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Analysis of the Archaic lithic artifacts from the Buchanan site, 13SR153, Ames, Iowa

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by

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CHAPTER I

INTRODUCTION

The Buchanan site,13SR153, is a multi-component site at the northeast edge of Ames that was intermittently occupied over a few thousand years (Figures 1 and 2). The site contains several stratified archaeological deposits some of which have been radiocarbon dated. The deposits are situated near the southern edge of the Wisconsinan age Des Moines Lobe within a steep, narrow valley which drains into the South Skunk River to the west (Van Nest 1987:2). Water moves along three main drainages referred to as Laterals A, B, and C.

The objectives of the research reported in this thesis were to describe the lithic artifacts from the Buchanan site and to evaluate the site's archaeological evidence regarding technology, subsistence and settlement during the Archaic period, about 8000-3000 years ago (see Chapter III)`. The ultimate aim of these investigations is to identify patterns of continuity and change within and between different episodes of occupation and to coordinate those patterns with models for the Archaic period in Iowa and, more generally, in the Midwest. Additionally, the research was focussed on purely local aspects of Archaic life-ways such as what kinds of camps were established at the Buchanan site and what kinds of needs or challenges were being met locally and by what, if any, special adaptations.

The field work at the Buchanan site was undertaken as part of a cooperative alliance between Iowa State University and The Institute for the History of Material Culture (IHKM), Polish Academy of Sciences, to focus on "comparative studies of late Pleistocene and early Holocene hunting-gathering cultures in Poland and the United States (Bower 1987:1) for the purpose of better comprehension of economic and technological accommodations to major

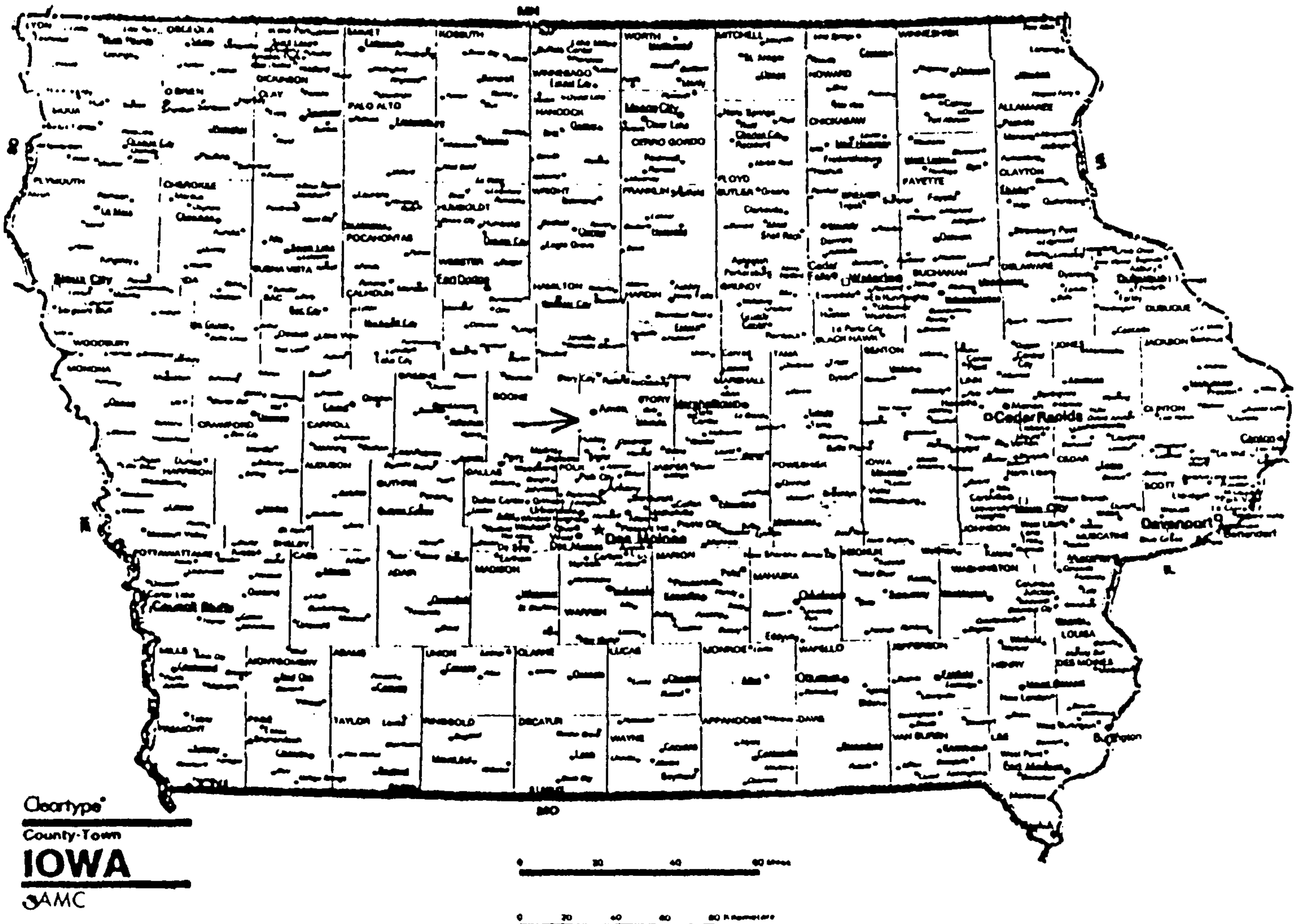


Figure 1. Map of Iowa showing the location of Ames.

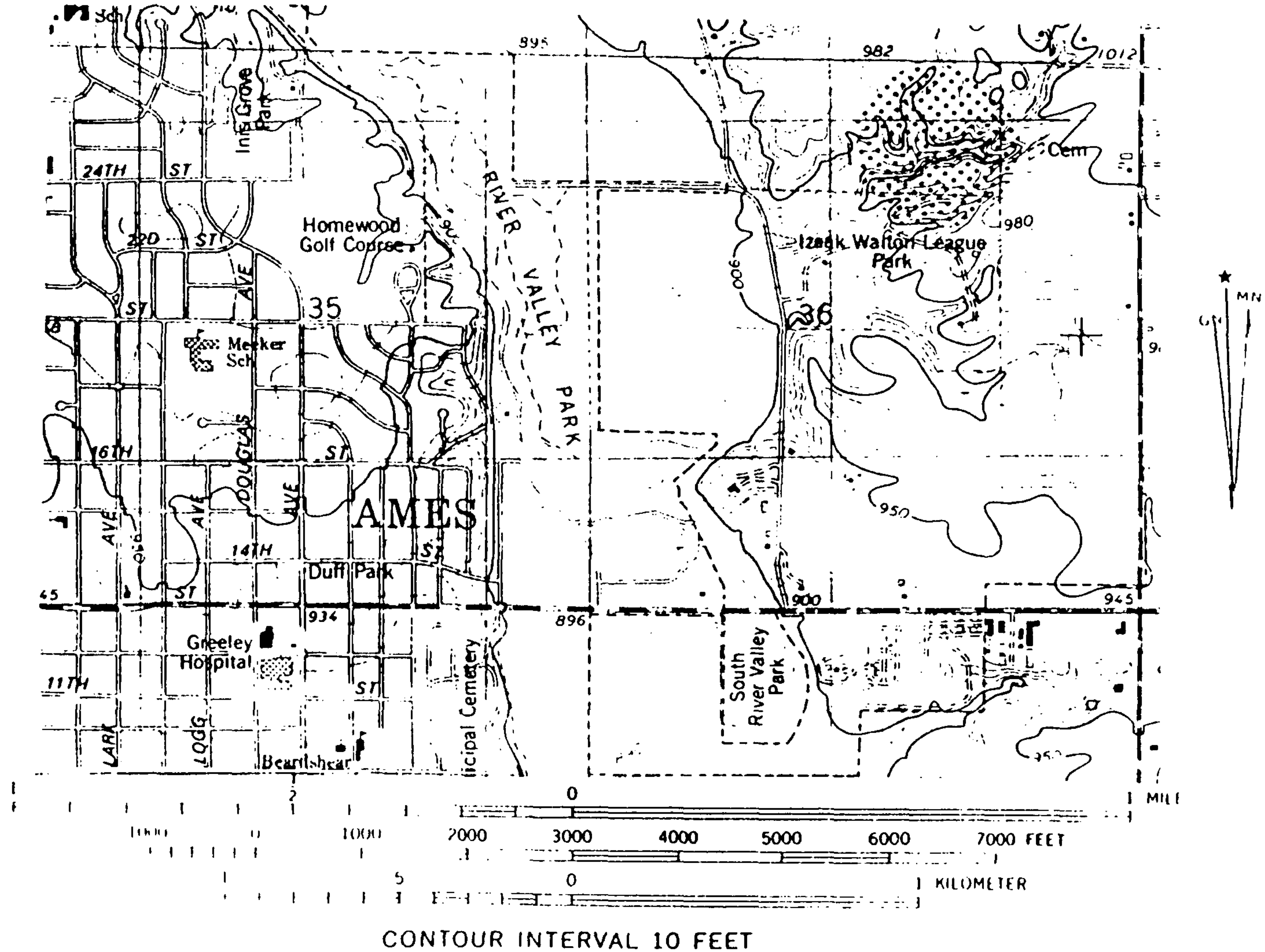


Figure 2. Map of Ames showing the location of the Buchanan site (stippled area), 13SR153, (Adapted from the USGS Ames East, Iowa quadrangle map 1974).

climatic change by prehistoric peoples. Therefore this thesis is offered toward the general aims of the project from which its data is derived.

A lithic analysis was undertaken in order to help answer questions regarding the types of activities that may have been conducted at the site. The archaeological debris did not seem to be as deep or as continuous as might be expected from repeated base camp occupation. Moreover, glacially transported rock in the drainage, rather than exotic material, seems to have been the raw material source for most tools and debitage recovered from the site. Manufacturing rather than resharpening of tools was a prime activity. The presence of expedient type tools, such as utilized flakes (LTU), irregular side-scrapers (LTS), retouched flakes (LTR), and casually retouched tools (LTT) was common. The practice of heat treating rock to improve chipping qualities was also a persistent feature of the Buchanan assemblages. All in all, the lithic assemblage from the Buchanan site suggests a variety of special purpose occupations rather than base camp settlement.

Extensive excavation began at the Buchanan Site (13SR153) during the Iowa State University summer field school of 1987. At this time, three of the four excavation areas, Grids A, B, and C, were established on two of the drainages, Laterals A and B. Summer excavations continued each summer through 1991. Archaic artifacts were recovered from the levels dug in 1987, 1989 and 1991. Grid D, opened in 1989, was not excavated to Archaic levels, having been terminated in a Woodland component. Therefore, only materials from Grids A, B and C will be considered in this study, with samples restricted to artifacts that are clearly of Archaic age. These depths vary from grid to grid and are based on artifact typology and radiocarbon dates. In Grid A, the depth is from 200 cm and downward. In Grid B, the 60-70 cm spit yielded a radiocarbon date of about 3000 years ago (Table 1). Also, while the archaeological materials from the sediments above this level contained pottery, none was found below 60 cm. Thus, 60 cm was taken as an upper limit for Archaic occurrances in Grid B. A profile of the trench at Grid C displays an episode of disturbance due to stream activity but below these sediments the deposits are undisturbed. Charcoal taken from the base of the the channel sediments rendered a radiocarbon date of about 2450 years ago (Beta-30338), at about the upper limint of the Late Archaic interval. Thus, material from the base of the channel fill at Grid C and below is included in the present analysis.

Previous Studies

Early investigations The area now known as the Buchanan Site is identified in local lore as the "Ames Bog" and has long been known to contain sizable peat and bison bone deposits. The name Buchanan is in recognition of the Buchanan family who own the site and have allowed the scientific investigations to take place. The contents of the "Ames Bog" were reported by Beal who came across it sometime between 1876 and 1883 when he had a position with Iowa's land grant agricultural college, now Iowa State University. The bison bones apparently were blackened from lengthy immersion in the peat deposits (Beal 1903:122). The bone deposit was said to have represented several hundred or more of the animals. Aldrich broke small pieces from some of the bones noting that the discoloration was a surface stain (Aldrich 1903:124). The area was described as one of slow drainage, perhaps due to a temporary dam of accumulated vegetational debris which may have encouraged the development of peat. It was thought that the bison bones may have represented animals that became mired in the soft soil when seeking water from the drainage which may have been preferred because of its possible higher concentration of various salts than is found in freer flowing streams (Beal 1903:122-123).

Pammel and Becraft in the early years of this century studied the vegetation in the area of the South Skunk drainage, including the "Ames Bog," then called the "Pettinger Bog." In the process, they described quantities of elk, deer and (especially) bison bones (Pammel 1930:404-406,422; Van Nest 1987:7-8). Pammel suggested that the slow drainage was due to damming by beavers (Pammel 1930:408-409)

Gwynne (1942) noted that the "Ames Peat Bog" deposits were in two adjacent side valleys of the South Skunk River. He reported the existence of a man-made dam near the drainage's confluence with the South Skunk. The drainage was said to have been incised to an exceptional depth. Also, other valleys draining into the South Skunk were noted to lack peat deposits. In addition to the large quantity of bison bones the peat was said to have contained many snail shells and a few deer remains. The peat deposits generally were declining in quantity in the 1930s. Gwynne explained the peat development as being due to the construction of beaver dams (Gwynne 1942:351-354). Ballard has observed that the topography of the northern reach of Lateral B could easily have served hunters as a bison jump (1992:personal communication).

Surveys In the 1960s the proposed construction of a dam and reservoir on the South Skunk River just north of Ames resulted in multidisciplinary studies of the area that was expected to be affected by the dam (Sendlein and Dougal 1968:1; Gradwohl and Osborn 1972:1-2). An estimated 2100 to 5000 acres would have been affected by the dam and reservoir (Gradwohl and Osborn 1972:1-2).

A geological and geohydrological study was conducted on a portion of the South Skunk watershed in order to describe the configuration of the underlying bedrock. This was intended to determine more accurately the extent of a buried valley and its possible effect on the movement of water below the surface (Sendlein and Dougal 1968:1).

An archaeological reconnaissance survey, the first to be done in this locale, was organized to locate sites, assess their significance and to estimate possibilities of salvage within as brief a time as possible (Gradwohl And Osborn 1972:1-2). Scores of sites were located. Previously, except for a bow found in the 1930s along Squaw Creek and recorded with the Office of the State Archaeologist in 1961, no other sites within Story County had been officially acknowledged by the mid-1960s. Although assorted artifacts had been found along the streams in this area, fewer people seemed to be collecting informally in this area than elsewhere (Gradwohl and Osborn 1972:5, 17,19).

The lithic artifacts recovered from this survey were found to be of microcrystalline cherts and chalcedony, some with a carbonate cortex (Gradwohl and Osborn 1972:28-29). Tools and manufacturing debris indicated that preheating treatment was practiced by the local prehistoric flint knappers, possibly in response to the relative unavailability of better quality chipping stone. Some corner notched and stemmed points indicated the presence of Archaic camp sites and perhaps a several thousand year occupation of Archaic peoples (Gradwohl and Osborn 1972:35-36,120-121). In the Buchanan site drainage the survey crew reported that the erosion of bison bone from the peat was continuing. Bone and stone flakes were exposed in the bank of one of the laterals. Also lithic artifacts were sighted in the stream beds (Gradwohl and Osborn 1972:115-116). On the basis of the collected artifacts and the possible association with the faunal assemblage known from the Ames "bog" area, Gradwohl and Osborn officially designated this site as 13SR153 in the Smithsonian Trinomial System. In the Survey area numerous chert and dolomite outcrops were observed fairly close to the Buchanan site; a number of them were associated with cultural materials, possibly of Archaic age (Gradwohl and Osborn 1972:7,8,28-29,120). The availability of chert seems to decline north of the study area and this may have drawn people to the general area near Ames (Gradwohl and Osborn 1972:120-121).

Ballard's research For nearly two decades avocational archaeologist David N. Ballard, Jr. has surface collected from the 40-acre Buchanan site and adjacent upland areas. The tools he collected from the Buchanan site came mainly from the drainages. One specimen was identified as an Agate Basin point made of Burlington chert. Another item was a base tentatively identified as a Hell Gap type that had been collected in a nearby upland area. Ballard's collection included the base of what may be a Dalton style point, from the late Paleo-indian or Early Archaic period. Other tools of early Archaic forms had also come from an adjacent upland surface. Three points in his collection resemble some points recovered from the Cherokee Sewer site in northwest Iowa. An example of a heat-altered point was composed of Tongue River Silica (or Silcrete). Ballard noted that except for examples made of Burlington or Winterset chert, most lithic artifacts could have been made from various cherts found in the glacial materials exposed in the Buchanan drainages. (David N. Ballard, Jr. 1992: personal communication).

Van Nest investigations   In the mid-1980s, a geomorphological study was conducted in the drainage containing the Buchanan site which focussed on events developing since the beginning of the Holocene. Periods of stability and of change, such as erosion or the headward lengthening of the drainages, were traced. Vegetational patterns were reconstructed and tied to changes in climate (Van Nest 1987:iii). This important study is further discussed at the end of Chapter V.

CHAPTER II

METHODS OF INVESTIGATION

The Buchanan site was chosen for the Polish-American comparative study based on evidence of a hearth and other cultural material recovered from geological field work conducted by Julieann Van Nest (University of Iowa geology graduate student) during the summer of 1986. Additionally, the artifacts collected by David N. Ballard, Jr. (an avocational archaeologist), for a period of over more than ten years suggested episodes of occupation that sampled most, if not all, of the Archaic period (Bower 1987:1). It was the potential of recovering evidence of an interaction of cultures and their environments over a long span of the Holocene epoch that decided on 13SR153. Such a record lends itself to comparison with similar, longitudinal data from Poland.

Excavation Units

As the site is large, actual excavations were separated in space throughout the small valley (Figures 3 and 4). Each excavation was plotted as a grid and designated by a capital letter. Each grid is divided into meter squares aligned in Rows indicated by Roman numerals. Each row is divided into squares indicated by Arabic numerals. An exception to this pattern occurred in Rows III-V, Grid C, where it was necessary to "step in" a trench whose subdivisions were labelled with lower case letters. Excavation proceeded by spits measured in centimeters. Each spit is identified and located by grid, by row, by square and by depth; for example, a large deposit of artifacts were recovered from a spit at 240 to 255 cm from Square 8 in Row II located in Grid B.

Since 1985, four grids, A, B, C, and D, have been plotted for excavation. Grids A and B are adjacent to Lateral A; Grid D is upslope in a northwesterly direction of Grid B, and Grid

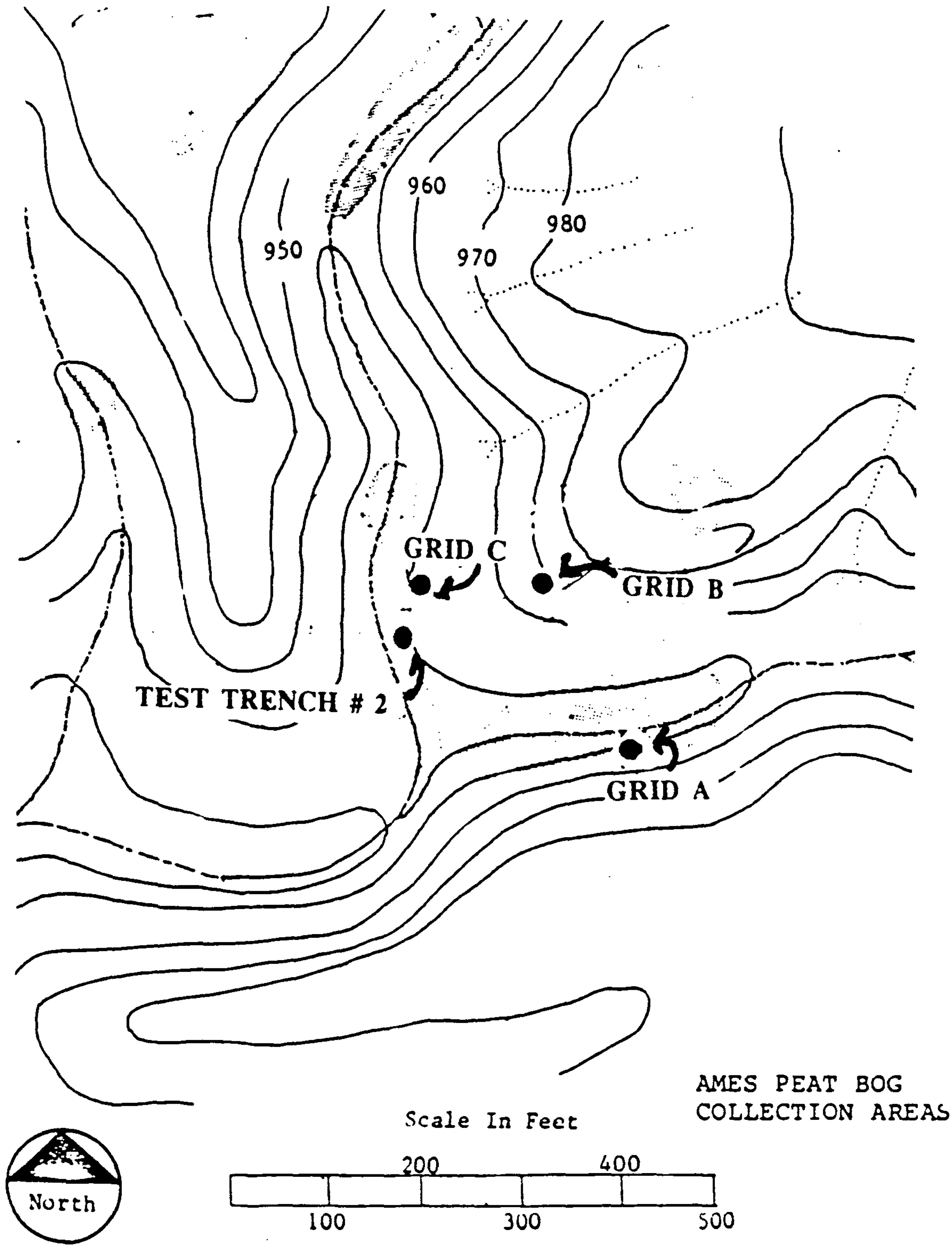


Figure 3. Map showing the approximate locations of Grids A, B, and C. Map sketched by Dave Ballard.

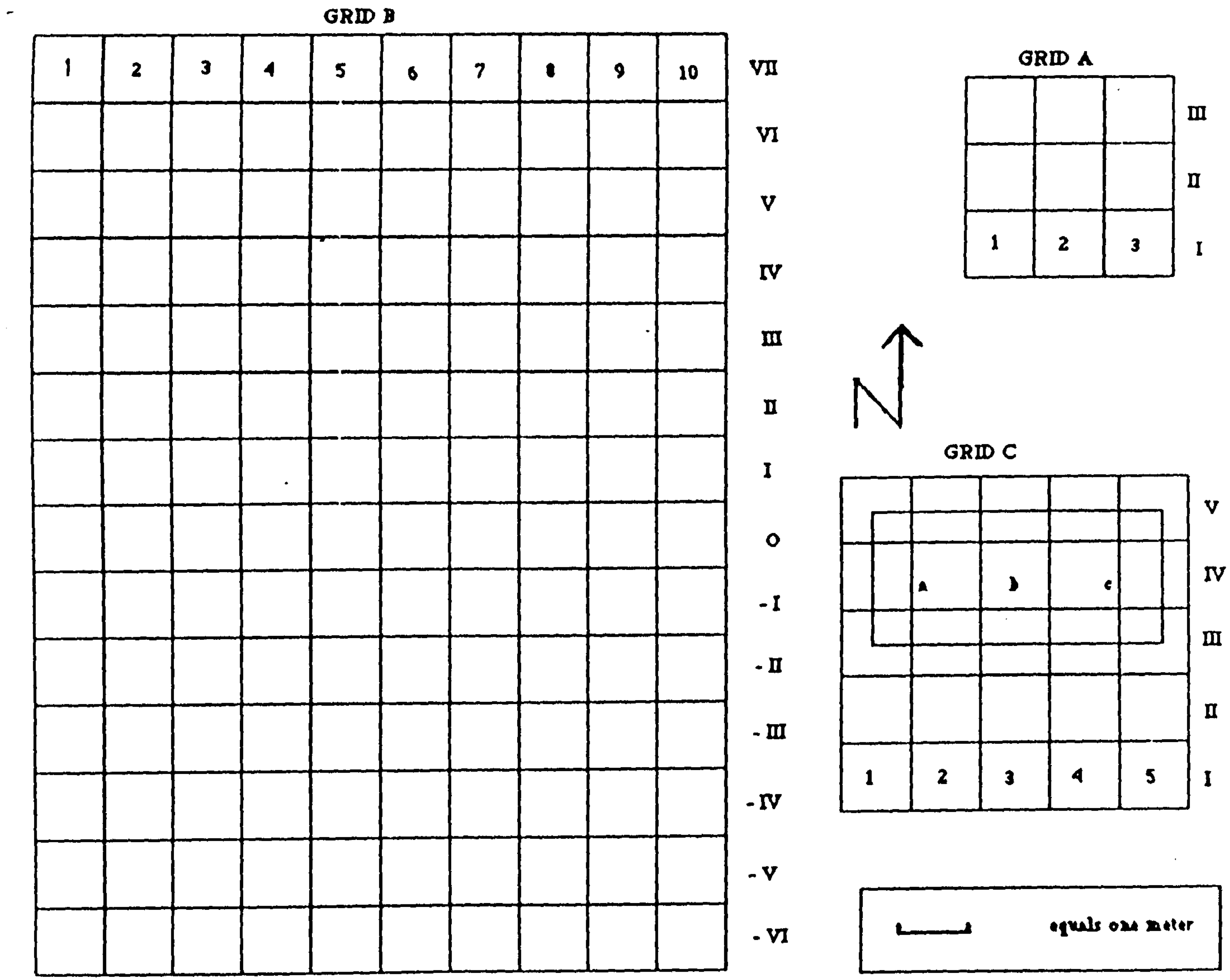


Figure 4. Layout of Grids A, B and C with rows and squares numbered.

C, is adjacent to Lateral B (Figure 2). Additionally, several shovel tests and surface surveys were conducted on the adjacent uplands. However, as was noted earlier, only material from certain levels in Grids A, B and C can be confidently assigned to the Archaic range of time.

Analytic Procedures

In order to achieve the research goals outlined in Chapter I, Archaic lithic artifacts collected during the 1987, 1989, and 1991 Iowa State University field school excavations were subjected to the following analytical procedures. Formal tools were identified according to a previously compiled typology manual (see Appendix A). Points were identified with reference to published projectile point typologies. Different types of debitage and cores were also identified both formally and with respect to their position in the reduction sequence for flint knapping.

In the laboratory, the cleaned artifacts were counted, weighed and identified according to each lithic artifact sub-group of the typology. The data were entered into a chart history of each square, spit by spit. Color was also noted. Additionally, heat-altered artifacts were identified and counted. Heat treatment technology is described at the end of this chapter. Those objects thought to have been heat treated were compared with written descriptions of the changed characteristics observed during experiments. A glossy appearance sometimes co-occuring with a pink color apparently indicates such treatment.

Quantities of fire-cracked rock were found throughout the excavated levels in all grids . A comparison of the weight of fire-cracked rock, both horizontally and vertically, to lithic tools and debitage suggested various types of activities. Weight was the common unit of measure as the fire-cracked rock excavated in 1987 had been weighed, recorded and then discarded.

Although, four grids, A, B, C, and D, were excavated between 1987 and 1991, data from Grid D was excluded as the artifacts recovered appeared to be Woodland in style. Additionally, in Grid A only material from 200 cm or below was studied as the strata above appeared to have been disturbed by erosion and redeposition. During a previous geomorphological study (Van Nest 1987), a hearth and a paleosol were identified at about 200 cm. Charcoal retrieved from the hearth at 205 cm in Grid A provided a radiocarbon date of 6000 ± 120 BP (Beta-18028). All 14 C dates in this thesis are expressed in uncalibrated radiocarbon years before the present. A few pieces of charcoal probably associated with the hearth were found in a few centimeters above and below this level (Van Nest 1987:39,95). In adjacent squares excavated during 1987 artifacts were found to be concentrated mostly from 210-215 cm with only a few pieces from spits above and below. Since most, if not all the material seemed to be part of the same episode of occupation containing the hearth, the data were combined for the levels from 200-220 cm in Grid A.

In Grid B, Woodland style materials were recovered from the upper levels. During the 1989 field season a paleosol was identified whose upper surface ranged from about 60 cm below the modern surface at the western edge of the main excavation trench (Row I, square 1) to about 50 cm below the surface at the eastern end of the row. Charcoal recovered from Row V, square 2 at 60-70 cm. gave a radiocarbon date of 3010 ± 140 BP (Beta-44529), well within the Archaic time frame. Therefore, it was thought that material recovered from below 60 cm in Grid B would likely be of Archaic age.

Grid C presented stratigraphic problems involving channel fill sands which had interrupted the loam deposits down to about 145 cm. in square b. In profile the bottom of these sands resembled a broad saucer. Based on a radiocarbon date of 2450 ± 100 BP (Beta-30338) from 130-140 cm near the base of the sands, materials recovered from the levels stratigraphically lower than the sands were thought to be Archaic artifacts and were included in this study. Several Pelican Lake style points were at the base of the sands and from the same stratigraphic position as the dated material.

Combined Data

Since Grid B's bedding is fairly level at the shallow depths, data from several squares and identical depth were combined for purposes of analysis of debitage type distribution at such depths. It is assumed that each combined unit represents a more or less continuous episode of occupation, or occupation level. One of these levels contained lithic artifacts from all the Grid B squares at the 60-70 cm level. Another level consisted of the artifacts from squares 1 to 4 in Rows I and II at the combined depths of 190 to 230 cm.

Spits were not always ten centimeters thick. Field decisions based on stratigraphic observations and logistical constraints resulted in thicker or thinner spits. Where the depth of the spits did not match those in other squares, equivalents were calculated in terms of numbers of artifacts of a given type per each 10 centimeters and added to the appropriate spit, in this case 190 to 230 cm. For example, the number of artifacts of a given type in 180-200 unit in Row I, square 4, a spit excavated in 1987, were divided in two with half being added to the data list. This calculation accounts for the fractional amounts in the number of types.

Lithic Typology Manual

The classification system employed here is based upon the Dynamic Technological Analysis described by (Schild 1980:57) in which the lithic artifacts are "classified in accordance to their appearance during the process of core and tool preparation, exploitation, [use, repairing,] and remodelling." The stone artifacts from the Buchanan site were classified according to four main types of lithic artifacts: cores, debitage, tools and miscellaneous. Cores are distinguished by the presence of single or of opposed striking platforms or by informal platform distribution (Kobusiewicz, M. and J. Bower: In Press).

The debitage subcategories are based on characteristics such as size and shape. Flakes are classified according to such features as the amount of cortex remaining, the number and direction of dorsal scars and whether the flakes or blades resulted from initial manufacturing or from resharpening practices. Chips and chunks are differentiated from flakes or blades by the absence of a bulb of percussion or striking platform. They are further defined according to the presence of cortex.

The tool category includes 14 sub-groups. These might be considered to be clustered into three main divisions. One of these contains two types of bifaces, either of which may have served as cores. However, the thicker type may have served as a core more often than the thinner biface. A second of the groups would include all of the relatively easy to identify formal tools, such as points, drills or endscrapers. The third group contains the less easily identifiable informal tools with a minimum of secondary flaking. This group includes irregular scrapers (LTS), retouched flakes/blades (LTR), utilized flakes/blades (LTU), and unshaped tools (LTT).

Heat Altered Rock

The heat treating of rock in the making of stone tools was practiced throughout North America as well as elsewhere in the world (Collins and Fenwick 1974:134). The coloring and fracturing characteristics of rock can be altered by heat generated in a campfire. Rock used in or around a hearth may be fractured without intent. However, techniques were developed in prehistoric times for intentionally improving the flaking qualities of chert. Although widely practised through space and time, heat-treating was not uniformly employed (Mandeville 1973: 183-184; Rick 1978:3-4).

<u>Fire-cracked rock</u> Fire-cracked rock (LMF) is included in the miscellaneous category. Rocks associated with hearth activity, including food preparation procedures, develop angular fractures and discoloration due to the temperatures generated by fire. Water, microorganisms, frost and roots contribute to the decay of rocks at, and just below, the surface. Fire of sufficient magnitude promotes decay, through fracture, by increasing the surface exposed to the atmosphere. Daily solar heating does not involve temperature changes sufficient to account

for the breakage. A daily range in desert surface temperatures from a high of 70° C down to to 5° C, for example, does not necessarily cause spalling. A sharp increase of temperature within a short period of time produces spalls resulting from the rapid expansion of a rock's outer margin. Spalling tends to increase the "roundedness" of a rock. Such rounded rocks have been found in areas subject to forest fires but not above the tree line (Blackwelder 1927:134-136;138-139).

Fire-induced spalls occur in different "shapes and sizes" and according to different rock types (Blackwelder 1927:134-136;138-139). Igneous rocks maintain cohesiveness until subjected to a rapid rise in temperature to 300-375° C. However, igneous rocks survive a slow heating-cooling regime without flaking. There is a considerable range in the incidence of fragmentation due to temperature changes among different rocks (Blackwelder 1927:138-139).

