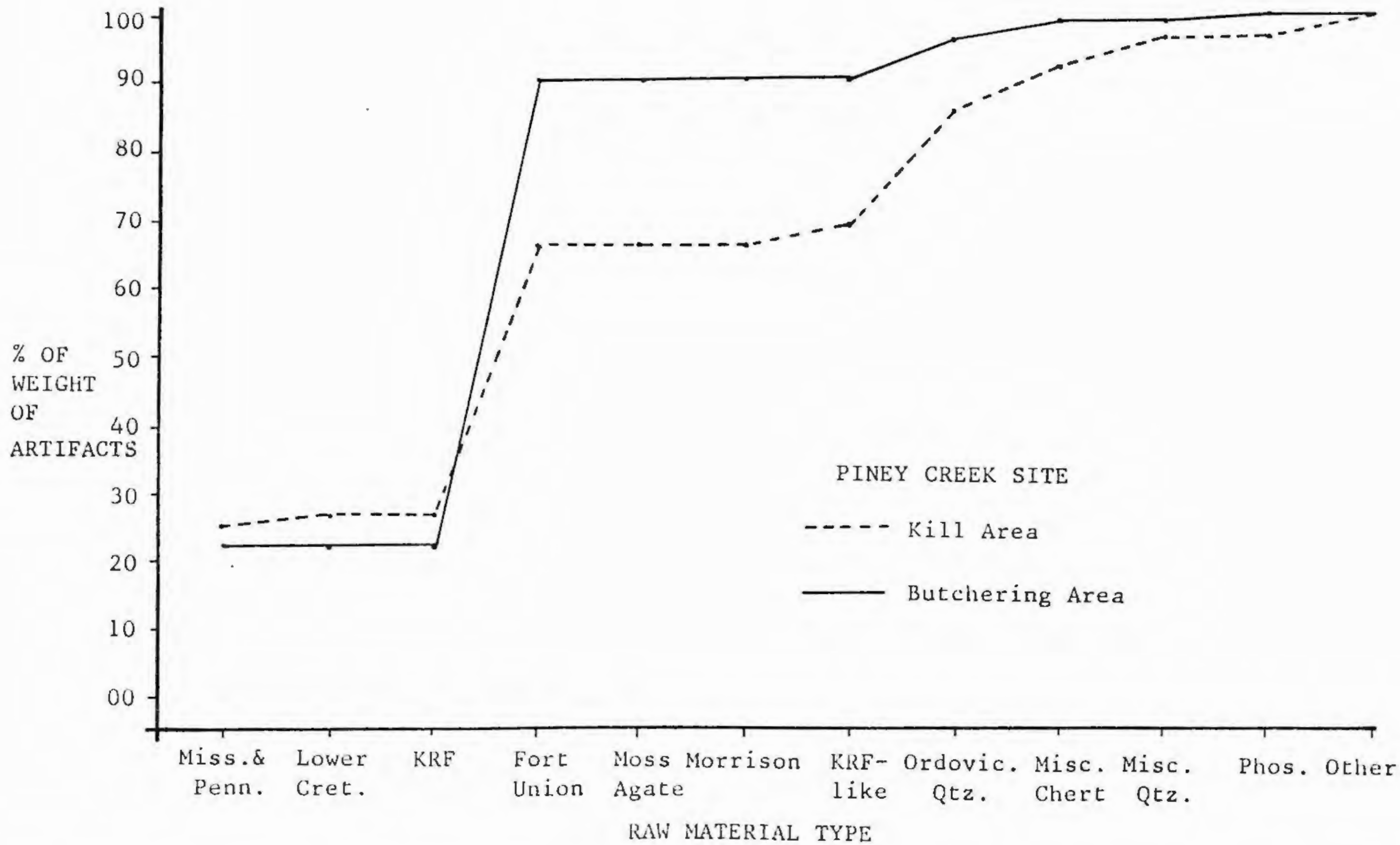


Figure 14. Cumulative graph comparing raw material types of the kill and butchering areas of Piney Creek site.

the controlling factor. If proximity and availability are important factors, then the relative frequency of raw material should be roughly proportional to the overall relative availability of that material in the environment in relation to other materials. Examination of the tools and material types at the Piney Creek butchering area illustrates this situation. Sixty-five percent of the tools are made of porcellanite (67% of the weight). Mississippian and Pennsylvanian cherts are the second dominant material making up 22% of the tools (23% of the weight). Ten other material types make up the remaining 13% of the tools (23% of weight) in the assemblage. The predominance of porcellanite at Piney Creek is not attributed to preference for the material over the Mississippian and Pennsylvanian cherts or other silicates. Porcellanite is not as hard a material nor does it in general have the good flaking quality of silicates (quartzites and cherts). However, the Fort Union Formation is exposed in the vicinity of the site and sources of good quality porcellanite are known to occur to the north around Sheridan, Wyoming and Decker, Montana.

Several materials are absent in the butchering area and found only in projectile points in the kill area at Piney Creek. These include obsidian, Knife River flint-like chert, moss agate and Lower Cretaceous quartzite. The fact that these materials are present only in projectile points suggests they may be curated items. Frison (1967:55) reports obsidian as comprising .6% of the weight of debitage in the butchering area and absent in the debitage of the kill area. In addition, Frison (1967:55) notes that it comprised 12% of the debitage weight for material in the campsite (48J0311). Sources of obsidian are over 300 kilometers west of the Piney Creek site in the Jackson and Yellowstone Park area. It is not known whether this material was procured directly by the group or acquired through trade. In either case, contact with regions to the west is indicated. The Knife River Flint-like material, is believed to originate east of the Black Hills and, thus, also represents a relatively distant source. Together, these two materials indicate a wide area of contact. The moss agate and Lower Cretaceous quartzite are available around the Bighorn and Pryor Mountains as well as in the Black Hills. Their relative scarcity in the assemblage might indicate the more distant source, though this is only speculation.

Curation was a factor in the representation of materials at Piney Creek. Frison (1967:11, 18) notes that "a far greater number" of tools are represented by the retouched flakes than were recovered. This is based to a large extent on material types. Detailed analysis of retouch flakes and their raw materials might indicate the number and types of tools which were carried away from the site. Frison (1967:7) notes that at least twenty more tools are represented in the retouch flakes from the camp site at Piney Creek than were recovered in excavation.

Vore Site

The Vore site in the Black Hills exhibits variation in the major material sources represented in levels 1 through 8, as is illustrated in the cumulative graph (Figure 15). The greatest differences are in

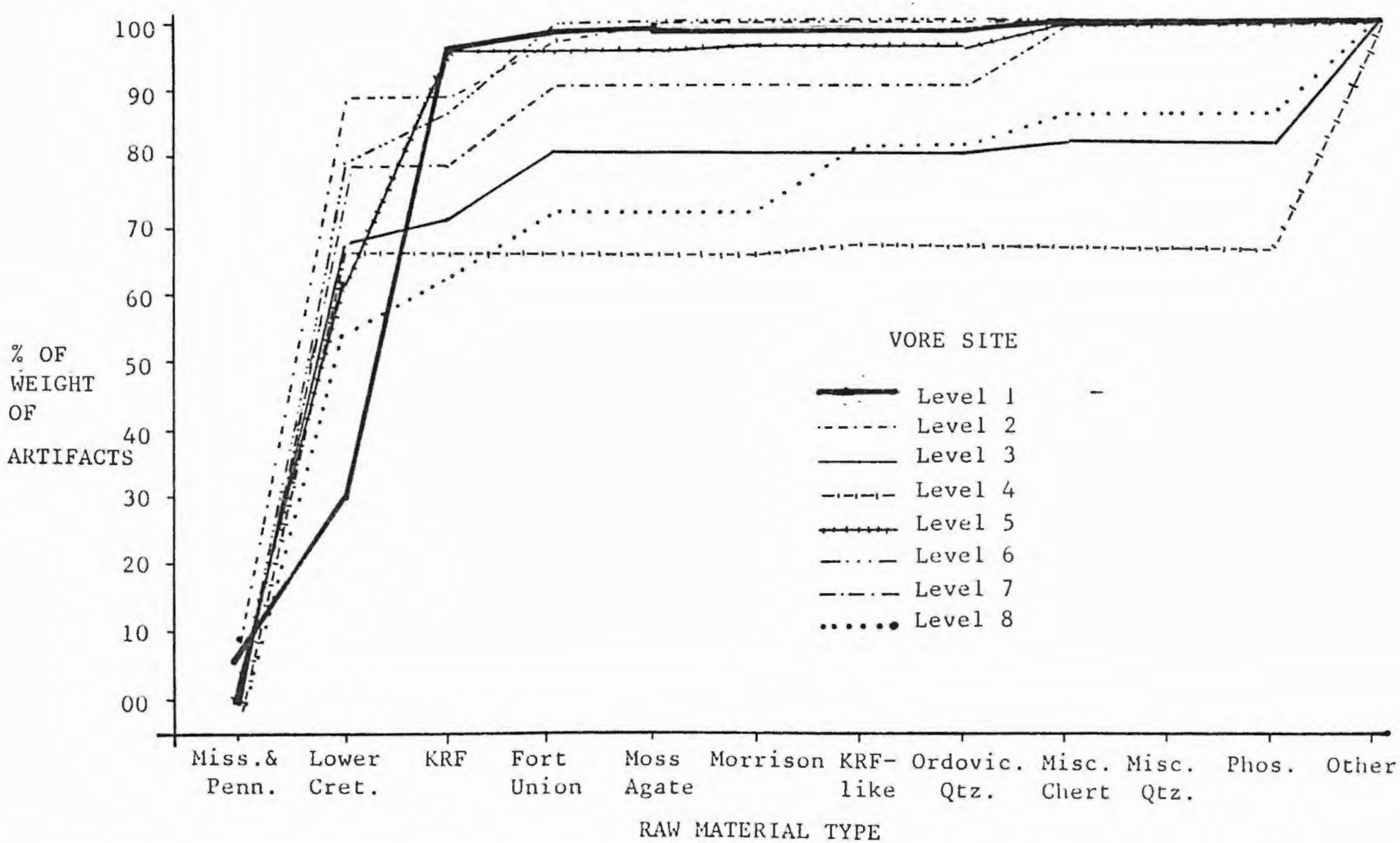


Figure 15. Cumulative graph comparing raw material types by level in the Vore site.

the varying frequencies of Lower Cretaceous quartzites and Knife River Flint. Level 1 is different from the other 7 levels with a low frequency of Lower Cretaceous quartzites and a high frequency of Knife River Flint. Level 5 also exhibits a relatively high frequency of Knife River Flint, though not to the extent of level 1. The high frequency of Knife River Flint in levels 1 and 5 might suggest more intensive or more recent utilization of areas north of the Black Hills than is exhibited in the other levels.

The differences in raw material frequency may be reflecting seasonality. Reher and Frison (1980:66) present data on the season of use of the site based on bison tooth eruption and wear schedules. If seasonality were an important factor in the representation of raw materials, then levels which represent similar seasons of use might reflect similarities in the raw materials represented. However, in the Vore assemblage there is not a strong correlation between levels which represent similar seasons. For example, Levels 2 and 4, which indicate spring and summer occupations, differ significantly in the amount of porcellanite and miscellaneous quartzites represented. Levels 3 and 5 represent the most intensive use throughout the year, yet reflect differences in raw material representation.

It is pertinent to mention that projectile point styles indicate that the Vore site was utilized by five different ethnic groups throughout its period of use (Reher and Frison 1980:121, 142). In addition, historically there has been a great deal of movement of Plains Indian groups through the northeastern Wyoming area (Reher and

Frison 1980:29-35). Both factors undoubtedly account for some of the variability in raw materials in the Vore site. Knife River Flint is present in 5 of the 8 levels (levels 1, 3, 5, 6, 8) at the Vore site. The frequency of this material, given the distance to its source area suggests it is a valued resource. The frequency of Knife River Flint is very similar to that of porcellanite, a poorer quality material from a much closer source area.

Morrison quartzite makes up only a small percent of the raw material at the Vore site in the two levels in which it is present (2.5% of level 1, 2.6% of level 5). The low frequency of this material in the Vore assemblage may be due to less extensive exploitation of the Black Hills area. The high frequency of Lower Cretaceous quartzites which appear to be from the Hartville region, and relatively high frequency of Knife River Flint from North Dakota and porcellanite from the Powder River Basin suggest these areas were more extensively exploited prior to the kill event.

Hawken Site

The Hawken site is located in the Black Hills, as is the Vore site, but reflects very different raw material patterns (Figure 16). Comparison of the raw material types of the Vore and Hawken sites illustrates that the location of a site with respect to raw material sources does not necessarily dictate the kinds or amounts of materials which will be represented in the assemblage. The Hawken site contains a relatively high frequency of Mississippian and Pennsylvanian cherts and much lower frequency of Lower Cretaceous quartzite while the reverse is true for the Vore site. In addition,

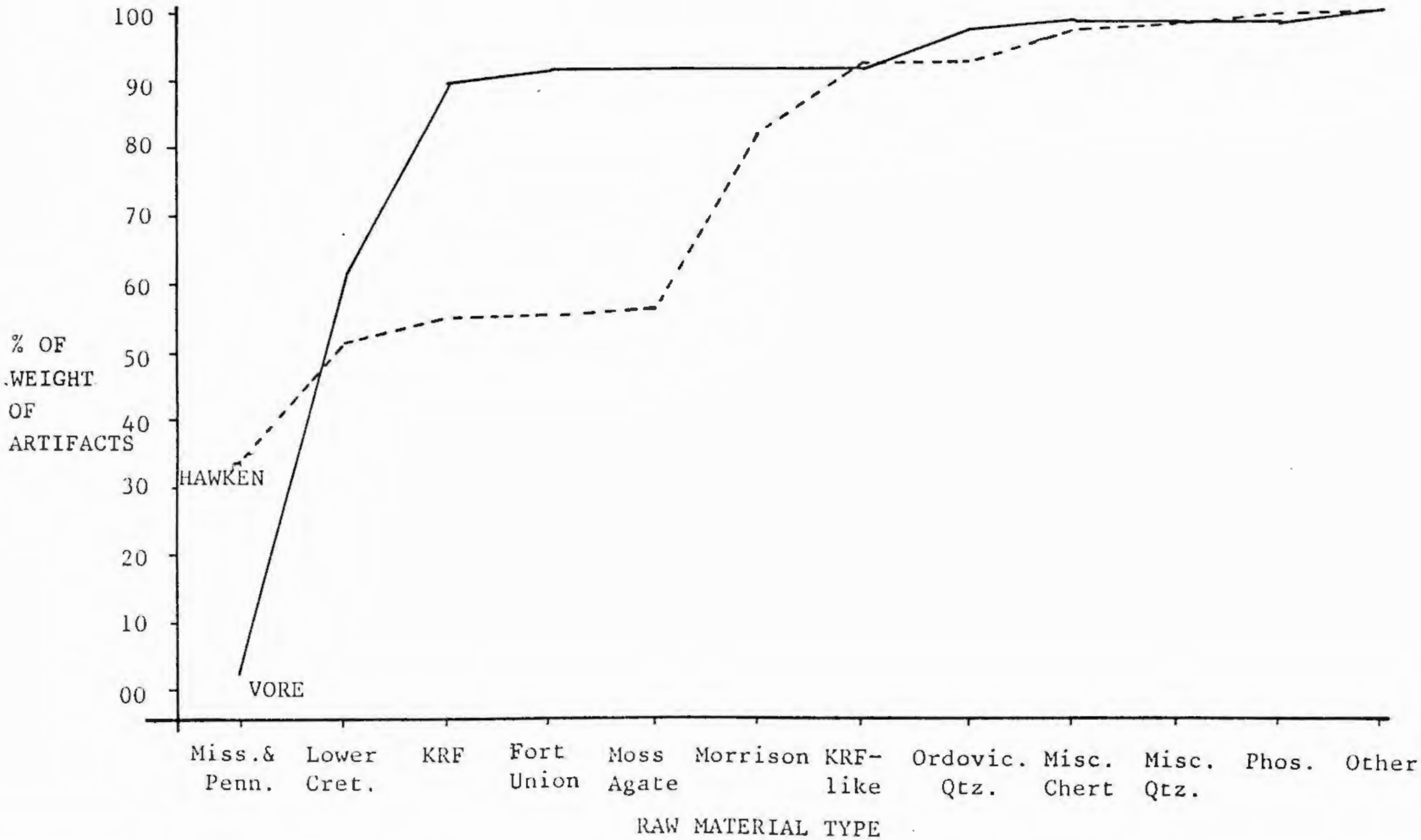


Figure 16. Cumulative graph comparing raw material types at Hawken and Vore sites.

the Lower Cretaceous Age quartzites of Vore and Hawken appear to come from different source areas. Most of the quartzites in the Vore site are similar in color and grain size to the material from the Hartville Uplift area, while the Lower Cretaceous quartzites from Hawken are more similar to the material from the Black Hills. The Hawken assemblage also has quartzite from the Jurassic Age Morrison Formation and Knife River Flint-like chert, while the Vore assemblages have only trace amounts of both. The dominant materials at the Hawken site are from sources in and around the Black Hills, suggesting that this area was intensely exploited by the occupants of the site. In contrast, the dominant materials in the Vore assemblages are quartzites from the Hartville area, Knife River Flint from southeastern North Dakota, and porcellanite from the Powder River Basin. These materials represent a much larger area of exploitation. If it had not been possible to distinguish between the quartzites from the Hartville Uplift and Black Hills source areas, then it would have been assumed that the quartzites were from the Black Hills because it is the nearest potential source. Assuming the nearest source for a raw material may result in an interpretation of a smaller home range than is actually the case. The size of the area represented by raw materials may reflect the type of social aggregation at the kill site. The predominance of materials from distant sources might represent the aggregation of bands, while materials from closer sources might represent the aggregation of one or more dispersed family groups. Reher and Frison (1980:131-133) suggest the

Hawken site represents a dispersed local group while Vore represents the aggregation of centralized bands.

The high frequency of Mississippian and Pennsylvanian cherts at the Hawken site and relatively low frequency of Lower Cretaceous quartzites is unexpected. Present knowledge of Mississippian and Pennsylvanian chert sources in the Black Hills suggests that cherts of good quality are relatively limited. Unfortunately, it is not possible at present to distinguish these cherts by source area. Preliminary observations on the Black Hills cherts and Hartville Uplift cherts suggests there may be some visual differences between the two. However, based on the relatively small samples of cherts from the Black Hills, it would be speculative to make distinctions between the materials.

Multiple occupancies of the Hawken site during the Early Plains Archaic is suggested, but as most of the material was recovered from the back dirt of unauthorized excavations, differentiation between the separate bison kill events in the archeological assemblage was not possible. Analysis of the assemblage as a whole may result in somewhat different interpretations than would be attained were it possible to separate the material from each occupation. The Vore site assemblage illustrates this point. The Vore site represents several kill events over 300 years during the Late Prehistoric Period (Reher and Frison 1980:1). Many differences are noted between the material types and tool types in the different levels. The Vore site represents a wider span of seasonal use than Hawken; this is likely to influence the amount of similarity and difference between levels.

Therefore, the differences between levels exemplified in the Vore assemblage may be greater than those expected for the Hawken site.

The diversity indices based on tool types for levels 1 through 8 of the Vore site range from 0 to 1.05 (Figure 10). When the site is considered as a whole (i.e. all levels are combined), the diversity index which results is .73. The diversity indices for levels 6, 7, and 8 fall far below this number while levels 1, 2, and 5 have considerably higher indices. The .73 index is also greater than the averaged index from levels 1 though 8 (.56 or .64 without level 6). The diversity indices for tool material types calculated for levels 1 through 8 range from .75 to 1.47, with the average at .95. However, when all assemblages are considered as one, the diversity index is 1.58, considerably higher than that of any one level. These differences might be significant if the diversity indices were to be used for comparative purposes as they often are for the analysis of site function.

A total of 15 material types are evident at the Vore site. However, only 4 to 8 raw material types are represented in each level. In addition, not all levels contain the same raw materials or the same frequency of materials. The Lower Cretaceous quartzite and porcellanite are the only two material types which levels 1 through 8 have in common. The cumulative graphs (Figures 15 and 16) illustrate the differences between the combined Vore assemblage and the individual levels. Taken as a whole, Mississippian and Pennsylvanian cherts in the Vore assemblage make up only a small percent of the raw materials while Lower Cretaceous quartzites are the predominant material with Knife River Flint the second most common material. Porcellanite appears to represent only a very small percent of the combined assemblages. Examination of the raw materials by individual level indicates the combined assemblage is not representative of the site assemblage as a whole. Level 1 contains relatively little Lower Cretaceous quartzite, and Knife River Flint is the dominant material. In contrast, 80% of the material in level 2 is Lower Cretaceous quartzite and Knife River Flint is totally absent. All but three levels have a much higher proportion of porcellanite than is represented in the overall figure.

In summary, there is variation between levels in raw material representation at the Vore site. This might indicate variability in the intensity of expoitation of different regional areas. Figure 16, which represents the combined levels, is actually representative of only one of the eight levels (level 5). Therefore, interpretations based on this figure may not be accurate for examining the areas of exploitation and resource utilization.

Figure 15 does indicate Lower Cretaceous quartzites from the Hartville Uplift-Old Woman anticline area, Knife River Flint from North Dakota and porcellanite from the Powder River Basin as the major materials exploited by occupants of the Vore site. However, interpretation based on the relative frequencies of these materials may not be accurate. Caution is, therefore, appropriate in the examination and interpretation of raw material frequencies in assemblages which may represent several occupations.

Agate Basin Site

Analysis of the raw materials from the Folsom and Agate Basin components of the Agate Basin site reveals some similarities and differences in the make-up of the assemblages. The differences are not likely to be due to differential recovery in the field as the matrix of both Agate Basin and Folsom levels was waterscreened using 1/8 inch mesh. Since the assumption of similar erosional processes acting on both components is made, the similarities and differences are therefore attributed to behavioral processes.

Basically, the same raw materials are represented in the Folsom and Agate Basin assemblages with the exception that there is no Morrison quartzite in the Folsom level and no non-volcanic glass in the Agate Basin component. Furthermore, the same material types tend to predominate in both assemblages. These are Mississippian and Pennsylvanian cherts, Lower Cretaceous quartzites, Knife River Flint, and local moss agate. Other things being equal, the similarity of the raw materials suggests that approximately the same areas were exploited by the inhabitants of both the Folsom and Agate Basin levels.

Raw material frequencies for the artifacts from the Folsom and Agate Basin levels are similar to each other as are the raw material frequencies for the debitage (Figure 17). It had been assumed that the raw materials of artifacts and debitage for one component would more closely resemble each other than another level, however, this was not the case (Figure 17). The similarity in the frequency of materials among tools for the Agate Basin and Folsom assemblage

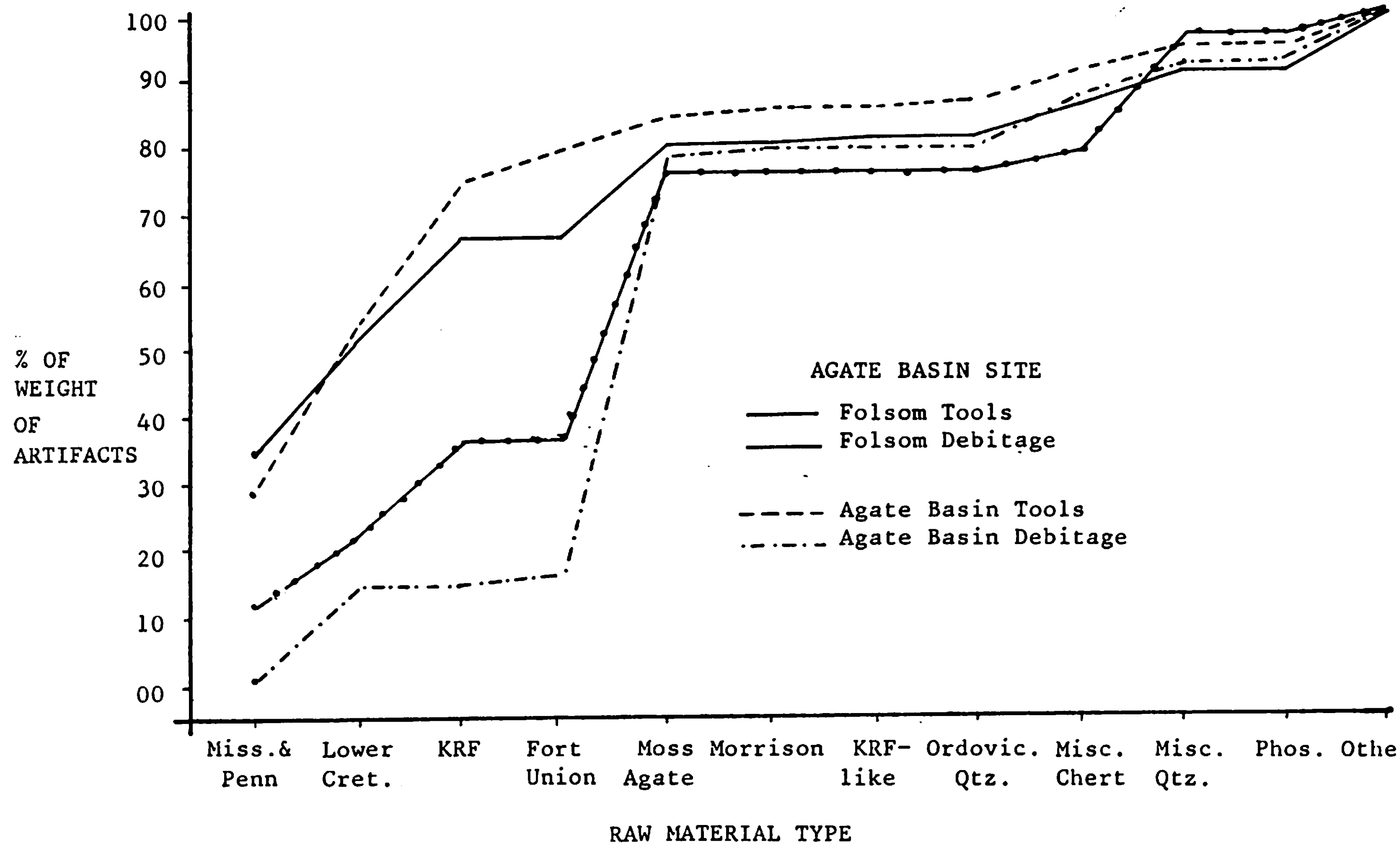


Figure 17. Cumulative graph comparing raw material types of the Folsom and Agate Basin components of the Agate Basin site.

suggests that similar forces were in effect for selection and acquisition of raw materials for tool manufacture. Apparently, the Mississippian and Pennsylvanian cherts, Lower Cretaceous quartzites and Knife River Flint were preferred for tools in both components. Moss agate from local lag deposits was utilized extensively in both components as shown from the debitage, but makes up only a small percent of the tools.

The differences in raw material frequency between the tools and debitage is important given different inferences which might be drawn if only the tools or only the debitage were studied. Analysis of tools suggests that moss agate, a material locally available around the site, was not extensively utilized especially in the Agate Basin level. The debitage, in contrast, indicates that moss agate is one of the dominant material types.

The lack of debitage in relation to tools is also informative. In the Agate Basin component a high proportion of tools were of Knife River Flint but the material is absent in the debitage. This suggests that tools of Knife River Flint were not manufactured or reworked at the site but were brought to the site in finished form. In comparison, Knife River Flint is present in nearly equal frequency in the tools and the debitage of the Folsom component. This would indicate that some working of tools of this material was performed however, there is not enough debitage to account for all of the tools, indicating that many of the tools were brought to the site already completed. This appears to be the case for nearly all the tools and materials represented in both assemblages with the exception of moss agate.

Porcellanite makes up only a small percent of the materials of both the Agate Basin and Folsom components with the Agate Basin component containing slightly more. In both components porcellanite makes up a slightly larger percent of the tools than the debitage. Porcellanite is not immediately available around the Agate Basin site, nor is it generally as good a quality material as the cherts and quartzites available in the Hartville Uplift and Black Hills. With good quality cherts and quartzites in hand, presumably a large amountof porcellanite would not have been used, although it appears that some tools of this material were curated, and possibly reworked. The porcellanite from the northern portions of the Powder River Basin is generally of good quality. However, even this is not as hard a material as chert or quartzite. Thus, it is unlikely that porcellanite would have been an item of exchange. The material is considered to represent direct procurement and thus reflects utilization of the Powder River Basin. The porcellanite at the site is of good quality which suggests it originated in the northern portion of the Powder River Basin in Wyoming and Montana.

The debitage of the Agate Basin component makes up a much larger percent (61%) of the total assemblage weight (tools and debitage) than does the debitage of the Folsom assemblage (49%). By weight there is more debitage in the Agate Basin component, but in actual numbers, there is more debitage in the Folsom assemblage. Comparison of the number of items by size grade categories indicates differences in material utilization between assemblages. Overall, the debitage of the Agate Basin assemblage is generally larger than that of the Folsom assemblage (Table VII).

Comparison of raw material types by size grade categories indicated differences in raw material utilization between the Folsom and Agate Basin assemblages (Table VII). The debitage from the Agate Basin component is dominated in nearly all material types by size grade 3 material (1/2 - 1 inch), and also contains more flakes of size grade 4 (1-2 inches) than the Folsom component. Seven raw material types in the Agate Basin assemblage contain flakes of size grade 5 (Numbers 2, 8, 10, 18, 22, 24, 26) and one raw material type has flakes of size grade 6 (Number 8; see Table II for raw material code numbers).

The debitage of the entire Folsom component contains approximately the same number of size grade 2 material as size grade 3 material (see Table VII). However, examination of the size grades of each material type reveals that there are some major differences. Moss agate is locally available in the area of the site and is the only material in the Folsom debitage which has flakes of size grade 5 and/or 6. Mississippian and Pennsylvanian chert have nearly twice as many flakes of size grade 2 as of size grade 3. In contrast, Lower Cretaceous Age quartzite and moss agate have nearly half the number of flakes in size grade 2 as in size grade 3. Knife River Flint has nearly equal amounts of size grade 2 and 3 material.

