Interpreting Northern Plains Subsistence Practices: An Analysis of the Faunal and Floral Assemblages From the Thundercloud Site (FbNp-25)

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Abstract

The Thundercloud site (FbNp-25) is a multi-component processing/habitation site located within Wanuskewin Heritage Park near the city of Saskatoon, Saskatchewan. The site contains at least ten cultural occupations ranging from the period of European contact to 4,000 years before present. In 1993 the University of Saskatchewan chose the site for their annual field school and excavations continued at the site until the summer of 1998. During that time sediment samples were collected from every unit as part of the paleoenvironmental program.

In 1996, a detailed analysis of the faunal and floral assemblage was begun including a complete examination of all sediment samples. The samples revealed a diversity of micro-remains which would not have been collected using standard screening techniques. The analysis of these remains provided a wealth of new archaeological and paleobiological data including new insights into pre-contact subsistence practices and paleoenvironmental studies. More specifically, analysis of these data played a pivotal role in the interpretation of seasonal occupation patterns, the depositional history of some levels, and in the reconstruction of past environments. More importantly, by examining hearth samples, suggestions were made regarding the human utilization of small animals. These analyses suggest that small animals have played a minor role in the subsistence strategies of all cultures represented at the Thundercloud site. This discussion was expanded into an examination of McKean subsistence on the Northern Plains and forms the basis for further studies in this area.

Acknowledgments

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Chapter 1

Introduction

1.1 Statement of Objectives

In 1986 a site survey and assessment conducted in the valley surrounding Tipperary creek, now known as Opimihaw creek, led to the discovery of 19 previously unknown pre-contact archaeological sites. To protect the valley from development Wanuskewin Heritage Park was created and the area was declared a national heritage site. As part of the parks commitment to research, a section of the interpretive center was set aside for the University of Saskatchewan as an archaeological and paleo-environmental laboratory. Once developed, the University of Saskatchewan began research at several sites within the valley. One of these, the Thundercloud site (FbNp-25), appeared to represent a multi-component campsite with at least six intact occupation layers. In 1993 excavations began at the site as an extension of the archaeological field school. Excavation continued over a period of six summers and was completed during the summer of 1998.

In total, 45 square metres have been excavated through as many as ten occupation levels. Due to the large number of artifacts recovered the analysis was split into two assemblages. The first, which includes all of the pottery and lithic artifacts, is currently being analyzed by graduate student Lis Mack from the University of Saskatchewan. Data obtained by that analysis will be presented in her Masters thesis. The other assemblage, consisting of all faunal and floral artifacts, was analyzed by the author and the data obtained forms the basis of the following chapters.

During excavation it was noted that most of the bone was well preserved suggesting that elements from smaller fauna may also be present. In accordance with the research objectives of the park, soil samples were collected from each excavation unit and were later water-screened in the laboratory. The analysis of these samples resulted in the collection of numerous small faunal and floral artifacts. This research project was created to analyze the faunal and floral assemblages recovered and to interpret data revealed by the analysis. In terms of objectives, this study is designed to follow the research goals created by Wanuskewin Heritage Park which include;

(1) the examination of the sequence of occupation at various sites within the park boundary,

(2) the study of cultural change between these occupations with **specific reference to plant and animal utilization, and**

(3) **the investigation of the paleo-environmental record for the Saskatoon region** (Walker et.al.,1994, emphasis mine).

More specifically, this project will attempt to accomplish several main objectives. Initially, it is hoped that an analysis of the faunal and floral remains from each level will be useful in determining some aspects of the subsistence patterns of pre-contact populations. Secondly, an analysis of the distribution patterns of these artifacts may yield evidence useful in determining activity areas. Furthermore, the presence of foetal and immature bison, along with data from other species, will be used to determine seasonal patterns of occupation. Finally, suggestions will be made regarding the importance of fine screen analysis in archaeology including several conclusions which may not have been possible in the absence of this type of research.

1.2 Chapter Summary

Chapter Two outlines the physical environment of the region surrounding the Thundercloud site. This includes a brief history of archaeology within the Opimihaw valley and specifically at the site locality. A discussion of the physiography, geography and soils follows, including a brief introduction to the site climate, hydrology, flora and fauna.

Chapter Three introduces the cultural occupations of the Thundercloud site. This includes a summary of the culture history of the Saskatoon region followed by the cultural stratigraphy of each level and their placement within the cultural historical framework. Finally, site formation processes are examined and the natural stratigraphy of the site is described.

Chapter Four outlines the methodology used in both excavation and analysis. It begins with an examination of excavation and laboratory procedures including the methods used in the preparation and analysis of fine-screened sediment samples. A discussion of the methodology and terminology used during the analysis of the faunal and floral assemblage follows.

Chapters Five through Eleven present the faunal and floral assemblages for each of the seven levels noted within the site stratigraphy. Each chapter begins with a summary of the faunal assemblage for that level including; the number of identified and unidentified faunal specimens, species identified within the level, and a discussion of the identified specimens. If present a similar discussion of the floral assemblage follows. Next, the distribution of the faunal and floral artifacts is described and their association with known features is examined in an attempt to delineate cultural activity areas. Finally, any immature or foetal bison elements are examined to determine the seasonal usage of the site. In some cases other species are also included within this discussion.

Chapter Twelve addresses the importance of fine-screen analysis within archaeological interpretations. The chapter begins with a summary of the artifacts recovered by fine-screen analysis. Suggestions are then made regarding the interpretation of assemblage composition if fine-screened samples had not been examined. The second section of the chapter is devoted to the analysis of the assemblages from levels four and five which have been identified as McKean complex occupations. Several interpretations using data obtained from the analysis of the micro-assemblage will be discussed including, an overview of McKean subsistence on the Northern Plains, and a brief discussion of the paleo-environment of the site approximately 4,000 years ago.

Chapter Thirteen summarizes the results of the Thundercloud site faunal and floral analysis including a restatement of the research objectives. Several conclusions are presented regarding the use of fine-screen analysis in archaeological research including a summary of the importance of micro-remains in the interpretation of the Thundercloud Site assemblage.

Chapter 2

Introduction to the Thundercloud Site

2.1 Site History

The location of the Thundercloud site has been known since 1982; however, other sites near Opimihaw Creek (formerly Tipperary Creek) were recorded as far back as the 1930s. The Saskatoon Archaeological Society (SAS) first visited the valley in 1932, with continued exploration occurring throughout the 1940s and 50s (Walker 1983). Both amateur and professional archaeologists conducted small scale excavations throughout the 1960s and 70s including a research project conducted by the University of Saskatchewan in 1965 (Walker 1988).

In 1978 the Meewasin Valley Authority (MVA) became interested in protecting the area as a natural heritage site and in 1982 they contacted Dr. Ernie Walker of the University of Saskatchewan to complete an archaeological survey and assessment. The study resulted in the discovery of 21 archaeological sites, 19 pre-contact and two post-contact, supporting the idea that the valley should be protected from future development. Shortly after the assessment, the MVA initiated the creation of a heritage park, named Wanuskewin, which was completed in 1992 (Walker; personal communication). Currently the University of Saskatchewan maintains a laboratory facility within the interpretive center and to date excavation has been completed at four sites in the park including: the Amisk site (Amundsen 1986), the Newo Asiniak site (Kelly 1986), the Redtail site (Ramsay 1993), and FbNp-1 (Morlan and Walker, research in progress).

In 1993, the Department of Anthropology and Archaeology at the University of Saskatchewan established an archaeological field school at Wanuskewin. The Thundercloud site was selected as a candidate because test pits, excavated in 1982, revealed the presence of a rich multi-component site with relatively intact stratigraphy (Figure 2.1). Excavation was completed in 1998 marking the sixth field season at the site.

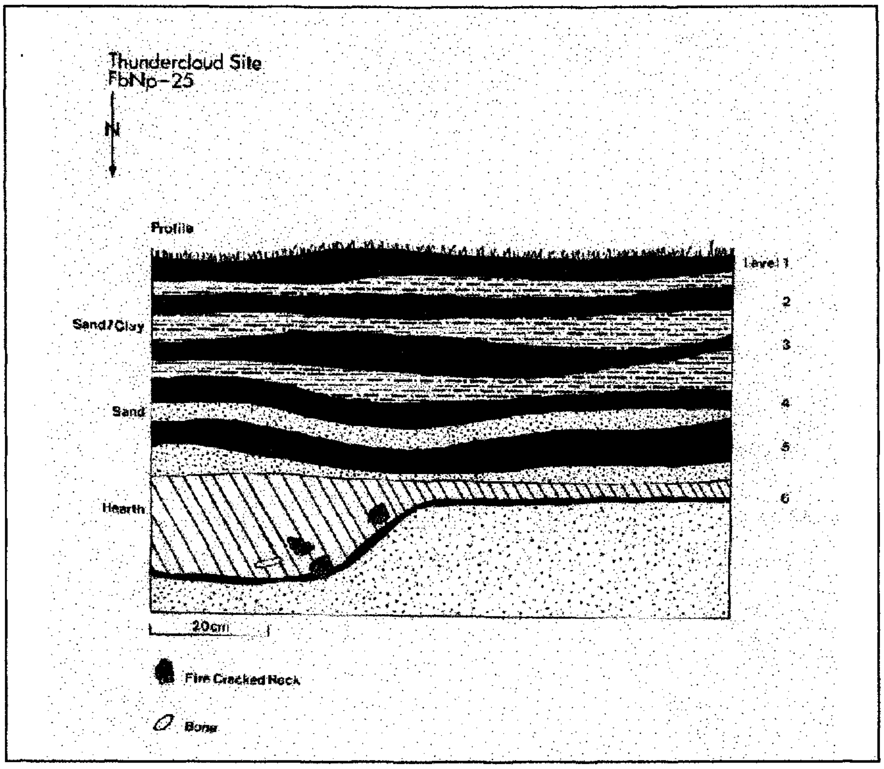

Figure 2.1. 1982 test pit profile (drawing by Phyllis Loeden)

2.2 Physiography, Geography and Soils

The Thundercloud site is located within Wanuskewin Heritage Park approximately three kilometres north of the City of Saskatoon, Saskatchewan. Although often quoted as being situated in the aspen parkland, the upland areas near the vicinity of the site more closely resemble the moist mixed grassland ecotone (Figure 2.2).

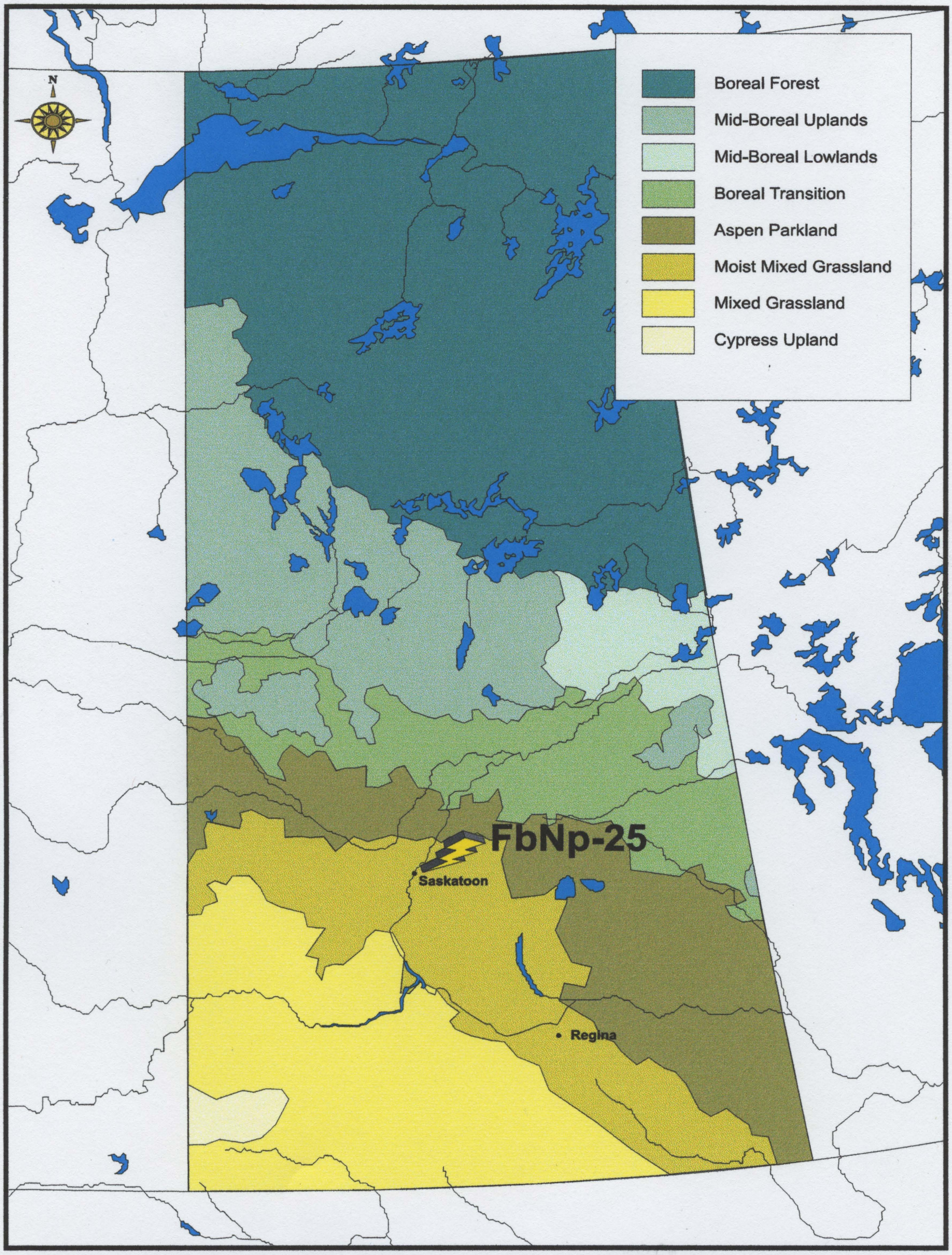

Figure 2.2 Location of the Thundercloud Site (FbNp-25) (Original map from Environment Canada Website, digitized version by author).

The park encompasses 63 hectares of land in the SW ¼ Section 36 and SE ¼ Section 35, Township 36, Range 5, West of the 3rd Meridian at 52° 13' North Latitude and 106° 35' West Longitude. Opimihaw Valley is situated in the Warman Plain, a subdivision of a larger physiographic region known as the Saskatoon Plain. This area is characterized by, "undulating and eroded till plains and gravelly glacio-fluvial plains" (Acton and Ellis 1978:5).

The park surrounds the main portion of Opimihaw Creek, a tributary of the South Saskatchewan River. The Thundercloud site is centred on a point bar to the east side of the creek (Figure 2.3). Prior to the construction of Gardiner Dam in 1960 the creek was subjected to periodic episodes of overbank flooding primarily due to ice jams at the mouth of the creek. Since that time regulated water levels have led to the stabilization of the lower terraces which are now covered by riparian vegetation typical of other banks throughout the South Saskatchewan River system.

Grassland soils, classified as Dark Brown Chernozemic, dominate the upland areas surrounding the park. Soils to the east of the valley are common to the Orthic Dark Brown Series of the Weyburn Association; however, others such as Calcareous Dark Brown and Eluviated Dark Brown are not uncommon (Ellis and Stonehouse 1970). Landforms are gently sloping with a knoll and depression pattern. Surface textures range from sandy to clayey loam (Acton and Ellis 1978). To the west of the valley the soils are typical of the Bradwell Association with a dominance of Orthic Dark Brown Chernozems and significant inclusions of Eluviated Dark Brown Chernozems (Ellis and Stonehouse 1970). In general the western upland is characterized by a flat shallow glacio-fluvial plain with very little slope although ridges are present in areas with shallow deposits of glacial till (Acton and Ellis 1978). Soil in the valley is classified as Hillwash containing a mixture of Regosolic, Chernozemic and Podzolic soils (Acton and Ellis

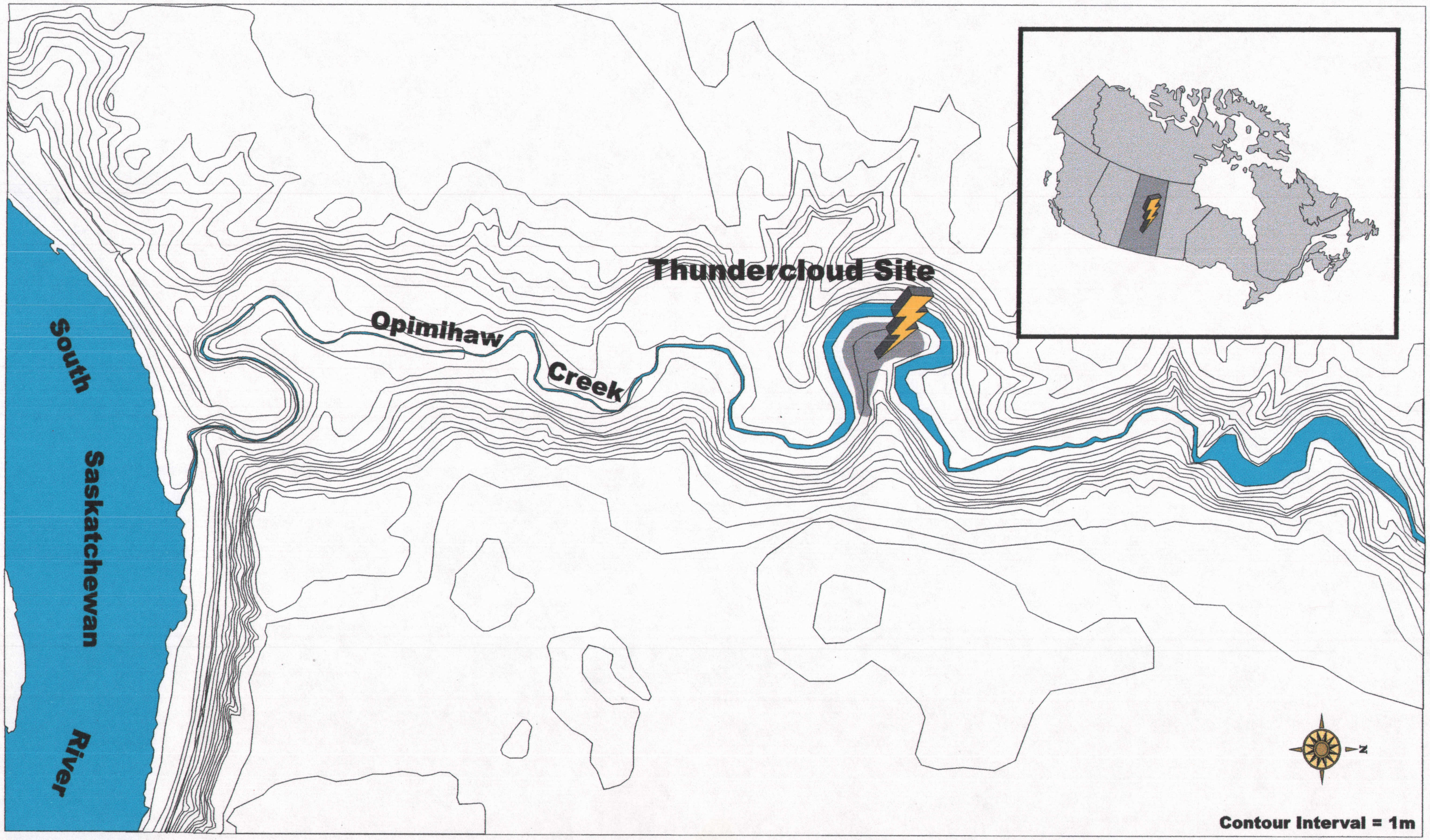

Figure 2.3. Contour Map of the Thundercloud Site Locality (approximate site area shown in grey).

1978). Soil formation processes within sediments in the valley bottom, and specifically at the Thundercloud site, are variable in nature and are discussed further in the stratigraphy section of this chapter.

2.3 Climate

The modern climate is classified as *Dfb* using the Köppen-Geiger System. This refers to a cold snowy- "forest" climate with warm summers and cold, moist winters (Strahler and Strahler 1992:159). During the period between 1941-1977 January was the coldest month with an average temperature of -17.3°C while July, the warmest month, averaged 19.1°C (Bergsteinsson and Calvert 1977). The mean annual precipitation for the same time period was between 36 - 41 cm, with 102 - 114 cm of snowfall. On average there were between 80 - 100 frost free days per year (Chakravarti 1969). Average wind speeds are moderate, between 12.8 - 19.2 km/h and have a tendency to blow from the northwest. The wind speed average is a balance of brisk to strong northwest winds common in spring and summer and calm south and southwest winds which are more prevalent in the fall and winter months (Maybank and Bergsteinsson 1970).

2.4 Hydrology

The closest water source, Opimihaw Creek, is currently located within five metres of the site margin (see Figure 2.3). The creek is fed by a number of springs located to the north of the site area which in turn feeds into the South Saskatchewan River approximately 720 metres south of the site. Water is slow moving and stagnant pools often form in low areas, especially during dry years when groundwater discharge is very low. Prior to the construction of Gardiner Dam, flooding was common and unregulated flow during the spring often forced backwater up the creek and over the flood banks surrounding the site. In recent years the terrace has been flooded several times due to the activity of beavers very close to the site area. A large volume of spring meltwater is often held back by the beaver dam and in some instances water as deep as 30 cm has been observed over the eastern borders of the site.

The majority of underlying sediments contain a high percentage of sand and/or gravel leading to excellent drainage. The cultural levels are located well above the current water table and no groundwater was encountered during excavation.

2.5 Flora

Many of the floral communities in Opimihaw Valley are in a state of change and do not accurately represent the biotic environment that would have been present during the periods of occupation noted at the Thundercloud site. These changes have been very dramatic during the past six years and are the result of two main factors; the absence of herbivore grazing and the presence of a large population of beavers. Cows, and prior to that bison, were the main herbivores represented in the valley. Grazing and trampling kept many of the small to medium shrubs from growing and led to an abundance of grasses and herbs throughout the valley slopes and terraces. Currently many of the grasses are being replaced by shrubs, dramatically changing the appearance of the valley. Also, beavers have been actively removing many of the large trees which has also reduced the overall number of shade-loving forbs which were common in the understory of these large trees.

Prior to European settlement, and the development of large scale agricultural operations, fire would have also contributed to the dominance of many grasses and small shrubs. In the presence of fire, large trees would have been limited to protected coulees and sheltered valley bottoms. A thin layer of charcoal and stained soil just below the sod indicates that at least one large prairie fire swept over the Thundercloud site locality.

While there have been many changes in the vegetation surrounding the site it is still possible to recognize important zones which may represent past plant communities. Walker (1983) defines three important vegetation zones which can be recognized in and around the valley: the Upland Prairie Zone, the Valley Slope Zone and the Floodplain Zone. The Upland Prairie Zone is comprised mainly of two plant communities; grasses and Aspen bluffs. Typical grasses include wheat grass (*Agropyron* sp.), June grass (*Koeleria cristata*) and blue gramma grass (*Bouteloua gracilis*). These grasses are interspersed by a mixture of herbaceous plants including sage (*Artemisia* sp.), vetch (*Astragalus* sp.), cinquefoil (*Potentilla* sp.) and selaginella (*Selaginella* sp.). Aspen (*Populus* sp.) bluffs occur in low, wet areas and include some understory shrubs like rose (*Rosa* sp.) and silverberry (*Elaeagnus commutata*).

The Valley Slope Zone contains a large variety of communities. Open areas contain grasses typically found in the uplands. By far the most common community consists of medium to low shrubs which grow heaviest along drainage channels. Chokecherry (*Prunus virginiana*), saskatoon (*Amelanchier alnifolia*), pin cherry (*Prunus pennsylvanica*), rose (*Rosa* sp.), wild raspberry (*Rubus idaeus*), buffaloberry (*Shepherdia canadensis*) and silverberry (*Elaeagnus commutata*) are most common. Juniper is often present on steeper slopes. Wildflower communities are also well developed and include three-flowered avens (*Geum triflorum*), prairie crocus (*Anemone patens*), and buttercup (*Ranunculus* sp.) to name a few.

Perhaps the most diverse of all zones is the Floodplain Zone. Many communities are present and their make-up is dependant upon many factors, most notably available sunlight, proximity to water, drainage and elevation. At the Thundercloud site, the alluvial terrace is covered by a mixture of shrubs, grasses and forbs including wheat grass (*Agropyron* sp.), spear grass (*Stipa comata*), blue gramma grass (*Bouteloua gracilis*), snowberry (*Symphoricarpos* sp.), rose (*Rosa* sp.), and nettle (*Urtica dioica*). Towards the outer margins of the terrace, close to the creek, the community changes and consists mainly of low to medium shrubs such as willow (*Salix* sp.), rose (*Rosa* sp.), and chokecherry (*Prunus virginiana*).

Rogal (1982) compiled a complete list of all plant species observed within close proximity to the valley. In total 200 species were discovered. (See Appendix I, Table 1). Note that some specimens are rare and may not currently inhabit the valley.

2.6 Fauna

The modern faunal community at the Thundercloud site is very diverse and many species are abundant. Even so there are many species that have been eradicated or affected by ecological change and are no longer inhabitants of the valley. A complete list of all vertebrate faunal species (both past and present) is included in Appendix I (Table 2).

2.6.1 Mammalian Fauna

Large mammals were most affected by the arrival of European settlers. Several species have been extirpated including bison (*Bison bison*), elk (*Cervus elaphus*), grizzly bear (*Ursus arctos*), wolf (*Canis lupus*), and the swift fox (*Vulpes velox*). Other species like the cougar (*Felis concolor*) and Nuttall's cottontail (*Sylvilagus nuttallii*) have only recently returned to the area.

During pre-contact times the predominant large herbivore was bison. Elk, pronghorn (*Antilocapra americana*), white-tailed deer (*Odocoileus virginianus*), mule deer (*Odocoileus hemionus*) and occasionally moose (*Alces alces*) would also have been present. Currently only white-tailed deer occupy Opimihaw Valley with occasional appearances of mule deer. Mule deer tend to occupy more open regions such as upland areas and valley slopes. White-tailed deer prefer more wooded areas located in the valley bottom and along the shoreline of the South Saskatchewan River.

Large carnivores would have included grizzly bear, cougar, wolf, and coyote *(Canis latrans)*. Presently the coyote is the dominant carnivore in the valley although in recent years cougars have been spotted near the city of Saskatoon. Other carnivores included the wolverine (*Gulo gulo*), badger (*Taxidea taxus*), skunk (*Mephitis mephitis*), raccoon (*Procyon lotor*), red fox (*Vulpes vulpes)*, swift fox (*Vulpes velox*), long-tailed weasel (*Mustela frenata*), mink (*Mustela vison*), least weasel (*Mustela nivalis*) and occasionally river otter (*Lontra canadensis*). The wolverine, swift fox and river otter are no longer present in the valley.

Leporids are represented by three species; the white-tailed jackrabbit (*Lepus townsendii*), snowshoe hare (*Lepus americanus*) and very recently Nuttall's cottontail (*Sylvilagus nuttallii*). Nuttall's cottontail was noted by myself, Lis Mack and several students during the field school. This is likely an isolated population since the northernmost record of Nuttall's prior to this sighting was by F.A. Banfield (1941: 122-123) near the town of Dundurn, Saskatchewan. The identification of a Nuttall's cottontail at the Sjovold site (Dyck and Morlan 1995: 140) just southwest of this area further suggests that the species is extending its northern range.

Many rodents are attracted to the valley. Beaver (*Castor canadensis*) and muskrat (*Ondatra zibethicus*) are found in many areas where sufficient water can be retained for winter survival. Porcupine (*Erethizon dorsatum*) are also common in the more heavily wooded areas. Several fossorial species are very active throughout the park. Most common are Richardson's ground squirrel (*Spermophilus richardsonii*) and the thirteen-lined ground squirrel (*Spermophilus tridecemlineatus*). Northern pocket gopher (*Thomomys talpoides*) and Franklin's ground squirrel (*Spermophilus franklinii*) also exist in small populations. Mice, voles and shrews are numerous; the most common species include: Gapper's red-backed vole (*Clethrionomys gapperi*), meadow vole (*Microtus pennsylvanicus*), prairie vole (*Microtus ochrogaster*), deer mouse (*Peromyscus maniculatus*), white-footed mouse (*Peromyscus leucopus*), masked shrew (*Sorex cinereus*) and pygmy shrew (*Microsorex hoyi*).

2.6.2 Avian Fauna

Many different avian species utilize the resources of Opimihaw Valley and the nearby South Saskatchewan River. A variety of migratory waterfowl and wading birds can be found at the mouth of the creek occasionally inhabiting deeper pools of water in the valley as well. Smaller trees and brush are home to songbirds, while larger stands of trees are often occupied by birds of prey. Although the valley is most heavily populated in the summer, the area also retains a resident population of songbirds and upland game birds throughout the winter months.

2.6.3 Amphibians and Reptiles

Five amphibians and three reptiles have been recorded in Opimihaw Valley. Amphibians are represented by the tiger salamander (*Ambystoma tigrinum*), Canadian toad (*Bufo hemiophrys*), boreal chorus frog (*Pseudacris triseriata*), leopard frog (*Rana pipiens*) and the wood frog (*Rana sylvatica*). Reptiles include western garter snake (*Thamnophis elegans*) and the red-sided garter snake (*Thamnophis sirtalis*). Diversity is low because species are limited to those which can hibernate to escape freezing temperatures during the winter months.

2.6.4 Fish

There are several fish species which occupy Opimihaw Creek. Near the Thundercloud site shallow water restricts all but a few species of minnows (Cyprinidae). Larger game fish are present closer to the mouth of the creek and are plentiful in the South Saskatchewan River (see Appendix I, Table 2). It is possible that some of the larger species would have migrated upstream during flood conditions and would have been trapped in deeper pools when the flood waters receded. The river near the mouth of the creek is very productive and is often used by local fisherman.

2.6.5 Molluscs

The shallow water and dense aquatic vegetation in Opimihaw Creek is home to many species of freshwater molluscs. Several clam (Pelecypoda) species are found in the soft riverbank sediments adjacent to the site and are easily located during summer and late fall. Large snails (Gastropoda) are also common although there is a predominance of smaller species. A complete list of all freshwater molluscs common to the area is included in Appendix I (Table 3).

Chapter 3

Cultural Occupation at the Thundercloud Site

3.1 Cultural Chronology

Before discussing the various cultural occupations which have been discovered at the Thundercloud site it is important to discuss cultural development on the Northern Plains and the placement of these cultures within a cultural historical framework. Mulloy (1958) proposed the first framework geared specifically towards the Northern Plains. His chronology included the concept of a cultural hiatus, an abandonment of the Northern Plains, during the Altithermal period (7500-5000 BP). Archaeological excavations occurring in the Northern Plains in the 1960s and 70s revealed the presence of multiple sites with occupations dating to the Altithermal period (see Walker 1992: 169-202 for summary). This led to a re-examination of the Middle Prehistoric period and to the development of several new chronologies (Figure 3.1).

This thesis will follow Walker (1992) for several reasons. Frison's (1978) use of the term "Archaic" cannot be applied to Saskatchewan, while Dyck (1983) is rejected here because his "Middle Plains Indian" does not include further separation of the Middle Prehistoric period as seen in the other three chronologies. Walker's (1992) use of the Paleo-Indian period is more widely accepted than the Early Prehistoric proposed by Reeves (1973). While the use of the Middle Middle Prehistoric can be confusing, Walker (1992) provides a chronology which best suits the cultural history of the Northern Plains.

Years B.P.	Reeves 1973		Frison 1978		Dyck 1983	Walker 1992	
	Historic		Historic		Historic	Historic	
200	Late Prehistoric		Late Prehistoric		Late Plains Indian	Late Prehistoric	
2000	Middle Prehistoric	Late	Plains Archaic	Late	Middle Plains Indian	Middle Prehistoric	Late
3000		Early I		Middle			Middle
5000		Early II		Early			Early
7500	Early Prehistoric		Paleo-Indian		Early Plains Indian	Paleo-Indian	
10500					Pleistocene Hunters		
12000							

Figure 3.1. Summary of recent Northern Plains cultural chronologies (After Walker 1992: 120)

3.2 Cultural History of the Saskatoon Area

The Paleo-Indian period begins with the retreat of the Laurentide Ice Sheet approximately 11500 BP (Linnamae et. al. 1988). Clovis artifacts, dated to this time period, represent the earliest form of cultural occupation in the Northern Plains. Until recently, Folsom was believed to represent the subsequent cultural complex but excavations at the Mill Iron site in Montana revealed the presence of an unfluted form called Goshen with AMS (Accelerator Mass Spectrometer) dates between 11400 to 10700 BP (Frison 1991a). Goshen projectile points include traits common to both Clovis and Folsom. Investigations at other sites have shown that Goshen points are often found below Folsom and average earlier dates (Frison 1991a: 146-147) although an overlap in these dates is quite common. Faunal remains may provide further means to temporally separate these groups. Clovis has long been known to represent mammoth hunters and several mammoth kills have been described (Frison and Todd 1986;

Hannus 1990; Walker and Frison 1980). At the Bentzen-Kaufman Cave in Wyoming a Goshen point was found in association with a mammoth scapula (Grey 1963) suggesting that Goshen may be older than Folsom which is generally associated with fossil forms of bison (*Bison antiquus* and *Bison occidentalis*). Clovis, Goshen and Folsom artifacts have only been found in surface collections within the province. A mammoth foreshaft excavated near Grenfel, Saskatchewan may represent an *in situ* artifact but unfortunately accurate provenience was not recorded (Wilmeth 1968).

In the later stages of the Paleo-Indian period (10000 to 8000 BP) other cultural complexes, such as Agate Basin and Cody, become well established in Saskatchewan and are represented in several large surface collections (Ebell 1980; Joyes 1997). The Heron Eden site near Prelate, Saskatchewan provides an excellent example of a Cody complex bison kill including eight complete Scottsbluff and Eden projectile points. Radiocarbon dates of 8930±120 BP (S-3114) and 8920±130 BP (S-3309) place the occupation near the end of the Paleo-Indian period (Corbeil 1995: 21-22). Other terminal Paleo-Indian projectile points, such as Lusk and Angostura, have been found in the east and southeastern areas of the province.

The Early Middle Prehistoric period begins with the onset of the Altithermal approximately 7500 BP (Walker 1992). It was initially believed that the warmer conditions of the Altithermal caused an overall abandonment of the Northern Plains (see Walker 1992: 122-132 for discussion). Recent evidence suggests that abandonment is unlikely and that groups began to congregate near areas with a permanent source of water. This is evidenced in the Saskatoon area by the Gowen (Walker 1992) and Norby sites (Zurburg 1991) located along the terraces of the South Saskatchewan river. Levels from the Gowen sites revealed small Mummy Cave-like points (now known as Gowen points) with a radiocarbon average of 5870±48 BP (Walker 1992: 26). Small side-notched points were also identified in the Norby site assemblage with associated radiocarbon dates of 5885±265 BP (S-3006) and 5740±110 BP (S-3205) (Zurberg 1991:21). These projectile point varieties indicate a shift in technology from large lanceolate spear points to smaller side-notched atlatl or dart tips. Known as early Side-Notched points, they include several complexes collectively known as the Mummy Cave series. At Wanuskewin, radiocarbon dates from the Amisk (Amundsen 1986: 194) and Redtail sites (Ramsay 1993: 90) suggest the presence of Early Middle period occupations but unfortunately diagnostic projectile points were absent.

The Middle Middle Prehistoric, from 5000 to 3000 BP, marks an end to the Altithermal with a return to wetter conditions in the Sub-Boreal. This is also the beginning of a new side-notched projectile point called Oxbow which may have developed *in situ* from the previous Mummy Cave series (Walker 1992). The Oxbow complex is often dated between 6000 to 4000 BP (Morlan 1993: 38; Wright 1995: 299) based, in part, on the original date of 5100±210 BP (S-44) from the Oxbow Dam site (Nero and McCorquodale 1958). While it is true that many dates fall within this range, a recent re-examination of the Oxbow Dam site suggests that the early date is the result of a mixed sample. The new calibrated date of 4513 [4277] 3994 BP (S-3648, 2 sigma) suggests a slightly later time span (Green 1998).

The origin of the McKean complex, at approximately 4000 BP, has been a topic of debate since the first description of the projectile points over 40 years ago (Mulloy 1954). McKean radiocarbon dates often overlap Oxbow but Oxbow projectile points are usually located below McKean in sites where both complexes are represented. This, coupled with the fact that the McKean Lanceolate point type resembles an un-notched Oxbow, has led some researchers to believe that McKean developed directly out of the Oxbow complex (Wright 1995: 299). Others suggest that McKean represents a migration of peoples from the Great Basin area of the United States (Brumley 1975; Reeves 1983; Walker, personal communication) where radiocarbon dates are 400 to 800 years older than those obtained in Saskatchewan (Frison 1991b:100).