Blackwelder (1927) conducted experiments on different rock types under varying conditions with shorter or longer heating and cooling regimes. A fine-grained pink granite pebble was heated to 880° C for about two hours then cooled for 10 hours, resulting in a slightly darker color and a tiny crack perpendicular to the rock's surface (Blackwelder 1927:136-137). Slower chemical weathering produces "crumbly discolored shells" (Blackwelder 1927:134-136).

<u>Intentionally altered rock</u> Heating stone that has a high silica content seems to make the texture more consistent throughout the rock making it easier to work (Crabtree 1975:109-110). Texture becomes glossy with or without a color change (Crabtree 1975:109-110). The outer surface of such an annealed rock looks no different than one that had not been heated. Only the internal area displays the changed characteristics when the rock is broken open (Mandeville 1973:183-184). A lithic artifact which displays both a glossiness and a color change is especially diagnostic of heat treatment (Crabtree 1975:109-110).

Rock thus tempered may reflect a change in color if "impurities " are present (Crabtree 1975:109-110). The particular shade depends on mineral content. Colors may range from slightly darkened through various shades of orange and red indicating the presence of iron (Mandeville 1973:183-184).

Temperature range, length of heating and cooling time, and the type of lithic material are critical for the successful completion of heat treatment (Crabtree 1975:109-110; Flenniken and Garrison 1975:126,129; Mandeville 1973:183-188). Various experimenters in heat treatment have used different heat sources and environments: kilns, charcoal, wood, fireplace and campfires. Wood fires can achieve temperatures up to about 800° C and heating with charcoal can achieve temperatures up to about 500° C (Mandeville 1973:188-189). In some experiments the lithic material was surrounded by sand, or ash, or soil in order to avoid thermal shock (Flenniken and Garrison 1975:126,), in others no insulating material was used (Mandeville 1973:186-188). Purdy found that a slow temperature increase is necessary to avoid exploding a specimen otherwise rocks can explode or spalling and potlid and other fractures developed (Purdy 1975:135-136,138-139; Rick 1978:20). Collins and Fenwick contended that the point at which water is released is also the point at which the knapping characteristics change (1974:137).

Thinner pieces are more apt to successfully survive high temperatures than blocky pieces. Small grained cherts respond more quickly to lower temperatures than do larger grained types (Mandeville 1973:188-189). As thermally altered chert fractures across the grain rather that around it, knapping problems are reduced and chert tools are more easily crafted after being heat-treated (Mandeville 1973:188-189). Longer and thinner flakes may be removed through the pressure technique when rock is heat treated (Rick 1978:2).

The above sources were consulted to determine distinctive characteristics of both intentionally and unintentionally heat-altered rock in order to identify macroscopically such pieces in the Buchanan collection. These pieces were counted and recorded. The proportion of heated to non-heated lithic material was calculated in order to determine technological change through time. Some of the angular and spall fracturing described for deliberate heat-altering for tool making may also occur in rock found in hearth areas. Additionally, discoloration also, perhaps in lesser degree, occurs in hearth rock.

CHAPTER III

A DEFINITION AND OVERVIEW OF THE ARCHAIC IN NORTH AMERICAN PREHISTORY

Models of prehistory in North America have divided archaeological record into segments identified by the terms Paleo-Indian, Archaic and Woodland which refers to (among other things) to distinctive lifestyles and artifact traditions. The earliest segment is the Paleo-Indian, followed by the Archaic and then the Woodland. These terms are commonly used interchangeably in referring to both time and to cultural expression; such ambiguity often leads to confusion. Attempting to counteract this problem, Stoltman, in the late 1970s, developed an alternative chronological model, arguing that the term Archaic should be confined to mean a cultural stage rather than being used in a temporal sense (1978:706). He attempted to eliminate erroneous terminological implications (Figure 5). In this model, he suggested substituting different terms for periods of time rather than the terms commonly used in reference to cultural style. This scheme was offered to relieve the terms of erroneous implications (Stoltman 1978:728-729).

For example:

> ... [T]he traditional dichotomy between Paleo-Indian and Archaic has biased our perception of culture processes during the broad interval of time at the turn of the Pleistocene by encouraging the view that one monolithic cultural entity arose from another...Almost certainly multiple regional adaptations taxonomically assignable to the Archaic stage arose more or less simultaneously across the East from a fluted-point-tradition base (Stoltman 1978:714).

However, the terms appear to be imbedded in the minds and writings of archaeologists, apparently difficult to dislodge from their thinking, and continue to be commonly employed in reference to both time and attributes of material culture. If, and only if, qualifying terms are used to clearly delineate which is meant should these terms continue to be employed.

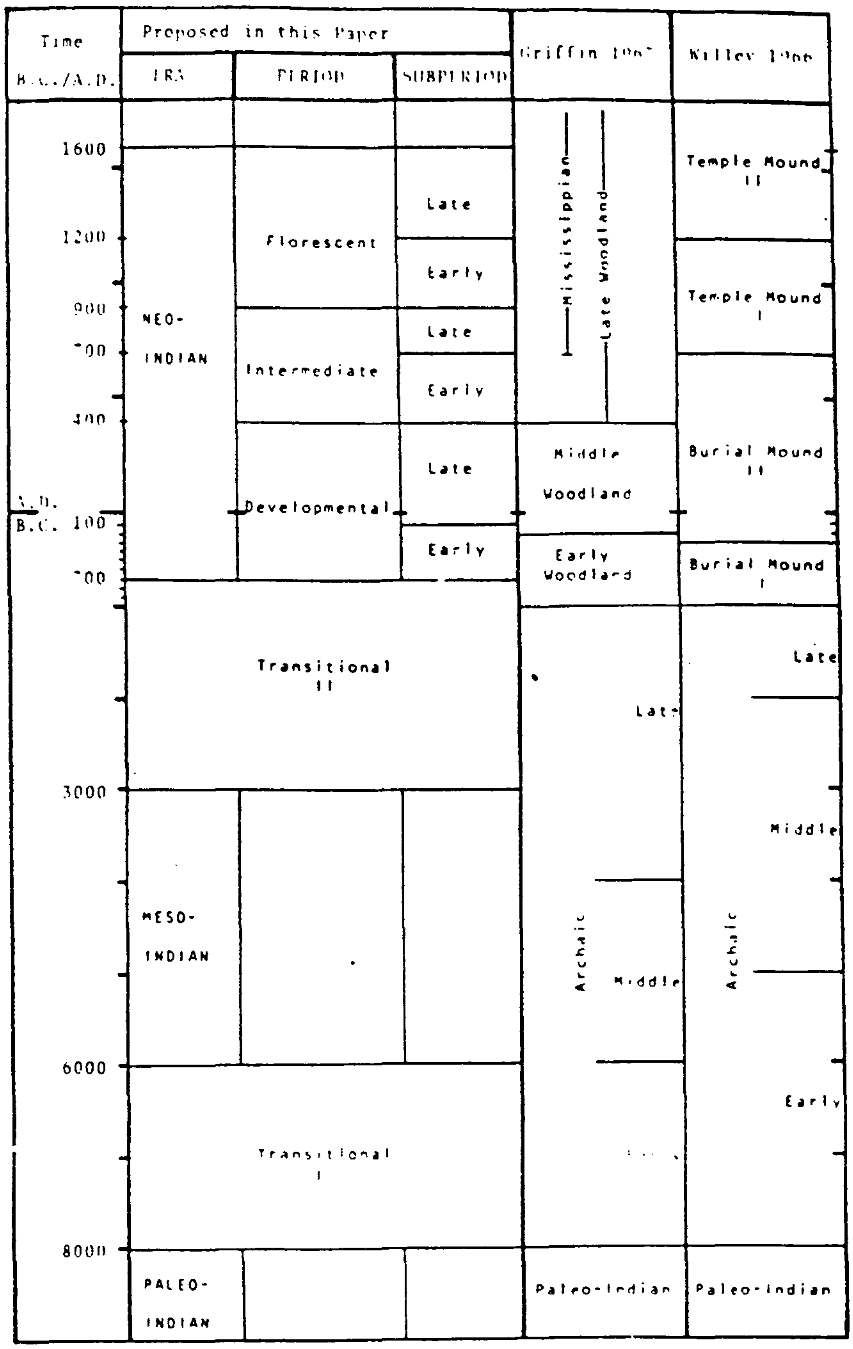


Figure 5. Stoltman's chronological and nomenclatural classification model (1978:709).

The decades between 1920 and 1950 saw the development of regional and continental chronologies in North America (Alex 1980:14). The Midwest Taxonomic Method made its appearance in these decades. It is a classification system devised to create order out of seemingly chaotic and rapidly growing collections of artifacts. The method was founded on the idea that similarity of style resulted from a shared cultural relationship A model of prehistory based on form was devised by McKern (1939:301-305, 308-310) in the 1930s to which Ritchie introduced the idea of the Archaic defined as cultural entities without pottery (Stoltman 1978:708). By the 1940s Griffin added various qualifiers related to time: transitional, early and middle. By the 1950s versions of the McKern structure had been modified by Griffin to include both form and time (Alex 1980:15-16; Stoltman 1978:708). Willey and Phillips introduced the idea of an Archaic Tradition, referring to persistent, customary and distinctive ways of doing things as opposed to some specific kind of strictly technological "stage" of human development (Willey and Phillips 1958:34-37, 62-64,107).

By the 1960s, the terms Paleo-Indian; Archaic; Early Woodland; Middle Woodland; Late Woodland; and Mississippian were widely used (Alex 1980:15-16; Stoltman 1978:708). The carbon 14 dating technique developed in mid-twentieth century resulted in the clarification of the temporal contours of North American prehistory (Alex 1980:18). In the east, many Paleo-Indian sites are not dated by radiocarbon methods; some have been subjected to geochronological methods, such as association with beaches of proglacial lakes. However, interpreting age based on these associations does not work in non-glaciated areas or areas that were ice-free relatively early (Meltzer 1988:1,18-19).

By the end of the 1950s, Willey and Phillips had devised a model of culture change in the western hemisphere composed of five parts: an early Lithic tradition, a hunting-gathering Archaic tradition, followed by the Formative, Classic and Post classic traditions (Willey and Phillips 1958:73). More recently, Stoltman presented a new classification model that he applied to the wooded eastern portion of the United States, although it was not intended as a replacement for local models (1978:703). Three basic eras and their related transitional eras were proposed using easily understood terms that applied to the whole region: Paleo-Indian, Transitional I, Meso-Indian, Transitional II, and Neo-Indian, avoiding such terms as Burial Mound or Mississippian which apply to smaller areas (Stoltman 1978:712,709). The terminology used in this thesis is more akin to the Willey and Phillips model, with the addition of the terms that are in common usage: Early Archaic, Middle Archaic and Late Archaic subdivisions (see page 29).

Paleo-Indian Period

In Stoltman's scheme, the term Paleo-indian is maintained and is the earliest time period, occurring before 8,000 B.C. More recently a broad survey of Paleo-Indian sites was conducted in the eastern part of North America. Based on radiocarbon dates, the Paleo-Indian period was initiated by at least 12,000 years ago and continued until about 10,200 years ago in this part of the continent (Meltzer 1988:1).

Since the first discovery of Paleo-Indian points in the 1920s, several of the points have been found in association with mostly bison or mammoth remains at "kill sites" located in the western United States. Because the bones were often more easily spotted than the artifacts, "...sites lacking bones were frequently overlooked (Meltzer 1988:2-3)." Before radiocarbon dating was developed other criteria, such as association with extinct mammals, were needed for dating purposes, which also helps explain why attention was concentrated on kill sites.

In the 1960s Jennings described the earliest known peoples in North America as the big-game hunters, also termed Paleo-Indian cultures, whose economy centered on hunting large game animals. Much of the evidence for big-game hunting centers around lithic artifacts as other items either did not survive or had not yet been found (Jennings 1968:109). Towards the end of this early period different hunting methods were adopted that required communal participation, such as the jump-kill (Jennings 1968:107). In general, Paleo-indian points are described as lanceolate having a fluted channel down the middle to the base. Such points were widespread over the North American continent before about 10,000 years ago (Meltzer 1988:2; Stoltman 1978:709, 712).

Emphasis on the western Paleo-Indian "kill sites" also resulted in the supposition that these early peoples practiced a specialized subsistence based on the abundance and the predictability of a narrow range of resources, a strategy that is rarely practiced among human groups. However, some sites contain evidence indicating that tundra conditions prevailed at the time of occupation and the occupants of these sites may have focussed on caribou as do some contemporary northern groups (Meltzer 1988:8).

Kill sites are rare in the eastern United States, much of which was forested 10,000-12,000 years ago and would have been home to numerous species that do not group together in large herds (Meltzer 1988:3,4,7,8). Beaver, birds, fish, carbonized fruits and chenopod have been recovered from various sites in this area. Meltzer suggested that eastern fluted points may have served multiple purposes (Meltzer 1988:21,24-25).

Sites and surface finds of isolated points of the eastern United States were mapped by Meltzer (1988:11-14); the results illustrated a different distribution pattern in the north than in the south. In the south, sites are relatively scarce compared to the numbers of isolated finds. This pattern reverses northward with sites more numerous than isolated finds. Also, north-south regional differences were noted in the composition of the tool kits. In the north, the kits contained "points, scrapers, biface knives and drills." The tools, of exotic lithic materials, were badly worn and the debitage was too small to parlay into other uses. Flakes for expedient tool purposes were scarce. The southern kits, of local stone, were "blocky and irregular." Considerable debitage resulted from the manufacture of tools. Flakes produced as informal tools were abundant.

The glaciated area in the north, contains large quarry and related sites; large and small settlement and hunting sites; and one site where specialized activities occurred. By contrast, most sites in the unglaciated southern region most sites are quarries or related to quarrying activity. As the buildup of visible sites depends on repeated visits or on extractive activities that produce large quantities of waste, Meltzer suggested that groups in the unglaciated area developed different foraging patterns in which repeat visits were not made to a single site (1988:11-14). Additionally, with the regional differences in pattern Meltzer suggests that the northern sites represent a later occupation than the non-glaciated south and that sites in both areas, excepting those northern sites that may result from a strategy of specialized caribou hunting, reflect a generalized foraging strategy (Meltzer 1988:42).

Archaic Period

The subsequent stage is the Archaic, which occurred between about 10,000 and 2500 years ago in the midwest (Phillips 1983:1) and lasted until about the mid-19th century in some places. Generally, Archaic peoples were thought to be hunters of game and gatherers of assorted vegetal products practicing what has been described in early models as a non-sedentary lifestyle. However, in their rounds they frequently inhabited the same areas so that debris accumulated in deep deposits (Jennings 1968:110, 112). Their seasonal moves were thought to reflect "scheduling" through the different seasons in order to take advantage of nature's harvests which are available at different times and different places through the year (Anderson 1981:15). Brose noted that between about 4000 and 400 years ago, the climate stabilized allowing the establishment of seasonal and micro-environmental communities. Scheduled optimal harvesting of these environments led to well-defined differences in regional subsistence (Brose 1978:730).

The Archaic data indicate a sudden diversification of technology based on different tool styles and a greater variety of artifacts and ecofacts compared to the Paleo-indian period (Alex 1980:116-117).Groundstone tools composed of more-difficult-to-work stone for grinding, crushing and chopping jobs appeared with the Archaic. These took the form of abradors, axes and manos and metates and others. Bone tools were also made, for example, awls, scraping tools, and a hollow bird bone whistle were recovered from Archaic levels at the Cherokee site (Alex 1980:116-117). Dependence on smaller animals and a larger variety of them seemed to increase during Archaic times. Increasing utilization of vegetal materials also seemed to have occurred. Seeds and nuts were especially noted in the food remains, for example, hackberry seed, goosefoot and hickory nuts were found at the Cherokee site (Alex 1980:116-117).

In Stoltman's scheme, these eras encompass the range of time during which the Archaic period persisted: Transitional I, Meso-Indian, and Transitional II. The 2000 years following Paleo-indian time, 8000-6000 B.C., were named Transitional I; this was a time when people began to target other means of supply with decreasing dependence on the very large game animals. It was thought that white tailed deer became the main hunting target with small animals such as rabbit, beaver and turkey supplementing the diet. Also, sparse remains of fish and plant suggested these items were gathered but reflected a small fraction of food consumed.The scarcity of milling stones from this time period suggests that seed and nut gathering were being done but also were still less essential to the diet (Stoltman 1978:714, 715, 718). Additionally, the period is marked by a change in point style. Regional variations began to be expressed in lithic tool design, point styles such as Dalton, Agate Basin and Scottsbluff which are marked by basal thinning and edge-grinding. The increased profusion of scrapers, blades and gravers and the, as yet to be generally adopted, scarce milling stones accent the passage from one subsistence style to another (Stoltman 1978:714).

The Meso-Indian era, between 8000 and 5000 years ago, occurred during the warm and dry altithermal. Evidence indicates greater collection of and greater dependence on aquatic and plant resources. The latter may be linked to the spread of nut bearing trees in the forested areas. The development of shell middens and an increase in the number of milling stones characterize the Meso-Indian era. Polished lithic tools were also commonly present in sites of this time (Stoltman 1978:714, 715).

In Stoltman's Transition II era, from about 5000 to 2700 years ago, the beginnings of mound building, ceramic production and horticultural practices became consolidated within various cultural entities, or Stoltman's Neo-Indian Era. Of the three, only pottery is uniquely associated with the onset of the Early Woodland tradition (Stoltman 1978:710). Dependence on nuts and seeds further increased during these years. Some aspects of mound burials show some similarities throughout the eastern woodland region but many display local variations.The Old Copper and the Red Ochre are two of several cultural entities showing more localized expressions of burial practices (Stoltman 1978:714-715,718). The exchange of goods originating from far distant locations escalated during the Transition II era. Coastal shell, copper from the great lakes region, slate from Appalachia and a type of chert from Indiana were found in sites far from their sources (Stoltman 1978:715-717). Brose argued that the exotic trade existed to "...maintain access to territorially restricted subsistence resources (Brose 1978:730)."

The Archaic stage, then, reflected numerous changes involving increased diversity within the tool kit and in increased diversity in utilization of types of food resources. Another trend was toward a more sedentary way of life with repeated, or scheduled, visits to collecting locales. Settlement patterns were such that temporary kill sites are clearly distinguished from more heavily used base camps where dense midden debris and/or evidence of more permanent housing has been found, such as at Modoc (Styles et al 1983:283) or Koster (Brown and Vierra 1983:188). Towards the end of the stage additional technological changes were taking place in the form of the adoption of pottery making, or of mound building or of horticulture: all three of which were more fully utilized and interdependent in the following Woodland period.

Woodland Period

The Woodland period followed the Archaic period in some areas as early as about 3,000 years ago. Formerly, this period was thought to be distinguished by the introduction of pottery manufacture, the practice of horticulture and the construction of burial mounds. However, all three of these activities did not appear simultaneously at all locations (Alex 1980:122). Stoltman classified this portion of time as the Neo-Indian era which extended from about 2700 to about 400 years ago. This era is further divided into three periods: the developmental from about 700 BC to AD 400; the Intermediate period from about AD 400 to AD 900; and the Florescent period from about AD 900 to about AD 1600. During the Developmental, horticulture, mound building and pottery making were first practiced within sedentary communities, such as the Adena settlements. During the Florescent period, Mississippian culture flourished (Stoltman 1978:718,721).

Problems of the Iowa Archaic

Deposits with Archaic material were not of foremost interest to 19th century antiquarians in Iowa. Even later, with the development of the archaeological discipline, Archaic cultures were not the primary focus of scientific endeavor as nineteenth century interest centered on mound constructions (Alex 1980:10-12, Anderson 1975:72). In Iowa, the labors of Ellison Orr and Charles R. Keyes beginning in 1927 contributed to the development of a cultural framework for this state which contained four prehistoric cultures: Oneota, Mill Creek, Effigy Mound, and Glenwood - all Woodland period cultures (Alex 1980:14, Anderson 1975:73). A second classification scheme added the Woodland which was the earliest occurring culture in this scenario (Alex 1980:14, Anderson 1975:73). Subsequent work by avocational and professional archaeologists and organizations projected models further into Iowa's past and fleshed out knowledge of Iowa's prehistoric cultures (Alex 1980:17,19).

The earliest human groups have left their traces in Iowa in the form of isolated, largely surface finds, of fluted points (Alex 1980:60-61, 113). In Iowa, a point found in a lower level at the important Cherokee site may be an Agate Basin type and dates to about 8600 years ago (Alex 1980: 114).

The Archaic in Iowa is estimated to have occurred from about 8,500 to 3,000 years ago (Alex 1980:116). This time period is marked in Iowa's archaeological record by increased usage of the atlatl or spear thrower. Generally, point size decreased and the manner of hafting changed. The new style of points included tanged and stemmed shapes. Also some points had side notches and others had corner notches, perhaps to accommodate hafting. The areas of the points which were in contact with the hafting material, of sinew, were dulled to avoid cutting it. Some of the lithic artifacts found in Iowa sites have been traced to sources in areas somewhat far afield such as North Dakota, Illinois or the Yellowstone area (Alex 1980:61-62).

Archaeological data accumulated at an accelerated pace after 1950 due to intensified field work related to highway construction, agricultural practices and urban growth in the late 1950s (Alex 1980:18). By 1961 the term Archaic in Iowa contained three categories of meanings:

1. As a culture stage in which life was sustained by fishing, hunting and gathering certain plants for food. Habitation was trending toward sedentism. Rock shelters were often used.
2. As a time period between the big-game hunters and the adoption of agriculture and ceramics (about 2-3,000 b.p.). Both ends of this time period blend and mingle with preceding and subsequent lifestyles (Stoltman's Transitional periods).
3. As a style of artifacts which include percussion and pressure flaking, ground and polished lithic artifacts and no pottery. Frankforter observed that these criteria may have been too simple, but they had provided general, quick and easy rules for identification of assemblages (Frankforter 1961:26).

The Archaic designation has been revised in recent years on the basis of new information (Alex 1980:122). Previously defined as occurring before the adoption of mound building, agriculture, sedentism and ceramics, these practices are now included (Phillips 1983:1). The Archaic is considered to be a period which extends from about 10,000 to 2500 years ago, a time that was far more complex culturally, and increasingly so through time, than had been previously thought (Phillips 1983:2).

Styles et al noted that some earlier research models from the 1950s, such as that developed by Caldwell in 1958, had viewed culture as having the capacity to be changeable, but ignored changes in environment (Styles et al 1983:264). Some later studies from the 1970s and early 1980s, possibly too simplistic, connected cultural change with environmental change. Also, previous studies had often been hampered by a lack of ecological information of prehistoric times. That local resource patterns are of as great a variety as are the human adaptations to them should enter into the considerations of broader changes through time (Styles et al 1983:264-268). Climatic changes would have resulted in different availability of vegetational and faunal resources which in turn could challenge the human response (Bettis and Littke 1987:46). Climatic changes have been found and dated for the Buchanan site (Van Nest and Bettis 1990:80-81). Climatic fluctuations, involving warming and cooling, as well as moistening and drying, are trends addressed more fully in Chapter V.

CHAPTER IV

CONTEXT: CULTURAL

The Archaic in the Midwest

Numerous Archaic sites have been investigated in the midwest region (Figure 6). Two particularly important sites are the Koster and the Modoc Rock Shelter sites, both located in Illinois. Prior to the discoveries of the deep deposits at Koster and Modoc knowledge of Archaic peoples was largely based on the limited information to be gained from surface finds. Modoc, Koster and Pigeon Creek are especially important because of their stratified character which permits the tracing of change over time. The Cherokee site also has sealed, stratified deposits as does the Buchanan site (13SR153). Various Archaic sites are described briefly in the following pages, and some generalizations about the Archaic in the Midwest are derived from data recovered at these sites.

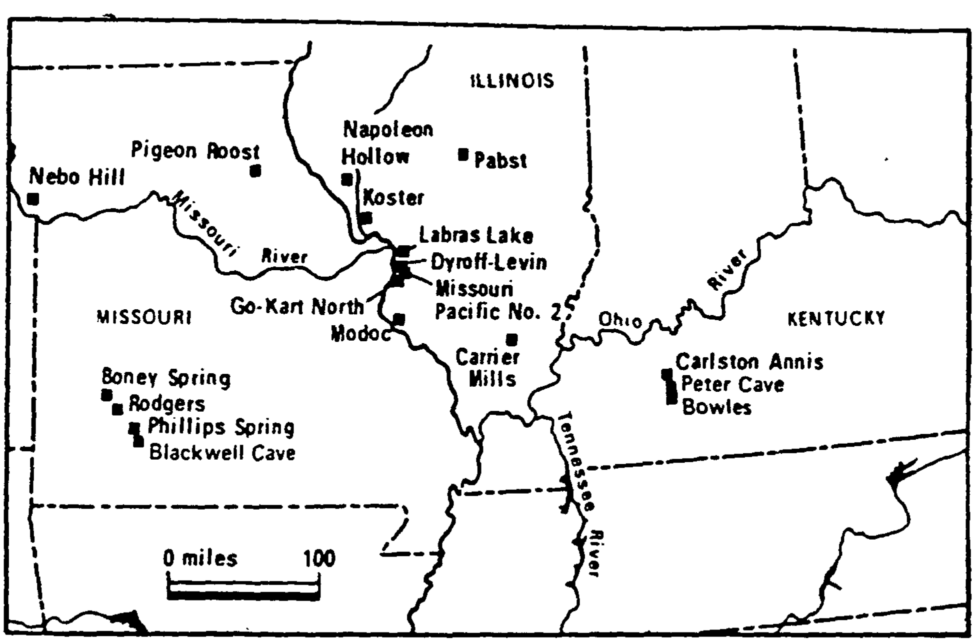


Figure 6. Map showing some midwestern Archaic sites (Phillips 1983:2).

Modoc Rockshelter

Modoc contains 28 feet (8.6 meters) of well preserved archaeological deposits representing human occupation during the Archaic period 10,000 to 3,000 ago (Styles et al 1983:261). Changes in the length of occupations and resource use through time are indicated by the materials recovered from this important site (Styles et al 1983:291-292).

Located in the Mississippi River valley (Figure 6), below the confluence with the Missouri River, Modoc Rock Shelter is in an area with a concentrated and varied floral and faunal resource base representing valley swamps, marshes and upland forest with some prairie (Styles et al 1983:268-269). Analysis of pollen from the Modoc deposits revealed changes in vegetation patterns which reflected climatic shifts. Increases in the percentages of grass pollen imply reduced precipitation about 8700 B.P. with the dry period ending about 5000 B.P. in this area. Assorted studies indicated that river valleys, although somewhat protected from climatic extremes, can experience alterations in geomorphic conditions and in resource distribution when major changes in climate occur (Styles et al 1983:268-269).

Chert from nearby locales and some exotic chert was utilized at Modoc for assorted tool production. Tools, cores and debitage were recovered. Some resharpening flakes were detached from non-local chert tools. Through time, primary and secondary flakes declined while tertiary flakes increased (equivalent to LDC1, LDC2 and LDF or LDB in the Buchanan study). When local chert was utilized only initial flakes with cortex were struck resulting in a crude core. The only tertiary flakes (or LDF or LDB) present at this time were of an exotic chert carried in from elsewhere suggesting that maintenance activities rather than initial manufacturing procedures predominated, except in the case of exotic material. In later deposits, these resharpening flakes of exotic cherts were in the ascendant as the local chert was no longer available due to burial by sediment deposition. Dalton style and side-notched points were present. By the Middle Archaic increased numbers and varieties of formal tools were being made and maintained. (Styles et al 1983:279-283). As at the Koster site, burials were emplaced in the Modoc sediments (Charles and Buikstra 1983:134). Through time human occupation intensified resulting in increased quantities and varieties of artifacts, plant and animal food debris and features such as pits (Styles et al 1983:291-292).

Pigeon Roost Creek Site

Projectile points have for a long time served as cultural markers in archaeological research. A series of points, found in deposits spanning early Archaic to Woodland occupations of northeast Missouri, provided a basis for constructing a style sequence in the Archaic of the midwest. The site serving as focus for this study is the Pigeon Roost Creek valley site located on a terrace about three and a half meters above this stream within the Mississippi watershed. The site occurs in a mixed forest-prairie area which was at one time completely forested. A marshy spring nearby adds to the variety of locally available resources. The deposits are deep yet restricted laterally. Four major separate occupations occurred between 8500 and 2900 BP (O'Brien and Warren 1983:71-75,82).

The most recent of the Late Archaic deposits began at about 60 cm. An earlier Archaic sequence was at about 240 cm below surface, which was at the level of the water table. The largest concentrations of cultural material, dated at about 6150 to 5250 BP, were at 130 to 160 cm. A gap of approximately 2000 years appeared in the stratigraphy, possibly between Middle and Late Archaic times. The 170 to 210 cm levels might be attributed to the Middle Archaic but little cultural material was found. Deposits containing Early Archaic cultural materials, including Dalton points, were found at 270 to 330 cm, below the water table.

Points (Figure 7) from the Pigeon Roost Creek site were classified according to size and shape, the latter including categories such as lanceolate, side-notched, corner notched, andstemmed. Some of the point styles identified included specimens similar to Dalton (12) and Kirk (60) from the Early Archaic; Raddatz (25) and Osceola (23) from the Middle Archaic; and

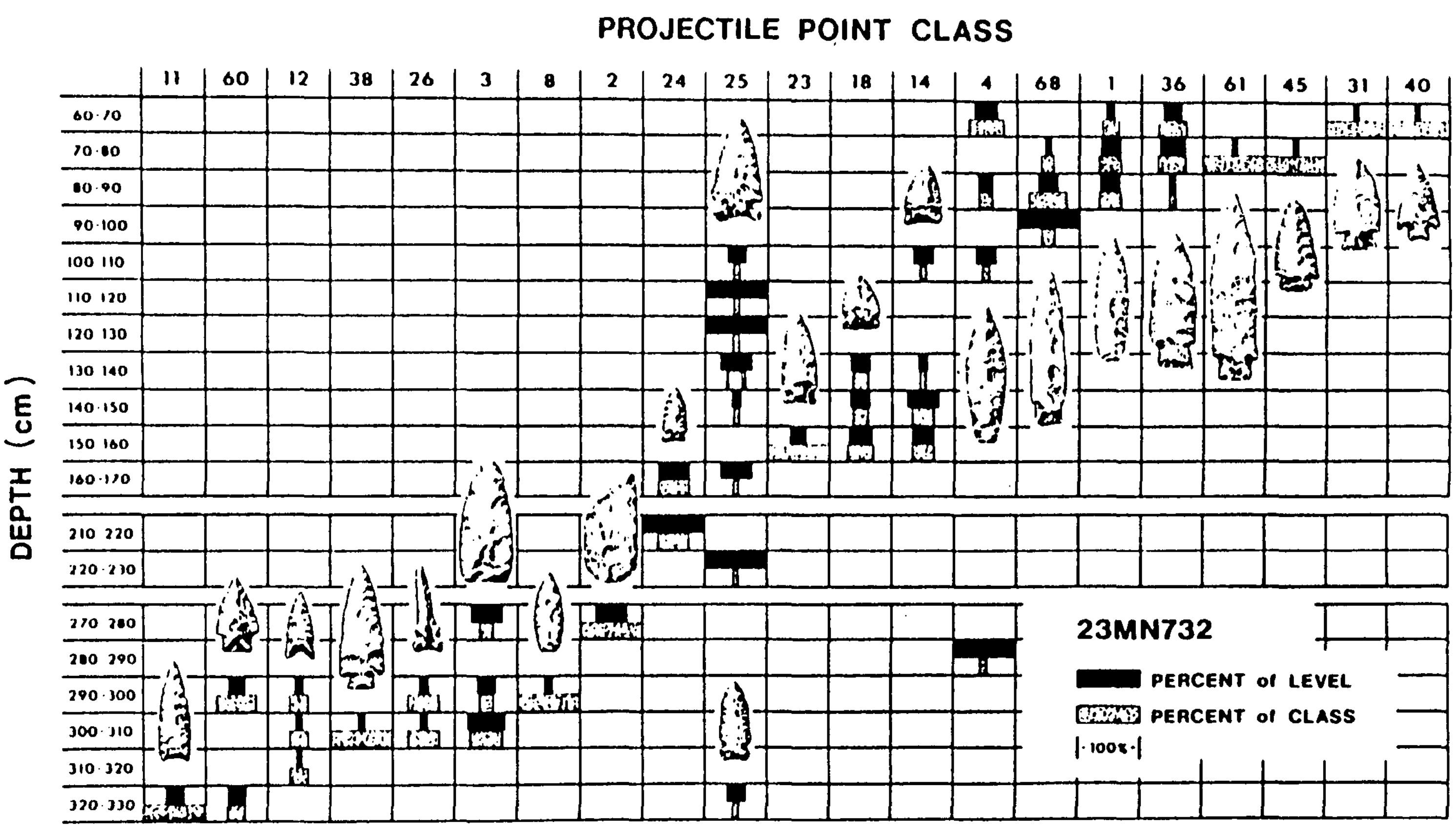


Figure 7. Point styles from the Pigeon Roost Creek site (O'Brien and Warren 1983:91).

Sedalia (1) and Stone square-stem (36) from the Late Archaic (O'Brien and Warren 1983: 90-96).