If the same activities relating to tool and raw material use were performed in the Agate Basin and Folsom components, then one would

TABLE VII

PERCENT OF DEBITAGE (BY COUNT) OF SELECTED RAW MATERIAL TYPES BY SIZE GRADE CATEGORY FOR THE AGATE BASIN SITE ASSEMBLAGES

	Size Grade (% of #)				
FOLSOM LEVEL:	2	3	4	5	6
Mississippian & Pennsylvanian	62.9	34.3	2.8	0	0
Lower Cretaceous	33.9	54.8	11.3	0	0
Knife River Flint	48.4	44.8	6.9	0	0
Moss Agate	31.7	54.3	12.3	1.2	0.4
Knife River Flint-like	33.3	66.7	0	0	0
Total of All Materials In Assemblage	48.6	43.3	7.8	0.2	0.1
AGATE BASIN LEVEL:					
Mississippian & Pennsylvanian	16.4	69.8	13.8	0	0
Lower Cretaceous	23.8	64.3	11.7	0.2	0
Knife River Flint	25.0	65.0	10.0	0	0
Porcellanite	23.9	58.0	18.2	0	0
Moss Agate	14.5	55.9	26.4	2.9	0.2
Morrison	11.4	65.7	22.9	0	0
Knife River Flint-like	20.0	40.0	26.6	13.0	0
Petrified Wood	6.4	53.2	38.3	2.1	0
Total of All Materials In Assemblage	18.8	60.9	19.1	1.3	0.1

expect similar debitage patterns to result. However, the same patterns are not apparent in size grade categories. The Folsom debitage indicates greater variability in the use of different raw materials as demonstrated by the variation between the relative frequencies of size grade 2 and 3 materials. Frison and Stanford (1982b:70) note that projectile point manufacture was a major activity in the Agate Basin Folsom level which helps to account for the high proportion of small flakes. In addition, he states that while some core and biface reduction occurred in the Folsom level most was probably done elsewhere. In regard to the Agate Basin component, Frison and Stanford (1982b:130) note that core and biface reduction flakes are abundant in the assemblage while tool sharpening flakes are relatively rare.

Reher and Frison (1980:128) note that the communal bison kill is essentially the point of overlap of several band or family territories and that the lithic assemblages of kill sites are usually dominated by lithic material types from the main quarries utilized by each social segment. Three basic assumptions are presented by Reher and Frison (1980:128) as a basis for the interpretation of lithic raw materials in kill site assemblages: First, that other things being equal, the distribution of sources represented in the kill site assemblages approximately denotes the territory exploited by the site users. Second, the distance to the sources is proportional to the territory size, and finally that the percent of material derived from a given source area is roughly proportional to the number of people from that area. The first two assumptions appear to be straightforward. However, the third assumption is more complex because it involves the frequency of materials. This analysis has suggested that several factors may influence these frequencies. For example, the frequency of material may vary according to distance to source, the season of occupation, or the unit of measure. Material from the Folsom and Agate Basin components of the Agate Basin site are used to illustrate these differences as shown in Table VIII. There is often a significant difference between raw material frequencies calculated from artifacts and those calculated from debitage. In addition, there may be a difference in the relative frequency of materials based on the number of items and the relative frequency of materials based on the weight of the same items. Therefore, the percentage of a raw material type can vary greatly depending upon whether it is calculated from the number of items of that material type or weight of the material. Additionally, the frequencies of raw material type may vary depending on whether they are calculated from artifacts, debitage or both.

Generally, archeologists assume that as distance from a given source increases, the amount of material from that source decreases, including the amount of material with cortex. At the Agate Basin site, Knife River Flint represents the most distant known source. The Knife River Flint source area is about 520 kilometers to the north, yet in quantity, it ranks among the top four raw materials. The other three materials are local moss agates, Mississippian and Pennsylvanian cherts, and Lower Cretaceous quartzite, all of which

TABLE VIII

FREQUENCIES OF THE FOUR MAJOR RAW MATERIALS AT THE AGATE BASIN SITE BASED ON NUMBER OF ITEMS AND WEIGHT OF MATERIALS

	Tools		Debitage		Tools		Debitage	
	%#	%WT	%#	%WT	%#	%WT	%#	%WT
Mississippian & Pennsylvanian chert	27	35	40	13	35	27	9	2
Lower Cretaceous quartzite	14	17	11	11	19	27	38	13
Knife River Flint	31	15	27	14	22	21	1	0.4
Moss agate	11	13	14	39	5	5	28	62

are available within 100 kilometers of the site. In the Agate Basin assemblage there are 41 artifacts of Knife River Flint but little debitage, as might be expected of material from such a distant source. In the Folsom material, however, there are 74 artifacts of Knife River Flint as well as a relatively large amount of debitage. The debitage exceeds that of the Lower Cretaceous quartzite in number and weight, though the quartzite represents a closer source. The amount of debitage of Knife River Flint also exceeds that of the Mississippian and Pennsylvanian cherts in weight, though not in number of flakes.

In the Folsom assemblage, the number of flakes of Knife River Flint with cortex (14) exceeds the number of cortex flakes of Lower Cretaceous quartzite (4) and of Mississippian and Pennsylvanian cherts (5). The cortex of Knife River Flint is generally thin and does not necessarily lower the quality of the material as is generally the case with the cortex of lithic materials. In the Agate Basin material, there are three flakes of Knife River Flint with cortex, 20 flakes of Mississippian and Pennsylvanian chert with cortex and 16 flakes of Lower Cretaceous quartzite with cortex. Evidently, the number of flakes with cortex does not necessarily indicate the proximity of the source.

An important factor in the correlation of cortex with distance to source may be the relative frequency of cortex. In the debitage of the Agate Basin site the number of flakes with cortex from sources greater than 40 kilometers comprise between 0 and 13.4% of the assemblage with 15% for Knife River Flint (Table IX). The number of

TABLE IX

DISTANCE TO SOURCE AND PERCENT OF DEBITAGE (BY NUMBER) WITH CORTEX FROM THE AGATE BASIN SITE

Distance to source in km	*Material Type	Percentage of debitage with cortex Folsom Level	Agate Basin Level
0-40	8	16.9	31.0
0-40	20, 22, 26	50.0	29.2
40-150	1	0.7	1.7
40-150	2	2.2	2.3
40-150	9	0	2.9
40-150	18	0	13.4
300	7	0	5.7
350	3	3.0	15.0
Unknown	10	46.9	32.3
Unknown	12	0	23.0

* Refer to Table II for raw material key.

cortex flakes of materials available within 40 kilometers ranges from 16.9% to 50%. Miscellaneous material types with cortex from both assemblages range between 23% and 46.9%, which falls within the range for closer sources. It is noted that this analysis is based only on two assemblages from one site, and is suggestive, but by no means conclusive.

Moss agate is available in the immediate environs of the Agate Basin site and it is one of the dominant materials in both components of the site. The amount of debitage is considerably greater than the amount of artifacts in number and weight. Moss agate also has significantly more flakes with cortex than any other material. In addition, only two cores were recovered from the Folsom component, and both were of moss agate. Similarly, 23 of the 24 cores from the Agate Basin component were of moss agate (the other one was Knife River Flint-like material).

Distance to the raw material source area is expected to effect the size of debitage. Economizing behavior with respect to raw material use might result in small flake size as material is conserved. However, examination of the Agate Basin site debitage assemblages does not indicate any relationship between size and distance (Table X and XI). The frequency of flake size differs between the two components and it appears that flake size is probably depends more on the nature of the activities at the site than on the distance to sources.

At the Agate Basin site 17 material types are represented in the

TABLE X

PERCENT OF THE NUMBER OF ITEMS BY DISTANCE TO SOURCE
AND SIZE GRADE FROM THE FOLSOM COMPONENT OF THE AGATE BASIN SITE

Distance to source in km	*Material	Size Grade 2	3	4	5	6
0-40	8	31.7	54.3	12.3	1.2	0.4
0-40	20, 22, 26	0	50.0	50.0	0	0
40-150	1	62.9	34.3	2.8	0	0
40-150	2	33.9	54.8	11.3	0	0
40-150	18	33.3	66.7	0	0	0
300	7	0	100.0	0	0	0
350	3	48.4	44.8	6.9	0	0
Unknown	10	22.4	34.7	42.9	0	0
Unknown	11	0	100.0	0	0	0
Unknown	12	60.0	20.0	20.0	0	0

* Refer to Table II for raw material key.

TABLE XI

PERCENT OF NUMBER OF ITEMS BY DISTANCE TO SOURCE AND SIZE GRADE FROM THE AGATE BASIN COMPONENT OF THE AGATE BASIN SITE

Distance to source in km	*Material	Size Grade 2	3	4	5	6
0-40	8	14.5	55.9	26.4	2.9	0.2
0-40	20, 22, 26	5.9	51.0	39.2	3.9	0
40-150	1	16.4	69.8	13.8	0	0
40-150	2	23.8	64.3	11.7	0	0
40-150	9	11.4	65.7	22.9	0	0
40-150	18	20.0	40.0	26.7	13.3	0
300	7	23.9	58.0	18.2	0	0
350	3	25.0	65.0	10.0	0	0
Unknown	10	2.9	50.0	44.1	2.9	0
Unknown	11	18.2	72.7	9.1	0	0
Unknown	12	34.6	42.3	23.1	0	0

* Refer to Table II for raw material key.

Folsom level debitage and 15 in the artifacts. Channel flakes are the largest artifact category (45.8% of assemblage) of which nearly half (49.5%) are of Knife River Flint. The number of channel flakes indicates there were more than seven projectile points of Knife River Flint at the site at one time; however, only this number of point were recovered from the site. In general, the material type of the channel flakes indicates there were many more projectile points than were recovered in excavation. Curation would seem to be an important factor here and might account for the relatively low representation of projectile points in contrast to the other kill sites analyzed.

Channel flakes make up 61.8 percent of the artifacts of Lower Cretaceous quartzite. The frequency of materials suggests that Knife River Flint and Lower Cretaceous quartzites were the preferred materials for Folsom point manufacture. Mississippian and Pennsylvanian cherts are the second most common material in the Folsom assemblage comprising nearly half of the utilized flakes (42.9%) and over half of the scrapers (63.2%) yet, there are relatively few channel flakes of this material. These cherts appear to have been more extensively worked than Knife River Flint or Lower Cretaceous quartzites is indicated by the 673 flakes of this material compared with 467 flakes of Knife River Flint and 186 flakes of Lower Cretaceous quartzite. It appears that the Mississippian and Pennsylvanian cherts were not particularly preferred for projectiles point manufacture at the site. Given that Mississippian and Pennsylvanian cherts are among the predominate raw materials at the site, if there was no material preference the number of channel flakes should be roughly proportionate to the relative frequency of the material. While 27.3% of the tools are of Mississippian and Pennsylvanian chert, only 16.9% of the material is channel flakes and 10.8% is projectile points and preforms; yet 46.2% of the material is utilized flakes. Each of the seven tool types evident in the assemblage is represented by Mississippian and Pennsylvanian cherts. This is greater tool variety than is evident in any other material type.

Another disproportionate category is moss agate. Over half of the material (59.3%) is utilized flakes and nearly one-third (29.6%) is channel flakes. This is a locally available material which may account for its relative abundance. By weight it comprises 12.6% of the artifacts and 38.6% of the debitage thus predominating the debitage assemblage. This is due largely to two cores which together weigh 267.7 grams, over half of the debitage weight of this material. The presence of eight channel flake fragments indicates projectile points were also manufactured from it.

There are concentrations of raw material types within the Folsom component which are separated by the bone bed (Frison 1982:39). The N090 line marks the approximate dividing line of the main bone concentration (Frison 1982:40, Figure 2.14). Table XII illustrates the division of raw material types to the north and south of this line. The great majority of Knife River Flint was found north of the bone bed and primarily in the area of what may have been a habitation structure (Frison 1982:39). The bulk of the Lower Cretaceous

TABLE XII

DISTRIBUTION OF RAW MATERIALS OF DEBITAGE IN THE FOLSOM LEVEL OF THE AGATE BASIN SITE

	Material Type	% of material type	#of flakes	% of all materials
North of N090	1	12.4	83	15.1
	2	16.7	31	5.6
	3	67.0	313	57.1
	8	29.3	71	12.9
South of N090	1	21.8	147	38.5
	2	60.7	113	29.6
	3	1.7	8	2.1
	8	20.9	51	13.1
Other	1	65.8	443	
	2	22.6	42	
	3	31.3	146	
	8	49.8	121	

* Refer to Table II for raw material key.

quartzites are located south of the bone bed as are the Mississippian and Pennsylvanian cherts. Moss agate, on the other hand, is fairly evenly distributed throughout the site.

The distinction between local and non-local materials appears significant. The separation of these raw material types suggests that the groups who came together for the bison kill maintained a separation after the event. The material types are concentrated on opposite sides of the bone bed which also served as a meat cache (Frison 1982:38). The Knife River Flint comes from sources to the north in North Dakota. The Mississippian and Pennsylvanian cherts and Lower Cretaceous quartzites represent both the Black Hills and Hartville Uplift of eastern Wyoming. The moss agate, which is available locally, was found throughout the site and was apparently used equally by all site occupants. This evidence suggests that at least two groups are represented here, one which came from the north, and one from the region of northeastern Wyoming and that these groups maintained some degree of separation.

The concentration of material types might also be accounted for by activity areas where specific raw material types happened to be worked. Another explanation might be that one set of the raw materials actually represents an earlier occupation (Frison 1982:38).

The Agate Basin component of the Agate Basin site has 17 material types represented in the tool assemblage and 19 in the debitage assemblage. Mississippian and Pennsylvanian cherts and Lower Cretaceous quartzites make up an equal percent of the tools by weight (27%). By count, however, there are nearly twice as many tools of the cherts than of the quartzite. The tools of this quartzite tend to be larger than those of chert.

Tools of Knife River Flint comprise 21.5% of the tool assemblage (20.7% of weight). Of the 41 artifacts of this material, 78% are projectile points. This is nearly half (42.1%) of the projectile points in the assemblage. The distance to the source of this material along with its relatively high frequency in the tool assemblage suggests that there was a preference for the material. There is very little debitage of Knife River Flint indicating that most of the material was brought to the site in the form of completed tools. Most of the projectile points recovered from the site were broken. This might account for the fact that they were not carried off when the site was abandoned.

Twenty-five of the 26 scrapers in the Agate Basin component are made of chert. Nearly half (46.2%) are made of Mississippian and Pennsylvanian chert and three are of Knife River Flint. One scraper is made of Lower Cretaceous quartzite. These are the three most abundant raw material types in the assemblage. Thus, apparently the raw materials are not equally distributed within the tool categories.

Most of the utilized flakes in the Agate Basin component (44.4% of number) are of Mississippian and Pennsylvanian chert. By count 35.1% of the tools are of this material. They make up 27.2% of the weight. Some curation or preservation of the material is suggested by the low proportion of debitage which accounts for only 2.4% of the total debitage weight of all materials. The total weight of tools of

Mississippian and Pennsylvanian chert is 714.7 grams while that of the debitage of this material is 98.4 grams.

The weight of tools in the Agate Basin component of Lower Cretaceous quartzite (710.3 grams) is more nearly equal to the debitage weight (525.6 grams). The quartzites generally or frequently resemble the material from the Hartville Uplift and Old Woman anticline area. As Mississippian and Pennsylvanian cherts of good quality are also available in the Hartville Uplift, both materials may have been acquired at the same time. Overall weight indicates much more quartzite was acquired than chert, suggesting it is the preferred material.

The weight of material types was plotted against distance to source areas (Figures 18-22). The dominant material types tended to be those with sources within 100 kilometers of the sites. However, given the location of the sites and source areas, and the assumption of closest possible source, this analysis suggests that this graph may actually reflect the geographic positioning of the site in relation to uplifts rather than a true correlation of material types with distance. There appears to be drop-off in the frequency of material from sources greater than 100 kilometers from the Agate Basin site. At the other sites the drop-off distance is even less. Knife River Flint is the exception, exhibiting a relatively high frequency in relation to the distance to its source area.

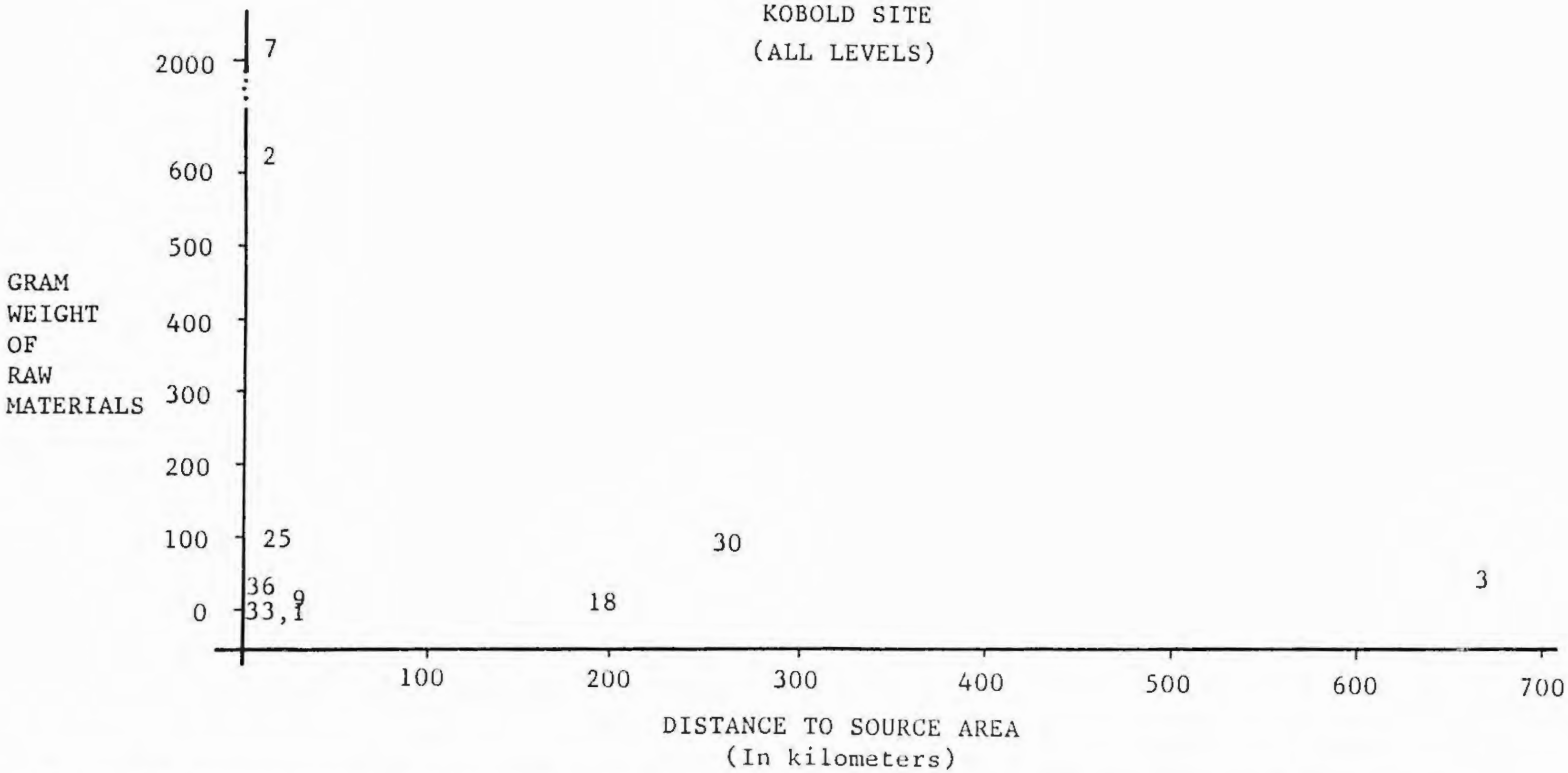


Figure 18. Correlation of material weight and distance to source for the combined levels of the Kobold site. Numbers refer to raw material types (See Table II for key to raw material types).

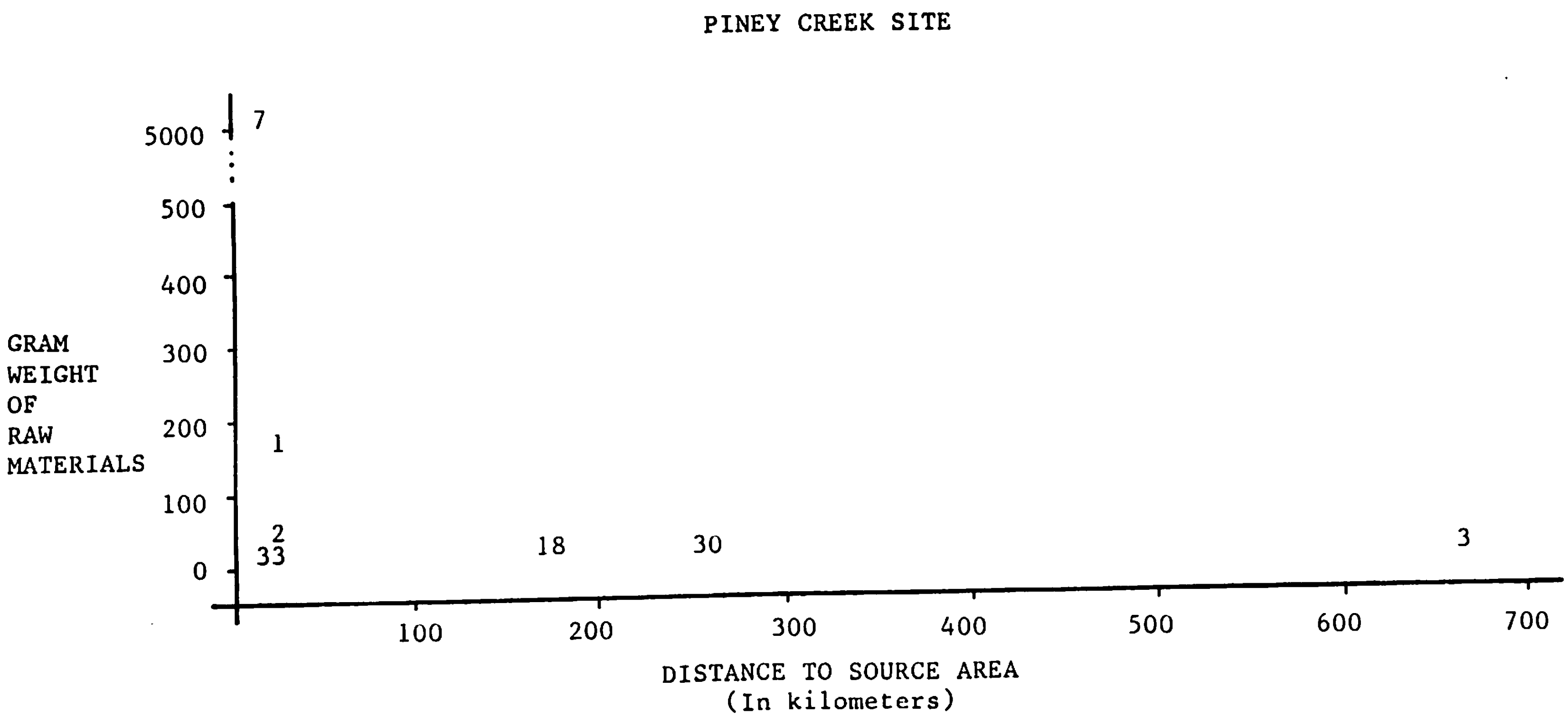


Figure 19. Correlation of material weight and distance to source for the Piney Creek site. Numbers refer to raw material types (See Table II for key to raw material types).

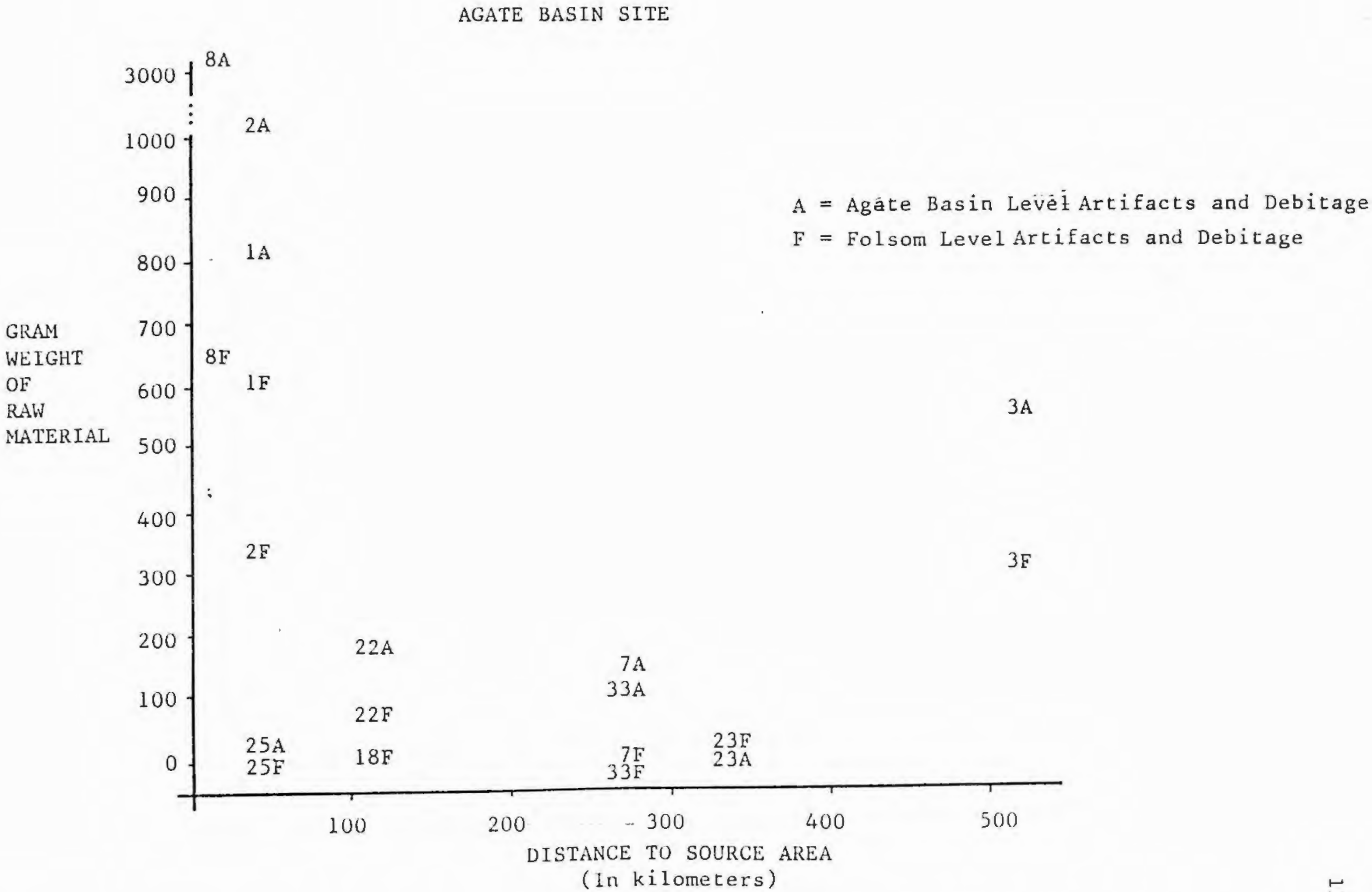


Figure 20. Correlation of material weight and distance to source for the Agate Basin site assemblages. Numbers refer to raw material types (See Table 11 for key to raw material types).

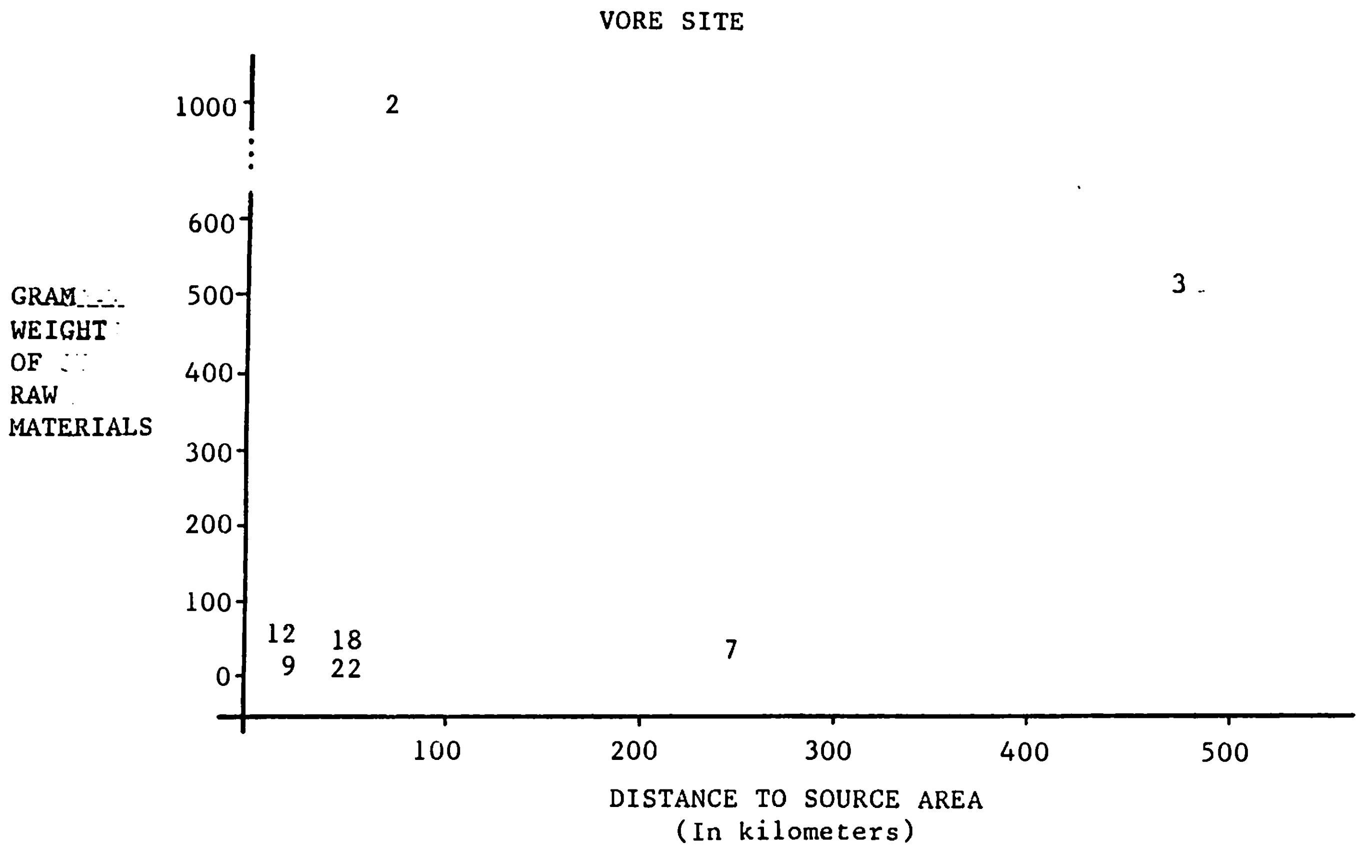


Figure 21. Correlation of material weight and distance to source for the Vore site. Numbers refer to raw material types (See Table II for key to raw material types).