There are three projectile point types included within the McKean cultural complex; McKean Lanceolate, Duncan and Hanna. Whether these types represent coeval groups within the same complex or separate distinct cultural phases is not yet known. The McKean complex is well represented in Opimihaw Valley including all three projectile point varieties. Multi-component occupations have been recorded at the Thundercloud and Redtail sites. A radiocarbon date of 4320±85 BP (S-2532) from the Newo Asiniak site may represent a McKean complex level, however, no diagnostic projectile points were recovered (Kelly 1986: 178).

The Late Middle Prehistoric, from 3000 to 2000 BP, marks the beginning of a new cultural complex called Pelican Lake. Described as triangular corner-notched points, they were first noted by Wettlaufer (1955) at the Mortlach site in southern Saskatchewan. It has been suggested that the Pelican Lake complex developed from McKean (Reeves 1983), however, radiocarbon dates from level 20 of the Sjovold site of 3900 to 3600 BP (S-2061) may suggest an earlier appearance than once believed (Dyck and Morlan 1995: 521). The Pelican Lake complex is found throughout the Northern Plains and its borders but it is not common in the Saskatoon area. Level 4 at the Newo Asiniak site yielded a single Pelican Lake point with a radiocarbon date of 3025 ± 250 BP (S-2764) (Kelly 1986). The Rocky Island site, within the city of Saskatoon, has been interpreted as a Pelican Lake camp site. Numerous hearths and several Pelican Lake projectile points were recovered during initial excavations (Walker, personal communication). Other sites within the province include: Bracken Cairn (Pendree 1980), Long Creek (Wettlaufer and Meyer-Oakes 1960) and Walter Felt (Kehoe, 1965).

The onset of the Late Prehistoric period denotes another shift in technology. The Besant complex is believed to represent the first cultural group to make use of the bow and arrow and pottery vessels. The presence of these new technologies suggest a migration of new peoples into the area, most likely from the north-central United States (Dyck 1983). Besant sites are represented by numerous kill sites, bison jumps, bison pounds, processing areas and habitations. Large kill sites like the Meewasin bison pound in Opimihaw Valley and the Fitzgerald site just south of the city of Saskatoon suggest a strong Besant presence within the Saskatoon area. It has been suggested that people of the Besant complex were extremely effective bison hunters and may have even developed a bison "cult" as evidenced by the remains of a ritualistic structure from the Ruby site in Wyoming (Frison 1971). Calibrated radiocarbon dates from Besant levels at the Sjovold site range from 2800-2500 (in level XIV) to 2300-2100 (in level X) (Dyck and Morlan 1995: 95). A more recent average of 1800-1300 BP was obtained in level VII and is associated with a projectile point believed to be an intermediate form between Besant and Avonlea (Dyck and Morlan 1995: 103).

Many researchers suggest that the Avonlea complex developed along side Besant, from 1750 to 1150 BP (Vickers 1986: 90). While these dates have been accepted others have been quick to point out that Avonlea projectile points have never been found with or below Besant in sites where both types are present (Walde et.al. 1995: 19). Based on this stratigraphic evidence it would seem that Besant must pre-date Avonlea.

The Avonlea complex includes small projectile points which are generally well made with small side-notches and a slightly concave base. Pottery vessels are conoidal with spiral grooves or net impressions. Avonlea occupations have been identified within Opimihaw Valley at the Amisk and Newo Asiniak sites with radiocarbon dates of

905±155 BP(S-2537) and 915±70 (S-2353) respectively (Amundson 1986; Kelly 1986). For an overview of Avonlea sites in the Northern Plains see Davis (1988).

The Late Side-Notched series (Dyck 1983) of projectile points appear near the end of the Late Prehistoric period, approximately 1150 BP. This series includes both Plains and Prairie Side-Notched varieties. The Prairie Side-Notched type tends to exhibit earlier radiocarbon dates than the Plains type, which extends into the beginning of the Historic period. Pottery vessels continue to be used but change from conoidal to globular in shape with elaborate rim and shoulder designs often present. Projectile points in the Late Side-Notched series are not associated with specific complexes but their relationship to the native tribes of the Historic period has been examined (Meyer 1983). Approximately 300 years ago European explorers and traders began introducing new materials into native culture. Occupation levels dated to the beginning of the Historic period commonly contain evidence of this trade including metal projectile points, small glass seed beads and brass fragments from shell casings.

3.3 Stratigraphy

3.3.1 Cultural Stratigraphy

The Thundercloud site was chosen for excavation in part because of the existence of multiple intact cultural layers (see Figure 2.1). Initially six occupation levels were discovered, each located within a distinct buried soil horizon. Excavations conducted in 1993 revealed a stratigraphic profile that was slightly more complex than originally described. By the end of 1997 seven buried soil horizons had been uncovered containing at least ten occupations. In most of the units the soil horizons are very close together, especially in the upper levels where sedimentation rates have slowed considerably (Figure 3.2). Towards the western edge of the site several of these levels separated, however, the majority of the units retained the initial six horizons

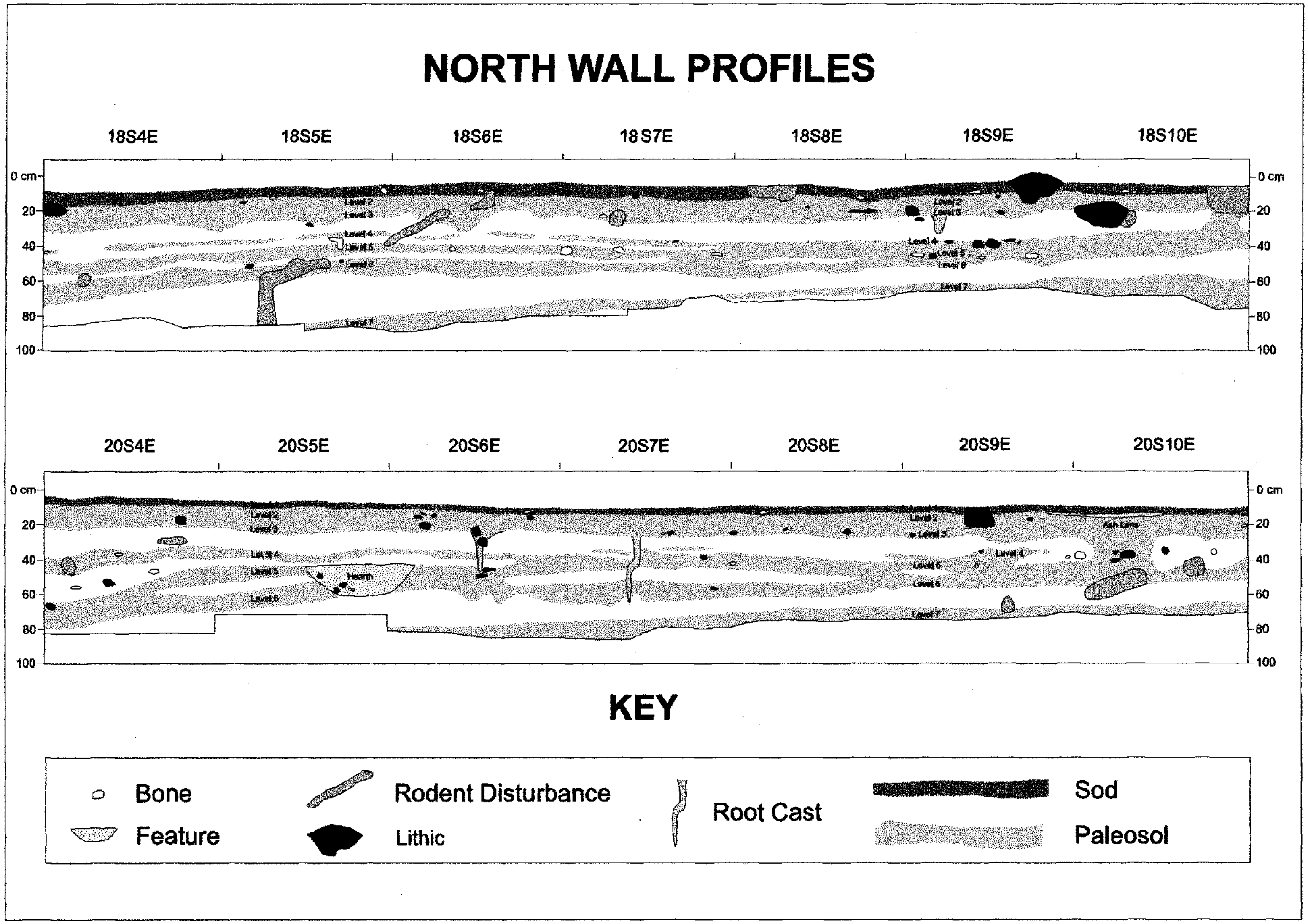

Figure 3.2 Stratigraphic Profile of Buried Soil Horizons at the Thundercloud Site.

discovered in 1982. The complexity of these multiple occupation units led to the analysis of the levels by buried soil horizon rather than by distinct cultural occupation. Soil horizons that split into multiple levels were still excavated as a single buried component but were separated alphabetically (a,b,c, etc.).

Level One

Level one begins just below the thin layer of sod that covers the terrace. On average level one is located between 2.5 and 10 cm in depth, with some artifacts recorded as deep as 15 cm below surface. This is a complex level which contains a number of occupations. Cultural artifacts include at least four different projectile point types including metal, Prairie Side-Notched, Plains Triangular and Plains Side-Notched. The individual occupation levels within this soil horizon could not be separated in the stratigraphy at any time. Nine features were uncovered and have been interpreted as a bone-filled pit, a stone boiling pit, a hearth, a pottery cluster, two ash stains and three organic stains. This level contained the highest number of artifacts recovered although faunal remains were highly fragmented.

Level Two

Level two is separated from level one by slight inclusions of sandy silt, however, in most excavation units it is nearly impossible to separate the levels stratigraphically. In general, level two ranges from 10 to 15 cm below surface but there is considerable variation in depth both above and below this average. As with level one, level two contains a mixture of artifacts including four different projectile point types: Prairie Side-Notched, Plains Triangular, Plains Side-Notched and Avonlea Triangular. Ten features were described and include: three hearths, two lithic flaking stations, two organic stains, a bone concentration, an ash stain and a large bone and ash lens covering at least 2 m^2. Individual occupation layers could not be separated in the stratigraphy. On average the Avonlea Triangular projectile points were located towards the bottom of the paleosol.

<u>Level Three</u>

Soil horizon three is located between 15 to 25 cm in depth and is often separated from level two by a thin layer of sandy clay. Towards the eastern edge of the excavation, levels two and three are very close stratigraphically and could not be easily separated. Identified projectile point types include Prairie Side-Notched (an early variant), Avonlea and Besant (Mack, pers. comm.). Eight features were described and include two stone filled pits (one with a maximum depth of 80 cm below surface), one hearth, two ash stains, a concentration of flakes and debitage, and three bone uprights (two ribs and a humerus). Unit 17S4E revealed the separation of level three into two distinct layers which were designated levels 3a and 3b.

<u>Level Four</u>

Level four is separated from level three by a sterile layer of gravelly mud. It is difficult to assign an average depth to this level because it slopes downwards from east to west (see Figure 3.2). The calculated average falls between 27 to 33 cm in depth with a range of at least 4 cm above and below this average. This soil horizon is poorly developed and is often thin, periodically disappearing in the stratigraphy. No projectile points were identified in level four but it is believed to represent a McKean level.

<u>Level Five</u>

On average level five is located between 33 to 47 cm below surface but again there is considerable variation due to sloping. All of the projectile points recovered in this level are typical of the McKean Cultural complex and include three varieties: Duncan, Hanna and McKean Lanceolate. Nine features were discovered including six hearths, two organic stains and an area of concentrated bone. For the most part, level five was comprised of a single continuous soil horizon, however, in several units the horizons separated into multiple levels which were designated 5a, 5b and 5c (Figure 3.3). A humerus from level 5c has yielded the only radio-carbon date thus far at 4040 +/- 90 uncalibrated RCYBP (S-3645).

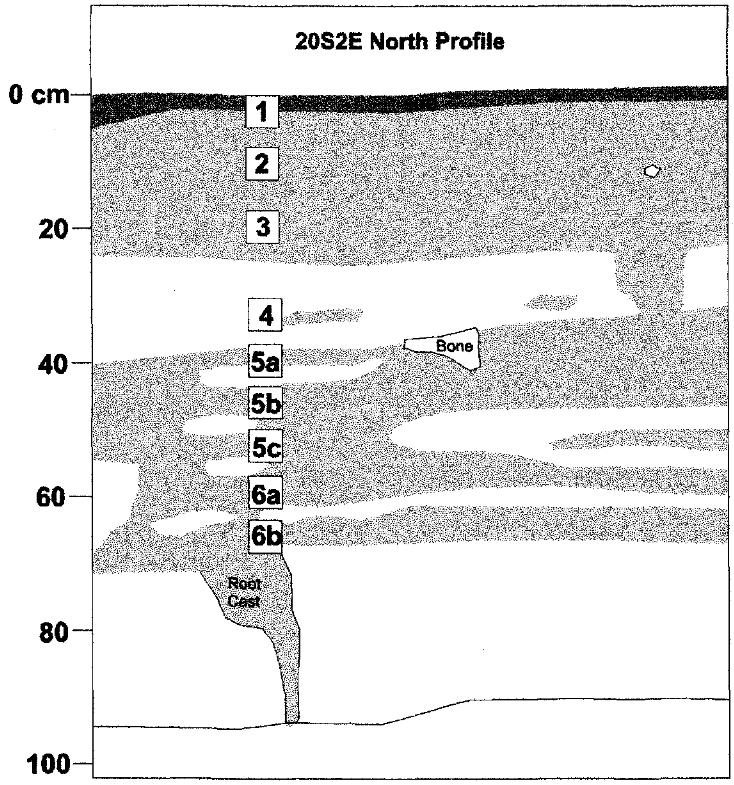

Figure 3.3 Wall profile revealing the separation of buried soil horizons.

Level Six

Level six was initially recorded immediately below level five with only slight inclusions of sand or sandy silt. Excavation in the western units later revealed a separation of the two levels by a sterile sandy layer. The average depth is 45 to 57 cm but again this average can be deceiving due to the large degree of slope at the western ends of the excavation (see Figure 3.2). This level also separated, towards the western edge of the site, into two levels designated 6a and 6b (Figure 3.3). All of the projectile points from level six have been identified as Oxbow with the exception of a Duncan base. The Duncan point was found at 43 cm below surface and may have been recorded in the wrong level. Four features were excavated including a hearth, an ash lens, an organic stain and a lithic concentration.

Level Seven

Soil horizon seven is only present in the eastern portions on the excavation with an average depth between 70 to 80 cm below surface. This level was separated from level six by a relatively thick layer of sand. No diagnostic cultural artifacts were recovered but cultural materials were present including a Knife River Flint endscraper and numerous Knife River Flint flakes. There were few mammalian faunal remains and most were highly fragmented. It is believed that the creek channel crossed the terrace after the deposition of these artifacts and the majority of the level was redeposited by the flow of water. The remains of many aquatic animals, such as frogs, salamanders and snails, seems to support this hypothesis.

3.3.2 Natural Stratigraphy

Opimihaw Creek is a typical meandering stream with multiple point bars and a highly sinuous channel. The Thundercloud site is located on a large point bar on the eastern side of the creek (see Figure 2.3) and the natural stratigraphy of the site has been dictated, for the most part, by this alluvial environment. An initial investigation of the Thundercloud site stratigraphy was conducted in 1995 by Abigail Burt, a graduate student at the University of Saskatchewan (Burt 1997). Data from her thesis (Burt 1997:127-134), in conjunction with personal observations made during excavation, form the basis for the following descriptions.

Figure 3.4 reveals a photographic profile of the Thundercloud site stratigraphy in comparison to the sediment profile described by Burt. It should be noted that some of the original facies descriptions (Burt 1997: 94-100) have been slightly modified by me due to additional information provided by the 1996-1998 field seasons.

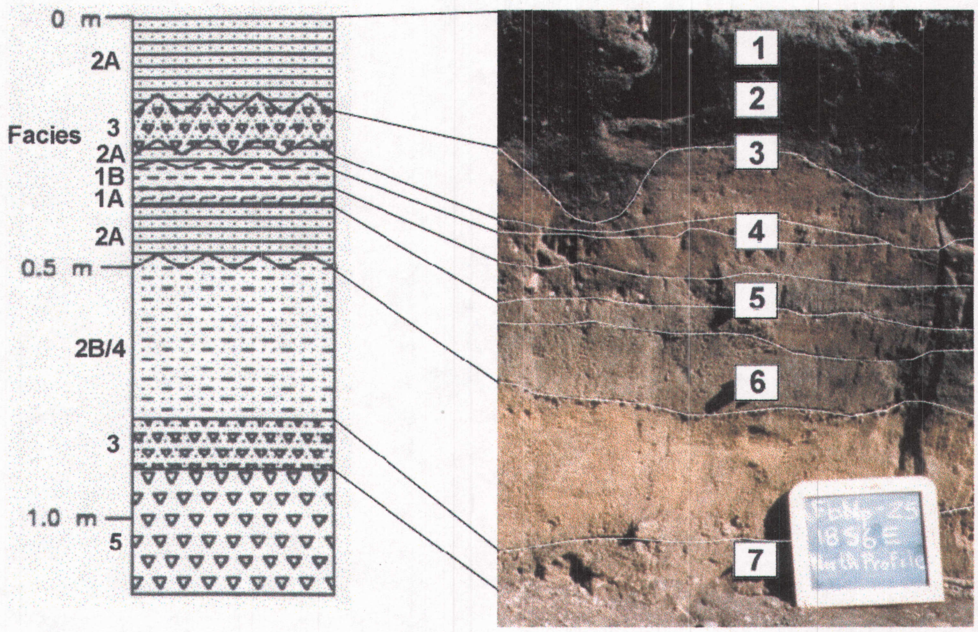

Figure 3.4 Comparison of natural and cultural stratigraphy at the Thundercloud Site (natural stratigraphy from Burt 1997: 130).

The sod layer is generally quite thin, between 0 to 5 cm below the surface. Directly below the sod, but above the first buried soil horizon, is a thin layer of charcoal and stained earth which has been interpreted as the remains of prairie fire. Directly below this is a thick sediment layer, facies 2A, which includes buried soil horizons one, two and three. On average this facies starts at 5 cm and ends at 24 cm below the surface. It is described as slightly gravelly sandy mud (Burt 1997: 95) with a high organic content. This sediment tends to be quite fine-grained suggesting some distance from the creek channel and was formed from periodic episodes of overbank flooding. Sediment load is lowest towards the outer margins of the flood water leading to the deposition of these finer-grained particles.

Between soil horizons three and four, from 24 to 28 cm in depth, is a thin layer of facies 3. This layer is defined as gravelly mud and gravelly muddy sands (Burt 1997: 96-98). These sediments may represent colluvium which was deposited on the site due to slumping from the eastern slope. Several large boulders, deposited on the eastern border of the site, suggest that severe slumping has occurred in the past. Directly below this layer is another inclusion of facies 2A which contains paleosol four.

A thin layer of facies 1B separates levels four and five, approximately 28 to 35 cm in depth. These are fine-grained sediments consisting of muddy sands and sandy silts (Burt,1997: 94). Sediments within this facies are more fine-grained than facies described higher up in the stratigraphy. This suggests two possibilities: the creek is farther from the terrace and only marginal flood waters are covering the site surface, or that water levels were lower during this time period and flooding was less common and less severe. Environmental change may be a likely hypothesis and is discussed further in Chapter 12. This situation is further exaggerated in facies 1A, directly below facies 1B, between 34 and 37 cm below surface. In some areas of the site, where level five is separate, this layer corresponds to level 5a. Facies 1A is similar to 1B with fine-grained particles but there tends to be less sand.

Heavier flood conditions return below facies 1A in the form of facies 2A. This thick layer of muddy sand lies between 37 and 53 cm below surface and includes the majority of soil horizons five and six. In the western excavations a thin inclusion of facies 1A was noted at the bottom of this layer, corresponding with buried soil horizon 6b. The presence of Oxbow cultural artifacts within paleosol six suggests that during the past 4000 years B.P. the alluvial terrace has remained the dominant landform.

Burt (1997: 130) described the next layer, between 53 to 70 cm, as facies 2B. This facies tends to be similar to facies 2A, with gravelly muddy sand, but tends to be more coarse grained. Burt suggests that this may represent areas very close to the stream channel, perhaps even the stream bank area. This interpretation seems likely since excavations to the west of Burt's unit (closer to the creek) revealed a gradual replacement of facies 2A by facies 4 within the same layer. Facies 4 consists of sand and muddy sand and represents fluvial transport of sediments, in the form of channel sands, onto the point bar (Burt 1997: 99).

At 70 cm below surface Burt (1997: 130) describes a thin layer of facies 3. This layer is only present in the eastern excavations and contains the remnants of buried soil horizon seven. Previously facies 3 was interpreted as colluvium, consisting of gravelly muddy sands. This layer is not likely colluvium, rather it probably represents stabilized bank sediments (facies 2B) that were degraded as the river passed over the terrace towards its present location.

Below 75 cm, to a depth of at least 120 cm, is a thick layer of facies 5. This layer consists of muddy sandy gravel and gravelly muddy sand (Burt 1997: 100). These sediments are stream deposits and represent the movement of the creek into its current position. No cultural materials were discovered in this level. These materials may have been present but would have been eroded by creek flow.

3.4 Summary

An examination of the culture history of the Saskatoon area reveals a complex and diverse series of occupations during the past 10000 years. Located within a sheltered valley on the edge of the Northern Plains, Opimihaw creek provided an ideal campsite which has seen continued occupation during the past 5500 years BP. The site is located within close proximity to the creek channel and the site stratigraphy reveals a long sequence of alluvial deposition. Closer to the modern creek channel, the stratigraphy is well separated and reveals a rich history of occupation. More importantly, at least four occupation levels have been identified to the McKean cultural complex, a complex that tends to be poorly represented in Saskatchewan.

Chapter 4

Methodology

4.1 Excavation Procedures

As previously mentioned, the Thundercloud site was initially surveyed in 1982. Full scale excavations did not begin until the summer of 1993 when the Department of Anthropology and Archaeology at the University of Saskatchewan chose the site for the annual archaeological field school (Figure 4.1).

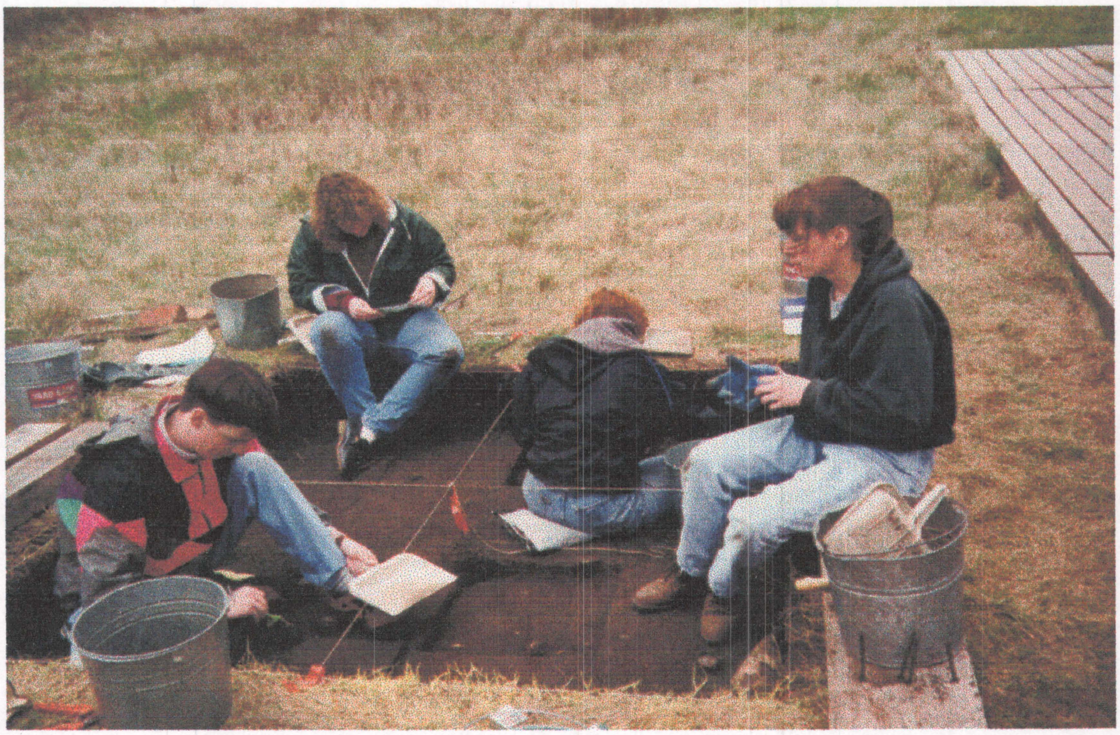

Figure 4.1 1996 Field school students at the Thundercloud site.

The main datum was placed to the northwest of the site proper and was designated 0 north/south, 0 east/west. All of the 1 x 1 metre excavation units were laid in to the south and east of the main datum point. Each unit was then divided into four quadrants to maintain tight control of provenience during excavation. Work was completed using trowels and brushes, except in the lowermost levels where shovels were often used.

The compact nature of the stratigraphy in cultural levels one, two and three (see Figure 2.4) led to the use of arbitrary 5 cm levels to a depth of at least 25 cm (the average bottom depth of cultural level three). Natural levels were then used to excavate levels four through seven. Exposed artifacts were left *in situ* and pedestaled when possible. After the exposure of each level, planviews were drawn and three-dimensional provenience was recorded for each artifact. Any features were drawn on the planview and cross-sections of many features were completed as well. Photographs were taken of each completed level prior to the removal of any artifacts. Sediment excavated from the northwest quadrant of each unit as well as from all features was placed in bags and taken to the laboratory for water screening. All other matrix was screened through 6 mm mesh sieves.

In total 45 units (excluding the 1982 test pit) were excavated over a period of six summers (Figure 4.2). Note that three of these were 1m x 0.5m units. The highest artifact density was recorded to the west and south of the main excavation trench. Work was expanded in these areas during the field seasons of 1997 and 1998. Due to time constraints artifacts recovered during the 1998 field season will not be analyzed for the purposes of this report.

4.2 Laboratory Procedures

4.2.1 Treatment of Artifacts

Artifacts recovered in the field were taken to the archaeological and paleoenvironmental laboratory located within the interpretive centre at Wanuskewin Heritage Park. Specimens were washed, sorted and identified, if possible, by the field school students. Identifications were later confirmed by myself using the comparative collection at the University of Saskatchewan. Bone fragments were separated by degree of burning and then counted and weighed. Any identifiable specimen found within a fragment bag was separated and catalogued with an individual identification number. Relevant information was recorded on a card and placed in the bag with each specimen and then artifacts were boxed by excavation unit.

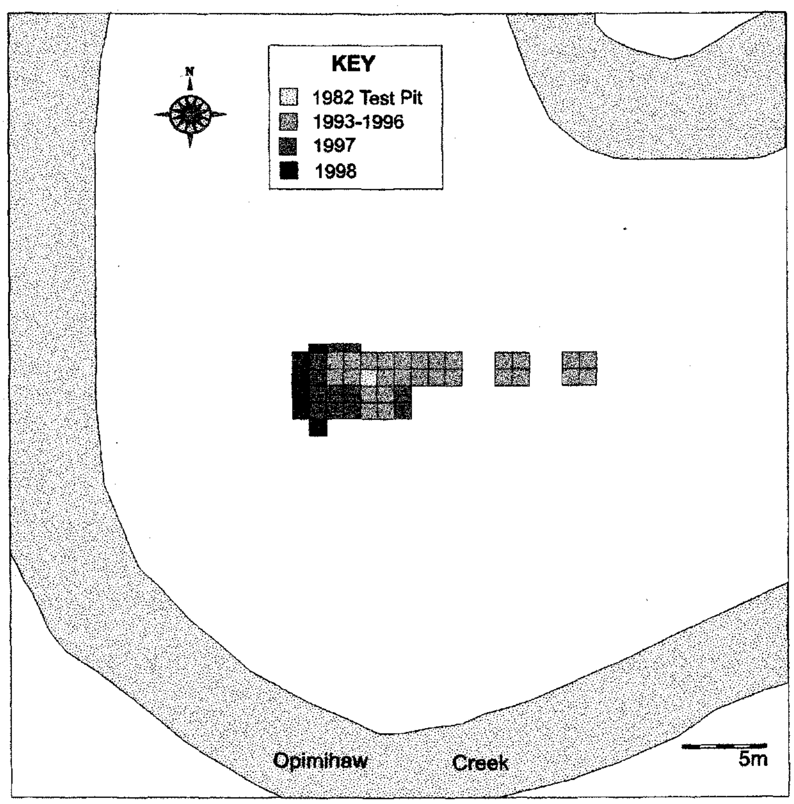

Figure 4.2 Map of excavation units by excavation year at the Thundercloud site.

Students also completed an initial catalogue of the artifacts from each unit. Unfortunately, every group began cataloguing at one creating problems during analysis. For this reason all faunal artifacts, from the entire assemblage, were renumbered to ensure that each artifact had an individual and unique identification number. The catalogue was entered into the computer using a database designed in Microsoft™Access.

4.2.2 Treatment of Sediment Samples

Sediment samples were dried in the laboratory prior to storage to prevent the formation of fungus. Initially this project was designed to process the samples in a flotation machine but this method proved too costly. As a result all samples, excluding those taken from features, were water-screened. Using this method samples were placed into a container covered by 1.6 mm diameter screen. Gentle water pressure was applied to the sample and any sediment grains were washed through the screen leaving the artifacts and larger pebbles behind. The remaining materials were then placed on drying trays and later re-bagged.

Feature samples were hand-floated using a manual flotation bucket (described in Pearsall, 1989:36). To summarize, the bottom of a galvanized bucket is removed and replaced by fine mesh (less than 1mm in diameter). The bucket is immersed in a large container filled with water and the sample is slowly poured into the bucket. The bucket is then gently raised and lowered and a scoop is used to collect the light fraction as it floats to the surface. The heavy fraction remains on the bottom of the bucket and is removed when all of the sediment has been displaced through the screen. This method is much more time consuming than water-screening but it is less abrasive leading to the recovery of many more fragile artifacts such as seeds and small vertebrate remains.

Once the samples were dry they were examined under a light magnifier and any identifiable artifacts were removed. These included vertebrate and invertebrate remains, tool fragments, pottery remnants, micro-flakes, and paleontological specimens (shark teeth, coral). All non-faunal cultural artifacts were separated for further analysis by graduate student Lis Mack.

Finally, all artifacts were separated by type and bagged with an individual artifact number. Identifiable faunal specimens were identified by myself while all floral remains were identified by Dr. John Hudson from the Department of Agriculture at the University of Saskatchewan. The artifacts were then catalogued and added to the database noted previously.

4.3 Qualitative and Quantitative Analysis

4.3.1 Methodology

Qualitative analysis was conducted during the early stages of identification. This descriptive process involved recording any bone modifications which were present on each specimen and included the presence or absence of the following: weathering, weathering type, burning, cut marks, tooth marks and root erosion. General notes were also included for each specimen and included remarks such as proximity to features and possible association to other artifacts.

Quantitative analysis was conducted after all artifacts had been catalogued. Simple statistic calculations were completed by hand and confirmed by the computer. Complex analyses were conducted using various formulations programmed into Microsoft™ Excel. Charts and tables were created in a similar fashion.

4.3.2 Terminology

There are many terms used in this thesis, both statistical and descriptive, which must be described. The terms **specimen**, **element** and **fragment** are perhaps the most difficult to separate. This thesis follows Grayson (1984:16) who suggests, "a specimen is a bone or tooth, or fragment thereof, from an archaeological or paleontological site, while an element is a single complete bone or tooth in the skeleton of an animal." This definition of specimen is not without its flaws and must be modified here to include non-vertebrate faunal remains. A more accurate definition then, for the purpose of this report, would be as follows; a specimen is a bone, tooth, shell or seed, or fragment thereof, from an archaeological or paleontological site. The definition of element is not without its own problems. A single complete snail shell cannot be described as an element because an element in itself describes something that is a part of a whole (for example many elements make up an entire skeleton). The definition of a fragment will follow Brink and Dawe (1989:80) who suggest that a fragment is a fraction of an element which cannot be recognized to a specific element but may be assigned to a class of elements such as tooth enamel or long bones. It should be obvious that there is considerable overlap in the definition of these three terms and indeed the terms fragment and unidentifiable specimen could be used to describe the same artifact. Similarly some identified specimens could also be called elements. This thesis attempts to avoid using an overlap in terms whenever possible.

Statistical abbreviations used in this thesis include the following: **N** (number), **NISP** (number of identified specimens), **MNI** (minimum number of individuals), **MNE** (minimum number of elements), **MAU** (minimum number of animal units) and **%MAU**. N is a simple abbreviation for number and is used to summarize specimen counts. The NISP is a unit of abundance which refers to all specimens that have been identified to a specific element or class of elements. The MNI refers to the minimum number of individual animals needed to account for the NISP (Grayson 1984). MNI values account for side but not for degree of fragmentation and for this reason MNE is a more accurate count of the number of animals present in the assemblage. The MNE is the minimum number of elements needed to account for the NISP. Lyman (1994:102-104) notes that several methods can be used to derive the MNE from the NISP. These methods vary but what is most critical is that the analyst describe the method used. In this thesis MNE values were derived by counting anatomical landmarks (such as the deltoid tuberosity on the humerus). The landmark with the highest count became the count for the element. Note that in some instances the side of the specimen was taken into account to determine these values.

MNE values were then used to calculate the MAU. Binford (1978:70) describes the MAU as the observed bone count for each anatomical unit (MNE) divided by the number of times that anatomical unit occurs within the animal's complete skeleton. Calculated MAU's were then used to create a table of %MAU which involves dividing all MAU values by the highest MAU value calculated for the assemblage. The %MAU provides a method of measuring how well different elements are represented within the archaeological assemblage.

The terms **light**, **medium** and **heavy concentration** are used to describe many of the distribution patterns. For the purposes of this thesis a light concentration consists of one to three identified specimens, a medium of four to six identified specimens, and a heavy concentration refers to seven or more identified specimens.

Background faunal and floral specimens are specimens which were deposited during the period of occupation but are not present as a direct result of cultural activity. Although they are not part of the cultural assemblage they are still contemporaneous and provide insights into the environmental and seasonal conditions at the site at the time of occupation.

Finally, during the analysis and classification of many of the faunal remains, specifically the non-bison specimens, it was necessary to adopt a number of size classes used to describe specimens that could not be assigned to a given taxon yet their size suggested they belonged to a certain weight or size grouping. Table 4.1 lists the terms and classes (adapted from Dyck and Morlan 1995:140) which are used in this thesis.

Weight specification was not used to create the size classes for birds and miscellaneous vertebrates, instead gross body size is used as an overall estimate. This presents obvious problems for animals which overlap in body size, however, very few avian elements were recovered and an extensive list was not needed in this study.

Table 4.1 Description of size classes used in this thesis (Mammal classes from Dyck and Morlan 1995:140).

Size Class	Weight	Associated Terms	Examples
SC6	200-700 kg	Very Large Mammal	Elk, Bison
SC5	25-200 kg	Large Mammal	Wolf, Pronghorn
SC4	5-25 kg	Medium Mammal	Coyote, Badger
SC3	700-5000 g	Small-Medium Mammal	Fox, Hares, Skunk
SC2	100-700 g	Small Mammal	Ground Squirrel
SC1	<100 g	Micro-Mammal	Mice, Voles
SC5	-	Large Bird	Crane, Eagle
SC4	-	Medium Bird	Raven
SC3	-	Small-Medium Bird	Ducks
SC2	-	Small Bird	Robin
SC1	-	Micro-Bird	Warblers
SC2	-	Small Vertebrate	Ground Squirrel, Meadowlark
SC1	-	Micro-Vertebrate	Mice, Frogs, Salamanders, Warblers

Chapter 5

The Level One Faunal and Floral Assemblage

5.1 The Level One Faunal Assemblage

A total of 31734 faunal specimens were recovered from level one with a weight of 29.98 kg (Table 5.1) . Due to the high degree of fragmentation 95.4% of the assemblage is unidentifiable and the majority of these (83.8%) are represented by unburned specimens.

Table 5.1 Level one faunal assemblage separated by degree of burning.

	Identified			Unidentified			Total	
	N	%N	Weight (g)	N	%N	Weight (g)	N	Weight (g)
Unburned	1342	5.0	13415.3	25363	95.0	15637.6	26705	29052.9
Burned	7	0.2	2.9	3786	99.8	687.7	3793	690.6
Calcined	107	8.7	1.4	1129	91.3	236.5	1236	237.9
Total	**1456**	**4.6**	**13419.6**	**30278**	**95.4**	**16561.8**	**31734**	**29981.4**

By weight, the majority of burned and calcined specimens were unidentified, however, unburned bone weights were split more evenly between identified and unidentified specimens at 46.2% and 53.8% respectively.