Koster Site

Attention in the 1960s was directed to surfaces finds on the Koster farm in Illinois. Koster is an open site with deep, well preserved and well stratified deposits that had developed over 7000 years (Struever and Holton 1983:22,23, 244). It has provided much new information, especially on the Middle Archaic period. Some of the lifeway elements that characterized the Late Archaic had already developed in the middle of the Archaic period (Struever and Holton 1983:243). Cultural developments included the establishment of more or less permanent settlement and the development of specialized food gathering technologies (Struever and Holton 1983:243).

Brown and Vierra (1983:183-186) described a variety of chipped stone tools from the early part of the Middle Archaic, with eight components, including corner notched points, drills and gravers. Numerous groundstone tools were employed, including manos and metates. Jakie, Godar and Matanzas were some of the point styles (Figure 8) recovered from the middle part of the Middle Archaic sequence, which consisted of three subdivisions: Middle Archaic 1 (8300-7600 years ago), Middle Archaic 2 (7300-6850 years ago) and Middle Archaic 3 (5800-4900 years ago). Other chipped stone tools recovered were drills, scrapers and bifaces. Bone and antler tools were present as well as cups made of turtle shell. These deposits also contained hearths, burials with grave goods, and postholes. The sediments from the final part of the Middle Archaic, with four components, contained Matanzas, Godar, and Karnak points, as well as other styles.

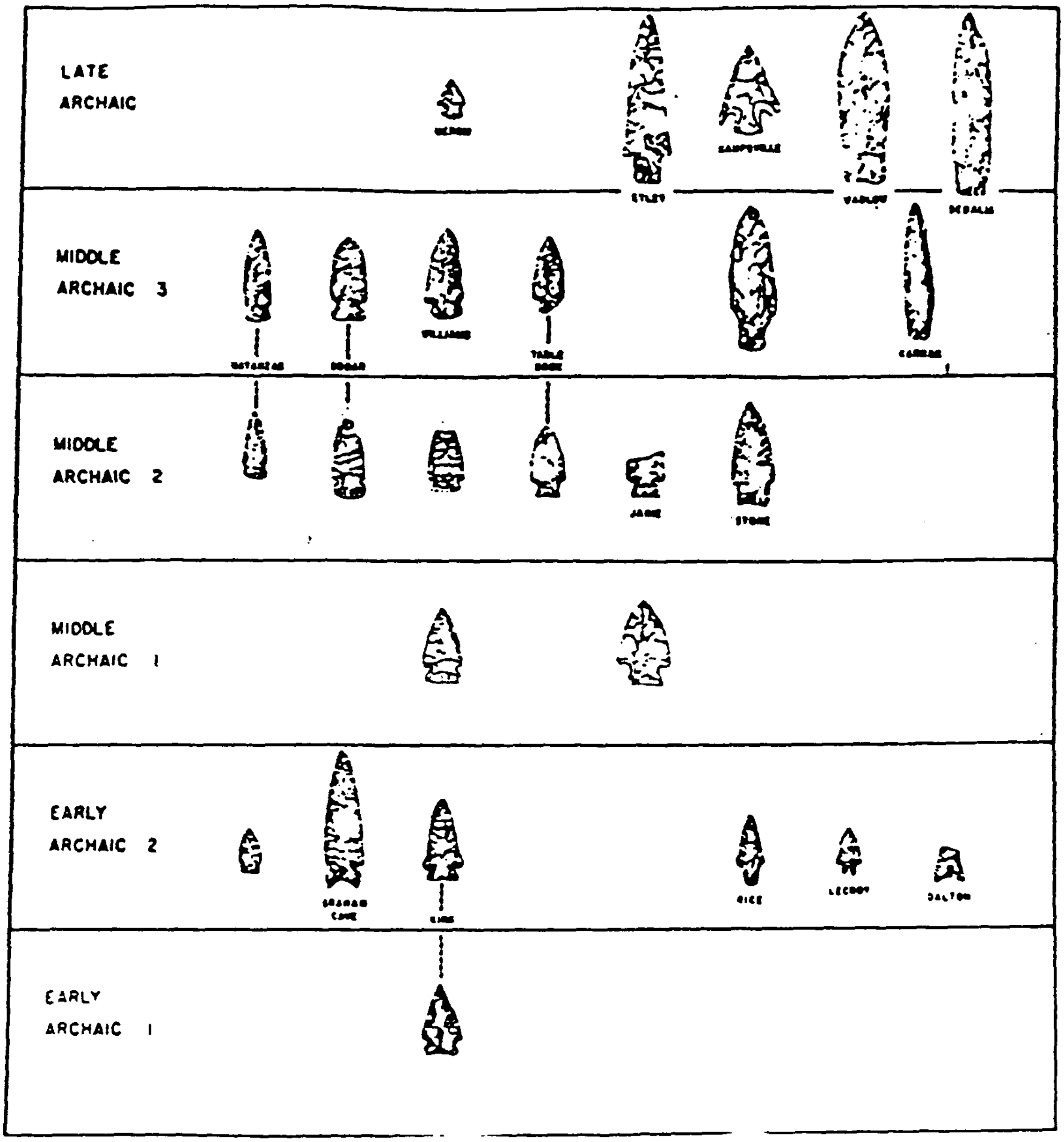


Figure 8. Koster site projectile points (Brown and Vierra 1983:182).

Other chipped stone tools included bifaces, drills, gravers and scrapers. Groundstone tools, grooved axes and mano/metate tools were recovered. Exotic materials, including copper and galena, were present. Hearths, postholes with wall trenches, burials and a midden were identified from this time period (Brown and Vierra 1983:183-186).

Other Archaic Sites

Lewis (1983:102) has classified a variety of Archaic sites in Central Illinois into three types of occupation camps: base camps, hunting camps and processing camps based on the types of tools found during the various excavations. The first certain evidence for recognition of base camps was found in an Early Archaic context and these were located exclusively in valleys containing streams. This type of site was larger and contained a more diverse tool assemblage than the other two types. The base camps were thought to have been occupied longer and by larger groups and were more likely to have been reused than hunting or processing camps (Lewis 1983:102-111). In this central Illinois study, archaeological sites containing clear evidence of midden deposits and large quantities of fire-cracked rock were classified as base camps even though they may not have contained burials or house remains (Lewis 1992: personal communication). The far more numerous hunting camps were about equally distributed between the valleys and the uplands. Tool manufacturing occurred in both camp types, but broken tools usually were not found in the hunting camps, the interpretation being that they may have been brought back to be repaired. Also lacking in hunting camps were tools such as drills, anvils, or spokeshaves which are essentially tools used to make tools. These processing tools are associated (Lewis 1977:64-68; 1992: personal communication) with the thin deposits representing processing camps. They are uncommon but are found in both valleys and uplands (Lewis 1983:102-111).

One of Lewis' (1983:102-111) study sites, occupied about 4300 to 3000 years ago, contained a broad variety of tools associated with hunting and other living activities, especially common are projectile points, some of which resemble late Archaic Helton types from the Illinois River Valley. This site seems to have been a base camp occupied during all seasons, but not necessarily by one group continuously all year. Thus, it appears that the combination of a base camp and specialized camps was maintained in this area through late Archaic time.

In Lewis' study area (1983:102-111), most base camps are concentrated in the stream valley at the confluence of two streams. The location also marks an increase in topographic relief and accessibility to a more diverse floral and faunal resource base (Lewis 1983:102-111).

Iowa Archaic

Western Iowa Archaic sites seem to share an affiliation with those in the Prairie-Plains while eastern Iowa finds are more closely linked with sites in woodland environments such as Modoc Rock Shelter in Illinois or Graham Cave in Missouri (Alex 1980:116-120). In Iowa various archaeological survey projects have noted the presence of Archaic materials (Anderson 1975:76), and their presence has also been detected by geological survey (Bettis and Littke 1987:47-49).

Simonsen Site

At the early end of the Archaic time span the Simonsen site in northwest Iowa represents a Paleo-Indian to early Archaic occupation (Figure 9). Several strata, beginning about 15 (about 5 m) feet below the surface indicated successive occupation at this bank-side site on the Little Sioux River, a tributary of the Missouri River. Eight stratigraphic levels were identified and of these three contained cultural remains. Ash and a fire pit with a charred log were found in the upper level. The second cultural layer contained a projectile point and charcoal. The lowest stratum revealed knives, flakes, and points. A radiocarbon date of 8430+520 B.P. was obtained for the lowest cultural level . Based the presence of bison bone in the excavation and on the valley topography, it was surmised that bison may have been stampeded over a steep bank (Frankforter 1960:65,69).

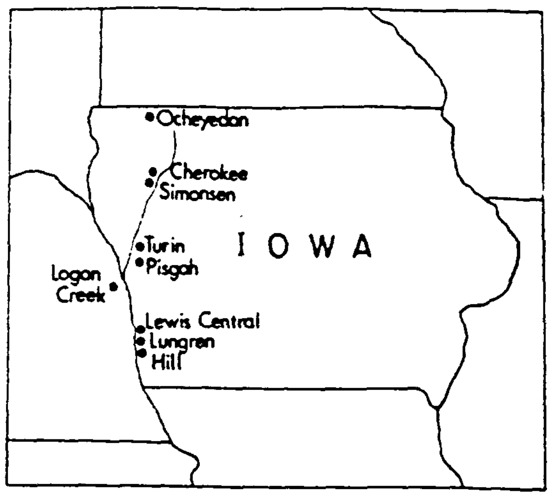


Figure 9. Map showing location of Iowa Archaic sites (Anderson et al 1980:262).

Cherokee Sewer Site

The deeply buried Cherokee Sewer site, located on an alluvial fan of the Little Sioux River, contained the most extensive cultural deposit found from the pre-Archaic to Early Archaic period in Iowa. Three cultural strata were identified. The upper cultural level is interpreted as having been both a kill and a camp site. The second level is considered a camp but with a kill site near it. C14 dates (Figure 10) registered at about 7370 and 7480 B.P. for Horizon II (Shutler and Anderson 1974:9). Horizon III, about two meters below level II, was dated at about 8500 and 8570 B.P.(Shutler and Anderson 1974:6-9).The lower Horizon III may be a Paleo-Indian big-game hunter kill site. The two upper levels are diagnosed as having Archaic components. Projectile points from Cherokee resemble those from Simonsen,

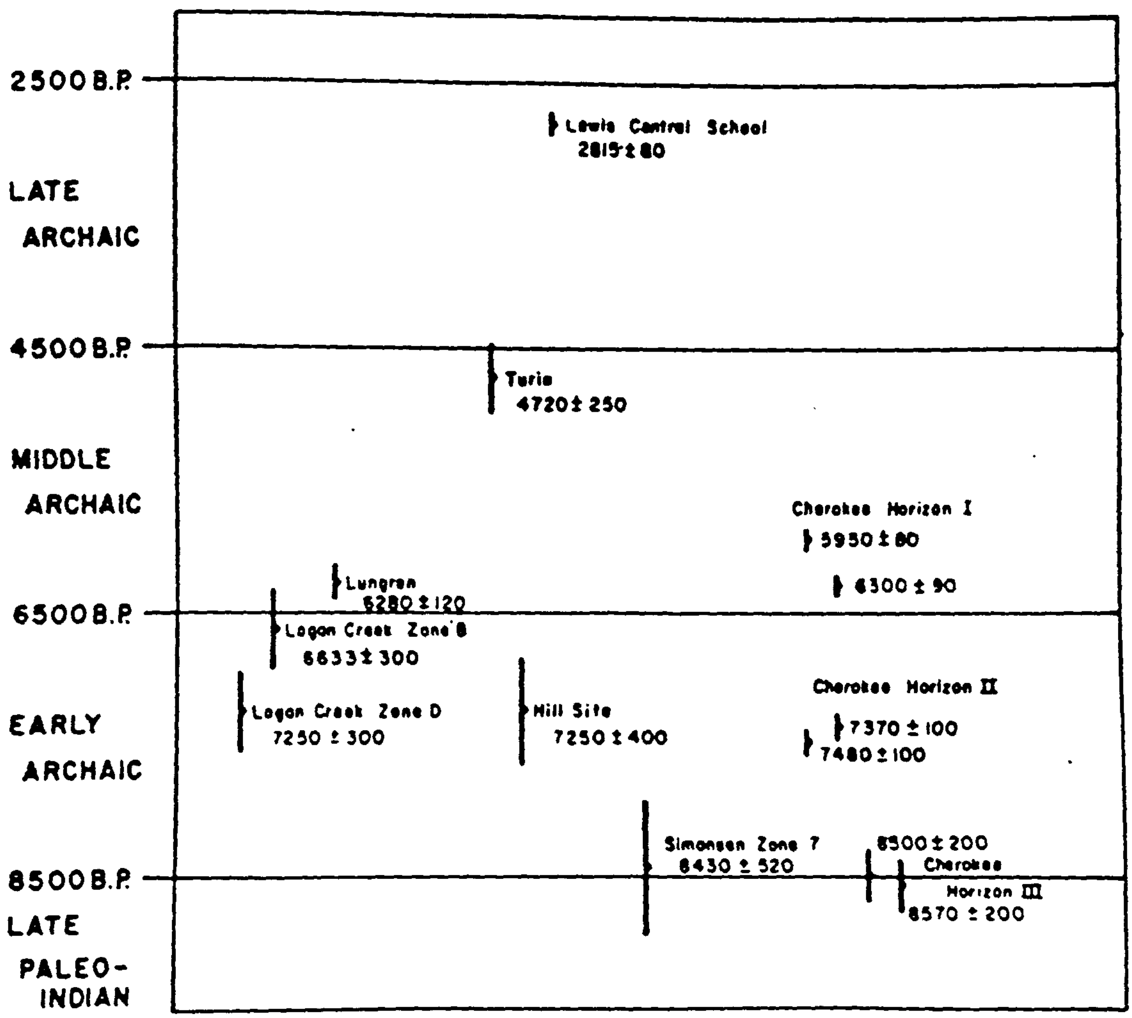


Figure 10. Radiocarbon dates for western Iowa sites (Anderson et al 1980:263).

Hill, Logan Creek (Nebraska), Lungren, Ocheydan and Turin (Shutler and Anderson 1974:161-164).

Analysis of the Cherokee lithic artifacts was concerned with the composition of rock materials and tool and debris types (Shutler and Anderson 1974:4,). Artifact classification included observations on unmodified stone, waste flakes and whether the material had been heat treated and how much. Both worked and unworked tools and flakes were measured. (Anderson 1980:198-203). Tools were made from assorted cherts, chalcedonies and quartzites. Anvils or hammerstones, cooking and grinding stones were of igneous or metamorphic stone. Cherts or chalcedonies were utilized for scraping tools (Anderson 1974:57). Local glacial deposits could have provided material for the manufacture of the site's lithic tools. However, one major group of lithic artifacts in Level I was made from a southwestern Iowa fossiliferous chert (Shutler and Anderson 1974:51). Based on debitage, it was concluded that most of the chipped tools found had been made or resharpened at Cherokee (Anderson 1980:202).

The presence of end scrapers suggested that the preliminary removal of flesh and muscles from hides occurred here. Estimates of possible tasks were listed for each Horizon. Evidence was found for stone tool manufacturing and maintenance, grinding, hide working, bone cutting and breaking, chopping, killing, skinning, pounding, abrading, collecting lithic resources, as well as building fires for cooking and heating (Anderson 1980:229,230).

In the Early Archaic at Cherokee, stone usage focussed heavily on Tongue River Silica. In Horizon I 43% of the flakes were of the fusilinid chert with 27% of assorted chert and chalcedony. However, in Horizon II Tongue River Silica represented 89.7% of the lithic artifacts. In Horizon III, the oldest stratum, a pink mottled quartzite accounted for 27%, a honey colored chalcedony for 14% and the Tongue River silcrete for 19.5% (Anderson and Semken 1980:200-201). The silcrete, of Paleocene origin, outcrops in the western Dakotas and elsewhere to the west. It is differentiated by the presence of root casts. The working of this poor quality stone benefited from heat treatment. Found locally in glacial deposits, its use continued down to the Late Prehistoric Period. In its unheated state it ranges from yellow through shades of brown, but with overnight heating under a charcoal fire it reddens from light red through brown to dark red to dark grey (Anderson 1980:200-201,203). Major changes from Paleo-Indian to the Archaic were in the projectile point hafting styles and in the presence of milling stones in the latter period (Anderson 1980:231).

Central Iowa Surveys

A geological survey in central Iowa (Benn and Bettis III 1985:15,17-19) in the Des Moines River valley reported the finding of Archaic materials (Figure 11). At about 9500 B.P. the valley combined western prairie and eastern woodland vegetation. A Kirk point is the only early Archaic representative that was found in the upland. Three Middle Archaic sites were found in the Saylorville area. Apparently, the Middle Archaic was a time during which sediment eroded from the surrounding watershed and accumulated into terraces and alluvial fans between about 8400 and 5060 B.P. In this study the late Archaic is attributed to about 4500 (inferred from Illinois, Missouri sites and the Cherokee Sewer site in northwest Iowa) to 2350 B.P. when pottery is visible in the Des Moines River Valley deposits (Benn and Bettis III 1985:15,17-19). At the end of the warm dry period cultural debris increased implying increasing population, possibly due to a local surge in immigration (Benn and Bettis 1985:21).

The Cambridge site is located about 10 miles southeast of Ames on a tributary of the South Skunk River. A recent geological study threw light on the valley's history during the past eight thousand years. In the mid-1970s an archaeological deposit (13SR162) was excavated and another deposit (13SR163) was excavated during the geological study. The earlier excavation yielded assorted archaeological materials including a hearth, chipped stone and burned bone. A date of 6510 ± 190 B.P (Beta-13730) was recorded based on charcoal. In 1990 materials were retrieved from a bone deposit that also contained archaeological artifacts and was dated to 7,530 ± 80 B.P. (Beta-42816). From another deposit, charcoal associated

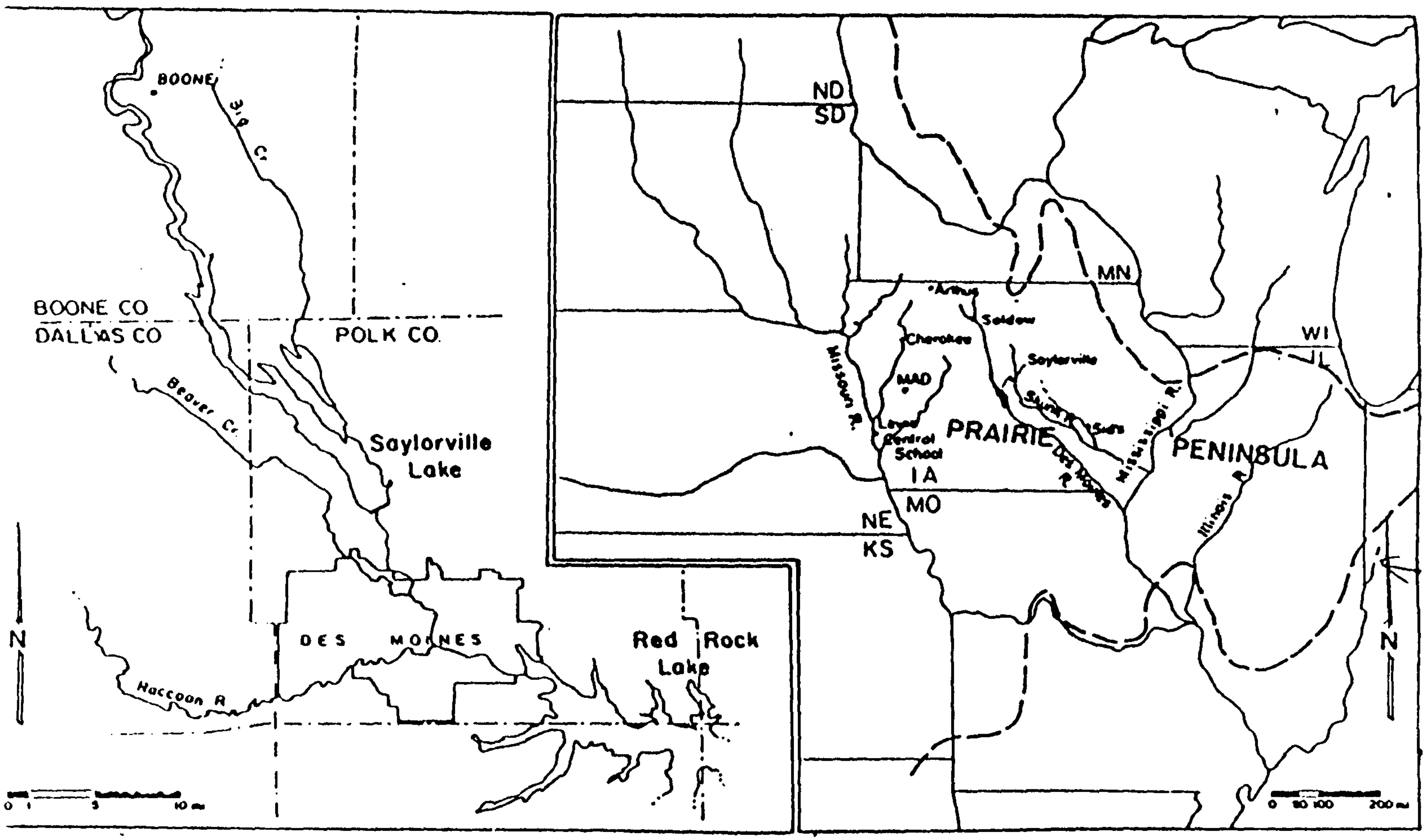


Figure 11. Map of Des Moines River Valley survey area (Benn and Bettis 1985:6).

with a hearth, burned bone and chipped stone gave a date of 7490 ±90 B. P. (Beta-39806) (Bower and Bettis nd: Table 1).

Other Iowa Archaic Sites

In the mid-1950s the discovery of bones and tools at an eastern Iowa quarry was reported to archaeologists after a considerable delay. The site, dubbed the Olin site, contained bison, beaver and caribou bones and two flaked projectile points identified as Archaic. Also a copper pin was remembered by the quarry operator but was lost before the finds were reported (Ruppé 1954:12-13). The Keystone site, badly damaged by vandalism and erosion, is a rockshelter site in eastern Iowa that has an early and late Archaic component (Anderson 1987:1-6).

Archaic sites in western Iowa (Figure 9) include Lungren, Hill, Ocheydan and Soldow sites (Flanders 1977:125-133) which are small locations whose deposits are composed of hearths, flint chips, animal bones, and stone and bone tools (Alex 1980:118-119). The Lungren site, with a radiocarbon date of about 6280 years ago, contained a hearth and assorted lithic tools including multiple side and end scrapers (Anderson and Shutler 1974:164). At the Hill site a hearth and a variety of cultural materials were found along with remnants of bison and several other animals. A radiocarbon date obtained for this site indicated a time of ocupation about 7250 years ago. Four levels containing cultural materials were identified (Anderson and Shutler 1974:163). At the Soldow site near Fort Dodge, the cultural material was compressed within the top few inches of sediment. The time of occupation is roughly estimated, based on style similarities with lithic artifacts at the Simonsen site, at about 9,000 to 6,000 years ago (Flanders 1977:125-133). Sites with burials are the Lewis Central School dated to about 2800 BP. (Anderson et al 1978:76; 195) and the Turin site a middle Archaic date of 4720 + 250 y.b.p. (Alex 1980:118-119; Anderson and Shutler 1974:163). Five cultural horizons were recognized at the Logan Creek site just west of the Missouri River in Nebraska. Hearths, pits, assorted lithic and bone tools, and worked shell were recovered. One level registered a radiocarbon date of 6633 $\pm$ 300 y.b.p. From two levels below, a radiocarbon date of 7250 $\pm$ 300 was found (Anderson and Shutler 1974:163).

Two important Archaic sites of central Iowa are the Conrad and the Bash sites, located about 30 miles east of Ames. The Conrad site was reported by Toby Morrow in 1981 as a briefly occupied mid-Archaic site containing stone debitage (Collins et al 1991:15). The Bash site is a quarry site, located on a tributary of the Iowa River, that was worked throughout the entire Archaic period. Recently, a geomorphological and archaeological study was conducted on the approximately 100 acres comprising the site. Three levels of archaeological deposits from here were described as "Late Archaic/Woodland, Middle/Late Archaic and Early/Middle Archaic." Preliminary dating was by location within recognized Holocene sediment deposits (Collins et al 1991:1,15,17,98)

Mississippian age rocks containing assorted cherts valuable for tool manufacture outcrops at the Bash site, and rocks are easily collected from the bed of Burnett Creek. Pieces of chert were found stored in cache pits. Large anvil stones were also recovered further suggesting quarrying activities (Collins et al 1991:17, 84,95,98,102).

An analysis of lithic artifacts was part of the Bash study. A small number of microblades, about 2-3 cm long, and cores from which blades were struck were recovered; these were of interest as no other such occurrence has been noted in the Iowa Archaic (Collins et al 1991:87). Heat-altered pieces were counted along with cortex pieces and a relationship between the two was found. During the Early/Mid Archaic heat was applied after cortex removal. Later this changed to heat alteration with the cobbles' cortex intact in Late Archaic/Woodland times (Collins et al 1991:12,81)

Summary of the Midwest Archaic

Numerous Archaic sites in the region seem to be the result of brief periods of occupation for such purposes as hunting and/or gathering of a broad variety of food and non-food resources. A few sites with very deep deposits, such as Modoc and Koster, appear to have developed through repeated occupation by relatively large groups of human supported by a generalized hunting and gathering strategy. An increasing degree of sedentism appears to have developed during the Archaic period, beginning perhaps in the middle Archaic.

Until recently, most Iowa Archaic sites had been found in the western part of the state. The western Iowa sites of Simonsen, Cherokee, and Hill contained buried deposits representing multiple occupations. Except for the two burial sites, Lewis Central School and Turin, and the multiple horizons of the Bash quarry, most of the Archaic occurrences appear to be hearths with associated debris likely to have been discarded by a hunting group.

Numerous variations occur within the Buchanan site. Grid A appears to contain only one, relatively brief episode of Archaic occupation, whereas the other two excavated areas were occupied repeatedly over long span of time. The occupation levels in Grid B dated at about 5500 years ago suggest a preferred camp site within the Buchanan drainage at that time. Later occupations of the valley apparently shifted to the Grid C area. The presence of clam shell in Grid C, but not in Grids B or A, may represent a shift in the collecting strategy of organic materials; either seasonally or as part of a long-term trend. Point styles from Grid B and the lower levels of Grid C are similar to some points from Missouri, Illinois or from the Cherokee Sewer site in Iowa suggesting some tie with eastern and southern peoples. The presence of Pelican Lake style points in Grid C suggests the presence of people from the west during the Late Archaic.

The different degree of usage through time suggest different subsistence strategies. Point style differences could have been due to migrations from the southeast or they could have been adopted by local residents through contact for trading purposes. The changing climate and the resulting change in available resources since the onset of the Holocene period probably inspired changes of some kind in resource procurement strategies. The patterns of those adjustments need to be identified regionally and locally in terms of group size; mobility;

resource locations; contact, and the nature of that contact, with other groups. The Buchanan site's well stratified and sealed deposits should add a wealth of information to the knowledge about Archaic age peoples, particularly regarding local Archaic age adaptations to the environment through time.

CHAPTER V

PHYSICAL CONTEXT OF THE ARCHAIC OCCURRENCES AT 13SR153

Geology

Story County is covered by Wisconsinan age glacial deposits. The low slopes and dips of the topography are generally unmodified by stream action except where some streams have cut down to depths of about 100 feet (30.80 m). Generally, the land was poorly drained until modified by recent inhabitants. The glacial sediments were transported by both glacial streams and subsequent streams (Zimmerman 1952:1,3,6). Glacial sediments of all sizes and of a broad spectrum of rock varieties and colors are found in the Buchanan site drainages, together with alluvial deposits.

North of Ames, the South Skunk River follows an ancient valley that had been in existence before the most recent glaciers spread over the land. In its southerly portion the river had developed a wide flood plain in pre-glacial times. The more northerly section may have had a topographic relief of about 200 feet. The southern part of the South Skunk valley is underlain by Pennsylvanian age rocks that are less resistant to erosion than the Mississippian bedrock in the northerly section. The Pennsylvanian Cherokee group of limestone, shale, sandstone and dolomite outcrops to the east of the Buchanan site near Nevada. The Mississippian St. Louis formation underlies the Cherokee and is exposed in the Bear Creek drainage, part of the South Skunk watershed to the north of the Buchanan site. Ames rests on the apex of an anticlinal deformation which accounts for the exposure of both Pennsylvanian and Mississippian rocks near the city (Zimmerman 1952:10-12,14,23-24).

Climate

The modern climate of the Buchanan drainage is typical of mid-continental areas in the middle latitudes with a broad range of seasonal temperatures. In a widely used climatic classification (Akin 1981:7,30-31), central Iowa is identified as an area with cold winters (D) and warm summers (a). Although precipitation (f), averaging about 32 inches (82 cm), can occur in all seasons about 23 inches (58.9 cm) of it falls in the warm months. The mean annual temperature for central Iowa is about 49° F (9.4° C) with an annual range of about 55° F (12.8° C) (Akin 1981:7,30-31; Iowa Water Plan 1978:13,15).

Stream flow follows the precipitation pattern although it differs markedly through the seasons with a spring-early summer peak that declines with the progression of summer (Burmeister 1970:5,6). To the southwest of the Buchanan site, Squaw Creek flowing into the South Skunk downstream drains 204 square miles (538.20 km^2) with an estimated average flow of about 133 ft^3/s (3.87 m^3). A maximum was measured at 11,300 ft^3/s (329.176 m^3) compared to the many years during which not enough water is available to generate a flow (Melcher et al 1987:125).

Paleoclimates

Pollen analysis has indicated that at the beginning of the Holocene, 10,000-9000 years ago, the climate at the Cherokee Sewer site in northwest Iowa was cooler and more moist than it is today. By about 8400 years ago prairie prevailed except for gallery forests in stream valleys.The vegetation shifted from mixed forest to prairie flora between 9000-7700 BP at Lake West Okoboji. Fires were frequent at about 8500 BP based upon the evidence of charcoal. A warm, arid period occurred between 7200 and 6300 BP. The prairie vegetational pattern, similar to eastern South Dakota today, occurred between 7700-3200 years ago (Baker and Van Zant 1980:126,133-134,136).

Another climatic reconstruction at the Cherokee Sewer site is based on very small mammals found in the three levels from which artifacts were recovered. The oldest level was dated to about 8400 years ago and was the least dry of the three levels. Grassland species were less abundant and forest species more numerous than in the two later Horizons. Temperatures were more moderate resulting in a longer growing season than today (Semken 1980:84-85,89,90). At about 7300 BP the climate was drier than at 8400 years ago but wetter than the uppermost level dated at about 6350 BP. Vegetation is described as hardwood parkland with the same varieties in the gallery forests of stream banks. The prairie was well-developed but the climate was more arid than today's. Temperatures were cooler, reducing the growing season. The uppermost level, dated to about 6350 years ago, experienced the driest climate of the three levels found. Vegetation was steppe-like but with some forest. However, a corresponding response to this aridity in eastern Iowa appeared to have been less severe, especially in the Mississippi River Valley (Semken 1980:94,97). This is supported by a comparative study by Baker et al (1990:175,177) of three sites in the eastern half of Iowa based on plant community responses to climatic changes.

Plants and pollen collected from Colo Marsh, located on the Des Moines Lobe east of the Buchanan site, reflected the presence of a spruce-larch community at about 11,000 BP which possibly was spread over the rest of Iowa at that time. The warming climate from about 11,000 to 8300 B.P. resulted in a change to a mixed deciduous flora. Finally prairie was quickly established at the end of this period peaking by 4500 B.P. During the warm climatic regime, water levels were also lowered. Then the climate cooled and moistened. Further east at Indian Creek Nature Center prairie plants peaked in the period 6000-4500 B.P. Subsequently a cooler and more moist climate allowed oak to become established. At the easternmost of the three sites, Mud Creek, the climate seemed to have been unchanged at 9300, 6800 and 5500 B.P. continuing to support a thick deciduous forest containing varieties very sensitive to heat.

This climate also seemed to have prevailed in northeast Iowa. It is suggested that these difference are due to regional shifts in dominant air masses (Baker et al 1990:175,177).

The boundary between forest and prairie also reflects the boundary between a region dominated by the relatively drier Pacific-Arctic air masses and the region dominated by the relatively wetter Atlantic-Gulf of Mexico air masses. Dominance of the dry Pacific air masses occurred over central Iowa causing the warmer and drier conditions while eastern Iowa remained under the effects of the Atlantic-Gulf air masses (Baker et al 1990:175,177).

Generally, then the warming trend from about 11,000 years ago resulted in changed vegetation patterns across the state except for the eastern region along the Mississippi River valley. The time of greatest aridity changed plant communities from spruce forest to mixed deciduous forest to prairie with gallery forests along stream valleys, except in eastern Iowa. Aridity seems to have increased in intensity and spread in an easterly direction from the west through time moderating after about 5000 years ago. Although some climatic data was extrapolated from Colo Marsh data, the findings from the Buchanan site fit within the climatic change model developed in the above studies.

Spruce needles recovered from the Buchanan site, in central Iowa, dated to about 10,000 years ago, indicate the presence of spruce forest. Twenty kilometers east at Colo Marsh a spruce-larch forest changed to mixed forest and then to prairie by about 8300 years ago, reaching a maximum prairie vegetation by about 6100 B.P. In the Buchanan drainage, the presence of prairie vegetation and trees such as cottonwood indicates drier conditions by about 6000 BP Here, the deposition of sediments was a major occurrence until about 6300 BP At this time, a decrease in sedimentation resulted in stable conditions allowing soil formation to proceed. At about 4000 BP, the aridity eased and upland mixed forest increased. Plant remnants that were recovered from deposits of about this age indicate a forest mix that is much like today (Figure 12) with oak-hickory on the uplands and oak, maple and basswood dominating in the valley (Van Nest and Bettis 1990:80-81).