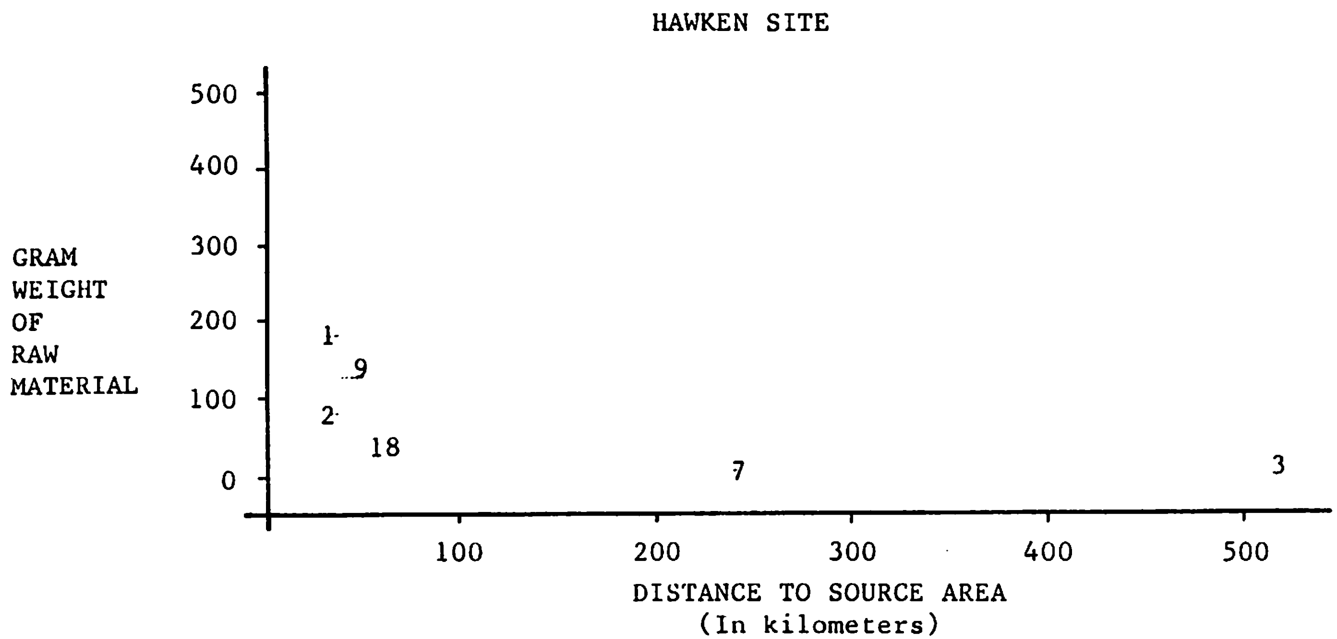


Figure 22. Correlation of material weight and distance to source for the Hawken site. Numbers refer to raw material types (See Table II for key to raw material types).

CHAPTER VIII

SUMMARY OF RESEARCH AND CONCLUSIONS

The significance of raw material representation is a complex issue. It is apparent that several factors influence the types and amounts of raw materials found in an archeological site. However, the influence of each factor and the degree to which it can be examined varies with each site.

It is assumed that lithic raw materials reflect areas exploited and that the distances between source areas and sites may be indicative of the size of the areas exploited. The raw materials at the Hawken site are primarily from sources in and around the Black Hills area, which suggests a relatively small range of exploitation. Sites such as Vore, Piney Creek and Agate Basin contain raw materials such as obsidian (Piney Creek site) and Knife River Flint (Vore and Agate Basin sites) from more distant sources which suggests a wider range of exploitation. Reher and Frison (1980:128-134) have used distance to sources in calculating a "mobility index" for several sites in northeastern Wyoming, which includes the five sites examined here, and found similarities in the degree of mobility represented in sites of similar ages. It is suggested that the size of the range and number of distinct sources exhibited might also be indicative of the type of aggregation represented at the site. Aggregation of a few family groups would likely result in raw materials representing a smaller range, while large aggregation of one or several bands would probably result in the representation of raw materials from more distant sources.

The raw material types represented in the Agate Basin and Folsom assemblages of the Agate Basin site are very similar. This suggests the same areas were exploited by the inhabitants of both levels. Some continuity in adaptive strategies in this area during the early part of the PaleoIndian period might be indicated. In contrast, the variation in frequency of raw materials represented in levels 1 through 8 of the Vore site suggests variability in areas exploited by the occupants of the site. These are tentative but suggestive conclusions based on two sites and further analysis of other sites is required to determine the consistency of these findings.

The assumption that the relative frequency of raw materials may be proportional to the number of people at the site from that area is complex. Simplistic applications of this assumption were not intended by the authors (Reher and Frison, personal communication) and could result in inaccurate interpretations. Several potential problems with interpreting the frequency of raw materials are illustrated with data from the Vore site. Calculation of raw material representation by weight and by actual numbers result in figures which are considerably different. In addition, the frequencies calculated may vary depending upon whether one analyzes artifacts, debitage or both. Furthermore, it is apparent that distance from a source has some affect on the amount of material represented, as does material preference, and other factors, indicating that the frequency of material may not reflect the proportion of people from a source area.

Apparently, it may also be questionable to assume, that raw materials at a site were procured from the closest possible source. Analysis of materials from the Vore site in the Black Hills suggests that many of the Lower Cretaceous quartzites in the assemblage were from the Hartville Uplift or Old Woman anticline source areas, which is not the closest source. In contrast, the Lower Cretaceous quartzites from the Hawken site, also in the Black Hills, indicates that the Black Hills was the source of these quartzites. Thus, the assumption works for some cases and not for others. The ability to identify the source area of the Lower Cretaceous quartzites makes a significant contribution to analysis of both sites.

Tools and debitage were examined from the Agate Basin site assemblages allowing for more extensive examination and comparison of raw material representations. It is apparent from examination of the Agate Basin assemblages, that there are some differences between the representation of raw materials in the debitage and in the tools. Comparison of tools and debitage can be informative about the curation of tools and raw materials and extent of utilization of raw materials. For example, many of the tools in the Agate Basin and Folsom components were of Knife River Flint, especially projectile points. The relatively small amount of debitage of this material in both assemblages indicates most of these tools were not manufactured at the site but were brought in as completed or nearly completed tools. In addition, the presence of raw material types found in debitage but not in tools is indicative of tools which were present at one time (Frison 1967, 1970).

The stratified sites indicated that there was some variation in the types of materials used over time, especially at Vore and Kobold. In most cases, the major material types were represented in all levels of a site, though in varying frequency. However, variation of raw material frequency between only five sites cannot necessarily be attributed to change through time; because analysis of only five sites does not provide an adequate basis for such determinations. The variation in frequency of raw materials may also reflect the intensity or duration of exploitation of the areas represented by the material types.

Variation in the frequency of raw materials was expected to reflect seasonality to some extent (Loendorf 1973). However, the frequency of raw material types at the Vore site was examined with reference to seasonality of site use as determined from tooth eruption schedules and the correlation between raw material frequency and seasonality was not shown. Assemblages representing similar seasons of use were not necessarily similar in raw material representation. It is also noted that the Vore site represents a very complex record of use because it was utilized for approximately 300 years during several seasons. It is possible that seasonality was important in raw material representation, but could not be ascertained in this analysis.

An inverse relationship in the frequency of porcellanite and

Lower Cretaceous quartzite was noted in the site assemblages. This may reflect seasonality given the degree of exploitation of the basin as opposed to the foothills areas, the respective sources of these materials. The trend was also noted in the two site areas of the Piney Creek site, although both areas represent the same season of use. The trend at Piney Creek is, however, very slight and possibly insignificant. In general, the raw material representation of both kill and butchering areas at the site is very similar.

The provenience of raw materials in a site proved significant in the Folsom component of the Agate Basin site. Here there was a marked separation of Knife River Flint from Lower Cretaceous quartzite and Mississippian and Pennsylvanian cherts. This separation is attributed to the post-kill occupation of the site and may suggest that a separation of groups was maintained. There did not appear to be any significant concentrations of raw material types at the other sites examined.

Distance appears to be significant in the frequency of raw material. The dominant raw materials tend to be from sources within 100 kilometers of the sites. The exception to this is Knife River Flint. In many cases the amount of Knife River Flint exceeds that of material from closer sources. The high proportion of Knife River Flint might indicate direct procurement of the material and curation of the artifacts manufactured from it (Luedtke 1976).

The frequency of cortex on flakes appears to be related to distance. In the Agate Basin site, the percent of debitage with cortex from sources greater than 40 kilometers away was significantly less than that of material from sources within 40 kilometers. This may be a useful indicator for determining possible sources of miscellaneous raw materials.

The size of debitage was expected to be related to distance, however, no correlation was noted and the nature of site activities appears to be more significant with regard to debitage size. The Folsom level of the Agate Basin site exhibits more variation in the size of debitage of the various raw materials than is apparent in the Agate Basin assemblage. The greater variation in raw material size in the Folsom assemblage probably relates to the variety of activities and tool working needs associated with the post-kill occupation of the site.

Though raw material representation can be informative it is obvious that more research is necessary since the representation of raw materials in a site is more complex than is commonly assumed. The analyses presented here deal with five sites and the results are not intended as conclusive statements, but are suggestions and comparative data for further work. Some of the assumptions made concerning raw material representation have been examined and a measure of caution is suggested for the analysis and interpretation of lithic raw materials.

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A P P E N D I C E S

APPENDIX A

KOBOLD TOOLS

Column	Information
1	catalog number
2	material type
3	tool type
4	completeness
5	size
6	weight in decigrams
7	provenience
8	level

13620	1	1	5	3	17	RS	0
13746	1	4	1	2	2	RS	0
13344	2	4	3	2	2	RS	0
13194	7	1	1	3	8	RS	0
13155	7	4	3	2	5	RS	0
13163	7	4	1	2	4	RS	0
13199	7	4	1	2	4	RS	0
13356	7	4	1	2	3	RS	0
13745	7	4	2	2	1	RS	0
13081	33	4	1	3	3	RS	0
13571	33	4	4	2	4	RS	0
13738	2	2	3	4	155	N110W020	1
13657	7	4	5	4	39	N110W050	1
13703	7	4	5	4	27	N110W040	1
13704	7	4	2	2	9	N110W040	1
13705	7	4	4	3	13	N110W040	1
13736	11	4	2	3	11	N110W020	1
13728	12	4	2	3	15	N105W035	1
13706	25	4	1	3	10	N110W040	1
13733	36	4	2	4	35	N095W000	1
13381	1	4	4	4	23	N105W035	2
13565	2	1	1	4	15	N070W025	2
13637	2	4	2	3	12	N125W055	2
12503	7	1	5	4	73	N125W050	2
12540	7	1	5	4	205	N100W045	2
12541	7	1	5	4	57	N100W045	2
12553	7	1	5	4	172	N100W045	2
12555	7	1	5	4	179	N100W045	2
13372	7	1	5	4	70	N080W015	2
13377	7	1	5	4	179	N105W035	2
13428	7	1	1	3	12	N110W035	2
13433	7	1	5	5	311	N110W035	2
13436	7	1	5	4	345	N075W010	2
13430	7	1	5	5	931	N075W010	2
13563	7	1	5	4	293	N110W040	2
13574	7	1	5	5	119	N110W040	2
13594	7	1	5	5	453	N080W015	2
13635	7	1	5	4	129	N125W055	2
13536	7	1	5	4	37	RS	2
13548	7	1	5	5	283	N095W060	2
13660	7	1	5	4	145	N110W045	2
13661	7	1	5	3	17	N110W045	2
13677	7	1	5	4	183	N110W040	2
13678	7	1	5	5	219	N110W040	2
12558	7	2	3	4	93	N100W045	2
13345	7	2	2	4	72	N095W010	2
13362	7	2	2	5	245	N105W035	2
13581	7	2	5	4	183	N095W050	2
13591	7	2	2	5	320	N110W050	2
13593	7	2	2	4	75	N070W015	2
13623	7	2	5	5	379	N115W055	2
12552	7	4	5	3	16	N100W045	2
12554	7	4	5	4	20	N100W045	2
12570	7	4	5	4	41	N100W045	2
13214	7	4	2	4	64	N095W050	2
13346	7	4	5	4	43	N095W010	2
13350	7	4	4	4	34	N095W010	2
13351	7	4	3	3	17	N095W010	2
13411	7	4	3	4	49	N080W040	2
13562	7	4	2	3	28	N110W040	2
13567	7	4	3	3	22	N095W060	2
13572	7	4	5	4	33	N110W040	2
13576	7	4	5	4	42	N110W070	2
13622	7	4	5	4	45	N115W050	2
13524	7	4	2	2	3	N115W050	2
13631	7	4	5	4	21	N125W055	2
13638	7	4	3	3	27	N125W055	2
13641	7	4	4	4	57	N110W050	2
13665	7	4	2	4	54	N125W050	2
13676	7	4	4	3	31	N110W040	2
13679	7	4	3	3	11	N110W040	2
13694	7	4	3	3	10	NOPRO	2
13699	7	4	2	4	56	N125W055	2
12700	7	4	5	4	60	N125W055	2
13701	7	4	3	4	30	N125W055	2
13786	7	4	1	3	9	NOPRO	2
13787	7	4	2	3	7	NOPRO	2
13788	7	4	2	3	6	NOPRO	2
13789	7	4	2	3	7	NOPRO	2
13791	7	4	2	2	5	NOPRO	2
13796	7	4	3	3	8	NOPRO	2
C3500	7	4	5	5	100	NOPRO	2
13698	7	6	5	4	85	N125W055	2
12564	9	4	4	2	5	N100W045	2
13378	9	4	5	4	33	N105W035	2
13562	9	4	4	3	25	N095W050	2
13621	9	4	5	4	56	N115W050	2
13610	11	2	1	4	56	N110W035	2
13149	11	4	3	3	37	N110W040	2
13346	11	4	5	4	47	N095W010	2
13433	11	4	5	4	52	N075W010	2
13611	11	4	5	4	23	N110W035	2
13626	11	4	2	2	4	N115W050	2
13630	11	4	5	4	48	N125W055	2
13680	11	4	5	4	42	N110W040	2
13681	11	4	3	4	33	N110W040	2
13609	12	1	5	4	92	N110W035	2
12504	12	4	2	3	9	N125W050	2
12569	12	4	5	4	37	N100W045	2
13633	12	4	1	2	4	N120W055	2
13682	12	4	5	3	18	N110W040	2
13790	25	4	3	2	4	NOPRO	2
13584	33	1	5	3	21	N080W025	2
13434	34	2	1	3	17	N075W010	2
13212	1	1	5	4	44	N095W050	3
13092	2	1	5	3	9	N095W060	3
13603	2	1	5	4	4	N115W050	3
13565	2	4	4	4	52	N095W080	3
13600	3	4	2	4	31	N080W035	3
12501	7	1	5	4	44	N125W055	3
12507	7	1	5	4	94	N095E010	3
12511	7	1	5	4	40	N095E010	3
12618	7	1	5	4	56	N100W045	3
12625	7	1	5	5	207	N100W045	3
12626	7	1	5	4	142	N080W025	3
13084	7	1	5	3	16	N080W015	3
13086	7	1	5	4	134	N080W015	3
13087	7	1	5	3	37	N080W015	3
13094	7	1	5	4	82	N095W060	3
13154	7	1	1	4	17	N110W050	3
13182	7	1	5	4	74	N110W035	3
13190	7	1	5	4	94	N095W060	3
13200	7	1	5	4	63	N125W055	3
13215	7	1	5	3	11	N095W050	3
13218	7	1	5	4	236	N115W050	3
13220	7	1	5	4	55	N115W050	3
13331	7	1	5	4	117	N080W035	3
13364	7	1	5	3	17	N095W040	3
13525	7	1	1	3	21	N080W035	3
13601	7	1	5	5	275	N080W035	3
13654	7	1	1	3	9	N095E010	3
12515	7	2	2	3	39	N095E010	3
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12632	7	2	1	4	104	N080W025	3
12634	7	2	2	4	61	N080W025	3
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13118	7	2	1	3	28	N095W050	3
13209	7	2	1	4	126	N095W050	3
13334	7	2	5	3	20	N080W035	3
13335	7	2	2	3	20	N080W035	3
13513	7	2	3	4	65	N095W000	3
13793	7	2	1	3	8	NOPRO	3
12506	7	4	5	4	72	N095E010	3
12567	7	4	5	4	48	N100W045	3
12572	7	4	5	4	35	N100W045	3
12573	7	4	4	3	22	N100W045	3
12574	7	4	5	4	34	N100W045	3
12582	7	4	4	3	14	N100W045	3
12615	7	4	2	3	11	N065W010	3
12649	7	4	5	4	56	N100W045	3
12624	7	4	4	3	5	N100W045	3
12629	7	4	5	3	26	N080W025	3
12631	7	4	1	2	3	N080W025	3
12633	7	4	2	4	33	N080W025	3
12671	7	4	5	4	44	N080W040	3
13046	7	4	1	3	5	NOPRO	3
13085	7	4	5	3	10	N080W015	3
13091	7	4	2	3	19	N095W060	3
13093	7	4	5	4	42	N095W060	3
13111	7	4	4	3	11	N095W060	3
13162	7	4	2	3	6	N065W010	3
13177	7	4	5	4	49	N080W015	3
13180	7	4	2	3	4	N125W050	3
13183	7	4	2	4	32	N110W035	3
13197	7	4	4	3	20	N125W055	3
13203	7	4	4	3	37	N110W050	3
13208	7	4	5	4	40	N110W040	3
13213	7	4	2	3	9	N095W050	3
13228	7	4	2	4	29	N075W010	3
13336	7	4	3	4	29	N080W035	3
13341	7	4	5	4	37	N080W035	3
13354	7	4	4	4	40	N080W040	3
13357	7	4	4	3	7	N080W040	3
13368	7	4	2	2	4	N095W090	3
13396	7	4	5	4	42	N080W040	3
13509	7	4	5	4	41	N080W035	3
13511	7	4	4	4	25	N110W030	3
13558	7	4	2	2	5	NOPRO	3
13566	7	4	3	3	14	N095W080	3
13568	7	4	3	4	59	N095W080	3
13569	7	4	5	4	29	N095W080	3
13580	7	4	5	4	28	NOPRO	3
13598	7	4	4	3	36	N080W035	3
13604	7	4	5	4	24	N115W050	3
13615	7	4	2	3	29	N095W060	3
13632	7	4	3	2	7	NOPRO	3
13649	7	4	5	4	33	N095W060	3
13798	7	4	1	2	5	NOPRO	3
13799	7	4	1	2	5	NOPRO	3
12544	9	4	3	3	35	N100W045	3

13205	11	2	5	5	1082	N110W010	3	12720	2	2	1	4	13	N130W045	4	13422	2	4	2	4	16	N075W010	4
13370	11	2	1	4	247	N080W015	3	12791	2	2	1	4	78	N095W050	4	13445	2	4	5	3	10	N095E010	4
12575	11	4	5	4	39	N100W045	3	12801	2	2	3	4	208	N100W015	4	13472	2	4	5	3	7	N095E010	4
12617	11	4	2	4	27	N065W010	3	13027	2	2	1	3	34	N125W055	4	13494	2	4	5	3	10	N080W035	4
13412	11	4	5	4	27	N095W060	3	13004	2	2	1	4	84	N125W050	4	13500	2	4	5	3	13	N080W035	4
13547	11	4	4	3	23	N080W035	3	13024	2	2	2	5	384	N125W055	4	13590	2	4	5	3	7	N110W050	4
13442	12	1	5	4	187	N095W060	3	13466	2	2	5	4	51	N095E010	4	13756	2	4	4	2	3	NOPRO	4
13520	12	2	1	3	12	N080W035	3	13493	2	2	5	4	175	N080W035	4	13758	2	4	5	3	6	NOPRO	4
13105	12	4	5	3	9	N115W050	3	13770	2	2	1	3	22	NOPRO	4	13763	2	4	2	2	3	NOPRO	4
13335	12	4	5	3	23	N080W035	3	12513	2	4	5	3	19	N080W040	4	13766	2	4	2	3	9	NOPRO	4
13599	12	4	5	4	40	N080W035	3	12594	2	4	4	3	7	N095W090	4	13780	2	4	2	2	2	NOPRO	4
13605	12	4	2	4	28	N115W050	3	12607	2	4	3	3	9	N080W015	4	12643	2	5	2	3	8	N095W000	4
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13042	7	10	5	5	555	N110W035	4
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12852	11	3	5	3	16	N100E010	4
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12991	11	4	4	3	12	N115W050	4
13477	11	4	2	3	8	N095E010	4
13507	11	4	5	3	22	N080W035	4
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13781	11	4	1	3	10	NOPRO	4
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13165	12	1	5	4	115	NOPRO	4
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12738	12	2	5	6	713	N110W040	4
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12965	12	4	3	3	5	N125W080	4
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12747	12	5	5	4	42	N100W015	4
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12636	13	1	5	4	43	N100W015	4
12648	13	4	2	3	11	N110W040	4
13536	13	4	5	3	21	N095E010	4
13463	13	6	5	4	77	N095E010	4
12700	17	2	1	5	358	N085E015	4
12522	17	6	5	5	464	N080W040	4
13015	18	1	1	3	13	N125W050	4
12767	18	4	3	3	9	N095W050	4
12769	18	4	4	2	6	N095W060	4
12779	18	4	2	3	9	N095W080	4
12656	25	1	5	5	268	N110W040	4
12985	25	1	5	4	279	N115W050	4
12716	25	4	5	3	10	N085E015	4
12752	25	4	3	2	2	N110W040	4
12859	25	4	3	3	8	N100E010	4
12902	25	4	5	3	8	N115W050	4
12925	25	4	2	3	[illegible]	N125W050	4
12957	25	4	3	3	10	N095W080	4
13012	25	4	5	3	13	N125W050	4
13150	25	4	2	2	3	N110W040	4
13466	25	4	1	2	3	N095E010	4
13505	25	4	3	2	2	N080W035	4
13548	25	4	5	3	18	N095E010	4
13767	25	4	2	3	8	NOPRO	4
13772	25	4	4	3	12	NOPRO	4
13774	25	4	2	3	9	NOPRO	4
13776	25	4	1	2	4	NOPRO	4
13471	25	6	5	4	14	N095E010	4
12717	30	2	5	6	1061	N100W045	4
12821	31	4	2	4	29	N100W015	4
12588	32	4	5	3	6	N100W045	4
12708	32	4	1	3	5	N085E015	4
12921	33	1	1	4	51	N125W050	4
13097	33	1	5	3	16	N110W035	4
13502	33	1	5	3	19	N080W035	4
13784	33	1	1	3	5	NOPRO	4
12711	33	4	5	3	5	N085E015	4
13389	33	4	1	2	4	N080W025	4
13469	33	4	5	3	6	N095E010	4
13779	33	4	2	3	7	NOPRO	4
12640	34	1	5	5	226	N105W035	4
12723	34	2	2	6	646	N100W045	4
13444	34	2	4	4	313	N095E010	4
13446	34	2	5	5	230	N095E010	4
12601	34	4	2	3	14	N080W025	4
12654	34	4	5	3	15	N110W040	4
13480	34	4	2	3	6	N095E010	4
13759	34	4	2	3	6	NOPRO	4
13047	35	1	5	3	26	N110W035	4
12662	35	4	4	3	5	N110W050	4
12678	35	4	5	3	23	N095W050	4
13028	35	4	5	3	5	N125W055	4
13124	35	4	5	3	5	N125W055	4
12837	36	1	5	3	19	N100E010	4
13014	36	1	5	4	206	N125W050	4

APPENDIX B

PINEY CREEK SITE TOOLS

Column	Information
1	* area
2	catalog number
3	material type
4	tool type
5	completeness
6	size
7	weight in decigrams
8	provenience

B	8024	1	1	5	4	201	N040W020	B	7557	1	2	5	4	172	S010W010	B	7613	7	1	5	5	605	N040W010
B	7983	1	1	5	4	30	S040E050	B	7537	1	2	3	3	37	N000W010	B	7718	7	1	5	5	579	N010E020
B	7963	1	1	1	3	15	N050E030	B	7809	1	2	2	5	200	N040E030	B	7690	7	1	5	4	119	NOPRO
B	8030	1	1	5	4	91	N020W050	B	7528	1	2	1	4	50	N050W020	B	7697	7	1	5	4	109	S010E020
B	7763	1	1	5	4	43	S010E020	B	8156	1	2	5	4	260	N020W040	B	7636	7	1	5	4	67	N010W010
B	7632	1	1	5	4	134	N060W010	B	8073	1	2	2	4	262	N020W050	B	7747	7	1	5	4	89	S010E000
B	7648	1	1	5	4	69	S000E020	B	8246	1	2	3	4	141	N060W000	B	7588	7	1	5	4	100	N020E010
B	7535	1	1	5	5	216	N000W000	B	8277	1	2	5	4	229	NOPRO	B	7508	7	1	1	5	200	N050W020
B	7852	1	1	5	4	45	S050E040	B	7645	1	4	5	3	14	S050E030	B	7500	7	1	1	4	75	N050W020
B	7861	1	1	5	4	34	S050E040	B	7867	1	4	5	3	9	S010W030	B	7799	7	1	5	5	120	S020E010
B	7853	1	1	5	4	27	S050E040	B	8245	1	4	5	3	7	N060W000	B	7593	7	1	5	4	122	N030E010
B	7860	1	1	5	4	30	S050E040	B	8027	1	6	5	4	182	N030E020	B	7573	7	1	1	4	56	S000W010
B	7578	1	1	5	4	23	S010W020	B	8028	1	6	5	4	144	N020W050	B	7553	7	1	1	4	41	N000W010
B	7581	1	1	5	4	80	N010W020	B	7700	1	6	5	5	437	S010E020	B	7512	7	1	5	5	210	N040W010
B	7566	1	1	5	4	100	S000W020	B	7601	1	6	5	6	1128	N020E010	B	7551	7	1	5	4	72	S000W000
B	7569	1	1	5	5	216	N020W020	B	7505	1	6	5	6	1566	N040W020	B	7558	7	1	5	4	84	S010W010
B	7565	1	1	5	4	33	S000W020	B	7814	1	6	5	5	719	S000E030	B	7527	7	1	1	3	14	N040W000
B	7758	1	1	5	4	49	S020E010	B	7523	1	6	5	5	250	N050W020	B	7565	7	1	4	5	143	N020E010
B	7603	1	1	5	4	25	S000W020	B	8109	1	6	5	5	214	N010W070	B	7514	7	1	5	4	59	N050W010
B	7561	1	1	5	4	39	S000E000	B	7518	1	6	5	4	191	N040W010	B	7580	7	1	1	4	134	N010W020
B	7524	1	1	5	4	96	N020W020	B	8209	1	6	5	4	98	N070W030	B	7543	7	1	5	4	118	N000W010
B	7608	1	1	5	4	29	N050E020	B	8230	1	6	5	5	427	N060W030	B	7584	7	1	5	4	117	N020E010
B	7822	1	1	5	3	21	S050E030	B	8275	1	6	5	4	336	NOPRO	B	7608	7	1	5	4	49	N050W010
B	8125	1	1	5	4	201	N010W030	B	7539	1	7	3	3	45	N030W010	B	7556	7	1	5	5	160	S010W010
B	8155	1	1	5	4	63	N020W040	B	8225	1	7	5	3	9	N040W080	B	7582	7	1	5	4	38	N010W020
B	8152	1	1	5	4	80	N020W040	B	8339	3	1	5	4	63	NOPRO	B	7540	7	1	5	4	57	S010W020
B	8162	1	1	5	4	100	N030W020	B	7661	7	1	5	5	180	N020E020	B	7560	7	1	5	5	95	S000W010
B	8051	1	1	5	4	47	N020W040	B	7968	7	1	5	4	61	S040E050	B	8150	7	1	5	4	98	N020W040
B	8082	1	1	5	4	47	N015W060	B	7964	7	1	5	4	27	S040E050	B	8127	7	1	5	5	177	N010W030
B	8055	1	1	5	4	47	N020W040	B	7992	7	1	5	4	68	S030E050	B	8112	7	1	1	3	27	N010W070
B	8165	1	1	5	4	148	N060W040	B	7990	7	1	5	4	112	S030E050	B	8410	7	1	5	5	630	N010W070
B	8187	1	1	5	5	237	N060W040	B	7698	7	1	5	4	27	S010E020	B	8122	7	1	5	5	904	N020W050
B	8201	1	1	5	5	572	S050W000	B	7801	7	1	5	3	28	N010W010	B	8131	7	1	1	4	28	N010W080
B	8212	1	1	5	5	444	NOPRO	B	7807	7	1	5	4	27	S010W020	B	8116	7	1	1	4	26	N010W070
B	8224	1	1	5	4	125	N060W080	B	7813	7	1	5	5	180	N040E030	B	8068	7	1	5	4	91	N020W050
B	8229	1	1	5	4	148	N060W030	B	7985	7	1	5	5	133	S040E050	B	8123	7	1	5	4	50	N020W050
B	8260	1	1	5	4	62	S010E010	B	7987	7	1	5	5	66	S040E050	B	8114	7	1	5	4	32	N010W070
B	8375	1	1	5	4	70	NOPRO	B	8000	7	1	5	5	223	S030E050	B	8100	7	1	5	5	849	N010W040
B	8366	1	1	5	3	6	NOPRO	B	8004	7	1	5	4	180	S030E050	B	8147	7	1	5	5	172	N020W040
B	8265	1	1	5	4	21	NOPRO	B	8044	7	1	5	4	91	N020W030	B	8065	7	1	5	5	225	N020W050
B	8269	1	1	5	3	7	NOPRO	B	7802	7	1	5	5	168	N050E020	B	8069	7	1	5	4	90	N020W050
B	8276	1	1	5	4	152	NOPRO	B	7842	7	1	5	5	528	S050E040	B	8091	7	1	5	4	79	N010W060
B	8279	1	1	1	3	6	NOPRO	B	7864	7	1	5	6	532	S030S010	B	8060	7	1	5	4	60	N020W040
B	8291	1	1	5	3	25	NOPRO	B	7957	7	1	2	4	63	S000E030	B	8095	7	1	1	3	5	N010W060
B	8292	1	1	5	4	30	NOPRO	B	7851	7	1	5	4	94	S050E040	B	8050	7	1	5	4	33	N020W040
B	8298	1	1	5	3	35	NOPRO	B	7800	7	1	5	6	1005	N010W010	B	8057	7	1	5	4	41	N020W040
B	8300	1	1	5	4	44	NOPRO	B	7850	7	1	5	5	190	S050E040	B	8103	7	1	5	4	81	N010W050
B	8303	1	1	5	4	35	NOPRO	B	8062	7	1	5	4	75	S030E050	B	8093	7	1	5	4	70	N010W060
B	8305	1	1	5	3	15	NOPRO	B	7635	7	1	5	4	103	N000W010	B	8107	7	1	5	4	66	N010W070
B	8311	1	1	5	4	23	NOPRO	B	7844	7	1	5	4	73	S050E040	B	8096	7	1	5	4	106	N010W060
B	8312	1	1	5	4	22	NOPRO	B	7825	7	1	5	4	26	S050E030	B	8203	7	1	5	4	51	S050E000
B	8314	1	1	5	4	21	NOPRO	B	7859	7	1	5	5	426	S050E040	B	8203	7	1	5	4	51	S050E000
B	8316	1	1	5	3	12	NOPRO	B	7846	7	1	5	5	123	S050E030	B	8175	7	1	5	4	136	N060W050
B	8317	1	1	1	3	6	NOPRO	B	7797	7	1	5	5	400	S020E010	B	8171	7	1	5	5	96	N060W030
B	8318	1	1	5	3	16	NOPRO	B	7986	7	1	5	4	77	S040E050	B	8172	7	1	5	4	23	N060W030
B	8319	1	1	1	3	34	NOPRO	B	7675	7	1	5	4	39	N050W010	B	8202	7	1	5	4	109	S050E000
B	8323	1	1	5	4	79	NOPRO	B	7641	7	1	5	5	206	S000E020	B	8207	7	1	5	4	72	S060E010
B	8334	1	1	5	4	40	NOPRO	B	7951	7	1	5	4	92	S030E050	B	8251	7	1	5	3	18	N060W110
B	8338	1	1	5	4	80	NOPRO	B	7719	7	1	5	4	101	N010E020	B	8360	7	1	5	3	22	NOPRO
B	8341	1	1	5	4	36	NOPRO	B	7982	7	1	5	4	202	S040E050	B	8361	7	1	5	4	41	NOPRO
B	8344	1	1	5	4	37	NOPRO	B	8045	7	1	5	5	347	N020W040	B	8362	7	1	5	4	113	NOPRO
B	8346	1	1	5	4	36	NOPRO	B	8001	7	1	5	4	142	S030E050	B	8364	7	1	5	4	50	NOPRO
B	7614	1	1	5	4	275	NOPRO	B	7674	7	1	5	4	64	N050W010	B	8365	7	1	5	4	38	NOPRO
B	7614	1	1	5	4	256	N040W010	B	7657	7	1	1	2	5	N020E010	B	8367	7	1	5	3	31	NOPRO