At least 14 taxa are represented in level one (Table 5.2). Due to a lack of identifiable characteristics 152 specimens were assigned to the category of size class. Undoubtedly some of these specimens represent taxa that were not identified.

Table 5.2 Summary of level one faunal remains by taxa.

Common Name	Taxon	NISP	MNI
Mammals			
Bison	*Bison bison*	1229	8
Pronghorn	*Antilocapra americana*	5	1
Small-Medium Artiodactyl (SC5)		4	-
Medium-Large Canid (SC5)	*Canis sp.*	9	1
Small-Medium Canid (SC4)	*Canis sp.*	20	2
Badger	*Taxidea taxus*	1	1
Skunk	*Mephitis mephitis*	1	1
Weasel family	Mustelidae	1	-
Hares	*Lepus sp.*	1	1
Rabbit family	Leporidae	2	-
Ground squirrel	*Spermophilus sp.*	6	1
Meadow vole	*Microtus pennsylvanicus*	8	1
Voles	*Microtus sp.*	1	1
Pygmy shrew	*Microsorex hoyi*	1	1
Birds			
Warbler	Emberizidae	1	1
Amphibians			
Frogs	*Rana sp*	1	1
Frogs and Toads	Anura	3	-
Invertebrates			
Clams	Pelecypoda	4	1
Valve snail	*Valvata sincera*	2	2
Snails (shell fragments)	Gastropoda	4	1
Miscellaneous			
Large Mammal (SC5)		12	-
Medium Mammal (SC4)		3	-
Small-Medium Mammal (SC3)		96	-
Small Mammal (SC2)		35	-
Small Vertebrate (SC2)		4	-
Microvertebrate (SC1)		2	-
Total		1456	25

Order Artiodactyla

Bison bison

Specimens identified: NISP=1229; see Table 5.3 for a summary. MNE and MAU values were calculated by landmark. A summary of these calculations can be found in Appendix II (Table 1).

Distribution and habitat: Bison were hunted to near extinction in North America and now exist in isolated herds located within various National Parks in Canada and the United States. Bison once ranged throughout most of central North America from northern Mexico to the Great Slave Lake region of the North West Territories. They are highly gregarious and would often undergo extensive migrations in order to find food. They inhabit a wide range of habitats including open plains, river valleys, and aspen parkland (Banfield 1974: 405-407). A northern subspecies, *Bison bison athabascae*, was common throughout the boreal forest.

Discussion: The majority of the identified specimens recovered (82.5%) are classified as bison. At least eight individuals are represented by the specimens identified, based on the number of lateral malleoli. The majority of the specimens lack any form of cultural modification. Only one specimen exhibits burning and six have evidence of cut marks. Weathering is described as light to absent with rootlet etching and exfoliation being most common. Most specimens are highly fragmented and it is believed that the majority of the 30728 unidentified specimens represent bison bone fragments.

Table 5.3 Summary of bison elements from level one.

	NISP	MNI (Side)	Total MNE	Total MAU	%MAU
Axial Skeleton					
Cranium (M^1)	116	6	8	4	72.7
Mandible	168	6	10	5	90.1
Hyoid	5	2	3	1.5	27.3
Sternum	0	0	0	0	0
Atlas	1	1	1	1	18.2
Axis	0	0	0	0	0
Cervical Vertebrae	11	1	2	0.29	5.3
Thoracic Vertebrae	17	1	2	0.14	2.5
Lumbar Vertebrae	6	1	1	0.17	3.1
Sacrum	2	1	1	1	18.2
Caudal Vertebrae	1	1	1	0.07	1.3
Forelimb					
Scapula	41	1	2	1	18.2
Humerus	57	4	7	3.5	63.6
Radius	46	7	10	5	90.9
Ulna	34	5	8	4	72.7
Internal Carpal	11	6	9	4.5	81.8
Radial Carpal	10	4	6	3	54.5
Accessory Carpal	3	1	2	1	18.2
Ulnar Carpal	9	5	9	4.5	81.8
Unciform Carpal	7	6	7	3.5	63.6
Fused 2/3 Carpal	7	5	6	3	54.5
Metacarpal	37	7	11	5.5	100
5th Metacarpal	1	1	1	0.5	9.1
Hindlimb					
Innominate	15	2	3	1.5	27.3
Femur	26	5	8	4	72.7
Patella	2	1	1	0.5	9.1
Tibia	91	6	10	5	90.9
Lateral Malleolus	14	8	11	5.5	100
Calcaneus	5	2	4	2	36.4
Astragalus	3	3	3	1.5	27.3
Fused C/4 Tarsal	7	3	5	2.5	45.5
Fused 2/3 Tarsal	12	5	9	4.5	81.8
1st Tarsal	1	1	1	0.5	9.1
Metatarsal	53	4	7	3.5	63.6
2nd Metatarsal	2	1	2	1	18.2
5th Metatarsal	1	1	1	0.5	9.1
Other Elements					
1st Phalanx	26	3	18	2.25	40.9
2nd Phalanx	26	3	20	2.5	45.5
3rd Phalanx	36	3	20	3.5	45.5
Proximal Lateral Sesamoid	10	1	8	1	18.2
Proximal Medial Sesamoid	9	1	6	0.75	13.6
Distal Inferior Sesamoid	10	2	10	1.25	22.7
Miscellaneous					
Vertebrae Indeterminate	5	-	-	-	-
Metapodial Indeterminate	7	-	-	-	-
Molar/Premolar Indeterminate	18	-	-	-	-
Rib Head	6	-	-	-	-
Rib Shaft	254	-	-	-	-

Antilocapra americana

<u>Specimens identified</u>: NISP=5; atlas (5543), left P^2 (5546-1), left P^3 (5546-2), right M_2 (5547), indeterminate premolar (5569).

Small-medium artiodactyl (SC5)

<u>Specimens identified</u>: NISP=4; axis fragment (5588), distal second phalanx (5554).

<u>Distribution and habitat</u>: While the pronghorn once ranged throughout the entire southern half of Saskatchewan, it is now limited to the extreme south and southwest (Banfield 1977:404). Pronghorn are at home on open grasslands where they use their speed to escape predators. In winter pronghorn commonly migrate to the south and west to escape deep snow cover. They often shelter in coulees and open river valleys.

<u>Discussion</u>: This small assemblage, representing one individual, was recovered within two adjacent excavation units and is likely associated. Numerous tooth marks are present on the atlas and phalanx including both pitting and punctures. The size of the punctures suggests they were made by a large carnivore. No cultural modifications were observed.

Order Carnivora

Canis sp. (SC5)

<u>Specimens identified</u>: NISP=9; left I^3 (5567), four indeterminate incisors (5550, 5565, 5566, 5573-1), left C_1 (5548), right C_1 (5549), left P^2 (5552), indeterminate right premolar (5550).

<u>Discussion</u>: The majority of these teeth were recovered within the same excavation unit. They are all heavily worn and likely represent one individual. These teeth are larger than those on the specimen of *Canis lupus* at the University of

Saskatchewan. They are likely from a wolf, but may also represent a large domestic dog.

***Canis sp.* (SC4)**

Specimens identified: NISP=20; left I^1 (5592), left P_2 (5570), right P_4 (5580), P_4 (6388), indeterminate premolar (5572), M_3 (6387), two indeterminate molars (5568, 5573-2), basihyoid (6403), stylohyoid (6404), thyrohyoid (6405), atlas (5544), sacrum (5545), proximal left scapula (5579), metapodial shaft fragments (5563, 5582, 5586), left 4th carpal (5589).

Discussion: These specimens, with the exception of the sacrum, are similar in size to several *Canis latrans* specimens present in the faunal collection. They are likely coyote or domestic dog. The sacrum is from an immature individual and could represent any of the large canids. Based on the presence of the sacrum at least two individuals can be identified. The majority of teeth examined exhibit slight to moderate weathering including abrasion, exfoliation and cracking. The postcranial remains do not exhibit weathering and may represent a different individual.

Taxidea taxus

Specimens identified: NISP=1; right 3rd carpal (5590).

Distribution and habitat: The American badger is common throughout the Northern Plains and parklands, but rarely ventures into the forest. Badgers are fossorial animals, digging large burrows up to 10 feet deep. They prefer open areas where they hunt for ground squirrels. On the Northern Plains, badgers hibernate during the winter months (Banfield 1977:335-336).

Discussion: It is unknown whether or not this specimen is part of the cultural assemblage. There are no cut marks or burning present. The bone exhibits staining similar to that of other faunal remains in the assemblage and there is no evidence of a burrow nearby.

Mephitis mephitis

Specimens identified: NISP=1; right M^3 (5591)

Mustelidae Indeterminate

Specimens identified: NISP=1; indeterminate premolar (6016)

Distribution and habitat: The striped skunk is common throughout most of North America. They are at home in both grasslands and forests but they prefer areas with some covering vegetation. They are often found in river valleys and coulees. Striped skunks begin hibernation early in December (Banfield 1977:339).

Discussion: These specimens represent one individual. The premolar is missing a small fragment making identification difficult. Still, it is similar in size and shape to the specimens at the University of Saskatchewan. There are no cultural modifications on either specimen.

Order Lagomorpha

Lepus sp.

Specimens identified: NISP=1; indeterminate molar (6014).

Leporidae Indeterminate

Specimens identified: NISP=2; right ramus (5587), rib head (5559).

Discussion: These specimens likely represent one individual. The rib head and the molar were found in the same excavation unit. There is no cultural modification present on any of the specimens. Bone colour is consistent with the rest of the assemblage. The molar could not be identified to species as it was similar in size to both *L. townsendii* (white-tailed jack rabbit) and *L. americanus* (snowshoe hare). Both species are commonly found within the site vicinity, although *L. townsendii* tends to have a more southerly distribution.

Order Rodentia

Spermophilus sp.

Specimens identified: NISP=6; right I^1 (5575), right M^1 (6230), right M^2 (6265), indeterminate molar (5852), proximal right ulna (5555), distal right humerus (5574).

Discussion: These remains represent one individual. There is no cultural modification present though bone colour is consistent with the rest of the assemblage. Identification to species is difficult with individual teeth. Both *S. richardsonii* (Richardson's ground squirrel) and *S. tridecemlineatus* (13-lined ground squirrel) are common at the site and, while *S. tridecemlineatus* tends to be the smaller of the two species, there is considerable overlap in body size.

Microtus pennsylvanicus

Specimens identified: NISP=8; right I^1 (6237), left I^1 (6234), left I_1 (6236), left M_2 (6232), left M_3 (6233), right M^2 (6081), right M^3 (6080), left ramus (6235).

Distribution and habitat: The meadow vole is common across Canada and the northern United States. They are found in moist meadows and wet grasslands. They tend to avoid dry grasslands and forested areas (Banfield 1977:210). Meadow voles are active throughout the winter living in tunnels under the snow. They do not live in burrows, but may use them for shelter and to avoid predation.

Discussion: Specimens 6232-6237 were found associated and are identified here by association. No cultural modification is evident on any of the specimens although their colour is consistent with the rest of the faunal assemblage.

Microtus sp.

Specimens identified: NISP=1; indeterminate molar (5893).

Discussion: This specimen was separated from those described above because it is calcined and was associated with feature 1-2 (see Figure 5.1 for feature location and description). For this reason it is believed to represent a separate individual. The tooth was slightly fragmented and could not be identified to species.

Order Insectivora

Microsorex hoyi

Specimens identified: NISP=1; right mandible with tooth roots (5961).

Distribution and habitat: The pigmy shrew is found throughout most of southern and central Canada with a limited range in the north-eastern United States. Pygmy shrews prefer the boreal forest but will inhabit any area with a heavy protection of grasses (Banfield 1977:20).

Discussion: This specimen is completely burned but was not found within the vicinity of a visible feature. The crowns of all of the teeth are absent but the rest of the mandible is complete. It was identified based on its size and matches the comparative specimen at the University of Saskatchewan.

Order Passeriformes

Emberizidae

Specimens identified: NISP=1; proximal right ulna (5593).

Discussion: This specimen is identified as a warbler based on its size. It matches many of the specimens in the comparative collection but unfortunately it is too fragmented to make a more accurate identification. This specimen is not culturally modified but does exhibit colouration similar to the rest of the assemblage.

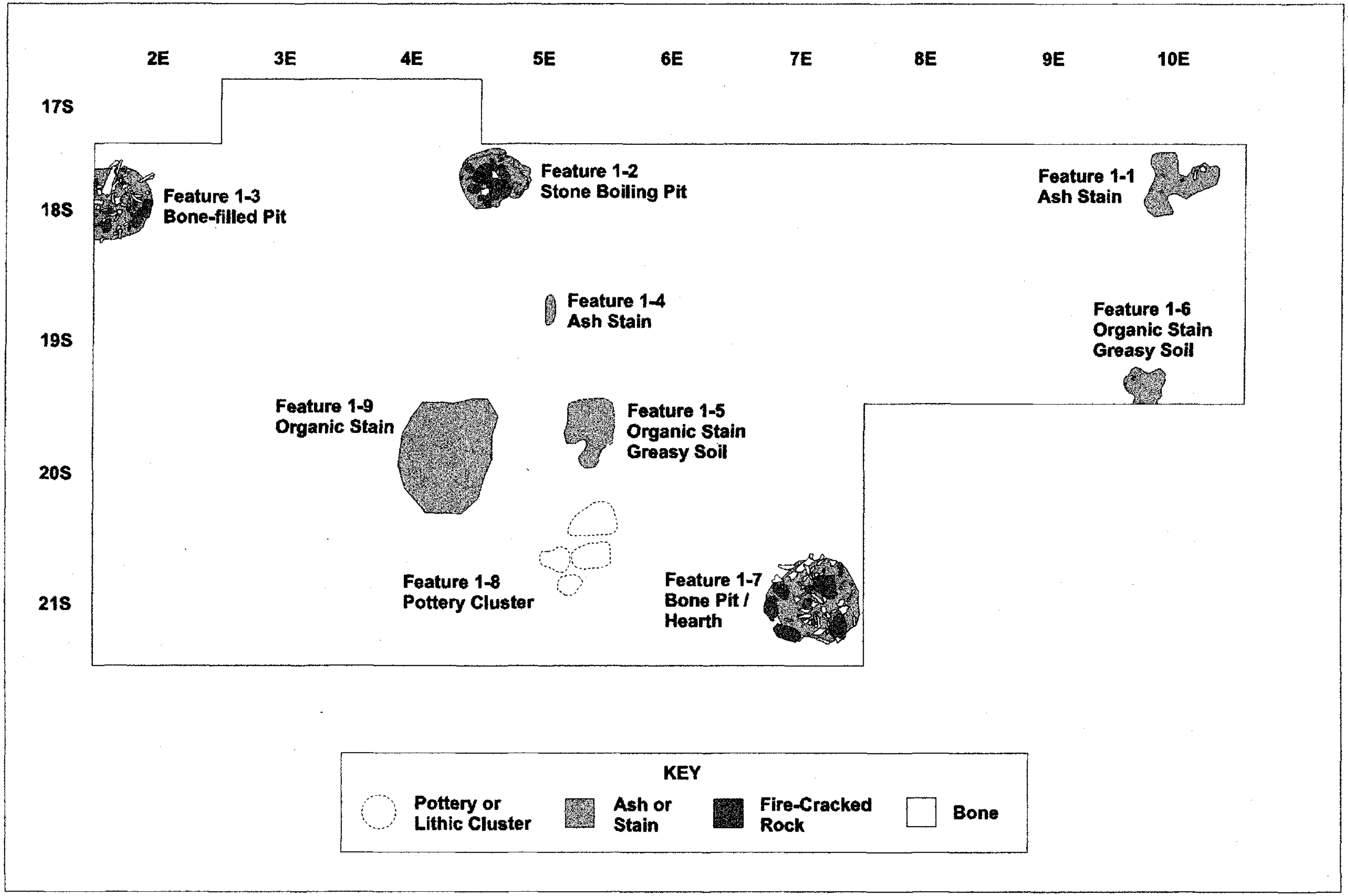

Figure 5.1. Layout and description of features from level one of the Thundercloud site.

Order Anura

Rana sp.

Specimens identified: NISP=1; right innominate (6276).

Anura Indeterminate

Specimens identified: NISP=3; humerus (5963), proximal right humerus (6013), longbone (6275).

Discussion: These specimens represent one, possibly two, individuals. Specimens 6276 and 6275 were found together in feature 1-2 and are burned. Another element (5963) was also burned but was found outside the hearth. The broken humerus was not burned but bone staining is consistent with the rest of the assemblage.

Order Eulamellibranchia

Pelecypoda Indeterminate

Specimens identified: NISP=4; two margin fragments (5598,5541), two body fragments (5542,5543).

Discussion: One individual is represented by the specimens recovered. The largest fragment (5541) is quite robust and, based on the shell thickness, can be assigned to the family Unionidae. Three genera of unionid pelecypods are represented in Saskatchewan; *Lampsilis*, *Lasmigona* and *Anodonta*. These are large mussels (80-110cm long) which are found in many habitats (Clarke 1981). Several species are found in small streams in water as shallow as 8 cm in depth. The other margin fragment (5598) is rectangular in shape and is highly polished. This specimen may have been part of a shell pendant.

Order Mesogastropoda

Valvata sincera

Specimens identified: NISP=2; two complete shells (5839,5840).

Distribution and habitat: A widely distributed species throughout most of Canada. There are two subspecies; *V. sincera sincera* and *V. sincera helicoidea*. *V. sincera helicoidea* is an arctic and subarctic subspecies, while *V. sincera sincera* is a southern variant. There is a broad region of overlap where both species co-exist. In Saskatchewan this area of overlap includes areas just north of the South Saskatchewan river. Common in lakes (up to 15 metres in depth) they may also be found in slow moving rivers and streams. They are most numerous in submerged vegetation and in muddy substrates (Clarke 1981:46-49).

Discussion: Two complete individuals are represented in this assemblage. Due to their small size (maximum width 7mm) these specimens are undoubtedly not present as a result of cultural activities. There are few methods which can be used to determine the taphonomic history of these specimens. They may have been deposited during a period of overbank flooding; however, these specimens are small enough that they could have easily been deposited within a rodent burrow and then covered at a later date. For this reason it is difficult to discern whether these specimens are intrusive or contemporaneous.

Miscellaneous Specimens

Specimens identified: NISP=152; see Table 5.4.

Discussion: A total of 152 specimens were identified to the category of size class. Table 5.4 summarizes the number and type of elements assigned to each of these classes. Many of the specimens were burned suggesting cultural modification and therefore a summary of burned specimens is also included.

Table 5.4. Summary of level one miscellaneous specimens by size class.

Size Class	NISP	Elements Represented	# Burned	Type burned
5 - Large Mammal	12	Rib and Vertebrae frags	0	N/A
4 - Medium Mammal	3	Tooth Roots	0	N/A
3 - Small/Med Mammal	96	Longbone Shaft, Femur Head	95	Longbone Shaft Frags
2 - Small Mammal	35	Longbone Shaft, Phalanges	12	Longbone Shaft, Distal Phalanges
2 - Small Vertebrates	4	Longbone Shaft, Phalanges	1	Second Phalanx
1 - Microvertebrate	2	Longbone Shaft	0	N/A

Species from each size class have been identified in the faunal assemblage and these specimens likely represent animals which were previously described in this chapter.

5.2 The Level One Floral Assemblage

Ninety-three seeds were identified in the level one assemblage and 92.5% of these are burned. At least 12 taxa are represented (Table 5.5) but identification is limited due to burning which destroys many of the necessary features needed to classify specimens to the level of species.

Table 5.5 Summary of level one floral assemblage by taxa.

Common Name	Taxon	MNI seeds
Grasses	*Gramineae*	3
Water Sedge	*Carex aquatilis*	1
Graceful Sedge	*Carex* cf. *praegracilis*	1
Sedge	*Carex sp.*	11
Bushy Knotweed	*Polygonum* cf. *ramosissimum*	2
Doorweed	*Polygonum sp.*	10
Goosefoot	*Chenopodium sp.*	9
Amaranthus	*Amaranthus sp.*	3
Goosefoot/Amaranthus	*Cheno-Am	28
Saskatoon	*Amelanchier alnifolia*	2
Pin Cherry	*Prunus pensylvanica*	8
Choke Cherry	*Prunus virginiana*	10
Plum	*Prunus sp.*	1
Wild Red Raspberry	*Rubus idaeus*	2
Silverberry	*Elaeagnus commutata*	1
High Bush-Cranberry	*Viburnum opulus*	1
Total		93

*Refers to Chenopodiaceae / Amaranthaceae

Family Gramineae

Gramineae Indeterminate

Specimens identified: NISP=3; three burned seeds (6481, 6482).

Discussion: These specimens could represent a number of grasses which are common to Opimihaw valley (see Appendix I, Table 1). All three of the seeds are complete but lack necessary characteristics needed for identification to species. Two of the specimens (6481) were found next to feature 1-2.

Family Cyperaceae

Carex aquatilis

Specimens identified: NISP=1; burned seed (6471).

Distribution and habitat: Found on slough margins and wet areas throughout the Prairie Provinces. It is an important species forming a great majority of slough hay used to feed cattle (Looman and Best 1987: 201).

Carex* cf *praegracilis

Specimens identified: NISP=1; burned seed (6480).

Distribution and habitat: Similar to *C.aquatilis*, found in wet meadows and around sloughs throughout the Prairie Provinces. This species tends to be slightly taller than *C.aquatilis* but may not be as abundant as it is not mentioned as a food source for cattle (Looman and Best 1987: 223).

Carex sp.

Specimens identified: NISP=11; 11 burned seeds (6457, 6460, 6461, 6463, 6464, 6467, 6468, 6469, 6470).

Discussion: Identification based on seed morphology is very difficult within the genus *Carex* and as such it cannot be assumed that these specimens represent either of the two species previously described. It is also possible that these specimens do not represent species common to wet habitats. Other species, such as *C.filifolia* and *C.stenophylla* are dry grassland species and may account for some of the specimens identified. Only three of the specimens were found in association with known features. Two specimens were found near feature 1-1 and another near feature 1-2. All specimens recovered are burned.

Family Polygonaceae

Polygonum* cf.*ramosissimum

Specimens identified: NISP=2; two burned seeds (6458, 6485).

Distribution and habitat: Bushy knotweed is found throughout the Prairie and Parkland ecotones in river valleys and lake shores on sandy substrates. It is less common than most species of *Polygonum* (Looman and Best 1987: 318).

Discussion: One specimen (6485) was found within feature 1-5.

Polygonum sp.

Specimens identified: NISP=10; 10 burned seeds (6462, 6465).

Discussion: All of these specimens are either too fractured or too small to be identified to species. They may represent *P.amphibium* (swamp persicaria) which is common in Opimihaw Valley, usually found in standing water. Eight of these specimens were found associated with feature 1-2.

Family Chenopodiaceae / Family Amaranthaceae

Chenopodiaceae/Amaranthaceae (Cheno-Am)

Specimens identified: NISP=28; 28 burned seeds (6486-6490, 6492, 6495, 6497, 6499, 6500, 6502, 6504).

Discussion: Seeds from both of these families are very similar and identification can be difficult unless seed structures are well preserved. Commonly these seeds are grouped together and classified as Cheno-Ams. While all 28 of these seeds are burned only one was noted in association with a known feature (feature 1-5).

Chenopodium sp.

Specimens identified: NISP=9; nine burned seeds (6491, 6494, 6496, 6498, 6503).

Discussion: Several species of *Chenopodium* are common in Saskatchewan. Most species are found in moist, saline soils or in woody undergrowth (Looman and Best 1987: 331-333). All of these specimens are burned but only three are associated with a known feature (feature 1-6).

Amaranthus sp.

Specimens identified: NISP=3; three burned seeds (6493, 6501).

Discussion: *Amaranthus albus* is the only species native to Saskatchewan, however, two other species (*A.graecizans* and *A.retroflexus*) are native to the south-western United States and it is not known when they first appeared in the area. They are all common in waste areas and open ground (Looman and Best 1987: 342-344). None of these specimens is associated with a feature.

Family Rosaceae

Amelanchier alnifolia

Specimens identified: NISP=2; two burned seeds (6466, 6477)

Distribution and habitat: Saskatoons are medium to large sized shrubs which are very common throughout the Prairie Provinces in a variety of habitats from open woodlands to coulees and river valleys (Looman and Best 1987: 438). Saskatoons bloom in May and June and produce ripe berries in August (Wilkinson 1990: 106).

Discussion: These specimens are both burned but only one is in direct association with a feature (feature 1-3).

Prunus pensylvanica

Specimens identified: NISP=8; six burned seeds (6478, 6479, 6506, 6483), two unburned seeds (6474, 6475).

Distribution and habitat: Pin cherries are small trees (4-8 m high) which are common throughout the Prairie Provinces (Looman and Best 1987: 455). They are less abundant than choke cherry or saskatoon because they are shade intolerant. They are common in clearings, hillsides and river valleys and prefer dry, sandy soil. Flowers bloom from May to June and fruit ripens during August to September (Wilkinson 1990: 112).

Discussion: Three of the seeds were found within feature 1-5. The two unburned seeds may have been deposited onto the site by animals and can not be considered to be cultural.

Prunus virginiana

Specimens identified: NISP=10; seven burned seeds (5854, 5922-5924, 6008, 6459, 6484), three unburned seeds (5853, 6059, 6063).

Distribution and habitat: Choke cherries are found in a variety of habitats throughout the Prairie Provinces but they are most common in the Aspen Parkland. Unlike pin cherries, choke cherries prefer shade and are often found in the understory of larger shrubs and trees. They are common in sheltered valleys and coulees and along sandy hillsides (Looman and Best 1987: 455). Flowers bloom during May and June and berries ripen in August (Wilkinson 1990: 114)

Discussion: Several of these specimens were found in association to features: one in feature 1-1, two in feature 1-2, and one in feature 1-5. Three of the seeds exhibit no form of cultural modification and may be intrusive.

Prunus sp.

Specimens identified: NISP=1; unburned seed (6476).

Discussion: This specimen is broken and could represent either *P. virginiana* or *P. pensylvanica*. This specimen shows no sign of cultural modification and may be intrusive.

Rubus idaeus

Specimens identified: NISP=2; two burned seeds (6472, 6473).

Distribution and habitat: Wild raspberry is a medium to large bush found throughout the Prairie Provinces. They are common in shady woodlands, riverbanks, and coulees (Looman and Best 1987: 458). Flowers bloom in June and July and fruits ripen in August (Wilkinson 1990: 120).

Discussion: Both of these specimens are burned and were found in association with feature 1-2.

5.2.6 Family Elaeagnaceae

Elaeagnus commutata

Specimens identified: NISP=1; burned seed (5562).

Distribution and habitat: Shrubs or small trees common throughout the Prairies in coulees, stream banks, and moist plains. Silverberries are named for the silvery sheath which surrounds the seeds (Wilkinson 1990: 142).

Discussion: This specimen is burned slightly but was not found close to any known feature.

Family Caprifoliaceae

Viburnum opulus

Specimens identified: NISP=1; unburned seed (6505).

Distribution and habitat: High bush-cranberry is common throughout the parklands and boreal forest. It prefers the moist soils of river valleys, woodlands and poplar bluffs. Flowers bloom in May and June and fruit ripens in August (Wilkinson 1990: 178).

Discussion: This specimen is not burned and is not associated with any feature. It is not believed to be intrusive and may be part of the background fauna.

5.3 Faunal and Floral Distribution Patterns

Distribution maps were created for most faunal and floral species in order to locate and describe concentrations which may represent past human activities. In some cases maps were generated for higher taxa (Order, Family) if species distributions were not possible due to low element counts. Distribution maps for bison were split into the following body regions: cranium, vertebrae, forelimb, hindlimb, and phalanges. All of the distribution maps have been included in Appendix III.

Bison cranial distribution

Cranial elements are highly fragmented with the exception of maxillary and mandibular teeth and as a result the distribution map (Appendix III, Figure 1) more closely represents these portions of the skull. Multiple concentrations are present with the majority located between two or more features. Several light concentrations are noted in units 18S9E and 19S10E just to the west of ash feature 1-1 and an organic stain (feature 1-6). Another light concentration is present between feature 1-2 (a stone-filled pit) and an ash feature (feature 1-4).

Three separate clusters are present around feature 1-3 (a bone-filled pit) with a heavy concentration in units 18S3E and 19S3E. A light concentration to the south of feature 1-3 may also be associated with feature 1-9, described as a large, dark organic stain.

Features 1-5 (an organic stain), 1-8 (a pottery cluster), and 1-9 surround another light concentration which expands towards the east into a heavy concentration of elements located within hearth feature 1-7. Two more smaller concentrations are located in the eastern units and do not appear to be associated with features, however, it is possible that features could be present in the adjacent units which were not excavated.

Bison vertebral distribution

Few vertebrae were recovered in the level one assemblage leading to the development of six very light concentrations (Appendix III, Figure 2). Three of the concentrations are located to the north and east of the bone pit (feature 1-3). Another, located in unit 20S5E, is located between features 1-5, 1-8, and 1-9. Several specimens were found in unit 21S7E in association with hearth feature 1-7. Finally, a small concentration was found between units 18S17E and 19S17E and is not associated with a known feature.

Bison forelimb distribution

Forelimb elements are clustered in several areas throughout the site (Appendix III, Figure 3). Three small concentrations are located to the north and west of ash feature 1-1. The heaviest accumulation occurs within the bone pit (feature 1-3) with another large cluster directly to the south of this feature and a lighter concentration to the north. Small accumulations are also present to the west and east of feature 1-9, although the eastern cluster may also be associated with features 1-5 and 1-8. A medium concentration is present within hearth feature 1-7 which also extends out of the feature to the north. Finally, there is a small concentration in unit 19S13E which is not associated with a known feature.

Bison hindlimb distribution

Hindlimb element distribution (Appendix III, Figure 4) is similar to the forelimb pattern described previously. There are several concentrations surrounding feature 1-3, the heaviest occurring just south of the feature in units 19S2E and 20S2E and another heavy distribution within the bone-filled pit. Another heavy concentration is present within hearth feature 1-7 which extends outwards to the north and northwest where it connects to a medium concentration shared by features 1-5, 1-8, and 1-9. A light accumulation is also present just west of feature 1-9. Two small accumulations in units 18S7E and 18S8E do not appear to be associated with any feature.

Bison phalanx distribution

Phalanges are not abundant in the level one assemblage leading to very light patterns of distribution throughout excavated units (Appendix III, Figure 5). The heaviest concentration is recorded within hearth feature 1-7. Smaller concentrations are present within ash feature 1-1 and around feature 1-3. Two accumulations are present in the easternmost excavation units and are not associated with known features.

Pronghorn element distribution

Few pronghorn elements were recovered in level one although the distribution of these elements seems significant when examined on the map (Appendix III, Figure 6). All of the elements are located within the bone-filled pit (feature 1-3).

Canid element distribution

Three areas of concentration are present in level one (Appendix III, Figure 7) but by far the heaviest concentration is present within feature 1-3 consisting of both large (SC5) and medium (SC4) sized canids. A smaller accumulation is present just to the west of feature 1-9 consisting of medium sized canids only. A smaller concentration in units 18S6E and 19S6E may be associated with feature 1-2.

Rodent element distribution

With the exception of a single burned *Microtus* molar from feature 1-2 all of the identified rodent elements were located within the middle excavation block in units 18S13E and 19S13E (Appendix III, Figure 8). This heavy distribution contained a large number of elements, however, only two individuals, *Microtus pennsylvanicus* and *Spermophilus*, were represented. These elements are not believed to be cultural but appear to have been deposited as part of the background fauna.

Miscellaneous element distribution

Several species were identified in level one with a limited number of elements. While distribution maps could not be created for these elements some of the patterns were examined and several associations were noted. Two burned anuran elements and a burned small vertebrate element, which could be an anuran, were found in feature 1-2. Ash feature 1-1 revealed two leporid elements (unburned) as well as multiple longbone shaft fragments from a small-medium mammal (SC3) which may also be from a leporid.

Seed distribution

Seeds appear to be distributed randomly throughout the site (Appendix III, Figure 9). The heaviest concentration occurs directly between features 1-2 and 1-3. The only features which contained a significant number of seeds were features 1-2 and 1-5 (an organic stain) in which numerous species are represented. Several medium patterns are exhibited in units 18S6E and 18S8E and do not appear to be associated with any feature. Similar small distributions are also present in the middle and eastern excavation blocks, also not associated with known features. Due to the light weight of seeds, especially after they are burned, it seems likely that the patterns observed are the result of dispersal by wind rather than by human activity.

5.3.1 Discussion

The analysis of distribution patterns provides some insight into the various activity areas within level one. Table 5.6 summarizes these distributions and their associations to various features.

Table 5.6 Summary of level one features and associated distributions.

Feature #	Feature Description	Associated Element Distributions
1-1	Small ash stain	*Bison* crania *Bison* forelimb *Bison* phalanges Leporidae / small-medium mammal (SC3)
1-2	Stone-filled pit	*Bison* crania *Bison* hindlimb *Microtus* Anura / small vertebrate (SC2) Seeds
1-3	Bone-filled pit	*Bison* crania *Bison* vertebrae *Bison* forelimb *Bison* hindlimb *Bison* phalanges *Antilocapra americana* *Canis* (SC4 and SC5) Seeds
1-4	Ash stain	*Bison* crania
1-5	Greasy organic stain	*Bison* crania *Bison* vertebrae *Bison* forelimb *Bison* hindlimb Seeds
1-6	Greasy organic stain	*Bison* crania *Bison* forelimb
1-7	Large hearth	*Bison* crania *Bison* vertebrae *Bison* forelimb *Bison* hindlimb *Bison* phalanges
1-8	Pottery cluster	*Bison* crania *Bison* vertebrae *Bison* forelimb *Bison* hindlimb
1-9	Organic stain	*Bison* crania *Bison* vertebrae *Bison* forelimb *Bison* hindlimb *Canis* (SC4)

It is important to remember that level one is a conglomeration of artifacts from at least three different cultural groups. Based on this evidence it becomes very difficult to discuss activity areas since some of the patterns are the result of artifacts overlapping in multiple occupation sequences. Even so, some of these patterns are undoubtedly the result of a single occupation providing some evidence regarding site usage.

After examining the various distribution maps it becomes clear that several features are associated with the bulk of the faunal and floral artifacts recovered in level one. Large concentrations of bison forelimb and hindlimb elements, including phalanges, are present in the bone-filled pit (feature 1-3), while bison cranial and vertebral elements are clustered around the outer margins of the feature. Pronghorn and canid elements are also concentrated within this feature. Several fragments of fire-cracked rock (fcr) were recovered within the feature but the bone is not burned and the soil, while greasy, showed no evidence of burning. It seems likely that this is a refuse pit associated with the stone-boiling pit (feature 1-2) in unit 18S5E. The absence of burning and high degree of fragmentation of most of the elements suggests activities related to the production of pemmican.

Feature 1-2 is associated with small concentrations of bison cranial and hindlimb element which were found around the margins of the feature. The feature itself contained a large amount of fcr and little else. Some burned anuran elements were present in limited number. The size of the elements suggests that a very small frog, perhaps 3-4 cm in length, could have been trapped within the pit. Whyte (1991) showed that frogs are commonly caught in any type of open pit feature and while this explanation seems likely it is possible that the remains are the direct result of human activity. Numerous burned seeds were also recovered from feature 1-2. A variety of specimens were identified and include species commonly used as food (raspberry, saskatoon, and chokecherry) and species which are more likely associated as fuel (grasses and sedge). Rocks heated in a hearth may have had adhering seeds which were later introduced into the feature with the fcr.

Another heavy concentration of materials was noted within, and around, hearth feature 1-7. All elements within this feature are identified as bison with hindlimb and cranial elements being most abundant. This is a difficult feature to interpret because a large amount of bone was uncovered on the top of the feature directly above the charcoal, ash and burned soil. This may indicate two features placed directly on top of one another, the first being a bone-filled pit and the second a hearth. None of the bone in the upper layers of the feature is burned which lends further evidence to this claim. The hearth contained numerous burned bone fragments and fcr which may have been used to heat the stones within feature 1-2.

The absence of artifacts within features 1-5, 1-8, and 1-9 may suggest that an object was lying on the ground when the elements were deposited. Many of the distribution maps show a distinct concentration of artifacts amongst these three features but rarely within them. Features 1-5 and 1-9 are organic stains and could correspond to the placement of a hide or work area which was kept free of debris. Several smaller distributions of canid and bison elements continue directly to the west of feature 1-9 which also suggests some form of work area within the immediate vicinity.

Small concentrations of bison forelimb and cranial elements were recovered near ash feature 1-1 and feature 1-6 (a soil stain). Leporid elements were also recovered within feature 1-1 including numerous burned longbone fragments. This may represent a small hearth and a processing area, secondary to the main features in the western excavation units.