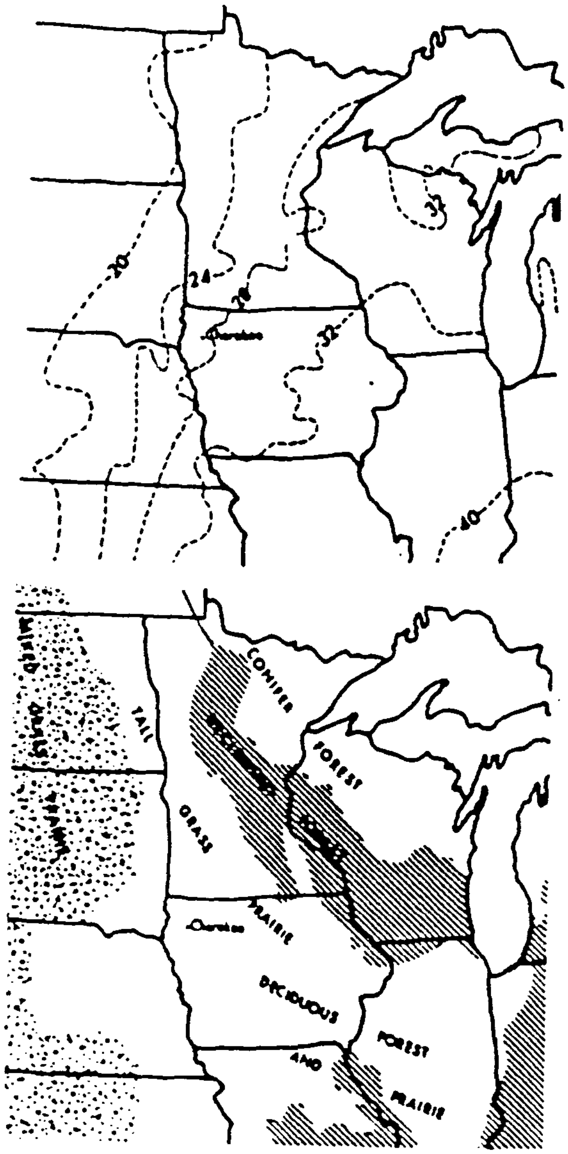


Figure 12. Average precipitation and vegetation patterns of the upper Midwest (Shutler et al 1980:2).

CHAPTER VI

DESCRIPTIVE ANALYSIS OF THE ARCHAIC LITHIC ARTIFACTS FROM 13SR153

An analysis of the lithic artifacts, particularly as regards the distribution of debitage types according to the classification scheme mentioned in Chapter II and the frequency of heat treated material, was undertaken in order to determine what kinds of activities were being done at the Buchanan site, and to see what changes, if any, in these practices occurred over time. Four notable patterns in the distribution of type emerged in Grids B and C (Figure 13 and Table 1). The data from Grid A did not yield sufficient quantities of material to be able to permit an examination of temporal change within the grid, but can be related to patterns in other grids by matching the radiocarbon chronologies. The first pattern noted was the predominance of manufacturing flakes. The second pattern was the virtual absence of resharpening flakes. The third striking feature of the assemblages was the ubiquitous presence of expedient type tools, such as utilized flakes (LTU), irregular side-scrapers (LTS), retouched flakes (LTR), and casually retouched tools (LTT). The fourth feature was the persistence of thermal alteration technology, ranging from about 16-21 percent in Grid B and from about 14 - 33 percent in Grid C. Finally, none of these patterns exhibited substantial alteration over time, except for the use of heat treatment in Grid C where it seems to have increased through time to the more recent deposits.

Grid A

Grid A has a complex stratigraphy, such that there is some uncertainty regarding the relative chronology of some of the levels (Table 2). Because of this problem it was determined that only levels below 200 cm could be unambiguously assigned to the Archaic period.

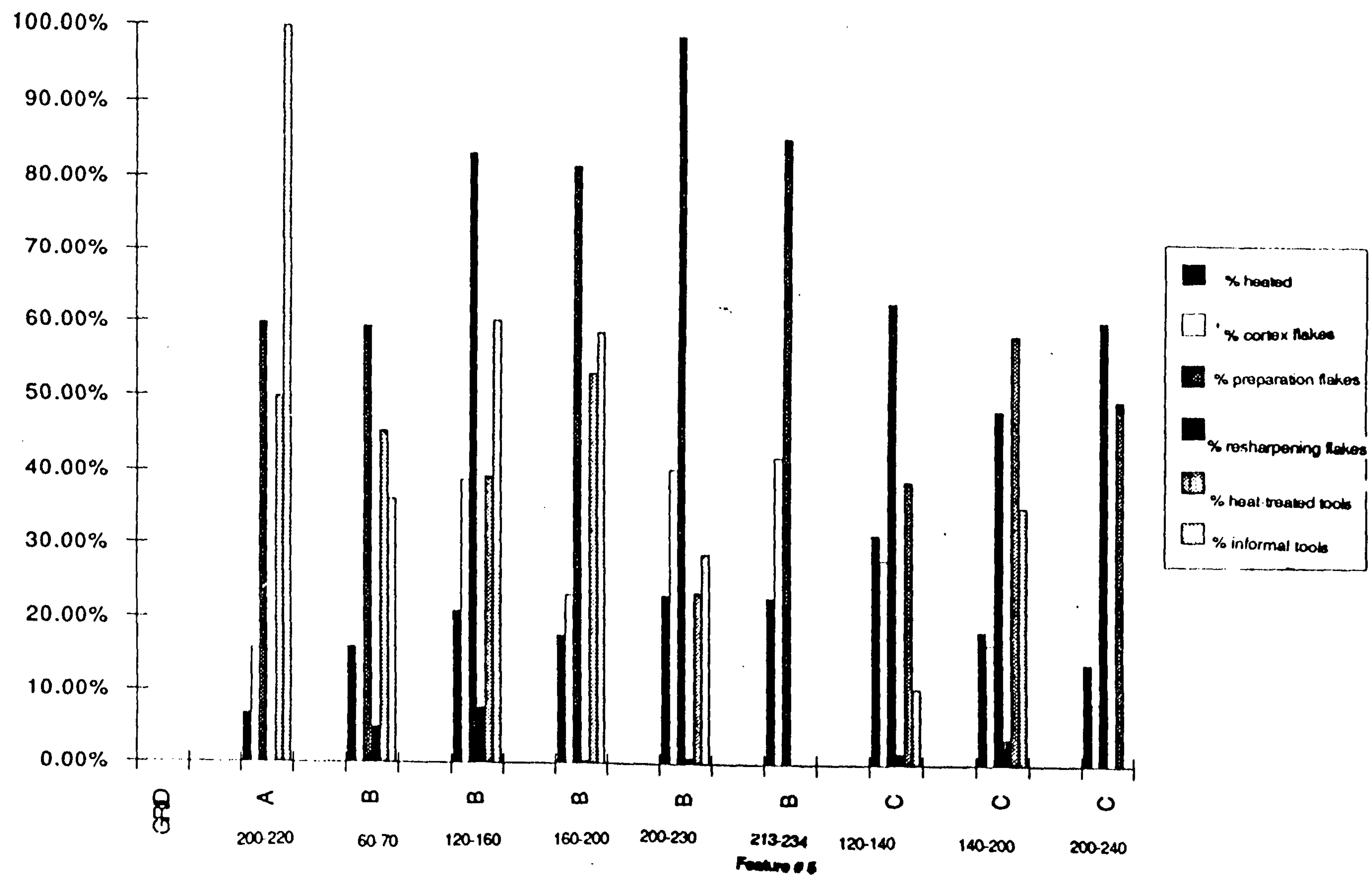


Figure 13.Graph showing the percentages of various lithic artifact categories.

Table 1. Percentages of various lithic artifact categories.

GRID	LEVEL	% HEAT	% CORTEX FLAKES	% PREP FLAKES	% RESHARP	% HEATED TOOLS	% INFORMAL TO ALL TOOLS	# S *	#'S TOOLS
A	200-220	6.90%	16.00%	60.00%	0.00%	50.00%	100.00%	29	2
B	60-70	16.26%	13.54%	55.21%	4.69%	45.45%	36.36%	203.00	11
B	120-160	21.15%	24.27%	51.94%	4.87%	39.53%	60.47%	52.00	8.6
B	160-200	17.97%	16.07%	68.69%	0.35%	53.33%	58.89%	317.80	18
B	200-230	23.24%	27.56%	67.31%	0.65%	52.63%	35.71%	185.00	19
C	120-140	31.77%	28.21%	63.25%	1.71%	39.29%	10.71%	277	28
C	140-200	18.76%	18.67%	48.63%	3.75%	58.93%	35.71%	671	56
C	200-240	14.29%	8.70%	60.87%	0.00%	50.00%	0.00%	28	2

* #S = Numbers of artifacts.

Note: The results in Tables 1, 3, 4, 8, and 10 referring to flakes were based on the percentage of debitage only. The numbers of cores and tools were subtracted from the total artifacts recorded for that unit. For example in Table 3, the two cores and two tools were subtracted from the total of 29; the number of the cortex flakes were then divided by the sub-total of 25: 4/25 (100) = 16 %.

Table 2. Radiocarbon dates from the Buchanan drainage (site 12S153), Story County Iowa (Bower and Bettis n.d.; Van Nest 1987:39)

Date (RCYBP) [1]	Lab #	Horiz. Prov. [2]	Vert. Prov [3]	Material
2450 ± 100	Beta-30338	C (I,3)	130-140	Charcoal
3000 ± 140	Beta-44529	B(V,2)	60-70	Charcoal
3095 ± 55	Beta 44070 ETH-7840	BP1 (NA)	92-120	Charcoal
4230 ± 160	Beta-30337	C (I, 1& 2; II, 1 & 2)	170-185	Charcoal
5220 ± 70	Beta-39670	B (I, 3)	170-190	Charcoal
5480 ± 170	Beta-39899	B (I, 1 & 2, 3)	220-230	Charcoal
5560 ± 110	Beta-39672	B (II, 1 & 2)	200-210	Charcoal
5600 ± 140	Beta-44068	B (I, 1 & 2, 3)	120-140	Sediment
5570 ± 60	Beta-51683	C (Trench 2)	200-206	Charcoal
5820 ± 190	Beta-44069	B (I, 3; II, 1 & 2, 3 & 4, 5 & 6)	250-260	Charcoal
6000 ± 120	Beta-18028	Trench A-4 (NA)	210	Charcoal
6120 ± 240	Beta-25037	B (I, 8)	225-240	Charcoal

[1] RCYBP = radiocarbon years before the present. All dates are uncalibrated, but adjusted for the 13C/12C ratio. Sample Beta-44070/ETH-7840 was dated using the AMS technique (sample preparation by Beta Analytic, Inc., Miami, Florida; ALMS measurements by Eidgenossische Technische Hochschule, Zurich, Switzerland). All other samples were dated by the conventional method. Dates are listed in chronological order.

[2] Horizontal provenience refers to grid location except in the case of sample Beta-18028, which come from one of Van Nest's (1987) geological cuttings, and Beta 44070/ETH 7840, which is a bank profile sample taken on the south edge of Grid B. Numbers in parentheses: Roman numerals = rows, Arabic numerals = squares; NA = not applicable.

[3] Vertical provenience is expressed in cm below the surface.

Excavation proceeded in 5 cm spits from 205-220 cm. At these levels, materials were collected from square 1 in each of three rows, I, II, and III (Figure 4).

During Van Nest's work on Bank profile A-4 adjacent to Grid A, a hearth was identified between 205 and 210 cm (Figure 14). Also, in each of the five centimeter levels above and below the level that contained the hearth, charcoal and "dark red to yellowish brown" burnt earth was recovered that was thought to be from the hearth (Van Nest 1987:91-95). A radiocarbon date of 6000 ± 120 B. P. (A-4-205-h: Beta-18028) was derived from the hearth's charcoal (Van Nest 1987:39). A loam paleosol surface was identified beginning at 200 cm with sub-divisions of it extending down to about 220 cm (Van Nest 1987:93,95).

The artifacts collected in 1987 reflected a vertical distribution consistent with Van Nest's observations regarding the vertical position of the hearth in that the greatest quantities were between 210-215 cm with fewer from 205-210 cm and from 215-220. Since all of this material may have represented a single, more or less discrete occupation, the Grid A data were combined (Table 3) for analysis into one 20-centimeter unit (200-220 cm.).

A total of 29 pieces was counted in these combined levels and only two had been heat-altered. Two deposits of fire-cracked rock (hereafter referred to as LMF) weighing 1928 g were recovered. For the other lithic artifact categories the combined distribution consisted of two cores, 25 pieces of debitage, and two tools, both of which were utilized flakes. Of the debitage, nine were chips or chunks, six were flakes with cortex associated with an early stage of manufacturing and five were biface preparation flakes. Chert was the rock of choice for tool manufacturing. White, various shades of gray and mottled tan chert were observed.

The greatest number of pieces were found in Row II, square 1, the closest square to the hearth. One core, six pieces of debitage, one utilized flake, and 1812 g. of fire-cracked rock (LMF) were collected from the 210-215 cm level in that square. A second deposit of fire-

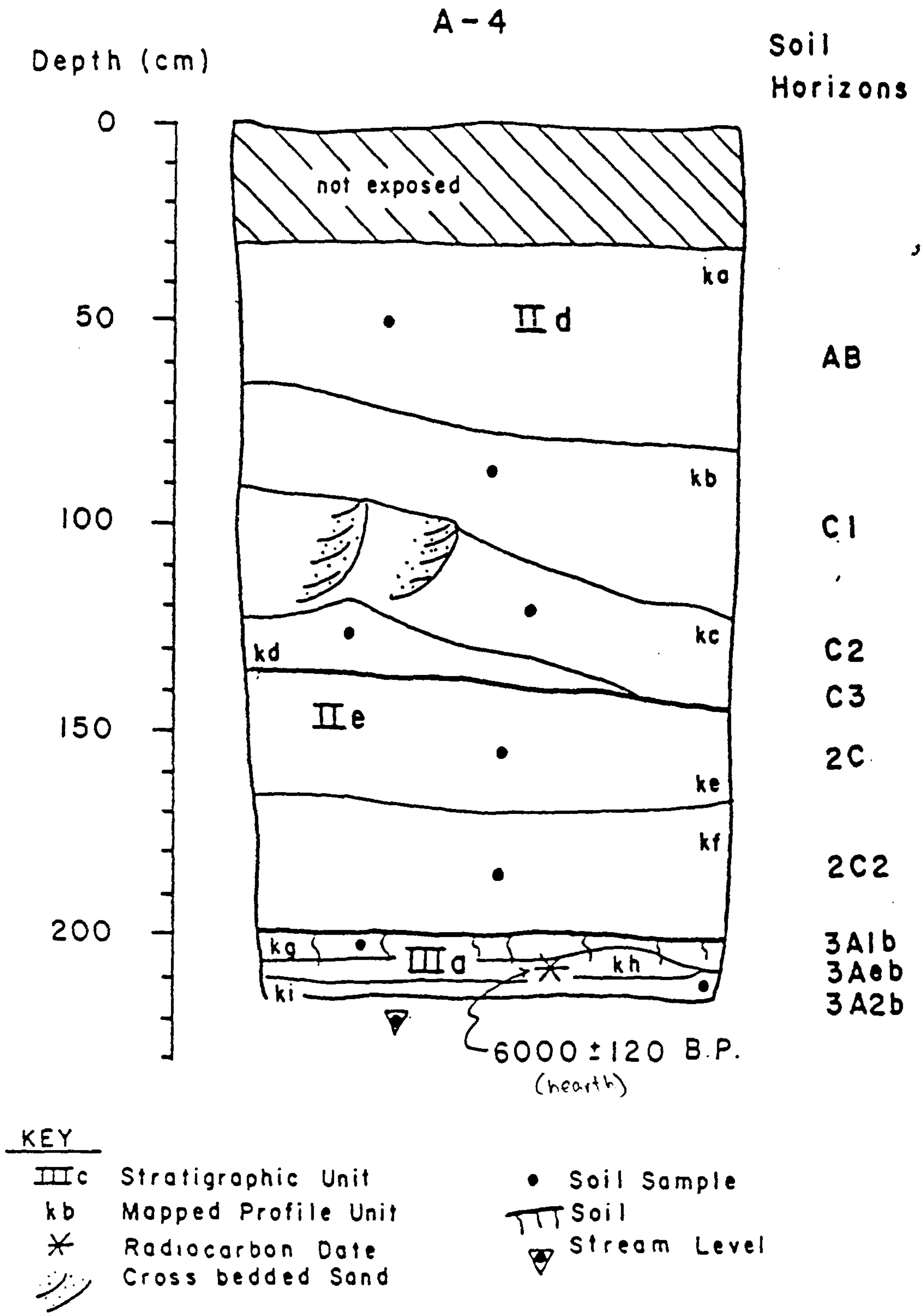


Figure 14. Profile of bank at Grid A showing the location of the hearth (Van Nest 1987:93).

Table 3. Combined data from Grid A 200-220 cm.

TYPE	#'s	HEAT	% HEAT of TOTAL	% CORTEX FLAKES	% PREP FLAKES	%RESHARP FLAKES	% HEATED TOOLS	% INFORMAL TO ALL TOOLS
LCI	2							
LDBB	1							
LDBF	3							
LDBU	1							
LDC	5	1						
LDC1	2							
LDC2	2							
LDFU	4							
LDH	3							
LDHC	1							
LDMF	2							
LDT	1							
LTU	2	1						
TOTAL	29	2	6.90%	16.00%	60.00%	0.00%	50.00%	100.00%

cracked rock (LMF) weighing 116.0 g. was found in Row I, square 1 at 215-220 cm. This spit also is the only unit in which all four categories of debitage were found.

Wood, bone, clam shell, a turtle shell fragment and an antler tip were also recovered from these depths. A concentration of charcoal probably related to Van Nest's hearth was uncovered at 200-215 cm from Rows I, II, and III, square 1.

Grid B

In this grid the stratigraphy above 150 cm is fairly level with two paleosols extending through all squares (Figure 15). However, the deposits below about 150 cm consisted of two types of sediments. In the western part of the Grid B trench, eight squares, Rows I and II, Squares 1-4, of the grid consist of fine grained stratified sediments with three, possibly four paleosols, of which the upper two are radiocarbon dated (see Table 2 and discussion below). To the east, in Rows I and II, Squares 5 and 6 were transitional from loam into the channel sands and gravels in levels below about 190 cm. Rows I and II, Squares 7-10 were channel sands and gravels below about 190 cm. Generally, in both eastern and western sections of the trench, artifacts were found throughout all levels, although the amount sharply decreased between 70-120 cm. Quantities increased steadily below 120 cm to about 200 cm. In the western section the cultural deposits were sharply reduced at about 230 cm with only a few artifacts recovered in the lower spits. In the eastern end, the deepest artifacts were recovered from channel sediments at the 260-270 cm level. However, a piece of antler was recovered from just above the glacial till at about 390 cm in the eastern end, Row I, squares 8 and 9. An unpublished undergraduate student project described the antler tip as having been modified into a tool (Ogier n.d.:10).

Eight radiocarbon dates were obtained for this grid (Table 2). However, one of them,

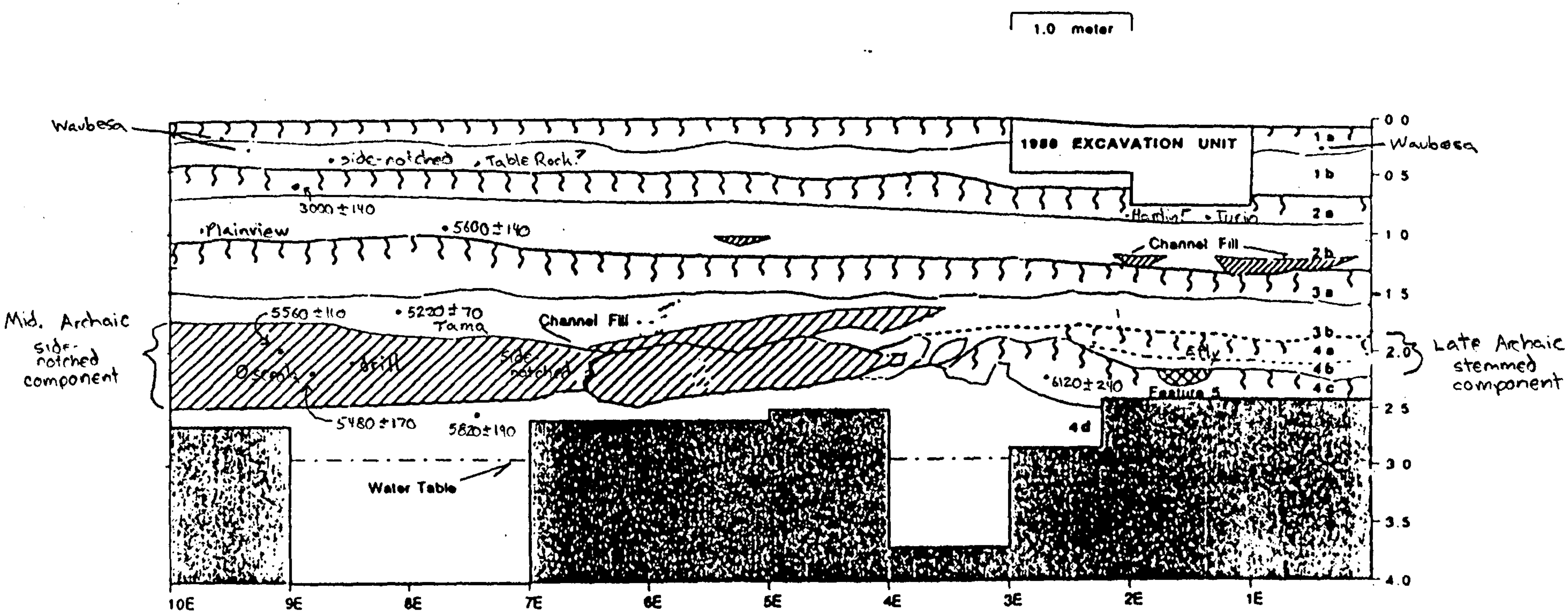


Figure 15. Profile of the south wall of the Grid B trench. Drawn by Dan Hayes.

Beta-44068, is stratigraphically discordant and resulted from dating the organic content of whole sediment from Row I, Squares 1 & 2 at 120-140 cm; it is therefore rejected. The oldest date from Grid B was based on charcoal recovered from the channel deposits at the same 240-255 cm level containing a large deposit of lithic artifacts. This deposit is discussed below under "Features."

Combined Data Since Grid B's strata are fairly level in the upper part of the sequence, artifact data from several squares over a vertical interval with a more or less continuous occurrence of cultural material were combined for purposes of analysis of type distribution. Such a combination was based on the assumption that the materials from the same depth but different squares represent a single occupation level. It was hoped that such levels would yield sufficiently large quantities of data for meaningful inter-assemblage comparison. Level I included the 10 cm spit at 60-70 cm (Table 4) from all squares, 26 of them, that contained cultural material associated with a paleosol at this depth . A radiocarbon date of about 3000 years ago was found for this Level (Beta-44529), which comprised a total volume of 2.6 m^3 of excavated soil, or a trench 1 m x 26 m x .1m.

Based upon the vertical frequency distribution pattern of the lithic artifacts, the location of paleosols and radiocarbon dates, three other levels were recognized in Grid B. The following three levels are based on material excavated from Rows I and II, Squares 1-4 (Table 5). The upper limit of Level II is based on a paleosol, located at about 120 cm and dated to about 3100 years ago according to a radiocarbon sample (Beta-44070; ETH-7840) taken from the bank profile at the 92-120 cm level. A date of about 5220 years ago was derived from the 170-190 cm spit (Beta-39670) and provides the lower age limit for Level II; the level, which extends from 120 to 160 cm, is equivalent to a trench 2 m x 4 m x .4 m. with a total volume of 3.2 m^3.

Table 4. Combined data for Grid B at 60-70 cm.

TYPE	#'S	HEAT	% HEAT OF TOTAL	%CORTEX FLAKES	% PREP FLAKE	% RESHARP FLAKE	% HEATED TOOLS	% INFORMAL TO ALL TOOLS
LCI	3							
LCS	1	1						
LDB	2							
LDBF	18	1						
LDBU	1							
LDC	40	6						
LDC1	8							
LDC2	18	8						
LDCC	6							
LDF	8	1						
LDFU	25	1						
LDH	15	2						
LDHC	15	2						
LDMB	2							
LDMF	24	5						
LDRF	9	1						
LDT	1							
LTBC	2	2						
LTP	1							
LTR	3	3						
LTU	1							
TOTAL	203	33	16.26%	13.54%	55.21%	4.69%	45.45%	36.36%

Table 5. Combined data for Grid B, Rows I-II, Squares 1-4, all spits below 70 cm.

DEPTH	TYPES	NUMBERS	WEIGHT	LMF	HEATED	DEPTH	TYPES	NUMBERS	WEIGHT	LMF	HEATED
120-160	LCI	1	4.80		1	160-200	LCI	4	51.60		1
120-160	LCM	2.6	23.40			160-200	LCM	9.4	126.50		
120-160	LDB	0.4				160-200	LDB	1.6	1.00		
120-160	LDBF	2	1.20		2	160-200	LDBB	8	5.40		1
120-160	LDC	2.2	0.50		1	160-200	LDBF	57	5.90		11
120-160	LDCI	5.6	2.70		1	160-200	LDC	30.8	16.70		4
120-160	LDC2	4.4	10.20			160-200	LDCI	23.4	91.50		
120-160	LDCC	2.4				160-200	LDC2	22.6	30.30		9
120-160	LDF	3.8	2.10			160-200	LDCC	14.6	2.60		1
120-160	LDFU	1	0.60			160-200	LDF	41.2	22.70		2
120-160	LDH	7	15.90		0.4	160-200	LDFU	8	15.90		4
120-160	LDHC	4.8	13.50		0.4	160-200	LDH	23	49.60		5.6
120-160	LDMF	4.2	12.30		1	160-200	LDHC	20.2	87.70		2.6
120-160	LDRB	1	0.80			160-200	LDMF	34.8	62.20		6.2
120-160	LTBT	0.4				160-200	LDRF	1	0.40		
120-160	LDRF	1	0.20		1	160-200	LTBC	1	18.10		1
120-160	LTH	1	5.50		1	160-200	LTBT	2.4	12.90		1
120-160	LTP	1	1.00		1	160-200	LTE	1	7.10		
120-160	LTR	1	3.30			160-200	LTP	3	9.60		2
120-160	LTS	2.4	4.70			160-200	LTR	1	3.00		1
120-160	LTU	2.8	13.40		1.4	160-200	LTS	.6			
120-160	TOTALS	52	116.10	1707.70	11	160-200	LTU	9	31.80		4.6
						160-200	TOTALS	317.2	652.50	3868.70	57

Table 5 continued

DEPTH	TYPES	NUMBERS	WEIGHT	LMF	HEATED
200-230	LCI	8	105.30		
200-230	LCM	3	391.90		1
200-230	LDB	4	1.60		
200-230	LDBF	8	1.00		2
200-230	LDC	4	5.90		1
200-230	LDC1	24	63.50		6
200-230	LDC2	30	110.70		9
200-230	LDCC	4	1.90		
200-230	LDF	25	17.80		3
200-230	LDFU	1	2.20		
200-230	LDH	5	7.40		
200-230	LDHC	15	51.00		1
200-230	LDMB	2	0.90		1
200-230	LDMF	32	84.30		10
200-230	LDRF	1	3.00		
200-230	LTBC	1	38.90		
200-230	LTBT	2	20.70		1
200-230	LTD	1	4.10		1
200-230	LTP	4	14.40		2
200-230	LTS	3	8.60		2
200-230	LTT	1	12.60		1
200-230	LTU	7	69.60		2
200-230	TOTALS	185	1017.30	4754.70	43
230-250	LDF	1	0.30		
230-250	LDMF	2	5.90		
230-250	TOTALS	3	6.20	42.40	

Level III, between 160 and 200 cm, appear to be related to a weak paleosol at about 170 cm (Figure 15). A radiocarbon date of about 5200 years ago was recorded for samples from 170-190 cm (Beta-39899). The Level III excavation is equivalent to a trench 2 m x 4 m x .4, or 3.2 m^3 of excavated soil.

Level IV, 200-230 cm, appears to be associated with a paleosol occurring at about 210 to 220 cm. A radiocarbon date of about 5500 years ago was recorded for a sample from about 220-230 cm (Beta-39899). Additional archaeological material recovered from 250-260 cm in very small amounts was dated to about 5800 years ago (Beta--44069). Level IV is equivalent to a trench 2 m x 4 m x .3 m, or the equivalent of about 2.4 m^3 of excavated soil.

Converting the quantities in each level to amounts per cubic meter allowed a comparison of density values among levels (Table 6). In terms of numbers of artifacts per unit volume of excavated soil, rather than their weights, in Levels I, II, and III the relatively lean interval represented by the second level, 120-160 cm, clearly shows in the table for Grid B. However, this level constitutes a substantially larger concentration than in the lower level, 200-240 cm, in Grid C and is nearly equal to the density of artifacts in the 200-220 cm level in Grid A.

A combination comprised of redeposited material from the channel sands and gravels, was composed of the spits in the 190-270 cm levels of Rows I and II, squares 7-10 (Table 8). The distribution patterns of types were calculated as though for a trench equivalent to an excavation 2 m x 4 m x .8 m, or the equivalent of 6.4 m^3.

Flake Type Distribution The bulk of the flakes from Grid B seemed to be the result of manufacturing processes (Table 1). If tools were resharpened it was mostly done elsewhere. The high percentage of manufacturing detritus suggested that tool preparation occurred at this site from materials collected from this locale. The broad spectrum of stone color and of texture of the debitage resembles the assortment of color and texture of rocks found in the drainages.

Table 6. Numbers of artifacts per unit volume of excavated soil.*

HORIZON (cm)	NUMBERS	WEIGHT	LMF	HEAT	NO. CU/M	WT CU/M	LMF CU/M	HEATED CU/M
GRID A								
200-220	29.00	245.60	1,928.00	2.00	145.00	1,228.00	9,640.00	10.00
GRID B								
60-70	203.00	535.10	3,674.60	33.00	1,015.00	2,675.50	18,373.00	165.00
120-160	52.00	177.46	1,809.30	11.00	130.00	443.65	4,523.25	27.50
160-200	318.00	744.54	4,021.10	57.00	795.00	1,861.35	10,052.75	142.50
200-230	185.00	1,017.30	4,736.30	43.00	616.67	3,391.00	15,787.67	143.33
GRID C								
120-140	277.00	921.70	2,809.70	88.00	1,385.00	4,608.50	14,048.50	440.00
140-200	671.00	3,115.30	18,730.10	193.00	1,118.33	5,192.17	31,216.83	321.67
200-240	28.00	132.30	1,866.30	4.00	70.00	330.75	4,665.75	10.00

* Tables 6 through 9 reflect data "normalized to one cubic meter of sediment.

Table 7. Lithic artifact types from the channel sands and gravels.

TYPE	NUMBERS	WEIGHT	LMF WT	HEAT	# CU/M	WT CU/M	LMF CU/M	HEATED CU/M
LCI	5	97.30		2				
LCM	11	562.10		3				
LCS	1	6.30						
LDBB	3	0.70		3				
LDBF	4	0.90		3				
LDC	5	26.40						
LDC1	32	118.00		11				
LDC2	39	132.00		14				
LDCC	3	3.50		2				
LDF	12	24.00		2				
LDFU	33	41.10		16				
LDH	17	43.40		5				
LDHC	17	97.30		9				
LDMF	45	117.80		21				
LDRF	3	4.30						
LTBC	2	26.60		1				
LTBT	1	1.00						
LTE	1	4.90						
LTP	1	2.70		1				
LTR	1	23.70		1				
LTS	1	13.10						
LTU	8	32.80		3				
TOTAL	245	1379.90	3075.90	97	306.25	1,724.88	3,844.88	121.25

Ballard's analysis of the lithic artifacts recovered from the 1987 excavation of Row I, square 8, indicated that, except for artifacts made of Burlington or Winterset chert, the raw material for the lithic artifacts could have been obtained from the Buchanan drainage (Ballard 1992; personal communication).

Comprising about 13 percent of the total debitage from Level I, cortex flakes represented a smaller proportion of the debitage in the upper level than in the three below. In Level II, cortex flakes comprised about a fourth of the debitage; about 16 percent in Level III; and about 34 percent in Level IV. The proportion of biface preparation flakes ranged from about 53 percent in Level II to about 80 percent in Level IV. The proportion of resharpening flakes ranged from less than a percent in Levels IV and III to about 5 percent in the 60-70 cm level.

In the channel sands and gravels, about a third of the debitage (Table 8) was cortex flakes. Preparation flakes accounted for nearly 80 percent while resharpening flakes comprised less than 2 percent. Additionally, it should be pointed out that most, 75.5 percent, of the 245 pieces from the channel sands and gravels were recovered from one spit, I, 8 at 240-255 cm. This notable deposit is described below under "Features."