B	8370	7	1	5	4	19	NOPRO
B	8371	7	1	1	3	8	NOPRO
B	8373	7	1	1	4	30	NOPRO
B	8374	7	1	5	4	69	NOPRO
B	8376	7	1	5	4	31	NOPRO
B	8377	7	1	5	3	11	NOPRO
B	8378	7	1	1	3	4	NOPRO
B	8380	7	1	5	4	90	NOPRO
B	8381	7	1	5	3	10	NOPRO
B	8383	7	1	5	4	69	NOPRO
B	8384	7	1	1	4	73	NOPRO
B	8385	7	1	5	3	22	NOPRO
B	8387	7	1	5	3	19	NOPRO
B	8388	7	1	5	4	49	NOPRO
B	8389	7	1	5	4	48	NOPRO
B	8391	7	1	1	3	7	NOPRO
B	8268	7	1	5	3	6	NOPRO
B	8271	7	1	5	4	95	NOPRO
B	8272	7	1	5	3	38	NOPRO
B	8274	7	1	5	4	29	NOPRO
B	8279	7	1	5	4	147	NOPRO
B	8280	7	1	5	4	28	NOPRO
B	8281	7	1	1	2	6	NOPRO
B	8282	7	1	5	3	17	NOPRO
B	8283	7	1	5	4	20	NOPRO
B	8285	7	1	5	4	37	NOPRO
B	8286	7	1	1	2	22	NOPRO
B	8293	7	1	5	4	21	NOPRO
B	8294	7	1	5	4	17	NOPRO
B	8295	7	1	5	4	37	NOPRO
B	8301	7	1	5	3	10	NOPRO
B	8302	7	1	5	3	13	NOPRO
B	8304	7	1	5	3	10	NOPRO
B	8306	7	1	5	4	37	NOPRO
B	8307	7	1	5	3	17	NOPRO
B	8310	7	1	1	3	9	NOPRO
B	8313	7	1	5	3	8	NOPRO
B	8315	7	1	1	4	45	NOPRO
B	8333	7	1	5	4	61	NOPRO
B	8320	7	1	5	4	79	NOPRO
B	8324	7	1	5	4	144	NOPRO
B	8327	7	1	5	4	83	NOPRO
B	8328	7	1	5	4	113	NOPRO
B	8329	7	1	5	4	62	NOPRO
B	8330	7	1	1	4	20	NOPRO
B	8331	7	1	5	4	82	NOPRO
B	8339	7	1	5	4	61	NOPRO
B	8340	7	1	5	3	14	NOPRO
B	8342	7	1	5	3	16	NOPRO
B	8347	7	1	5	4	61	NOPRO
B	8349	7	1	5	4	62	NOPRO
B	8350	7	1	5	4	26	NOPRO
B	8351	7	1	5	4	73	NOPRO
B	8353	7	1	5	3	11	NOPRO
B	8352	7	1	5	4	46	NOPRO
B	8372	7	1	5	4	96	NOPRO
B	8357	7	1	5	4	31	NOPRO
B	8359	7	1	5	4	34	NOPRO
B	8058	7	1	5	5	187	NOPRO
B	7688	7	1	5	5	228	NOPRO
B	7688	7	1	5	5	229	NO10E02
B	8058	7	1	5	5	187	NO20W04
B	7677	7	2	5	3	19	NO40E02
B	7965	7	2	5	5	340	S050E01
B	7856	7	2	5	6	482	S050E040
B	7554	7	2	5	5	295	N040E030
B	7812	7	2	2	5	462	N040E030
B	7955	7	2	5	5	589	S000E030
B	7536	7	2	1	4	168	N000W010
B	7511	7	2	2	4	139	N020W020
B	7863	7	2	2	5	594	S010E030
B	7562	7	2	5	5	331	S000W010
B	7579	7	2	1	4	60	N010W020
B	8102	7	2	5	6	1300	N010W050
B	8133	7	2	5	4	332	N010W080
B	8066	7	2	5	4	148	N020W050
B	8270	7	2	1	4	78	NOPRO
B	8359	7	2	2	3	29	NOPRO
B	8510	7	2	5	4	300	NOPRO
B	7681	7	4	5	3	6	N020E020
B	7621	7	4	5	3	10	N060W000
B	8193	7	4	5	4	33	N060W030
B	8198	7	4	1	3	5	N060W030
B	8067	7	4	5	3	7	NOPRO
B	8067	7	4	5	3	9	N020W050
B	8227	7	4	5	3	8	N020W040
B	7559	7	4	5	3	11	S010W010
B	8178	7	4	5	4	22	N060W050
B	7572	7	4	5	3	10	S000W020
B	7824	7	4	3	3	7	S050E020
B	7739	7	4	5	3	5	S010E010
B	8195	7	4	5	3	10	N060W030
B	8080	7	4	3	3	9	N020W050
B	7811	7	4	3	3	6	N040E030
B	7960	7	4	5	3	9	S040E050
B	7947	7	4	5	3	8	S080E050
B	7594	7	4	3	3	11	N060E010
B	8059	7	4	4	2	3	N020W040
B	8088	7	4	2	3	6	N010W080
B	7644	7	4	5	3	10	S000E020
B	7643	7	4	3	3	7	S050E040
B	8231	7	4	2	3	8	N060W030
B	8482	7	4	4	3	6	NOPRO
B	7598	7	4	2	4	22	N020E010
B	7622	7	4	3	3	5	N060W010
B	8244	7	4	3	3	9	N060W000
B	8223	7	4	5	3	9	N060W080
B	7815	7	4	5	3	9	S000E030
B	7946	7	4	5	3	9	S080E050
B	8077	7	4	5	3	6	N020W050
B	7749	7	4	1	3	8	S010E000
B	8079	7	4	5	3	7	N020W050
B	7821	7	4	2	2	2	N030W050
B	7810	7	4	3	3	7	N040E030
B	7849	7	4	5	3	7	S050E040
B	7676	7	4	3	3	5	N040E020
B	8063	7	4	1	3	3	N020W030
B	7862	7	4	3	2	4	S050E040
B	8228	7	4	2	3	4	N060W120
B	7653	7	6	5	5	301	N010E010
B	7993	7	6	5	5	493	S030E050
B	7660	7	6	5	5	400	N020E020
B	7995	7	6	5	5	538	S030E050
B	8026	7	6	5	5	320	S020E040
B	8047	7	6	5	5	316	N020W040
B	8005	7	6	5	5	204	S030E040
B	8025	7	6	5	5	349	N060W020
B	7954	7	6	5	5	58	S030E050
B	7671	7	6	5	5	400	N030E020
B	7741	7	6	5	4	87	S010E010
B	7953	7	6	5	5	375	N040E030
B	8016	7	6	5	5	392	S030E040
B	7997	7	6	5	5	276	S030E050
B	7673	7	6	5	5	726	N030E020
B	7624	7	6	5	5	226	N040W010
B	7521	7	6	1	4	78	N040W010
B	7567	7	6	5	5	285	N020E010
B	7720	7	6	1	4	198	N010E020
B	7530	7	6	5	6	575	N080W020
B	7501	7	6	1	4	221	S010W020
B	7591	7	6	5	4	163	N020E010
B	7515	7	6	5	5	510	N050W010
B	7555	7	6	5	5	138	S010W010
B	7586	7	6	5	5	246	N020E010
B	7535	7	6	5	5	391	N000W000
B	7504	7	6	5	5	220	S010W020
B	7510	7	6	5	6	544	N040W020
B	7522	7	6	5	4	198	N050W020
B	7569	7	6	1	4	54	N020E010
B	7590	7	6	1	4	39	N020E010
B	8074	7	6	5	6	598	N020W050
B	8129	7	6	5	6	511	S050W000
B	8149	7	6	5	4	243	N020W040
B	8106	7	6	1	4	30	N010W070
B	8113	7	6	5	5	233	N010W070
B	8087	7	6	1	4	79	N010W060
B	8098	7	6	5	5	563	N010W040
B	8264	7	6	5	5	513	NOPRO
B	8321	7	6	5	5	788	NOPRO
B	8247	11	4	3	3	6	N060W070
B	8222	12	1	5	4	192	N060W080
B	8174	12	1	5	4	181	N060W060
B	7554	12	2	5	5	600	S010W010
B	7666	12	4	4	3	9	N050E020
B	8481	12	4	3	3	5	NOPRO
B	7667	12	4	5	3	6	N050E020
B	7738	13	1	5	4	49	S010E010
B	8076	13	1	5	4	38	N020W050
B	8390	13	1	1	3	15	NOPRO
B	8283	13	1	5	5	257	NOPRO
B	7966	13	2	5	4	64	S050E010
B	7599	13	4	4	4	33	N060E010
B	8108	13	4	5	3	8	N010W070
B	7608	13	4	4	2	6	N040W000
B	7820	13	4	2	3	6	S050E030
B	7961	13	4	5	5	85	N050E030
B	8250	13	6	5	4	32	N030W110
B	8261	13	6	5	4	37	S010E010
B	8403	13	7	1	3	23	NOPRO
B	8085	17	1	5	4	93	N010W060
B	8287	25	1	5	4	58	NOPRO
B	8299	25	1	5	4	30	NOPRO
B	7640	25	2	2	4	108	S000E020
B	8460	25	4	3	3	6	NOPRO
B	7647	25	6	5	4	130	S000E020
B	8189	30	1	5	4	194	N060W040
B	8287	31	1	1	3	9	NOPRO
B	8308	31	1	5	4	12	NOPRO
B	8354	31	6	1	3	12	NOPRO
B	7958	33	4	2	3	12	S030E050
B	8121	33	10	5	4	40	N020W050
B	7956	34	1	5	6	823	S000E030

B	7664	34	1	5	4	3	N010W240
B	8120	34	1	5	4	59	N010W080
B	8072	34	1	5	5	385	N020W050
B	8233	34	1	5	5	156	N060V030
B	8221	34	1	5	4	90	N060V080
B	8366	34	1	1	3	9	NOPRO
B	8268	34	1	5	3	16	NOPRO
B	8365	34	1	5	4	38	NOPRO
B	8379	34	1	5	4	43	NOPRO
B	8273	34	1	5	4	20	NOPRO
B	8284	34	1	5	3	18	NOPRO
B	7567	34	2	2	5	235	N060E010
B	8326	34	2	1	4	163	NOPRO
B	7633	34	4	5	3	26	N060W010
B	7683	34	4	4	3	8	S010W260
B	7634	34	6	5	5	658	S000E020
B	8322	34	6	5	4	365	NOPRO
C	8399	7	1	5	5	170	NOPRO
C	8400	7	1	5	5	300	NOPRO
C	8401	7	1	5	5	200	NOPRO
C	8404	7	1	5	4	135	NOPRO
C	8405	7	1	5	4	61	NOPRO
C	8456	7	6	5	5	275	NOPRO
C	8451	33	1	5	4	102	NOPRO
K	8019	1	1	5	4	57	N010W030
K	7724	1	1	5	4	76	N020W030
K	7769	1	1	5	4	154	S000W030
K	7638	1	1	1	4	23	S000
K	8164	1	1	5	5	364	N010W040
K	8243	1	1	5	4	80	N010W000
K	8467	1	1	5	4	76	NOPRO
K	8040	1	4	4	3	10	N010W030
K	7716	1	4	5	4	18	NOPRO
K	7885	1	4	5	4	11	S000W050
K	8242	1	4	5	3	9	N010W000
K	7952	1	4	3	3	8	N000W040
K	7977	1	4	3	2	3	N010W040
K	7929	1	6	5	4	166	N010W030
K	7939	1	4	5	4	156	N010W030
K	7773	1	6	5	5	251	N000W060
K	8169	1	6	1	4	67	NOPRO
K	8490	1	6	5	4	55	NOPRO
K	7792	2	4	3	3	12	N005W060
K	8142	2	4	2	3	9	N010W050
K	7781	2	4	2	2	4	W065
K	7765	2	4	5	3	10	S000W040
K	7753	2	4	5	3	14	N000W070
K	7757	2	4	2	3	3	NOPRO
K	7762	2	4	3	3	3	W040
K	7763	2	4	2	2	2	S000W045
K	7827	2	4	5	3	5	W040
K	7882	2	4	4	2	4	N000W040
K	7688	2	4	3	3	6	S000W050
K	7775	2	4	5	3	8	N000W040
K	7915	2	4	5	4	15	N010W040
K	7919	2	4	5	3	10	N030W040
K	7974	2	4	5	3	12	N010W040
K	8022	2	4	2	3	7	N010W030
K	8165	2	4	3	3	6	N020W040
K	8241	2	4	5	3	15	N010W000
K	7875	2	4	4	3	8	NOPRO
K	7932	7	1	5	4	38	N010W010
K	7941	7	1	5	3	10	N000W040
K	7895	7	1	5	4	291	S000W050
K	7830	7	1	1	4	18	N000W060
K	8039	7	1	5	4	33	N020W030
K	7735	7	1	5	4	64	W050
K	7836	7	1	5	4	126	S000
K	7923	7	1	5	4	73	N010W040
K	8257	7	1	5	5	100	S000W060
K	8485	7	1	5	4	106	NOPRO
K	8489	7	1	5	3	10	NOPRO
K	8451	7	1	5	4	43	NOPRO
K	8495	7	1	1	3	6	NOPRO
K	8496	7	1	5	3	13	NOPRO
K	8497	7	1	1	3	6	NOPRO
K	8493	7	1	5	4	100	NOPRO
K	8225	7	2	3	5	434	S010W080
K	8167	7	2	2	3	138	N010W050
K	7764	7	4	3	3	7	W040
K	7897	7	4	2	3	11	N010W040
K	7920	7	4	5	3	8	N030W040
K	7752	7	4	5	3	12	W060
K	7772	7	4	2	3	4	S000W040
K	7930	7	4	5	3	6	N010W040
K	7778	7	4	4	2	4	W060
K	7755	7	4	5	3	11	N010W050
K	7785	7	4	5	3	9	S000W040
K	7905	7	4	5	3	15	N000W050
K	8013	7	4	5	3	9	N020W000
K	7951	7	4	5	3	9	N000W040
K	7894	7	4	2	2	3	N010W040
K	8141	7	4	4	3	5	N010W050
K	7884	7	4	3	3	6	N000W030
K	8253	7	4	5	4	18	NOPRO
K	7706	7	4	5	3	8	N000W030
K	7722	7	4	5	3	10	N000W020
K	7840	7	4	3	3	6	S000W060
K	7855	7	4	2	3	5	N010W040
K	7764	7	4	5	3	7	W060
K	8015	7	4	2	3	9	N030W040
K	7975	7	4	3	3	6	N010W050
K	8255	7	4	5	3	16	S000W060
K	8037	7	4	3	3	6	N010W030
K	7779	7	4	2	3	7	W050
K	7945	7	4	5	3	9	N010W040
K	7922	7	4	2	2	2	N030W040
K	7906	7	4	5	3	11	N000W050
K	8163	7	4	1	3	8	N010W040
K	7730	7	4	1	3	5	W060
K	7936	7	4	4	3	6	N010W040
K	7913	7	4	3	3	6	N010W040
K	7834	7	4	3	2	3	S000W070
K	8234	7	4	2	2	1	N020W040
K	7771	7	4	3	3	7	S000W050
K	7777	7	4	1	3	2	S000W040
K	7924	7	4	1	3	5	N030W040
K	7733	7	4	5	3	6	S000W050
K	8006	7	4	2	3	4	N020W000
K	7881	7	4	4	3	5	S000W050
K	7921	7	4	5	3	7	N030W040
K	8144	7	4	1	3	6	N010W050
K	7929	7	4	3	3	8	N032W040
K	7971	7	4	1	2	2	N030W050
K	7967	7	4	2	2	3	N020W040
K	8258	7	6	5	5	405	S010W060
K	7725	8	4	5	3	8	N020W030
K	7886	8	4	5	3	9	S000W050
K	7751	13	1	5	4	111	S000W060
K	7767	19	6	1	4	122	S000W020
K	8011	12	1	5	5	130	N020W050
K	8007	12	4	3	3	6	NOPRO
K	7894	12	4	2	3	4	N010W040
K	7821	12	4	2	3	7	N000W060
K	7736	12	4	5	4	11	S000W050
K	7768	12	4	5	3	7	S000W030
K	8498	13	1	5	4	23	NOPRO
K	8017	13	4	5	3	12	N010W030
K	8006	13	4	5	3	10	N000W020
K	8143	13	4	5	3	9	N010W050
K	7901	13	4	5	3	19	S000W050
K	8016	13	4	5	2	5	N010W030
K	7708	13	6	1	4	47	NOPRO
K	8499	13	6	1	3	46	NOPRO
K	7794	18	2	3	4	80	N000W040
K	7944	18	4	2	2	3	N010W040
K	7909	18	4	5	3	6	N020W050
K	7872	18	6	1	4	67	S000W060
K	7728	18	6	1	4	47	W040
K	7769	22	4	5	3	7	S000W060
K	8042	25	4	3	3	13	N010W030
K	7869	26	4	1	3	4	S000W040
K	7926	31	4	5	3	9	N010W040
K	8012	32	4	2	2	4	NOPRO
K	7770	32	4	1	3	6	S000W030
K	7860	32	4	5	3	7	S000W050
K	7632	32	4	1	3	6	S000W020
K	7766	32	4	1	3	6	S000W050
K	7732	32	4	5	3	10	S000W050
K	7914	32	4	5	3	6	N010W040
K	7892	32	4	2	2	2	N010W040
K	8491	33	1	5	4	30	NOPRO
K	7763	33	4	5	3	10	S000W050
K	7912	34	1	1	5	133	N010W040
K	7715	34	1	5	4	147	N000W060
K	7910	34	1	1	3	30	N010W040
K	8493	34	1	5	4	103	NOPRO
K	7655	34	2	3	4	68	NOPRO
K	8168	34	2	1	5	400	N050E020
K	8454	34	2	1	4	200	NOPRO
K	7716	35	4	5	4	13	N000W060
K	7714	35	4	3	3	8	W060
K	7826	35	4	5	4	16	N000W060
K	7828	35	4	2	3	6	N000W060
K	7927	35	4	2	2	4	N020W040
K	8023	36	4	5	3	9	N010W030
K	7774	35	4	4	3	7	W070
K	7925	37	4	2	3	7	N030W040
K	7727	37	4	5	3	8	W040
K	7731	37	4	5	3	9	S000W050
K	7833	37	4	5	3	10	S000W070
K	7751	37	4	2	2	3	N000W060
K	7744	37	4	3	3	8	S000W050
K	7839	37	4	2	3	3	S000W010
K	7837	37	4	2	3	6	S000
K	7883	37	4	5	3	6	N000W030
K	7851	37	4	5	3	7	N010W040
K	7942	37	4	2	3	6	N010W040
K	7943	37	4	1	3	5	N010W040
K	7970	37	4	5	3	9	N020W040
K	8020	37	4	5	3	6	N010W030
K	8166	37	4	5	3	8	N013W040

N	7784	37	4	5	3	8	N000V060
N	A073	3	2	1	3	4	S
N	A071	1	1	5	4	40	O
N	A058	1	1	5	4	81	C
N	A051	1	1	5	4	163	A
N	A057	1	1	5	3	74	C
N	A061	1	1	5	4	28	F
N	A062	1	1	5	4	97	G
N	A064	1	1	5	4	175	N
N	A065	1	1	5	4	207	N
N	A071	1	1	5	4	80	O
N	A077	1	1	5	4	75	F
N	A078	1	1	5	3	37	F
N	A071	1	1	5	4	83	O
N	A078	1	1	5	3	33	F
N	A051	1	1	5	4	144	A
N	A057	1	1	5	4	193	C
N	A061	1	1	5	4	29	F
N	A062	1	1	5	4	97	G
N	A065	1	1	5	4	208	N
N	A071	1	1	5	4	42	O
N	A077	1	1	5	4	75	F
N	A078	1	1	5	4	178	F
N	A072	1	2	5	4	340	F
N	8196	1	4	1	2	4	N060W020
N	A059	1	6	5	4	65	C
N	A072	1	6	5	5	339	P
N	A079	1	6	5	4	179	F
N	A074	2	1	5	4	73	S
N	A063	3	1	5	4	46	R
N	A064	7	4	5	3	4	N
N	8500	7	1	5	4	43	NOPRO
N	A058	7	1	5	5	435	C
N	A058	7	1	5	5	477	C
N	A059	7	1	5	4	137	D
N	A058	7	1	5	4	215	C
N	A064	7	1	5	4	66	N
N	A064	7	1	5	4	39	N
N	A061	7	1	1	4	37	E
N	A057	7	1	5	3	16	C
N	A057	7	1	5	4	59	C
N	A056	7	1	5	4	23	C
N	A061	7	1	5	4	24	E
N	A068	7	1	5	4	121	P
N	A071	7	1	5	5	107	O
N	A078	7	1	5	4	85	F
N	A073	7	1	5	4	40	R
N	A078	7	1	5	3	24	F
N	A073	7	1	5	4	67	R
N	A078	7	1	5	4	58	F
N	A073	7	1	5	4	46	R
N	A078	7	1	1	3	13	F
N	A077	7	1	1	3	5	F
N	A071	7	1	5	4	76	O
N	A058	7	1	5	5	478	C
N	A071	7	1	5	4	76	O
N	A073	7	1	2	4	41	R
N	A078	7	1	5	4	59	F
N	A078	7	1	1	3	25	F
N	A073	7	1	5	4	66	
N	A058	7	1	5	4	24	C
N	A061	7	1	5	4	25	E
N	A057	7	1	5	3	17	C
N	A059	7	1	5	4	130	D
N	A061	7	1	5	4	35	E
N	A068	7	1	5	4	121	P
N	A064	7	1	5	4	40	N
N	A064	7	1	5	4	62	N
N	A071	7	1	5	5	107	O
N	A073	7	1	5	4	47	R
N	A077	7	1	5	3	6	F
N	A078	7	1	5	4	87	F
N	7662	7	2	5	5	805	N020F020
N	A063	7	2	2	4	236	H
N	A056	7	2	1	4	106	C
N	A071	7	2	5	4	150	O
N	A054	7	2	2	4	86	B
N	A077	7	2	5	3	20	F
N	A063	7	2	5	6	592	I
N	A057	7	2	2	4	69	C
N	A058	7	2	5	5	411	C
N	A063	7	2	2	4	238	H
N	A056	7	2	5	5	436	C
N	A078	7	2	1	4	15	F
N	A063	7	2	5	6	592	I
N	A056	7	2	1	4	105	C
N	A054	7	2	2	4	87	B
N	A071	7	2	1	4	150	O
N	A073	7	2	1	2	4	R
N	A077	7	2	4	3	20	F
N	A071	7	4	5	3	11	O
N	A062	7	4	5	4	15	G
N	A054	7	4	5	4	13	B
N	A064	7	4	5	3	5	N
N	A065	7	4	5	3	14	N
N	A065	7	4	5	4	7	N
N	A068	7	4	5	3	11	P
N	A054	7	4	5	4	13	B
N	A062	7	4	5	4	15	G
N	A064	7	4	3	3	6	N
N	A065	7	4	5	3	14	N
N	A065	7	4	5	4	7	N
N	A068	7	4	5	3	12	P
N	A071	7	4	3	3	12	O
N	8173	7	4	5	3	7	NOPRO
N	7979	7	4	5	3	6	N020W040
N	8194	7	4	3	3	4	N060W030
N	A064	7	6	5	5	210	N
N	A058	7	6	5	5	411	C
N	A072	7	6	5	4	191	P
N	A057	7	6	1	4	70	C
N	A057	7	6	1	4	59	C
N	A058	7	6	5	4	216	C
N	A064	7	6	5	5	210	N
N	A072	7	6	5	4	191	R
N	A058	8	6	5	4	65	C
N	A064	13	1	5	5	174	N
N	9225	13	1	5	4	129	NOPRO
N	9226	13	1	1	4	40	NOPRO
N	A068	13	4	5	3	5	P
N	A068	13	4	5	3	5	P
N	A064	17	2	4	4	153	N
N	A057	17	2	2	5	298	C
N	A057	17	2	2	5	300	C
N	A064	17	2	4	4	153	N
N	A071	32	1	5	4	84	O
N	A071	32	2	5	4	84	O
N	A058	33	1	5	3	36	C
N	A058	33	1	5	3	37	C
N	A054	34	1	5	4	67	B
N	A063	34	1	5	4	44	I
N	A054	34	1	5	4	69	B
N	A064	34	4	3	3	3	N
N	7695	34	6	5	4	18	N010F010
S	9224	7	2	1	4	85	NOPRO
S	9227	12	4	5	4	64	NOPRO

APPENDIX C

VORE SITE TOOLS

Column	Information
1	catalog number
2	material type
3	tool type
4	completeness
5	size
6	weight in decigrams
7	level
8	unit
9	square