Finally, several small concentrations of bison vertebral, cranial, and forelimb elements where recovered from the easternmost excavation units. No features were found within these units but they may be present within the unexcavated blocks which separate them. A heavy concentration of rodent elements was noted within the middle excavation block but is not believed to be the result of cultural activity.

The overall pattern of distribution seems to suggest that level one of the Thundercloud site represents a secondary processing area. For the most part activities are centred around several major features including a bone-filled pit, two hearths, and a stone-filled pit. The placement of the features and their contents suggest that site inhabitants were involved in the production of pemmican. High bone fragmentation, low burning and the presence of berries may also suggest this activity. An examination of the %MAU for bison elements shows that many of the high utility items, such as limb elements, are present while vertebrae and pelvic elements are missing (figure 5.2). The Wolf Willow site (FbNp-26) is a known kill site approximately 100 meters south of the Thundercloud excavations and may represent the primary kill area, although the time span of the kill episodes is currently unknown.

Besides bison, it seems that the inhabitants of level one are also involved in processing several other species for human consumption. Concentrations of pronghorn, medium to large canids, and leporid elements were found in direct association with several features. While some of these elements exhibit burning, the majority of the specimens are unburned and exhibit weathering and breakage patterns similar to the bison elements within the same features.

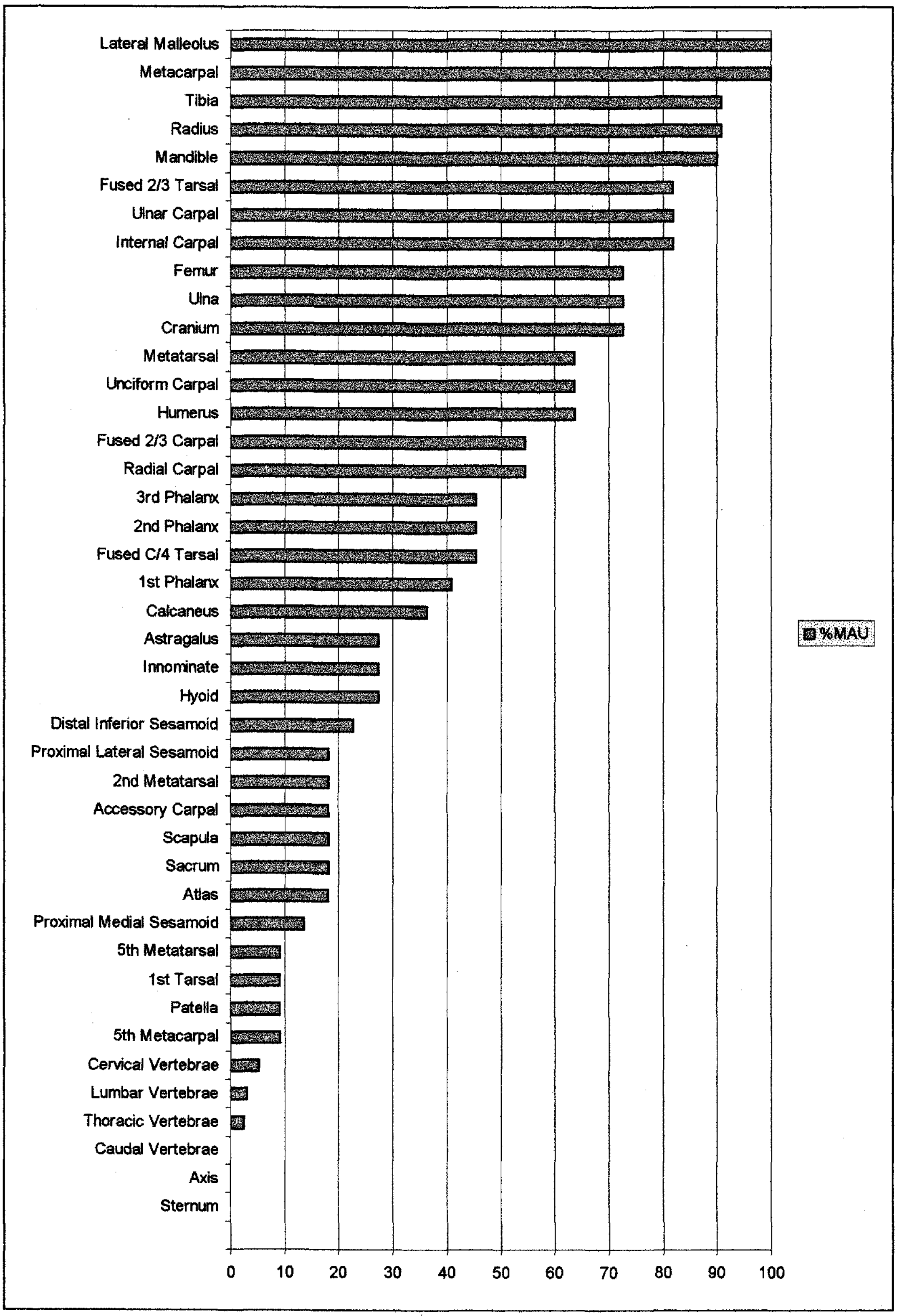

Figure 5.2 %MAU for bison elements in level one at the Thundercloud site.

5.4 Seasonality

Typically, dental eruption patterns are examined in an attempt to determine bison age structure lending clues to the time of year that the animals were killed. The level one assemblage contained no complete mandibular or maxillary tooth rows and few complete individual molars, therefore no dental measurements were completed.

5.4.1 Immature Bison Elements

Five immature bison elements were recovered in level one. Two of the elements are broken phalanges which did not display characteristics that could be used to determine age. Figure 5.3 displays the remaining three elements, of which two are complete enough to provide a reasonably accurate age estimate.

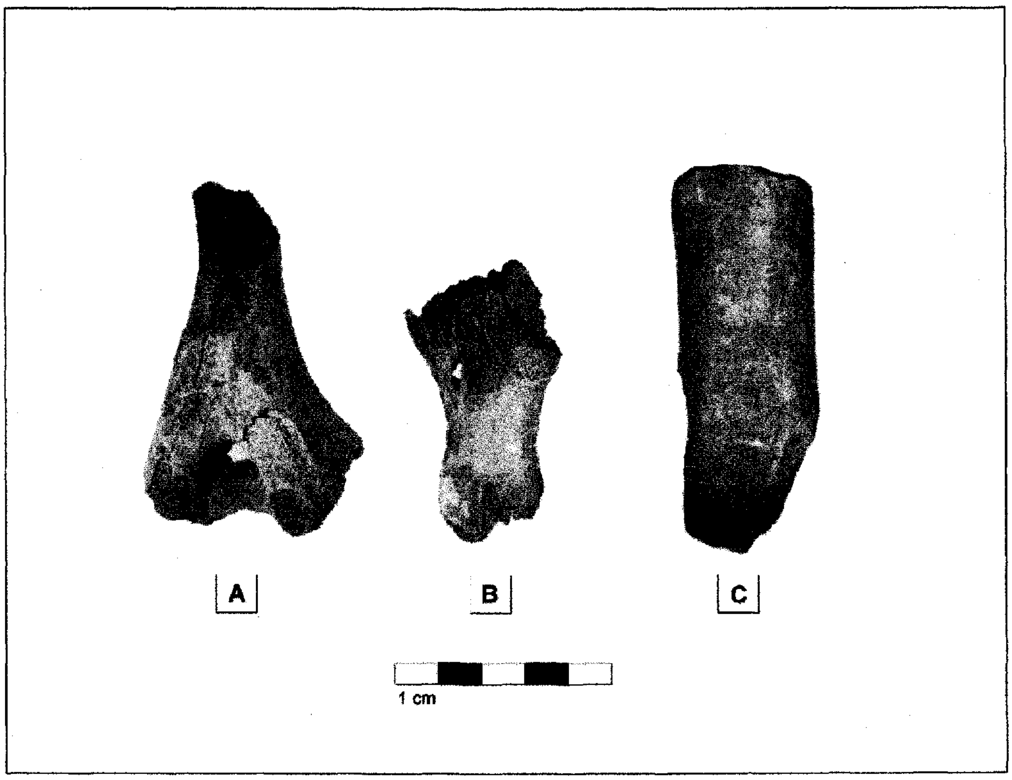

Figure 5.3 Immature bison elements from level one

The metric attributes of the elements were not recorded because the specimens are too fragmented to yield accurate results. Age identifications were based on the overall physical size and appearance of the specimens in comparison to the immature bison elements of known age in the comparative collection.

The first element (figure 5.2 A) is a distal left humerus. It is slightly weathered and exhibits punctures from a carnivore on the lateral and medial borders. No forms of cultural modification are present. This specimen is slightly larger than a one week old bison but is smaller than a bison that is three weeks old. It appears to be closer in size to the one week old animal.

The second element (figure 5.2 B) is a right ilium with a portion of the acetabulum. It has also been punctured on the lateral surface, likely from the canine of a medium to large carnivore. This specimen is marginally smaller than the one week old bison in the comparative collection and is classified here as newborn to one week old.

The last element (Figure 5.2C) is a midshaft from a right femur including part of the supracondyloid fossa and the posterio-medial foramen. Age identification of this specimen is speculative due to a lack of intact landmarks, however, this specimen appears larger than the femur of a 10 month old bison but smaller than a yearling. While quite a broad time span, this specimen appears to belong to an individual which is between 10 months to a year old.

5.4.2 Other Faunal Indicators

The presence other animal species in the level one assemblage may yield hints regarding the time of year in which the site was occupied. Most obvious are the presence of animals which normally hibernate during the winter months. In Canada, *Taxidea taxus* hibernates from November to April (Banfield 1974: 335) and *Mephitis mephitis* from December to March (Banfield 1974: 339) . While none of the specimens from these taxa exhibit signs of cultural modification, they were found associated with other faunal materials believed to be part of the cultural assemblage. One ground squirrel was also recovered and is believed to be contemporaneous but not cultural. Both *S.richardsonii* and *S.tridecemlineatus* hibernate, on average, from October to March (Banfield 1987: 115-123). Finally, several burned anuran elements were recovered from feature 1-2. During the winter months frogs and toads spend the winter in underground burrows or in the mud of standing water to escape freezing temperatures (Russell and Bauer 1993: 175).

5.4.3 Discussion

An analysis of the immature bison elements suggests that the site was occupied during the spring. It is known that bison birth within a relatively tight period of time between the middle of April and the second week of June (Roe 1970). One to three week old bison would only be available within the months of May and June. The older bison femur is too fragmented to provide an accurate age and could represent a yearling born in April or May of the previous year. Non-bison faunal elements suggest that the site was not occupied prior to March and perhaps into April. While this sample is very small, all of the indicators point towards a spring occupation for level one.

5.5 Summary

The majority of faunal remains recovered from the level one assemblage have been identified as *Bison bison*. Most of the specimens in level one were highly fragmented with light weathering and slight rootlet etching. Burning was uncommon for most of the assemblage, especially on bison elements. While bison appears to be the dominant food item, a number of other species were described which were undoubtedly utilized by the human occupants. The majority of seeds collected from sediment samples are believed to be cultural. Floral remains are limited to a number of burned seeds including a variety of berries which could have been used as food items.

An analysis of the distribution of faunal and floral remains from level one indicated a number of activity areas. Based on this evidence level one is believed to represent a secondary processing area. Several kill sites have been recorded within Opimihaw Valley, including the Wolf Willow site which is located just south of Thundercloud.

Methods for determining seasonality are limited in level one, but the presence of immature bison and species which hibernate during the winter months indicate that the site was occupied during the spring.

Chapter 6

The Level Two Faunal and Floral Assemblage

6.1 The Level Two Faunal Assemblage

In total, 15603 faunal specimens were recovered from level two with a total weight of 9.42 kg (Table 6.1). The majority of the assemblage is unidentifiable (95.2%) and a large percentage of these (42.5%) are burned. This is due, in part, to a large number of calcined and burned specimens which were recovered from a bone scatter.

Table 6.1 Level two faunal assemblage separated by degree of burning.

	Identified			Unidentified			Total	
	N	%N	Weight (g)	N	%N	Weight (g)	N	Weight (g)
Unburned	711	7.7	3263.0	8542	92.3	4496.6	9253	7759.6
Burned	16	0.5	17.1	3322	99.5	959.8	3338	976.9
Calcined	24	0.8	0.1	2988	99.2	684.9	3012	685
Total	**751**	**4.8**	**3280.2**	**1485**	**95.2**	**6141.3**	**15603**	**9421.5**

By weight, the majority of burned specimens are unidentifiable. Unburned specimens are split more evenly with unidentified specimens weighing slightly more.

At least 14 different taxa have been identified, represented by no less than 21 individuals (Table 6.2). Forty-one specimens could not be classified below the category of size class. Bison represents the most dominant animal accounting for 85.9% of all specimens identified. Some rib, vertebrae and metapodial fragments were identified as bison based on their overall size and shape.

Table 6.2 Summary of level two faunal remains by taxa.

Common Name	Taxon	NISP	MNI
Mammals			
Bison	*Bison bison*	645	5
Medium-Large Canid (SC5)	*Canis sp.*	1	1
Small-Medium Canid (SC4)	*Canis sp.*	9	2
Badger	*Taxidea taxus*	1	1
Skunk	*Mephitis mephitis*	1	1
American mink	*Mustela* cf. *vison*	1	1
Weasel family	*Mustela sp.*	1	-
Indeterminate carnivore	Carnivora indeterminate	1	-
Hares	*Lepus sp.*	2	1
Beaver	*Castor canadensis*	1	1
Richardson's ground squirrel	*Spermophilus richardsonii*	1	1
Ground squirrels	*Spermophilus sp.*	17	1
Voles	*Microtus sp.*	3	1
Mice and vole family	Cricetidae indeterminate	5	-
Birds			
Small bird	Avian (SC2)	1	1
Micro-bird	Avian (SC1)	1	1
Invertebrates			
Valve snail	*Valvata sincera*	2	2
Ramshorn snail	*Helisoma sp.*	1	1
Snails (shell fragments)	Gastropoda	16	-
Miscellaneous			
Large Mammal (SC5)		2	-
Medium Mammal (SC4)		6	-
Small-Medium Mammal (SC3)		11	-
Small Mammal (SC2)		15	-
Micro-mammal (SC1)		2	-
Small Vertebrate (SC2)		2	-
Microvertebrate (SC1)		3	-
Total		**751**	**21**

Order Artiodactyla

Bison bison

Specimens Identified: Table 6.3 summarizes the 645 bison elements from level two. MNE and MAU were calculated using landmarks for each element. These calculations are included in Appendix II (Table 1).

Distribution and habitat: See page 43.

Discussion: Based on the number of petrous temporal elements, at least five individuals have been identified within this level. Most of the specimens are unburned with little weathering. Cut marks are present on several tibia and along the vertebral spine of two thoracic vertebrae. With the exception of carpals and tarsals all of the elements are highly fragmented. The majority of the 15603 unidentifiable bone specimens recorded within level two are believed to represent bison. One foetal and six immature bison elements were also identified and will be discussed further in the seasonality section of this chapter.

Order Carnivora

***Canis sp.* (SC5)**

Specimens Identified: NISP=1; right M_1 (5601).

Discussion: This specimen is very worn and exhibits heavy weathering in the form of exfoliation. A high degree of weathering is absent in the majority of the level two assemblage. It is possible that this specimen was exposed within a ground squirrel burrow after the assemblage was buried since several burrows were recorded within this excavation unit. This tooth is quite large and matches the specimen of *Canus lupus* in the faunal collection at the University of Saskatchewan.

Table 6.3 Summary of bison elements from level two.

	NISP	MNI (Side)	Total MNE	Total MAU	%MAU
Axial Skeleton					
Cranium (petrous)	67	5	9	4.5	100
Mandible	66	2	3	1.5	33.3
Hyoid	0	0	0	0	0
Sternum	0	0	0	0	0
Atlas	1	1	1	1	22.2
Axis	0	0	0	0	0
Cervical Vertebrae	9	1	2	0.29	6.4
Thoracic Vertebrae	16	1	4	0.29	6.4
Lumbar Vertebrae	0	0	0	0	0
Sacrum	0	0	0	0	0
Caudal Vertebrae	1	1	1	0.07	1.6
Forelimb					
Scapula	14	1	2	1	22.2
Humerus	11	2	2	1	22.2
Radius	16	3	5	2.5	55.6
Ulna	26	3	5	2.5	55.6
Internal Carpal	1	1	1	0.5	11.1
Radial Carpal	2	2	2	1	22.2
Accessory Carpal	1	1	1	0.5	11.1
Ulnar Carpal	2	1	2	1	22.2
Unciform Carpal	1	1	1	0.5	11.1
Fused 2/3 Carpal	3	3	3	1.5	33.3
Metacarpal	58	1	2	1	22.2
5th Metacarpal	0	0	0	0	0
Hindlimb					
Innominate	4	3	3	1.5	33.3
Femur	22	1	2	1	22.2
Patella	0	0	0	0	0
Tibia	35	2	3	1.5	33.3
Lateral Malleolus	4	2	2	1	22.2
Calcaneus	14	1	1	0.5	11.1
Astragalus	0	0	0	0	0
Fused C/4 Tarsal	1	1	1	0.5	11.1
Fused 2/3 Tarsal	7	4	5	2.5	55.6
1st Tarsal	0	0	0	0	0
Metatarsal	46	3	4	2	44.4
2nd Metatarsal	0	0	0	0	0
5th Metatarsal	0	0	0	0	0
Other Elements					
1st Phalanx	46	2	10	1.25	27.8
2nd Phalanx	33	1	7	0.88	19.6
3rd Phalanx	2	1	1	0.13	2.9
Proximal Lateral Sesamoid	3	1	3	0.38	8.4
Proximal Medial Sesamoid	1	1	1	0.13	2.9
Distal Inferior Sesamoid	0	0	0	0	0
Miscellaneous					
Vertebrae Indeterminate	-	-	-	-	-
Metapodial Indeterminate	32	-	-	-	-
Molar/Premolar Indeterminate	-	-	-	-	-
Rib Head	3	-	-	-	-
Rib Shaft	97	-	-	-	-

***Canis sp.* (SC4)**

Specimens Identified: NISP=9; right P_2 (5603), P_4 (6406), indeterminate deciduous premolar (5610), indeterminate premolar (5611), left M_2 (5604), two indeterminate molars (5626,5627), left coronoid of mandible (5599), left astragalus (5622).

Discussion: The presence of a P_4 and a deciduous premolar suggests that two individuals are represented by these specimens. Several specimens exhibit slight weathering with evidence of small cracks and exfoliation. No cultural modifications were noted on these specimens. The overall size of most of the teeth suggest that they represent either a small domestic dog or a coyote.

Taxidea taxus

Specimens Identified: NISP=1; distal right humerus (5605).

Distribution and habitat: See page 46.

Discussion: This specimen was highly fragmented and was reconstructed for the purposes of identification. No cultural modifications were noted after reconstruction but bone colour is consistent with the rest of the assemblage.

Mephitis mephitis

Specimens Identified: NISP=1; left temporal/parietal (5623)

Distribution and habitat: See page 47.

Discussion: This specimen was very fragile and fell apart during removal. Rootlet etching is present, although slight and bone colour is similar to the rest of the assemblage. No cultural modification is present.

Mustela cf. *vison*

Specimens Identified: NISP=1; right femur (5609).

Distribution and habitat: The American mink occurs throughout most of North America. They are usually found close to water, such as river banks and lakeshores, where they hunt for fish, frogs and crayfish. Mink are also predators on small mammals and will kill animals as large as a cottontail rabbit. They are active through the winter months (Banfield 1977: 330-331).

Discussion: This specimen was identified as mink based on its overall size. No cultural modifications were recorded on the specimen but bone colour is similar to the rest of the assemblage. Slight rootlet etching was recorded on the shaft.

Mustela sp.

Specimens Identified: NISP=1; left metapodial (5621).

Discussion: This specimen is burned but was not found within the vicinity of a known feature. It was found four metres from the specimen of *Mustela vison* described above and could represent the same animal.

Carnivora Indeterminate

Specimens Identified: NISP=1; canine root (5631).

Discussion: This specimen is identified as the complete root and part of the crown, of a canine from a small carnivore (SC2).

Order Lagomorpha

Lepus sp.

Specimens Identified: NISP=2; indeterminate maxillary molar (5613), rib (6281).

Discussion: These specimens were found within one metre of each other and may represent one individual. The molar lacks any sign of cultural modification while the rib is completely calcined and was found within hearth feature 2-4 (figure 6.1).

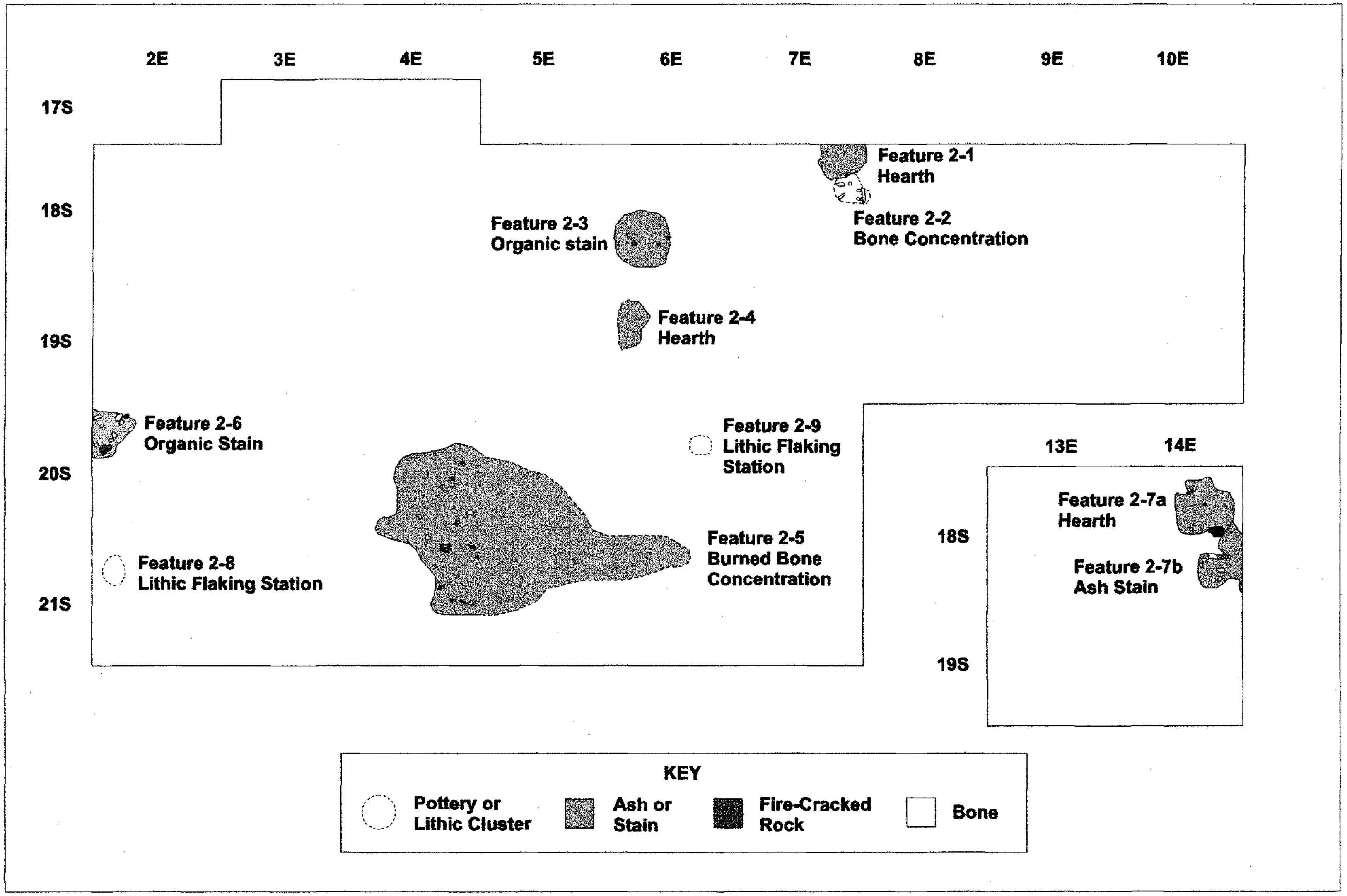

Figure 6.1. Layout and description of features from level two of the Thundercloud site.

Order Rodentia

Castor canadensis

Specimens Identified: NISP=1; right M_2 (5630).

Distribution and habitat: The American beaver ranges throughout most of North America from Mexico to Alaska. They are found in moderate to slow moving streams, lakes, rivers and marshes. They tend to colonize heavily wooded areas but will inhabit prairie streams as long as aspen or willows can be found close by. Beavers do not hibernate in the winter but they tend to remain in or near their den until the ice melts in spring (Banfield 1977: 160-162).

Discussion: This specimen is a complete molar with no sign of cultural modification or weathering present. Beavers are very active near the site and it seems likely that they would have been numerous in the past as well. For this reason it is difficult to determine if this specimen is cultural or part of the background fauna. It is unlikely that this specimen is intrusive.

Spermophilus richardsonii

Specimens Identified: NISP=1; right maxilla with teeth (5600).

Distribution and habitat: Richardson's ground squirrel are found in the Central Plains from southern Canada to the mid United States. They are fossorial and excavate deep burrows with multiple entrances. They prefer open prairie with gravelly or sandy substrates in which to burrow and they avoid wet areas. Hibernation usually lasts for seven months beginning at the end of August and ending around the middle of March (Banfield 1977: 114-117).

Discussion: This specimen is much lighter in colour than the rest of the assemblage. There is no evidence of any weathering or cultural modification. For these reasons this specimen is believed to be intrusive.

Spermophilus sp.

Specimens Identified: NISP=17; two indeterminate molars (6115,6266), maxilla fragment (5628), three thoracic vertebrae (5615-1,5615-2,5617), two lumbar vertebrae (5607,5620), indeterminate vertebra (6043), left ilium (5608), distal left femur (5616), proximal left femur (5619), left tibia (5629), distal left tibia (5618), right tibia (5602), left 2nd metacarpal (6112), left 3rd metacarpal (6111).

Discussion: Two individuals are represented by these specimens. A complete left tibia (5629) and a left ilium (5608) exhibit different coloration and state of preservation than the other artifacts and are believed to be intrusive. The other elements are darker stained and resemble other faunal remains in the assemblage. Several of the larger fragments show signs of slight weathering in the form of rootlet etching and abrasion. None of the specimens shows signs of cultural modification.

Microtus sp.

Specimens Identified: NISP=3; three indeterminate molars (6285-6287).

Discussion: These specimens, which likely represent one individual, are all burned and were found in direct association with a small hearth (feature 2-4). Much of the enamel has been cracked due to the effects of burning making species identification impossible.

Cricetidae indeterminate

Specimens Identified: NISP=5; right I^1 (6139-2), left I^1 (6140), right maxilla (6139-1), tibia (6042), indeterminate metapodial (6110).

Discussion: Although these specimens are not burned they cannot be separated from the *Microtus* elements described above and therefore may not represent a separate individual. No cultural modifications or patterns of weathering were noted. Bone colour is consistent with the rest of the assemblage.

Miscellaneous Avians

Avia indeterminate (SC2)

Specimens Identified: NISP=1; coracoid (6136).

Discussion: This specimen is a coracoid fragment from a robin-sized bird. It is broken and displays no signs of cultural modification or weathering.

Avia indeterminate (SC1)

Specimens Identified: NISP=1; longbone shaft (5967).

Discussion: This is a longbone shaft fragment from a small warbler-sized bird. The walls of the element are extremely thin. The bone is quite long and is rounded, resembling the midshaft of a femur or tibio-tarsus. No cultural modification is present.

Order Mesogastropoda

Valvata sincera

Specimens Identified: NISP=2; two complete shells (6290,6292).

Distribution and habitat: See page 52.

Discussion: As in the level one assemblage (see page 52) these specimens are likely too small to be present as a result of cultural activity. It is also impossible to determine whether they are intrusive or part of the background fauna.

Order Basommatophora

Helisoma sp.

Specimens Identified: NISP=1; shell fragment (6289).

Discussion: Three species of *Helisoma* are common in Saskatchewan; *H. anceps, H. pilsbryi* and *H. trivolis.* All three species are common in lakes, ponds rivers and streams among a variety of substrates as long as there is an abundance aquatic vegetation, conditions which are present in the creek next to the site. This specimen may have been deposited during flood conditions or by a predator.

Miscellaneous Specimens

Specimens Identified: NISP=41; see Table 6.4.

Discussion: Most of these specimens are longbone fragments from small to medium sized mammals. Weathering was absent from most specimens and burning was the only cultural modification recorded. Most of the 25 burned specimens are longbone shaft fragments.

Table 6.4. Summary of level two miscellaneous specimens by size class.

Size Class	NISP	Elements Represented	# Burned	Type burned
5 - Large Mammal	2	Vertebrae frags	0	N/A
4 - Medium Mammal	6	Metapodial, Phalanges	4	Metapodial, Phalanges
3 - Small/Med Mammal	11	Longbone Shaft	11	Longbone Shaft
2 - Small Mammal	15	Longbone, Phalanges, Rib	9	Longbone Shaft
1 - Micro-mammal	2	Longbone Shaft	1	Longbone Shaft
2 - Small Vertebrates	2	Longbone Shaft, Distal Phalanx	0	N/A
1 - Microvertebrate	3	Flatbone, Longbone Shaft	1	Longbone Shaft

6.2 The Level Two Floral Assemblage

Fifty-three seeds have been identified from level two, of which 86.8% are burned. The majority of the seeds (44) have been identified as members of the genus *Prunus*. Unlike level one most of the specimens have been identified to species because the majority are larger seeds which are more readily preserved.

Table 6.5 Summary of level two floral assemblage by taxa.

Common Name	**Taxon**	**MNI seeds**
Goosefoot	*Chenopodium sp.*	1
Western Sea-blite	*Suaeda depressa*	4
Saskatoon	*Amelanchier alnifolia*	1
Pin Cherry	*Prunus pensylvanica*	26
Choke Cherry	*Prunus virginiana*	17
Plum	*Prunus sp.*	1
Vetch	*Astragalus sp.*	1
Red-osier Dogwood	*Cornus alba*	2
Total		**53**

Family Chenopodiaceae

Chenopodium sp.

Specimens identified: NISP=1; burned seed (6507).

Discussion: The seed coat of this specimen was damaged by burning making species identification nearly impossible. It was found just outside of hearth feature 2-7a and is likely associated.

Suaeda depressa

Specimens identified: NISP=4; four burned seeds (6509).

Distribution and habitat: Western sea-blite is a low-growing annual or perennial. It is common throughout the Prairie and Parkland ecotones where it prefers saline soils around sloughs and open flats (Looman and Best 1987: 339).

Discussion: All of these specimens were found in association within the same excavation unit and all are burned. They were not found in association with any known feature. They may have been brought into the valley from the surrounding uplands since saline soils are not common near the site area.

Family Rosaceae

Amelanchier alnifolia

Specimens identified: NISP=1; burned seed (6510).

Distribution and habitat: see page 56.

Discussion: This specimen is burned but was not recovered within, or near, any feature.

Prunus pensylvanica

Specimens identified: NISP=26; 23 burned seeds (6508, 6520), three unburned seeds (6516, 6517, 6519).

Distribution and habitat: see page 57.

Discussion: Nineteen of the 26 seeds were found in hearth feature 2-1. Four of the burned seeds were found in unit 18S4E and are not associated with a known feature. The unburned seeds show no sign of cultural modification and may be intrusive.

Prunus virginiana

Specimens identified: NISP=17; 15 burned seeds (5966, 6514, 6518, 6521), two unburned seeds (6515, 6090).

Distribution and habitat: see page 57.

Discussion: Two of the burned seeds were found within hearth feature 2-1. The remainder of the burned seeds were found in unit 18S4E and are not associated with a known feature. The unburned seeds were discovered within the easternmost excavation block and are likely non-cultural.

Prunus sp.

Specimens identified: NISP=1; burned seed (6513).

Discussion: This specimen, found in unit 18S17E, is fragmented and could not be identified to species. This specimen may have been secondarily re-deposited by wind.

Family Leguminosae

Astragalus sp.

Specimens identified: NISP=1; burned seed (6512).

Discussion: Members of the genus *Astragalus* are common in Saskatchewan and are found in a variety of habitats from open grasslands to river valleys. They are perennial herbs which produce large numbers of seeds within fleshy pods. Some members of the genus are poisonous (Looman and Best 1987: 464). This specimen is burned and was found in association to hearth feature 2-1.

Family Cornaceae

Cornus alba

Specimens identified: NISP=2; two unburned seeds (6511).

Distribution and habitat: Dogwood are medium sized shrubs found throughout Saskatchewan. They are common in moist woodlands, coulees and on stream and river banks (Looman and Best 1987: 565). Berries, which ripen in August and September, are described as "bitter but edible" (Wilkinson 1990: 152).

Discussion: These specimens are not burned, though they were found just outside of feature 1-2. It is believed that they are associated with the feature and, as such, are part of the cultural assemblage.

6.3 Faunal and Floral Distribution Patterns

Most of the distribution maps created for the level two assemblage exhibit light to moderate concentrations due to the relatively low number of artifacts recovered from this level. Even so the distribution patterns suggest that artifacts are clustered around a number of important features.

Bison cranial distribution

At least seven light to medium clusters of bison cranial elements have been recorded in level two (Appendix III, Figure 10). Medium concentrations were noted within hearth feature 2-1 and organic stain 2-6. The remaining concentrations were all light consisting of between 2-4 elements. Several elements were recovered between a lithic concentration (feature 2-9) and hearth feature 2-4. Another light concentration is present just to the west of feature 2-5 (a large bone scatter) which may also be associated with feature 2-8 (a lithic concentration). Two concentrations were recorded that are not associated with known feature, one in unit 17S3E and another in 18S4E. It is possible that features may be present in the northern excavation units which were not excavated.

Bison vertebrae distribution

Very few vertebral elements were identified in level two, reflected on the distribution map by the presence of two small accumulations of bone (Appendix III, Figure 11). One of the concentrations is located just to the west (30 cm) of hearth feature 2-1. The other, located within the easternmost excavation block, runs into the wall of units 18S17E and 19S17E and is not associated with a known feature.

Bison forelimb distribution

Forelimb elements are clustered in four areas all with light distributions (Appendix III, Figure 12). The greatest number of elements was recorded within and around feature 2-6. The distribution is skewed slightly to the south which may also be associated with the lithic concentration. A small accumulation is present in the middle excavation block next to hearth feature 2-7a and its associated ash deposit (feature 2-7b). Another is located within hearth feature 2-1. A small concentration in unit 17S3E is not associated with a known feature.

Bison hindlimb distribution

Hindlimb and forelimb elements are distributed in a similar pattern (Appendix III, Figure 13). The largest number of elements came from inside feature 2-6 with another light concentration just to the west (50 cm). A small concentration was present in hearth feature 2-1 and another was located just outside of feature 2-7b. Unlike the forelimb pattern, at least five hindlimb elements were found next to the eastern lithic scatter (feature 2-9). A small concentration was also found in the corner of unit 17S3E.

Bison phalanx distribution

Phalangeal distribution patterns are very light and are based on a limited number of specimens (Appendix III, Figure 14). Two concentrations are present near feature 2-1, one on the margin to the west and another to the south. Several specimens were recovered near the western lithic scatter (feature 2-8) and several more within feature 2-6. A final pattern was noted in the corner of unit 17S3E.

Canid element distribution

Both large (SC5) and medium (SC4) sized canids were identified in the level two assemblage. Nearly all of the specimens were found within unit 18S6E directly associated with feature 2-3 (an organic stain).

Rodent element distribution

The majority of the rodent elements identified appear to exhibit a random distribution (Appendix III, Figure 16). A medium concentration centred around units 18S3E, 18S4E, 19S3E, and 19S4E contains the majority of *Spermophilus* elements discovered in this level. These elements did not appear to be intrusive and are likely part of the background fauna. Another medium concentration is present in unit 19S9E and contains most of the specimens believed to be intrusive. Several rodent burrows were noted in the unit during excavation and are likely the source of these elements. Two smaller concentrations, which appear to be associated with features, were also noted. The first, which is actually part of feature 2-2 (a concentration of bone and bone fragments), consists of various unburned Cricetid elements. The second is located within hearth feature 2-4 and includes three burned *Microtus* molars and several unburned limb elements.

Miscellaneous element distribution

Several elements were identified from features which were limited in number and could not be used to create distribution maps. Two burned elements, identified as *Mustela*, were discovered within samples from ash feature 2-7b. A calcined rib from a leporid was found with numerous burned elements from a small-medium sized mammal (SC3) within samples taken from hearth feature 2-4. Finally, several calcined and burned small mammal (SC2) elements were found within hearth feature 2-1.