<u>Heat Treatment</u> Another technique employed was to thermally modify the stone used in tool-making. Such heat altered artifacts were present in all levels of Grid B (Table 5). The percentage of heat treated lithic materials of all types ranged between 16 percent and 21 percent through the levels. However, heat treated tools comprised about 40 to about 50 percent of all tools. In the channel sands the ratio was about 40 percent. However, in the Row I, Square 8 unit only, and at the same 240-255 cm level, more than 85 percent of all lithic artifacts had been heat-altered.

Table 8. Percentages of various lithic artifact categories from the channel sands and gravels.

TYPE	#'S	HEAT	% HEAT	% CORTEX FLAKES	% PREP FLAKES	% RESHARP FLAKES	% HEATED TOOLS	#'S TOOLS	#S TOOLS INFORM	% INFORMAL TOOLS
LCI	5	2								
LCM	11	3								
LCS	1									
LDBB	3	3								
LDBF	4	3								
LDC	5									
LDC1	32	11								
LDC2	39	14								
LDCC	3	2								
LDF	12	2								
LDFU	33	16								
LDH	17	5								
LDHC	17	9								
LDMF	45	21								
LDRF	3									
LTBC	2	1								
LTBT	1									
LTE	1									
LTP	1	1								
LTR	1	1								
LTS	1									
LTU	8	3								
	245	97	39.59%	33.33%	78.87%	1.41%	33.33%	15	10	66.67%

Informal Tools The ubiquitous informal tools, utilized flakes (LTU), irregular side-scrapers (LTS), retouched flakes (LTR), and casually retouched tools (LTT) were present in every level in the southwest corner of Grid B. A total of about 30 of them represent about half of all tools recovered from all levels. Utilized flakes are the most common and are found in all levels, save the upper two spits. They represent nearly 30 percent of all tools found. In the first level, 60-70 cm, about a third of the tools were of the expedient variety, down from 60 and 70 percent in the lower levels.

Formal Tools Formal tools, with a more finished appearance, include points (LTP), drills (LTD), endscrapers (LTE) and perforators (LTH). One perforator, eight points, one end-scraper and one drill were identified. These 11 tools represent about 17 percent of all types of tools. Six of the 11 spits contained only informal tools. The points (Figure 16) had all been thermally altered and were distinguished by a glossy appearance and sometimes exhibited a pinkish discoloration. Colors noted were cream-pink and various shades of gray-pink. One point, gray and glossy, recovered from Row I, square 3, at 170-180 cm may be of Tama type (Figure 16-a). Another Tama type point, also heat treated, was recovered from the 70-120 cm spit in II, 9 & 10 (Figure 16-b) (Morrow 1984:60). A stemmed point (Figure 16-c) with barbs

recovered from I, 9 & 10 at 190-220 cm is somewhat similar to a Hidden Valley type (Morrow 1984:50) but the configuration is also similar to an Etley point illustrated by Brown and Vierra (Brown, Vierra 1983:182). A heat treated point base (Figure 16-d) recovered from II, 1 & 2 at the 120-130 cm spit resembles the Sedalia type (Morrow 1984:19). Another point base (Figure 16-c), heat treated, from I, 1 & 2 from 210-220 cm may be of the Osceola type (Morrow 1984:56).

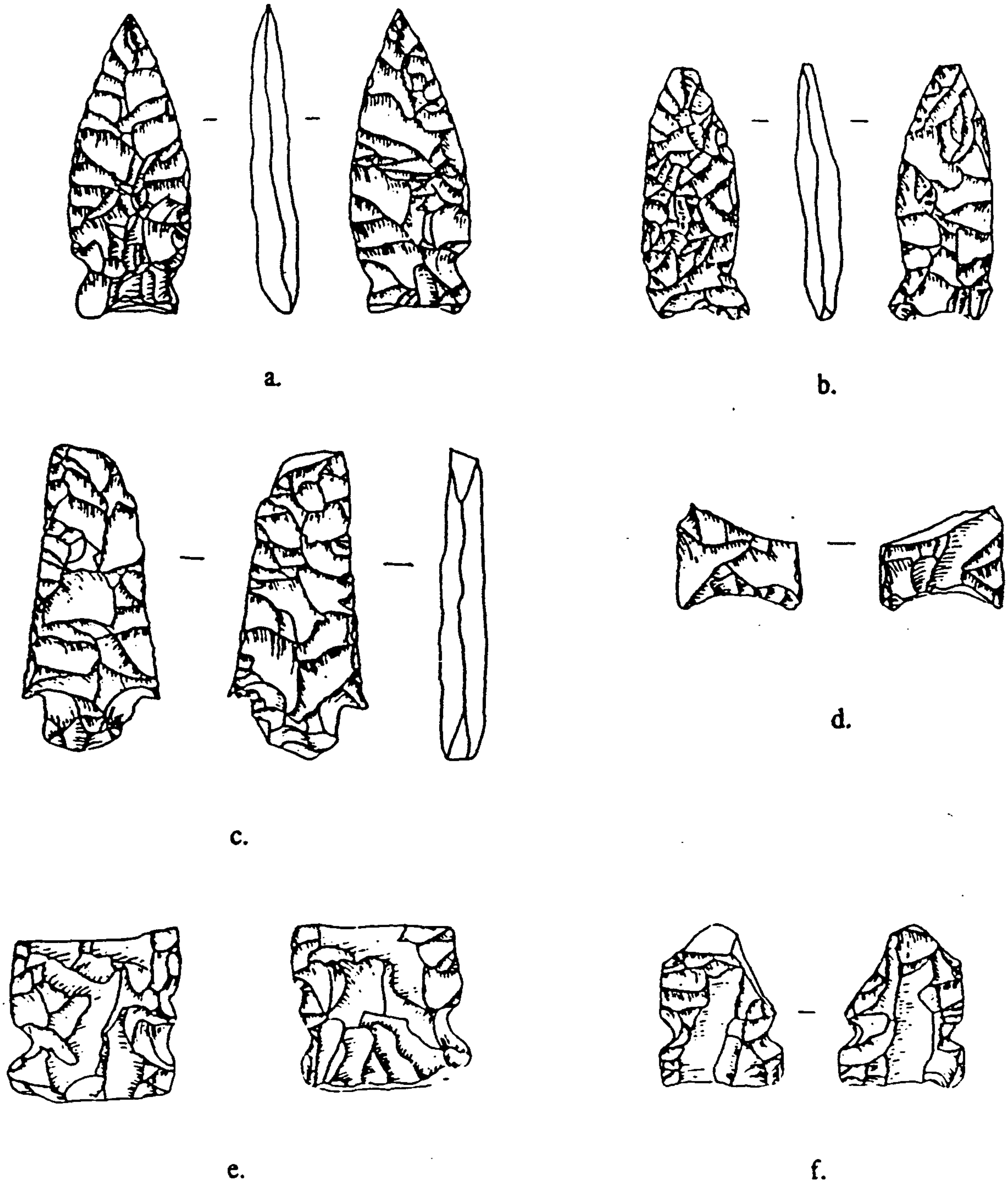


Figure 16. Projectile points from Grid B. a. Tama style from I, 3, 170-180cm; b. Tama style from II, 9 & 10, 70-120 cm; c. Hidden Valley or Etley style from, I, 9 & 10 cm; d. Sedalia type from II, 1 & 2, 120-130 cm; e. Osceola type from I, 1 & 2, 210-220 cm; f. Unidentified from II, 3 & 4, 190-200 cm. Drawings by Esperanza Postigo.

Features Excavations in 1989 in Row I, squares 1 and 2, exposed feature 5 at 213-234 cm (see Figure 15). A variety of cultural refuse including bone (some of it calcined) teeth, flakes, charcoal and fire cracked rock had been dumped into this basin-shaped feature that had a maximum thickness of 42 cm. The more than 4000 grams of hearth rock (LMF) recovered from Row I, square 3 at 200-210 cm probably is related to the Feature 5 deposit.

Another exceptional lithic artifact accumulation was uncovered in the channel sands and gravels. As noted earlier a concentration of 185 lithic artifacts were excavated from Row I, Square 8 at 240-250 cm. Since far fewer artifacts were found in adjacent spits, the deposits might be considered to have been dumped at that particular place rather than to have washed down from upslope. Charcoal recovered from just above the artifact concentration was dated at about 6100 years ago (Beta-25037).

Grid C

As originally noted by Van Nest in 1986 (1987:110) and subsequently confirmed through archaeological excavations in 1987 and in 1991, the stratigraphy at Grid C includes stratified channel sediments in the upper levels (Figure 17) Below them, beginning at about 120 cm, however, the strata consist of relatively homogeneous level overbank alluvial deposits.

Van Nest (1987:110; 1986) profiled a segment of the east bank on Lateral B. Stratified sands were identified at about 150-190 cm in the western part of the profile (Van Nest 1987:108-111). A portion of these sands had been disturbed and it was suggested that the likely cause was from cultural activity . At the other side of the profile a dark gray-brown loam was identified at 130-160 cm. Another occurrence of dark disturbed loam was encountered at 160-190 cm. An ash deposit was found at 186-192 cm. Large clam shells were found in the underlying stratum of dark gray-brown loam (Van Nest 1987:111-112).

Combined Data A profile developed during the 1991 season shows channel sediments extending down into the underlying stratum to about 140 cm (Figure 18). Therefore, it was reasoned that the materials recovered from below that depth would be relatively undisturbed and that material from the same depth but different squares would represent a single level, as was assumed in Grid B.

The excavated materials are divided into three levels (Tables 9 and 10) which include the materials recovered from Rows I and II in 1987, the 1991 units of a, b, c, and Test Trench # 2. Level I extends from 120-140 cm, includes a date of about 2400 years ago (Beta-30338) based on charcoal from Row I, square 3 at 130-140 cm, and is equivalent to 2.8 m^3 of excavated soil. Due to bank slumping, materials were not recovered from Test Trench # 2 until a depth of about 170 cm was reached,which is why there are no materials from Test Trench # 2 in Level I. Level II, from 140-200 cm, is dated to about 4200 years ago (Beta-30337) based on charcoal recovered from 170-185 cm in Rows I and II, Squares 1 and 2, and is equivalent to 9.75 m^3 of excavated soil. Level III at 200-240 cm, equivalent to 6.5 m^3 of excavated soil is dated to at least 5500 years ago according to the radiocarbon sample (Beta-51683) from the 200-206 cm level in Test Trench # 2. Level III contained very few lithic artifacts, only 28 pieces compared with the 522 pieces recovered from Levels I and II. Concentrations converted to amounts per cubic meter range from six pieces/m^3 in the lower level to about 116/m^3 in the upper level (Table 9).

Flake Type Distribution In all three levels, more of the debitage resulted from the manufacturing process than the resharpening process (Table 10). Of the total 28 pieces recovered from Level III, cortex flakes make up about eight percent and the manufacturing process produced about 60 percent of the debitage. No resharpening flakes were recovered. However, the total numbers of recovered pieces is so small that the percentages may not reflect accurately the distribution of types. Cortex flakes increased to about 11 percent and to 28 per cent in Level

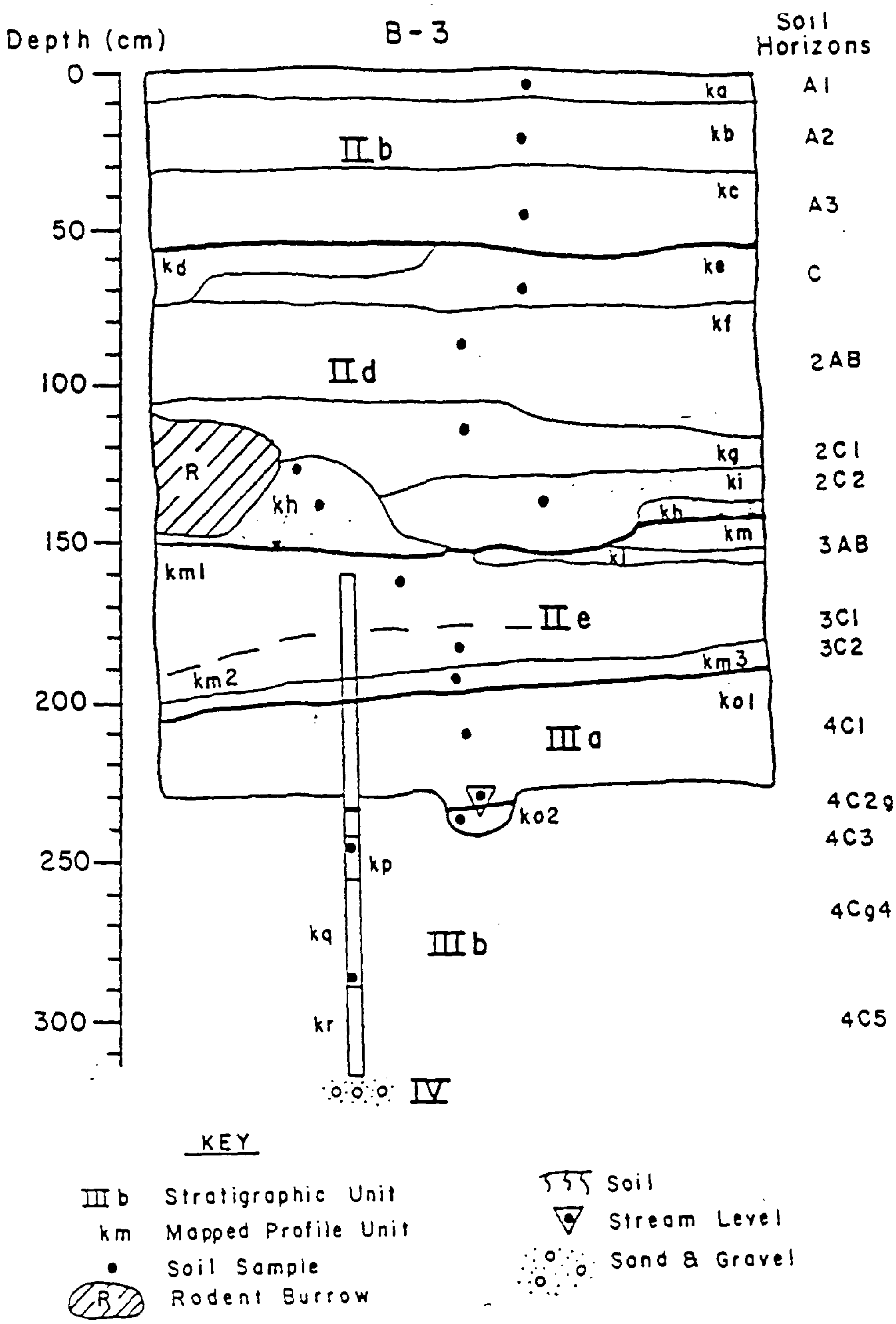


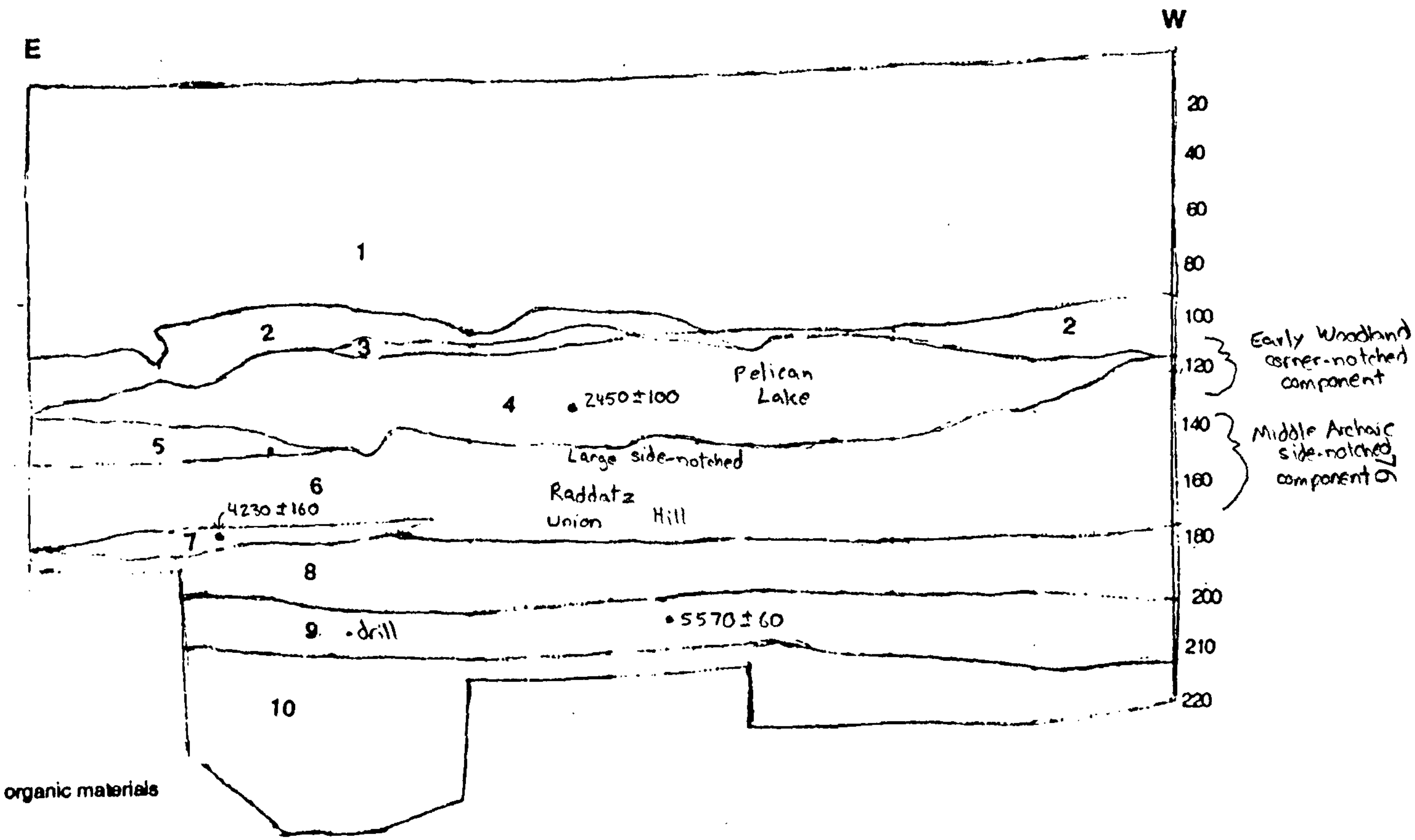
Figure 17. Bank profile at Grid C (Van Nest 1987:110).

I. In Level II about half of the debitage can be attributed to the manufacturing process, and this increases to about 60 percent in the upper level. Resharpening flakes decline from nearly four percent in Level II to a little less than 2 percent in Level I.

Heat Treatment Thermal alteration is represented in all three levels, increasing through time from about 14 percent of all artifacts in Level III to about 31 percent in Level I. However, the heat treatment of tools at about 60 percent in Level II declined to about 40 percent in Level I. Of only two tools found in the 200-240 cm unit, one had been heat altered.

Informal Tools As in Grid B, utilized flakes, irregular side-scrapers, retouched flakes and casually retouch flakes are the four varieties of informal tools found. None were found in Level III. In Level II they constituted about a third of all tools found. The proportion declined to about a tenth of the tools in Level I where there was an extraordinary concentration of projectile points and point fragments.

Formal Tools Points and point fragments (Figure 19) were recovered from Level II in unit b. A base from 140-150 cm had been heated and was a cream and pink color (Figure 19-a). A mottled tan point (Figure 19-b) with some cortex from 160-170 cm was similar to a Raddatz style (Morrow 1984:59). Two points from 170-180 cm had both been heat treated. One was a medium gray and the other was a gray and pink color. One was similar to a Union style (Figure 19-c) and the other (Figure 19-d) was similar to a Hill style (Morrow 1984:41, 87). In unit c, at the east end of the 1991 trench, about a half dozen points (Figure 20) and point fragments were recovered from sediments in and just under the channel sand deposits and below the level dated at 2450 ± 100 BP. These points were similar to a Pelican Lake style point (Morrow 1984:76).



1. Modern soil
2. Upper paleosol
3. Channel fill sands mixed with organic materials
4. Stratified sands
5. Silty clay loam
6. Stratified loam with medium to fine sand laminae
7. Sand lens
8. Fine to medium sand with silt laminae
9. Lower paleosol (A & B horizons)
10. C horizon of lower paleosol

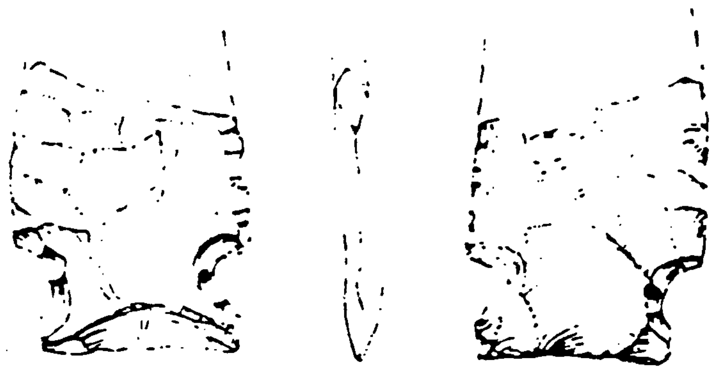
Figure 18. Profile of south wall of Grid C.

Table 9. Grid C artifacts in terms of numbers per cubic meter.

DEPTH	NUMBERS	WEIGHT	LMF WT	HEAT	# CU/M	WT CU/M	LMF CU/M	HEATED CU/M
120-140	277.00	921.70	2,809.70	88.00	1,385.00	4,608.50	14,048.50	440.00
140-200	671.00	3,115.30	18,730.10	193.00	1,118.33	5,192.17	31,216.83	321.67
200-240	28.00	132.30	1,866.30	4.00	70.00	330.75	4,665.75	10.00
TOTALS	781.00	3,498.50	12,778.10	226.00	2,573.33	10,131.42	49,931.08	771.67

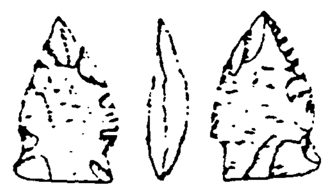
Table 10. Grid C Horizons in terms of types of flakes and amount of heat treatment.

DEPTH	NUMBERS	HEAT	%HEAT	% CORTEX FLAKES	% PREP FLAKES	%RESHARP FLAKES	%HEAT TOOLS	% INFORMAL TO ALL TOOLS
120-140	277	88	31.77%	28.21%	63.25%	1.71%	39.29%	10.71%
140-200	671	193	18.76%	16.93%	48.63%	3.75%	58.93%	35.71%
200-240	28	4	14.29%	8.70%	60.87%	0.00%	50.00%	0.00%

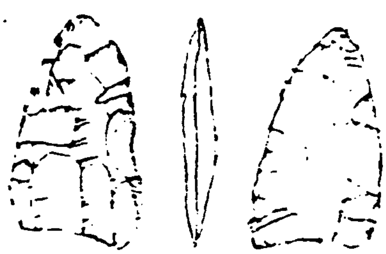


a.

b.



c.



d.

Figure 19 Projectile points from Grid C. a. Point base from C, b, 140-150 cm; b. Raddatz style from C, b, 160-170 cm; c. Union style from C, b, 170-180 cm; d. Hill style from C, b, 170-180. Drawings by Michael Kobusiewicz.

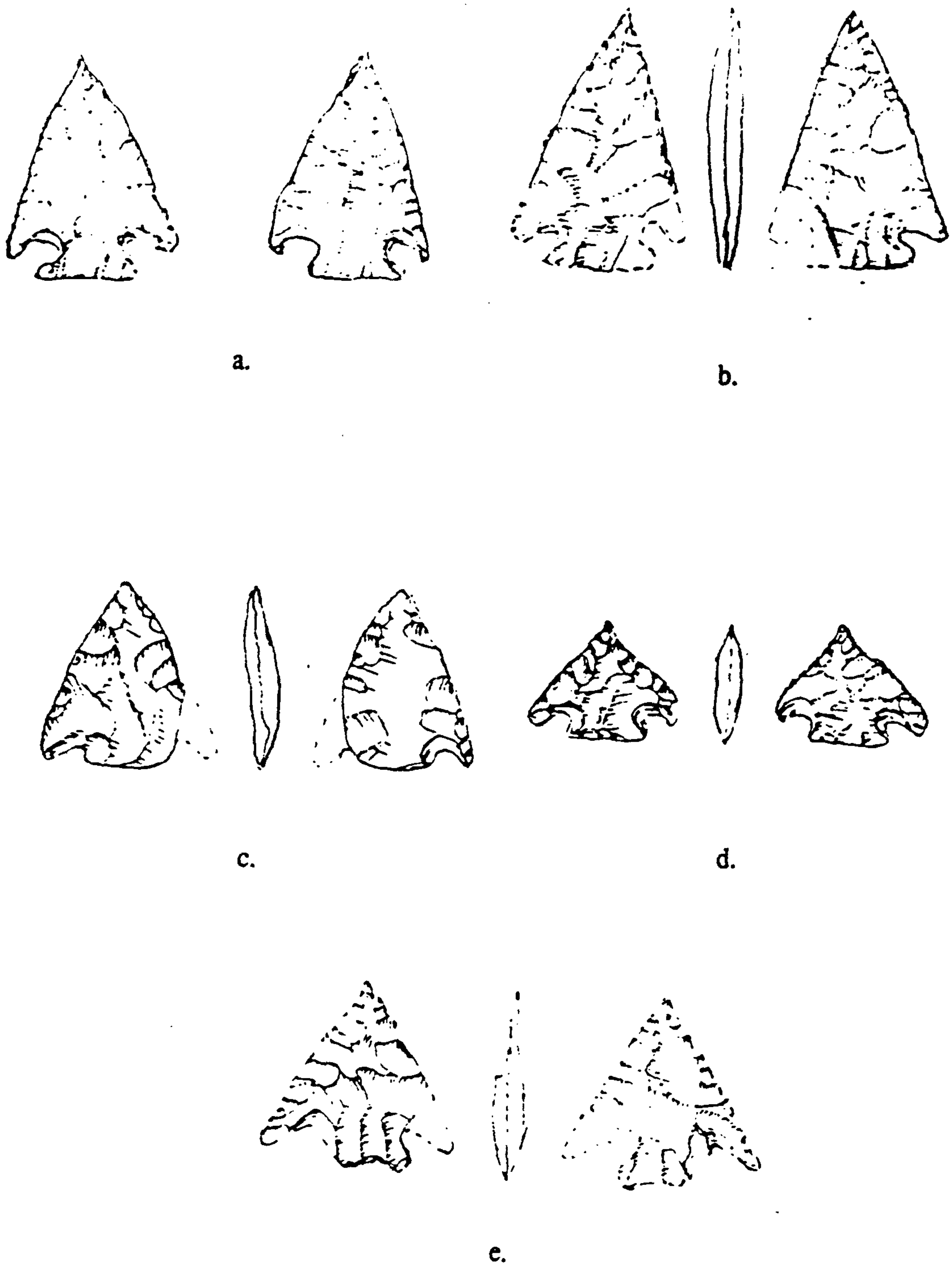


Figure 20. Pelican Lake type points from Grid C. a, b, c and d from square c, 120-130 cm; e. Row II, square 3, 140-150 cm. Drawings by Michael Kobusiewicz.

CHAPTER VII

CONCLUSION

The Buchanan site

The Buchanan site provides an extremely important window to aid understanding of human adaptations in the Middle and Late Archaic periods of the midwest and of Iowa. The moderately deep cultural deposits were sealed and relatively undisturbed, although stream activity wrought changes in parts of the deposits, especially in portions of the upper layers of Grid C and possibly in the south eastern portion of Grid B. The paleosols serve as well-defined time markers, confirmed by 11 radiocarbon dates. The site contains a wealth of information about Archaic age human habits from about 6000 years ago down to about 2500 years ago. Later Woodland age materials such as ceramic sherds also were recovered from layers closer to the modern surface. Historic materials are present as well. In order to gain understanding of what was happening at the site, it helps to attempt placing information gained from them into previously postulated models developed from ethnographic, historical and archaeological records.

Subsistence - Settlement Models

Hunter-gatherer conduct seems to follow the idea that benefit is gained when paid for by the least expenditure of energy, which describes a group of subsistence/settlement models known as "optimal foraging" plans. Ambrose and Lorenz (1990:8-18) offer a "flexible" model with four sub-groups within the "optimal foraging" category of behavioral models. In their model a relationship is seen to exist between the abundance and predictability of resources and hunter-gatherer choices of survival strategies. The abundance and predictability of floral and faunal resources can vary both seasonally and regionally. They may be evenly dispersed or congregate in a single locale. The number of plant or animal species within an area can be highly variable. The outcropping of rock suitable for tool manufacturing does not occur evenly over the landscape. The quality of available rock is quite diverse as well (Ambrose and Lorenz 1990:8-18).

Drawing from ethnographic and archaeological accounts, Ambrose and Lorenz developed a model with four parts relating the relative predictability and abundance of resources to settlement patterns, resource gathering and territoriality. In the first part resources are both predictable and dense supporting medium-sized, and geographically stable groups. In the second one, resources are predictable but scarce supporting small groups with a medium amount of mobility. In the third part of the model, resources are unpredictable but dense supporting large and highly mobile populations. And in the fourth part, resources are both unpredictable and scarce supporting only small highly mobile groups (Ambrose and Lorenz 1990:8-18).

Of the four scenarios depicted (Figures 21 and 22), the first most closely matches the model for the eastern woodlands devised by Meltzer (1988). In his survey of Early Paleo-indian period sites in eastern North America, Meltzer has proposed a different settlement pattern for the forested east than that of specialized hunting, including the megafauna, that is generally portrayed for the supposedly highly mobile peoples living in the western grasslands (Meltzer 1988:3,41). In the eastern woodlands where kill sites are rare, the evidence does not support that model for all of the makers of fluted points (Meltzer 1988:3-4). A few sites in the northern part of the region contained caribou remains when that area possibly supported tundra fauna and flora. However, sites in southerly forested areas contained fruits, nuts and fish, indicating a generalized harvesting. Meltzer suggested that many of the "fluted projectile points" were intended to be hafted knives, and used as all-purpose tool. These "points" display markings commensurate with cutting activities. Meltzer advanced the idea that late tundra specialized

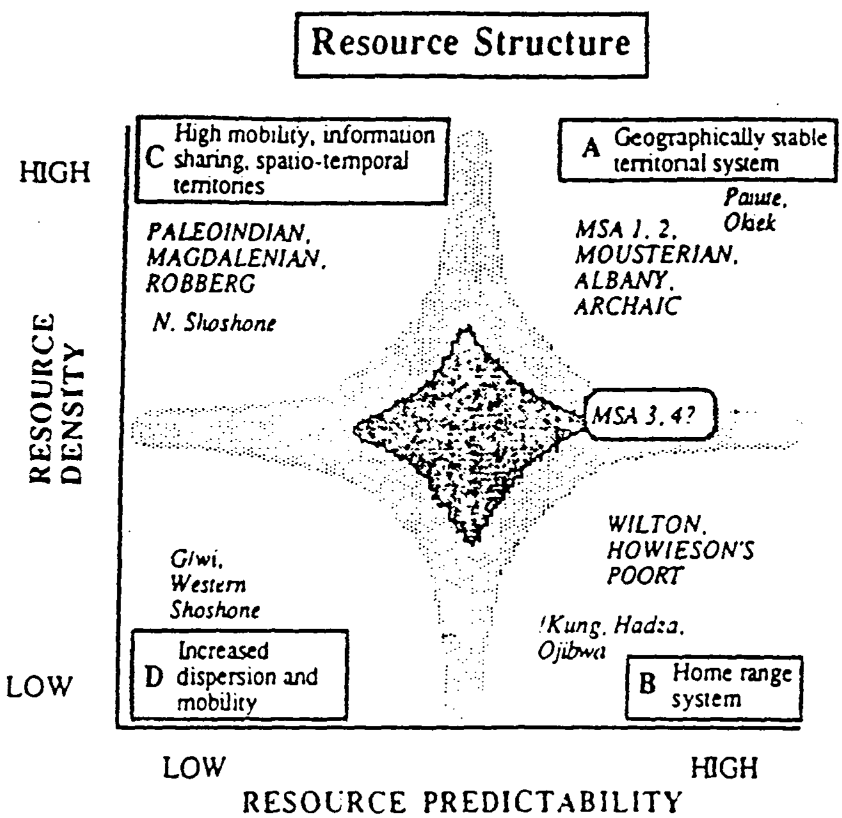


Figure 21. Relationship between resource patterns and hunter-gatherer strategies. (Ambrose and Lorenz 1990:9).