27771	2	4	5	4	29	1	E1	-0
27761	3	2	5	4	253	1	E1	3
27760	3	2	1	4	215	1	E1	3
27888	7	4	5	4	14	1	01	1
27536	7	4	5	3	11	1	S1	1
27900	7	4	5	4	10	1	S1	-0
27511	7	4	4	3	5	1	S1	-0
27899	7	4	4	3	7	1	S1	-0
27622	5	4	2	3	3	1	S1	-0
27858	7	4	5	4	13	1	W1	1
27565	7	4	5	3	10	1	W1	-0
27562	8	4	4	3	9	1	W1	-0
27880	2	1	1	3	60	1	W3	-0
27814	2	4	5	4	23	1	W3	-0
27745	2	4	5	4	10	1	W3	7
27813	2	6	5	4	84	1	W3	-0
27803	3	4	5	4	19	1	W3	-0
27815	7	4	5	3	9	1	W3	-0
27746	33	4	1	3	9	1	W3	-0
27756	1	1	5	4	50	1	W4	7
27757	1	6	5	5	221	1	W4	10
27831	2	1	5	5	355	1	W4	12
27885	2	1	1	3	19	1	W4	-0
27682	2	1	5	4	59	1	W4	-0
27788	2	2	1	5	472	1	W4	4
27759	2	2	1	4	62	1	W4	-0
27779	2	4	5	3	9	1	W4	12
27770	2	4	5	3	9	1	W4	-0
27839	2	4	4	3	11	1	W4	-0
27786	2	4	5	4	16	1	W4	-0
27637	2	4	3	3	5	1	W4	12
27796	3	1	5	5	425	1	W4	3
27782	3	1	5	6	1872	1	W4	1
27882	3	1	5	4	332	1	W4	-0
27840	3	1	5	4	73	1	W4	-0
27878	3	1	5	4	21	1	W4	-0
27792	3	4	5	3	9	1	W4	4
27785	7	4	5	4	13	1	W4	7
27836	7	4	1	3	11	1	W4	-0
27887	10	1	5	4	53	1	W4	-0
27689	2	2	5	5	442	2	E1	4
27585	7	2	2	5	209	2	E1	4
27714	7	4	5	4	17	2	E1	12
27713	7	4	5	4	13	2	E1	12
27609	7	4	5	3	9	2	E1	-0
27867	22	4	5	3	11	2	E1	12
27847	1	2	5	5	227	2	N1	8
27877	2	1	1	3	16	2	N1	-0
27661	2	4	5	4	12	2	N1	6
27559	2	4	5	4	13	2	N1	-0
27868	2	4	3	3	8	2	N1	-0
27557	7	1	5	4	7	2	N1	-0
27570	7	4	5	4	17	2	N1	-0
27565	7	4	5	3	7	2	N1	-0
27558	7	4	5	3	8	2	N1	5
27672	7	4	5	3	7	2	N1	-0
17743	12	4	5	3	13	2	N1	2
27863	12	4	2	3	3	2	N1	6
27862	22	4	5	3	10	2	N1	1
27588	2	1	5	4	67	2	01	2
27871	2	4	5	3	7	2	01	-0
27603	2	4	5	3	5	2	01	-0
27602	2	4	5	3	5	2	01	5
27884	7	1	5	4	17	2	01	3
27870	7	4	5	3	10	2	01	-0
27669	12	4	3	3	2	2	01	-0
27577	2	4	5	3	11	2	S1	2
27575	2	4	1	2	2	2	S1	2
27586	2	4	5	4	15	2	S1	-0
27582	7	4	5	4	18	2	S1	-0
27532	7	4	5	4	10	2	S1	4
27567	7	4	5	3	9	2	S1	-0
27576	7	4	5	3	15	2	S1	9
27605	35	4	5	4	20	2	S1	7
27747	2	4	5	3	11	2	W1	-0
27579	2	4	5	3	8	2	W1	2
27659	2	4	5	3	13	2	W1	3
27884	2	6	5	5	373	2	W1	6
27748	2	4	5	4	16	2	W2	2
27784	2	1	5	4	157	2	W3	-0
27795	2	6	5	4	266	2	W3	-0
27794	33	4	5	3	5	2	W3	-0
27843	2	4	2	4	16	2	W4	9
27645	2	6	5	4	210	2	W4	8
27844	2	6	5	4	161	2	W4	12
27596	2	1	5	5	455	3	E1	10
27568	2	4	5	4	11	3	E1	-0
27601	3	4	5	3	9	3	E1	3
27624	3	4	5	3	15	3	E1	11
27505	7	4	5	4	8	3	E1	11
27550	2	4	5	3	9	3	N0	-0
27629	2	4	5	3	12	3	N1	5
27506	2	4	5	3	10	3	N1	1
27516	2	4	5	3	5	3	N1	3
27593	2	4	5	4	11	3	N1	9
27660	2	4	5	3	9	3	N1	2
27528	2	4	3	2	3	3	N1	-0
27571	3	4	2	3	7	3	N1	2
27628	35	4	5	4	13	3	N1	6
27580	1	4	5	4	13	3	01	-0
27521	2	1	5	4	19	3	01	2
27883	2	1	1	4	50	3	01	-0
27817	2	4	5	3	11	3	01	-0
27546	3	4	5	3	11	3	S1	-0
27534	7	4	5	3	16	3	S1	-0
27805	35	4	5	3	8	3	S1	-0
27549	2	4	5	3	9	3	W1	1
27829	17	2	5	5	210	3	W1	12
27724	1	4	5	3	7	3	W2	-0
27744	2	4	5	4	20	3	W2	2
27728	2	4	5	3	10	3	W2	-0
27726	2	4	5	3	9	3	W2	5
27727	2	4	5	3	12	3	W2	1
27725	2	4	5	3	9	3	W2	7
27723	2	4	5	3	12	3	W2	-0
27797	7	4	5	4	14	3	W2	-0
27798	7	6	5	4	68	3	W2	1
27722	35	4	5	3	10	3	W2	-0
27822	2	4	5	3	9	3	W3	-0
27821	2	1	5	4	127	3	W4	-0
27850	2	4	5	3	9	3	W4	11
27514	2	1	1	3	39	4	E1	10
27881	2	1	1	3	24	4	E1	3
27760	2	4	5	4	17	4	E1	1
27504	2	4	5	4	13	4	E1	3
27539	2	4	5	4	14	4	E1	-0
27600	2	4	5	4	10	4	E1	-0
27543	2	4	3	2	5	4	E1	-0
27599	2	4	4	3	6	4	E1	-0
27542	2	4	2	3	7	4	E1	-0
27544	2	4	3	3	2	4	E1	-0
27562	2	4	3	3	9	4	E1	9
27538	2	4	5	3	13	4	E1	-0
27590	2	4	5	3	6	4	E1	2
27540	2	4	5	3	8	4	E1	-0
27594	2	4	5	3	7	4	E1	-0
27823	2	4	5	3	11	4	E1	-0
27541	2	4	5	3	13	4	E1	-0
27513	2	4	5	3	6	4	E1	8
27512	2	4	5	4	9	4	E1	10
27585	12	4	5	3	6	4	E1	-0
27519	2	4	5	4	22	4	N1	9
27529	2	4	5	4	18	4	N1	-0
27525	18	2	1	3	18	4	N1	5
27522	22	4	5	4	13	4	N1	-0
27592	22	4	5	3	7	4	N1	2
27535	2	4	5	4	12	4	01	7
27591	2	1	1	4	49	4	W1	1
27834	2	2	5	5	410	4	W1	3
27717	2	4	5	4	16	4	W1	2
27849	2	4	5	3	11	4	W1	1
27793	11	1	5	6	871	4	W1	7
27618	2	1	5	5	366	4	W2	12
27624	2	4	5	4	20	4	W2	10
27826	2	4	5	3	13	4	W2	3
27851	2	4	5	3	11	4	W2	3
27852	2	4	5	4	14	4	W2	10
27853	2	4	5	3	9	4	W2	2
27836	2	4	5	3	11	4	W2	7
27825	2	4	5	3	10	4	W2	1
27777	2	4	5	3	5	4	W2	11
27810	2	4	5	3	11	4	W2	-0
27778	7	4	4	3	11	4	W2	-0
27775	2	6	5	6	644	4	W3	-0
27761	2	1	5	6	719	5	E1	4
27548	2	2	2	3	19	5	E1	5
27547	2	4	5	3	12	5	E1	5
27621	2	4	2	4	12	5	E1	9
27567	2	4	4	3	10	5	E1	11
27800	3	1	5	5	263	5	E1	4
27596	1	1	1	3	9	5	N1	5
27608	2	4	5	4	23	5	N1	-0
27607	2	4	5	4	18	5	N1	2
27606	2	4	2	4	14	5	N1	2
27554	2	4	5	4	20	5	N1	7
27626	3	1	1	3	71	5	N1	-0
27627	3	2	5	6	1364	5	N1	-0
27537	3	4	5	4	22	5	N1	1
27610	3	4	5	4	17	5	N1	2
27597	7	4	5	3	10	5	N1	1
27718	2	4	5	4	21	5	01	1
27719	2	4	5	4	18	5	01	1
27804	2	4	5	3	9	5	01	8
27721	2	4	5	4	20	5	01	-0
27739	2	4	5	4	15	5	01	3
27738	2	4	5	3	14	5	01	-0
27742	2	4	5	3	14	5	01	4
27764	3	1	5	6	663	5	01	1
27720	3	4	5	4	27	5	01	9
27740	3	4	5	4	17	5	01	4
27741	3	4	5	4	20	5	01	-0
27848	35	4	5	3	12	5	01	6

27830	2	4	5	3	11	5	V1	1
27835	2	2	5	4	120	5	V2	-0
27841	9	1	5	4	43	5	V2	-0
27801	2	1	5	6	2571	5	V2	17
27832	2	1	5	5	470	5	V2	-0
27753	2	2	5	6	584	5	V2	2
27819	2	4	5	4	19	5	V3	12
27774	13	2	5	4	179	5	V3	-0
27620	2	4	5	3	13	5	V4	-0
27806	7	4	5	3	14	5	V4	-0
27754	1	4	5	4	35	6	E1	17
27809	2	4	5	4	16	6	E1	1
27770	2	4	5	4	27	6	E1	12
27828	2	4	1	3	11	6	E1	-0
27807	7	4	5	3	16	6	E1	1
27857	3	4	5	4	22	6	N0	-0
27846	2	4	5	4	19	6	N1	-0
27864	2	4	5	4	15	6	N1	10
27595	2	4	5	3	11	6	N1	-0
27876	2	4	5	3	12	6	N1	1
27523	2	4	5	3	14	6	N1	5
27806	7	4	5	3	15	6	O1	7
27716	2	4	5	4	21	6	V3	3
27776	2	4	5	3	12	6	V3	-0
27802	2	4	5	3	15	6	V3	1
27752	2	4	5	4	16	7	E1	10
27614	2	4	5	3	14	7	N1	-0
27616	2	4	5	4	20	7	N1	-0
27569	2	4	5	3	13	7	N1	1
27594	2	4	5	3	10	7	N1	1
27617	2	4	5	3	16	7	N1	-0
27649	2	4	5	3	10	7	N1	-0
27620	2	4	2	2	2	7	N1	-0
27509	7	4	5	3	14	7	N1	6
27551	7	4	5	3	17	7	N1	4
27618	11	1	5	4	37	7	N1	-0
27695	11	4	5	4	19	7	N1	17
27596	11	4	4	3	11	7	N1	12
27533	11	4	5	3	13	7	N1	3
27524	33	4	5	3	13	7	N1	11
27897	33	4	5	3	10	7	N1	12
27615	33	4	5	3	13	7	N1	-0
27578	2	1	5	5	515	7	O1	-0
27755	2	4	5	4	26	7	O1	-0
27812	2	4	5	3	19	7	O1	5
27765	2	4	5	4	25	7	O1	9
27751	2	4	5	4	21	7	O1	-0
27758	2	4	5	3	9	7	O1	-0
27749	7	4	5	3	15	7	O1	5
27811	7	4	5	3	14	7	O1	5
27833	7	4	5	3	8	7	O1	1
27750	33	4	5	3	12	7	O1	2
27763	2	4	5	3	15	8	E1	3
27799	2	4	5	4	25	8	E1	-0
27855	2	4	5	4	25	8	E1	9
27772	2	4	5	4	14	8	E1	-0
27773	7	4	5	4	30	8	E1	-0
27856	7	4	5	3	10	8	E1	7
27768	18	4	5	4	19	8	E1	-0
27854	18	4	5	4	19	8	E1	8
27581	2	1	5	4	27	8	N1	12
27574	2	4	5	4	13	8	N1	3
27604	35	4	5	4	20	8	N1	3
27779	2	4	5	4	15	8	O1	-0
27737	2	4	5	3	12	8	O1	-0
27735	2	4	5	4	14	8	O1	-0
27734	2	4	5	3	18	8	O1	-0
27732	2	4	5	4	21	8	O1	-0
27520	2	4	1	2	3	8	O1	-0
27783	3	4	5	4	18	8	O1	-0
27736	3	4	5	4	19	8	O1	-0
27767	22	4	5	4	25	8	O1	3
27730	22	4	5	4	16	8	O1	-0
27731	22	4	5	3	11	8	O1	-0
27501	2	4	3	3	10	9	E1	-0
27552	2	2	3	4	223	10	N1	6
27553	2	4	3	2	4	10	N1	6

APPENDIX D

HAWKEN SITE TOOLS

Column	Information
1	catalog number
2	material type
3	tool type
4	completeness
5	size
6	weight in decigrams
7	provenience

60002	1	2	4	4	173	NE30NW00
60138	1	4	1	3	27	NE40NW10
60158	1	4	1	2	13	NE40NW00
60159	1	4	1	2	6	NE50NW10
60046	1	4	2	3	17	NE40NW10
60021	1	4	2	4	29	NE40NW10
60060	1	4	5	4	36	NE30NW00
60081	1	4	3	3	25	NE40NW00
60064	1	4	5	4	30	NE30NW00
60042	1	4	5	4	53	NE40NW10
60049	1	4	5	4	40	NE50NW10
60066	1	4	2	4	31	NOPR
60076	1	4	2	4	26	NE30NW00
60024	1	4	2	4	63	NE40NW10
60089	1	4	4	3	33	NE40NW00
60010	1	4	2	3	19	NE30NW00
60129	1	4	5	4	46	NE40NW00
60077	1	4	5	4	36	NOPR
60069	1	4	5	4	57	NE40NW00
60023	1	4	5	4	37	NE40NW00
60038	1	4	5	4	26	NE30NW10
60065	1	4	5	3	47	NE40NW10
60125	1	4	5	4	42	NOPR
60075	1	4	3	3	36	NOPR
60085	1	4	5	3	21	NE30NW00
60055	1	4	5	4	37	NE20NW00
60061	1	4	5	4	67	NE30NW00
60078	1	4	2	3	25	NE50NW10
60151	1	4	5	4	79	NOPR
60060	1	4	5	4	49	NE40NW00
60081	1	4	5	4	67	NOPR
60045	1	4	5	4	57	NE30NW10
60013	1	4	5	4	43	NE30NW00
60037	1	4	4	3	25	NE40NW10
NF322	1	4	5	4	35	NOPR
60029	1	4	5	4	69	NE40NW00
60043	1	4	2	4	67	NE40NW10
60135	1	4	5	4	93	NOPRO
60017	2	4	2	4	51	NE50NW10
60055	2	4	2	4	66	NOPR
60064	2	4	2	4	64	NE60NW00
60067	2	4	5	4	36	NE40NW10
60041	2	4	2	4	49	NE20NW00
60069	2	4	2	4	39	NE20NW00
60054	2	4	5	4	42	NE40NW10
60042	2	4	5	4	49	NE40NW10
60086	2	4	2	4	82	NE00NW10
60036	2	4	2	4	44	NE30NW20
60130	2	4	5	4	63	NE50NW10
60074	2	4	5	4	73	NE50NW10
60170	2	4	5	4	41	NE20NW00
60073	2	4	5	4	50	NOPR
60035	2	4	5	4	35	NOPR
60152	2	4	5	4	70	NOPR
60046	2	4	5	4	58	NE30NW00
60054	2	4	3	3	10	NE40NW10
NE333	3	4	3	4	49	NOPR
60026	3	4	2	3	31	NOPR
60072	3	4	2	4	95	NE30NW10
60030	7	4	2	4	40	NE40NW10
60068	7	4	2	3	21	NE40NW10
60153	7	4	2	2	5	NE40NW00
60083	8	4	5	4	67	NE40NW00
60057	9	4	5	4	33	NE40NW10
60015	9	4	5	4	30	NOPR
60066	9	4	5	4	30	NE30NW00
60016	9	4	3	4	29	NE30NW10
60022	9	4	3	4	35	NE50NW10
60082	9	4	2	4	56	NE30NW00
60033	9	4	2	4	71	NE40NW00
60167	9	4	2	4	45	NE30NW00
60039	9	4	2	4	80	NE40NW10
60034	9	4	5	4	47	NE30NW10
60074	9	4	5	4	66	NE50NW10
60068	9	4	5	4	42	NE30NW00
60127	9	4	5	4	83	NE40NW10
60083	9	4	5	4	52	NE40NW10
60150	9	4	2	3	8	NOPR
60003	9	4	4	4	50	NE30NW00
60000	9	4	5	4	44	NE20NW00
60011	9	4	5	4	43	NE40NW00
60061	9	4	4	4	40	NE40NW00
60019	9	4	3	4	76	NE40NW10
60190	9	4	5	4	56	NOPR
60059	9	4	2	3	20	NE20NW00
60052	9	4	3	4	44	NOPR
60185	9	4	5	4	62	NOPR
60165	9	4	4	4	51	NE40NW10
60062	9	4	2	4	52	NE40NW10
60166	9	4	2	4	74	NOPR
60028	11	4	5	4	55	NE40NW10
C3464	12	4	5	4	41	NOPR
60044	12	4	2	3	20	NOPR
60207	12	4	5	3	21	NOPR
60067	12	4	5	4	34	NE40NW10
60031	12	4	5	4	58	NE30NW10
60027	12	4	5	4	38	NE50NW10
60065	12	4	5	4	29	NE40NW10
60140	18	4	1	3	8	NE40NW10
60081	18	4	3	3	31	NE40NW00
60018	18	4	5	4	29	NE30NW10
60014	18	4	3	4	39	NE20NW00
60051	18	4	2	4	25	NOPR
60023	18	4	5	4	55	NOPR
60012	18	4	5	4	37	NE50NW10
60047	18	4	5	4	52	NE30NW10
60058	18	4	2	4	72	NE50NW00
60032	18	4	5	4	49	NE30NW00
60053	18	4	5	4	41	NOPR
60029	18	4	5	4	37	NE40NW00
60010	25	4	5	3	21	NE30NW10

APPENDIX E
AGATE BASIN SITE
FOLSOM TOOLS

Column	Information
1	catalog number
2	material type
3	tool type
4	completeness
5	size
6	weight in decigrams
7	provenience

0A121	1	1	5	4	173	N120E010	0A119	2	1	1	4	49	N105E020	0A031	3	5	3	3	9	N110E010
0A367	1	1	5	4	23	N085E020	0A188	2	4	1	3	8	N105E010	0A007	3	5	3	3	8	N000F000
0A330	1	1	1	2	1	N095E015	0A188	2	4	1	3	8	N105E000	0A025	3	5	3	3	9	N110E010
0A043	1	1	5	3	11	N100W010	0A290	2	1	5	4	78	N100W000	96540	3	5	4	3	7	
0A344	1	1	1	3	3	N085E010	96502	2	3	4	5	54	N100W000	0A014	3	5	4	4	12	NOPRO
96553	1	1	5	5	76	N095E005	96501	2	5	5	4	56	N100W000	96611	3	5	4	3	9	NOPRO
96560	1	1	5	4	18	N100W000	96504	2	4	4	4	66	N100W000	0A040	3	5	4	3	13	NOPRO
0A034	1	1	1	3	7	N115W010	96503	2	3	4	3	23	NOPRO	C3487	3	5	4	2	3	NOPRO
0A297	1	1	1	3	6	N095E015	96550	2	3	3	3	15	N105E010	0A037	3	5	4	3	7	NOPRO
0A395	1	1	1	3	8	N100W000	0A039	2	2	5	5	279	N110E010	0A028	3	5	4	3	11	NOPRO
0A053	1	1	1	3	6	N100W010	96563	2	2	5	5	576	N110W000	0A029	3	5	4	3	8	NOPRO
0A329	1	1	5	3	9	N080E020	0A305	2	1	5	5	400	N090E015	0A036	3	5	4	3	9	NOPRO
96525	1	3	1	4	9	N110E010	0A119	2	1	1	4	50	N105E020	96510	3	5	3	4	13	NOPRO
0A013	1	9	5	5	132	N110E005	0A076	2	5	3	4	15	N085E000	06520	3	5	4	2	3	NOPRO
0A293	1	1	5	4	52	N085W010	0A092	2	5	4	3	5	N080E000	06539	3	5	4	3	10	NOPRO
0A099	1	9	5	4	16	N085E020	0A106	2	5	4	3	10	N075E000	0A281	3	5	4	3	5	NOPRO
96558	1	9	5	4	33	N095E010	0A392	2	5	4	2	2	NOPRO	96531	3	5	3	2	3	NOPRO
0A055	1	9	5	4	66	N090E020	NOCAT	2	5	3	3	5	NOPRO	96521	3	5	4	2	3	NOPRO
96600	1	2	5	4	36	N100E015	0A395	2	5	4	3	9	NOPRO	0A173	3	5	3	2	3	NOPRO
0A338	1	1	5	3	8	N080W000	0A079	2	5	4	4	19	NOPRO	0A021	3	5	4	3	13	NOPRO
0A052	1	1	5	4	49	N100W010	11301	2	5	4	3	8	NOPRO	96534	3	5	4	4	20	NOPRO
0A085	1	3	5	4	59	N085E000	0A057	2	5	4	3	5	NOPRO	0A022	3	5	4	4	17	NOPRO
0A078	1	3	2	3	39	N085E000	06551	2	5	4	2	3	NOPRO	96518	3	5	3	3	7	NOPRO
0A112	1	4	5	4	31	N090W005	0A072	2	5	4	2	3	NOPRO	0A284	3	5	4	3	7	NOPRO
96533	1	4	3	3	21	N090E020	NOCAT	2	5	3	2	5	NOPRO	96513	3	5	4	3	6	NOPRO
0A093	1	3	5	5	153	N080E000	A6	2	5	4	3	13	NOPRO	0A280	3	5	4	3	7	NOPRO
0A082	1	5	1	3	10	N085E000	0A335	2	5	4	2	3	NOPRO	0A125	3	5	4	3	9	NOPRO
0A174	1	5	1	4	16	N075W235	96536	2	5	4	2	3	NOPRO	0A393	3	5	4	3	5	NOPRO
0A316	1	1	5	5	126	N085E010	0A167	2	5	4	3	7	NOPRO	96542	3	5	4	3	3	N110E010
0A131	1	6	5	5	445	N105E025	0A080	2	5	4	3	5	NOPRO	0A013	3	5	4	3	10	N110E000
0A187	1	1	5	4	154	N110E015	0A065	2	5	4	4	26	NOPRO	0A015	3	5	4	3	8	N010E000
0A026	1	1	5	4	42	N110E010	0A073	2	5	4	3	18	NOPRO	0A181	3	5	4	2	3	NOPRO
0A277	1	1	5	4	100	N115E030	0A104	2	5	4	3	16	NOPRO	0A054	3	5	3	3	8	N100E020
0A052	1	1	5	5	382	N090E020	96568	3	3	1	3	18	N110E010	46519	3	5	4	2	2	NOPRO
0A085	1	1	5	5	123	N085E010	0A354	3	1	5	4	18	N105E015	95511	3	5	4	3	10	N110E010
0A173	1	1	5	4	132	N095E000	0A242	3	1	5	3	16	N110E010	06514	3	5	3	2	4	N110E010
0A121	1	1	5	5	97	N110W005	0A239	3	1	5	4	51	N085E010	06529	3	5	3	3	11	N110E015
96598	1	1	5	5	121	N095E005	96528	3	3	1	3	7	N080E020	06607	3	5	3	2	4	N110E010
96567	1	1	5	4	81	NOPRO	0A020	3	3	3	4	70	N110E010	06516	3	5	4	3	5	N110E010
96570	1	1	5	5	284	NOPRO	96507	3	3	5	4	59	N110E010	0A175	3	5	4	2	2	N085E015
0A295	1	1	5	5	312	N085W010	0A175	3	3	3	4	40	N075W235	0A183	3	5	4	2	2	NOPRO
0A286	1	1	5	4	70	N095E010	0A017	3	9	5	4	31	N110E005	0A179	3	5	4	3	3	N085E025
0A439	1	6	5	4	91	N095E010	0A193	3	1	5	4	20	N110E005	96539	3	5	4	3	6	NOPRO
0A191	1	6	5	4	49	NOPRO	0A400	3	1	5	4	27	N080W235	0A095	4	5	4	3	11	N080W000
0A430	1	6	5	3	33	N080W240	0A047	3	1	5	4	26	N110E005	0A091	4	5	3	2	4	NOPRO
0A100	1	6	5	3	23	N065E020	0A030	3	1	5	4	9	N110E010	96589	8	1	5	4	42	N115E010
0A429	1	6	5	3	58	N080W245	96541	3	5	1	3	4	N110E010	0A247	8	1	5	4	65	N110E010
0A276	1	6	5	4	88	N110E035	96542	3	5	1	3	4	N110E010	0A299	8	1	5	4	110	NOPRO
96597	1	6	5	4	68	N115E010	0A296	3	9	5	4	13	N075W235	0A355	8	1	5	4	62	N115E010
11303	1	6	5	4	100	N090W010	0A024	3	9	5	3	9	N110E010	96573	8	1	5	4	78	N100W000
96565	1	6	5	4	113	N110E010	0A016	3	3	2	5	34	N110E005	96572	8	6	5	4	289	N105E000
0A123	1	6	5	4	74	N110E025	0A098	3	1	5	4	15	N115E000	0A242	9	1	5	3	9	N085W010
0A061	1	6	5	4	112	N090E020	0A107	3	5	5	4	21	N095E025	0A170	8	2	2	3	22	N110E015
0A081	1	4	5	3	11	N085E000	96557	3	9	5	4	9	N110E015	96545	8	3	2	4	27	N110E010
0A069	1	5	4	3	12	N085E000	F06	3	5	1	3	3	N110E015	96594	8	1	5	4	82	N115E075
0A084	1	5	3	3	8	N080W000	96527	3	3	1	3	4	N110E015	0A355	8	1	5	4	64	N115E010
F039	1	5	4	2	1	NOPRO	96567	3	2	5	4	193	N100E010	0A055	8	1	5	4	44	N095E005
0A070	1	5	4	3	9	N085E000	0A032	3	2	5	5	282	N100E010	96591	8	1	5	4	109	N105E000
0A102	1	5	3	3	9	N075E000	96537	3	2	5	5	327	NOPRO	0A067	8	1	5	4	61	N085E005
96039	1	5	4	4	13	N095E015	0A012	3	6	5	4	122	N110E010	0A299	8	1	5	4	112	NOPRO
0A363	1	5	3	3	5	NOPRO	96595	3	6	5	4	133	N115E005	0A247	8	1	5	4	66	N110E010
0A094	1	5	3	3	11	N080E000	0A019	3	5	4	4	26	N110E010	96599	8	1	5	4	53	N115E010
0A493	1	5	5	4	10	NOPRO	96547	3	5	4	4	28	N100E010	96573	8	1	5	4	79	N100W000
0A305	2	1	5	5	400	N090E015	96512	3	5	4	2	5	N110E010	0A320	8	1	5	4	240	N105E015

06523	8	5	4	3	7	N110E010
06524	8	5	4	3	8	N110E010
0A130	8	5	3	2	1	NOPRO
0A185	8	5	3	2	4	NOPRO
0A105	8	5	4	2	3	NOPRO
96539	8	5	4	2	4	NOPRO
96223	8	5	4	3	4	NOPRO
96546	8	5	3	3	6	NOPRO
0A089	11	1	5	5	254	N105W015
96592	11	1	5	5	304	N105E000
96569	12	1	5	4	90	NOPRO
96532	12	3	3	4	29	N090E010
0A039	12	1	5	5	239	N110E015
96571	12	1	5	5	195	NOPRO
96426	12	6	5	4	51	NOPRO
0A083	12	5	3	3	7	N085W000
0A075	12	5	4	3	6	N085E000
0A074	12	5	4	2	2	N085E000
0A311	13	9	5	3	28	N095E015
96543	13	5	4	3	8	N110E010
0A194	13	5	4	3	4	NOPRO
0A180	13	5	3	3	9	NOPRO
0A304	13	5	4	3	3	NOPRO
0A165	15	5	4	3	10	N100W000
96537	15	5	4	3	7	N085E010
0A233	15	5	4	2	3	NOPRO
0A390	15	5	4	2	2	NOPRO
F052	15	5	1	2	1	NOPRO
F027	15	5	4	3	5	NOPRO
0A362	18	1	5	4	82	N101W000
96526	18	3	2	3	32	N110E010
0A096	18	1	5	4	19	N090W000
0A417	18	6	5	3	37	N085W230
0A182	18	5	4	3	5	NOPRO
C3488	19	5	3	2	5	NOPRO
96522	16	5	4	2	5	N110E010
96517	18	5	4	3	7	N110E010
0A110	22	3	3	4	40	N090W005
0A391	22	1	5	5	490	N100W000
0A006	23	6	5	4	70	N110E005
0A045	23	6	5	4	85	N100W010
0A044	28	1	5	3	16	N100W010
96564	30	1	1	5	503	N110W000
96574	33	1	5	4	48	N100E010

APPENDIX F
AGATE BASIN SITE
FOLSOM DEBITAGE

Column	Information
1	catalog number
2	material type
3	flake type
4	platform
5	size
6	(disregard)
7	provenience

CA241	1 3 3 4	55	N085E010	F046	1 3 1 3	-0	N080E020	F057	1 3 3 2	-0	NOPRO
F032	1 3 3 3	-0	N090E015	F046	1 3 3 3	15	N080E020	F057	1 3 3 2	-0	NOPRO
FC32	1 3 3 4	17	N090E015	F	1 3 3 2	2	NOPRO	F057	1 3 3 2	-0	NOPRO
F047	1 3 3 3	-0	N090E000	FF	1 3 3 2	2	NOPRO	F057	1 3 3 2	16	NOPRO
F047	1 3 3 3	-0	N080E000	F040	1 3 3 3	-0	N085E000	0A361	1 3 3 4	48	N110E015
FC47	1 3 3 3	-0	N080E000	F040	1 3 3 3	-0	N085E000	NN	1 3 1 2	1	N100W010
FC47	1 3 3 3	-0	N080E000	F040	1 3 3 3	-0	N085E000	NN	1 3 1 2	2	NOPRO
F047	1 3 1 2	-0	N080E000	FC40	1 3 3 3	-0	N085E000	F025	1 1 1 4	47	N095E005
F047	1 3 1 2	-0	N080E000	FC40	1 3 3 3	-0	N085E000	F039	1 3 1 2	2	N085W000
F047	1 3 1 2	-0	N080E000	FC40	1 3 3 3	-0	N085E000	F027	1 3 3 4	-0	N095E015
FC47	1 3 3 2	18	N080E000	F040	1 3 3 3	-0	N085E000	F027	1 3 3 2	-0	N095E015
F041	1 3 3 3	-0	N085E005	F040	1 3 3 3	-0	N085E000	F027	1 3 3 2	-0	N095E015
F041	1 3 3 3	-0	NC95E005	F040	1 3 3 3	-0	N085E000	F025	1 3 3 2	16	N095E015
F041	1 3 3 3	-0	N085E005	F040	1 3 1 3	-0	N085E000	F027	1 3 1 2	-0	N095E015
F041	1 3 3 3	-0	N085E005	FC4C	1 3 3 3	-0	N085E000	F027	1 3 3 2	-0	N095E015
F041	1 3 3 3	-0	N085E005	FC40	1 3 3 2	-0	N085E000	F027	1 3 3 2	-0	N095E015
F041	1 3 3 3	27	N085E005	F040	1 3 3 2	-0	N085E000	F027	1 3 1 2	-0	N095E015
FC41	1 3 1 3	-0	N095E005	F040	1 3 1 3	-0	N085E000	F027	1 3 3 2	-0	N095E015
FC41	1 3 1 3	-0	N085E005	F040	1 3 1 2	-0	N085E000	F027	1 3 3 2	-0	N095E015
F041	1 3 1 3	-0	N085F005	F04C	1 3 3 2	-0	N085F000	F027	1 3 3 2	-0	N095E015
FC41	1 3 1 3	-0	N085E0C5	FC40	1 3 3 3	-0	N095E000	F027	1 3 1 2	-0	N095EC15
F041	1 3 1 3	-0	NG85E005	F040	1 3 3 2	-0	N085E000	F027	1 3 3 2	-0	N095E015
FC41	1 3 1 3	-0	N095E005	F040	1 3 1 2	-0	N085E000	F027	1 3 1 2	-0	N095E015
F041	1 3 1 2	-0	N085E005	F040	1 3 1 3	-0	N095E000	F027	1 3 3 2	-0	N095E015
FC41	1 3 1 2	-0	N085E005	F040	1 3 3 2	-0	N085E000	F029	1 3 3 3	10	N095E015
F041	1 3 3 2	-0	N085E005	FC4C	1 3 1 2	-0	N085E000	F029	1 3 3 3	-0	N095E015
FC41	1 3 1 2	-0	N085E005	FC40	1 3 1 2	105	N085E000	F029	1 3 1 2	4	N095E015
F041	1 3 3 2	-0	N085E005	F040	1 3 1 2	-0	N085F000	F033	1 3 3 4	-0	N090E010
FC41	1 3 3 2	-G	NC85EC05	F040	1 3 1 2	-0	N085E000	F033	1 3 3 3	-0	N090E01C
F041	1 3 1 2	-0	N085E005	F040	1 3 3 2	4	N085E000	F033	1 3 3 2	-0	N090E010
F041	1 3 1 2	-0	N085E005	F03	1 3 3 3	-0	N085E010	F033	1 3 1 2	-0	N090F010
FC41	1 3 1 2	-0	N085E005	F03	1 3 3 3	-0	N085E010	F033	1 3 1 3	-0	N090E010
F065	1 2 1 4	-0	NOPRO	FC3	1 3 3 3	-0	N085E010	F033	1 3 3 2	-0	N090E010
0A307	1 3 3 3	-0	N085E010	F03	1 3 1 3	-0	N085E010	F033	1 3 3 2	-0	N090E010
0A360	1 3 1 3	-0	N090E000	F03	1 3 1 4	-0	N085E010	F033	1 3 1 3	-0	N090E010
0A371	1 3 3 3	-0	N080E020	F03	1 3 3 3	-0	N085E010	F033	1 3 3 3	-0	N090E010
0A360	1 3 3 4	-0	N090E000	F03	1 3 3 3	-0	N085E010	F033	1 3 3 2	-0	N090E010
0A346	1 3 1 4	-0	N085W000	F03	1 3 1 3	41	N085E010	F033	1 3 3 2	-0	N090E010
0A318	1 3 3 4	-0	N085EC10	F03	1 3 3 3	-0	N085E010	F033	1 3 1 2	-0	N090E010
0A359	1 2 1 3	-0	N080E020	F03	1 3 3 2	-0	N085F010	FC33	1 3 1 2	-0	N090EC10
0A338	1 3 3 3	-0	N080W000	F03	1 3 3 2	-0	N085E010	F033	1 3 1 2	-0	N090E010
F064	1 3 1 3	-0	N005E000	FC3	1 3 1 2	-0	N085E010	F033	1 3 3 2	-0	N090E010
0A369	1 3 3 3	-0	N080E000	F03	1 3 1 2	-0	N085E010	F033	1 3 1 2	-0	N090E010
0A360	1 3 3 3	-0	N090E0CC	F03	1 3 1 2	-0	N085E010	F033	1 3 3 2	-0	N090E010
0A339	1 3 3 3	-0	N085E000	F03	1 3 1 2	10	N085E010	F033	1 3 1 3	-0	N090EC10
0A339	1 3 1 3	-0	N085E000	34802	1 3 1 4	20	NOPRO	F033	1 3 3 2	-0	N090E010
0A357	1 3 1 3	-0	N090E020	0A336	1 3 3 3	-0	N085E000	F033	1 3 1 2	-0	N090E010
NN	1 3 3 3	-0	NOPRO	0A359	1 3 3 4	48	N080E020	F033	1 3 1 2	-0	N090E010
NN	1 3 1 3	-0	NOPRO	0A298	1 3 3 4	-0	NOPRO	F033	1 3 3 3	-0	N090E010
NN	1 3 1 3	-0	NOPRO	0A289	1 3 3 4	-0	NC80W000	F033	1 3 1 3	35	N090E010
01	1 3 1 3	-0	NOPRO	F064	1 3 3 4	87	N005E000	F1	1 3 3 3	-0	N075E5W5
NN	1 3 3 2	202	NOPRO	F038	1 3 3 2	1	NC85W005	F1	1 3 3 4	-0	N075E5W5
0A213	1 3 3 2	1	N105E015	F024	1 3 3 2	-0	N095E000	F1	1 3 3 3	-0	N075E5W5
0A196	1 3 3 3	6	N105E015	F024	1 3 3 3	-0	N095E000	F1	1 3 3 3	-0	N075E5W5
F046	1 2 1 3	15	N080E020	F024	1 3 3 3	-0	N095E000	F1	1 3 3 3	-0	N075E5W5
F046	1 3 1 2	-0	N080E020	F024	1 3 3 3	17	N095EC00	F1	1 3 3 3	-0	N075E5W5
FC46	1 3 1 2	-0	N080F020	F026	1 3 1 3	-0	N095E005	F1	1 3 3 3	-0	N075E5W5
F046	1 3 1 2	-0	N080E020	F026	1 3 1 3	-0	N095E005	F1	1 3 1 3	63	N075E5W5
F046	1 3 1 2	-0	N080E020	F026	1 3 1 3	-0	N095E005	F1	1 3 3 3	-0	N075E5W5
F046	1 3 1 2	-0	N080E020	F026	1 3 3 3	-0	N095E005	F1	1 3 1 3	-0	N075E5W5
F046	1 3 1 2	-0	N080E020	F026	1 3 3 2	17	N095E005	F1	1 3 3 3	-0	N075E5W5
FC46	1 3 1 2	-0	N080E020	F057	1 3 1 3	-0	NOPRO	F1	1 3 3 3	-0	N075E5W5
F046	1 3 1 2	-0	N080E020	F057	1 3 3 3	-0	NUPRO	F1	1 3 3 2	-0	N075E5W5
FC46	1 3 1 2	-0	N080E020	F057	1 3 3 3	-0	NUPRO	F1	1 3 3 3	-0	N075E5W5