Seed distribution

Seeds are heavily concentrated in two major areas. The first is a medium accumulation centred in units 17S4E and 18S4E made up mostly of *Prunus pensylvanica*. The largest concentration (over 20 seeds) was found within samples taken from hearth feature 2-1. *Prunus pensylvanica, Prunus virginiana*, and *Amelanchier* are represented. A smaller concentration including seeds of *Cornus alba* was also present just outside of the hearth. Another small collection of seeds was recovered in units 19S17E and 19S18E but is not associated with a known feature. Several specimens were burned suggesting that a feature may be nearby in adjacent, un-excavated units.

6.3.1 Discussion

The majority of faunal and floral artifacts from level two are concentrated around features (Table 6.6). A large concentration of bison faunal elements was noted within unit 17S3E which was not associated with a known feature. It is likely that a feature is present in the northern half of the unit, an area that was not excavated.

Table 6.6 Summary of level two features and associated distributions.

Feature #	Feature Description	Associated Element Distributions
2-1	Small hearth	*Bison* crania *Bison* vertebrae *Bison* forelimb *Bison* hindlimb *Bison* phalanges Small mammals (SC2) Seeds
2-2	Bone concentration	Cricetidae
2-3	Organic stain	*Canis* elements
2-4	Small hearth	*Bison* crania *Microtus* elements Leporid elements
2-5	Burned bone concentration	*Bison* crania
2-6	Organic stain	*Bison* crania *Bison* forelimb *Bison* hindlimb *Bison* phalanges
2-7a	Hearth	*Bison* forelimb
2-7b	Ash stain	*Bison* forelimb *Bison* hindlimb *Mustela* elements
2-8	Flake concentration	*Bison* crania *Bison* phalanges
2-9	Flake concentration	*Bison* crania *Bison* hindlimb
*17S3E	N/A	*Bison* crania *Bison* forelimb *Bison* hindlimb *Bison* phalanges

*Not a feature

As with the level one assemblage, the faunal remains from level two represent a mixture of multiple occupations represented by several projectile point varieties. While an examination of activity areas is worthwhile it is important to remember that concentrations may be the result of overlying occupation units rather than actual accumulations.

Activities in level two seem to be centred around several small hearths. Hearth feature 2-1 revealed high concentrations of all bison elements, several small mammal longbone fragments, and the majority of the seeds that were recovered in the level.

Most of the seeds and all of the small mammal elements are burned but the bison elements do not exhibit burning and may have been deposited when the hearth was no longer in use. A smaller bone concentration, feature 2-2, which contained a number unburned Cricetid elements may also be associated with the hearth. Most of the bone specimens from feature 2-2 were highly fragmented and could not be identified to element. The majority of bone from feature 2-1 was also fragmented suggesting marrow was being extracted for consumption.

Feature 2-3 is described as a small organic stain. Nearly all of the elements identified as *Canis* were associated with this feature. With the exception of an astragalus all of the elements were from the cranium. It is possible that at least one canid was processed in this area, although none of the elements shows signs of cultural modification. The nature of the stain is not known. Unlike many of the stains described at the site this feature did not appear to be greasy.

Feature 2-4 is a very small hearth located quite close to hearth feature 2-1. Bison remains were limited to several cranial fragments. Three burned *Microtus* molars and several burned leporid elements were discovered along with many calcined metapodial and phalanges from a small to medium mammal (SC3), likely a leporid. This small hearth appears to have been used to process smaller mammals. All of the smaller mammal elements are burned suggesting several animals were cooked over a small fire, likely for immediate consumption.

Feature 2-5 is a large deposit of burned and calcined bone which was spread over five excavation units and was on average 1 cm thick. All specimens were chalky and highly fragmented suggesting an extended period of heating, probably within a hearth. It appears that these specimens represent the contents of a hearth that may have been emptied to facilitate further use. Soil under feature 2-5 was not burned, further evidence that these specimens were burned in another location. After deposition these specimens may have been dispersed laterally (to the east) from flood waters which breached the riverbank to the west.

A heavy concentration of bison elements was also recorded in and around feature 2-6. This is another organic stain located very close to a lithic flaking area (feature 2-8). Elements near the concentration of flakes are of the same type as those recorded around the stain. Feature 2-8 may represent an area where a tool was re-sharpened as bison was being processed. Several elements recovered near these features exhibit cut marks. None of the elements is burned but all are heavily fragmented suggesting that marrow was being extracted.

Feature 2-9 is another concentration of flakes located to the southeast of hearth feature 2-4. Several bison cranial and hindlimb elements were discovered near the feature and may represent a small processing area. The presence of numerous secondary and tertiary flakes suggests that tools were re-sharpened during this process.

Features 2-7a and 2-7b are located in the middle excavation block. Feature 2-7b is an ash stain which projects out of feature 2-7a and appears to have been formed when a rodent created a burrow through the hearth. Only bison limb elements are represented, and all are heavily fragmented but burning is absent. Several burned mustelid elements were also present within the feature. This feature, located on the eastern end of the occupation, appears to represent a limb processing area. The mustelid may have been cooked over the fire during the processing and was used for immediate consumption.

Finally, bison elements were also concentrated in the southwest quadrant of unit 17S3E. Elements were highly processed but not associated with a known feature, nor was this concentration of bone noted during excavation. It is possible that a feature is located just to the north of this unit.

Much like level one, level two appears to represent a processing area. Most of the faunal materials are centred around hearths or flake concentrations. Burning is absent but elements are highly fragmented suggesting that marrow is being removed. It is also assumed that many of the fragmented specimens are being boiled for grease extraction, although a stone heating or boiling pit was not recorded. These features may be present in unexcavated units. An examination of the %MAU for bison elements suggests that vertebrae, sternebrae, and some cranial elements are under represented in the assemblage (Figure 6.2). High representation by crania is based on the presence of the petrous temporal. Some of the limb elements are also under-represented but this may be the result of the small sample of elements recovered.

Several smaller mammals including two canids, a leporid, a mustelid, and *Microtus* are also represented in features by burned elements. These elements may represent species which were consumed during bison procurement. One hearth feature (feature 2-4) contained the remains of several small mammals. It is in the centre of the occupation and could represent a small roasting pit used to cook small game.

6.4 Seasonality

The level two bison assemblage was quite small and heavily fragmented. Few teeth were found complete and none was found within a mandibular or maxillary socket. In the absence of measurements seasonality determination is based on the presence of foetal and immature specimens and the presence of some species which hibernate during the winter months.

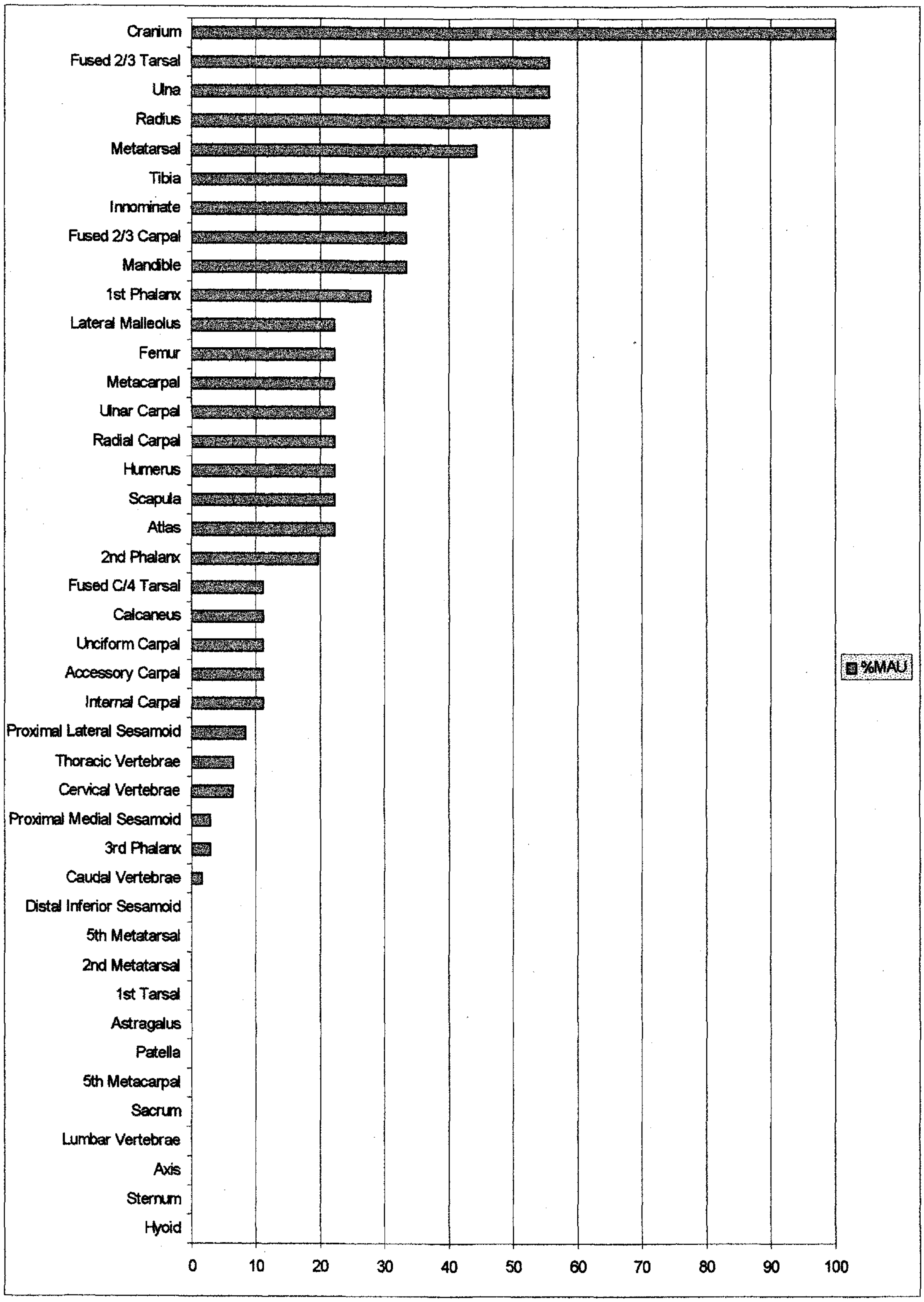

Figure 6.2 %MAU for bison elements in level two at the Thundercloud site.

6.4.1 Foetal and Immature Bison Elements

Seven foetal or immature bison elements were identified in level two. Two of the specimens represent phalanges from an immature individual and another is a partial cervical vertebra. These specimens are too fragmented to be useful in age determination.

Four other specimens representing two immature and one foetal bison were also recovered (Figure 6.3). Since specimens are too fragmented to complete a metric analysis, age determination was completed based upon the overall size and appearance as compared to specimens of known age within the faunal collection.

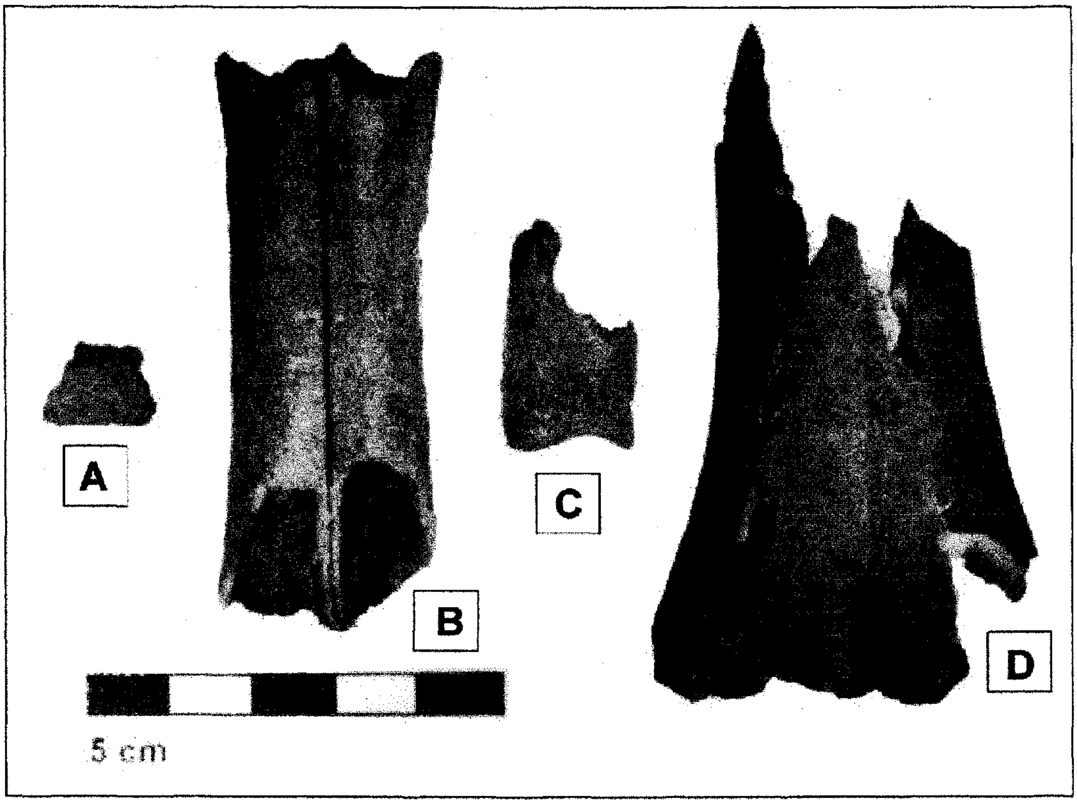

Figure 6.3 Foetal and immature bison elements from level two.

One foetal element (Figure 6.3 A) was identified in level two. The specimen is a small rib fragment and is in poor condition. Three elements have been identified as immature bison. The first (Figure 6.3 B) is a metacarpal midshaft fragment. It is slightly weathered with light cracking and exfoliation. The second (Figure 6.3 C) is a distal first phalanx. Both of the specimens are very close in size to the one week old bison in the comparative collection.

The last specimen (Figure 6.3 D) is a distal metacarpal which was reconstructed for the purposes of this analysis. It is larger than the seven month old bison but smaller than the ten month old individual.

6.4.2 Other Faunal Indicators

Three species were identified in the level two assemblage which hibernate during the winter months: *Taxidea taxus* which hibernates from November to April, *Mephitis mephitis* from December to March, and *Spermophilus richardsonii* which generally hibernate from October to March. None of the specimens is culturally modified but all are believed to be contemporaneous.

6.4.3 Discussion

Based on the evidence provided by the analysis of faunal elements it appears that level two was occupied at various times of the year. The presence of a foetal element and another from seven to ten months old suggests that the site was occupied during the winter. Based on the birthing schedule, a seven to ten month old bison would only be available between the end of November to the beginning of April.

The presence of several one week old specimens, coupled with evidence from species which normally hibernate, may suggest that the occupation extended into the spring. This may also represent a separate occupation, likely in the month of May. Note that this temporal separation may be related to the multiple occupations recorded for the level. Unfortunately, cultural affiliation cannot be assigned to either occupation due to mixing of all artifacts in this level.

6.5 Summary

The level two assemblage is dominated by *Bison bison*. Five individuals have been identified represented for the most part by limb elements. Like level one, nearly all of the elements are highly fragmented. Little weathering is present although rootlet etching and exfoliation were recorded. Bison is not the only species being utilized as several other animals, such as canids, leporids, mustelids and a microtine rodent were found with evidence of cultural modification. As well, hearth feature 2-4 appears to represent a small roasting pit used in processing several small mammal species. Hearth feature 2-1 revealed numerous burned seeds from species normally identified as food items (choke cherry, pin cherry, and saskatoon) suggesting that numerous plant species also play an important role.

The distribution of artifacts revealed several activity areas, most of which are centered around processing various bison elements. These elements are heavily fragmented suggesting that bones are being processed to remove marrow. While grease manufacture and the production of pemmican seem likely, stone pits were absent.

The recovery of both foetal and immature bison of various ages indicates that the site was occupied at several times throughout the year. Based on this indirect evidence it would appear that the site was occupied at least once in the winter and again in the spring.

Chapter 7

The Level Three Faunal and Floral Assemblage

7.1 The Level Three Faunal Assemblage

A total of 16874 faunal specimens have been catalogued in level three with a combined weight of 15.99 kg (Table 7.1). In total 94.9% of all specimens are unidentifiable and most of these are unburned (89.7%). Similarly, 96.1% of all identified specimens are represented by unburned bone.

Table 7.1 Level three faunal assemblage separated by degree of burning.

	Identified			Unidentified			Total	
	N	%N	Weight (g)	N	%N	Weight (g)	N	Weight (g)
Unburned	822	5.4	5770.9	1437	94.6	9350.1	15198	15121.0
Burned	31	1.9	30.9	1641	98.1	535.4	1672	566.3
Calcined	2	0.1	1.6	1374	99.9	296.2	1376	297.8
Total	**855**	**5.1**	**5803.4**	**1601**	**94.9**	**9887.1**	**16874**	**15985.1**

Twenty-four individuals representing 16 taxa have been identified in level three (Table 7.2). Some specimens could not be identified below the category of size class with the majority of these belonging to size class two (small mammals/vertebrates). Bison accounts for 70.1% of the identified faunal assemblage although a number of vertebrae, metapodial and rib fragments were calculated into this average.

Table 7.2 Summary of level three faunal remains by taxa.

Common Name	Taxon	NISP	MNI
Mammals			
Bison	*Bison bison*	599	5
Large Artiodactyl (SC6)		1	-
Elk	*Cervus elaphus*	4	1
Medium-Large Canid (SC5)	*Canis sp.*	1	1
Small-Medium Canid (SC4)	*Canis sp.*	10	1
Skunk	*Mephitis mephitis*	8	1
Beaver	*Castor canadensis*	1	1
Porcupine	*Erethizon dorsatum*	2	1
Richardson's ground squirrel	*Spermophilus richardsonii*	3	2
Ground squirrel	*Spermophilus sp.*	22	1
Meadow vole	*Microtus pennsylvanicus*	13	2
Voles	*Microtus sp.*	1	-
Mice and Voles	Cricetidae	9	-
Birds			
Warbler	Emberizidae	1	1
Small Bird	Avian (SC2)	86	1
Amphibians			
Frogs and Toads	Anura	1	1
Fish			
Osteichthyes	Fish	3	1
Invertebrates			
Clams	Pelecypoda	13	1
Valve snail	*Valvata sincera*	1	1
Umbilicate promenetus	*Promenetus umbilicatellus*	1	1
Snails (shell fragments)	Gastropoda	14	1
Miscellaneous			
Large Mammal (SC5)		1	-
Medium Mammal (SC4)		1	-
Small-Medium Mammal (SC3)		1	-
Small Mammal (SC2)		40	-
Small Vertebrate (SC2)		12	-
Microvertebrate (SC1)		6	-
Total		855	24

Order Artiodactyla

Bison bison

Specimens Identified: NISP=599; see Table 7.3 for a summary. MNE and MAU values were calculated using landmarks. A complete list of all landmark values can be found in Appendix II (Table 1).

Distribution and Habitat: See page 43.

Discussion: Five bison have been identified based on the number of lateral malleoli. The majority of all elements are unburned with little weathering and cut marks are rare. Slight exfoliation, cracking, and rootlet etching was recorded on some specimens. Limb and cranial elements are fragmented but not to the same degree as elements from levels one and two. Most of the unidentified fragments are believed to represent bison elements, although at least one elk has been identified and could account for some of the specimens present.

Cervus elaphus

Specimens Identified: NISP=4; thoracic spine (5636), right scapula (5653).

Indeterminate Artiodactyl (SC6)

Specimens Identified: NISP=1; thoracic spine (5639).

Distribution and habitat: In Saskatchewan modern elk populations are limited to small herds located in Prince Albert and Duck Mountain Provincial Parks. Prior to European contact the elk ranged throughout most of North America with the exception of the arctic tundra. Elk prefer open areas such as alpine meadows, grasslands, aspen parkland and river valleys. They occasionally venture into coniferous forests (Banfield 1977: 400-401).

Table 7.3 Summary of bison elements from level three.

	NISP	MNI (Side)	Total MNE	Total MAU	%MAU
Axial Skeleton					
Cranium	38	4	7	3.5	87.5
Mandible	56	2	4	2	50
Hyoid	0	0	0	0	0
Sternum	0	0	0	0	0
Atlas	0	0	0	0	0
Axis	0	0	0	0	0
Cervical Vertebrae	0	0	0	0	0
Thoracic Vertebrae	23	1	5	0.38	9.5
Lumbar Vertebrae	0	0	0	0	0
Sacrum	1	1	1	1	25
Caudal Vertebrae	0	0	0	0	0
Forelimb					
Scapula	32	1	2	1	25
Humerus	13	4	5	2.5	62.5
Radius	31	4	6	3	75
Ulna	9	3	5	2.5	62.5
Internal Carpal	12	3	5	2.5	62.5
Radial Carpal	3	2	3	1.5	37.5
Accessory Carpal	0	0	0	0	0
Ulnar Carpal	6	3	5	2.5	62.5
Unciform Carpal	5	5	5	2.5	62.5
Fused 2/3 Carpal	1	1	1	0.5	12.5
Metacarpal	6	2	2	1	25
5th Metacarpal	1	1	1	0.5	12.5
Hindlimb					
Innominate	1	1	1	0.5	12.5
Femur	18	2	3	1.5	37.5
Patella	0	0	0	0	0
Tibia	109	4	8	4	100
Lateral Malleolus	8	5	8	4	100
Calcaneus	6	2	4	2	50
Astragalus	2	1	2	1	25
Fused C/4 Tarsal	11	4	6	3	75
Fused 2/3 Tarsal	4	2	3	1.5	37.5
1st Tarsal	1	1	1	0.5	12.5
Metatarsal	19	3	4	2	50
2nd Metatarsal	0	0	0	0	0
5th Metatarsal	0	0	0	0	0
Other Elements					
1st Phalanx	48	1	7	0.88	22
2nd Phalanx	22	2	10	1.25	31.3
3rd Phalanx	3	1	3	0.38	9.5
Proximal Lateral Sesamoid	4	1	5	0.63	15.8
Proximal Medial Sesamoid	6	1	2	0.25	6.3
Distal Inferior Sesamoid	4	1	4	0.5	12.5
Miscellaneous					
Vertebrae Indeterminate	3	-	-	-	-
Metapodial Indeterminate	4	-	-	-	-
Molar/Premolar Indeterminate	7	-	-	-	-
Rib Head	5	-	-	-	-
Rib Shaft	77	-	-	-	-

Discussion: These specimens represent one individual. Admittedly, identification to species based on the thoracic spine is open to some criticism. They are included here because they resemble elk more than bison. They are less robust than bison of similar size. Also, a shallow groove is present of the anterior border of the spine which is also present on the elk in the comparative collection but not in any of the bison. This may not be a consistent trait, again open to some scrutiny. The second thoracic spine fragment (5639) is calcined but was not found near a known feature. No form of cultural modification is present on the other specimens.

Order Carnivora

***Canis sp.* (SC5)**

Specimens Identified: NISP=1; right P^4 (6400)

Discussion: This specimen was fragmented and was partially reconstructed for identification. It is larger than the teeth of the wolf in the comparative collection at the University of Saskatchewan.

***Canis sp.* (SC4)**

Specimens Identified: NISP=10; indeterminate incisor (6400), indeterminate molar/premolar (5638), indeterminate molar (5654), prezygopophysis of axis (5648), cervical vertebrae (5646), metapodial shaft (5650).

Discussion: The majority of these specimens could not be identified to a specific element due to a high degree of fragmentation. All specimens are comparable in size to a large coyote or medium-sized domestic dog. None of the specimens shows signs of cultural modification but most are slightly weathered.

Mephitis mephitis

Specimens Identified: NISP=8; I_1 (5895), I_2 (5896), I_3 (5897), C_1 (5898), P_2 (5899), three indeterminate tooth roots (5900-5902).

Distribution and Habitat: See page 47.

Discussion: These specimens represent one individual. All of the teeth were found in the same excavation unit in close association. None of the specimens has cut marks or burning but all show signs of slight weathering.

Order Rodentia

Castor canadensis

Specimens identified: NISP=1; left central tarsal (5637).

Distribution and habitat: See page 79.

Discussion: This specimen is complete but exhibits no form of cultural modification. It is slightly weathered and is similar in colour to other elements in the assemblage.

Erethizon dorsatum

Specimens identified: NISP=2; two indeterminate molars (5658-1, 5658-2).

Distribution and habitat: The porcupine is found throughout most of North America from Mexico to Alaska. It is normally found in deciduous and coniferous forests but will venture into the grasslands during summer. Porcupines are active throughout the winter months (Banfield,1974: 233-235).

Discussion: These specimens were found associated within the same excavation unit. The occlusal surface is cracked on both specimens but several lophs were noted on one of the teeth. Neither specimen appears to be culturally modified.

Spermophilus richardsonii

Specimens identified: NISP=3; right mandible and teeth (5645), right mandible with teeth (5657), left mandible with teeth (5659).

Distribution and habitat: See page 79.

Discussion: One mandible was found in the eastern excavation block and appears to be intrusive. It shows no sign of weathering and is lighter in colour than other bones in the assemblage. The other two mandibles were found in the same excavation unit and may represent the same animal. They are both burned and were recorded just outside of feature 3-1 (Figure 7.1).

Spermophilus sp.

Specimens identified: NISP=22; right I^1 (6357), indeterminate molar (6239), right maxilla (6361), occipital (5647), cervical vertebrae (6360), lumbar vertebrae (5642), right humerus (6268), left radius (6267), left ulna (5644), right femur (5643), right tibia (6066), left tibia (6359), left calcaneus (6358), left talus (6297), left 2nd metatarsal (6378), right 3rd metatarsal (6376), right 4th metatarsal (6379), left 4th metatarsal (6382), right 4th metatarsal (6383), right 2nd metacarpal (6380-3), right 3rd metacarpal (6380-1), right 4th metacarpal (6380-2).

Discussion: At least two individuals are represented by these specimens. The majority of the specimens recovered are light coloured with little or no weathering and are believed to be intrusive. Specimens 6376 - 6383 (metapodials) were found within feature 3-7a. They are not burned but are darker stained and are slightly weathered. A burned talus (6297) was found within ash feature 3-7b and may be associated with these elements.

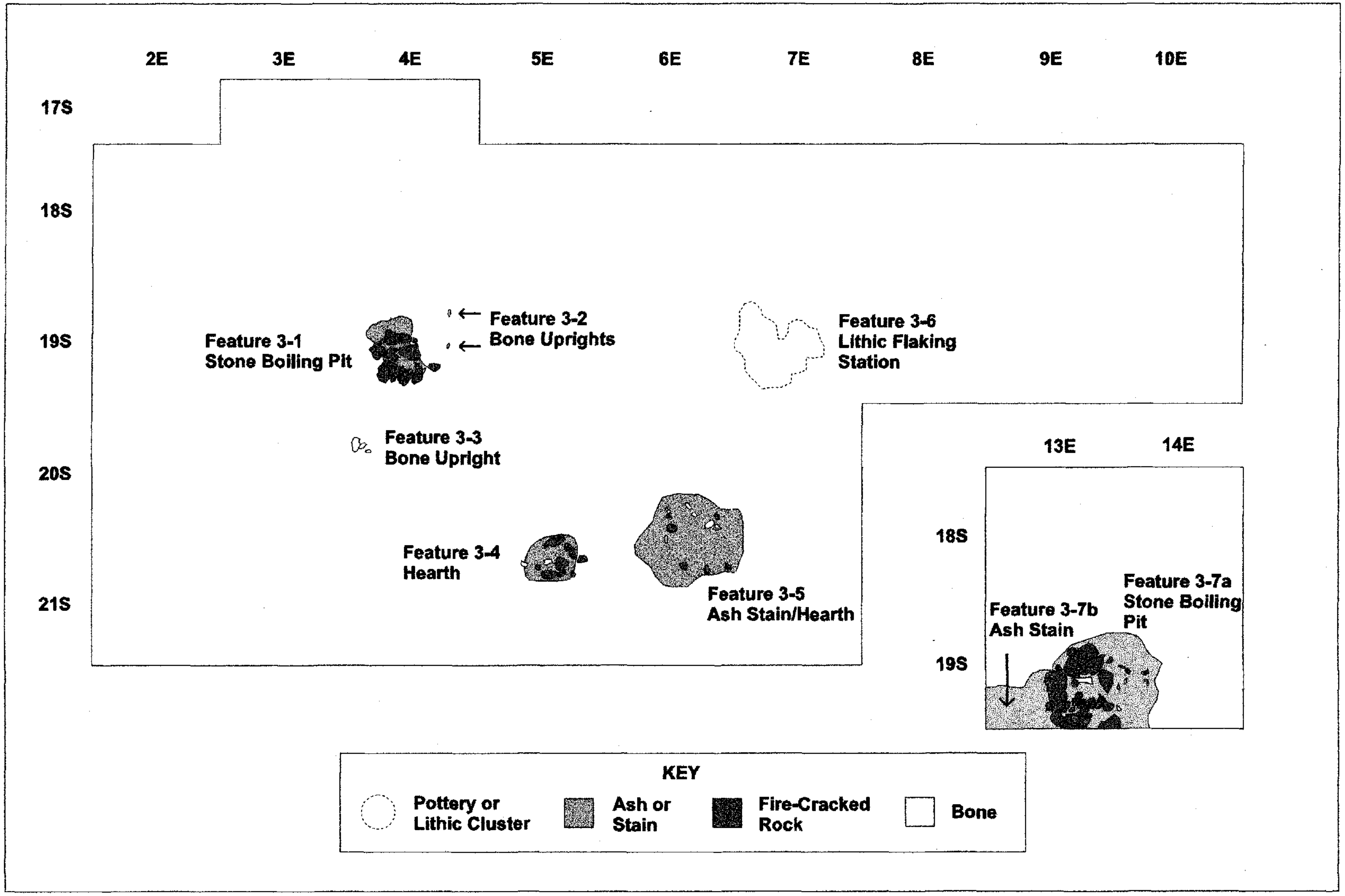

Figure 7.1. Layout and description of features from level three of the Thundercloud site.

Microtus pennsylvanicus

Specimens identified: NISP=13; indeterminate M_3 (6117), right M_1 (6293-1), right M_2 (6293-2), right I_1 (6293-3), right ramus/alveolar (6293-4), right M^3 (6364), right M^2 (6365), left M^3 (6366), right M^3 (6367), right M^2 (6368), right M_2 (6369), left M^2 (6370), left M_1 (6371).

Distribution and habitat: See page 48.

Discussion: Specimens 6293-1 to 6393-4 were found within feature 3-1. Both of the lower molars were re-fitted into the alveolar portion of the mandible fragment for identification. Specimens 6364 to 6371 were found within feature 3-7a and were identified by association. None of the specimens is burned and no cut marks are present.

Microtus sp.

Specimens identified: NISP=1; indeterminate molar (6048).

Discussion: This specimen is fragmented and could not be identified to species. It was found in unit 18S10E and is not close to any known feature. It may represent one of the *M.pennsylvanicus* individuals described previously.

Cricetidae indeterminate

Specimens identified: NISP=9; indeterminate incisor (5858), right I_1 (6295), right zygomatic (6363), right scapula blade (6294), right scapula blade (6377), left humerus (6385), left proximal radius (6069), right tibia (6049).

Discussion: All of the specimens described are similar in colour to other bones in the assemblage and appear to be contemporaneous. The right incisor (6295) and scapula blade (6294) were found within feature 3-1. The other scapula blade, the zygomatic, and the humerus were found within feature 3-7a. None of the specimens was burned. They are likely associated with the teeth identified as *M. pennsylvanicus* found in the same features.

Order Passeriformes

Emberizidae indeterminate

Specimens identified: NISP=1; left distal tarso-metatarsus (6255).

Discussion: This specimen is fragmented and could not be identified past the level of Family. It is the same size as a number of warblers in the comparative collection. It was found in the eastern excavation block and may be intrusive.

Avia indeterminate (SC2)

Specimens identified: NISP=86; various elements, a nearly complete skeleton which is missing the cranium.

Discussion: These specimens represent one immature bird, approximately the size of a robin. It was found articulated within a burrow. The bones are lightly weathered and several of the longbones are fragmented. The specimens do not appear to be cultural but may be part of the background fauna in the assemblage.

Order Anura

Anura indeterminate

Specimens identified: NISP=1; femur fragment (6116).

Discussion: This specimen was found in association with feature 3-1. It is slightly weathered and fragmented but is not burned. This specimen is too fragmented to be identified to Genus.

Order Clupeiformes/Cypriniformes

Osteichthyes indeterminate

Specimens identified: NISP=3; burned vertebra (6173), unburned vertebra (6296), maxilla fragment (6399).

Discussion: These specimens are all fragmented and could not be identified to beyond two Orders; the herring-like fishes and the minnows. The burned vertebra is not associated with a feature. The unburned vertebra was found in feature 3-5 and the maxilla fragment in feature 3-7a. Based on size, all of the specimens could represent the same individual. They appear to be the size of a small perch but are too fragmented to provide an accurate identification.

Order Eulamellibranchia

Pelecypoda indeterminate

Specimens identified: NISP=13; margin and body fragments (5634).

Discussion: All of these fragments were found in the same excavation unit and likely represent one individual. Most of the fragments are worn with well rounded edges. One specimen is thinned and rounded at one end and may have been culturally modified. No other cultural modification was noted. Several of the specimens are large enough to suggest they represent a unionid pelecypod, either *Lampsilis*, *Lasmigona* and *Anodonta*. These are large mussels (80-110cm long) which are found in many habitats including small streams in shallow water (Clarke 1981).

Order Mesogastropoda

Valvata sincera

Specimens identified: NISP=1; complete shell (6362).

Distribution and habitat: See page 52.

Discussion: This specimen was found within feature 3-7a. Due to the small size of these snails (1-2 mm) it is not believed to be present as a result of cultural activities. It is likely part of the background fauna which could have been introduced into the assemblage by a variety of animals or natural occurrences.

Order Basommatophora

Promenetus umbilicatellus

Specimens identified: NISP=1; complete shell (6398).

Distribution and habitat: This is a prairie species found in southern Alberta, Saskatchewan and Manitoba extending to the northern areas of New Mexico. It is an uncommon species that is found most often in ponds and marshes and along the flooded margins of streams in dense vegetation or mud (Clarke 1981: 190).

Discussion: This specimen was found outside of feature 3-1. It was likely deposited during a spring flood. It is a small species (2-5 mm) and is likely not part of the cultural assemblage.

Miscellaneous Specimens

Specimens identified: NISP=61; see Table 7.4.

Discussion: The majority of the 61 specimens recovered are represented by small animals (SC1 and SC2). 24 specimens are burned and the majority were recovered in features 3-7a and 3-7b. At least seven of the unburned specimens were also recovered from these features.

Table 7.4. Summary of level three miscellaneous specimens by size class.

Size Class	NISP	Elements Represented	# Burned	Type burned
5 - Large Mammal	1	Thoracic vertebrae	0	N/A
4 - Medium Mammal	1	Femur head	0	N/A
3 - Small/Med Mammal	1	Third phalanx	1	Third phalanx
2 - Small Mammal	40	Longbone, Phalanges, Vertebrae	16	Humerus, Longbone Shaft, Phalanges
1 - Micro-mammal	12	Vertebrae, Longbone Shaft, Rib	5	Caudal Vertebrae, Longbone Shaft
1 - Microvertebrate	6	Longbone Shaft	2	Longbone Shaft

7.2 The Level Three Floral Assemblage

Only 15 seeds were recovered from level three (Table 7.5) and 12 of these are burned. Seeds from level three are in relatively poor condition and include a number of fragmented specimens. The single *Chenopodium* seed is well preserved and may have been introduced into the level, a theory discussed in more detail in the following section.

Table 7.5 Summary of level three floral assemblage by taxa.

Common Name	Taxon	MNI seeds
Bushy Knotweed	*Polygonum ramosissimum*	1
Doorweed	*Polygonum sp.*	6
Goosefoot	*Chenopodium sp.*	1
Pin Cherry	*Prunus pensylvanica*	3
Choke Cherry	*Prunus virginiana*	3
Plum	*Prunus sp.*	1
Total		**15**

Family Polygonaceae

Polygonum ramosissimum

Specimens identified: NISP=1; burned seed (6524).

Distribution and habitat: See page 55.

Discussion: This specimen was found within excavation unit 18S18E, far from any known feature. It is possible that a feature is present in nearby unexcavated units or that this specimen was secondarily deposited, either by wind or by water.

Polygonum sp.

Specimens identified: NISP=6; six burned seeds (6522).

Discussion: These seeds may be *P. ramosissimum* but are too fragmented for positive identification. They were all found in unit 18S17E, just north of the specimen described above. As with the previous specimen, it is possible that they are associated with an unknown feature.

Family Chenopodiaceae

Chenopodium sp.

Specimens identified: NISP=1; burned seed (6526).

Discussion: This specimen is very well preserved, more so than the other seeds in the assemblage. *Chenopodium* seeds are quite small (2-4 mm) with thin walls making them more susceptible to weathering and pressure. This specimen resembles many of the *Chenopodium* seeds recovered in level one of the same excavation unit. It seems probable that this specimen fell out of the wall from level one and was secondarily deposited into the level three assemblage at some point during excavation.