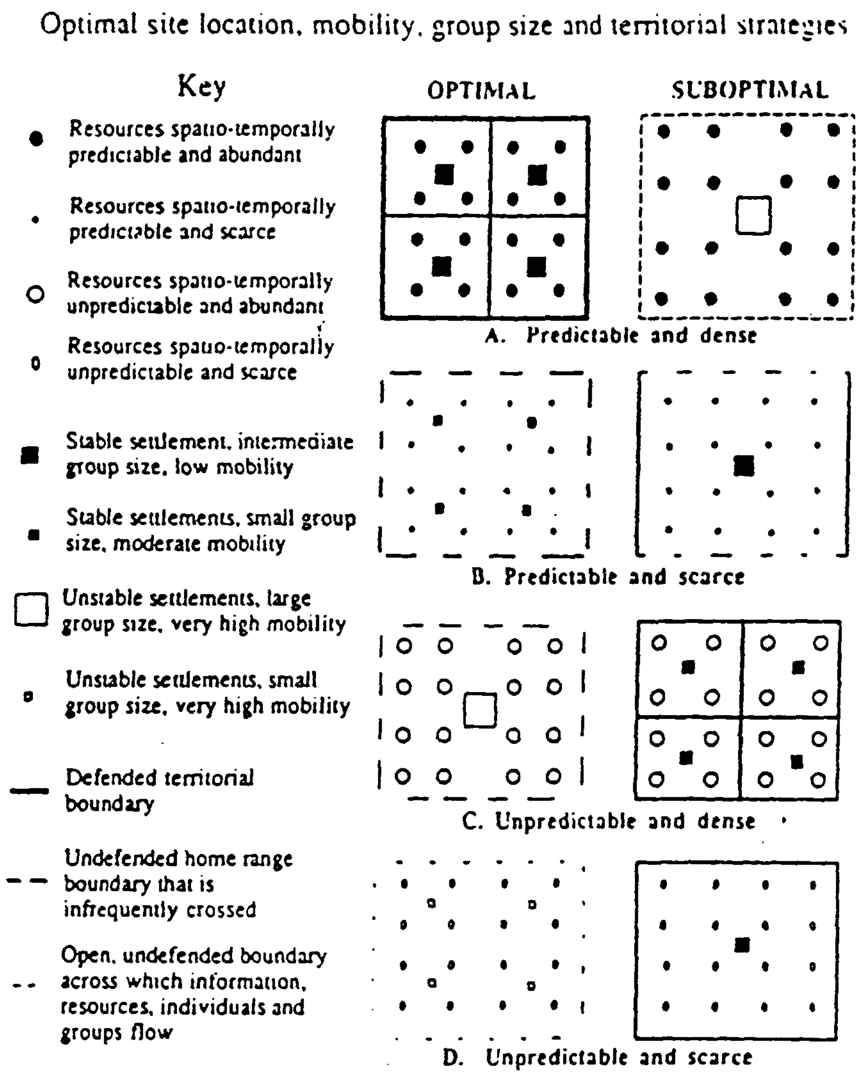


Figure 22. Four patterns of settlement strategies proposed by Ambrose and Lorenz (1990:15).

hunting developed out of a general foraging pattern in which diverse resources are harvested by a population settled in a stable pattern that continued down through time in the eastern forested regions (1988:41-43). If, as Meltzer suggests stable settlement patterns were established early in the forested areas then this same pattern likely continued westward to the Modoc Rock Shelter and Koster sites in the forested (but with prairie in the uplands) Mississippi valley with their deeply stratified deposits.

Generally, this middle part of the continent is a transitional zone grading, east to west, from a dominant forested environment into various types of grass communities from tallgrass prairie to shortgrass plains. Trees decline in abundance to the west, but it is a mistake to assume that this means an absence of forest and a decline in resources. Gallery forests were present in stream valleys and as groves in the uplands. Floral and faunal species from both forest and grass lands were not only present but abundant before European settlement in North America, as John Madson has noted:

> The tallgrass prairie was a great faunal crossroads -- the eastern limit of some wildlife species, the western limit of others....[A]nd its carrying capacity for many types of wildlife was immense. (1982:130).

Northward from Modoc and Koster, the Buchanan site is located within a relatively rich area at the edges of forest and tallgrass prairie. This zone of forest-prairie provides habitat for more species than do either forest or prairie singly, that is, the zone exhibits the "edge effect" (Brown 1985:30,40).

Based on ethnographic and historic records, Tatum (1980) developed a model for hunting groups following the bison migrations in the short grass prairie region. The introduction of the horse changed some parts of the basic pre-existing communal hunting patterns but for the most part others, such as hunting by small groups, were left untouched. The hunters, on foot, knew and took advantage of the seasonal changes in bison behavior by using different hunting methods (Tatum 1980:149-151). During warm seasons groups came together to engage in communal hunts when the bison also congregated. They separated during the cold seasons into much smaller groups of two to three families when the bison also split into smaller units that during inclement weather were more likely to be found in the sheltering valleys than in the uplands. These peoples established semi-permanent camps in weather-protected valleys where important alternative food and non-food resources were available, such as deer, elk, wolf, and assorted useful plants (Tatum 1980:152-158,165). Practicing a seasonal scheduling they made repeated visits to specific locations where at least a minimum quantity of support resources were available. Tatum argued that this is specialized, adaptive behavior in order to harvest bison as a main resource. During the Altithermal, as the short grass province advanced eastward the bison followed, preferring the shorter grasses as these seem to be more nutritious per unit of volume (Tatum 1980:159,161,164,165).

Fit of the Buchanan Site into the Model

The location of the Buchanan site is unlike the forest environment described for Meltzer's southern region or the Ambrose and Lorenz Model A; neither for the semi-arid Woodland/scrub area for Model B nor the desert of Model D. At best the vegetation pattern may somewhat resemble portions of Meltzer's northern region as the melting ice released the land allowing the growth of low growing plants and eventually the gradual spread of forested areas. Perhaps, a better match would be with the lands inhabited by the bison-hunting Northern Shoshone.

Increasing aridity after about 7700 years ago resulted in the spread of prairie, at least in the uplands. However, gallery forests continued along stream valleys although with different species reflecting greater aridity. Willow and poplar mixed with prairie upland species were identified in valley sediments (Van Nest 1987:61-63). Presumably, the valley of the South Skunk in the past also contained varieties of vegetation that would have been beneficial to Archaic people. Assorted nuts and other plant materials were recovered from the excavation units. Today a mixed forest vegetation community, including oak, hickory, hackberry, and gooseberry, covers the Buchanan site valley. Assorted herbaceous plants, including poison ivy and nettles also grow here.

Wendland estimated precipitation rates at about ten percent lower than today's rate for the Cherokee site during the arid period following the onset of the Holocene (Wendland 1980:147). This would be a reduction from 28.5 inches (722.88 mm) down to about 25.5 inches (650.5 mm) in northwest Iowa (Shutler et al 1980:4). A ten percent reduction in central Iowa (see Chapter V) would reduce the 32 inches (82 cm) to about 28.8 inches (73.8 cm). This suggests that the climate and resulting vegetation pattern at the Buchanan site may have been similar to that existing in northwest Iowa today. It still would have been within the tall grass prairie climatic and vegetative province (Brown 1985:30) albeit possibly at the western edge of it. [Today the western edge of the tallgrass region lies at about the 98 th meridian in eastern Kansas, Nebraska and the Dakotas (Brown 1985:33).] At worst, such as in droughty years, it may have represented a transition zone between tall and short grass vegetation regions. In any case, it was not unrelieved grassland. The area was laced with river valleys containing gallery forests, extensions of the eastern woodlands, and other species in abundance that are not generally found in the uplands (Tatum 1980:151,160).

At the Buchanan site the predominant use of local stone is similar to Meltzer's groups in the non-glaciated region. Also, the high percentage of expedient tools is unlike the carefully crafted and curated northern tool kit in the same study. Local stone usage also fits in the Ambrose and Lorenz Model B. Most, if not all, of the lithic artifacts could have been made from the Buchanan drainage array of rocks (Ballard 1992; personal communication). The color spectrum and texture range of the artifacts coincide with that of rocks found in the drainages. Additional sources of lithic material are arrayed over the uplands. Numerous prehistoric quarrying sites have been located within a few miles of the Buchanan site (Gradwohl and Osborn 1972:7-9,15,28,29,109,112-115).

The high percentage of debitage resulting from the manufacturing rather than from the resharpening process suggested initial preparation within the source area. This high proportion is true for both Grids B and C through time. The use of heat treatment on lithic material, about 15 to 30 percent of all lithic artifacts, down through most of the horizons may reflect a stability in the lives of these peoples. The scrapers may have been used in the initial processing of meat and hide.

The sizable portion of expedient tools suggest their importance and may be an adaptive device in a place with plenty of lithic resources. These tools would have been quickly made and used, then tossed away when they were no longer needed or became too dulled for effective use. In Grid B, informal tools were about 30 percent at the 200-230 cm level, increasing through time to about 60 percent at the 120-160 level, and declining to about 36 percent at the 60-70 cm level. In Grid C, informal tools constituted about 35 percent in Horizon II and declined to about 10 percent in Horizon I.

The proportion of resharpening flakes never exceeded 10 percent in any of the levels. None were recovered from Grid C's Horizon III or from Grid A. Cortex flakes in Grid B at about 40 percent at the 200-230 cm level declined through time to about 13 percent at the 60-60 cm level. In Grid C, the proportion of cortex flakes increased through time from about eight percent to about 28 percent.

The ratio of heat treated lithic artifacts varied but was represented in all horizons in all grids. Grid A contained the least amount of treated items. Heat treatment fluctuated through time in Grid B but in Grid C, its use increased through time.

Four point styles were recovered from Grid B. The Tama style points came from sediments dated to about 5200 years ago. This point style is regularly found in Iowa and may be comparable to Brannon points from Koster (Morrow 1984:60). The Hidden Valley, or Etley, style point was recovered from the upper levels of the channel sands and gravels and dating is uncertain. However, points similar to the Buchanan point have been reported from the Koster dating to about 3900-2900 years ago (Brown and Vierra 1983:186). The Sedalia style point was found in sediments at least 3000 years old. This style of point has been reported from the Pigeon Roost Creek at about 2900 years old and also from Koster ranging from about 3900 to about 2900 years ago. The Osceola type was recovered from sediments about 5500 years old. This style has also been recovered from Pigeon Roost Creek site sediments dated at about 6100 to about 4800 years ago. The Cherokee site contained a representative of this style dated to about 6300 to 5900 years ago.

From Grid C the five points identified as Pelican Lake style are from sediments about 2400 years old. They are commonly found in Iowa and to the west and northwest. Also, one of the Buchanan examples (Figure 20, figure b) may resemble some Koster points as reported by Morrow (1984:76). A Hill style point and a Union style point came from sediments dated at about 4200 years ago. The Raddatz style point came from a level that is close to about 4200 years old. This style has also been reported from the Pigeon Roost Creek site at about 6000 to 4800 years ago.

The Buchanan site contained a variety of plant and animal remains from forest, prairie and riverine environments and is broadly similar to the generalized hunting and gathering groups of Meltzer's study and to the Ambrose and Lorenz Models A and D. Deer and bison bone found in the excavations attest to the presence of large animals of prey. Also, the remains of muskrat, badger, turtle, bird, and raccoon have been identified from the 1987 excavations (Semken nd). The hearth in Grid A contained remains of bird, otter, deer and turtle (Semken nd). In Grid B, bison and deer were recovered from the dump in the lowest horizon as well as small animals such as muskrat. Turtle remains were retrieved from this deposit as well (Semken nd; Field records). River fish bone and clam shell were recovered from only Grid C.

Bison herds migrated seasonally, followed in later centuries by mobile hunters on foot as described by Tatum (1980). Historic groups came together in the warm seasons for communal hunts and dispersed with the onset of winter. Repeated seasonal visits were made to favored river valley locations where alternate resources were available as well as the occasional bison (Tatum 1980:152-158) The large deposit of bison bone near the upper reaches of Lateral B may represent a jump episode organized by the site's inhabitants (Ballard 1992:personal communication).

Although, several point styles were found at the Buchanan site, they were spread over a 3000 year period and roughly equivalent chronologically with similar styles associated with the Pigeon Roost Creek site in central Missouri; the Koster site in southern Illinois; and with the Cherokee site in northwest Iowa. The presence of these point styles may have resulted from human migratory activity and/or an exchange of ideas.

The considerable depth of the deposits suggest repeated visits but not to the extent of Koster or other Archaic age base camp deposits. There were no deposits that were clearly midden areas, except possibly, for the few small features containing a concentration of debitage in Grid B. In Lewis' study, the central Illinois base camps did not necessarily contain burials or evidence of house structure, but they did have a midden area (Lewis 1992: personal communication).

A high faunal/floral diversity, due to the "edge effect," was available locally as well as regionally throughout the prairie/forest transition zone. Possibly these people practiced a mixed subsistence of seasonal hunts, involving a high degree of mobility,when the bison were more likely to be plentiful, shored up by the older generalized system of hunting and gathering as described by Meltzer.The densities in Table 6 indicate an increase in occupation beginning from, at least, 6000 years ago which seems to have continued through the Late Archaic at Grid C, and generally at Grid B except for the sharp decline at the 120-160 cm level. This trend toward increased occupation would have occurred as the altithermal climate ameliorated toward the cooler, more moist climate of the present.

The Buchanan site does not fall neatly into any of the four models proffered by Ambrose and Lorenz. Increased mobility in the warmer months while following the bison could put them into Model C. But reduced mobility and relatively confined to favored protected areas to which they made repeated visits, projects these people into Model B with its high diversity of resources. The selection of available resources at the protected Buchanan site and the surrounding area may have been a favored, semi-permanent camp (Tatum 1980). They possibly had a regional, customary home range with scheduled stops and an undefended boundary over which information passed freely, not unlike the basic traditional pattern still in place down to historic times as described by Tatum (1980).

Subsequent study A microwear analysis of the lithic artifacts from Buchanan should reveal what actual activities occurred, in addition to lithic tool manufacture. A faunal analysis needs to be conducted on all bone materials collected after 1987. Also, an analysis of the Buchanan site plant remains would more clearly delineate harvesting conditions during these early occupations. A study of the remaining bison bone in the upper reaches of the B Lateral could shed light on why they were there. The clam shells from Grid C also need study.

Currently the site is privately owned. In a broader scale, the ideal situation for the future of the Buchanan site would be to assure access to it by assorted researchers from multiple disciplines interested in various aspects of its present and past environmental conditions.

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APPENDIX A

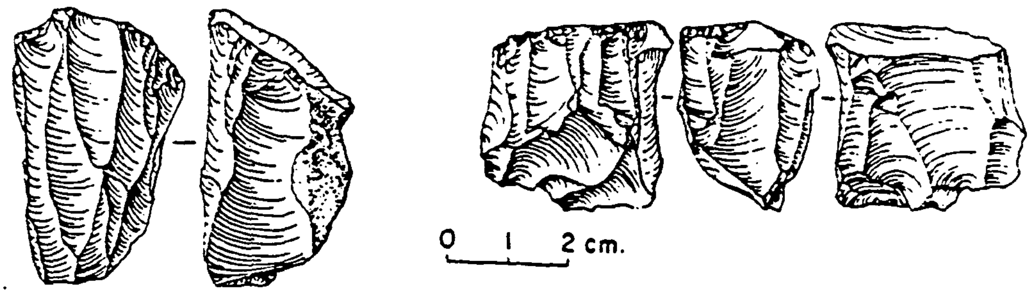
LITHIC TYPOLOGY FOR THE BUCHANAN SITE, AMES, IOWA

Revised summer 1989

CORES (LG)

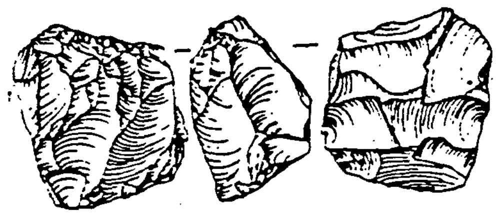
Formal core preparation does not seem to be widely evident in lithic assemblages of the Midwest (IA, IL).

LCS: Single Platform



LCM: Multi-directional bipolar and opposed platform cores, as well as cores with randomly oriented platforms.

(Addington 1986:figure 56)



LCI: Informal. Prepared platforms not evident. Cobbles or fragments with a few randomly oriented flake scars, indicating the removal of a few potentially useful flakes. (Also see Core Tablet p. 93 and also thick Bifaces p. 94.)

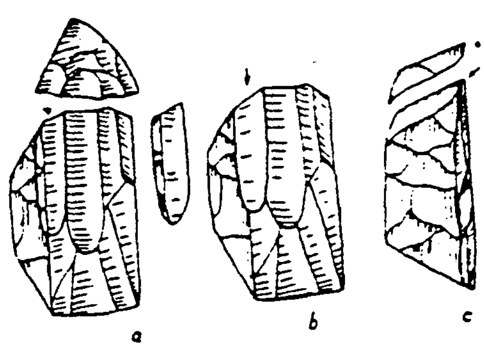


Figure from Schild showing simplified examples of later stages of core exploitation showing a blade removing portion of prepared side (a and b) and a rejuvenation flake (c) (1980:65).

DEBITAGE (LD)

The most general term for a product of reduction is flake, a more specific category is blade. The difference between flake and blade is metrical. A blade is at least two times as long as it is wide. A broken blade is classified as a flake if it does not meet this criterion.

A flake is a fragment detached from a stone: its sharp edge results from being removed from the stone's rim (i.e. core platform edge). Tools were often formed from such flakes (or blades); if so, the flake/blade is regarded as a blank, otherwise it is debitage.

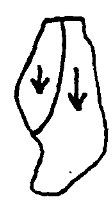
A synonym for debitage is waste, but this is misleading because unmodified flakes/blades were often used as tools. When such pieces exhibit use damage, they are classified as tools (see LTU).

Both flake and blade have a platform and bulb of percussion; otherwise the piece is a chip or chunk.

LDC1: Cortex Flakes - (more than) > 50 percent.

LDC2 Cortex Flakes - (less than) < 50 percent.

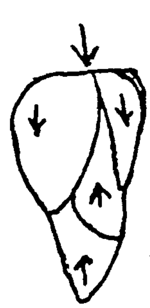
LDF: Flakes with unidirectional dorsal scars. (Probably from single platform cores.)



(Bower 1989)

LDB: Blades with unidirectional dorsal scars (Same as LDF except for dimensions.)

LDMF: Flakes from multi-directional core; opposed platforms or various platforms.



(Hayes and Bower 1989)

LDMB: Blade from multi-directional core (same as LDMF except for dimensions).

LDFU: Flakes of unknown origin. Impossible to determine whether core was single or multi-platform.

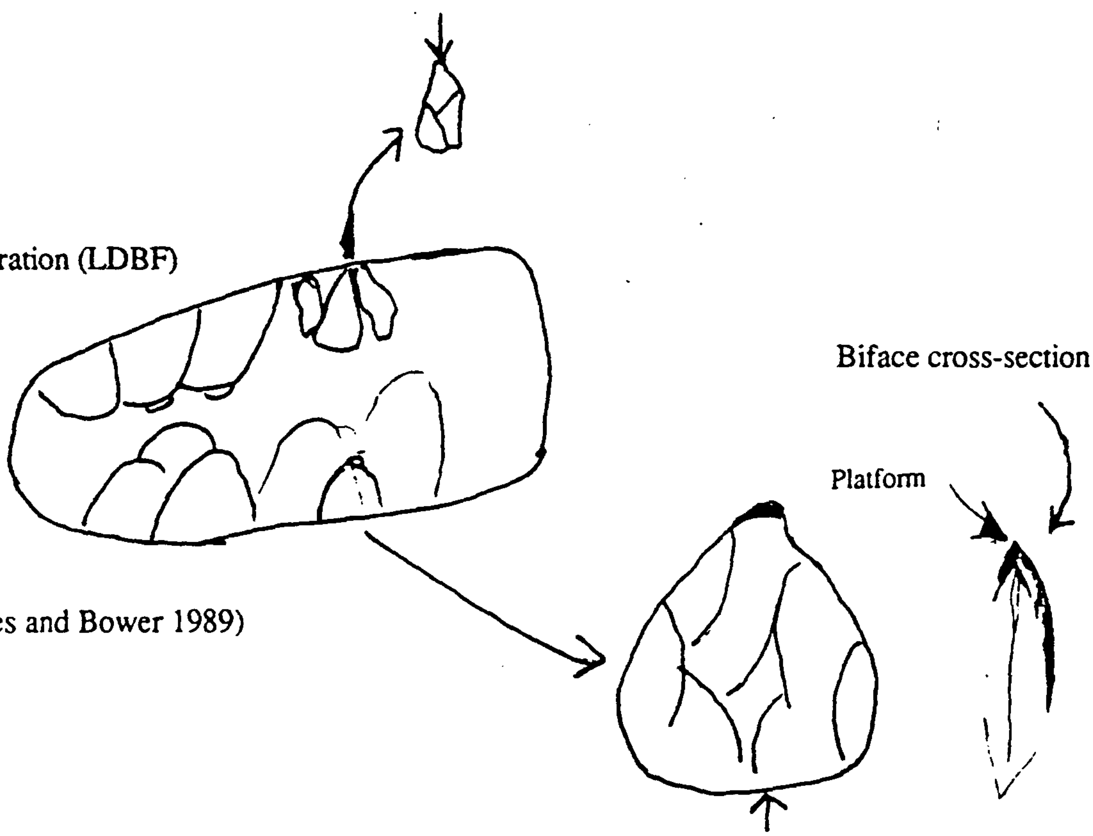
(Bower, 1989)

LDBU: Blade of unknown origin (same as LDFU except for dimensions).

LDT: Core Tablets - rejuvenation to restore appropriate angle for striking platform renewal.

LDBF: Biface preparation (or thinning) flake. Usually thin flake, relatively narrow, small platform. May have utilized edge (as in LTU)>

Preparation (LDBF)



(Hayes and Bower 1989)

Resharpening (LDRF)
(Hayes and Bower 1989)

(Hayes 1989)

LDBB: Biface preparation blade (same as LDBF, except for dimensions).

LDRF: Biface resharpening flake. Relatively broad, thick platform; flake may also be thick, contains substantial portion of original biface edge; platform often an acute angle in profile, sometimes exhibits lipping. May contain evidence of utilization. (See illustration with LDBF p. 93.)

LDRB: Biface resharpening blades (same as LDRF, except for dimensions).

LDC: Chips. Have no bulb of percussion or platform; some are broken flakes while others are merely shatter fragments. The difference between chips and chunks is one of size. Chips would have a maximum distance of five mm in at least one dimension, while chunks have a minimum dimension in excess of five mm.

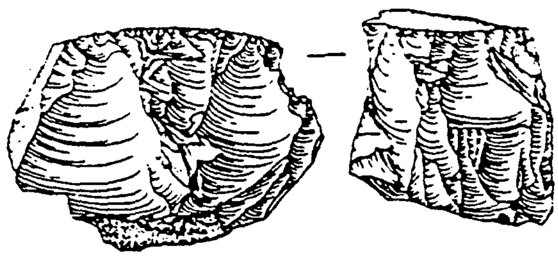
LDCC: Chips with cortex.

LDH: Chunks (see LDC).

LDHC Chunks with cortex. Core fragments, etc.

SHAPED (CHIPPED) TOOLS (LC)

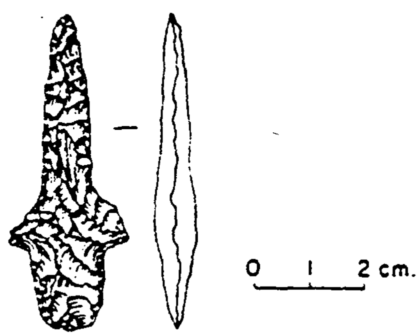
LTBC: Bifaces - crude, thick, irregular cross-section. Continuous edge. May have served as prepared cores. (Also see LCI p. 91.)



LTBT: Bifaces - thin with lenticular cross-section. Some may have served as cores, most probably blanks for manufacturing points, etc.

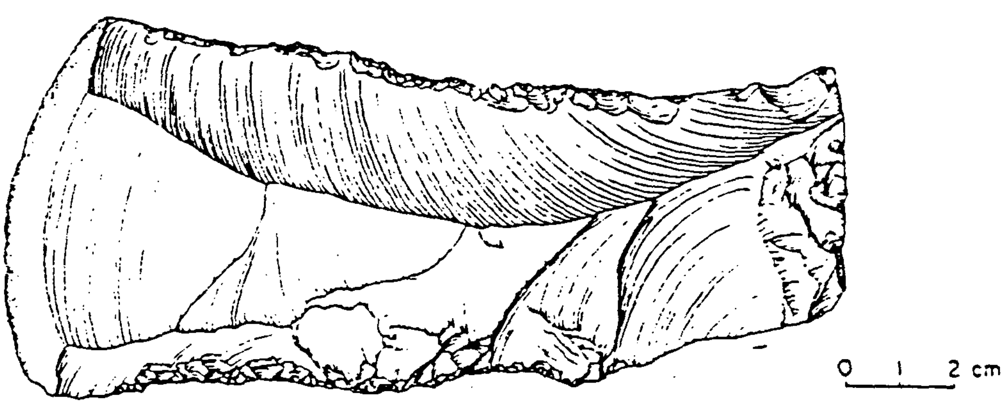
LTP: Points. Requires hafting element, i.e. must have flute, stem, tang, or notch.

LTD: Drills (usually T - shaped in Archaic assemblages).



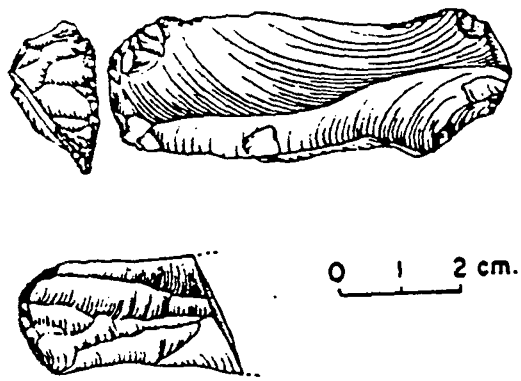
(Addington 1987:figure 46)

LTS: Scrapers - irregular. Steeply retouched flakes, retouch not normal to flake axis. (Old World Side-scrapers more formally made.)



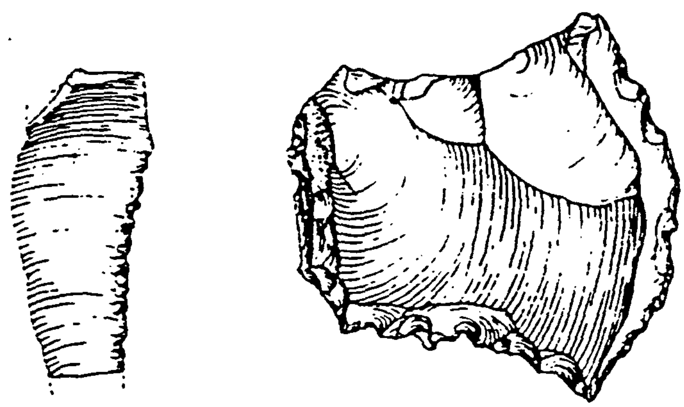
(Addington 1986:figure 21)

LTE: Endscrapers. Convex, steeply retouched edge more or less normal to flake axis.



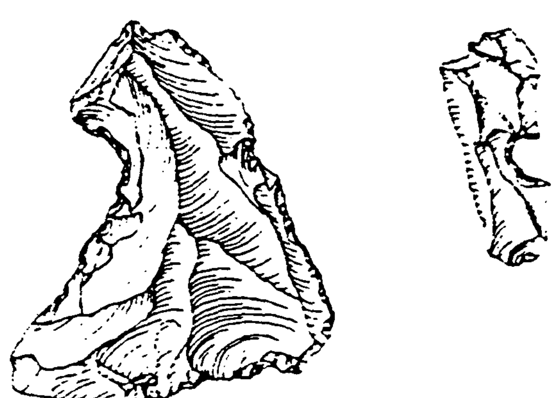
(Addington 1986:figure 13)

LTF: Denticulates on flakes. Serrated edge.



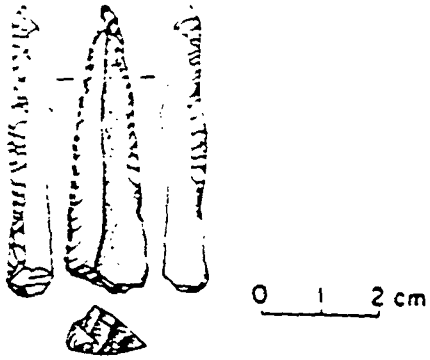
(Addington 1986:figure 27)

LTN: Notches. Concave retouched edge.



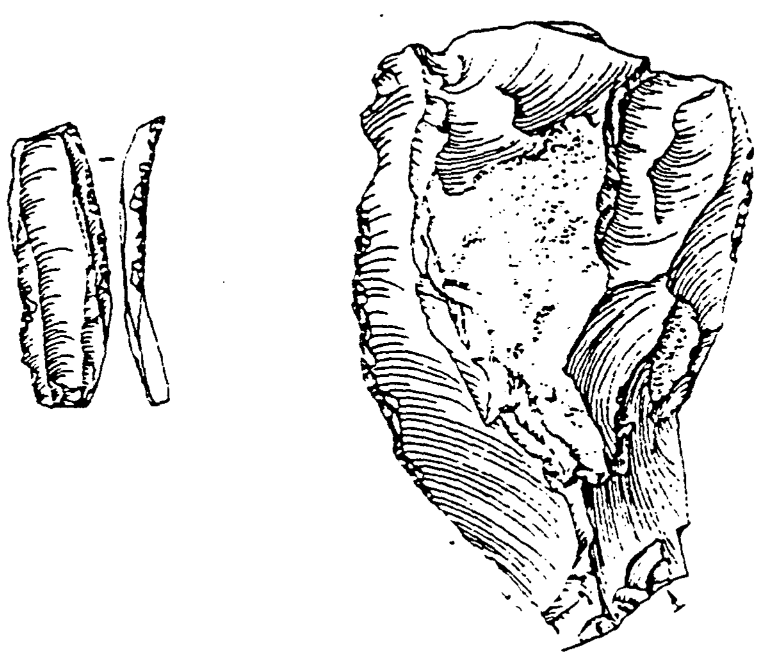
(Addington 1986:figure 29)

LTH: Perforators. Sharp point.



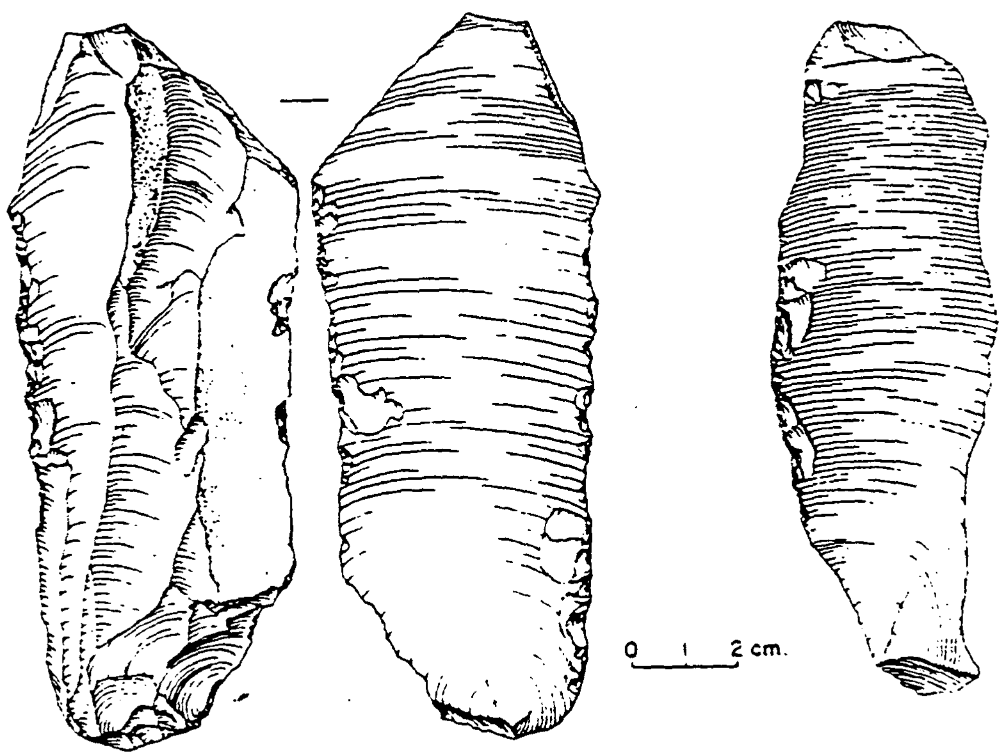
(Addington 1986:figure 38)

LTR: Retouched Flakes/Blades; low angle retouch (unlike scraper).



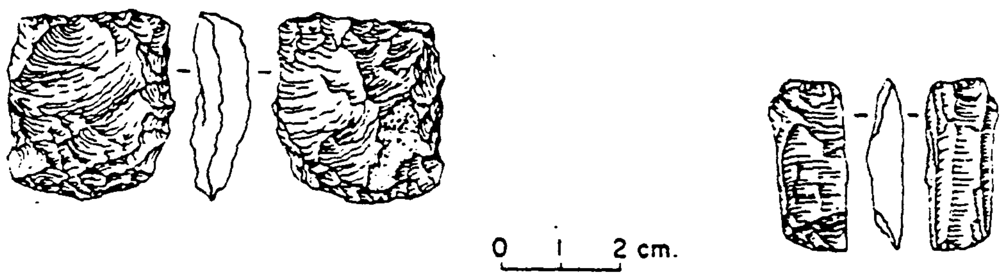
(Addington 1986:figure 24)

LTT: Unshaped tools. Casually retouched, sometimes difficult to distinguish from irregular scraper (LTS), whose retouch is steeper.