F1	1 3 3 3	-0	N075E5W5	F04	1 3 3 2	-0	N085E010	NN	1 3 1 2	-0	NOPRO
F1	1 3 3 3	-0	N075E5W5	F04	1 3 3 2	-0	N085E010	NN	1 3 1 2	-0	NOPRO
F1	1 3 3 3	-0	N075E5W5	F04	1 3 1 3	8	N085E010	NN	1 3 1 2	-0	NOPRO
F1	1 3 3 3	-0	N075E5W5	F07	1 3 3 3	-0	N110E010	NN	1 3 1 2	-0	NOPRO
F1	1 3 1 3	-0	N075E5W5	F07	1 3 3 2	2	N110E010	NN	1 3 1 2	-0	NOPRO
F1	1 3 3 2	-0	N075E5W5	OA194	1 3 3 2	1	N110E015	NN	1 3 1 2	-0	NOPRO
F1	1 3 3 3	-0	N075E5W5	NN	1 3 3 3	2	NOPRO	NN	1 3 1 3	-0	NOPRO
F1	1 3 3 3	-0	N075E5W5	NN	1 3 3 2	-0	NOPRO	NN	1 3 1 2	-0	NOPRO
F1	1 3 3 3	-0	N075E5W5	NN	1 3 3 2	2	NOPRO	NN	1 3 1 2	-0	NOPRO
F1	1 3 1 2	-0	N075E5W5	NN	1 3 1 2	-0	NOPRO	NN	1 3 1 2	-0	NOPRO
F1	1 3 1 2	-0	N075E5W5	NN	1 3 3 2	-0	NOPRO	NN	1 3 1 2	-0	NOPRO
F1	1 3 1 2	-0	N075E5W5	NN	1 3 3 3	-0	NOPRO	NN	1 3 1 2	-0	NOPRO
F1	1 3 3 3	-0	N075E5W5	NN	1 3 3 3	-0	NOPRO	NN	1 3 3 3	-0	NOPRO
F1	1 3 1 2	-0	N075E5W5	NN	1 3 1 3	-0	NOPRO	NN	1 3 3 2	-0	NOPRO
F1	1 3 3 3	-0	N075E5W5	NN	1 3 1 3	-0	NOPRO	NN	1 3 1 2	29	NOPRO
F1	1 3 1 3	-0	N075E5W5	NN	1 3 1 3	-0	NOPRO	NN	1 3 3 2	-0	NOPRO
F1	1 3 1 2	-0	N075E5W5	NN	1 3 1 2	-0	NOPRO	NN	1 3 3 2	-0	NOPRO
F1	1 3 3 2	66	N075E5W5	NN	1 3 3 2	-0	NOPRO	NN	1 3 1 2	-0	NOPRO
F027	1 3 3 3	-0	N095E015	NN	1 3 1 2	-0	NOPRO	NN	1 3 1 2	-0	NOPRO
F027	1 3 3 3	-0	N095E015	NN	1 3 1 2	-0	NOPRO	NN	1 3 1 2	-0	NOPRO
F027	1 3 3 3	-0	N095E015	NN	1 3 1 2	-0	NOPRO	NN	1 3 1 2	-0	NOPRO
F033	1 3 1 3	9	N090E010	NN	1 3 1 2	-0	NOPRO	NN	1 3 1 2	-0	NOPRO
NN	1 3 3 3	-0	NOPRO	NN	1 3 1 2	-0	NOPRO	NN	1 3 1 2	-0	NOPRO
NN	1 3 3 3	-0	NOPRO	NN	1 3 1 2	-0	NOPRO	NN	1 3 1 2	-0	NOPRO
NN	1 3 3 2	-0	NOPRO	NN	1 3 3 2	-0	NOPRO	NN	1 3 1 2	-0	NOPRO
NN	1 3 3 3	-0	NOPRO	NN	1 3 3 2	-0	NOPRO	NN	1 3 1 2	-0	NOPRO
NN	1 3 3 3	-0	NOPRO	NN	1 3 1 3	-0	NOPRO	NN	1 3 3 2	-0	NOPRO
NN	1 3 3 2	-0	NOPRO	NN	1 3 1 2	-0	NOPRO	NN	1 3 3 2	-0	NOPRO
NN	1 3 3 2	-0	NOPRO	NN	1 3 3 3	-0	NOPRO	NN	1 3 3 2	-0	NOPRO
NN	1 3 3 3	-0	NOPRO	NN	1 3 3 3	-0	NOPRO	NN	1 3 3 2	-0	NOPRO
NN	1 3 3 2	-0	NOPRO	NN	1 3 1 2	29	NOPRO	NN	1 3 1 2	-0	NOPRO
NN	1 3 3 2	-0	NOPRO	NN	1 3 1 3	-0	NOPRO	NN	1 3 3 2	-0	NOPRO
NN	1 3 3 2	-0	NOPRO	NN	1 3 1 2	-0	NOPRO	NN	1 3 1 2	-0	NOPRO
NN	1 3 3 2	26	NOPRO	NN	1 3 1 3	-0	NOPRO	NN	1 3 1 2	-0	NOPRO
NN	1 3 3 2	-0	NOPRO	NN	1 3 1 3	-0	NOPRO	NN	1 3 1 2	-0	NOPRO
NN	1 3 1 3	6	NOPRO	NN	1 3 1 2	-0	NOPRO	NN	1 3 1 2	-0	NOPRO
NN	1 3 1 3	-0	NOPRO	NN	1 3 1 2	-0	NOPRO	NN	1 3 1 2	-0	NOPRO
NN	1 3 1 2	2	NOPRO	NN	1 3 1 2	-0	NOPRO	NN	1 3 1 2	-0	NOPRO
F048	1 3 1 3	-0	N080W000	NN	1 3 1 2	-0	NOPRO	NN	1 3 1 2	25	NOPRO
F048	1 3 1 3	-0	N080W000	NN	1 3 3 2	-0	NOPRO	NN	1 1 3 3	2	NOPRO
F048	1 3 1 2	-0	N080W000	NN	1 3 1 3	-0	NOPRO	NN	1 3 3 3	-0	NOPRO
F048	1 3 1 2	-0	N080W000	NN	1 3 1 2	-0	NOPRO	NN	1 3 3 2	-0	NOPRO
F048	1 3 3 3	-0	N080W000	NN	1 3 3 2	-0	NOPRO	NN	1 3 1 3	-0	NOPRO
F048	1 3 3 3	-0	N080W000	NN	1 3 3 2	-0	NOPRO	NN	1 3 3 3	-0	NOPRO
F048	1 3 3 3	-0	N080W000	NN	1 3 1 2	-0	NOPRO	NN	1 3 3 3	-0	NOPRO
F048	1 3 3 2	21	N080W000	NN	1 3 1 2	12	NOPRO	NN	1 3 3 3	-0	NOPRO
F035	1 3 3 3	3	N090E000	NN	1 3 3 2	-0	NOPRO	NN	1 3 1 2	-0	NOPRO
NN	1 3 1 2	2	NOPRO	NN	1 3 3 2	-0	NOPRO	NN	1 3 3 2	-0	NOPRO
F016	1 3 3 3	-0	N105E020	NN	1 3 3 2	-0	NOPRO	NN	1 3 1 2	-0	NOPRO
F016	1 3 3 2	-0	N105E020	NN	1 3 1 2	-0	NOPRO	NN	1 3 1 2	-0	NOPRO
F09	1 3 3 3	7	N105W005	NN	1 3 1 2	6	NOPRO	NN	1 3 3 2	-0	NOPRO
F017	1 3 1 2	-0	N100E025	NN	1 3 3 2	-0	NOPRO	NN	1 3 1 2	-0	NOPRO
F017	1 3 1 2	3	N100E025	NN	1 3 1 3	-0	NOPRO	NN	1 3 3 2	-0	NOPRO
F6	1 3 3 3	-0	N110E015	NN	1 3 1 3	15	NOPRO	NN	1 3 3 2	-0	NOPRO
F6	1 3 3 2	-0	N110E015	NN	1 3 3 3	3	NOPRO	NN	1 3 1 2	-0	NOPRO
F6	1 3 3 2	-0	N110E015	NN	1 3 1 3	-0	NOPRO	NN	1 3 3 3	-0	NOPRO
F6	1 3 1 2	7	N110E015	NN	1 3 3 3	-0	NOPRO	NN	1 3 1 2	-0	NOPRO
F02	1 3 3 3	10	N085E010	NN	1 3 3 2	-0	NOPRO	NN	1 3 3 2	-0	NOPRO
F02	1 3 1 3	2	N085E010	NN	1 3 1 3	-0	NOPRO	NN	1 3 3 3	27	NOPRO
OA193	1 3 3 2	-0	N110E005	NN	1 3 3 3	-0	NOPRO	NN	1 3 1 2	-0	NOPRO
OA193	1 3 1 3	3	N110E005	NN	1 3 1 3	-0	NOPRO	NN	1 3 1 2	-0	NOPRO
F04	1 3 3 3	-0	N085E010	NN	1 3 3 2	-0	NOPRO	NN	1 3 3 2	-0	NOPRO
F04	1 3 3 3	8	N085E010	NN	1 3 1 2	-0	NOPRO	NN	1 3 3 2	-0	NOPRO
F04	1 3 3 2	-0	N085E010	NN	1 3 1 2	-0	NOPRO	NN	1 3 3 2	-0	NOPRO

NN	1 3 3 2	-0	NOPRO	NN	1 3 3 2	-0	NOPRO	NN	1 3 1 2	-0	NOPRO
NN	1 3 1 2	-0	NOPRO	NN	1 3 3 2	-0	NOPRO	NN	1 3 3 2	-0	NOPRO
NN	1 3 1 2	-0	NOPRO	NN	1 3 3 2	-0	NOPRO	NN	1 3 1 2	-0	NOPRO
NN	1 3 1 2	-0	NOPRO	NN	1 3 1 2	-0	NOPRO	NN	1 3 3 2	-0	NOPRO
NN	1 3 3 2	-0	NOPRO	NN	1 3 1 2	-0	NOPRO	NN	1 3 3 2	-0	NOPRO
NN	1 3 3 2	-0	NOPRO	NN	1 3 1 2	-0	NOPRO	NN	1 3 3 2	-0	NOPRO
NN	1 3 1 2	-0	NOPRO	NN	1 3 3 2	-0	NOPRO	NN	1 3 3 2	-0	NOPRO
NN	1 3 3 2	-0	NOPRO	NN	1 3 1 2	-0	NOPRO	NN	1 3 3 2	-0	NOPRO
NN	1 3 1 2	-0	NOPRO	NN	1 3 3 2	-0	NOPRO	NN	1 3 3 2	-0	NOPRO
NN	1 3 1 2	-0	NOPRO	NN	1 3 1 2	-0	NOPRO	NN	1 3 1 2	-0	NOPRO
NN	1 3 3 2	-0	NOPRO	NN	1 3 1 2	-0	NOPRO	NN	1 3 1 2	-0	NOPRO
NN	1 3 1 2	-0	NOPRO	NN	1 3 1 3	-0	NOPRO	NN	1 3 1 2	-0	NOPRO
NN	1 3 1 2	-0	NOPRO	NN	1 3 1 2	-0	NOPRO	NN	1 3 3 2	-0	NOPRO
NN	1 3 1 2	-0	NOPRO	NN	1 3 1 3	-0	NOPRO	NN	1 3 1 2	25	NOPRO
NN	1 3 1 2	14	NOPRO	NN	1 3 3 2	27	NOPRO	NN	1 3 3 2	-0	NOPRO
NN	1 3 3 3	-0	NOPRO	NN	1 3 1 2	-0	NOPRO	NN	1 3 1 2	-0	NOPRO
NN	1 3 3 3	-0	NOPRO	NN	1 3 1 2	-0	NOPRO	NN	1 3 3 2	-0	NOPRO
NN	1 3 3 3	-0	NOPRO	NN	1 3 3 2	-0	NOPRO	NN	1 3 3 2	-0	NOPRO
NN	1 3 3 2	-0	NOPRO	NN	1 3 1 3	-0	NOPRO	NN	1 3 3 3	-0	NOPRO
NN	1 3 3 2	-0	NOPRO	NN	1 3 3 2	-0	NOPRO	NN	1 3 1 3	6	NOPRO
NN	1 3 3 2	-0	NOPRO	NN	1 3 1 2	-0	NOPRO	NN	1 3 3 3	-0	NOPRO
NN	1 3 1 2	-0	NOPRO	NN	1 3 1 2	-0	NOPRO	NN	1 3 1 3	-0	NOPRO
NN	1 3 3 2	-0	NOPRO	NN	1 3 1 2	-0	NOPRO	NN	1 3 3 2	-0	NOPRO
NN	1 3 3 2	-0	NOPRO	NN	1 3 1 2	-0	NOPRO	NN	1 3 3 2	-0	NOPRO
NN	1 3 3 2	-0	NOPRO	NN	1 3 1 3	-0	NOPRO	NN	1 3 3 2	-0	NOPRO
NN	1 3 3 2	-0	NOPRO	NN	1 3 1 2	-0	NOPRO	NN	1 3 1 3	-0	NOPRO
NN	1 3 3 2	-0	NOPRO	NN	1 3 3 2	-0	NOPRO	NN	1 3 3 2	-0	NOPRO
NN	1 3 3 2	-0	NOPRO	NN	1 3 3 2	-0	NOPRO	NN	1 3 1 2	-0	NOPRO
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NN	1 3 3 2	-0	NOPRO	NN	1 3 1 2	-0	NOPRO	NN	1 3 3 3	-0	NOPRO
NN	1 3 3 2	23	NOPRO	NN	1 3 3 2	-0	NOPRO	NN	1 3 3 3	-0	NOPRO
NN	1 3 1 3	-0	NOPRO	NN	1 3 1 2	-0	NOPRO	NN	1 3 3 3	-0	NOPRO
NN	1 3 3 3	-0	NOPRO	NN	1 3 1 2	-0	NOPRO	NN	1 3 3 3	-0	NOPRO
NN	1 3 1 3	-0	NOPRO	NN	1 3 1 2	-0	NOPRO	NN	1 3 3 3	-0	NOPRO
NN	1 3 3 3	-0	NOPRO	NN	1 3 1 2	-0	NOPRO	NN	1 3 1 2	-0	NOPRO
NN	1 3 1 2	-0	NOPRO	NN	1 3 1 2	-0	NOPRO	NN	1 3 1 3	27	NOPRO
NN	1 3 1 3	-0	NOPRO	NN	1 3 1 2	-0	NOPRO	NN	1 3 1 2	-0	NOPRO
NN	1 3 3 3	-0	NOPRO	NN	1 3 1 3	-0	NOPRO	NN	1 3 3 3	-0	NOPRO
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NN	1 3 1 2	-0	NOPRO	NN	1 3 1 2	-0	NOPRO	NN	1 3 3 3	-0	NOPRO
NN	1 3 1 2	-0	NOPRO	NN	1 3 1 2	-0	NOPRO	NN	1 3 3 2	-0	NOPRO
NN	1 3 3 2	-0	NOPRO	NN	1 3 1 2	-0	NOPRO	NN	1 3 1 2	-0	NOPRO
NN	1 3 1 2	-0	NOPRO	NN	1 3 1 2	-0	NOPRO	NN	1 3 3 3	-0	NOPRO
NN	1 3 1 2	-0	NOPRO	NN	1 3 3 2	-0	NOPRO	NN	1 3 3 2	-0	NOPRO
NN	1 3 3 3	-0	NOPRO	NN	1 3 1 2	-0	NOPRO	NN	1 3 1 2	-0	NOPRO
NN	1 3 1 3	-0	NOPRO	NN	1 3 3 2	-0	NOPRO	NN	1 3 1 2	-0	NOPRO
NN	1 3 1 2	-0	NOPRO	NN	1 3 3 2	-0	NOPRO	NN	1 3 3 2	-0	NOPRO
NN	1 3 1 2	-0	NOPRO	NN	1 3 3 2	-0	NOPRO	NN	1 3 3 2	-0	NOPRO
NN	1 3 3 3	-0	NOPRO	NN	1 3 1 2	-0	NOPRO	NN	1 3 1 2	-0	NOPRO
NN	1 3 3 2	-0	NOPRO	NN	1 3 3 2	-0	NOPRO	NN	1 3 1 2	-0	NOPRO
NN	1 3 1 3	-0	NOPRO	NN	1 3 3 2	-0	NOPRO	NN	1 3 3 2	-0	NOPRO
NN	1 3 1 3	-0	NOPRO	NN	1 3 3 2	-0	NOPRO	NN	1 3 3 2	-0	NOPRO
NN	1 3 3 2	-0	NOPRO	NN	1 3 1 2	-0	NOPRO	NN	1 3 3 2	-0	NOPRO
NN	1 3 1 2	-0	NOPRO	NN	1 3 3 2	-0	NOPRO	NN	1 3 1 2	-0	NOPRO
NN	1 3 1 2	40	NOPRO	NN	1 3 3 3	19	NOPRO	NN	1 3 1 2	-0	NOPRO
NN	1 3 3 3	-0	NOPRO	NN	1 3 1 2	-0	NOPRO	NN	1 3 1 2	-0	NOPRO
NN	1 3 1 3	-0	NOPRO	NN	1 3 3 2	-0	NOPRO	NN	1 3 3 2	-0	NOPRO
NN	1 3 3 2	-0	NOPRO	NN	1 3 3 2	-0	NOPRO	NN	1 3 3 2	-0	NOPRO
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NN	1 3 1 3	-0	NOPRO	NN	1 3 1 2	-0	NOPRO	NN	1 3 1 2	28	NOPRO
NN	1 3 1 2	-0	NOPRO	NN	1 3 3 2	-0	NOPRO	NN	1 3 1 2	-0	NOPRO
NN	1 3 3 2	-0	NOPRO	NN	1 3 3 2	-0	NOPRO	NN	1 3 1 2	-0	NOPRO
NN	1 3 1 2	-0	NOPRO	NN	1 3 3 2	-0	NOPRO	NN	1 3 1 2	-0	NOPRO
NN	1 3 3 2	-0	NOPRO	NN	1 3 1 2	-0	NOPRO	NN	1 3 3 2	-0	NOPRO

NN	1 3 3 2	-0	NOPRO	NN	1 3 3 2	-0	NOPRO	F039	2 3 3 4	-0	N085W000
NN	1 3 3 2	-0	NOPRO	NN	1 3 1 3	15	NOPRO	0A341	2 3 3 4	-0	N085E000
NN	1 3 1 2	-0	NOPRO	NN	1 3 3 2	-0	NOPRO	F039	2 3 3 4	-0	N085W000
NN	1 3 1 2	-0	NOPRO	NN	1 3 1 2	-0	NOPRO	0A349	2 3 3 3	-0	N095E000
NN	1 3 1 2	6	NOPRO	NN	1 3 3 2	-0	NOPRO	0A361	2 3 3 4	-0	N080E000
NN	1 3 3 3	-0	NOPRO	NN	1 3 1 2	-0	NOPRO	F049	2 3 3 3	-0	N075E000
NN	1 3 3 3	-0	NOPRO	NN	1 3 3 2	-0	NOPRO	0A341	2 3 3 3	-0	N085E000
NN	1 3 3 3	-0	NOPRO	NN	1 3 1 3	-0	NOPRO	F1	2 3 3 3	-0	N075E5W5
NN	1 3 1 3	-0	NOPRO	NN	1 3 1 2	-0	NOPRO	F039	2 3 1 3	-0	N085W000
NN	1 3 3 3	-0	NOPRO	NN	1 3 3 2	-0	NOPRO	0A347	2 3 3 3	-0	N085E000
NN	1 3 1 3	-0	NOPRO	NN	1 3 1 3	-0	NOPRO	F041	2 3 3 3	-0	N085E005
NN	1 3 1 2	-0	NOPRO	NN	1 3 1 2	-0	NOPRO	F1	2 3 3 3	-0	N075E5W5
NN	1 3 1 3	-0	NOPRO	NN	1 3 3 2	-0	NOPRO	F1	2 3 3 3	198	N075E5W5
NN	1 3 3 3	-0	NOPRO	NN	1 3 3 2	-0	NOPRO	F038	2 3 3 2	-0	N085W005
NN	1 3 1 3	-0	NOPRO	NN	1 3 3 2	-0	NOPRO	F038	2 3 1 2	-0	N085W005
NN	1 3 1 3	-0	NOPRO	NN	1 3 3 2	-0	NOPRO	F038	2 3 1 2	-0	N085W005
NN	1 3 1 3	-0	NOPRO	NN	1 3 3 2	-0	NOPRO	F038	2 3 1 2	-0	N085W005
NN	1 3 3 2	-0	NOPRO	NN	1 3 3 2	-0	NOPRO	F038	2 3 1 2	6	N085W005
NN	1 3 1 2	-0	NOPRO	NN	1 3 1 3	-0	NOPRO	0A351	2 2 3 4	-0	N095E000
NN	1 3 3 2	-0	NOPRO	NN	1 3 3 2	-0	NOPRO	F061	2 3 1 3	35	N105E000
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NN	1 3 3 2	-0	NOPRO	NN	1 3 3 2	-0	NOPRO	F057	2 3 3 2	1	NOPRO
NN	1 3 1 2	-0	NOPRO	NN	1 3 3 2	-0	NOPRO	F025	2 3 1 3	3	N095E005
NN	1 3 1 2	-0	NOPRO	NN	1 3 1 2	-0	NOPRO	F039	2 3 1 2	2	N085W000
NN	1 3 3 2	-0	NOPRO	NN	1 3 1 2	-0	NOPRO	F029	2 3 1 3	-0	N095E015
NN	1 3 1 2	-0	NOPRO	NN	1 3 1 2	26	NOPRO	F029	2 3 1 2	-0	N095E015
NN	1 3 3 2	-0	NOPRO	0A301	1 3 1 4	31	N110E010	F029	2 3 1 2	7	N095E015
NN	1 3 3 2	-0	NOPRO	0A179	1 3 3 3	11	N110E010	F033	2 3 3 2	-0	N090E010
NN	1 3 1 2	-0	NOPRO	F031	1 3 1 4	-0	N090E020	F033	2 3 3 2	-0	N090E010
NN	1 3 3 2	-0	NOPRO	NN	1 3 3 2	-0	NOPRO	F033	2 3 1 2	-0	N090E010
NN	1 3 3 3	-0	NOPRO	NN	1 3 1 2	-0	NOPRO	F033	2 3 1 2	2	N090E010
NN	1 3 1 2	-0	NOPRO	NN	1 3 3 3	-0	NOPRO	F1	2 3 1 3	-0	N075E5W5
NN	1 3 3 3	-0	NOPRO	NN	1 3 3 2	29	NOPRO	F1	2 2 1 2	8	N075E5W5
NN	1 3 1 3	-0	NOPRO	F041	2 3 3 3	-0	N085E005	F048	2 3 1 2	-0	N080W000
NN	1 3 3 2	-0	NOPRO	F041	2 3 3 3	-0	N085E005	F048	2 3 3 3	3	N080W000
NN	1 3 3 2	-0	NOPRO	F041	2 3 1 3	-0	N085E005	F1	2 3 3 3	-0	N075E5W5
NN	1 3 3 2	-0	NOPRO	F041	2 3 1 3	-0	N085E005	F1	2 3 1 4	-0	N075E5W5
NN	1 3 3 2	-0	NOPRO	F041	2 3 3 2	-0	N085E005	F1	2 3 3 3	-0	N075E5W5
NN	1 3 1 3	-0	NOPRO	F041	2 3 3 2	-0	N085E005	F1	2 3 3 3	-0	N075E5W5
NN	1 3 3 3	-0	NOPRO	F041	2 3 1 2	-0	N085E005	F1	2 3 3 3	-0	N075E5W5
NN	1 3 3 2	-0	NOPRO	F041	2 3 1 2	-0	N085E005	F1	2 3 3 3	-0	N075E5W5
NN	1 3 3 2	-0	NOPRO	F041	2 3 1 2	-0	N085E005	F1	2 3 3 3	-0	N075E5W5
NN	1 3 1 3	-0	NOPRO	F041	2 3 1 2	25	N085E005	F1	2 3 3 3	-0	N075E5W5
NN	1 3 1 2	31	NOPRO	0A315	2 3 3 4	-0	N100E020	F1	2 3 3 3	-0	N075E5W5
NN	1 3 3 2	-0	NOPRO	0A345	2 3 1 3	-0	N085E000	F1	2 3 1 3	-0	N075E5W5
NN	1 3 3 2	-0	NOPRO	0A345	2 3 1 3	-0	N085E000	F1	2 3 1 3	-0	N075E5W5
NN	1 3 3 2	-0	NOPRO	0A334	2 3 1 3	-0	N085E000	F1	2 3 1 3	-0	N075E5W5
NN	1 3 1 2	-0	NOPRO	0A338	2 3 3 3	78	N080E000	F1	2 3 1 3	-0	N075E5W5
NN	1 3 1 2	-0	NOPRO	F046	2 3 3 2	2	N080E020	F1	2 3 3 3	-0	N075E5W5
NN	1 3 3 2	-0	NOPRO	F046	2 3 1 2	2	N080E020	F1	2 3 1 3	-0	N075E5W5
NN	1 3 1 2	-0	NOPRO	F040	2 3 1 2	-0	N085E000	F1	2 3 3 3	-0	N075E5W5
NN	1 3 1 3	-0	NOPRO	F040	2 3 1 2	-0	N085E000	F024	2 3 1 3	-0	N095E000
NN	1 3 3 2	-0	NOPRO	F040	2 3 1 2	-0	N085E000	F024	2 3 3 3	-0	N095E000
NN	1 3 3 2	-0	NOPRO	F040	2 3 1 2	7	N085E000	F025	2 3 1 3	121	N095E005
NN	1 3 2 2	-0	NOPRO	F03	2 3 1 3	-0	N085E010	F027	2 3 1 3	-0	N095E015
NN	1 3 1 2	-0	NOPRO	F03	2 3 3 3	-0	N085E010	F027	2 3 3 3	-0	N095E015
NN	1 3 3 2	-0	NOPRO	F03	2 3 1 3	-0	N085E010	F027	2 3 3 3	-0	N095E015
NN	1 3 1 2	18	NOPRO	F03	2 3 3 3	-0	N085E010	F027	2 3 1 4	-0	N095E015
NN	1 3 1 3	-0	NOPRO	F03	2 3 3 3	-0	N085E010	F027	2 3 1 4	-0	N095E015
NN	1 3 3 3	-0	NOPRO	F03	2 3 3 4	169	N085E010	F038	2 3 3 3	-0	N090W000
NN	1 3 3 3	-0	NOPRO	F03	2 3 3 2	2	N085E010	F038	2 3 3 3	-0	N085W005
NN	1 3 3 3	-0	NOPRO	F03	2 3 1 2	2	N085E010	F038	2 3 1 2	-0	N085W005
NN	1 3 3 3	-0	NOPRO	96040	2 3 1 4	40	NOPRO	F039	2 3 1 4	-0	N095W000
NN	1 3 3 3	-0	NOPRO	0A363	2 3 3 4	-0	N085E005	F039	2 3 1 3	-0	N095W000