Family Rosaceae

Prunus pensylvanica

Specimens identified: NISP=3; two burned seeds (6528), one unburned seed (6527).

Distribution and habitat: See page 57.

Discussion: All of these specimens were found around feature 3-1. The unburned seed may have been deposited in a rodent burrow and should be considered intrusive.

Prunus virginiana

Specimens identified: NISP=3; two unburned seeds (6092, 6523), one burned seed (6529).

Distribution and habitat: See page 57.

Discussion: The unburned specimens are complete and may be intrusive as they are not associated with any known feature. The burned seed was found just outside of feature 3-1.

Prunus sp.

Specimens identified: NISP=1; burned seed (6525).

Discussion: This specimen is fragmented and could not be identified to species. It was found within samples taken from feature 3-7a and is heavily burned.

7.3 Faunal and Floral Distribution Patterns

Most of the distribution maps created for the level three assemblage exhibit light concentrations due to low artifact numbers, but several heavy bone accumulations were recorded. As in previous levels distribution patterns suggest artifacts are clustered around features revealing the presence of several important activity areas.

Bison cranial distribution

Several light (1-3 elements) cranial distributions were mapped in level three (Appendix III, Figure 18). Two of the accumulations are centred around feature 3-1, one to the north and another just west. The heaviest concentration was noted just outside of hearth feature 3-4. Another concentration was recorded between features 3-7a and 3-7b. A final accumulation is present in unit 18S17E and is not associated with a visible feature.

Bison vertebrae distribution

Few bison vertebrae were identified in level three leading to the presence of one small distribution pattern (Appendix III, Figure 19). The small pattern is located directly between hearth feature 3-5 and the concentration of flakes (feature 3-6).

Bison forelimb distribution

Forelimb distribution patterns are variable and range from light to heavy concentrations (Appendix III, Figure 20). Three of the accumulations are distributed around feature 3-1. A light concentration to the north of the feature forms a large semi-circular pattern spanning five excavation units. Another light concentration was mapped immediately west and expands into the western wall. A medium accumulation occurs between feature 3-1 and bone upright feature 3-3 which extends into a light concentration further to the south. Just to the east of this accumulation is a light concentration which circles hearth features 3-4 and 3-5. Two concentrations were recorded in the middle excavation block. A light concentration occurs in feature 3-7a while the heaviest concentration in the level is centered between features 3-7a and 3-7b.

Bison hindlimb distribution

Much like the forelimb distribution, the hindlimb pattern includes light, medium, and heavy bone concentrations (Appendix III, Figure 21). Two of the accumulations are associated with feature 3-1, a medium concentration to the north and a light one to the west. A heavy concentration is present just north of hearth feature 3-5 which extends into a light concentration between feature 3-5 and hearth feature 3-4. Two light concentrations were mapped just north of the flaking area (feature 3-6) extending around the feature from the north to the northwest. A final heavy concentration is present between features 3-7a and 3-7b and extends north into excavation unit 18S13E.

Bison phalanx distribution

Few phalanges were identified in level three leading to light distributions throughout the level (Appendix III, Figure 22). Two small concentrations were mapped just north and northwest of feature 3-1. Another light accumulation was found within hearth feature 3-5 which extends to the north just outside of feature 3-6. Another light distribution is present between features 3-7a and 3-7b. A final small distribution runs into the western wall of units 18S17E and 19S17E and is not associated with a visible feature.

Canid element distribution

Small to medium sized (SC4) canid elements are concentrated in one area of level three (Appendix III, Figure 23) with most elements recovered from feature 3-7a. One large canid (SC5) element was recovered in the level but it does not appear to be associated with a visible feature.

Rodent element distribution

With the exception of a few small distributions all of the rodent elements in level three are concentrated within the two boiling pits (Appendix III, Figure 24). A medium concentration, consisting of *M. pennsylvanicus* and *S. richardsonii*, is present in feature 3-1 which extends slightly towards the north and south. A very heavy concentration of elements, also made up of *M. pennsylvanicus* and *S. richardsonii*, is present in features 3-7a and 3-7b. Three light concentrations were also present in the level; one between units 18S9E and 18S10E, one in the northwest corner of 18S13E, and a final distribution centered in the easternmost excavation block. None of these concentrations is associated with a known feature.

Seed distribution

Unlike other levels, seeds in level three are not concentrated in features as one might expect (Appendix III, Figure 25). A medium concentration is present between excavation units 17S4E and 18S4E consisting of *P. pensylvanica* and *P. virginiana*. A heavier concentration is located in the eastern excavation block in the corner of excavation unit 18S17E and consists mainly of *Polygonum*. This eastern distribution may be associated with a feature in the un-excavated units to the west.

Miscellaneous element distribution

Several other distributions were noted in the analysis of faunal remains recovered from level three. A large number of small mammal elements (23), most of which are phalanges, were recovered in features 3-7a and 3-7b. Twelve micro-mammal elements were also recovered from the same features. These are most likely from species already identified within the features, namely *M. pennsylvanicus* and *S. richardsonii*.

7.3.1 Discussion

Level three faunal elements are associated with a number of features, most numerous around stone-filled pits or hearths (Table 7.6). Some faunal material was also found in unit 18S17E and may be associated with an unknown feature.

Table 7.6 Summary of level three features and associated distributions.

Feature #	Feature Description	Associated Element Distributions
3-1	Stone-filled Pit	*Bison* crania *Bison* forelimb *Bison* hindlimb *Bison* phalanges *Microtus pennsylvanicus* *Spermophilus richardsonii*
3-2	Two Bone Uprights	Same as feature 3-1
3-3	Bone Upright	*Bison* forelimb
3-4	Hearth	*Bison* crania *Bison* forelimb *Bison* hindlimb
3-5	Ash Stain/Hearth	*Bison* vertebrae *Bison* forelimb *Bison* hindlimb *Bison* phalanges
3-6	Flake Concentration	*Bison* hindlimb *Bison* phalanges
3-7a	Stone-filled Pit	*Bison* crania *Bison* forelimb *Bison* hindlimb *Bison* phalanges *Canis* (SC4) *Microtus pennsylvanicus* *Spermophilus richardsonii* Small mammal (SC2) Micro-mammal (SC1)
3-7b	Ash stain	*Bison* crania *Bison* forelimb *Bison* hindlimb *Bison* phalanges *Microtus pennsylvanicus* *Spermophilus richardsonii* Small mammal (SC2) Micro-mammal (SC1)
*18S17E	N/A	*Bison* crania *Bison* phalanges Seeds

* Not a feature

As in the previous levels, the level three assemblage contains a number of projectile point types suggesting the presence of overlapping cultural occupations. Further evidence was recovered during the 1998 field season when a separation of level three (into 3a and 3b) was noted in unit 17S4E. With this in mind it appears that activities are centered around both hearths and stone-filled pits.

Feature 3-1, a stone-filled pit, is associated with all bison elements except vertebrae. Most of the elements were found outside of the pit although a small concentration of forelimb elements was found inside. Several rodents were also recovered within the feature. The stone-filled pit is also associated with two other bone features (features 3-2 and 3-3) which have been described as bone uprights. Two ribs and one humerus were noted in an upright position around feature 3-1 which could have been used to pin down a hide or to stabilize a structure. The humerus was found in a circular hole filled with a different matrix than the surrounding soil. A radius was also wedged into the bottom of the hole. No post holes were noted by the rib uprights.

Hearth feature 3-4 is associated with bison crania, forelimb and hindlimb elements. The crania were found to the west of the feature while the other elements were shared with the adjacent hearth/ash stain (feature 3-5). A heavy concentration of hindlimb elements was recorded in feature 3-5, with lower concentrations of other limb elements. Feature 3-5 is also associated with the only concentration of bison vertebrae noted in this level.

The concentration of flakes (feature 3-6) is located just north of hearth feature 3-5 and shares several of the distribution patterns. Bison hindlimb elements and phalanges are most prominent. Due to the large number of flakes present in feature 3-6 it would appear that tool manufacture and re-sharpening are taking place. Although cut marks are absent, these tools may have been used to process the associated elements.

Features 3-7a and 3-7b are located in the middle excavation block. Feature 3-7a is a large stone-filled pit which contained over 275 kg of fire-cracked rock. Feature 3-7b is a thin ash stain which projects laterally out of feature 3-7a and may have been deposited when the pit was being excavated or may represent some of the material that was removed from the pit during use. All bison elements, except vertebrae, are associated with these features. Limb elements are most common with medium to heavy concentrations recorded. All specimens are fragmented suggesting bones are being broken to extract marrow and grease. Several burned rodents are also associated with both features. A number of small and micro-mammal elements (mostly unburned and burned phalanges) were also recovered within the features. Lastly, several elements from a small to medium canid (SC4) were also concentrated in feature 3-7a.

Finally, several concentrations of material were noted in excavation unit 18S17E. Bison cranial elements and a number of phalanges were recovered in association with several burned seeds. Most of the distributions cluster in the western part of the unit and join with the western wall. It is possible that a feature exists in unit 18S16E which is not excavated at this time.

Once again it appears that activities are centred around a number of features commonly associated with secondary processing and the production of pemmican. An examination of the %MAU for bison elements shows that vertebrae, sternebrae, and the innominate are under represented in the assemblage (Figure 7.2). High utility limb elements are being processed at the site, while lower utility items are being left at the kill area. Grease manufacture is an important activity in level three, as evidenced by at least two large stone-filled boiling pits. Several hearths are associated with these features which could be used to heat the stones needed to boil water. A number of limb elements are being processed, most likely for marrow, around these hearths with crania

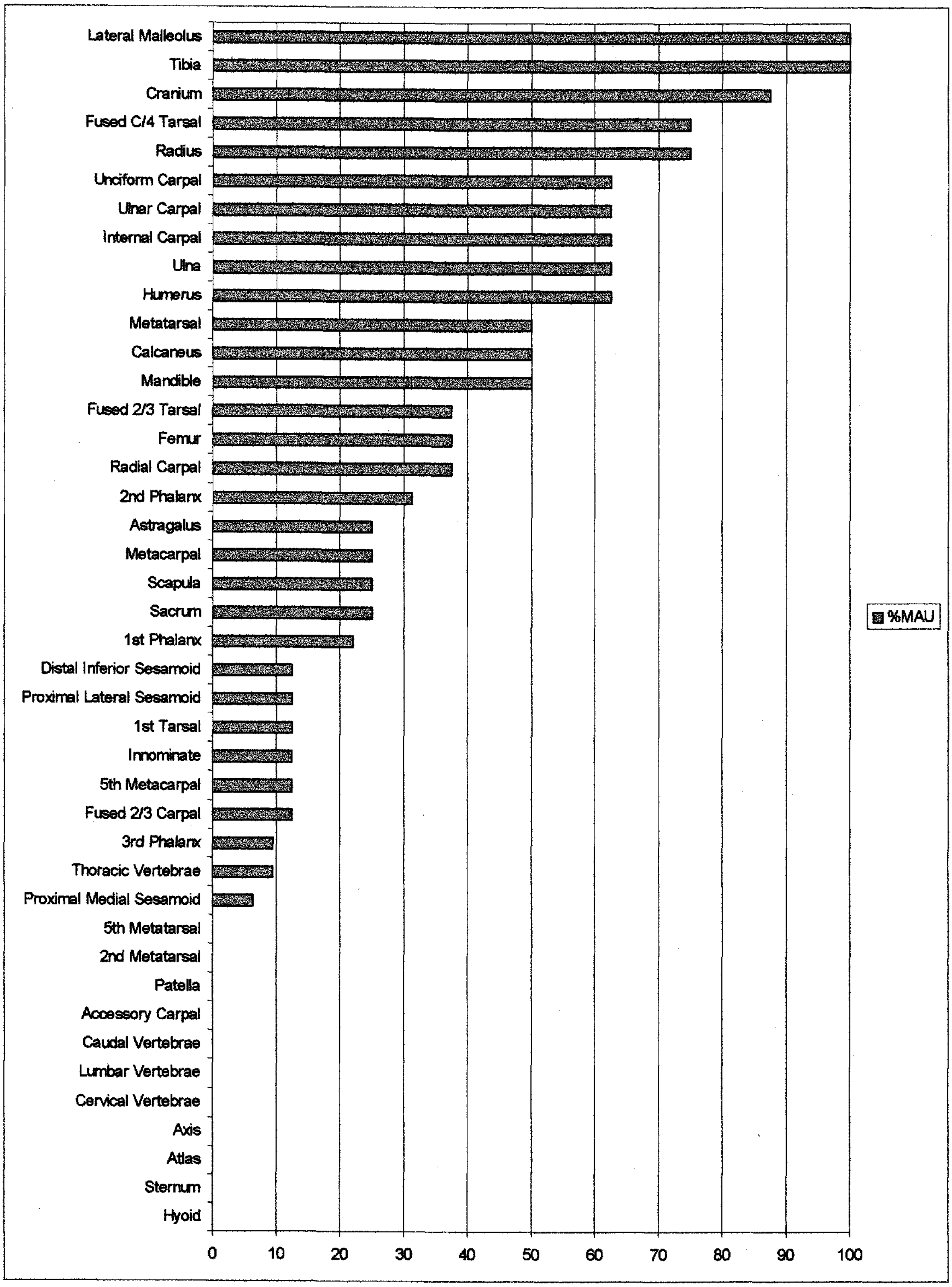

Figure 7.2 %MAU for bison elements in level three at the Thundercloud site.

and vertebrae separated between each. The nature of the bone uprights is unknown but they may be pinning a hide, especially the ribs which are not placed in a hole or post mold. As well, there are few artifacts to the east of feature 3-1 which may also suggest an object was placed on the ground in this area. Feature 3-7a is a massive stone-filled pit which is also associated with a variety of bison elements. Again, high fragmentation is common and burning is absent from most specimens suggesting bones have been boiled to extract grease. The presence of burned rodent elements from both stone-filled pits seems to be more than coincidental. Based on the evidence, it would seem that both *M. pennsylvanicus* and *S. richardsonii* are being processed as food items. Finally, at least one canid was also recovered in feature 3-7a which appears to have been processed in a similar fashion as the rest of the assemblage.

7.4 Seasonality

The level three assemblage contained few teeth which were complete enough for metric analysis. Unfortunately foetal elements were not identified in the assemblage increasing the difficulty in assigning a season to the occupation. Furthermore, only two immature elements were recovered and one is too fragmented to be useful in age determination. For these reasons the reconstruction of seasonal occupation for level three is highly speculative.

7.4.1 Immature Bison Elements

As was mentioned, two immature bison elements were recovered in level three. The first is a femur fragment which is too incomplete to be compared to other specimens. The second, a left humerus shaft fragment, is also incomplete and is quite difficult to age. Based on appearance, the specimen is very close in size to the week old bison in the comparative collection but due to the high degree of fragmentation this determination is open to some scrutiny.

7.4.2 Other Faunal Indicators

The remains of several animals are present in the assemblage that would only be available in warmer months. Pelecypods and fish are easier to catch in open water and may not be present during winter. Anurans escape freezing temperatures in burrows or by burying in mud. *Mephitis mephitis* and *Spermophilus richardsonii* hibernate throughout the winter and could only be caught in excavated burrows. Most of the specimens identified to these taxa are believed to be cultural and were likely processed during the spring, summer or fall.

7.4.3 Discussion

If the immature bison element is indeed a week old the site would have been occupied in the spring just after the bison birthing period, likely in the month of May or June. This corroborates evidence from other species which would have been available in the spring.

7.5 Summary

As in other levels, the level three faunal assemblage is dominated by bison. Five individuals are represented by the specimens recovered, represented for the most part by limb elements. Elements are highly fragmented with no cut marks and little burning. It appears that most elements are being processed for marrow and grease. That is not to say that bison is the only species being utilized. Elk and canids appear to be processed in a similar fashion as the bison. Also, a pattern of rodent procurement including both *S. richardsonii* and *M. pennsylvanicus* was noted in several features. Seeds were dispersed somewhat randomly with the exception of unit 18S17E which contained a number of concentrations but no apparent feature. Few seeds were recovered in level three and preservation is considerably worse than in the upper levels. Even so, burned seeds have been identified in the level and are likely cultural. It is possible that the distribution patterns recorded are a reflection of dispersal by wind or water after burning, and not the direct result of human activity.

Distribution maps suggest the presence of several activity areas around both hearths and stone-filled pits. Bone fragmentation and lack of burning seems to be consistent with boiling pits and the manufacture of grease. Some fragmented bones, found around hearths, may have been processed for marrow but were not boiled. Once again it seems that the level three assemblage resembles a secondary processing area rather than a campsite.

Seasonality was based on a single immature specimen and the presence of a number of species which are active throughout the warmer months. Based on this limited evidence it is believed that the site was occupied during the spring.

Chapter 8

The Level Four Faunal and Floral Assemblage

8.1 The Level Four Faunal Assemblage

The level four assemblage is quite small with only 6668 faunal specimens (Table 8.1). A total of 91.5% of all specimens are considered unidentifiable, represented for the most part by unburned specimens (83.2%). Similarly, a high percentage of the identified specimens (96.5%) are also unburned. Unlike the rest of the levels excavated, bone specimens in level four were moderately weathered resulting in a number of fragmented specimens which may not be the result of cultural activity. Note however, that by weight, 48.1% of the assemblage is identifiable which can be attributed to elements which are more complete than those in levels one, two, and three.

Table 8.1 Level four faunal assemblage separated by degree of burning.

	Identified			Unidentified			Total	
	N	%N	Weight (g)	N	%N	Weight (g)	N	Weight (g)
Unburned	548	9.7	3331	5073	90.3	3236.5	5621	6567.5
Burned	20	3.5	34.7	549	96.5	278.8	569	313.5
Calcined	0	0	0	478	100	113.9	478	113.9
Total	**568**	**8.5**	**3365.7**	**6100**	**91.5**	**3629.2**	**6668**	**6994.9**

Eleven taxa have been identified in level four representing at least 17 individuals (Table 8.2). Fifteen specimens were categorized into size classes and likely represent some of the species identified in the assemblage. By NISP the majority of the identified specimens are *Bison bison*. All of the rib and metapodial fragments were included in this number.

Table 8.2 Summary of level four faunal remains by taxa.

Common Name	Taxon	NISP	MNI
Mammals			
Bison	*Bison bison*	481	*4
Pronghorn	*Antilocapra americana*	7	1
Medium-Large Canid (SC5)	*Canis sp.*	1	1
Small-Medium Canid (SC4)	*Canis sp.*	11	1
Fox	*Vulpes sp.*	1	1
Rabbits and Hares	Leporidae	2	1
Ground squirrel	*Spermophilus sp.*	2	1
Meadow vole	*Microtus pennsylvanicus*	8	2
Voles	*Microtus sp.*	1	-
Mice and Voles	Cricetidae	10	1
Birds			
Ducks	Anatinae	1	1
Medium Avian (SC3)		1	-
Amphibians			
Frogs	*Rana sp.*	1	1
Frogs and Toads	Anura	5	-
Reptiles			
Garter snakes	*Thamnophis sp.*	11	1
Invertebrates			
Snails (shell fragments)	Gastropoda	8	1
Miscellaneous			
Large Mammal (SC5)		1	-
Small-Medium Mammal (SC3)		1	-
Small Mammal (SC2)		6	-
Micro-Mammal (SC1)		1	-
Microvertebrate (SC1)		6	-
Total		**568**	**17**

* Based on the presence of immature specimens

Order Artiodactyla

Bison bison

Specimens identified: NISP=481; see Table 8.3 for a summary. MNE and MAU values were calculated using landmarks. A complete list of all landmark values can be found in Appendix II (Table 2).

Distribution and habitat: See page 43.

Discussion: Four bison are represented by the specimens identified. The majority of the specimens are unburned with light to moderate weathering. Cut marks are absent on most specimens. Elements are relatively more complete in level four than in the previous levels. The majority of the unidentifiable specimens recovered are believed to represent fragmented bison elements although other large species could account for some of the specimens present. At least two immature bison have been identified and will be discussed further in the seasonality section of this chapter.

Antilocapra americana

Specimens identified: NISP=7; left occipital condyle (5662), distal right tibia (5665), two distal metacarpals (5664, 5671), two distal metapodials (5661, 5663), second phalanx (5668).

Distribution and habitat: See page 45.

Discussion: One individual is represented by the specimens identified. Several specimens are lightly weathered and all have slight rootlet etching. One metacarpal fragment (5663) has many tooth marks including several large punctures. None of the specimens appears to be culturally modified. Three of the specimens were found partially associated in unit 18S18E and may represent a separate animal from the other specimens recovered 16 metres to the west in units 19S2E and 20S2E.

Table 8.3 Summary of bison elements from level four.

	NISP	MNI (Side)	Total MNE	Total MAU	%MAU
Axial Skeleton					
Cranium	171	2	3	1.5	100
Mandible	6	1	1	0.5	33.3
Hyoid	0	0	0	0	0
Sternum	0	0	0	0	0
Atlas	0	0	0	0	0
Axis	0	0	0	0	0
Cervical Vertebrae	2	1	1	0.14	9.3
Thoracic Vertebrae	2	1	1	0.14	9.3
Lumbar Vertebrae	13	1	1	0.2	13.3
Sacrum	0	0	0	0	0
Caudal Vertebrae	0	0	0	0	0
Forelimb					
Scapula	4	1	1	0.5	33.3
Humerus	9	1	1	0.5	33.3
Radius	21	1	2	1	66.7
Ulna	3	1	2	1	66.7
Internal Carpal	5	1	1	0.5	33.3
Radial Carpal	0	0	0	0	0
Accessory Carpal	2	2	2	1	66.7
Ulnar Carpal	1	1	1	0.5	33.3
Unciform Carpal	1	1	1	0.5	33.3
Fused 2/3 Carpal	2	2	2	1	66.7
Metacarpal	12	1	2	1	66.7
5th Metacarpal	1	1	1	0.5	33.3
Hindlimb					
Innominate	64	2	3	1.5	100
Femur	54	3	3	1.5	100
Patella	0	0	0	0	0
Tibia	4	1	2	1	66.7
Lateral Malleolus	2	2	2	1	66.7
Calcaneus	4	1	1	0.5	33.3
Astragalus	0	0	0	0	0
Fused C/4 Tarsal	3	2	2	1	66.7
Fused 2/3 Tarsal	4	2	3	1.5	100
1st Tarsal	2	1	1	0.5	33.3
Metatarsal	8	2	2	1	66.7
2nd Metatarsal	0	0	0	0	0
5th Metatarsal	0	0	0	0	0
Other Elements					
1st Phalanx	6	1	5	0.63	42
2nd Phalanx	3	1	3	0.38	25.3
3rd Phalanx	3	1	3	0.38	25.3
Proximal Lateral Sesamoid	2	1	2	0.25	16.7
Proximal Medial Sesamoid	2	1	2	0.25	16.7
Distal Inferior Sesamoid	0	0	0	0	0
Miscellaneous					
Vertebrae Indeterminate	-	-	-	-	-
Metapodial Indeterminate	15	-	-	-	-
Molar/Premolar Indeterminate	3	-	-	-	-
Rib Head	2	-	-	-	-
Rib Shaft	45	-	-	-	-

Order Carnivora

Canis sp. (SC5)

Specimens identified: NISP=1; right humerus shaft (5677).

Discussion: This specimen is a humerus from an immature canid. This element is believed to represent a larger canid due to the large size of the shaft. Although immature, this specimen is already larger than many of the *Canis latrans* humeri in the comparative collection.

Canis sp. (SC4)

Specimens identified: NISP=11; 10 metapodial shaft fragments (5666, 5673, 5674), left radius shaft (5672).

Discussion: These specimens, representing one individual, are lightly weathered with rootlet etching. One specimen has been chewed by a large carnivore. The radius shaft (5672) is similar in size to radii of *Canis latrans* in the comparative collection. The metapodial fragments were found in association with the radius and are believed to be from the same animal.

Vulpes sp.

Specimens identified: NISP=1; right proximal scapula.

Discussion: This specimen is too fragmented to be identified to species. Both *Vulpes vulpes* and *Vulpes velox* were present in the past. *Vulpes vulpes* is commonly found in semi-open country such as valleys, lakeshores, and open brush, unlike *Vulpes velox* which prefers open grasslands and shrubby deserts (Banfield 1974: 300-302). This specimen is not culturally modified.

Order Lagomorpha

Leporidae indeterminate

Specimens identified: NISP=2; right distal humerus (6020), right calcaneus (6019).

Discussion: Both specimens were found in the same excavation unit and are believed to represent the same animal. The specimens are close in size to *Lepus* but could also represent a large *Sylvilagus*. The specimens are not burned and have no cut marks. They are similar in colour to the rest of the assemblage and are thought to be cultural.

Order Rodentia

Spermophilus sp.

Specimens identified: NISP=2; right M_2 (6218), right humerus (5675).

Discussion: These specimens are small enough that they could represent either *S.richardsonii* or *S.tridecemlineatus*. Both specimens are burned but neither was found in close proximity to a visible feature.

Microtus pennsylvanicus

Specimens identified: NISP=8; right I_1 (6093), right M_1 (6094), right M_1 (5868), left M_1 (5867), right M_2 (6095), right M_2 (5861), left M_2 (5862), left ramus (5863).

Distribution and habitat: See page 48.

Discussion: Two individuals are represented by the specimens identified. All elements were found in two groups and species identification was made by association. One group (6093-6095) was found in unit 18S18E. The second group, which includes the remaining elements, was found in unit 18S5E. None of the specimens appears to be culturally modified. The ramus fragment is slightly weathered and several of the teeth are lightly exfoliated.

Microtus sp.

Specimens identified: NISP=1; indeterminate molar (6177).

Discussion: This specimen is too fragmented to be identified to species. It may represent *M. pennsylvanicus* but may also be from *M. ochrogaster* which is also common in the valley. This specimen was not found close to either of the *M. pennsylvanicus* assemblages described previously.

Cricetidae indeterminate

Specimens identified: NISP=10; right I_1 (5865), right I_1 (5904), right I_1 (5905), left I_1 (5866), indeterminate vertebra (5844), left proximal humerus (5843), right proximal ulna (6178), right femur (6179), left tibia (6219), distal tibia (5860).

Discussion: Most of these specimens were recovered in and around unit 18S5E and are probably from the *M. pennsylvanicus* individuals described previously. Three right lower incisors were identified meaning at least one more individual is present. The distal tibia fragment (5860) is burned but the rest of the specimens do not appear to be culturally modified.

Order Anseriformes

Anatinae indeterminate

Specimens identified: NISP=1; left proximal ulna (5669).

Small-medium Aves (SC3)

Specimens identified: NISP=1; longbone shaft fragment (5670).

Discussion: Both of these specimens were recovered in excavation unit 19S18E. They are believed to represent the same individual. Both specimens are too fragmented to provide an accurate identification. The ulna is similar in size and shape to ulnae from several duck species. Both specimens are lightly weathered.

Order Anura

Rana sp.

Specimens identified: NISP=1; left tibia (5864).

Discussion: This specimen was identified as a frog based on its overall appearance when compared to both frogs and toads in the comparative collection. This specimen does not appear to be culturally modified.

Anura indeterminate

Specimens identified: NISP=5; left humerus (6121), longbone indeterminate (6021), left innominate (6220), right innominate (6176), urostyle fragment (6193).

Discussion: The left humerus is burned and was found in the adjacent unit to the *Rana* element described above. The rest of the elements were clustered in and around unit 19S9E. None of these specimens exhibits signs of cultural modification but all are similar in colour to other elements in the assemblage.

Order Squamata

Thamnophis sp.

Specimens identified: NISP=11; 11 vertebrae (5713, 6145, 6146, 6148, 6174, 6175, 6299-6303).

Discussion: Two species of *Thamnophis* are common in Opimihaw Valley, *T.sirtalis* (the common or red-sided garter snake) and *T.radix* (the plains garter snake). *T.sirtalis* has a wide range throughout most of southern Canada and prefers moist grasslands, riverbanks, ponds and areas with heavy cover (Harding 1997: 271). *T.radix* is common throughout the Plains region and prefers open grasslands but will venture into moist areas (Harding 1997: 281-284). Two small accumulations were recovered separated by six metres. The first group of elements (6299-6303) were all recovered within hearth feature 4-1 (Figure 8.1) and four of the five vertebrae are burned.

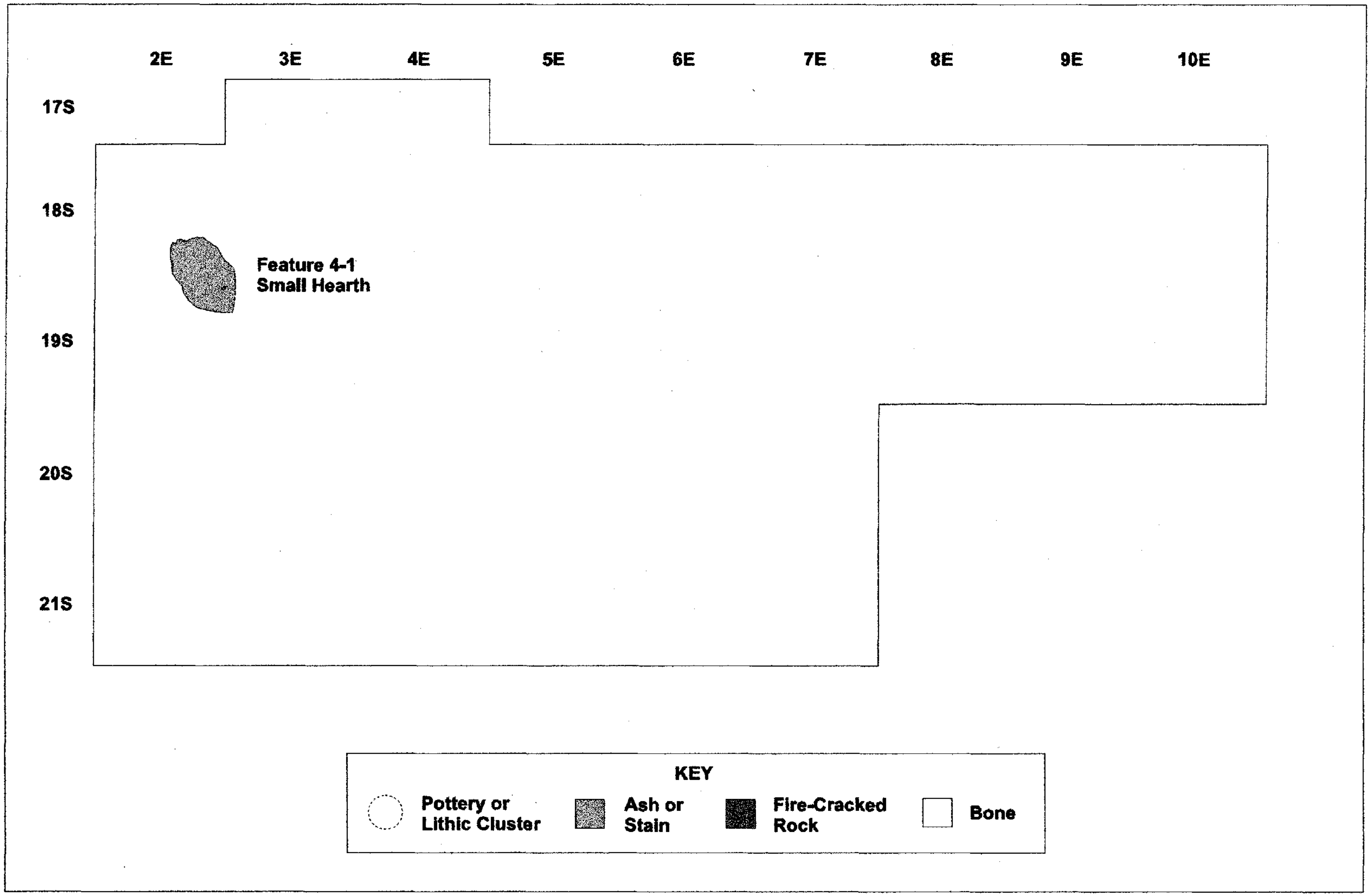

Figure 8.1. Layout and description of features from level four of the Thundercloud site.

The remaining vertebrae were recovered in units 19S7E and 19S8E. None of the latter specimens is burned. The specimens identified may represent two individuals or an individual that was split into two parts prior to burning.

Miscellaneous specimens

Specimens identified: NISP=15; see table 8.4 for a summary.

Discussion: Few miscellaneous elements were identified in level four. The majority of the specimens are from small mammals and microvertebrates. Three burned specimens were identified, two of which (the microvertebrate elements) were recovered in samples taken from feature 4-1.

Table 8.4. Summary of level four miscellaneous specimens by size class.

Size Class	NISP	Elements Represented	# Burned	Type burned
5 - Large Mammal	1	Longbone Shaft	0	N/A
3 - Small/Med Mammal	1	Second Phalanx	0	N/A
2 - Small Mammal	6	Longbone, Phalanges, Tooth	1	Indeterminate Tooth (Enamel)
1 - Micro-mammal	1	Longbone Shaft	0	N/A
1 - Microvertebrate	6	Longbone Shaft	2	Longbone Shaft

8.2 The Level Four Floral Assemblage

Seed preservation was poor in level four leading to the recovery of only two seeds, both identified as *Prunus virginiana*. One specimen is burned and the other is unburned. Neither specimen is associated with a visible feature. The unburned seed was found near a rodent burrow and may be intrusive.

8.3 Faunal Distribution Patterns

As stated earlier, the number of faunal and floral specimens recovered from level four was very low. This is, in part, due to the depositional history of the level (see Chapter 3). As a result distribution patterns were sparse to non-existent. Even so, a number of clusters are present focusing around hearth feature 4-1.

Bison cranial distribution

Three light concentrations were recorded for cranial elements (Appendix III, Figure 26). The largest pattern spans two units, 19S2E and 20S2E, just south of hearth feature 4-1. The other two concentrations are quite small and are not associated with a visible feature. One is located in unit 21S4E and another is centered between units 18S7E and 18S8E.

Bison forelimb distribution

Few forelimb elements were identified in the level leading to only one obvious cluster (Appendix III, Figure 27), present just southeast of feature 4-1 in units 20S3E and 20S4E.

Bison hindlimb elements

Hindlimb elements account for most of the bison identified in level four. Two medium concentrations were mapped; one just to the southwest of feature 4-1 in unit 19S2E, and another just north in unit 17S3E (Appendix III, Figure 28).

Bison phalanx distribution

Much like forelimb elements, bison phalanges are relatively rare in level four. One small accumulation was present in the middle of the main excavation block (Appendix III, Figure 29). Several other clusters of two to three elements are also present. None of the patterns is associated with a visible feature.

Rodent element distribution

Rodent elements are concentrated in several areas of level four (Appendix III, Figure 30). The heaviest concentration occurred in units 18S4E and 18S5E and includes the remains of at least three *Microtus pennsylvanicus*. A light concentration, shared by four units (18S7E, 18S8E, 19S7E, 19S8E), also contains *Microtus* elements.

Two small concentrations in the eastern excavation block contain elements from *Microtus pennsylvanicus* and *Spermophilus richardsonii*. None of the patterns seems to be associated with a known feature.

Pronghorn element distribution

Most of the pronghorn elements were found in excavation unit 18S18E. No feature was found in the eastern excavation block, but one could be present in the adjacent units.

***Thamnophis* element distribution**

As mentioned previously, all of the *Thamnophis* vertebrae were found in two clusters (Appendix III, Figure 31). The first, consisting mainly of burned vertebrae, was found in samples taken from feature 4-1. The second was shared between units 19S7E and 19S8E. None of the specimens in the second cluster is burned.

Miscellaneous element distribution

The majority of taxa identified in level four are represented by a limited number of elements that, when mapped, result in little or no distribution pattern. For instance all of the small-medium (SC4) canid elements were found around feature 4-1 along with several burned longbone fragments from a microvertebrate. Both of the Anatid elements were found in unit 19S18E, quite close to the elements from *Antilocapra americana*. Finally, both Leporid and Anuran elements were recovered in unit 18S9E in association with elements from several other identified taxa.

8.3.1 Discussion

Level four marks the first of five McKean Complex occupations identified at the Thundercloud site. A single Pelican Lake point was also recovered which may have been secondarily redeposited. Elements are accumulated in several areas of level four, but the only definite activity area appears around the single hearth feature (Table 8.5). Two other areas appear to exhibit a slight pattern but element counts are too low to suggest they are the result of cultural activities.

Table 8.5 Summary of level four features and associated distributions.