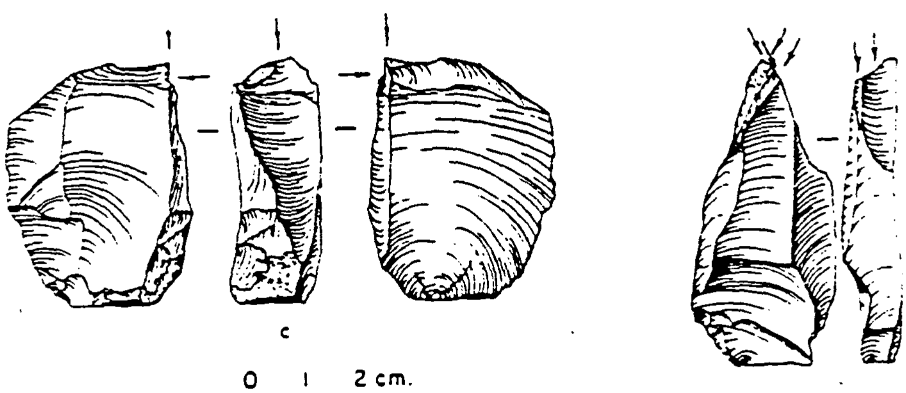
(Addington 1986:figure 52)

LTW: Wedge. With damaged edge, erratic flake removal. Flakes with two or three edges, heavily battered with scaliform, bruised, bashed edge. Opposed edges battered. Used in (eg.) cracking bones for marrow. Can grade into bipolar cores. (Also, found in Old World called *Outils Ecailles* or *Pîece Esquillées* i.c., scaled pieces.)



(Addington 1986:figure 30)

LTG: Graver. Bone working tool, often shaped by burin scar(s).



(Addington 1986:figure 32)

GROUND STONE (LG)

LGa: Axes - large woodworking implements.

LGC: Celts - small axe heads, sometimes ceremonial (e.g. hematite celt, too soft for wood cutting).

LGX: Abraders - includes shaft straighteners and abrader for edge sharpening.

LGG: Grinder - lower grindstone - LGGG; Grinder - upper (mano) - LGGM

LGS: Pipes.

LGN: Pendants.

MISCELLANEOUG (LM)

LMP: Pigment.

LMPW: Worked pigment.

LMF: Fire-cracked rock - Fractured cobble with angular intersection of fracture surfaces, heavily weathered and often exhibit red discoloration due to oxidation by high temperature fires. Often consists of igneous and metamorphic rock types common to glacial till deposits, though sedimentary (e.g. limestone) are also included.

LMA: Anvil/pecked stone.

LMH: Hammerstone.

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APPENDIX B

BUCHANAN SITE LITHIC ARTIFACT DATA FROM GRIDS A, B, AND C

Table 1. Data from Grid A

DEPTH	SQUARE	TYPE	#'S	WT	LMF	HEATED	DESCRIPTION
200-205	I, 1	LTU	1	2.80		1	light gray/gloss
205-210	I, 1	LDH	1	1.50			white
205-210	I, 1	LDHC	1	3.70			mottled gray
	I, 1		2	5.20			
205-210	II, 1	LDBF	1	0.10			white
205-210	II, 1	LDC	1	0.20		1	cream-pink
205-210	II, 1	LDC1	1	2.20			med gray
205-210	II, 1	LDFU	1	0.80			dark gray
205-210	II, 1	LDMF	1	2.30			dark gray
	II, 1		5	5.60		1	
205-210	III, 1	LDC	1	0.05			mottled tan
210-215	I, 1	LCI	1	35.70			white
210-215	I, 1	LDBU	1	7.10			mottled gray
210-215	I, 1	LDC2	1	7.90			mottled gray
210-215	I, 1	LDH	1	69.90			mottled gray
210-215	I, 1	LDMF	1	5.40			mottled gray
210-215	I, 1		5	126.00			gray-green rhyolite/LMH/54.6 g
210-215	II, 1	LCI	1	82.10			white
210-215	II, 1	LDBB	1	0.05			dark gray
210-215	II, 1	LDBF	2	0.20			dark gray
210-215	II, 1	LDC	1	0.10			light gray
210-215	II, 1	LDC1	1	2.20			white
210-215	II, 1	LDH	1	0.60			white
210-215	II, 1	LTU	1	11.50			mottled gray
210-215	II, 1						gray-green rhyolite/LMH 81.3 g
210-215	II, 1		8	96.75	1812.00		
215-220	I, 1	LDC2	1	1.50			
215-220	I, 1	LDFU	3	5.10			mottled gray
215-220	I, 1	LDT	1	2.30			white
215-220	I, 1		5	8.90	116.00		
215-220	II, 1	LDC	2	0.30			mottled gray
TOTALS			31	245.60	2063.90	2	

Table 2. Data from Grid B, -I,1 & 2

DEPTH	TYPES	#'S	WT	LMF	HEATED	DESCRIPTIONS
110-120				28.00		
160-170	LDHC	2	3.80		1	chert, 1 cream 1 gray-pink
160-170				13.70		
170-180	LDRF	1	0.60			cream
170-180	LDC	1	1.70			black
170-180	LDCC	2	0.50		1	1 cream-pink 1 dark gray
170-180	LDF	1	0.80		1	pink
170-180	LDC1	1	0.20			white
170-180	LDH	3	8.60			2 cream 1 light gray
170-180		9	12.40	436.90	1	
180-190	LDHC	1	0.70			mottled
180-190	LDH	1	13.20			light gray
180-190	LDMF	2	5.50		1	1 cream 1 red
180-190		4	19.40		1	

Table 3. Data from Grid B, -II, 2 & 3

DEPTH	TYPES	#'S	WT	LMF	HEATED	DESCRIPTIONS
60-70	LDC2	1	2.80		1	gray-pink
90-100	LDH	1	1.20			light gray
140-160	LDC	1	0.40			lt gray
160-170	LDRB	1	0.60		1	gray-pink
160-170				7.10		
170-180	LDC2	1	2.50			med gray
170-180	LDMF	1	2.10			light gray
170-180	LDHC	6	40.50			LGX sandstone / 50.8 g
170-180	LDH	5	10.90			2 cream 4 tan
170-180	LDCC	2	2.80			3 cream 2 tan
170-180						cream
170-180						
170-180		15	58.80	65.80		
180-190	LCI	2	19.10		1	1 mottled tan 1 gray-pink / channel fill
180-190	LDC	2	2.80			2 cream/ channel fill
180-190	LDCC	2	4.20			1 tan/ 1 light gray/ channel fill
180-190	LDH	4	19.40			1 cream/ 1 mottled gray/1 tan/ channel fill
180-190	LDHC	5	16.30			1 mdd gray/3 tan/1 cream/ channel fill
180-190	LDMF	3	14.30		1	1 pink/1 med gray/ 1 gray pink/ channel fill
180-190						gry-gre rhyolite/multi/direct straia/LG 243.1
180-190				286.30		channel sands & gravels
180-190						gry-gre rhyolite/w/abrasions,LMH 241.7 g

Table 4. Data from Grid B, -III to -VI

DEPTH	SQUARES	TYPE	#'S	WT	LMF	HEATED	DESCRIPTION
80-90	(III, 2 & 3	LDC	4	2.80		2	1 pk/ 2 mtld gry
80-90	(III, 2 & 3	LDF	1	0.30			md gry
80-90	(III, 2 & 3	LDH	2	1.10			1 tan/1 md gry
80-90	(III, 2 & 3		7	2.20		2	
60-70	(IV, 2 & 3	LDC	6	6.20		2	1crm/1md gry/1pk/1crm-gloss/1 gry/1rd
60-70	(IV, 2 & 3	LDHC	2	2.50			1 gry/ 1 wh
60-70	(IV, 2 & 3	LDMF	2	2.00	109.80	1	pk
60-70	(IV, 2 & 3		10	10.70	109.80	3	
70-80	(IV, 2 & 3	LDC	2	11.30		1	pk
70-80	(IV, 2 & 3	LDC2	2	5.20		1	lt gry/ 1 glossy
70-80	(IV, 2 & 3	LDCC	1	0.30			lt gry
70-80	(IV, 2 & 3	LDF	1	0.90			tan
70-80	(IV, 2 & 3	LDFU	2	1.40			lt gry
70-80	(IV, 2 & 3	LDH	2	10.90			1 dk gry 1 crm
70-80	(IV, 2 & 3	LDHC	1	8.00			dk gry-brown
70-80	(IV, 2 & 3	LDMF	2	2.70		1	1 pk/ 1 wh
70-80	(IV, 2 & 3	LTBC	1	3.40			wh fragment
70-80	(IV, 2 & 3	LTH	1	9.10		1	gry-pnk
70-80	(IV, 2 & 3		15	53.20	35.40	4	
80-90	(IV, 2 & 3	LDC2	1	2.30		1	lt gry-pk
80-90	(IV, 2 & 3	LDH	3	11.20			1 wh/ 1 tan/ 1mtld gry
80-90	(IV, 2 & 3	LDMF	1	0.30			mtld gry
80-90	(IV, 2 & 3	LTU	1	5.80	17.60	1	mtld gry/gloss
80-90	(IV, 2 & 3		6	19.60	17.60	2	
100-110	(IV, 2 & 3				65.40		
80-90	(V&(VI,1				146.60		
90-100	(V&(VI,1	LDC	1	0.10			md gry
130-140	(V&(VI,1				169.10		
140-150	(V&(VI,1	LDC	1	0.30			brown

Table 4 continued.

DEPTH	SQUARES	TYPE	#'S	WT	LMF	HEATED	DESCRIPTION
60-70	(V, 1	LDC	4	6.20			1 wh 1 crm 2 mtld gry
60-70	(V, 1	LDH	1	2.80	79.8		
60-70	(V, 1		5	9.00	79.80		
70-80	(V, 1	LDC	1	1.10			mtld gry
70-80	(V, 1	LDH	1	2.80			mtld gry
70-80	(V, 1		2	3.90			
150-160	(V, 1	LDMC	1	1.10			lt gry
60-70	(VI, 1	LDB	1	2.30			wh
60-70	(VI, 1	LDBF	1	0.10		1	mtld gry-pink
60-70	(VI, 1	LDC	3	1.40		1	2 tan 1 pink
60-70	(VI, 1	LDC2	1	0.40		1	pink
60-70	(VI, 1	LDH	2	1.80			md gry
60-70	(VI, 1	LDHC	3	2.60			1 tan 1 lt gry 1 dk gry
60-70	(VI, 1	LDMF	3	5.70		1	1 pk/ 2 mtld crm
60-70	(VI, 1	LTP	1	2.70		1	base gry-pk/glossy
60-70	(VI, 1		15	17.00		5	
70-80	(VI, 1	LCS	1	18.50			wh
70-80	(VI, 1	LDC	4	1.70			3 lt gry 1 mtld gry
70-80	(VI, 1	LDCC	1	1.10			lt gry
70-80	(VI, 1	LDC2	1	8.40			wh
70-80	(VI, 1	LDF	1	0.80			md gry
70-80	(VI, 1	LDMF	7	15.90	111.20		1 crm 6 mtld gry
70-80	(VI, 1		15	46.40	111.20		

Table 5. Data from Grid B, I, 1 & 2

DEPTH	TYPES	#'S	WT	LMF	HEATED	DESCRIPTIONS
60-70	LDBF	3	0.20			
60-70	LDC1	1	0.90			
60-70	LDCC	2	0.30			
60-70	LDF	1	0.70			white
60-70	LDH	2	4.30			1 fine/1 med /grain fe stain
60-70	LDHC	4	2.40			
60-70	LDMF	3	1.40			white
60-70	LTU	1	7.90	9.60	1	
60-70		17	18.10	9.60	1	
120-130				74.10		mottled w/pink
130-140	LDC2	1	2.40			
130-140						granite./ LG 549.1 g
130-140						granit/decaying /LGG? 548.9 G
140-150	LDBF	1	1.00		1	pink
140-150	LDC	1	0.50		1	gray-pink
140-150	LDH	1	1.80			mottled gray
140-150		3	3.30	500.60	2	
150-160	LDF	1	2.10			med gray
150-160	LDH	1	1.20			mottled gray
150-160	LDMF	1	6.10			tan
150-160	LDRB	1	0.80			cream
150-160		4	10.20	51.00		
160-190	LCI	2	18.80		1	1 light gray w/some cortex
160-190	LDC	1	0.90		1	white-pink
160-190	LDC1	4	16.40			mottled gray
160-190	LDC2	1	9.70		1	gray-pink
160-190	LDF	1	0.70			
160-190	LDFU	3	4.80		1	1 tan/ 1 cream/ 1 cearm-pink
160-190	LDHC	5	23.30		2	mtld tan/1 gry pk/2 chalky/1 hetd w/spall
160-190	LDMF	8	13.80		3	
160-190	LTBC	1	18.10		1	pink-cream
160-190	LTR	1	3.00		1	light gray/sheen
160-190	LTU	1	2.20		1	white/slight sheen
160-190		28	111.70	50.80	12	3 gray 1 dark red

Table 5 continued.

DEPTH	TYPES	#'S	WT	LMF	HEATED	DESCRIPTIONS
190-200	LDF	2	0.40			
190-200	LDH	2	3.90		2	1 w/spall:limey
190-200	LDC1	1	7.90			
190-200	LDMF	3	3.20			limey
190-200		8	15.40	2.80	2	mottled gray-pink
200-210	LDB	1	0.60			
200-210	LDBF	4	0.40		1	
200-210	LDC1	2	2.20		1	unheatd/limey
200-210	LDC2	1	3.70		1	
200-210	LDF	1	0.30			
200-210	LDH	2	0.70			limey
200-210	LDMF	3	26.30		2	
200-210	LTT	1	12.60		1	
200-210		15	46.80		6	
210-230	LCI	3	32.30			1 cream/1 light gray/1 mixed gray
210-230	LDBF	2	0.20		1	mottled gray
210-230	LDC	1	0.30			dark gray
210-230	LDC1	5	19.70		3	
210-230	LDC2	7	40.30		1	3 white 2 light gry 1 med gry 1 dark gry
210-230	LDF	8	3.50			3 white1 dark gray 2 med gray 2 cream
210-230	LDHC	2	5.30			1 white/1 tan
210-230	LDMB	1	0.30		1	
210-230	LDMF	10	12.60		3	3 white 2 dark gray 2 tan 3 pink-tan
210-230	LTD	1	4.10		1	mottled gray-pink/Graham cave?
210-230	LTP	1	5.20		1	gray-pink/ 5.6T/25.9 W/23.9 L
210-230	LTS	2	6.10		1	red cortex
210-230		4	15.40		3	
213-234	LCI	1	5.50			Feature # 5 mottled gry
213-234	LDB	1	0.20			Feature # 5 med gray
213-234	LDBF	1	0.30			white
213-234	LDC1	5	7.00		1	2 white 2light gray1 pink Feature # 5
213-234	LDC2	6	11.90		2	Feature #5 2pink4white/1 w/spalls.fossil
213-234	LDF	3	3.40		1	Feature#5 2med gray/1cream w/red spots
213-234	LDH	2	5.80			Feature # 5
213-234	LDHC	2	0.80			Feature # 5
213-234	LDMF	5	6.20		2	2med gray1 wh 1 crm1dk gry w/dark red
213-234		26	41.10	4.30	6	Feature # 5

Table 6. Data from Grid B, I, 3 & 4

DEPTH	SQ	TYPE	#'S	WT	LMF	HEATED	DESCRIPTIONS
60-70	I, 3	LDC1	1	2.10			
60-70	I, 3	LDMF	1	0.70			
60-70	I, 3	LTR	1	14.30	6.30	1	
60-70			3	17.10	6.30	1	
120-130	I, 3	LDC1	1	1.10			
120-130	I, 3	LDH	1	4.60			
120-130	I, 3	LDHC	1	1.10			
120-130	I, 3	LDMF	1	4.10			
120-130	I, 3	LTR	1	3.30	9.70		
120-130			5	14.20	9.70		
130-140	I, 3	LTS	1	2.50			very rough
140-150	I, 3	LTU	1	8.10	2.30		
150-170	I, 3		2	10.60	4.60		gry-gre/w/pk rhyolite
170-180	I, 3	LDB	1	1.00			
170-180	I, 3	LDC	3	2.10			
170-180	I, 3	LDC1	1	5.60			
170-180	I, 3	LDC2	1	0.40			
170-180	I, 3	LDF	2	0.80			
170-180	I, 3	LDFU	1	0.90			
170-180	I, 3	LTP	1	5.80			gry gloss/ Tama
170-180	I, 3		9	10.80	8.40	1	
180-190	I, 3	LDBF	2	0.20			
180-190	I, 3	LDC	1	0.10			
180-190	I, 3	LDC2	3	1.20		1	
180-190	I, 3	LDF	5	1.80			sioux quartzite?
180-190	I, 3	LDFU	1	0.30		1	
180-190	I, 3	LDH	2	1.20			
180-190	I, 3	LDHC	1	2.50			wh.quartzite?
180-190	I, 3	LDMF	2	0.70			
180-190	I, 3		17	8.00	11.10		1 rhyolite 5 granite
190-200	I, 3	LDC	4	4.70			
190-200	I, 3	LDC1	1	2.20			
190-200	I, 3	LDH	2	2.00			chalky
190-200	I, 3	LDHC	1	1.30			
190-200	I, 3	LDMF	2	2.60			
190-200	I, 3		10	12.80			

Table 6 continued.

DEPTH	SQ	TYPE	#'S	WT	LMF	HEATED	DESCRIPTIONS
200-210	I, 3	LDC2	4	2.80		2	2lt gry/ 2 pnk-tan
200-210	I, 3	LDF	1	0.30		1	wh
200-210	I, 3	LDMF	1	0.40			md gry
200-210	I, 3	LTBT	1	12.60		1	
200-210	I, 3	LTS	1	2.50		1	crm
200-210	I, 3				2006.40		gry w/pnk
200-210	I, 3				2003.30		3 pk granite 1 cobble=1736.4 g
200-210	I, 3		8	18.60	4009.70	2	
210-220	I, 3	LDF	1	4.70			
210-220	I, 3	LDH	1	0.90			
210-220	I, 3	LDHC	1	9.60			
210-220	I, 3	LDMF	1	3.80			
210-220	I, 3	LTBC	1	38.90			
210-220	I, 3	LTU	1	5.10			
210-220	I, 3		6	63.00			
220-230	I, 3	LTU	3	54.80		1	
230-240	I, 3	LDMF	1	5.30			
230-240	I, 3	LDF	1	0.30			
230-240	I, 3				42.40		gry-gre rhyolite
230-240	I, 3		2	5.60	42.40		
240-250	I, 3	LDMF	1	0.60			

Table 6 continued.

DEPTH	SQ	TYPE	#'S	WT	LMF	HEATED	DESCRIPTIONS
60-70	I, 4	LDC	1	0.20			wh
60-70	I, 4	LDC2	1	3.10		1	pnk
60-70	I, 4	LDC2	1	3.10		1	pnk
60-70	I, 4	LDMF	1	5.90			md gry
60-70	I, 4		4	12.30			
140	I, 4	LCI	1	4.80		1	wh/gloss
140	I, 4	LDHC	1	11.10			crm
140	I, 4		2	15.90			
180	I, 4	LDHC	1	7.40			crm
180-200	I, 4	LDBF	1	0.40			wh
180-200	I, 4	LDC	1	1.00			wh
180-200	I, 4	LDMF	1	11.30		1	crm/gloss
180-200	I, 4	LDRF	1	0.40			wh
180-200	I, 4	LTP	1	1.10		1	lt gry/gloss broken
180-200	I, 4		4	13.10		1	
200-225	I, 4	LCM	1	327.10		1	md gry/gloss
200-225	I, 4	LDC2	1	5.90		1	crm/gloss
200-225	I, 4	LDF	1	1.40		1	crm
200-225	I, 4	LDFU	1	2.20			wh
200-225	I, 4	LDMF	1	1.10		1	lt gry/gloss
200-225	I, 4				256.00		
200-225	I, 4						gry-gre/rhyolite/ochre streak/LMH/201.7 g
200-225	I, 4					3	
			5	337.70	256.00		
225-245	I, 4	LCI	1	14.80			wh

Table 7. Data from Grid B, I, 5 & 6.

DEPTH	TYPES	#'S	WT	LMF	HEATED	DESCRIPTION
60-70	LDC2	1	0.60		1	white with gloss
60-70	LDMF	2	3.60		2	1 cream/gloss/ 1 lt gray w/red spots
60-70	LDRF	2	1.10		1	1med gray 1white-spots & gloss
60-70		5	5.30	642.00	4	
120-130	LDF	1	1.30		1	pink
120-130	LDHC	1	0.60			white
120-130	LTR	1	1.20	54.20	1	white-pink
120-130		3	3.10	54.20	1	
130-140	LDF	1	2.70			white
130-140	LDMF	1	1.90		1	pink
130-140		2	3.60	56.00		
140-150				12.00		mottled gray-pink
150-160	LCM	1	14.20			cream
160-170	LTU	1	2.90			cream
160-190	LCI	1	102.40			cream
160-190	LDC1	1	2.80			cream/ very chalky
160-190	LDC2	1	5.40			mottled gray
160-190	LDF	8	6.40		2	1white/3lt gray/4 cream
160-190	LDH	2	7.40		2	1 gray/pink 1 cream/pink
160-190	LDHC	3	1.70			2 white/ 1 gray
160-190	LDMF	4	3.70		2	1 dark gray/1lt gray/2 cream-red
160-190		20	129.80	28.00	6	granite

Table 7 continued.

DEPTH	TYPES	#'S	WT	LMF	HEATED	DESCRIPTION
190-200	LCI	1	9.90			med gray/channel sands
190-200	LDBF	2	0.30		1	1dark gray1white/channel sands
190-200	LDC	2	4.00		1	1brown/1dark gray/buried A
190-200	LDC1	9	21.60			cream/buried A
190-200	LDC2	12	32.30		4	cream red cortex/ buried A sev. grey
190-200	LDCC	2	11.20			1cream/1dark gray/buried A
190-200	LDF	9	7.20			med gray/pink/buried A/ tan white
190-200	LDH	1	1.00			cream/channel sands
190-200	LDHC	1	2.40			chky/lt gray/channel sands
190-200	LDMB	2	1.50			tan/channel sands
190-200	LDMF	7	7.10			1dark gray 2tan/buried A
190-200	LTU	3	25.70	158.00	2	1 tan1white1lt gray/buried A
190-200		51	124.20	158.00	9	
200-210	LDB	1	0.90		1	cream
200-210	LDC1	1	1.70			lt gray/white cortex
200-210	LDHC	2	13.90			1 tan/ 1 dark gray
200-210	LDMB	1	.0.80			cream
200-210	LDMF	1	10.80		1	dark gray/red
200-210		6	28.10	148.00	2	
210-220	LCM	4	110.80		1	iron-stained tan
210-220	LDC1	1	24.10		1	tan-orange
210-220	LDC2	3	10.10			2 fe stained/ 1 white
210-220	LDF	1	1.10			tan-iron stain
210-220	LDMF	2	7.20		1	1 cream/ 1 mottled gray
210-220		11	153.30		2	
220-230	LDF	1	1.10			
220-230	LTBC	1	33.90			fragment Mottled gray w/cortex
220-230	LTU	1	4.20	10.00	1	
220-230		3	39.20	10.00	1	
230-240	LDF	1	1.70		1	tan/orange/ N. wall/krotovina
230-240	LDMF	1	0.80		1	tan/orange/ from sands & gravels
230-240	LTBC	1	10.90			light gray
230-240	LTR	2	9.50	166.00		light gray
230-240		5	22.90	166.00		
240-250	LDC2	1	1.20		1	dark gray/pink
240-250				29.00		black & pink granite&w/pyrite crystals
250-260	LDRF	1	3.70			white/iron stain/chalky

Table 8. Data from Grid B, I, 7 & 8.

DEPTH	SQ	TYPES	#'S	WT	LMF	HEATED	DESCRIPTION
60-70	I, 7	LDF	1	1.40			mtld lt gry
60-70	I, 7	LDMF	1	0.70			lt gry
60-70	I, 7		2	2.10	3.10		
70-100	I, 7	LDMF	1	5.60			lt gry
70-100	I, 7				75.70		granite
130-140	I, 7	LDMF	3	9.20	4.60		mottled lt gray/ white
150-160	I, 7	LDC	1	0.70			med gry
150-160	I, 7	LDMF	1	1.50			med gry
150-160			2	2.20			
160-170	I, 7	LDC2	1	1.00		1	tan w/orgcrtx
160-170	I, 7	LDMF	1	1.00			crea,
160-170			2	2.00		1	
200-230	I, 7	LCM	4	151.30		1	1 yellow1 tan 2 mtld gry
200-230	I, 7	LDC	3	24.00			1tan/1 med gry/ 1 dk gry
200-230	I, 7	LDC1	2	8.30			1 wh/ 1 md gry
200-230	I, 7	LDC2	8	29.30		2	1crm-pk/4tn/1gry-pk2mtld gry
200-230	I, 7	LDF	4	7.50			tan
200-230	I, 7	LDHC	1	3.00			tan
200-230	I, 7	LTE	1	4.90			tan
200-230	I, 7	LTR	1	23.70	29.10	1	yellow
200-230			24	252.00	29.10	4	
230-250	I, 7	LCI	1	7.90		1	mtld gry/ from chnnl fill
230-250	I, 7	LDC2	2	3.90		1	1 dl gry (hetd) 1 lt gry
230-250	I, 7	LDHC	1	21.50			lt gry
230-250	I, 7	LDH	1	1.70		1	tan
230-250	I, 7	LDMF	4	45.30			1md gry/2 crmw/fe stain/1/w/red fe
250-260	I, 7	LDC2	1	1.50			wh
250-260			10	81.80		3	

Table 8 continued.

DEPTH	SQ	TYPES	#'S	WT	LMF	HEATED	DESCRIPTION
120-140	I, 8	LDBF	1	0.10		1	pnk
120-140	I, 8	LDFU	1	1.60			crm
120-140	I, 8	LDH	1	0.50			lt gry
120-140	I, 8	LDMF	1	1.80			lt gry
120-140	I, 8	LTBT	1	2.20			lt gry
120-140			5	6.20		1	
150-165	I, 8				22.00		
150-165	I, 8	LDC1	1	0.40			mtld gry
190-205	I, 8	LDFU	1	1.10			lt gry
190-205	I, 8	LDH	1	3.40			crm
190-205	I, 8	LDMF	1	1.60		1	md gry
190-205	I, 8	LTU	1	2.30			crm
190-205			4	8.40		1	
205-225	I, 8				72.00		
205-225	I, 8	LDC2	1	1.50			lt gry
225-240	I, 8	LCI	1	22.10			mtld gry
225-240	I, 8	LCM	1	17.20		1	crm w/orng crtx
225-240	I, 8	LDBF	2	0.50		2	1 pnk 1 gry-pnk
225-240	I, 8	LDC2	1	2.40			crm
225-240	I, 8	LDCC	1	0.70		1	
225-240	I, 8	LDFU	2	7.20			1 dk gry 1 crm
225-240	I, 8	LDH	1	6.00			dk gry
225-240	I, 8	LDH	3	9.90			tan
225-240	I, 8	LDMF	1	4.10			lt gry
240-255	I, 8	LDBB	3	0.70		3	pnk
240-255	I, 8	LDC1	21	81.90		9	tan
240-255	I, 8	LDFU	26	27.60		14	1 crm 3 lt gry 22 pnk
240-255	I, 8	LDH	5	6.70		2	2 pnk 2 crm 1 tan
240-255	I, 8	LDHC	8	55.20		7	7 pnk 1 wh
240-255	I, 8	LDMF	23	35.40		15	19 pnk 2 wh 1 tan 1 crm
240-255	I, 8	LDRF	2	4.20			pnk
240-255	I, 8	LTBC	1	14.20	89.00		wh-gr-orng Found South wall
240-255	I, 8	LTBT	1	1.00			pnk base fragment

Table 8 continued.

DEPTH	SQ	TYPES	#'S	WT	LMF	HEATED	DESCRIPTION
255-270	I, 8	LCI	2	40.20		1	mtld pnk
255-270	I, 8	LDC1	2	6.30		2	pnk
255-270	I, 8	LDC2	3	1.80		2	1 crm 1 pnk 1 red
255-270	I, 8	LDCC	1	0.90		1	crm-pnk
255-270	I, 8	LDFU	3	2.30		2	1 tan 2 pnk
255-270	I, 8	LDH	2	2.90		1	red
255-270	I, 8	LDMF	4	3.10		3	1 tan 3 pnk
255-270	I, 8	LTU	1	1.10		1	pnk

Table 9. Data from Grid B, I, 9 & 10.

DEPTH	TYPES	#'S	WT	LMF	HEATED	DESCRIPTION
60-70	LCI	1	28.50			tan
60-70	LDB	1	0.20			wh
60-70	LDC	6	4.70		1	2 md gry 1 lt gry 1 pk 1 wh 1 crm
60-70	LDHC	3	13.20		2	1 dk gry 1 pk-gry1 wh-dk gry-pk
60-70	LDFU	2	3.00			1 wh 1 crm
60-70	LDC1	5	15.70			2 crm 3 tan
60-70	LDC2	3	2.20		1	1 pk 1 tan 1 md gry
60-70	LDF	3	2.10		1	2 wh 1 pk
60-70	LDBF	10	2.00			3 wh 2 md gry 2 tan 1 pk 2 lt gry
60-70	LDMF	5	7.50	201.60	1	2 crm 2 lt gry 1 md gry
70-120	LDBF	3	0.40			1 vry tiny
70-120	LDC	1	0.10			lt gry
70-120	LDC1	1	4.80			vry lt tan
70-120	LDH	1	0.70			lt gry
70-120	LDHC	1	7.80			chalky
70-120	LDMF	2	12.30		1	
70-120	LTBT	1	21.60			fragment
70-120	LTP	1				gray&white
70-120	LTS	3	15.70		1	gray & white
70-120	LTU	1	3.60			tan&brown
70-120				1370.40		1 schist/rest granite
70-120						gry-gre rhyolite/2 LMH/156.1 g
120-130	LDBF	1	0.10			
120-130	LDH	2	12.10			i dk/1lt pink gray
120-130	LDHC	1	2.50			chalky
120-130	LDMF	2	2.10		1	unhetd dk&lt gray
120-130	LTP	1	3.20		1	tip only
120-130	LTT	1	2.10	440.00		
130-140	LCI	1	33.90		1	
130-140	LDH	1	66.30			tan/w/fossl
130-140					1	LMPW/ 29g
140-150	LDHC	2	1.70	50.00		

Table 9 continued.

DEPTH	TYPES	#'S	WT	LMF	HEATED	DESCRIPTION
150-190	LDC1	1	4.00			crm
150-190	LDC2	2	2.20		1	crm
150-190	LDF	1	2.70			med gry
150-190	LDMB	1	0.40			tam
150-190	LDMF	1	0.60			med gry
190-200	LDC1	2	9.10			1 wh/ 1 crm
190-200	LDFU	1	2.90			
190-200	LDMF	1	3.10			tan
190-200	LTP	1				
190-200	LTU	1	3.40		1	tan&pink/%crtx
190-220				45.00		
220-250	LCM	4	362.20			
220-250	LCS	1	6.30			
220-250	LDC	2	2.40			
220-250	LDC1	2	1.90			
220-250	LDC2	3	10.00		1	1 tan/1 dk gray
220-250	LDF	4	10.20		1	dark gray
220-250	LDHC	1	0.50			frm/bot/samp
220-250	LDMF	3	6.50			2gry/1 pnk
220-250	LDRF	1	0.10			
220-250	LTBC	1	12.40		1	
220-250	LTP	1	2.70		1	broken tip/dk,lt,gray,ping
220-250	LTS	1	13.10			sm/% chlk crtx/back/white
220-250	LTU	4	25.40			3lt/gray/1 dk gr/1 lrg w/hi%crtx
220-250				1665.00		1 cobble-510.6 g/220-below sands
250-260	LDBF	2	0.40		1	
250-260	LDC2	1	2.90			
250-260	LDCC	1	1.90			
250-260	LTU	1	0.60	1160.00	1	granite/ cobble

Table 10. Data from Grid B, II, 1 & 2.

DEPTH	TYPES	#'S	WT	LMF	HEATED	DESCRIPTION
120-130	LDBF	1	0.20		1	
120-130	LDC1	2	1.20			
120-130	LDHC	2	1.30			
120-130	LDRF	1	0.20		1	
120-130	LTH	1	5.50		1	
120-130	LTP	1	1.00		1	crm-pk/ Holland?
120-130		8	9.40	1.80	4	
130-140	LCM	1	23.40			
130-140	LDH	2	8.30			
130-140		3	31.70	773.10		
140-190	LCM	4	79.20			
140-190	LDB	1	0.40			
140-190	LDC	3	0.60			chalcedony
140-190	LDC1	4	4.90			
140-190	LDC2	1	6.30			
140-190	LDCC	6	2.90			
140-190	LDF	7	4.70			
140-190	LDH	5	24.50		1	
140-190	LDHC	2	5.90		1	
140-190	LDMF	3	7.60		2	
140-190	LTBT	1	1.00			broken
140-190	LTS	1	7.70			
140-190	LTU	2	7.70		1	
140-190		40	153.40	254.00	5	
190-200	LCM	7	126.50			chalcedony
190-200	LDC1	1	0.30			
190-200	LDF	6	2.10			
190-200	LDH	2	3.10			
190-200	LDHC	4	16.90			
190-200	LDMF	2	2.20			
190-200	LTBT	1	11.80			broken/reworked
190-200		23	162.90	726.00		gravel = 40.0 gr/total wt

Table 10 continued.