F039	2 3 1 4	-0	N085W000	F016	2 3 1 2	4	N105E020	F	3 3 3 2	-0	NOPRO
F039	2 3 1 4	-0	N085W000	F017	2 3 1 3	-0	N100E025	F	3 3 3 3	-0	NOPRO
F039	2 3 3 3	-0	N085W000	F017	2 3 1 2	-0	N100E025	F	3 3 3 3	-0	NOPRO
F040	2 3 1 3	-0	N085E000	F017	2 3 1 2	-0	N100E025	F	3 3 3 3	-0	NOPPO
F040	2 3 1 3	-0	N085E000	F017	2 3 1 2	-0	N100E025	F	3 3 1 2	-0	NOPRO
FC4C	2 3 3 3	-0	N085E000	F017	2 3 1 2	9	N100E025	F	3 3 1 2	-0	NOPRO
F04C	2 3 3 3	-0	N085E000	F019	2 3 1 3	6	N100E015	F	3 3 1 3	-0	NOPRO
F040	2 3 3 3	-0	N085E000	0A361	2 3 3 4	31	N090E000	F	3 3 3 3	-0	NOPRO
F04C	2 3 1 3	-0	N085E000	NN	2 3 3 2	-0	NOPRO	F	3 3 3 3	-0	NOPRO
F04C	2 3 3 3	-0	N085E000	NN	2 3 3 2	-0	NOPRO	F	3 3 3 3	-0	NOPPO
F040	2 3 1 3	-0	N085E000	NN	2 3 3 2	2	NOPRO	F	3 3 3 3	-0	NOPRO
FC4C	2 3 3 3	-0	N085E000	NN	2 3 3 3	-0	NOPRO	F	3 3 1 2	-0	NOPRO
F04C	2 3 1 3	-0	N085E000	NN	2 3 3 2	-0	NOPRO	F	3 3 3 3	-0	NOPRO
FC4C	2 3 1 3	171	N085E000	NN	2 3 1 3	6	NOPPO	F	3 3 1 3	-0	NOPRO
F040	2 3 3 2	-0	N085E000	NN	2 3 3 2	1	NOPRO	F	3 3 3 3	-0	NOPPO
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0A194	3 3 3 3	-0	N110E015	0A194	3 3 3 2	-0	N110E015	F039	4 2 3 4	36	N085W000
0A194	3 3 3 3	-0	N110E015	0A194	3 3 3 2	-0	N110E015	F1	4 2 3 3	-0	N075E5W5
0A194	3 3 3 3	-0	N110E015	0A194	3 3 3 2	-0	N110E015	F1	4 2 1 2	-0	N075E5W5
0A194	3 3 3 3	-0	N110E015	0A194	3 3 1 2	-0	N110E015	F1	4 2 3 3	-0	N075E5W5
0A194	3 3 3 3	-0	N110E015	0A194	3 3 1 2	27	N110E015	F1	4 3 3 3	-0	N075E5W5
0A194	3 3 3 3	-0	N110E015	0A194	3 3 1 2	-0	N110E015	F1	4 3 3 3	45	N075E5W5
0A194	3 3 3 3	-0	N110E015	0A194	3 3 1 2	-0	N110E015	0A302	7 3 1 3	11	N090W005

F053	8 1 1 5	-0	N115E010	NN	8 3 1 4	-0	NOPRO	F016	8 3 1 2	-0	N105E020
F053	8 1 3 4	-0	N115E010	NN	8 3 1 4	-0	NOPRO	F016	8 3 1 2	16	N105E020
F053	8 3 3 4	-0	N115E010	NN	8 2 1 4	-0	NOPRO	NN	8 2 3 4	-0	NOPRO
F053	8 3 1 3	-0	N115E010	NN	8 3 3 4	-0	NOPRO	NN	8 2 1 3	-0	NOPRO
F053	8 3 1 4	-0	N115E010	NN	8 3 1 3	-0	NOPRO	NN	8 2 1 3	-0	NOPRO
F053	8 3 1 4	-0	N115E010	NN	8 3 1 3	-0	NOPRO	NN	8 2 3 3	-0	NOPRO
F053	8 3 3 3	-0	N115E010	NN	8 3 1 3	-0	NOPRO	NN	8 1 1 3	-0	NOPRO
F053	8 3 1 3	-0	N115E010	NN	8 3 3 3	-0	NOPRO	NN	8 3 3 4	-0	NOPRO
F053	8 3 3 3	-0	N115E010	NN	8 3 3 3	-0	NOPRO	NN	8 3 3 3	-0	NOPRO
F053	8 3 1 3	-0	N115E010	NN	8 3 1 2	-0	NOPRO	NN	8 3 3 3	-0	NOPRO
F053	8 3 3 3	-0	N115E010	NN	8 3 1 2	160	NOPRO	NN	8 3 3 3	-0	NOPRO
FC53	8 3 1 3	-0	N115E010	0A356	8 2 3 4	28	N090W000	NN	8 3 3 4	-0	NOPRO
FC53	8 3 3 3	-0	N115E010	F038	8 3 1 2	-0	N085W005	NN	8 3 3 3	-0	NOPRO
F053	8 3 1 3	-0	N115E010	F038	8 3 3 3	-0	N085W005	NN	8 2 1 4	-0	NOPRO
F053	8 3 1 3	-0	N115E010	FC38	8 3 3 3	-0	N085WC05	NN	8 2 3 3	-0	NOPRO
F053	8 3 1 3	-0	N115E010	F038	8 3 1 2	-0	N085W005	NN	8 2 1 3	-0	NOPRO
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FC53	8 3 1 2	-0	N115E010	0A361	8 1 1 4	-0	N110E015	NN	8 3 1 3	-0	NOPRO
F053	8 3 1 2	-0	N115E010	F025	8 3 3 3	8	N095E005	NN	8 3 3 3	-0	NOPRO
F053	8 3 1 2	500	N115E010	F039	8 3 1 3	-0	N085W000	NN	8 3 3 3	-0	NOPRO
F047	8 3 3 2	2	N080E000	F039	8 3 1 2	12	N085W000	NN	8 3 3 3	-0	NOPRO
F047	6 3 3 3	4	N080E0C0	NN	8 3 3 3	-0	N085E015	NN	8 3 3 3	-0	NOPRO
F022	8 1 3 4	-0	N100WCC0	NN	8 3 1 3	-0	N095E015	NN	8 3 3 3	-0	NOPRO
F022	8 1 3 4	-0	N100W000	NN	8 2 1 3	-0	N095E015	NN	8 3 1 3	-0	NOPRO
F022	8 1 3 4	-0	N100W000	NN	8 3 1 2	-0	NOPRO	NN	8 3 3 3	-0	NOPRO
F022	8 3 3 4	-0	N100W000	NN	8 3 1 2	-0	NOPRO	NN	8 3 1 3	-0	NOPRO
F022	8 2 3 3	304	N100W000	NN	8 3 1 2	-0	NOPRO	NN	8 3 3 3	-0	NOPRO
F041	8 3 3 3	-0	N085E005	NN	8 3 1 2	13	NOPRO	NN	8 3 1 3	-0	NGPRO
FC41	8 3 3 4	-0	N085E005	F033	8 3 3 2	-0	N090E010	NN	8 3 3 3	-0	NOPRO
F041	8 2 3 3	-0	N095E005	F033	8 3 1 2	-0	N090E010	NN	8 3 1 3	-0	NOPRO
F041	8 3 3 3	-0	N085E005	FC33	8 3 1 2	-0	N090E010	NN	8 3 3 3	-0	NOPRO
F041	8 3 3 3	-0	N085E005	F033	8 3 3 2	5	N090E010	NN	8 3 1 2	-0	NOPRO
F041	8 2 3 3	-0	N085E005	NN	8 3 3 2	-0	NOPRO	NN	8 3 1 2	294	NOPRO
F041	8 3 3 3	-0	N085E005	NN	8 3 3 2	-0	NOPRO	F6	8 3 1 2	-0	N110E015
F041	8 3 3 3	100	N085E005	NN	8 3 3 2	-0	NOPRO	F6	6 2 1 2	3	N110E015
0A048	8 1 3 5	-0	N110E005	NN	8 3 1 2	-0	NOPRO	NN	8 1 1 3	-0	NOPRO
0A291	8 2 3 4	-0	N105E015	NN	8 3 1 2	-0	NOPRO	NN	8 1 3 3	-0	NOPRO
F062	8 3 3 4	-0	N100W000	NN	8 3 1 2	-0	NOPRO	NN	8 1 1 3	-0	NOPRO
F063	8 2 3 4	-0	N000E000	NN	8 3 1 2	7	NOPRO	NN	8 1 3 3	46	NOPRO
0A049	8 3 3 4	-0	N11CE005	NN	8 3 3 2	-0	NOPRO	NN	8 2 3 4	-0	NOPRO
0A383	8 3 3 4	-0	N105E015	NN	8 3 3 2	-0	NOPRO	NN	8 1 3 2	-0	NOPRO
0A339	8 2 3 3	-0	N085E000	NN	8 3 3 2	-0	NOPRO	NN	8 3 3 3	-0	NOPRO
0A352	8 2 3 3	-0	N095E020	NN	8 3 1 2	-0	NOPRO	NN	8 3 3 3	-0	NOPRO
0A339	8 3 3 3	-0	N085E000	NN	8 3 3 2	-0	NOPRO	NN	8 3 3 3	-0	NOPRO
0A339	8 3 3 3	-0	N085E000	NN	8 3 3 2	-0	NOPRO	NN	8 3 3 3	-0	NOPRO
FC65	8 3 3 3	-0	NOPPC	NN	8 3 1 2	-0	NOPRO	NN	8 3 1 3	-0	NOPRO
0A259	8 3 3 3	-0	N110E015	NN	8 3 1 2	7	NOPRO	NN	8 3 3 3	-0	NOPRO
0A343	8 3 3 3	-0	N085E000	F1	8 2 3 3	-0	N075E5W5	NN	8 3 1 4	-0	NOPRO
0A346	8 3 3 3	-0	N085W000	F1	8 1 1 3	-0	N075E5W5	NN	8 3 3 3	-0	NOPRO
0A350	8 3 3 3	-0	N105E000	F1	8 3 1 3	-0	N075E5W5	NN	8 3 3 3	-0	NOPRO
0A345	8 3 1 3	-0	N085E000	F1	8 2 1 3	-0	N075E5W5	NN	8 3 3 3	-0	NOPRO
0A345	8 3 3 3	-0	N085E000	F1	8 3 1 3	-0	N075E5W5	NN	8 3 3 3	-0	NOPRO
0A338	8 3 3 3	55	N080W000	F1	8 3 3 3	-0	N075E5W5	NN	8 3 1 3	-0	NOPRO
0A213	8 3 1 3	-0	N105E015	F1	8 3 3 3	-0	N075E5W5	NN	8 3 1 3	-0	NOPRO
0A213	8 3 1 3	10	N105E015	F1	8 3 3 3	-0	N075E5W5	NN	8 3 1 3	-0	NOPRO
F040	8 3 3 3	-0	N085E000	F1	8 3 3 2	-0	N075E5W5	NN	8 3 3 3	-0	NOPRO
FC40	8 3 1 3	-0	N085E000	F1	8 3 1 2	48	N075E5W5	NN	8 3 3 3	-0	NOPRO
F040	8 3 1 2	-0	N085E000	NN	8 3 1 2	2	NOPRO	NN	8 3 3 3	-0	NOPRO
F040	8 3 3 2	-0	N085E000	FC48	8 3 3 3	-0	N080W000	NN	8 3 1 3	-0	NOPRO
F040	8 2 1 2	-0	N085E000	F048	8 3 1 3	-0	N080W000	NN	8 3 1 3	-0	NOPRO
F040	8 3 3 3	-0	N085E000	F048	8 3 1 3	12	N080W000	NN	8 3 1 3	-0	NOPRO
FC40	8 3 1 2	16	N085E000	F040	8 3 3 2	2	N085E000	NN	8 3 3 3	-0	NOPRO
FC40	8 2 1 2	2	N085E000	F016	8 3 3 3	-0	N015E020	NN	8 3 3 3	210	NOPRO
0A243	8 2 1 4	-0	N110F010	F016	8 3 3 3	-0	N105E020	NN	8 3 3 3	-0	NOPRO

NN	8	3	1	3	-0	NOPRO
NN	8	3	1	3	-0	NOPRO
NN	8	3	3	3	-0	NOPRO
NN	8	3	3	3	-0	NOPRO
NN	8	3	1	3	-0	NOPRO
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NN	8	3	3	3	-0	NOPRO
NN	8	3	1	3	-0	NOPRO
NN	8	3	1	2	-0	NOPRO
NN	8	3	1	2	-0	NOPRO
NN	8	3	1	2	-0	NOPRO
NN	8	3	1	2	-0	NOPRO
NN	8	3	3	2	-0	NOPRO
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NN	8	3	1	3	-0	NOPRO
NN	8	3	1	2	-0	NOPRO
NN	8	3	1	2	40	NOPRO
F018	8	3	3	3	7	N105E015
F07	8	1	3	3	-0	N110E010
F07	8	3	3	3	-0	N110E010
F07	8	3	3	3	-0	N110E010
F07	8	3	3	3	-0	N110E010
F07	8	3	3	3	-0	N110E010
F07	8	3	1	3	-0	N110E010
F07	8	3	1	2	-0	N110E010
F07	8	3	1	2	-0	N110E010
F07	8	3	1	2	-0	N110E010
F07	8	3	1	2	-0	N110E010
F07	8	3	1	2	65	N110E010
0A194	8	3	3	2	-0	N110E015
0A194	8	3	1	2	-0	N110E015
0A194	8	3	1	2	2	N110E015
F013	8	3	3	2	-0	N105E005
F013	8	3	3	3	-0	N105E005
F013	8	3	3	3	6	N105E005
NN	8	3	3	2	-0	NOPRO
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NN	8	3	3	2	3	NOPRO
NN	8	3	3	2	-0	NOPRO
NN	8	3	3	2	-0	NOPRO
NN	8	3	1	2	-0	NOPRO
NN	8	3	1	2	-0	NOPRO
NN	8	3	3	2	-0	NOPRO
NN	8	3	1	2	8	NOPRO
0A077	8	1	3	4	18	N085E000
0A310	8	4	1	5	545	N115E010
96606	8	3	3	4	62	N105E000
0A259	8	2	3	4	85	N110E015
96554	8	4	3	6	2132	NOPRO
F053	10	1	1	4	27	N115E010
F047	10	1	1	4	-0	N080E000
F047	10	2	3	4	-0	N080E000
F047	10	1	1	4	-0	N080E000
F047	10	3	1	2	-0	N080E000
F047	10	3	1	2	341	N080E000
F041	10	1	1	4	29	N085E005
F041	10	3	1	3	7	N085E005
F059	10	3	3	4	42	N105E010
F046	10	3	1	2	-0	N080E020
F046	10	3	1	2	-0	N080E020
F046	10	3	1	2	8	N080E020
F03	10	2	1	4	-0	N085E010
F03	10	1	1	3	-0	N085E010
F03	10	2	1	3	-0	N085E010
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F03	10	3	1	3	-0	N085E010
F03	10	3	1	3	-0	N085E010
F03	10	3	1	3	181	N085E010
F03	10	1	1	3	15	N085E010
0A385	10	2	3	4	40	N075W235
F060	10	1	1	4	-0	N095E000
0A349	10	1	1	4	571	N095E000
F010	10	2	1	3	-0	N105W010
F010	10	2	1	3	-0	N105W010
F010	10	2	1	4	-0	N105W010
F010	10	3	3	4	-0	N105W010
F010	10	1	3	4	-0	N105W010
F010	10	1	3	4	-0	N105W010
F010	10	1	1	4	408	N105W010
F033	10	2	3	3	-0	N090E010
F033	10	3	1	3	-0	N090E010
F033	10	3	1	3	-0	N090E010
F033	10	3	3	3	-0	N090E010
F033	10	3	3	3	-0.	N090E010
F033	10	3	1	2	-0	N090E010
F033	10	3	1	2	-0	N090E010
F033	10	3	1	2	-0	N090E010
F033	10	3	1	2	45	N090E010
NN	10	3	3	4	40	NOPRO
F08	10	3	1	3	-0	N110E000
F08	10	2	1	4	248	N110E000
F017	10	3	1	2	2	N100E025
F6	10	3	1	3	-0	N110E015
F6	10	3	1	2	11	N110E015
0A384	10	2	1	4	167	N095E000
F04	10	3	3	4	-0	N085E010
F04	10	1	3	4	-0	N085E010
F04	10	3	3	4	34	N085E010
0A194	11	3	1	3	7	N110E015
F032	12	3	3	2	2	N090E015
F041	12	3	1	4	-0	N085E005
F041	12	3	1	2	25	N085E005
0A035	12	3	1	2	2	N085W005
F035	12	3	1	3	4	N090E000
F029	13	3	3	2	2	N095E025
F053	13	3	1	2	-0	N115E010
F053	13	3	1	3	4	N115E010
F032	13	3	3	3	-0	N090E015
F032	13	3	1	3	-0	N090E015
F032	13	3	1	4	35	N090E015
F046	13	3	1	2	-0	N080E020
F046	13	3	1	2	-0	N080E020
F046	13	3	1	3	-0	N080E020
F046	13	3	1	3	-0	N080E020
F046	13	3	1	3	26	N080E020
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NN	13	3	1	2	33	NOPRO
NN	13	3	3	2	1	NOPRO
NN	13	3	3	3	-0	NOPRO
NN	13	3	3	2	-0	NOPRO
NN	13	3	3	2	7	NOPRO
F017	13	3	1	3	6	N100E025
F017	13	3	1	2	2	N100E025
NN	13	3	3	3	6	NOPRO
F018	13	3	1	3	6	N105E015
F04	13	3	3	3	-0	N085E010
F04	13	3	3	2	-0	N085E010
F04	13	3	3	3	16	N085E010
NN	13	3	3	2	1	NOPRO
NN	13	3	3	2	2	NOPRO
NN	13	3	3	3	9	NOPRO
NN	13	3	3	3	-0	NOPRO
NN	13	3	3	3	4	NOPRO
0A368	13	2	3	4	5	N085E020
F025	15	3	1	2	1	N095E005
F038	15	3	3	2	-0	N085W005
NN	15	3	3	2	-0	NOPRO
NN	15	3	1	2	3	NOPRO
NN	15	3	3	2	-0	NOPRO
NN	15	3	3	2	-0	NOPRO
NN	15	3	3	2	-0	NOPRO
NN	15	3	1	2	-0	NOPRO
NN	15	3	3	2	8	NOPRO
F053	18	3	1	3	5	N115E010
F047	18	3	1	3	8	N080E000
NN	18	3	3	2	2	NOPRO
F041	22	3	1	3	5	N085F005
F041	22	1	1	3	6	N085E005
0A337	22	3	3	3	-0	N085E000
0A337	22	3	3	4	45	N085E000
0A214	22	1	1	4	38	N110E005
F025	22	1	3	4	35	N095E005
F013	22	3	1	3	4	N105E005
F08	22	2	3	4	83	N110E000
0A288	24	3	3	4	41	N080W000
F053	25	3	3	3	6	N115E010
F1	30	1	1	3	7	N075E5W5
F029	30	3	1	2	1	N095E025
F1	31	3	3	3	-0	N075E5W5
F1	31	3	3	3	-0	N075E5W5
F1	31	3	3	3	-0	N075E5W5
F1	31	3	3	3	-0	N075E5W5
F1	31	3	1	3	-0	N075E5W5
F1	31	3	1	3	25	N075E5W5
F013	31	3	1	3	10	N105E005

APPENDIX G
AGATE BASIN SITE
AGATE BASIN TOOLS

Column	Information
1	catalog number
2	material type
3	tool type
4	completeness
5	size
6	weight in decigrams
7	provenience

0A173	1	1	5	4	120	NO8CWE10
96C47	1	1	5	4	64	NO95E015
A6	1	1	1	3	25	NO95E015
A6	1	1	5	4	30	NO95E015
0A00H	1	1	5	4	36	NO90W005
11228	1	1	5	4	120	NOPP
A6	1	1	5	4	29	NO95E015
96C76	1	1	5	4	66	NO85E020
A15	1	1	5	4	71	N100E005
A7	1	1	5	3	6	NO85E015
96227	1	1	1	3	16	NO80W000
96220	1	1	5	4	61	NO80W005
11275	1	1	5	3	23	NO90E005
A5	1	1	1	4	42	NO95E025
34871	1	1	5	4	22	NOPP
A15	1	1	5	4	15	N100E005
A5	1	1	5	4	59	NO95E025
0A130	1	1	5	3	20	NO80W020
11255	1	1	5	4	25	NO95W015
0A358	1	1	5	4	58	N105E005
96585	1	1	5	5	183	NOPP
96C64	1	1	5	5	93	NO80E015
11302	1	1	5	4	62	NO90E000
96234	1	1	5	5	300	NO80W000
0A001	1	1	5	5	330	NO80W005
0A042	1	1	5	5	268	NO85W005
0A364	1	1	5	4	70	NO90E020
96C45	1	1	5	5	214	NO95E015
96204	1	1	5	5	296	NO75W000
11285	1	1	5	5	317	N100E000
0A002	1	1	5	5	271	NO90W000
96226	1	1	5	5	150	NO80W000
0A313	1	2	1	4	100	N105E005
0A314	1	2	1	4	124	N105E005
96C90	1	2	1	3	21	NO95E015
96124	1	4	3	3	15	NO90E015
0A282	1	4	3	3	14	N100W000
11310	1	4	2	3	19	NO90E010
96074	1	4	2	3	16	NO85E025
11297	1	4	2	2	3	NOPP
11330	1	4	2	4	123	NOPP
03422	1	4	2	4	54	NOPP
96C68	1	4	2	4	60	NO95E025
96C6C	1	4	5	5	183	N105E020
96C42	1	4	2	5	148	NO95E015
35007	1	4	4	4	103	NOPP
0A060	1	4	5	5	117	NOPP
96C0C	1	4	5	4	84	N100E000
96221	1	4	5	5	127	NO90W000
35C04	1	4	5	4	90	NOPP
0A090	1	4	2	5	134	NO75E025
0A274	1	4	1	4	62	NOPP
96C04	1	4	3	4	101	NO85W010
96038	1	4	2	4	77	NO80E030
96C85	1	4	5	5	161	NO85E025
96C58	1	6	5	4	98	NO90E005
96C45	1	6	5	4	35	NOPP
96216	1	6	5	5	267	NO85W000
11305	1	6	5	5	203	NO90E005
96220	1	6	5	4	55	NO75W005
96233	1	6	5	4	63	NO85W000
11304	1	6	5	4	64	NO95E005
11296	1	6	5	3	19	NOPP
11305	1	6	5	4	89	NO85W010
0A477	1	6	5	4	101	NOPP
11303	1	6	5	4	105	NO90W015
96072	1	6	5	4	100	NO80E015
A14	2	1	5	4	97	NOPP
96110	2	1	5	5	356	NO80E030
A5	2	1	5	4	42	NO95E025
96105	2	1	5	6	847	NO95E025
A5	2	1	5	3	15	NO95E025
0A355	2	1	5	4	61	N100W005
96101	2	1	5	4	41	NOPP
0A171	2	1	5	4	61	NOPP
11295	2	1	5	4	166	NO90W015
11287	2	1	5	5	566	N100E005
96593	2	1	5	5	174	N105E000
0A271	2	1	5	5	263	NO80E005
11266	2	1	5	5	634	N100E005
11314	2	2	2	4	86	NO90W010
96056	2	2	5	6	1000	NO90E040
11277	2	2	2	5	553	NO90E005
96105	2	2	2	5	337	N100E025
11312	2	4	2	4	76	NO70E140
96212	2	4	4	4	66	NO75W005
96054	2	4	3	3	22	NOPP
11300	2	4	2	4	21	NO90E005
96076	2	4	5	4	66	NO85E025
11318	2	4	2	5	143	NOPP
35005	2	4	5	4	111	NOPP
96122	2	4	2	4	104	NO85E015
11325	2	4	2	4	103	NOPP
11331	2	4	3	3	57	NOPP
11272	2	4	2	3	23	NO95E005
96092	2	4	3	3	29	NO90E015
96067	2	4	3	4	47	NO95E025
96202	2	4	3	3	24	NO85W000
96041	2	4	3	3	36	NO95E020
96055	2	4	3	3	21	N105E015
36003	2	4	5	5	200	NOPP
35008	2	4	5	5	210	NOPP
96096	2	6	5	5	211	NO95E025
A4	3	1	5	4	78	N105E025
0A225	3	1	5	4	101	NO90E015
96075	3	1	5	5	243	NO85E015
96206	3	1	5	5	308	NO75W000
11292	3	2	1	3	4	NO90E000
11332	3	4	5	5	86	NOPP
11333	3	4	2	4	114	NOPP
11324	3	4	2	4	111	NOPP
35002	3	4	5	5	183	NOPP
35006	3	4	2	5	205	NOPP
11317	3	4	5	6	272	NOPP
96602	3	4	2	6	165	N105W000
11307	3	4	5	5	100	S000E000
96118	3	4	2	6	241	NO95E035
96107	3	4	5	5	177	NO90E020
96610	3	4	5	6	291	NO90E015
96605	3	4	5	5	214	N100W000
0A375	3	4	5	4	70	N100E005
96205	3	4	5	5	66	NO80W000
0A268	3	4	4	5	220	NO85E040
0A051	3	4	5	5	70	NO85W000
96228	3	4	5	4	95	NO85W000
0A273	3	4	2	5	145	NO85W005
96071	3	4	3	4	106	NO85E030
11315	3	4	5	5	124	NOPP
35005	3	4	2	5	202	NOPP
96C58	3	4	2	5	252	NO95E025
96C57	3	4	2	5	143	NO95E040
C3431	3	4	2	4	100	NOPP
11322	3	4	4	5	147	N100E005
11326	3	4	4	4	80	NOPP
11248	3	4	3	4	41	NO95E000
96C57	3	4	3	4	46	N100E020
11326	3	4	4	4	60	NO95E005
96100	3	4	2	4	40	NO85E005
C3430	3	4	3	4	37	NOPP
96078	3	4	3	3	30	NO90E015
11334	3	6	5	4	140	NOPP
0A270	3	6	5	5	271	NO80E000
96C26	3	6	5	4	60	NO80E030
96C76	3	9	5	4	43	NO85E025
96C13	7	1	5	4	44	N105E025
11276	7	1	5	5	354	N100E005
0A275	7	1	5	5	229	NO75W005
0A456	8	1	5	4	72	NOPP
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96591	8	1	5	4	108	N105E000
11293	8	2	5	4	294	NO90E000
11284	8	2	5	5	328	N101E005
96044	8	3	5	4	90	NO90E010
96C95	8	6	5	4	45	NO95E025
96C51	8	6	5	4	77	NOPP
96214	8	6	5	4	70	NO90W005
A14	9	1	5	5	18	NOPP
35C10	9	4	5	5	173	NOPP
96213	9	4	3	3	13	NO90W005
96262	11	1	5	5	275	NO80W000
96201	12	1	5	4	103	NO90W000
96225	12	1	5	4	78	NO85W000
96C81	12	4	2	3	10	NO85E015
11315	12	4	3	4	68	NOPP
35011	12	4	5	4	75	NOPP
96108	12	6	5	4	67	NO95E025
A5	13	1	5	4	26	NO95E025
11271	13	6	5	4	62	NO95E000
96215	18	1	1	3	12	NO95W005
11278	18	1	5	4	60	NO95E005
11273	18	6	5	3	37	NO95E005
NCN	22	1	5	4	55	NOPP
A6	22	1	5	4	15	NO95E015
46219	22	1	5	4	80	NOPP
11283	22	1	5	5	298	N100E005
96104	22	2	2	4	185	N100E025
A20	22	6	1	4	25	NO90W005
34854	23	9	1	3	20	NOPP
0A287	25	4	5	4	59	NOPP
11290	30	1	1	4	153	NO95E000
11313	30	1	5	5	368	NO00E000
0A266	30	2	2	6	681	NO90W005
96C65	31	1	5	4	47	N105E015
0A457	31	1	5	4	56	NOPP
96217	31	2	5	4	273	NO80W000
0A050	31	6	5	5	371	NO80W000
0A173	31	6	5	4	61	NO80W010
96048	31	6	5	4	75	NO95E015
0A272	34	1	5	5	580	NO85W005
11325	35	2	4	4	63	NOPP

APPENDIX H
AGATE BASIN SITE
AGATE BASIN DEBITAGE

Column	Information
1	catalog number
2	material type
3	flake type
4	platform
5	size
6	(disregard)
7	provenience