Feature #	Feature Description	Associated Element Distributions
4-1	Small Hearth	*Bison* crania *Bison* forelimb *Bison* hindlimb *Canis* (SC4) elements *Thamnophis* vertebrae Microvertebrate elements
*18S7E/18S8E	N/A	*Bison* crania Leporid elements *Microtus* elements *Thamnophis* vertebrae Anuran elements
*18S18E/19S18E	N/A	*Antilocapra americana* elements *Microtus pennsylvanicus* elements Anatinae elements

*Not a feature

Feature 4-1 was the only feature recorded in level four and the majority of the bison elements were found near the hearth. At least one small-medium canid also appears to have been processed near the feature. Burned microvertebrate and *Thamnophis* vertebrae, found in the hearth samples, suggest that several small animals may have also been processed. Elements from units 18S7E and 18S8E are limited to two or three specimens and may not represent an actual activity area. Nonetheless such an accumulation seems strange in a level with relatively few faunal artifacts. Likewise, the elements found in the eastern excavation units are also limited in number but may be associated with a cultural activity. The absence of cut marks and burning makes interpretation all the more difficult. It is possible that features are present in adjacent units which have not been excavated at this time.

Due to the lack of faunal remains and the low number of features it is difficult to assess the overall nature of the level four assemblage. It does not appear to represent a secondary processing area. An examination of the %MAU for *Bison* (Figure 8.2) shows lower than expected numbers for vertebrae and some limb elements. Even so, most of the high utility items are present.

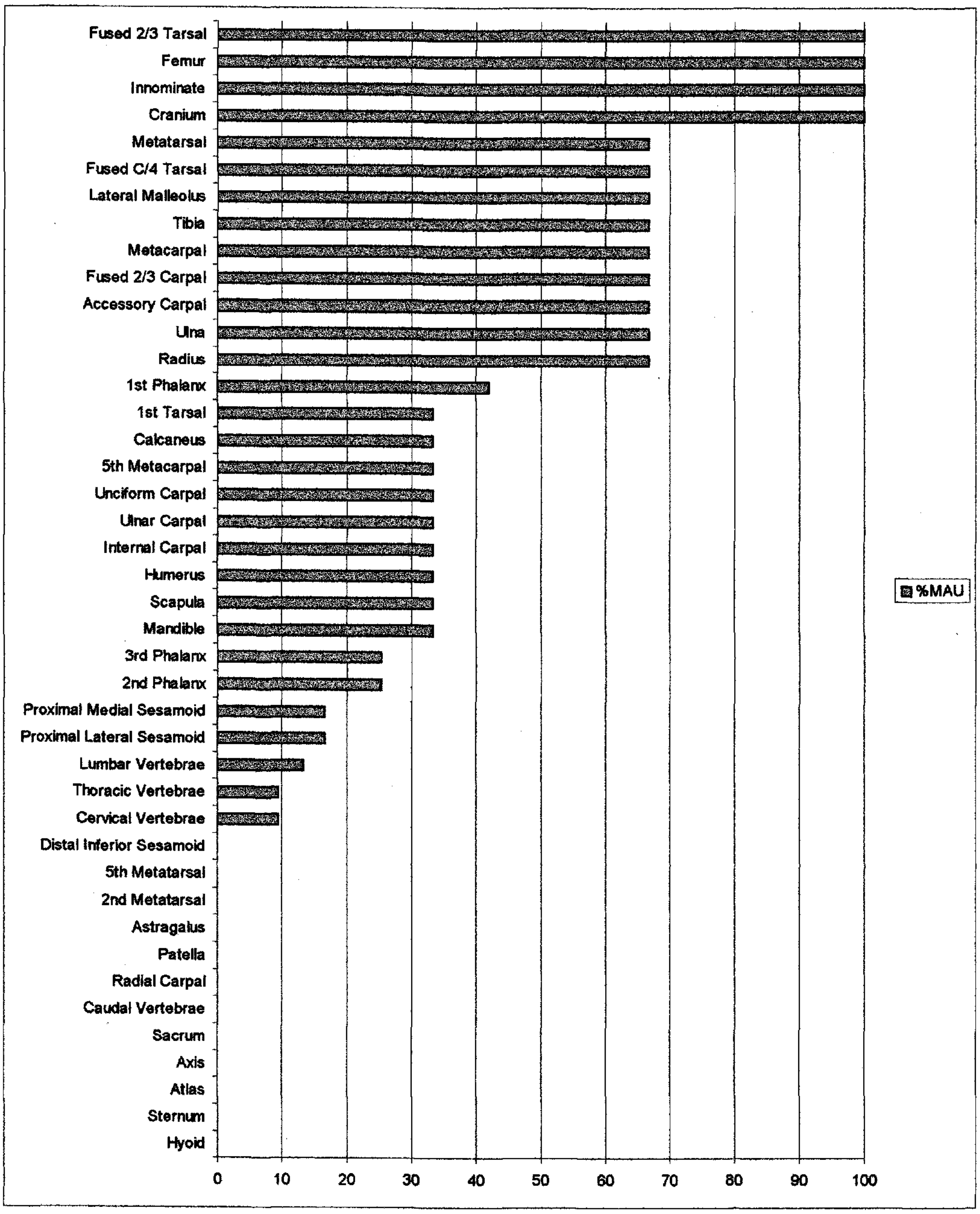

Figure 8.2 %MAU for bison elements in level four at the Thundercloud site.

Bones are not as processed as elements in overlying levels, suggesting that grease extraction may not be taking place. The presence of multiple longbone shaft fragments, and proximal and distal ends of longbones may suggest that marrow is being extracted. Without further evidence, level four is interpreted here under the broad category of campsite/processing area.

8.4 Seasonality

As in previous levels, seasonality for level four is based upon the identification of immature bison and from the hibernation schedules of animals identified in the assemblage.

8.4.1 Immature Bison Elements

Foetal bison elements were not recovered from level four, but at least two immature animals have been identified. A number of cranial fragments were recovered from unit 18S8E and include portions of the frontal, temporal, and occipital (Figure 8.3). All of the sutures are unfused and the overall size of the elements is similar to the one week old specimen in the comparative collection. The second immature element (not pictured) was recovered from unit 19S2E near feature 4-1. It is the shaft from a left femur. The diameter of the shaft and the size of the bone suggest an animal slightly older than 10 months.

8.4.2 Other Faunal Indicators

Several species were identified in level four which either hibernate or migrate out of the area during the winter months. Several anatid elements were recovered. Most waterfowl migrate south for the winter and return to Saskatchewan in mid-May. Ground squirrels generally hibernate from October to March. Finally, both frogs (*Rana*) and snakes (*Thamnophis*) hibernate during periods when the temperature is below freezing.

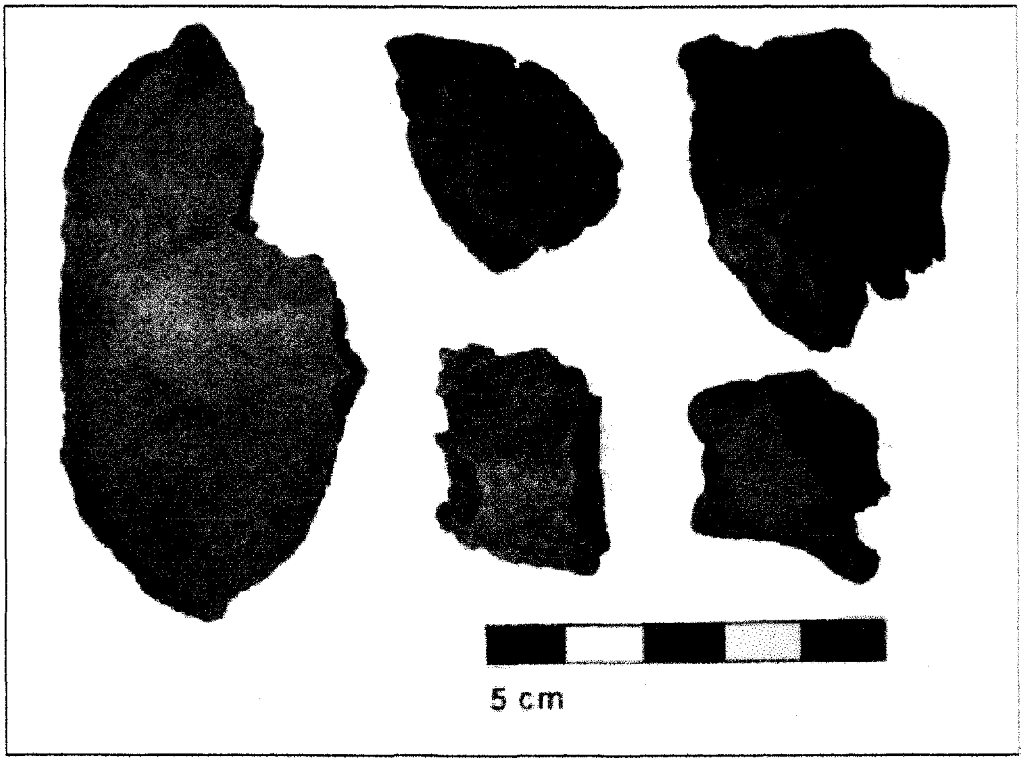

Figure 9.3 Immature bison cranial elements from level four.

8.4.3 Discussion

Based on the analysis of immature bison it appears that level four was occupied during the spring. The pattern is similar to level one, with both a newborn and a yearling identified. The presence of other species which hibernate or have migrated south during winter also supports this hypothesis.

8.5 Summary

As in previous levels, the level four assemblage is dominated by bison elements. Based on a number of limb elements and several immature specimens at least four bison have been identified. Specimens are more complete than in previous levels but it appears that marrow is being extracted for immediate consumption. Other animals which may have been utilized include canids, leporids, anatids, rodents and a garter snake.

Faunal distribution patterns suggest three activity areas are present. The majority of the faunal materials in the level were located around hearth feature 4-1. The other activity areas are not located around features although they may be present in adjacent un-excavated units. It is also possible that the other accumulations are not the result of cultural activities but instead are low areas which led to the natural entrapment of skeletal materials.

The presence of several immature bison of different age, coupled with data from other species, suggests that the site was occupied during the spring.

Chapter 9

The Level Five Faunal and Floral Assemblage

9.1 The Level Five Faunal Assemblage

In total, 22666 faunal specimens were identified in level five with a combined weight of 34.53 kg (Table 9.1). Identifiable specimens comprise 84.8% of the assemblage, which is relatively low when compared to previous levels. Burned specimens form 16.4% of all specimens, comprised mainly of unidentified fragments.

Table 9.1 Level five faunal assemblage separated by degree of burning.

	Identified			Unidentified			Total	
	N	%N	Weight(g)	N	%N	Weight(g)	N	Weight(g)
Unburned	3321	17.5	22924	15619	82.5	9560.2	18940	32484.2
Burned	94	4	378.3	2274	96	1135.3	2368	1513.6
Calcined	32	2.4	86.6	1326	97.6	444.9	1358	531.5
Total	**3447**	**15.2**	**23388.9**	**19219**	**84.8**	**11140.4**	**22666**	**34529.3**

Twenty-four taxa have been identified in level five represented by no less than 50 individuals (Table 9.2). Some of the specimens (6.1%) could not be identified beyond the category of size class due to a lack of taxonomic characteristics. Bison elements account for most of the specimens identified (78.3%) but this includes a large number of rib head and shaft fragments. Interestingly, the diversity of rodents in level five is considerably higher than in previous levels. Also, several species have been identified which no longer inhabit the valley. These two factors may have implications regarding paleo-environment and paleo-diet, ideas discussed further in Chapter 12.

Table 9.2 Summary of level five faunal remains by taxa.

Common Name	Taxon	NISP	MNI
Mammals			
Bison	*Bison bison*	2694	8
Pronghorn	*Antilocapra americana*	1	1
Medium-Large Canid (SC5)	*Canis sp.*	41	1
Small-Medium Canid (SC4)	*Canis sp.*	19	1
Fox	*Vulpes sp.*	12	1
Lynx and Allies	*Lynx sp.*	1	1
Badger	*Taxidea taxus*	44	1
Skunk	*Mephitis mephitis*	2	1
Cottontail rabbits	*Sylvilagus* cf. *nuttallii*	20	2
Hares	*Lepus sp.*	4	1
Rabbits and Hares	Leporidae	3	-
Ground squirrel	*Spermophilus sp.*	10	2
Northern pocket gopher	*Thomomys talpoides*	2	1
Meadow vole	*Microtus pennsylvanicus*	32	3
Voles	*Microtus sp.*	3	-
Gapper's red-backed vole	*Clethrionomys* cf. *gapperi*	4	2
Sagebrush vole	*Lagurus curtatus*	1	1
Deer mouse	*Peromyscus* cf. *maniculatus*	79	3
Mice and Voles	Cricetidae	49	4
Pygmy shrew	*Microsorex hoyi*	1	1
Birds			
Green winged teal	*Anas* cf. *crecca*	2	1
Grouse	Phasianidae	1	1
Blackbirds	Emberizidae: Icterinae	1	1
Warbler	Emberizidae: Parulinae	2	1
Medium bird	Avian (SC4)	1	-
Small bird	Avian (SC2)	1	-
Amphibians			
Toads	*Bufo sp.*	1	1
Frogs and Toads	Anura	23	2
Invertebrates			
Clams	Pelecypoda	5	1
Stagnicola	*Stagnicola sp.*	4	4
Valve snail	*Valvata sincera*	2	2
Snails (shell fragments)	Gastropoda	173	-
Miscellaneous			
Large Mammal (SC5)		1	-
Small-Medium Mammal (SC3)		117	-
Small Mammal (SC2)		59	-
Micro-Mammal (SC1)		18	-
Microvertebrate (SC1)		14	-
Total		**3447**	**50**

Order Artiodactyla

Bison bison

Specimens identified: NISP=2694; summarized in Table 9.3. MNE and MAU values were calculated using landmarks for each element. These calculations are included in Appendix II (Table 2).

Distribution and habitat: See page 43.

Discussion: Eight bison have been identified in level five based on the number of tibiae and lateral malleoli. Burning is rare but was recorded on a number of hindlimb elements and on one mandible. Weathering is light, if present, and includes exfoliation and rootlet etching. Cut marks are also rare but were noted on a number of hindlimb elements and on a mandible fragment. Elements are less fragmented than those in overlying levels and include a number of complete elements. Even so, 19219 unidentified specimens were recovered and most are believed to represent fragmented bison elements.

Antilocapra americana

Specimens identified: NISP=1; left scapula (5695).

Distribution and habitat: See page 45.

Discussion: This specimen is nearly complete and was identified as pronghorn based on overall size and shape. Most of the blade and parts of the acromial spine have been chewed by a large carnivore, evidenced by punctures, pitting and scoring. The specimen is moderately weathered with cracking and exfoliation. The bone does not appear to be culturally modified.

Table 9.3 Summary of bison elements from level five.

	NISP	MNI (Side)	Total MNE	Total MAU	%MAU
Axial Skeleton					
Cranium	600	5	9	4.5	64.3
Mandible	501	7	12	6	85.7
Hyoid	9	3	5	2.5	35.7
Sternum	0	0	0	0	0
Atlas	1	1	1	1	14.3
Axis	4	1	1	1	14.3
Cervical Vertebrae	8	1	2	0.29	4.1
Thoracic Vertebrae	33	1	9	0.64	9.1
Lumbar Vertebrae	88	1	3	0.6	8.6
Sacrum	9	3	3	3	42.9
Caudal Vertebrae	1	1	1	0.07	1
Forelimb					
Scapula	141	5	9	4.5	64.3
Humerus	52	5	7	3.5	50
Radius	59	4	7	3.5	50
Ulna	55	4	8	4	57.1
Internal Carpal	11	5	9	4.5	64.3
Radial Carpal	8	5	8	4	57.1
Accessory Carpal	3	2	3	1.5	21.4
Ulnar Carpal	7	4	7	3.5	50
Unciform Carpal	5	4	5	2.5	35.7
Fused 2/3 Carpal	8	4	8	4	57.1
Metacarpal	36	5	8	4	57.1
5th Metacarpal	1	1	1	0.5	7.1
Hindlimb					
Innominate	59	4	5	2.5	35.7
Femur	33	7	12	6	85.7
Patella	2	2	2	1	14.3
Tibia	120	8	12	6	85.7
Lateral Malleolus	14	8	14	7	100
Calcaneus	52	5	9	4.5	64.3
Astragalus	25	5	9	4.5	64.3
Fused C/4 Tarsal	33	5	7	3.5	50
Fused 2/3 Tarsal	4	3	4	2	28.6
1st Tarsal	3	2	3	1.5	21.4
Metatarsal	70	6	10	5	71.4
2nd Metatarsal	0	0	0	0	0
5th Metatarsal	0	0	0	0	0
Other Elements					
1st Phalanx	37	3	19	2.38	34
2nd Phalanx	34	4	26	3.25	46.4
3rd Phalanx	21	3	20	2.5	35.7
Proximal Lateral Sesamoid	13	2	12	1.5	21.4
Proximal Medial Sesamoid	7	1	7	0.88	12.6
Distal Inferior Sesamoid	6	1	6	0.75	10.7
Miscellaneous					
Vertebrae Indeterminate	10	-	-	-	-
Metapodial Indeterminate	25	-	-	-	-
Molar/Premolar Indeterminate	5	-	-	-	-
Rib Head	35	-	-	-	-
Rib Shaft	446	-	-	-	-

Order Carnivora

***Canis sp.* (SC5)**

Specimens identified: NISP=41; lumbar vertebra (5726), left distal humerus (5682), left proximal radius (5703), left proximal ulna (5704), left intermedioradial carpal (5738), left pollicial 1st phalanx (5739), right 4^{th} tarsal (5764), right central tarsal (5765), right 3^{rd} tarsal (5766), right 2^{nd} tarsal (5767), 5^{th} metatarsal (5740), 4^{th} metatarsal (5743), 3^{rd} metatarsal (5742), 2^{nd} metatarsal (5741), four 1^{st} phalanges (5746-5749), four proximal 2^{nd} phalanges (5751-5753, 5763), two distal 2^{nd} phalanges (5761, 5762), four 3^{rd} phalanges (5744, 5745, 5768, 5770), seven sesamoids (5754-5760).

Discussion: These specimens represent one individual. They are all very large and are believed to be from *Canis lupus*, but they could also represent a very large domestic dog. The humerus, radius and ulna were found semi-articulated in units 18S4E and 19S3E. The carpal and the first phalanx were found within unit 20S2E and represent the only forelimb elements. The vertebra is fragmented and was also found within 20S2E. The remainder of the specimens are all from a right pes (Figure 9.1). All of the pes elements were found articulated within units 20S2E and 21S2E. All of the specimens are lightly weathered with slight rootlet etching. No cultural modifications are evident.

***Canis sp.* (SC4)**

Specimens identified: NISP=19; indeterminate incisor (5723), right innominate (5716), right proximal scapula (5705), two distal metapodials (5715, 5734), three metapodial shaft fragments (5684, 5707), left proximal 3^{rd} metatarsal (5727), right ulnar carpal (5710), right 4^{th} carpal (5711), right proximal 2^{nd} metacarpal (5706), left 4^{th} metacarpal (5736), left 3^{rd} metacarpal (5737), left 2^{nd} metacarpal (5683).

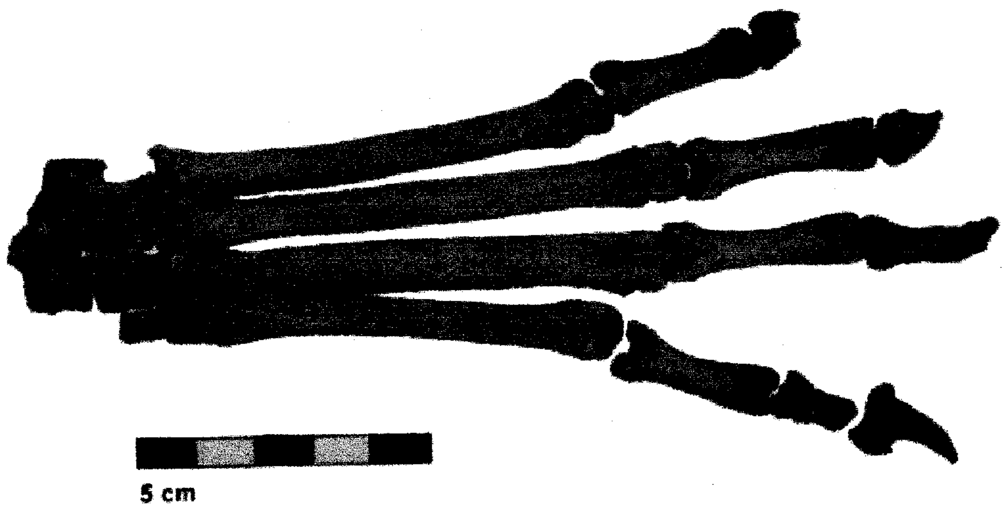

Figure 9.1 *Canis sp.* (SC5) articulated right pes from level five.

Discussion: These specimens have been classified as small-medium canids based on their overall size. Several specimens were large but are well within the range of overlap between coyotes, dogs and wolves. The exceptions are the distal limb elements. All of the carpals and metapodials are similar in size to specimens of *Canis latrans* from the comparative collection. Most of the distal limb elements were found within units 19S6E and, unlike the large canid elements described previously, have been chewed quite heavily by a large carnivore. Several of the metapodial shaft fragments are burned. No other cultural modifications were noted.

Vulpes sp.

Specimens identified: NISP=12; left mandible (11 alveolar margin fragments) with an indeterminate molar (5693).

Discussion: With the exception of the single molar, all of these specimens are alveolar fragments. The mandible is too fragmented to be identified to species and could represent either *V. vulpes* or *V. velox*. No cultural modifications are present but bone color is consistent with other specimens in the assemblage.

Lynx sp.

Specimens identified: NISP=1; right P_1 (5714).

Discussion: It is difficult to differentiate between *L. rufus* and *L. lynx*. *L. lynx* tends to be larger than *L. rufus*, reflected in specimens in the comparative collection at the University of Saskatchewan. In Saskatchewan *Lynx rufus* is limited to the southern boundaries of the Province. They are at home in a variety of habitats from deserts to forests (Banfield,1974: 352-353). *Lynx lynx* tends to inhabit the boreal forest region in the northern half of the Province but will venture in to the aspen parkland (Banfield,1974: 350). This specimen is similar to both species and could not be identified further than Genus. It is not weathered and shows no sign of cultural modification.

Taxidea taxus

Specimens identified: NISP=44; cranium (nearly complete) (5702), left mandible with three teeth (5701), right mandible with five teeth (5700), left P_4 (5777), left innominate (5799), right innominate (5800), left proximal femur (5717), right proximal femur (5788).

Distribution and habitat: See page 46.

Discussion: These specimens, representing one individual, were found within a three metre area. The cranium and mandibles were reconstructed for the purposes of identification (Figure 9.2). Both of the femora are missing the proximal epiphysis suggesting that the animal was not fully grown, although all of the teeth present are permanent. All of the specimens have slight rootlet etching but are otherwise extremely well preserved. Three cut marks are present; one on the left mandible, one on the right mandible, and another on the left femur. None of the specimens is burned.

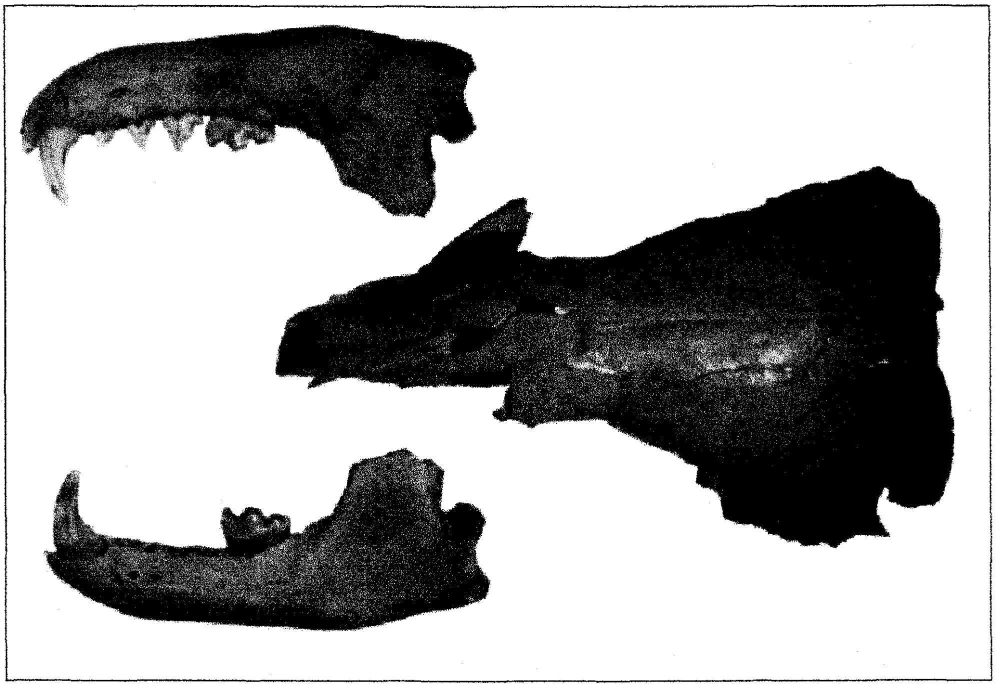

Figure 9.2 ***Taxidea taxus*** **reconstructed cranium and mandibles from level five.**

Mephitis mephitis

Specimens identified: NISP=2; right temporal (5721), left proximal ulna (5719).

Distribution and habitat: See page 47.

Discussion: These two specimens were located in the same excavation unit and likely represent one individual. The cranium fragment is lightly weathered with no cultural modifications. The ulna fragment is completely burned and is associated with hearth feature 5-4 (Figure 9.3).

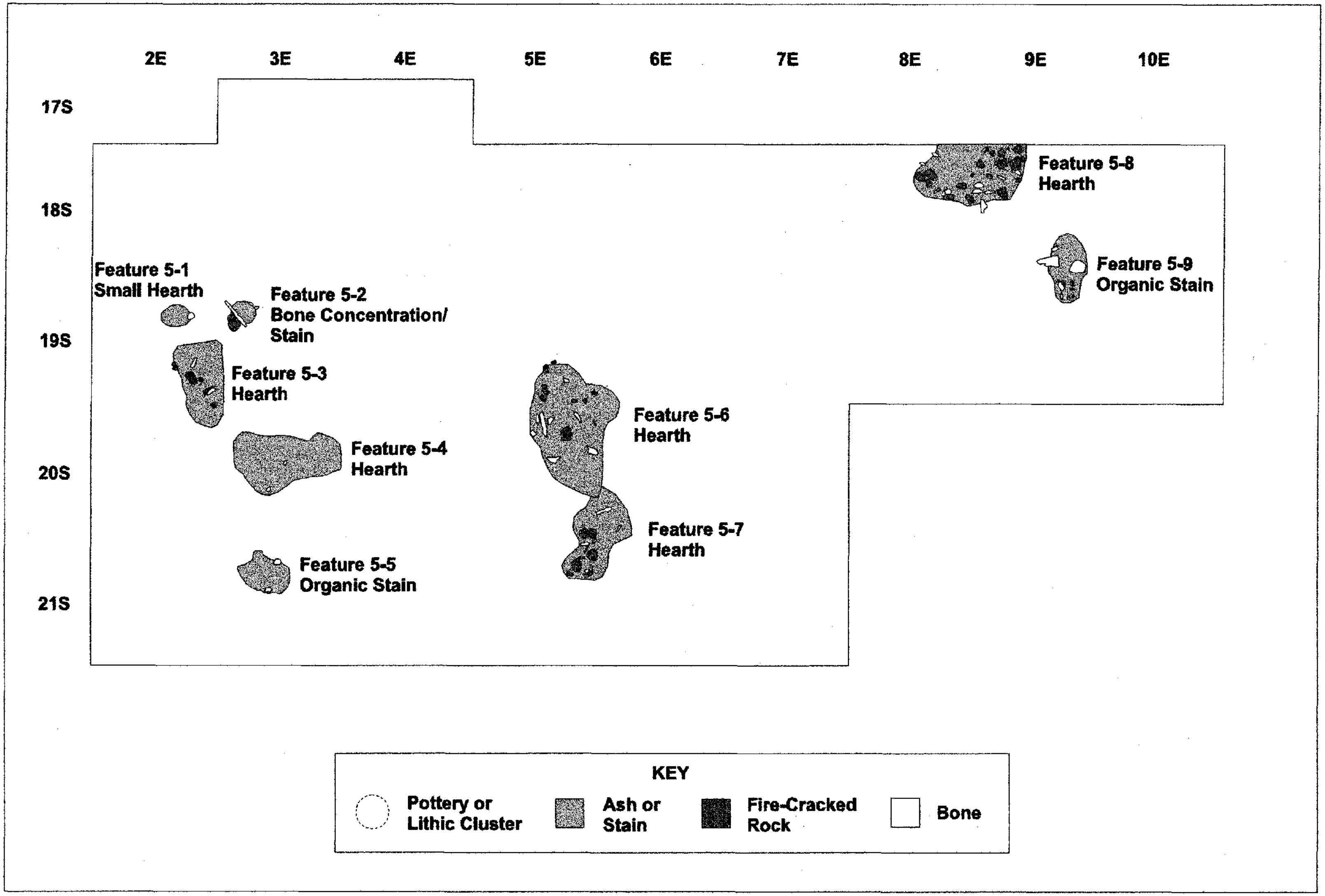

Figure 9.3. Layout and description of features from level five of the Thundercloud site.

Order Lagomorpha

Sylvilagus cf. *nuttallii*

Specimens identified: NISP=20; left fused 2nd/3rd carpal (5940-1), left internal carpal (5940-2), right radial carpal (5940-3), left radial carpal (5940-4), right ulnar carpal (5940-5), right internal carpal (5940-6), left ulnar carpal (5940-7), left unciform carpal (5940-8), left proximal 5th metacarpal (5941), left proximal 2nd metacarpal (5942), left proximal 3rd metacarpal (5943), left proximal 2nd metacarpal (5947), left proximal 3rd metacarpal (5945), left proximal 4th metacarpal (5944), right proximal 2nd metatarsal (5686), right proximal 3rd metatarsal (5687), right proximal 4th metatarsal (5688), proximal first phalanx (5689), distal second phalanx (5691), second phalanx (5690).

Distribution and habitat: Nuttall's cottontail is found in the Western Plains of North America. In Saskatchewan the species is found in the extreme southwest with populations which extend north along the South Saskatchewan river valley.
They prefer sagebrush and short grass prairies and shelter in open river valleys and coulees (Banfield,1974: 79). A small isolated population of Nuttall's cottontail has recently returned to Opimihaw Valley.

Discussion: Based on the metapodials recovered at least two individuals are represented. Forelimb elements 5940-1 to 5947 were found partially articulated within unit 18S7E. The second group, made up of hindlimb elements, was found articulated within unit 18S5E. Admittedly identification to species based on the elements present is very difficult. To aid in identification measurements were taken for some elements and compared to elements from specimens of *S. nuttalli* and *L. americanus* in the comparative collection at the University of Saskatchewan (included in Appendix IV). The results of these measurements are summarized in Table 9.4. Note that these measurements were based on the maximum width of the proximal end for each element, a trait which may not be consistent between individuals. Also, the sample size is extremely small. Furthermore, only one specimen of *S. nuttallii* is present in the comparative collection and the sex of the individual is not known. With this in mind, the results would appear to suggest that the archaeological specimens are closer in size to *S. nuttallii* than *L. americanus*.

Table 9.4. Summary of element measurements from archaeological specimens, *Sylvilagus nuttallii* and *Lepus americanus* (measurements in millimetres).

Element	Archaeological Specimens	*S. nuttallii*	* *L. americanus*
proximal second metatarsal	5.6	NA	6.14
proximal third metatarsal	5.2	4.8	6.38
proximal fourth metatarsal	4.95	4.65	5.75
proximal second metacarpal	3.65 & 3.7	3.2	4.51
proximal third metacarpal	3.3 & 3.75	3.2	4.18
proximal fourth metacarpal	3.75	3.15	3.93
proximal fifth metacarpal	3.45	2.65	3.83

* Average of seven specimens

None of the specimens exhibits direct signs of cultural modification but all of the metapodials are broken in the same position of the shaft suggesting that the feet were broken during processing and may have been removed with the hide. All specimens are slightly weathered in the form of rootlet etching.

Lepus sp.

Specimens identified: NISP=4; right P_2 (5725), distal tibia-fibula (6326), proximal metapodial (6325), right central tarsal (6327).

Discussion: These specimens are classified as Lepus based on overall size. They could represent either *L. americanus* or *L. townsendii*, both common species in the Province. All of the specimens were found in unit 20S3E. The premolar was found just outside of hearth feature 5-4 while the remaining specimens were recovered in soil samples taken from the feature. None of the specimens is culturally modified.

Leporidae indeterminate

Specimens identified: NISP=3; I^2 (5724), left distal humerus (5692), left calcaneus (5697).

Discussion: These specimens could not be identified below the level of Family because they are similar in size to specimens of both *Lepus* and *Sylvilagus*. The calcaneus was recovered in unit 18S13E and may represent a separate individual from the leporids described previously. The upper incisor was recovered within unit 20S3E close to the specimens of *Lepus* and is likely from the same individual. The distal humerus was recovered in unit 18S6E and is likely associated with the *Sylvilagus* specimens described from the same unit.

Order Rodentia

Spermophilus sp.

Specimens identified: NISP=10; left scapula (6243), right scapula blade (6252), occipital (6244), lumbar vertebra (6247), left femur (5576), right tibia (5577), right proximal humerus (6123), proximal right ulna (5681), left proximal femur (5771).

Discussion: These specimens are similar in size to both *S. richardsoni* and *S. tridecemlineatus*. It appears that at least two individuals are represented, possibly three. The proximal femur (5771) is quite small and likely represents *S. tridecemlineatus*. The proximal humerus and ulna are quite large and may represent *S. richardsonii*. These three specimens are lightly weathered and exhibit coloration similar to other bones in the assemblage. The remaining specimens are believed to be intrusive as they were all found in unit 19S14E and are light in color with a waxy appearance. None of the specimens is culturally modified.

Thomomys talpoides

Specimens identified: NISP=2; indeterminate molar (5984), right M_1 (6056).

Distribution and habitat: Northern pocket gophers prefer natural grasslands with well developed, deep, moist soils. During dry periods they abandon open grasslands for moist soil around sloughs, aspen bluffs and river banks. Pocket gophers are generally solitary and are primarily subterranean but may venture above ground at night. They are active throughout the winter. They are common throughout the Northern Plains and are found in all of the Prairie Provinces (Banfield,1974: 148-150).

Discussion: These isolated teeth represent one individual. The indeterminate molar was found in hearth feature 5-8. The other molar was found just east of the feature in excavation unit 18S10E. Neither specimen is burned.

Microtus pennsylvanicus

Specimens identified: NISP=32; summarized in Table 9.5.

Distribution and habitat: See page 48.

Discussion: Three individuals are represented by the specimens identified, found in three separate accumulations. The largest group (6101-6109) includes 17 elements collected from unit 19S2E in direct association with hearth feature 5-3. All of these specimens appear to be from the same animal. The second group (5975-5983) was found in unit 18S8E within hearth feature 5-8 and also appears to represent one individual. The final accumulation (5728, 6339-6341), representing the last individual, was recovered in hearth feature 5-6. Note that these specimens were identified by association. Although unlikely, it is possible that another species such as *M. ochrogaster* is represented. None of the specimens from any of the accumulations was burned.

Table 9.5. Summary of *Microtus pennsylvanicus* elements from level five.

Element	NISP	MNI	Catalogue Numbers
Maxilla	1	1	6107-1
Upper incisor	3	2	6105, 6106, 6107-4
Upper M1	4	3	5979, 6101, 6107-3, 6341
Upper M2	4	2	5978, 6104, 6107-2, 6340
Upper M3	4	2	5975, 5973, 6100, 6103
Mandible	3	2	5728-1, 6108-1, 6109-1
Lower incisor	3	2	5728-2, 6108-4, 6109-4
Lower M1	4	3	5728-3, 5982, 6108-3, 6109-3
Lower M2	5	3	5976, 5981, 6108-2, 6109-2, 6339
Lower M3	1	1	6117
Total	**32**	**3**	**N/A**

Microtus sp.

Specimens identified: NISP=3; left M^3 (5980), two indeterminate molars (6125, 6222).

Discussion: These molars are fragmented and could not be identified to species. The third molar is burned and was found in feature 5-8. It may belong to the *M. pennsylvanicus* specimens described previously that were found within the same feature. One of the other molars (6125) was also burned and was found in hearth feature 5-6. Again, it likely represents *M. pennsylvanicus* which was found in the feature samples. The final molar is unburned and was found in unit 19S10E. It may be associated with feature 5-9.

Clethrionomys cf. *gapperi*

Specimens identified: NISP=4; left M_1 (6083), left M_2 (6084), right M_2 (6122), right M_2 (6338).

Distribution and habitat: Gapper's red-backed voles are found throughout most of southern Canada. They are most common in coniferous forests around swamps and in wet meadows. One sub-species, *C. gapperi loringi*, is found in southern Saskatchewan and prefers aspen bluffs, coulees and vegetated river valleys. This species is active throughout the winter months finding cover in tunnels beneath the surface of the snow (Banfield,1974: 181-183).