DEPTH	TYPES	#'S	WT	LMF	HEATED	DESCRIPTION
200-210	LCM	1	32.90			
200-210	LDB	2	0.80			
200-210	LDC1	6	25.10		1	
200-210	LDCC	3	1.60			
200-210	LDF	7	1.90			
200-210	LDHC	8	32.10			
200-210	LTU	3	9.70		1	w%crtx
200-210		30	104.10	306.10	2	
210-220	LCI	1	31.80			wh/w/crtx
210-220	LCM	1	31.90			
210-220	LDC	1	0.30			
210-220	LDC1	5	3.20			chky/cht 4 1.9
210-220	LDC2	9	43.30			
210-220	LDMB	1	0.60			
210-220	LDMF	5	14.20			
210-220	LTBT	1	8.10			
210-220	LTP	1	5.20			
210-220				136.20		gravel=26.3 gr/total wt
210-220						rhyolite/LMH 146.0 G
210-220		25	138.60	136.20		
220-230	LDC	2	3.10		1	
220-230	LDCC	1	0.30			
220-230	LDHC	1	2.10			
220-230	LDMF	3	15.90		2	
220-230	LDRF	1	3.00			
220-230	LTP	2	4.00		1	broken
		10	28.40		4	
TOTALS		139	628.50	2197.2	15	

Table 11. Data from Grid B, II. 3 & 4.

DEPTH	TYPES	#'S	WT	LMF	HEATED	DESCRIPTION
120-130				164.20		
130-140	LDC1	1	0.40		1	
130-140	LDC2	1	6.50			
130-140	LDMF	1	2.10			
130-140		3	9.00	116.60	1	
140-150	LDC2	2	1.30			
140-150	LDFU	1	0.60			
140-150	LTU	1	5.30		1	
140-150		4	7.20		1	
150-160	LTS	1	2.20			
160-175	LCI	1	3.70			
160-175	LDBF	2	0.20			
160-175	LDC	3	3.10		1	
160-175	LDC2	3	3.60		2	
160-175	LDF	5	5.30		1	
160-175	LDH	2	4.80			
160-175	LDHC	3	14.10			
160-175	LDMF	3	2.70			
160-175	LTU	1	7.70			
160-175		23	45.20	56.90	4	2 gray-pink 1 gray-green rhyolite
175-190	LDBB	3	2.70			
175-190	LDBB	5	2.70		1	
175-190	LDBF	50	4.80		11	
175-190	LDC	16	4.80		2	
175-190	LDC1	8	55.10			
175-190	LDC2	12	6.60		4	
175-190	LDCC	10	2.50		1	
175-190	LDF	11	6.10		1	
175-190	LDH	6	9.90		2	1 chalcedony
175-190	LDHC	3	22.20			
175-190	LDMF	5	9.40		1	
175-190	LTBT	1	1.10		1	chalcedony
175-190	LTU	3	17.40		3	
175-190		133	145.30	888.10	27	2 LMH rhyolite/w/fe/785 g

Table 11 continued.

DEPTH	TYPES	#'S	WT	LMF	HEATED	DESCRIPTION
190-200	LCI	1	29.10			
190-200	LDBF	2	0.30			
190-200	LDC1	5	4.00			
190-200	LDC2	2	8.80		1	
190-200	LDCC	1	0.10			
190-200	LDF	5	5.50			
190-200	LDFU	3	9.90		2	
190-200	LDH	4	24.70		1	
190-200	LDHC	1	0.40			
190-200	LDMF	7	16.30		1	
190-200	LTE	1	7.10			
190-200	LTP	1	2.70		1	mtld gry-pk tip gone/Osceola?
190-200	LTU	3	4.50			
190-200		36	113.40	2124.60	6	
200-210	LCI	3	35.70			2 crm/1wh
200-210	LDBF	1	0.10			lt gry
200-210	LDC1	1	6.30			wh
200-210	LDC2	2	2.80		1	1pnk/ 1 wh
200-210	LDF	3	2.30			1 wh/ 1 lt gry/ 1 dk gry
200-210	LDHC	1	1.10		1	gry-pnk
200-210	LDMF	3	3.80			md gry
200-210						1 red/4 gry-gre rhyolite/LMH/1485.4 g
200-210		14	52.10		2	
210-220						gry-gre rhyolite/1 LMH/100.7 g
TOTALS		214	374.40	3350.4	41	

Table 12. Data from Grid B, II, 5, 6, 9 & 10.

DEPTH	SQUARE	TYPES	#'S	WT	LMF	HEATED	DESCRIPTIONS
120-130	II, 5 & 6	LDC	1	0.30			
120-130	II, 5 & 6	LDC1	1	0.20			
130-160	II, 5 & 6	LDH	1	0.70			
130-160	II, 5 & 6	LDHC	1	3.70			
130-160	II, 5 & 6	LDC2	1	1.80			
130-160	II, 5 & 6		5	6.70	90.20		1 granite 1 gry-gre rhyolite
70-120	II, 9 & 10	LDC1	1	7.50			
70-120	II, 9 & 10	LDH	1	7.70			
70-120	II, 9 & 10	LDM	2	36.80		2	
70-120	II, 9 & 10	LTP	1	3.30		1	lt gry-pk Turin
70-120	II, 9 & 10	LTP	1	6.80			md gry/gloss/snd/mtrxHardin-barbed?
70-120	II, 9 & 10	LTU	1	6.60			
70-120	II, 9 & 10		7	68.70		3	
120-190	II, 9 & 10	LCM	2	51.60		2	
120-190	II, 9 & 10	LDC1	1	2.50			
120-190	II, 9 & 10	LDC2	1	5.20		1	lots/fractures
120-190	II, 9 & 10	LDHC	1	2.60		1	
120-190	II, 9 & 10	LDMF	1	2.30			
120-190	II, 9 & 10	LDRF	1	1.90			
120-190	II, 9 & 10	LTBC	1	9.60		1	
136	II, 9 & 10	LTE	1	7.50		1	mtld gry-pk/embedW wall fe stained
120-190	II, 9 & 10	LTS	2	20.10		2	
120-190	II, 9 & 10		11	103.30	903.60	8	1 cobble =689.9
190-200	II, 9 & 10	LCM	2	31.40		1	
190-200	II, 9 & 10	LDC1	1	1.40			
190-200	II, 9 & 10	LDC2	5	22.30		1	
190-200	II, 9 & 10	LDF	2	2.20			
190-200	II, 9 & 10	LDH	2	2.70			
190-200	II, 9 & 10	LDHC	4	12.90		1	
190-200	II, 9 & 10	LDMF	2	6.90		1	
190-220	II, 9 & 10		18	79.80	15.80	4	

Table 12. continued.

DEPTH	SQUARE	TYPES	#'S	WT	LMF	HEATED	DESCRIPTIONS
220-250	II, 9 & 10	LCI	1	27.10			tan
220-250	II, 9 & 10	LDC1	2	9.10			tan
220-235	II, 9 & 10	LDC2	14	56.40		7	pk tan 2gry/wh1tanw/bone from E wall
220-250	II, 9 & 10	LDF	2	4.10		1	crm
220-235	II, 9 & 10	LDH	2	10.10		1	dk gry
220-250	II, 9 & 10	LDHC	1	0.90		1	crm/pnk
220-235	II, 9 & 10	LDHC	1	3.30			
220-250	II, 9 & 10	LDMF	5	7.70		1	4lt gry 1 dk gry
223	II, 9 & 10	LTE	1	6.00			
TOTALS			29	124.70		11	

Table 13. Data from Grid B, III, IX, and 0.

DEPTH	SQUARE	TYPE	#'S	WT	LMF	HEATED	DESCRIPTION
70	III, 2				173.00		
60-70	IX, 2	LCI	1	106.70			mtld gry
60-70	IX, 2	LDC1	1	16.30			gry
60-70	IX, 2	LDC2	2	3.50			mtld gry
60-70	IX, 2	LDFU	5	6.70			tan/ gray
60-70	IX, 2	LDH	1	10.20			gry
60-70	IX, 2	LDT	1	2.90			gry/"core fragment
60-70	IX, 2		11	146.30	184.00		
60-70	O, 2 & 3	LCI	1	31.50			md gry
60-70	O, 2 & 3	LDC	7	2.10		2	2 pink 3 med gray 1 lt gray white
60-70	O, 2 & 3	LDC2	4	3.80		2	2 mtld gry 1red 1 pink
60-70	O, 2 & 3	LDCC	3	1.30			mtld gry white
60-70	O, 2 & 3	LDF	2	1.70			mtld gry
60-70	O, 2 & 3	LDH	6	21.60		1	1 pk 2 tan 1 lt gry 2 mtld gry
60-70	O, 2 & 3	LDHC	3	16.70		1	gry-pk 1 white 1 cream
60-70	O, 2 & 3	LDMF	2	7.50			1 lt gry 1 dk gr
60-70	O, 2 & 3	LTR	1	1.70		1	gry-pk spots/gloss
60-70	O, 2 & 3		29	87.90	636.30	7	
70-80	O, 2 & 3	LDC2	1	0.20		1	crm-pk
70-80	O, 2 & 3	LDF	1	2.50		1	crm-pk
70-80	O, 2 & 3	LDH	1	2.50			wh
70-80	O, 2 & 3	LDHC	2	3.40			1 tan 1 crm
70-80	O, 2 & 3	LDMF	2	2.20		1	1 crm-pk 1 lt gry
70-80	O, 2 & 3	LTBT	1	2.30		1	gry-pk
70-80	O, 2 & 3		8	13.10	53.30	4	
80-90	O, 2 & 3				782.00		
100-110	O, 2 & 3	LDC2	1	0.70		1	crm-pk
100-110	O, 2 & 3	LDCC	3	11.80			1 lt gry 1 dk gry 1 pk

Table 13 continued.

DEPTH	SQUARE	TYPE	#'S	WT	LMF	HEATED	DESCRIPTION
110-120	O, 2 & 3	LDH	1	1.50			wh
110-120	O, 2 & 3	LDRF	1	0.60		1	pk
110-120	O, 2 & 3	LTBT	1	3.80			wh
110-120	O, 2 & 3		3	5.90	7.00	1	
120-130	O, 2 & 3	LDBF	1	0.10		1	crm-pk
120-130	O, 2 & 3	LDHC	2	3.90			2 tan
120-130	O, 2 & 3				28.90		
130-140	O, 2 & 3	LDHC	1	7.10		1	wh-pk
140-150	O, 2 & 3	LDH	1	2.70			md gry
140-150	O, 2 & 3				100.40		
150-160	O, 2 & 3	LDC	1	0.70			crm
150-160	O, 2 & 3	LDH	1	0.70			crm

Table 14. Data from Grid B, V, VI, and VII.

DEPTH	SQUARE	TYPE	#'S	WT	LMF	HEATED	DESCRIPTION
60-70	V, 2	LCS	1	7.8		1	dk gry
60-70	V, 2	LDBF	4	0.90			dk gry
60-70	V, 2	LDBU	1	0.20			md gry
60-70	V, 2	LDC	4	3.20		1	2dk gry 2lt gry
60-70	V, 2	LDC	6	0.70			dk gry
60-70	V, 2	LDC2	1	3.70		1	wh
60-70	V, 2	LDFU	13	13.20			dk gry
60-70	V, 2	LDH	1	0.70			dk gry
60-70	V, 2	LDMB	2	2.40			dk gry
60-70	V, 2	LDMF	4	8.90		1	3 dk gry/ 1 lt gry
60-70	V, 2	LDRF	3	2.10			2 dk gry/1 crm
60-70	V, 2		40	43.80	568.00	4	
60-70	V, 4	LDC2	1	1.20		1	wh
60-70	VI, 1	LDC2	1	5.80		1	
60-70	VI, 1				399.90		
70-120	VI, 1				133.70		
120-150	VI, 1				79.60		
150-170	VI, 1				304.60		
60-70	VII, 1	LDC	3	2.20			1 wh/ 2 dk gry
60-70	VII, 1	LDC2	1	0.50			md gry
60-70	VII, 1	LDCC	1	1.10			md gry
60-70	VII, 1	LDF	1	4.40			md gry
60-70	VII, 1	LDFU	4	2.40		1	3 lt gry/1 dk gry
60-70	VII, 1	LDRF	1	0.70			dk gry
60-70	VII, 1		11	11.30	468.00	1	
80-90	VII, 1				6.3		
60-70	VII, 3	LDC2	1	1.40			mtld gry
60-70	VII, 3	LDH	2	3.80		1	md gry/1 crm
60-70	VII, 3	LDRF	2	1.00			md gry
60-70	VII, 3	LTR	1	1.90		1	md gry
60-70	VII, 3		6	8.10	164.00	2	
60-70	VII, 5	LDFU	1	1.10			md gry
60-70	VII, 5				130.00		
60-70	VII, 5	LTBC	2	56.90		2	md gry
60-70	VII, 9	LDRF	1	0.40			tan

Table 15. Data from Grid C, I, 1 & 2.

DEPTH	TYPES	#'S	WT	LMF	HEATED	DESCRIPTIONS
120-130	LDC	1	0.40		1	mtld gry/gloss
130-140	LDMF	1	1.20			dk gry
140-150	LCI	1	44.20		1	crm-pk
140-150				1160.00		
150-160				1098.00		
150-160						ceramic/lumpy CPXG
160-170	LDC	1	1.10			wh
160-170	LDFU	1	2.10			mtld gry
160-170	LDH	1	1.50			wh
160-170	LDMF	4	17.10			3 lt gry 1 wh
160-170	LDRF	2	1.90		1	1 pk 1 md gry
160-170		9	23.70	1914.00		
170-175	LDH	1	13.00			mtld gry/ from clay
170-175	LDFU	2	7.50		1	1lt gry1crm-pk/ from clay
175-185	LDBF	3	2.30		1	1 pk 1 mtld gry 1 cream
175-185	LDC	4	3.80			2 crm/ 2 mtld gry/ loam
175-185	LDC1	2	2.20			md gry/ loam
175-185	LDC2	4	3.50			mottled gry/ mottled tan
175-185	LDCC	5	1.90		1	3 tan 1 crm-pk 1 mtld gry/wet screen
175-185	LDFU	6	7.70			med. gray 2 cream 3 lit gray
175-185	LDH	9	43.10		3	crm md gry mtld gry wh crm-pk gry-pk
175-185	LDHC	2	1.20			crm/ wet screen
175-185	LDMF	3	8.20			cream/ lit gray
175-185	LDRB	3	0.40		3	2 crm-pk 1 gry-pk/ wet screen
175-185	LDRF	1	2.70			mtld gry/ loam
175-185		42	77.00	938.00		
TOTALS		57	167.00	5110.00	12	

Table 16. Data from Grid C, II, 1 & 2.

DEPTH	TYPE	#"S	WT	LMF	HEATED	DESCRIPTION
80				172.00		
120				730.00		
130-140	LDBB	1	0.90		1	pk
130-140	LDC	1	3.10		1	tan-pk
130-140	LDC1	1	6.70			mtld gry
130-140	LDFU	2	2.10			crm
130-140	LDMF	1	0.90			md gry
130-140		6	13.70	129.00	2	black/coal w/iron oxide/LM 3.3 g
140-150	LDBB	1	1.20		1	
140-150	LDBF	7	11.20		4	mtld gry/gloss/ Feature #2
140-150	LDC	4	7.20		1	1md gry3 gry-pk1 wh Feature #2
140-150	LDC1	5	15.60			1 mtld gry-pk 2 gry/wet screen
140-150	LDC2	1	0.40		1	1 dk gry 3 mtld gry1 md gry Feature #2
140-150	LDCC	1	0.90		1	pk
140-150	LDFU	1	6.10			pk/ Feature # 2
140-150	LDH	4	14.10		2	dk gry/ Feature # 2
140-150	LDMB	1	1.00			mtld gry1 gry-pk 1pk Feature #2
140-150	LDMF	5	46.30		4	lt gry
140-150	LDRF	5	8.30		4	lt gry4 mtld gry-gloss Feature #2
140-150	LTBC	1	3.30			mtld tan-pk lt gry-pk crm-pk Feat.#2
140-150	LTBT	1	23.90		1	mtld gry/Feature #2
140-150	LTG	1	2.70		1	lt gry-pk/Feature #2
140-150	LTR	1	6.10			lt gry-pk
140-150	LTU	3	12.80		3	wh
140-150		42	161.10	10435.60	23	dk gry-pk mtld gry-pk Feature # 2
150-160	LCI	1	147.60			
150-160	LDBF	1	0.20			blk/lt gry crtx ?
150-160	LDC	2	2.30		2	md gry
150-160	LDC1	1	1.70		1	1 crm-pk 1 gry-pk
150-160	LDFU	1	1.00			gry-pk
150-160	LDH	2	7.80		1	wh
150-160	LDMF	4	5.40		1	1 wh 1 pk
150-160	LTR	1	1.90		1	1 mtld gry/1 wh/1crm/1 gry-pk
150-160	LTU	1	9.50			mtld gry/gloss
150-160		14	29.80	808.00	6	gry-gre rhyolite LMH 177.5g

Table 16 continued.

DEPTH	TYPE	#"S	WT	LMF	HEATED	DESCRIPTION
160-170	LDB	1	0.80			crm
160-170	LDBB	1	0.10		1	pk/ wet screen
160-170	LDBF	7	0.70			5 crm 2 lt gry
160-170	LDC	9	1.70			2 crm 2 tan 1 lt gry 1 dk gry 1 wh
160-170	LDCC	1	1.50			tan
160-170	LDF	1	0.50			mtld gry/ wet screen
160-170	LDFU	3	2.70			med gray 1 mottled gry 1 cream
160-170	LDH	2	4.90			1 wh 1 mtld gry
160-170	LDMF	2	4.20			1 lt gry 1 mtld gry
160-170	LDRB	2	0.30		1	1 md gry 1 pk
160-170	LDRF	3	2.00			1 cream1 dk gray 1 med gray
160-170	LTS	1	6.10		1	mtld gry/gloss
160-170		33	25.50		3	
170-180	LCI	2	315.30		1	lrg-mtled gry 303.7g/sml-11.6 g/gloss
170-180	LDC	1	0.40		1	crm-pk
170-180	LDC1	1	0.90			lt gry
170-180	LDFU	1	0.90			lt gry
170-180	LDH	1	20.50			gry-tan
170-180	LDMB	1	10.70			lt gry
170-180	LDRF	1	1.20		1	gry-pk
170-180	LTR	2	27.60			mtld gry
170-180		10	377.50		3	
180-190	LCI	1	41.30		1	mtld gry-pk
180-190	LDMF	2	2.70		1	1 lt gry 1 gry-pk
180-190	LTBC	2	34.70			1 mtld gry/ 1 brown-Knife River ?
180-190		5	78.70		2	
190-200	LDBF	1	0.20		1	crm-pk
190-200	LDCC	1	1.40		1	crm-pk
190-200		2	1.60		2	
TOTAL		112	687.90	12274.6	41	

Table 17. Data from Grid C, unit a.

DEPTH	TYPE	#'S	WT	LMF	HEATED	DESCRIPTION
120-130	LDC1	3	6.40		3	1 dk gry 2 crm w/red
120-130	LDH	1	3.20		1	lt gry-pk
120-130	LDHC	1	6.90		1	crm-pk
120-130	LDMF	1	1.60			md gry
120-130	LTBT	1	7.80			md gry
120-130		7	25.90		5	
130-140	LDCC	2	2.10			1 lt gry 1 tan
130-140	LDHC	1	6.50			mtld gry
130-140	LDMF	3	5.20			1 crm 2 md gry
130-140		6	13.80	169.70		
140-150	LCI	2	6.10			1 lt gry 1 mtld gry
140-150	LCM	2	38.20		1	1 tan 1 lt gry-pk
140-150	LDBF	1	0.30		1	crm-pk
140-150	LDC	1	0.40		1	crm-pk
140-150	LDC1	1	0.80			wh
140-150	LDC2	6	28.00		5	1 tan-rd 1 lt gry 3 crm-pk
140-150	LDF	1	0.50			wh
140-150	LDH	2	12.80			1 tan 1 lt gry
140-150	LDHC	4	12.10			2 md gry 2 lt gry
140-150	LDMF	4	16.40		3	1 lt gry 1 wh-pk 1 dk gry-pk 1 crm-pk
140-150		24	115.60	9.20	11	
150-160	LDF	1	0.80			mtld gry
150-160	LDMF	1	1.50			mtld gry
150-160	LTE	1	4.70		1	mtld crm
150-160		3	7.00		1	

Table 17 continued.

DEPTH	TYPE	#'S	WT	LMF	HEATED	DESCRIPTION
160-170	LCM	3	44.80			3 md gry
160-170	LDC2	1	17.50			md gry
160-170	LDCC	1	0.70			crm
160-170	LDH	1	1.10			lt gry
160-170	LDHC	1	4.20			wh
160-170	LDMF	2	6.60		1	1 cr, 1 crm-pk
160-170		10	74.90	265.00	1	
170-180	LCM	2	168.50			md gry
170-180	LDC2	1	0.50		1	crm-pk
170-180	LDCC	1	1.10			dk gry-pk ss
170-180	LDFU	1	1.00			mtld gry
170-180	LDH	1	9.30			mtld gry
170-180	LDMF	2	1.90			1 wh 1 crm
170-180	LTP	1	1.80			md gry/ unfinished fragment
170-180	LTS	1	3.40		1	md gry/scraper-borer
170-180		10	187.50		2	
200-210	LCM	1	17.50			mtld gry
200-210	LDHC	1	0.40			wh
200-210		2	17.90			
TOTALS		61	442.60	443.90	20	

Table 18. Data from Grid C, unit b.

DEPTH	TYPE	#"S	WT	LMF	HEATED	DESCRIPTIONS
160-170	LCM	4	82.10		2	1md gry1md gry-pk1mtld tan 1 pk
160-170	LDBB	4	1.50		1	3 tan 1 gry-pk
160-170	LDBF	8	0.50			8 lt gry
160-170	LDC	20	11.20			3mtld tan8lt gry4md gry5crm
160-170	LDC1	9	20.00		3	2crm3pk2lt gry 2 md gry
160-170	LDC2	30	41.50		8	11 lt gry2wh1crm1md gry7tan2pk1red4gry pk 1crm-p
160-170	LDCC	9	5.20		3	2lt gry1md gry3mtld tan3 gry-pk
160-170	LDF	11	11.50		2	5lt gry1wh3mtld tan2gry-pk
160-170	LDFU	1	0.40			lt gry
160-170	LDH	10	2.30		1	6 lt gry3 mtld tan 1 gry-pk
160-170	LDHC	20	44.10		13	4 mtld tan 2lt gry8gry-pk4 tan-pk1red
160-170	LDMF	3	3.50			2crm1mtld tan
160-170	LTBC	1	10.20		1	wh-pk
160-170	LTBT	2	15.50		2	lt gry-pk
160-170	LTP	1	3.10			mtld tan & wh crtx/ Raddatz?
160-170		133	252.60		36	
170-180	LCM	1	77.10			mtld gry
170-180	LDBF	1	0.20		1	crm-pk
170-180	LDC	1	1.00			
170-180	LDC	2	0.50		1	1 md gry 1 pk
170-180	LDC2	7	12.80		3	2pk1gry-pk2md gry 2 mtld gry
170-180	LDCC	3	4.90		1	2 lt gry 1 pk
170-180	LDF	1	0.30			wh
170-180	LDH	5	33.40		1	1 dk gry1lt gry2 crm 1 gry-pk
170-180	LDHC	5	22.10		4	1 lt gry 2 gry-pk 1 crm 1 red
170-180	LDMF	3	11.90		1	md gry & 1 w/gloss
170-180	LTBC	4	47.30		3	1 md gry 1 md gry-pk 1 crm-pk
170-180	LTP	4	12.70		3	1md gry3md gry-pk/1Union, 1 Hill
170-180	LTT	1	10.00		1	crm-pk
170-180				17.70		
170-180		38	234.20	17.70	19	
180-190	LDBB	1	0.50		1	crm-pk
180-190	LDC1	1	11.60			wh
180-190	LDMF	1	1.00		1	pk
180-190		3	13.10		2	
210-220	LCI	1	30.80			lt gry
TOTAL		232	745.5	128.7	81	

Table 18 continued.

DEPTH	TYPE	#"S	WT	LMF	HEATED	DESCRIPTIONS
120-130	LCI	1	6.20			mtld gry
120-130	LCM	1	18.00			mtld gry
120-130	LDBF	1	0.30		1	pk-wh
120-130	LDC	3	2.80			2 wh 1 lt gry
120-130	LDC1	1	2.10			lt gry
120-130	LDC2	7	10.20		6	1wh/5 gry-pk 1 crm-pk
120-130	LDCC	1	1.70			mtld crm
120-130	LDF	3	7.10			1 wh 1 crm 1 mtld gry
120-130	LDHC	1	0.90			crm
120-130	LDMF	8	12.60		3	3crm2mtld gry/3 gry-pk
120-130	LDRF	1	0.60			lt gry
120-130	LTBT	2	17.30		2	1 dk gry-pk 1 tan-pk
120-130		30	79.80		12	
130-140	LDC	3	5.90		1	1 pk 1 lt gry 1 dk gry
130-140	LDC1	1	3.50			md gry
130-140	LDC2	2	3.90		1	1 md gry 1 pk
130-140	LDCC	2	1.90		1	1 red 1 md gry
130-140	LDF	1	2.20		1	crm-pk
130-140	LDH	3	21.10		2	1 crm-pk 1 gry-pk 1 dk gry
130-140	LDMF	2	1.30			md gry
130-140	LTBT	1	23.90			md gry
130-140	LTR	1	12.10		1	pk w/wh crtx
130-140		16	75.80		7	
140-150	LDC	3	0.70			2 lt gry 1 pk
140-150	LDC2	3	11.10		3	2 gry-pk 1 tan-pk
140-150	LDCC	3	35.10			1 wh 1 blk 1 md gry
140-150	LDMF	1	1.50		1	mtld gry/gloss
140-150	LTP	1	10.80		1	base crm-pk
140-150				14.20		
140-150		11	59.20	14.20	5	
150-160				96.80		

Table 19. Data from Grid C, unit c.

DEPTH	TYPES	#'S	WT	LMF	HEATED	DESCRIPTION
110-120	LTP	1	1.70			crm/ tip only
120-130	LCI	4	12.40		1	3 dk gry 1 gry-pk
120-130	LCM	9	106.10		4	gray/gray-pin/pink
120-130	LDBB	1	0.50			md gry
120-130	LDBF	5	1.40		2	3 lt gry 2 gry-pk
120-130	LDC	13	7.40		4	cream/white/gray/pink-gloss
120-130	LDC1	10	16.80		2	2rd1wh1dk gry5lt gry1 tan
120-130	LDC2	36	115.40		12	tan crm lt gry pk dk gry
120-130	LDCC	2	1.70		1	1 pk 1 lt gry
120-130	LDF	19	32.80		3	10lt gry5wh 2 dk gry 2 tan
120-130	LDH	13	29.20		2	9 gry 2 crm 2 pk
120-130	LDHC	14	71.20		3	gray/ white/tan/pink
120-130	LDMF	27	90.60		7	gray/pink/tan
120-130	LDRB	1	0.50		1	pk
120-130	LDRF	2	1.70		1	1 red 1 pk
120-130	LTBC	4	24.60		1	lt gray fragment pink lit gray
120-130	LTBT	6	36.80		2	1red1mtld gry-pk4lt gry/broken
120-130	LTE	1	7.20		1	crm-pk/broken
120-130	LTP	1	1.30		1	mtld tan-pk fragment
120-130	LTP	6	13.30			gry-pk/crm-pk/tan/gray/Pelican L.?
120-130		174	570.90		48	
130-140	LDBF	1	0.20		1	lt gry/gloss
130-140	LDC	2	0.90		2	dk gry/gloss
130-140	LDC2	5	5.90			gray w/white cortex/tan-pink/lt gray
130-140	LDF	4	2.20		1	1md gry 2 mtld gry 1 gry-pk
130-140	LDH	5	11.50			1 red1dk gry 2 lt gry 1 crm
130-140	LDHC	12	70.40		5	gray/white/gray-pink/tan-pink
130-140	LDMF	2	2.20		1	1 wh 1 tan-pk
130-140	LTBC	2	6.20		2	1mtld gry1mtld gry-pk/ 1 broken
130-140	LTU	1	9.30		1	md gry-pk
130-140				127.70		
130-140		35	108.80	127.70	13	gry-gre rhyolite 1 LMH 910.6 g

Table 19 continued.

DEPTH	TYPES	#'S	WT	LMF	HEATED	DESCRIPTION
140-150	LCM	1	17.70			medium gray
140-150	LDC	1	0.90			cream
140-150	LDC1	1	2.50			light gray
140-150	LDHC	2	74.50			medium gray
140-150	LDMF	1	2.90			medium gray
140-150		6	98.50	89.40		
150-160	LCI	2	33.90			1 md gry 1 tan
150-160	LDC	1	2.10			mtld gry
150-160	LDC	4	3.60		2	1 lt gry 1 tan 1 crm pk 1 dk gry-pk
150-160	LDC2	4	8.60		1	med grqy/lit gray/ pink
150-160	LDF	2	1.20			dark gray/ mottled tan
150-160	LDHC	3	9.70			mtld gry
150-160	LTBC	1	6.00			mtld gry
150-160	LTP	2	10.10			
150-160		19	75.10		3	
160-170	LCI	1	98.40			mtld tan
160-170	LCM	1	21.20		1	lt gry-pk
160-170	LDBF	1	0.20			crm
160-170	LDC	26	20.60		6	12lt gry/7 crm/6md gry/1 blk
160-170	LDC1	2	11.50		1	1mtld gry1mtld gry-pk
160-170	LDC2	20	55.80		11	4tan3mtld gry1crm11gry pk
160-170	LDCC	10	7.40		2	tan/white/cream/gray/gray-pink
160-170	LDF	8	21.10			mtld gry
160-170	LDH	18	65.00		3	cream/gray/gray-pink
160-170	LDHC	25	127.60		9	gray-pink/tan/cream/white/gray
160-170	LDMF	14	66.60			white/gray
160-170	LDT	2	28.80			gray /platform renewal
160-170	LTBC	2	22.00			dk gry fragment
160-170	LTE	2	24.70			1 lt gry 1 md gry
160-170	LTP	1	4.10			md gry/tip gone Raddatz ?
160-170	LTR	1	4.90		1	mtld gry-pk
160-170	LTU	4	16.40		2	2 md gry 2 gry pk
160-170				13.30		gry-gre rhyolite/LMH 272.8 g
		138	596.30	13.30	37	

Table 19 continued.

DEPTH	TYPES	#'S	WT	LMF	HEATED	DESCRIPTION
170-180	LCM	1	9.20			mtld dk gry
170-180	LDBF	1	0.20			tan
170-180	LDC	5	3.30			3 mtld gry 2 mtld crm
170-180	LDC2	3	25.80			1 crm 2 mtld gry
170-180	LDCC	2	2.00			1 crm 1 md gry
170-180	LDF	1	0.60		1	crm-pk
170-180	LDH	5	39.80			md gry
170-180	LDHC	6	84.10		2	4 mtld gry 2 gry-pk
170-180	LDMF	3	5.20			mtld gry
170-180	LTBC	1	11.30		1	dk gry-pk
170-180	LTP	2	3.40		2	1pk1mtld gry/Fresno or Hill ?
170-180	LTR	1	3.20			lt gry
170-180	LTS	1	3.20		1	pk
170-180		32	191.30		7	
180-190	LCI	1	32.10			lt gry
180-190	LDH	1	1.90			md gry
180-190		2	34.00			
190-200	LCM	1	12.70			md gry
200-210	LDC2	1	9.30			mtld gry
200-210	LDH	1	6.00			crm
200-210	LDHC	2	8.30			lt gry
200-210	LDMF	1	6.80		1	lt gry-pk
200-210		5	30.40		1	
TOTALS		413	1719.70	230.40	109	

Table 20. Data from Grid C, Test Trench # 2.

DEPTH	TYPE	#'S	WT	LMF	HEATED	DESCRIPTION
178-188	LTU	1	1.30		1	cream-pink gloss
178-188	LDC	1	2.00		1	cream-pink
178-188	LDC2	2	3.00			light gray
178-188	LDH	1	2.10			med gray
178-188	LDMF	2	3.40			1 cream 1 light gray
178-188	LMF			124.60		
178-188	LTP	2	9.70			1 med gray 1 tan
		9	21.50	124.60	2	
188-198	LDC	1	1.50			white
188-198	LDF	1	0.60			cream
188-198	LDH	1	4.20			med gray
		3	6.30			
198-208	LDC	2	3.40			med gray
198-208	LDC2	1	4.60			white
198-208	LDF	1	0.20			cream
200-210	LTD	1	2.90			mottled/ spiral
208-218	LDC	2	1.10			cream
208-218	LDF	1	1.40			cream from step
208-218	LDH	2	7.90			step
208-218	LDH	1	2.50			white
208-218	LDMF	1	3.20			step
208-218	LDMF	1	2.70			mottled gray
208-218	LMF			15.10		
208-218	LMF			6.80		step
208-218	LTH	1	2.70		1	cream-pink/ bulb thinned-for hafting?
		9	21.50	21.90	1	
229-240	LMF			1844.40		step