A2	1 3 3 3	-0	N115F015	A6	1 3 3 4	-0	N095E015	A9	2 3 3 4	-0	N085E035
A3	1 3 1 3	-0	N105E015	A6	1 3 3 3	-0	N095E015	A9	2 3 1 3	-0	N085E035
A6	1 3 3 3	-0	N095E015	A6	1 3 3 3	-0	N095E015	A10	2 3 1 2	-0	N085E000
A6	1 3 3 3	-0	N095F015	A6	1 3 3 3	-0	N095EC15	A10	2 3 3 2	-0	N085E000
A6	1 3 3 3	-0	N095E015	A6	1 3 1 3	-0	N095E015	A10	2 3 3 3	-0	N085E000
A6	1 3 3 3	-0	N095E015	A6	1 3 1 3	-0	N095E015	A11	2 3 3 4	-0	N085W010
A7	1 2 3 3	-0	N085E015	A6	1 3 3 3	-0	N095E015	A11	2 3 1 3	-0	N085W010
A7	1 3 3 3	-0	N085E015	A6	1 3 1 2	-0	N095E015	A11	2 3 1 4	107	N085W010
A7	1 3 3 3	-0	N085E015	A6	1 3 1 2	-0	N095E015	A9	2 3 3 3	-0	N085E035
A7	1 3 1 3	-0	N085E015	A6	1 3 1 2	-0	N095E015	A9	2 3 3 3	-0	N085E035
A10	1 3 3 3	50	N085E000	A6	1 3 3 2	103	N095E015	A9	2 3 3 4	-0	N085E035
A11	1 3 1 3	5	N085W010	A9	1 3 3 3	5	N085E035	A9	2 3 3 4	-0	N085E035
A11	1 3 3 3	2	N085W010	A7	1 3 1 3	19	N085E015	A9	2 3 1 3	-0	N085E035
A11	1 3 1 3	-0	N085W010	A7	1 3 1 3	-0	N095E015	A9	2 3 1 3	98	N085E035
A11	1 3 1 2	3	N085W010	A7	1 3 1 3	-0	N085E015	A10	2 3 3 3	8	N085E000
A3	1 3 1 2	-0	N105E015	A7	1 3 1 3	-0	N085E015	A11	2 3 1 4	-0	N085W010
A3	1 3 3 2	-0	N105E015	A7	1 3 1 3	-0	N085E015	A11	2 3 3 4	-0	N085W010
A3	1 3 3 3	-0	N105E015	A7	1 3 1 2	25	N085E015	A11	2 3 3 3	-0	N085W010
A3	1 3 3 3	10	N105E015	A4	1 3 3 3	-0	N105E025	A11	2 3 3 3	-0	N085W010
A11	1 3 1 4	-0	N085W010	A4	1 3 3 4	-0	N105E025	A11	2 3 3 3	-0	N085W010
A11	1 3 1 3	-0	N085W010	A4	1 3 3 4	71	N105E025	A11	2 3 3 3	-0	N085W010
A11	1 3 3 3	27	N085W010	A8	1 3 3 4	-0	N085E025	A11	2 3 3 3	-0	N085W010
A16	1 3 3 2	-0	N075W000	A8	1 3 3 4	-0	N085E025	A11	2 3 1 3	-0	N085W010
A16	1 3 1 3	-0	N075W000	A8	1 3 3 4	-0	N085E025	A2	2 3 3 4	-0	N115E015
A16	1 3 1 3	-0	N075W000	A8	1 3 1 3	-0	N085E025	A2	2 3 1 4	-0	N115E015
A16	1 3 1 3	23	N075W000	A8	1 3 3 3	-0	N085E025	A2	2 3 3 4	-0	N115E015
A14	1 3 3 3	3	N0PRO	A8	1 3 1 2	111	N085E025	A2	2 3 3 3	-0	N115E015
A21	1 3 1 3	-0	N090W000	A2	1 3 3 3	5	N115E015	A9	2 3 1 3	-0	N085E035
A21	1 3 3 3	-0	N090W000	A5	1 3 3 3	-0	N095E025	A9	2 3 3 3	-0	N085E035
A21	1 3 3 3	18	N090W000	A5	1 3 1 2	-0	N095E025	A6	2 3 1 3	-0	N095E015
A21	1 3 3 4	-0	N090W000	A6	1 3 1 3	-0	N095E015	A6	2 3 1 3	-0	N095E015
A21	1 3 3 3	-0	N090W000	A6	1 3 3 3	-0	N095E015	A6	2 3 1 3	-0	N095E015
A21	1 3 3 3	-0	N090W000	A7	1 3 1 2	-0	N085E015	A7	2 3 1 3	-0	N095E015
A21	1 3 3 3	32	N090W000	A7	1 3 3 2	-0	N085E015	A7	2 3 3 3	-0	N085E015
A10	1 3 3 3	-0	N085E000	A7	1 3 3 2	-0	N085E015	A5	2 3 1 2	-0	N095E025
A10	1 3 1 3	-0	N085E000	A10	1 3 3 3	29	N085E000	A13	2 3 3 3	-0	N090W000
A10	1 3 3 3	-0	N085E000	A21	1 3 3 3	-0	N090W000	A2	2 3 3 3	-0	N115E015
A10	1 3 1 3	22	N095E000	A21	1 3 3 3	20	N090W000	A5	2 3 1 3	-0	N095E025
A10	1 3 1 3	-0	N085E000	A22	1 3 3 3	5	N085E005	A6	2 3 3 3	-0	N095E015
A10	1 3 1 3	5	N085E000	A23	1 3 3 3	-0	N080W005	A7	2 3 3 3	-0	N085E015
A15	1 3 1 3	-0	N100E005	A23	1 3 3 3	-0	N080W005	A10	2 3 1 3	-0	N085E000
A15	1 3 3 3	-0	N100E005	A23	1 3 1 3	17	N080W005	A11	2 1 3 3	-0	N085W010
A15	1 3 1 3	25	N100E005	A20	1 3 3 3	-0	N090W005	A11	2 3 1 3	-0	N085W010
A5	1 3 3 2	-0	N095E025	A20	1 3 1 3	11	N030W005	A11	2 3 1 3	-0	N085W010
A5	1 3 3 2	-0	N095E025	A17	1 3 3 3	-0	N080W000	A11	2 3 1 3	-0	N085W010
A5	1 3 3 2	-0	N095E025	A17	1 3 3 3	-0	N080W000	A11	2 3 1 3	-0	N085W010
A5	1 3 3 2	-0	N095E025	34878	1 3 3 4	36	N0PRO	A11	2 3 1 3	-0	N085W010
A5	1 3 3 3	-0	N095E025	96093	1 3 1 3	4	N085E015	A6	2 3 1 2	-0	N095E015
A5	1 3 1 3	-0	N095E025	80500	1 3 3 4	32	N0PRO	A6	2 3 1 2	-0	N095E015
A5	1 3 1 2	10	N095E025	A21	1 3 1 4	53	N090W000	A7	2 3 3 2	-0	N085E015
A3	1 3 3 3	5	N105E015	A22	1 3 3 4	33	N085W055	A11	2 3 3 2	-0	N085W010
A3	1 3 3 4	-0	N105E015	0A327	1 3 3 4	15	N085E015	A11	2 3 1 2	372	N085W010
A3	1 2 3 4	-0	N105E015	A10	2 3 3 3	-0	N085E000	A11	2 3 1 3	-0	N085W010
A3	1 3 3 4	-0	N105E015	A10	2 3 3 3	-0	N085E000	A11	2 3 1 3	5	N085W010
A3	1 3 3 3	-0	N105E015	A17	2 3 3 4	65	N080W000	A11	2 3 3 3	-0	N085W010
A3	1 3 3 3	105	N105E015	A6	2 2 3 4	-0	N095E015	A11	2 3 1 2	6	N085W010
A3	1 3 3 3	-0	N105E015	A6	2 3 3 4	-0	N095E015	A11	2 3 1 3	1	N085W010
A3	1 3 3 3	-0	N105E015	A6	2 3 3 3	80	N095E015	A11	2 3 1 3	-0	N085W010
A3	1 3 3 3	-0	N105E015	A11	2 3 1 4	72	N085W010	A11	2 3 1 3	-0	N085W010
A5	1 3 3 3	-0	N095E025	A3	2 3 3 3	6	N105E015	A11	2 3 1 3	-0	N085W010
A3	1 3 1 3	-0	N105E015	A2	2 3 3 3	-0	N115E015	A11	2 3 1 3	-0	N085W010
A3	1 3 3 2	-0	N105E015	A2	2 3 3 3	-0	N115E015	A11	2 3 1 2	-0	N085W010
A3	1 3 1 3	-0	N105E015	A7	2 3 3 2	-0	N085E015	A11	2 3 3 2	-0	N085W010
A3	1 3 3 3	45	N105E015	A9	2 3 3 3	-0	N085E035	A11	2 3 3 2	-0	N085W010

A11	2 3 3 3	-0	N085W010	A5	2 3 1 3	-0	N095E025	A13	2 3 1 3	-0	N090W000
A11	2 3 1 3	-0	N085W010	A5	2 3 1 3	-0	N095E025	A13	2 3 3 3	-0	N090W000
A11	2 3 1 2	-0	N085W010	A5	2 3 1 3	-0	N095E025	A4	2 3 3 4	-0	N105E025
A11	2 3 3 2	-0	N085W010	A5	2 3 3 3	-0	N095E025	A4	2 3 3 4	-0	N105E025
A11	2 3 1 2	-0	N085W010	A5	2 3 1 3	-0	N095E025	A4	2 3 3 4	-0	N105E025
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A11	2 3 1 3	-0	N085W010	A5	2 3 1 3	-0	N095E025	A5	2 3 3 4	-0	N095E025
A11	2 3 1 3	-0	N085W010	A5	2 3 3 3	-0	N095E025	A5	2 3 3 4	-0	N095E025
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A11	2 3 1 2	-0	N085W010	A6	2 2 1 3	-0	N095E015	A5	2 3 3 4	-0	N095E025
A11	2 3 1 3	-0	N085W010	A6	2 3 1 3	-0	N095E015	A5	2 3 3 4	-0	N095E025
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A11	2 3 3 2	-0	N085W010	A6	2 3 3 3	-0	N095E015	A9	2 3 1 4	615	N085E035
A11	2 3 1 2	-0	N085W010	A6	2 3 3 3	-0	N095E015	A10	2 3 3 4	-0	N085E000
A11	2 3 3 3	-0	N085W010	A6	2 3 3 3	-0	N095E015	A13	2 3 3 4	-0	N090W000
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A11	2 3 1 2	-0	N085W010	A6	2 3 1 3	-0	N095E015	A13	2 3 3 4	145	N090W000
A11	2 3 1 2	-0	N085W010	A6	2 3 3 3	-0	N095E015	A7	2 3 3 3	-0	N085E015
A11	2 3 1 2	-0	N085W010	A6	2 3 3 3	-0	N095E015	A12	2 3 3 4	-0	N080E010
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A11	2 3 1 3	-0	N085W010	A6	2 3 3 3	-0	N095E015	A12	2 3 1 3	-0	N080E010
A11	2 3 1 2	-0	N085W010	A6	2 2 3 3	-0	N095E015	A12	2 3 1 3	-0	N080E010
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A11	2 3 1 2	-0	N085W010	A6	2 3 3 3	-0	N095E015	A12	2 3 3 3	59	N080E010
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A11	2 3 1 2	-0	N085W010	A6	2 3 1 3	-0	N095E015	A12	2 3 3 4	117	N080E010
A11	2 3 1 2	-0	N085W010	A6	2 3 1 3	-0	N095E015	A21	2 3 3 3	-0	N090W000
A11	2 3 1 2	-0	N085W010	A6	2 3 3 3	-0	N095E015	A21	2 3 3 3	-0	N090W000
A11	2 3 1 2	83	N085W010	A6	2 3 3 3	-0	N095E015	A21	2 3 1 4	79	N090W000
A3	2 3 1 3	-0	N105E015	A6	2 3 3 3	-0	N095E015	36235	2 1 1 4	-0	NOPRO
A3	2 3 1 2	-0	N105E015	A6	2 3 3 3	-0	N095E015	A16	2 2 1 3	102	N075W000
A3	2 3 1 2	6	N105E015	A6	2 3 3 3	-0	N095E015	A21	2 3 3 4	-0	N090W000
A11	2 3 1 4	-0	N085W010	A6	2 3 3 3	-0	N095E015	A21	2 3 1 3	-0	N090W000
A11	2 3 3 3	-0	N085W010	A6	2 3 1 3	-0	N095E015	A21	2 2 3 3	-0	N090W000
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A11	2 3 1 3	-0	N085W010	A6	2 3 3 3	-0	N095E015	A21	2 3 3 3	125	N090W000
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A11	2 3 1 3	55	N085W010	A7	2 3 3 3	-0	N085E015	A6	2 3 1 3	-0	N095E015
A10	2 3 1 3	-0	N085E000	A7	2 3 1 3	-0	N085E015	A6	2 3 3 3	-0	N095E015
A10	2 3 1 3	7	N085E000	A8	2 3 3 3	-0	N085E025	A6	2 3 3 3	-0	N095E015
A16	2 3 3 2	4	N075W000	A9	2 3 3 3	-0	N085E035	A6	2 3 3 3	-0	N095E015
A6	2 3 3 2	-0	N095E015	A9	2 3 3 3	-0	N085E035	A6	2 3 3 3	-0	N095E015
A6	2 3 1 2	-0	N095E015	A9	2 3 1 3	-0	N085E035	A6	2 3 3 4	-0	N095E015
A6	2 3 1 2	-0	N095E015	A10	2 3 3 3	-0	N085E000	A10	2 3 1 3	-0	N085E000
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11274	8	4	2	5	595	N100E005	A3	10	3	3	3	2	N105E015	A4	12	1	1	3	-0	N105E025
C3469	8	4	3	4	580	NOPRO	A11	10	3	1	3	2	N085W010	A4	12	1	3	3	33	N105E025
0A467	8	4	2	4	523	NOPRO	A11	10	3	1	3	2	N085W010	A5	13	1	3	4	-0	N095E025
0A468	8	4	3	4	558	NOPRO	NN	10	1	1	5	-0	NOPRO	A5	13	2	1	3	-0	N095E025
96590	8	2	1	4	25	N105E000	NN	10	2	3	4	-0	NUPRO	A5	13	3	1	4	-0	N095E025

A5	13	2	1	4	350	N095E025
A6	13	2	1	3	-0	N095E015
A6	13	2	1	3	-0	N095E015
A6	13	2	1	3	-0	N095E015
A6	13	2	1	3	-0	N095E015
A6	13	2	1	3	-0	N095E015
A6	13	3	3	3	-0	N095E015
A6	13	2	1	3	-0	N095E015
A6	13	3	1	3	-0	N095E015
A6	13	3	1	3	-0	N095E015
A6	13	3	3	3	75	N095E015
A11	13	3	1	3	-0	N085W010
A11	13	3	1	3	9	N085W010
A10	13	3	1	3	4	N085E000
A14	13	2	1	3	-0	NOPRO
A14	13	3	1	3	55	NOPPO
A21	13	3	1	2	1	N090W000
A21	13	3	3	3	-0	N090W000
A21	13	3	3	3	-0	N090W000
A21	13	3	1	3	25	N090W000
A10	13	3	3	3	5	N085E000
A15	13	3	1	4	37	N100E005
A15	13	3	1	3	21	N100E005
A5	13	3	1	3	-0	N095E025
A5	13	3	1	3	5	N095E025
A5	13	3	1	3	4	N095E025
A5	13	3	1	4	50	N095E025
A9	13	3	1	3	10	N085E035
A4	13	3	3	3	6	N105E025
A11	13	1	1	3	26	N085W010
A3	13	3	1	4	66	N105E015
B1C60	15	3	3	4	25	N100E005
A6	15	3	3	2	2	N095E015
A2	17	3	3	3	-0	N115E015
A2	17	3	1	3	-0	N115E015
A2	17	3	3	3	-0	N105E015
A5	17	3	3	3	-0	N095E025
A5	17	3	3	3	-0	N095E025
A5	17	3	3	2	-0	N095E025
A6	17	3	3	3	-0	N095E015
A6	17	3	1	3	-0	N095E015
NN	17	3	1	2	-0	NO PRO
NN	17	3	1	3	43	NO PRO
A6	18	3	3	3	7	N095E015
B1061	18	4	3	5	737	NO PRO
A11	18	3	3	3	7	N085W010
A11	18	3	1	2	-0	N085W010
A11	18	3	1	2	-0	N085W010
A11	18	3	1	3	3	N085W010
A14	18	3	3	3	5	NOPPO
A5	18	3	3	2	2	N095E025
A5	18	3	1	3	4	N095E025
A6	18	3	3	5	72	N095E015
A7	18	3	3	3	3	N085E015
A2	18	3	3	4	-0	N115E015
A7	18	1	3	4	61	N085E015
NN	18	2	3	4	74	NOPRO
A2	18	3	3	4	48	N115E015
A17	20	3	1	3	17	N080W000
A21	20	3	1	4	25	N090W000
A13	20	3	3	4	140	N090W000
A11	22	3	1	3	-0	N085W010
A11	22	3	3	3	15	N085W010
A11	22	3	3	3	6	N085W010
A14	22	2	3	5	-0	NOPRO
A14	22	1	1	4	-0	NOPRO
A14	22	3	3	4	-0	NOPRO
A14	22	3	3	3	143	NOPRO
A12	22	3	3	3	12	N080E010
A12	22	3	3	4	32	N080E010
A12	22	3	3	3	3	N080E010
A21	22	2	1	4	50	N090W000
A10	22	3	1	3	-0	N085E000
A10	22	3	1	2	4	N085E000
A15	22	3	1	3	-0	N100E005
A11	22	3	1	4	-0	N085W010
A15	22	3	3	3	74	N100F005
AB96	22	2	1	4	40	NOPRO
B1344	22	1	1	4	50	N100E005
A6	22	3	3	2	2	N095E015
A6	22	3	1	2	3	N095E015
A6	22	3	1	3	6	N095E015
A7	22	3	3	3	5	N085E015
A2	22	3	3	4	22	N115E015
A5	22	2	3	4	-0	N095E025
A5	22	3	1	4	78	N095E025
A2	22	3	1	3	-0	N115E015
A2	22	2	3	3	-0	N115E015
A3	22	1	1	3	-0	N105E015
A3	22	3	1	3	-0	N105E015
A3	22	3	1	3	-0	N105E015
A3	22	2	1	4	-0	N105E015
NN	22	3	3	3	-0	NOPRO
A6	22	3	1	3	-0	N095E015
A6	22	3	1	3	-0	N095E015
A7	22	1	3	4	-0	N085E015
A9	22	3	3	3	-0	N085E035
A9	22	3	3	3	-0	N085E035
A9	22	3	1	3	-0	N085E035
A9	22	3	3	4	-0	N085E035
A11	22	3	1	3	214	N085W010
A4	22	3	3	4	26	N105E025
A4	22	1	1	3	18	N105E025
A8	22	3	3	4	-0	N085E025
NN	22	2	3	4	44	N085E025
9E096	22	2	1	4	116	NOPRO
A20	22	3	1	4	31	N095W005
A8	22	3	3	3	13	N085E025
A11	23	3	1	3	2	N085W010
A5	23	3	1	4	18	N095E025
A11	24	3	3	4	-0	N085W010
A11	24	3	1	3	46	N085W010
A11	24	3	1	2	1	N085W010
A5	24	3	1	3	5	N095E025
A7	24	3	1	3	2	N085E015
A2	24	2	3	4	-0	N115E015
A2	24	2	3	3	60	N115E015
0A381	24	4	3	4	549	NOPRO
11281	24	4	1	5	1326	N090E005
A7	25	3	3	2	3	N085E015
A6	25	3	3	2	-0	N095E015
A6	26	1	3	5	57	N095E015
A3	28	2	1	4	-0	N105E015
A3	28	1	1	3	-0	N105E015
A3	28	2	1	3	-0	N105E015
A3	28	1	1	3	-0	N105E015
A3	28	2	1	3	194	N105E015
A6	28	3	3	3	-0	N095E015
A6	28	3	1	4	-0	N095E015
A6	28	3	1	3	-0	N095E015
A6	28	3	1	3	-0	N095E015
A5	28	3	1	2	-0	N095E025
A7	28	3	1	3	-0	N085E015
A6	28	3	1	3	-0	N095E015

APPENDIX I
FREQUENCY OF RAW MATERIAL AT THE KOBOLD SITE

APPENDIX I

FREQUENCY OF RAW MATERIAL AT THE KOBOLD SITE

MATERIAL	LEVEL 1 #/%	1 WT/%	2 #/%	2 WT/%	3 #/%	3 WT/%	4 #/%	4 WT/%
Mississippian and Pennsylvanian chert	0	0	1/1	2.3/.3	1/1	4.4/.1	26/6	54.9/2
Lower Cretaceous quartzite	1/11	15.5/50	2/2	6.8/1	3/3	6.5/.1	95/21	614.7/19
Knife River Flint	0	0	0	0	1/1	3.1/.1	0	0
Fort Union Porcellanite	4/45	8.5/27	60/71	681.9/90	82/73	402.9/65	247/54	1921.1/58
Fort Union Vitriphere	1/11	3.5/11	0	0	0	0	2/.4	22.5/1
Fort Union Non-volcanic glass	0	0	1/1	2.1/.3	1/1	.9/.1	8/2	11.3/.3
Morrison Quartzite	0	0	4/5	12.5/2	1/1	3.5/.1	0	0
Knife River Flint-like	0	0	0	0	0	0	4/1	3.7/.1
Permian cherts	1/11	1.0/3	1/1	.4/.05	9/8	19.2/3	18/4	74.5/2
Plate Chalcedony	0	0	0	0	0	0	1/.2	106.1/3
Obsidian	0	0	0	0	1/1	.2/.03	2/.4	1.1/.03
Miscellaneous Cherts:								
Heated	0	0			1/1	1.7/.2	5/1	22.4/1
Translucent,dull white	0	0	0	0	0	0	1/.2	2.9/.08
Clean white chalcedony	0	0	0	0	0	0	5/1	6.5/.2
Other	1/11	1.5/5	5/6	16.0/2	6/5	30.5/5	20/4	151.0/5
Miscellaneous Quartzite:								
Fine	1/11	1.1/4	9/11	33.9/4	6/5	144.7/23	17/4	82.8/3
Ordovician	0	0	1/1	5.7/.01	0	0	8/2	145.6/4
Red speckeled grey	0	0	0	0	0	0	2/.4	86.2/3
TOTAL	9	31.1	84	761.6	112	617.6	461	3307.3

APPENDIX J
FREQUENCY OF RAW MATERIAL AT THE PINEY CREEK SITE

APPENDIX J

FREQUENCY OF RAW MATERIALS AT THE PINEY CREEK SITE

MATERIAL TYPE	Butchering Area #/%	Butchering Area WT/%	Kill Area #/%	Kill Area WT/%
Mississippian and Pennsylvanian Chert	89/22	1256.1/23	18/11	155.0/25
Lower Cretaceous Quartzite	0	0	19/11	15.4/2
Knife River Flint	1/0.2	6.3/0.1	0	0
Fort Union Porcellanite	261/65	3702.2/67	65/38	233.3/38
Fort Union Vitriphere	0	0	2/1	1.6/.2
Fort Union Non-volcanic Glass	2/0.4	5.2/0.1	2/1	4.0/.6
Moss Agate	0	0	2/1	1.7/.2
Knife River Flint-like Chert	0	0	5/3	20.3/3
Petrified Wood	0	0	1/1	1.2/.1
Permian Cherts	5/1	33.2/1	1/1	1.3/.1
Plate Chalcedony	1/0.2	19.4/0.3	0	0
Obsidian	0	0	8/5	4.7/.7
Miscellaneous Cherts:				
Heated chert	13/3	65.3/1	8/5	17.1/3
Translucent dull white	3/0.7	3.3/.05	1/1	.9/.1
Clean white chalcedony	0	0	5/3	4.5/1
Clear yellowish chalcedony	0	0	16/9	10.9/2
Other	6/1	99.3/2	6/4	16.5/3
Miscellaneous Quartzites:				
Coarse	0	0	2/1	23.3/4
Fine	1/0.2	.6/.01	0	0
Red speckeled grey	1/0.2	9.3/.2	0	0
Ordovician Age :	18/410.2	310.2/6	7/4	108.1/17
TOTAL	401	5510.4	169	619.7

APPENDIX K
FREQUENCY OF RAW MATERIAL AT THE VORE SITE

APPENDIX K

FREQUENCY OF RAW MATERIAL AT THE VORE SITE

MATERIAL	LEVEL 1 #/%	LEVEL 1 WT/%	LEVEL 2 #/%	LEVEL 2 WT/%	LEVEL 3 #/%	LEVEL 3 WT/%	LEVEL 4 #/%	LEVEL 4 WT/%
Mississippian and Pennsylvanian chert	2/5	27.1/6	1/2	22.7/7	2/5	2.0/2	0	0
Lower Cretaceous quartzite	15/38	120.1/24	23/51	201.3/80	22/61	85.1/66	37/86	187.0/67
Knife River Flint	9/23	322.1/66	0	0	4/11	4.2/3	0	0
Fort Union Porcellanite	10/25	10.3/2	14/31	20.4/8	4/11	12.6/10	1/2	1.1/.4
Fort Union Non-volcanic glass	1/3	.9/.2	1/2	.5/.2	0	0	0	0
Moss Agate	1/3	.9/.2	0	0	0	0	0	0
Morrison Quartzite	1/3	.3/.06	0	0	0	0	0	0
Knife River Flint-like	0	0	0	0	0	0	1/2	1.8/1
Petrified Wood	0	0	2/4	2.1/1	0	0	2/6	2.0/1
Miscellaneous Cherts:								
Heated	0	0	0	0	0	0	0	0
Clear white chalcedony	0	0	1/2	2.0/1	3/8	3.1/2	0	0
Other	0	0	3/6	2.0/1	0	0	1/2	.6/.2
Miscellaneous Quartzites:								
Coarse	1/3	9.3/2	0	0	0	0	0	0
Fine	0	0	0	0	0	0	1/2	87.1/31
Red speckeled grey	0	0	0	0	1/3	21.0/16	0	0
TOTAL	40	491.0	45	251.0	36	128.0	43	279.6

APPENDIX K (continued)

FREQUENCY OF RAW MATEIAL AT THE VORE SITE

MATERIAL	LEVEL 5 #/%	5 WT/%	6 #/%	6 WT/%	7 #/%	7 WT/%	8 #/%	8 WT/%
Mississippian and Pennsylvanian chert	1/3	.9/.1	1/7	3.5/13	0	0	0	0
Lower Cretaceous quartzite	23/61	469.6/63	11/73	17.3/66	14/52	71.4/79	12/55	22.3/54
Knife River Flint	9/24	249.4/33	1/7	2.2/8	0	0	2/9	3.7/9
Fort Union Porcellanite	2/5	2.4/.3	2/13	3.1/12	5/18	6.8/7	2/9	4.0/10
Fort Union Non-volcanic glass	0	0	0	0	4/15	4.8/5	0	0
Moss Agate	0	0	0	0	0	0	0	0
Morrison Quartzite	1/3	5.3/1	0	0	0	0	0	0
Knife River Flint-like	0	0	0	0	0	0	2/9	3.8/9
Petrified Wood	0	0	0	0	0	0	3/14	5.2/13
Miscellaneous Chert:								
Heated	1/3	17.9/2	0	0	0	0	0	0
Clear white chalcedony	1/3	1.2/.2	0	0	0	0	1/4	2.0/5
Other	0	0	0	0	0	0	0	0
Miscellaneous Quartzites:								
Coarse	0	0	0	0	0	0	0	0
Fine	0	0	0	0	4/15	8.0/9	0	0
Red speckeled grey	0	0	0	0	0	0	0	0
TOTAL	38	746.7	15	26.1	27	91.0	22	41.0

APPENDIX L
FREQUENCY OF RAW MATERIAL AT THE HAWKEN SITE

APPENDIX L

FREQUENCY OF RAW MATERIALS AT THE HAWKEN SITE

MATERIAL	#/%	WT/%
Mississippian and Pennsylvanian Chert	38	171.5/34
Lower Cretaceous Quartzite	18	92.1/18
Knife River Flint	3	17.5/3
Fort Union Porcellanite	3	6.6/1
Moss Agate	1	6.7/1
Morrison Quartzite	27	131.4/26
Knife River Flint-like	12	47.5/10
Permian Chert	1	21/1
Miscellaneous Quartzite - fine	1	5.6/1
Miscellaneous Chert - general	7	24.1/5
TOTAL	111	505.1

APPENDIX M

FREQUENCY OF RAW MATERIALS AT THE AGATE BASIN SITE

APPENDIX M

FREQUENCY OF RAW MATERIALS AT THE AGATE BASIN SITE

MATERIAL	FOLSOM				AGATE BASIN			
	Tools		Debitage		Tools		Debitage	
	#/%	WT/%	#/%	WT/%	#/%	WT/%	#/%	WT/%
Mississippian and Pennsylvanian chert	65/27.3	453.2/34.7	673/39.5	1691/13.4	67/35.1	7147/27.3	116/8.6	984/2.4
Lower Cretaceous quartzite	34/14.3	223.6/17.1	186/10.9	1327/10.5	36/18.8	7103/27.2	584/38.1	5256/12.8
Knife River Flint	74/31.1	195.1/15.0	467/27.4	1759/14.0	41/21.5	5413/20.7	20/1.4	174/0.4
Fort Union Porcellanite	0	0	1/0.1	11/0.1	3/1.6	627/4.2	88/6.0	878/2.1
Fort Union Non-volcanic glass	1/0.4	48/0.4	0	0	0	0	0	0
Moss Agate	27/11.3	164.1/12.6	243/14.3	4850/38.6	10/5.2	1278/4.8	413/27.9	2534.7/62.1
Morrison quartzite	0	0	0	0	3/1.6	10.4/0.7	35/2.4	52.2/1.2
Knife River Flint-like brown chert	8/3.4	18.3/1.4	3/0.2	1.5/0.1	3/1.6	10.9/0.4	15/0.9	102.3/0.4
Petrified Wood	2/0.8	53.0/4.0	8/0.5	21.6/1.7	6/3.1	65.8/2.5	51/3.5	124.6/2.9
Flattop chert (Colo.)	2/0.8	15.5/1.2	0	0	1/0.5	2.0/0.1	2/0.1	2.0/0.1
Permian cherts (Phos., Minnek)	0	0	1/0.1	0.6/0.1	1/0.5	5.9/0.2	2.0.1	0.3/0.1
Plate chalcedony	1/0.4	50.3/3.9	2/0.1	0.8/0.1	3/1.6	120.2/4.6	0	0
Miscellaneous Chert:								
brown speckeled clear	2/0.8	1.5/0.1	17/1.0	14.7/1.1	0	0	23/1.6	22.5/0.5
heated	5/2.1	5.2/0.4	31/1.8	16.5/1.3	2/1.0	8.8/0.3	34/2.3	7.5/1.8
opaque white	1/0.4	1.6/0.1	0	0	0	0	9/0.6	198.9/4.8
clear/white chalcedony	0	0	0	0	1/0.5	6.3/0.2	0	0
dull white/translucent	0	0	7/0.4	3.5/0.2	6/3.1	88.3/3.3	0	0
other	8/3.4	60.1/4.6	5/0.3	3.3/0.2	6/3.1	40.4/1.5	26/1.8	33.8/0.5
Miscellaneous Quartzite:								
coarse	0	0	49/2.9	221.6/17.7	0	0	34/2.3	168.6/4.1
fine	2/0.8	55.8/4.3	1/0.1	0.7/0.1	1/0.5	27.5/1.0	11/0.7	10.8/0.3
fine green	6/2.5	2.8/0.2	9/0.5	1.2/0.1	0	0	3/0.1	2.7/0.1
Ordovician	0	0	0	0	1/0.5	56.0/2.3	0	0
red speckeled grey	0	0	0	0	0	0	10/0.7	4.3/0.1
TOTAL	238	1304.9	1704	1251.5	191	2611.0	1478	4081