Discussion: These specimens represent two, and possibly three, individuals. Two of the specimens (6083 and 6084) were recovered from unit 18S17E and may be intrusive. The other two molars (both right M_2) were found in the main excavation block. One was recovered in hearth feature 5-6 and the other was just north of the feature in unit 19S6E. None of the specimens appears to be culturally modified.

Lagurus curtatus

Specimens identified: NISP=1; left M^3 (6195).

Distribution and habitat: The sagebrush vole inhabits arid steppes and mountainous regions in the west-central United States. In Saskatchewan, the species is limited to the extreme southwest of the Province in the Cypress Hills/Big Muddy region. They prefer arid sagebrush steppes and have been found at high altitudes. Unlike most voles they will excavate shallow borrows in sandy substrates. They are active throughout the winter months (Banfield,1974: 201-202).

Discussion: This specimen was identified using specimens in the comparative collection and reference notes from Gilbert (1993: 88-90). The cusps of this specimen have wide re-entrant angles. The tooth is rootless and there is cementum between the cusps. It matches diagrams provided by Gilbert (1993: 90) and is similar in size and shape to the specimen in the comparative collection. It is not culturally modified but was found close to hearth feature 5-8.

Peromyscus cf. *maniculatus*

Specimens identified: NISP=79; left I^1 (6317), right I^1 (6315), left I_1 (6316-3), right I_1 (6314-3), right M_1 (6314-1), right M_2 (6314-2), left M_2 (6316-1), left M_3 (6316-2), right mandible (6314-4), left mandible (6316-4), five cervical vertebrae (6318 to 6320-3), seven indeterminate vertebrae (6321-1 to 6321-7), sacrum (6310), two ribs (6323-1, 6323-2), left scapula (6312), scapula blade (6322), right tibia (6311), right calcaneus (6309). Note that 48 elements, representing two individuals, were recovered from a rodent burrow in unit 18S9E. They are believed to be intrusive and are not listed here.

Distribution and habitat: Deer mice are common in many habitats and are found throughout North America, except in the arctic above the tree line. They are active throughout the winter utilizing small caches of stored seeds (Banfield,1974: 165-168).

Discussion: The specimens described are likely from one individual and as such were identified together. All of the elements were found within samples taken from hearth feature 5-3. None of the specimens is burned but bone colour is similar to other specimens in the assemblage. The specimens are not likely cultural but may represent an *in situ* death during the time of occupation. As mentioned, faunal materials from two other individuals were recovered and are believed to be intrusive.

Cricetidae indeterminate

Specimens identified: NISP=49; two right I^1 (6344-1, 6344-2), three left I^1 (6151, 6345-1, 6345-2), indeterminate I^1 (5941), seven right I_1 (6260, 6342-1 to 6342-6), five left I_1 (6150, 6261, 6343-1 to 6343-3), indeterminate I_1 (6152, 6335), left zygomatic (5973), indeterminate vertebra (6197, 6245, 6349), left ilium (6026), three left femora (6127, 6205, 6351), right proximal femur (6102), distal femur (5970), fibula (6153), left calcaneus (6204), right calcaneus (6201), left humerus (6089), two right humeri (5846, 5952), left ulna (6196), left radius (6350), metapodial fragments (5985, 5986).

Discussion: These specimens could represent any of the mice or voles described previously. Based on the number of lower right incisors at least four more individuals have been identified. Nearly all of the incisors (6342-1 to 6345-2), 13 in total, were found in hearth feature 5-6. A left radius (6350), left femur (6351) and a vertebra

(6349) were found in hearth feature 5-8. One incisor (6335) was found in hearth feature 5-4. The majority of the remaining specimens were found in unit 18S8E, just outside of feature 5-8. The left zygomatic (5973) and the metapodial fragments (5985) are burned. All of the other specimens described show no sign of cultural modification.

Order Insectivora

Microsorex hoyi

Specimens identified: NISP=1; right femur (5846).

Distribution and habitat: See page 49.

Discussion: This specimen was identified as *Microsorex hoyi* based on its overall size. It is a mammalian femur and is extremely small (6mm long). It is the same size as the femur from the specimen in the comparative collection. The specimen is burned but was not found in a visible feature.

9.1.6 Order Anseriformes

Anas* cf. *crecca

Specimens identified: NISP=2; right proximal ulna (5698), right distal ulna (5699).

Distribution and habitat: The green-winged teal breeds in Canada during the summer and winters in the United States. It is common throughout Canada, except in the far north above the tree line, and prefers shallow ponds, marshes and lake margins. It is the smallest duck in Canada (Godfrey,1986: 83).

Discussion: These specimens were found within the same excavation unit and are from the same element. They were identified as *A. crecca* based on their overall size. When reconstructed, this element is the same size as the ulna from *A. crecca* in the comparative collection and smaller than the ulna of *A. discors* (the blue-winged teal). Neither specimen in culturally modified but their colour is consistent with the rest of the assemblage.

Order Galliformes

Phasianidae indeterminate

Specimens identified: NISP=1; right tibiotarsus (5718).

Discussion: This specimen is slightly fragmented making identification difficult. It is similar to both *Bonasa umbellus* (the ruffed grouse) and *Tympanuchus phasianellus* (the sharp-tailed grouse) although the latter species tends to be the larger of the two. Both species are common in Saskatchewan. This specimen exhibits light weathering and is not culturally modified.

Order Passeriformes

Icterinae indeterminate

Specimens identified: NISP=1; sternum fragment (5732).

Discussion: This specimen includes the anterior border, and part of the keel, of a sternum. The shape of the keel was useful in identifying this specimen to sub-family, but the fragment is too small to determine the species represented. It is close in size to both *Agelaius phoeniceus* (the red-winged blackbird) and *Xanthocephalus xanthocephalus* (the yellow-headed blackbird). The specimen exhibits light rootlet etching but does not appear to be culturally modified.

Parulinae indeterminate

Specimens identified: NISP=2; proximal scapula (6031), quadrate (6087).

Discussion: These specimens were found eight meters apart and may represent two individuals. They are very small and could represent a number of warblers which are common to Saskatchewan. The proximal scapula was found in hearth feature 5-8. Neither specimen appears to be culturally modified but both exhibit coloration similar to other specimens in the assemblage.

Miscellaneous Avians

Avia indeterminate (SC4)

Specimens identified: NISP=1; longbone shaft fragment (5708).

Discussion: This specimen was recovered in 1986 during the excavation of the test pit (unit 19S5E). It is quite large but is too fragmented to be identified beyond the category of size class. The surface of the bone is slightly exfoliated and rootlet etched. The specimen is not culturally modified.

Avia indeterminate (SC2)

Specimens identified: NISP=1; quadrate (6221).

Discussion: This specimen is fragmented and could not be identified beyond the category of size class. It was recovered in unit 19S10E just outside of hearth feature 5-8 and is completely burned.

Order Anura

Bufo sp.

Specimens identified: NISP=1; last lumbar vertebra (6182).

Discussion: This specimen was identified as *Bufo* based on the shape of the transverse processes. Two species of *Bufo* are present in Saskatchewan, *B. hemiophrys* (the Canadian toad) and *B. cognatus* (the Great Plains toad). *B. cognatus* is uncommon and is limited to the extreme southwestern areas of the Province, where it maintains an extralimital population (Russell and Bauer 1993: 69). While it could be *B. cognatus*, this specimen likely represents *B. hemiophrys* which is found throughout the Province. It prefers forested areas but will venture into the grasslands and is active from April to September (Russell and Bauer,1993: 70). This specimen does not appear to be culturally modified but is similar in colour to the rest of the assemblage.

Anura indeterminate

Specimens identified: NISP=23; four left humeri (5871-5874), two right humeri (5875, 5876), right proximal scapula (5685), scapula fragments (5879, 5880), two left innominates (5709, 6199), three urostyles (6149, 6200, 6308), indeterminate longbones (5877, 5878, 5881, 6030, 6124, 6185, 6306).

Discussion: Two individuals are represented by the specimens identified. Specimens 5871 to 5881 are associated and were recovered in unit 18S5E. One of these specimens (a humerus) is burned. Of the remaining specimens, two were recovered in hearth feature 5-1 and are burned. Another specimen (a longbone) was found in hearth feature 5-6 and is also burned. The remainder were found in, and around, hearth feature 5-8. None of these latter specimens appears to be culturally modified. All of the specimens are similar in colour to other bones in the assemblage.

Miscellaneous Pelecypods

Pelecypoda indeterminate

Specimens identified: NISP=5; five shell fragments (5735, 6078, 6246, 6324).

Discussion: These specimens are quite small and could not be further identified. One fragment was recovered in hearth feature 5-3 and another in hearth feature 5-6. The other fragments do not appear to be associated with a visible feature. None of the fragments is culturally modified.

Order Basommatophora

Stagnicola sp.

Specimens identified: NISP=4; four complete shells (5729-5731).

Discussion: A number of species of *Stagnicola* have been identified in Saskatchewan. These specimens closely resemble two of these; *S. elodes* and *S. caperata*. *S. elodes* is common in a variety of aquatic habitats, especially in areas with thick aquatic vegetation and muddy substrates (Clarke 1981: 142). *S. caperata* prefers temporary water sources and flooded margins of permanent water sources (Clarke 1981: 130). These specimens were all found within unit 20S7E and were likely deposited during a spring flood. They are not believed to be present as a result of cultural activity but are likely contemporaneous.

Order Mesogastropoda

Valvata sincera

Specimens identified: NISP=2; two complete shells (6198, 6249).

Distribution and habitat: See page 52.

Discussion: These specimens were likely deposited during flood conditions. They are not believed to have been introduced by human activity.

Miscellaneous Specimens

Specimens identified: NISP=209; see Table 9.6.

Discussion: The majority of these specimens are believed to represent species previously described in this chapter. The small-medium mammal elements are likely from *Sylvilagus nuttallii* as many were found in association with those specimens. Likewise, the small and micro-mammal specimens can be attributed to a number of rodents found within the same excavation units. Interestingly, the majority of the burned elements were not found associated with a visible feature.

Table 9.6. Summary of level five miscellaneous specimens by size class.

Size Class	NISP	Elements Represented	# Burned	Type burned
5 - Large Mammal	1	Vertebra	0	N/A
3 - Small/Med Mammal	117	Phalanges, Metapodials	0	N/A
2 - Small Mammal	59	Numerous	21	Longbone Shaft, Phalanges
1 - Micro-mammal	18	Longbone Shaft, Vertebrae	5	Longbone Shaft
1 - Microvertebrate	14	Longbone Shaft, Vertebrae	3	Longbone Shaft

9.2 The Level Five Floral Assemblage

Two seeds were identified in level five, one *Prunus virginiana* and one *Rosa sp.* Both specimens are burned but only one, the *Prunus* seed, was recovered within a feature (feature 5-4). They are both believed to be part of the cultural assemblage.

9.3 Faunal Distribution Patterns

The level five faunal assemblage is very large and includes a large number of identified specimens, especially when bison element counts are examined. This led to the creation of complex distribution maps with large numbers of elements and widespread accumulations which often cover the entire excavation surface. The analysis of these patterns was further complicated by the fact that level five contains a mixture of at least three, and possibly four, occupation layers. These layers were discovered in the 1996 field season when the level five stratigraphy began to separate in the western excavation units (see Figure 3.3). The levels, designated 5a, 5b, and 5c, all contain diagnostic projectile points from the McKean cultural complex. Unfortunately, these levels were separate in only a few units leading to the analysis of all occupations within the same stratigraphic unit (level five).

Bison cranial distribution

Cranial elements are clustered around a number of features. The largest accumulation spans seven excavation units and includes several heavier concentrations (Appendix III, Figure 33). It is centred around features 5-1, 5-2, 5-3 and 5-4 with the greatest concentration recorded between hearth features 5-3 and 5-4. A medium concentration, projecting to the east, is also present between hearth features 5-4 and 5-6. Several smaller concentrations were recorded around features and include; a small accumulation west of feature 5-5, one west of hearth feature 5-7, one east of hearth feature 5-6, and another just south of hearth feature 5-8. Two accumulations do not appear to be associated with features including a small cluster in the middle excavation block and a medium cluster in unit 17S3E. It is possible that features are present in adjacent un-excavated units.

Bison vertebrae distribution

Relatively few vertebral specimens were recovered in level five leading to the creation of three small distributions (Appendix III, Figure 34). The largest lies directly between four features: hearth features 5-4, 5-6, and 5-7 and stain feature 5-5. A second forms part of feature 5-2 (a bone concentration), just east of hearth feature 5-3. A final concentration is shared between units 17S3E and 17S4E and is not associated with a visible feature.

Bison forelimb distribution

A large number of forelimb elements have been identified in level five leading to the development of complex distribution patterns (Appendix III, Figure 35). Basically, all of the elements form one large interconnected concentration with several centers of higher concentration. The highest concentration runs directly through a line of features (hearth features 5-1, 5-3, and 5-4) with a spike directly east of feature 5-5. Three smaller accumulations surround hearth feature 5-6 to the west, north and east. A medium concentration is shared between hearth feature 5-8 and feature 5-9. Finally, a small concentration forms a portion of the bone concentration (feature 5-2). Three medium accumulations in units 17S3E, 18S5E, and 18S7E do not appear to be associated with a visible feature.

Bison hindlimb distribution

Hindlimb distribution patterns are very similar to the forelimb pattern forming one large concentration with separate centers of higher accumulation (Appendix III, Figure

36). By far the heaviest concentration occurs within hearth feature 5-4. This accumulation is shared with feature 5-5 located just south of the hearth. A small concentration is present within hearth feature 5-1 and another is located just east of hearth feature 5-3. Two accumulations are present around hearth feature 5-6, one to the east and one to the west. Finally, two accumulations were noted associated with hearth feature 5-8, one directly within the feature and another just to the south which may also be associated with feature 5-9. Accumulations in units 18S4E and 18S7E do not appear to be associated with a known feature.

Bison phalanx distribution

Phalanx distribution patterns are very similar to the patterns described for the hindlimb elements (Appendix III, Figure 37). All concentrations are light to medium. Medium concentrations are present within hearth feature 5-4, within feature 5-5 (an organic stain), and east of hearth feature 5-3. Light concentrations include; two around hearth feature 5-6 (one to the east and one west), and another in units 19S7E and 19S8E which is not associated with a visible feature.

Canid element distribution

Two concentrations of canid elements are present in level five (Appendix III, Figure 38). The largest, located within units 20S2E and 21S2E, can be attributed to the elements from the articulated pes believed to be from *Canis lupus*. The second, which is mainly in unit 21S4E, is a light accumulation of manus elements from a small-medium sized canid, believed to represent *Canis latrans*. Both concentrations are between hearth feature 5-4 and organic stain feature 5-5. The larger elements (SC5) are to the west while the smaller elements (SC4) are to the east.

Rodent element distribution

Unlike previous levels where the distribution of rodent elements was somewhat random, distributions in level five show distinct clusters within and around a number of hearths (Appendix III, Figure 39). The heaviest concentration is present within hearth feature 5-3 and includes the majority of the identified specimens of *Peromyscus.* These specimens may represent a false association since they are not believed to be cultural. Another heavy concentration is present in hearth feature 5-6. Two species have been identified by the specimens recovered, *Microtus pennsylvanicus* and *Clethrionomys gapperi*, including a number of burned specimens. A final heavy accumulation is present within hearth feature 5-8 and includes the following taxa: *Thomomys talpoides*, *Microtus pennsylvanicus*, *Lagurus curtatus*, and numerous burned cricetid specimens. A medium concentration is shared between hearth feature 5-8 and stain feature 5-9 made up of burned and unburned cricetid elements. Three small accumulations, including one in the middle excavation block, do not appear to be associated with any feature.

Leporid element distribution

Leporid elements are distributed in three clusters (Appendix III, Figure 40). A small concentration of *Lepus* elements is present in hearth feature 5-4 which extends out of the feature towards hearth feature 5-3. Two heavy clusters of *Sylvilagus* elements are present in units 18S5E and 18S7E which do not appear to be associated with a visible feature.

Anuran element distribution

The majority of the anuran elements are concentrated in units 17S4E and 18S4E (Appendix III, Figure 41). Several burned elements have been identified from the cluster, however, no feature has been identified in the immediate vicinity. Two small accumulations do appear to be associated with features; one just north of hearth feature 5-1 and another between features 5-8 and 5-9 which includes elements identified as *Bufo*.

Gastropod distribution

None of the gastropods in level five is believed to be present due to cultural activity. The distribution is examined here in an attempt to help understand the stratigraphic history of this level. As mentioned previously, level five separated into levels 5a, 5b, and 5c in some of the western excavation units and this area of separation was plotted against the gastropod distribution patterns (Appendix III, Figure 42) . The resulting map shows that no gastropods are found within the region of separation. Based on these results, it appears that the gastropods were deposited at the flood margin. Flood waters may have been present for extended periods leading to the separation of the levels, but then rapidly receded since no gastropods are present in the newly deposited sediments.

Miscellaneous element distribution

A number of species are associated with features which are present in limited number and could not be used to create distribution maps. Several burned avian elements (SC2) were found in hearth feature 5-8. Numerous micro- and small mammal elements, and a pronghorn scapula, were also recovered in the feature. The lone phasianid element was found within hearth feature 5-3. Finally nearly all of the medium mammal elements (SC3) were found in unit 18S7E and are believed to represent *Sylvilagus nuttallii*. These elements are not associated with a visible feature but are believed to be part of the cultural assemblage.

9.3.1 Discussion

Stratigraphic separation in the western excavation units reveals that at least three occupations are represented by the level five assemblage. Undoubtedly some of the distribution patterns described previously are a result of overlapping faunal materials and may not reflect actual activity patterns. With this in mind it becomes apparent that faunal materials are heavily concentrated around hearth features (Table 9.7).

Table 9.7 Summary of level five features and associated distributions.

Feature #	Feature Description	Associated Element Distributions
5-1	Small hearth	*Bison* crania *Bison* forelimb *Bison* hindlimb Anuran elements
5-2	Bone concentration	*Bison* crania *Bison* vertebrae
5-3	Hearth	*Bison* crania *Bison* vertebrae *Bison* forelimb *Bison* hindlimb *Bison* phalanges *Lepus* elements *Peromyscus* elements Phasianid elements
5-4	Hearth	*Bison* crania *Bison* vertebrae *Bison* forelimb *Bison* hindlimb *Bison* phalanges *Canis* elements *Lepus* elements
5-5	Organic stain	*Bison* crania *Bison* vertebrae *Bison* forelimb *Bison* hindlimb *Bison* phalanges *Canis* elements
5-6	Hearth	*Bison* crania *Bison* vertebrae *Bison* forelimb *Bison* hindlimb *Bison* phalanges *Microtus pennsylvanicus* elements *Clethrionomys gapperi* elements

Table 9.7 Continued

Feature #	Feature Description	Associated Element Distributions
5-7	Hearth	*Bison* crania *Bison* vertebrae
5-8	Hearth	*Bison* crania *Bison* forelimb *Bison* hindlimb *Thomomys talpoides* elements *Microtus pennsylvanicus* elements *Lagurus curtatus* elements Cricetid elements Anuran elements Small mammal (SC2) elements Micro-mammal (SC1) elements Avian (SC2) elements
5-9	Organic stain	*Bison* forelimb *Bison* hindlimb *Microtus* elements Cricetid elements Anuran elements
*17S3E	N/A	*Bison* crania *Bison* vertebrae *Bison* forelimb Anuran elements
*18S5E-18S7E	N/A	*Bison* forelimb *Bison* hindlimb *Bison* phalanges *Sylvilagus* elements Medium mammal (SC3) elements

*Not a feature

Feature 5-1 is a small hearth which is associated with a small number of bison elements. Several cranial and forelimb elements were found just outside of the feature, while the hindlimb elements were concentrated within the hearth. Finally, a small number of anuran elements, including some burned specimens, were also recovered from the hearth samples.

Feature 5-2 is a small concentration of bone that consists mainly of bison cranial and vertebral elements. This feature is likely associated with hearth feature 5-3 which is located just south of the bone concentration. Hearth feature 5-3 is associated with a large number of bison elements representing all areas of the body. Cranial elements were recovered within the feature while all other elements were found around the margins of the hearth. Most of the *Peromyscus* elements from level five were found within feature 5-3, but these elements are not believed to be cultural. Finally, elements described as *Lepus* are present between hearth feature 5-3 and 5-4.

Hearth feature 5-4 and organic stain 5-5 are also associated with bison elements from all body regions. Most elements are accumulated outside of the features with the exception of the hindlimb elements which conspicuously concentrated within hearth feature 5-4. Canid elements from both size classes (SC4 and SC5) are also shared by both features.

Hearth feature 5-6 is also associated with all types of bison elements but concentrations are relatively small when compared to other hearths found in this level. A number of *Microtus pennsylvanicus* and *Clethrionomys gapperi* elements were also identified in this feature including a number of burned specimens.

Hearth feature 5-7 was recorded several centimetres below hearth feature 5-6 and may represent a feature from a separate occupation. It has also been suggested that the feature represents the remnants of a rodent burrow which passed through feature 5-6. Only bison cranial and vertebral elements were found in association with this feature.

Hearth feature 5-8 is associated with a number of elements representing a diverse faunal community. Bison is limited to cranial, forelimb, and hindlimb elements. More interesting are the large number of rodent specimens found within the feature including; *Thomomys talpoides*, *Microtus pennsylvanicus* and *Lagurus curtatus.* A number of micro- and small mammal elements found within the feature likely represent these identified species. Finally, a number of burned anuran and small avian elements were also identified within the hearth samples.

The final feature, organic stain feature 5-9, is located just south of hearth feature 5-8 and shares a number of bison limb elements. Several *Microtus* and anuran elements were also recovered from the hearth samples.

Two areas exhibit faunal concentrations which are not associated with a visible feature. Bison crania, vertebrae and forelimb elements showed overlapping distributions within unit 17S3E. The majority of the anuran elements identified in the level are also from this unit. Bison forelimb, hindlimb and phalangeal elements exhibit light accumulations between units 18S5E and 18S7E. As well, all of the elements identified as *Sylvilagus nuttallii* were found within these units. It is probable that a feature is present in units directly to the north which have not been excavated at this time.

It is apparent that activities in level five are centered around a number of hearth features. Most hearths are associated with processing various bison elements but the majority of the elements are not burned. Most of the bison elements are located around hearths with the exception of hindlimb specimens which appear to be concentrated inside. Elements are relatively complete when compared to other levels and no boiling pit features were described suggesting that grease manufacture is not an important activity. Many of the longbone shafts are broken which may indicate that marrow was being processed for immediate consumption.

An examination of the %MAU for all bison elements shows that vertebrae and some distal limb elements are under represented in the level five assemblage (Figure 9.4). Once again it appears that only high utility items are being brought to the site. More interesting is the presence of many small animals within several of the hearth features. Hearth features 5-6 and 5-8 appear to have been used to process several small rodents while hearth features 5-1 and 5-8 contain many burned and unburned anuran elements. Burned avian elements were found in feature 5-8 and *Sylvilagus*

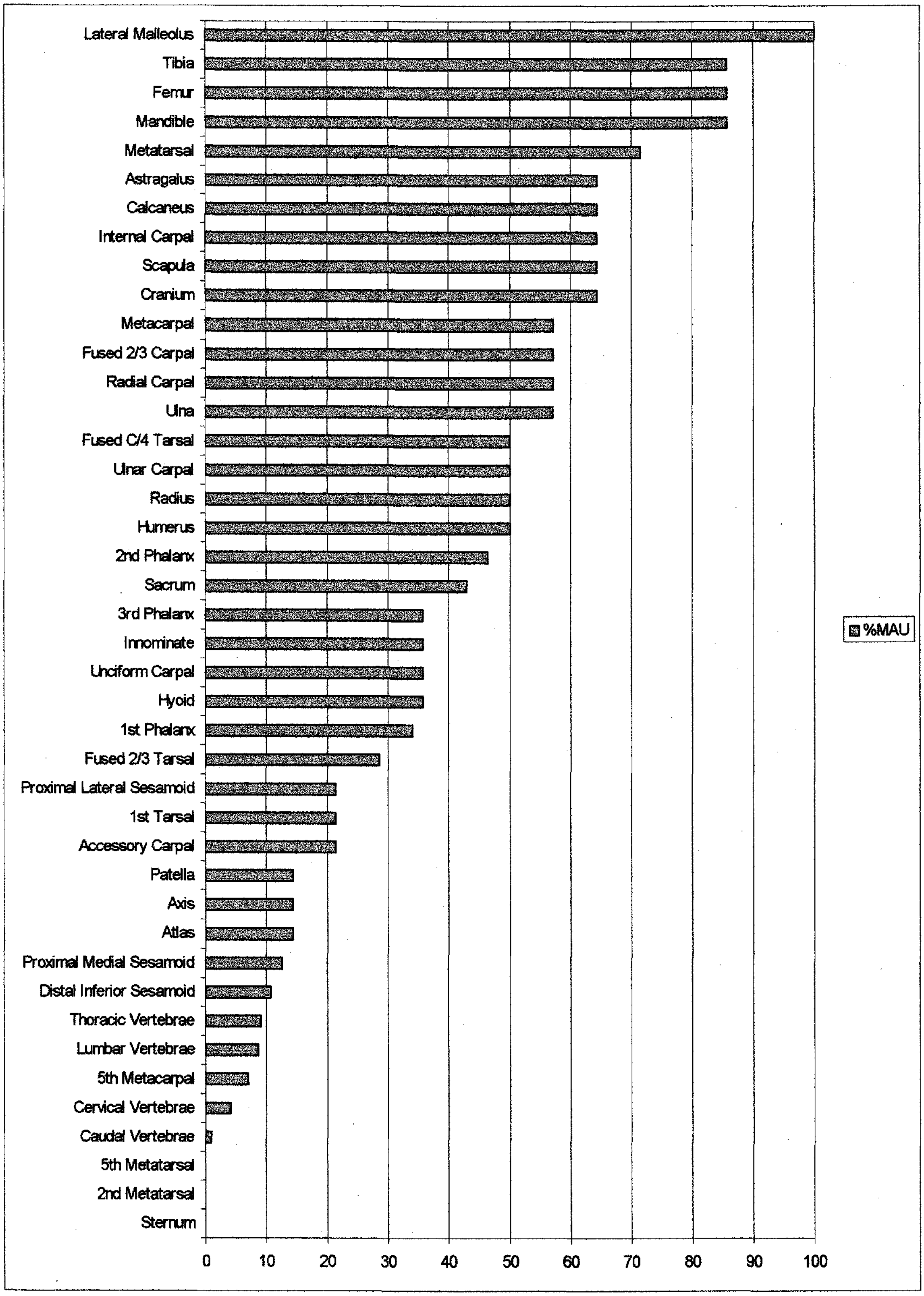

Figure 9.4 %MAU for bison elements in level five at the Thundercloud site.

elements found in unit 18S7E also appear to be processed. It appears that a greater number and diversity of species are being utilized in level five, a topic which will be discussed further in Chapter 12.

9.4 Seasonality

Although level five contained the largest number of bison elements there are few mandibles, maxillae and isolated teeth which could used to determine bison age structure. Unfortunately, there were also few immature elements and no foetal remains lending to the difficulty in determining the overall season of occupation.

9.4.1 Immature Bison Elements

Five immature bison elements have been identified in the level five assemblage. One longbone is too fragmented and could not be identified to element. Another is a longbone epiphysis which is also fragmented and could not be used to estimate age. The last three elements, two femora and an innominate, are also fragmented but were complete enough to provide a limited estimation of age. The right and left femurs include portions of the shaft and the supracondyloid fossa. They are very similar in size and could represent the same individual. They are larger than the seven month old bison but smaller than one that is ten months old. Based on their overall size, they appear to be closer in size to the femur of a ten month old bison. The innominate contains portions of the right ilium including the acetabulum. It is quite small and is slightly larger than a one week old bison. It is not larger than the innominate of the three week old bison in the comparative collection.

9.4.2 Other Faunal Indicators

As in previous levels, species were identified in the level five assemblage which normally hibernate during the winter months. *Taxidea taxus* typically hibernates from November to April and *Mephitis mephitis* from December to March. *Anas crecca* winters in the United States and returns to Canada to breed in May (Godfrey,1986: 87). Members of the genus *Bufo* seek shelter from freezing temperatures during the winter in muddy sediments or in deep burrows. Finally, the presence of pelecypods in features suggests that they may be cultural. If so they would be easier to harvest in warmer months during ice free periods.

9.4.3 Discussion

Based on the analysis of immature bison elements and the bison birthing schedule (from mid-April to mid-June) it appears that two time periods are represented. A seven to ten month old bison is available from mid-November to mid-March. The one to three week old bison would be available from the end of April to the beginning of July. Non-bison faunal materials include species which are active throughout the winter and those which hibernate or migrate. The presence of these latter species lends support to the presence of at least one spring occupation.

9.5 Summary

By number *Bison bison* elements make up the majority of the level five assemblage. Burning is limited to hindlimb elements which account for the majority of bison specimens recovered from hearth features. Light weathering is present on most specimens with exfoliation and rootlet etching most frequently recorded. Elements are relatively complete with few cultural modifications. The level five assemblage also has the highest faunal diversity of any level. A number of these taxa appear to have been utilized including canids, mustelids, leporids, small and micro-sized rodents, anatids, phasianids, anurans, and pelecypods.

Based on the analysis of the distribution maps all of the activities in level five are centered around a number of hearths. All of these hearths appear to be associated with processing bison elements and several also reveal evidence of small animal procurement. This marked increase in small mammal usage by peoples of the McKean cultural complex appears to be significant and is the topic of further discussion in Chapter 12.

Finally, through the analysis of a limited number of immature bison elements and the presence of species which normally hibernate or migrate during winter it has been determined that level five was occupied at least once during the winter and again in the spring. These time discrepancies are easily explained by the stratigraphic sequence which revealed the separation of level five into three distinct McKean Complex occupations.

Chapter 10

The Level Six Faunal Assemblage

10.1 The Level Six Faunal Assemblage

Level six has the second smallest faunal assemblage with 6658 specimens (Table 10.1). In total, 81% of the assemblage is comprised of unidentifiable fragments. Almost all of the burned specimens are unidentifiable attesting to the high degree of fragmentation in the burned assemblage. Unburned specimens are split more evenly between identified and unidentified but at least half of the identified specimens are represented by gastropods which are not believed to be part of the cultural assemblage. Identified specimens account for most of the weight in this level due to a relatively large number of complete bison elements.

Table 10.1 Level six faunal assemblage separated by degree of burning.

	Identified			Unidentified			Total	
	N	%N	Weight (g)	N	%N	Weight (g)	N	Weight (g)
Unburned	1266	24.5	7966.6	3900	75.5	2674	5166	10640.6
Burned	1	0.1	0.1	997	99.9	549.1	998	549.2
Calcined	1	0.2	0.1	493	99.8	191.9	494	192
Total	**1268**	**19.0**	**7966.8**	**5390**	**81.0**	**3415**	**6658**	**11381.8**

At least 19 different taxa are represented by the identified specimens, from at least 84 individuals (Table 10.2). Note that 66 of these individuals are gastropods which are not believed to be culturally deposited.

Table 10.2 Summary of level six faunal remains by taxa.

Common Name	Taxon	NISP	MNI
Mammals			
Bison	*Bison bison*	528	3
Elk	*Cervus elaphus*	1	1
Pronghorn	*Antilocapra americana*	3	1
Deer or Pronghorn	Small Artiodactyla	1	-
Small-Medium canid (SC4)	*Canis sp.*	7	1
Carnivore indeterminate	Carnivora	1	-
Rabbits and Hares	Leporidae	1	1
Richardson's ground squirrel	*Spermophilus richardsonii*	4	1
13-lined ground squirrel	*Spermophilus tridecemlineatus*	1	1
Ground squirrels	*Spermophilus sp.*	17	1
Meadow vole	*Microtus pennsylvanicus*	2	1
Gapper's red-backed vole	*Clethrionomys cf. gapperi*	2	1
Heather vole	*Phenacomys intermedius*	1	1
Mice and Voles	Cricetidae	5	-
Small rodent	Rodentia	1	-
Birds			
Warbler	Emberizidae	1	1
Small-Medium bird	Avian (SC3)	1	1
Micro-bird	Avian (SC1)	1	-
Amphibians			
Tiger salamander	*Ambystoma tigrinum*	1	1
Toads	*Bufo sp.*	1	1
Frogs	*Rana sp.*	1	1
Frogs and Toads	Anura	6	-
Invertebrates			
Keeled/Broad promenetus	*Promenetus exacuous*	1	1
Umbilicate promenetus	*Promenetus umbilicatellus*	4	4
Stagnicola	*Stagnicola sp.*	37	37
Valve snail	*Valvata sincera*	24	24
Snails (shell fragments)	Gastropoda	596	-
Miscellaneous			
Small-Medium Mammal (SC3)		1	-
Small Mammal (SC2)		10	-
Micro-Mammal (SC1)		2	-
Small Vertebrate (SC2)		3	-
Microvertebrate (SC1)		3	-
Total		**1268**	**84**

Order Artiodactyla

Bison bison

Specimens identified: NISP=528; see Table 10.3 for a summary. The MNE and MAU values were calculated using a number of landmarks. A summary of these calculations is included in Appendix II (Table 2).

Distribution and habitat: See page 43.

Discussion: Three individuals are represented by the identified specimens. None of the specimens is burned and weathering is limited to rootlet etching and slight abrasion. The majority of the specimens are covered with a light coating of calcium carbonate, absent from specimens in the upper levels. The layer is thin but covers enough of the bone surface to mask any cut marks that may be present. It is believed that the majority of the 5390 unidentified specimens represent fragmented bison elements.

Cervus elaphus

Specimens identified: NISP=1; canine (5782).

Distribution and habitat: See page 99.

Discussion: This specimen is the crown of an elk canine also known as an elk 'tusk'. It is slightly polished and may have been part of a pendant. No other signs of cultural modification are present on this specimen.

Antilocapra americana

Specimens identified: NISP=3; right mandible with molars (5774), right maxilla with molars (5776), left maxilla with molars (5775).

Distribution and habitat: See page 45.

Discussion: These specimens represent one individual and were associated within the same excavation unit. None of the specimens appears to have been culturally

Table 10.3 Summary of bison elements from level six.

	NISP	MNI (Side)	Total MNE	Total MAU	%MAU
Axial Skeleton					
Cranium	224	1	2	1	50
Mandible	78	2	3	1.5	75
Hyoid	0	0	0	0	0
Sternum	0	0	0	0	0
Atlas	0	0	0	0	0
Axis	0	0	0	0	0
Cervical Vertebrae	0	0	0	0	0
Thoracic Vertebrae	34	1	6	0.43	21.5
Lumbar Vertebrae	11	2	2	0.4	20
Sacrum	0	0	0	0	0
Caudal Vertebrae	0	0	0	0	0
Forelimb					
Scapula	21	1	2	1	50
Humerus	27	2	3	1.5	75
Radius	0	0	0	0	0
Ulna	2	2	2	1	50
Internal Carpal	0	0	0	0	0
Radial Carpal	0	0	0	0	0
Accessory Carpal	0	0	0	0	0
Ulnar Carpal	1	1	1	0.5	25
Unciform Carpal	1	1	1	0.5	25
Fused 2/3 Carpal	0	0	0	0	0
Metacarpal	7	2	4	2	100
5th Metacarpal	1	1	1	0.5	25
Hindlimb					
Innominate	14	3	4	2	100
Femur	1	1	1	0.5	25
Patella	6	1	1	0.5	25
Tibia	8	2	3	1.5	75
Lateral Malleolus	3	2	3	1.5	75
Calcaneus	4	2	3	1.5	75
Astragalus	2	1	2	1	50
Fused C/4 Tarsal	3	3	3	1.5	75
Fused 2/3 Tarsal	4	3	4	2	100
1st Tarsal	1	1	1	0.5	25
Metatarsal	5	2	2	1	50
2nd Metatarsal	0	0	0	0	0
5th Metatarsal	0	0	0	0	0
Other Elements					
1st Phalanx	7	2	7	0.88	44
2nd Phalanx	6	1	6	0.75	37.5
3rd Phalanx	5	1	5	0.63	31.5
Proximal Lateral Sesamoid	5	4	4	0.5	25
Proximal Medial Sesamoid	3	3	3	0.38	19
Distal Inferior Sesamoid	0	0	0	0	0
Miscellaneous					
Vertebrae Indeterminate	1	-	-	-	-
Metapodial Indeterminate	-	-	-	-	-
Molar/Premolar Indeterminate	6	-	-	-	-
Rib Head	4	-	-	-	-
Rib Shaft	33	-	-	-	-

modified but they are all covered by a thin layer of calcium carbonate and exhibit slight rootlet etching.

Artiodactyla indeterminate

Specimens identified: NISP=1; left scapula (5777).

Discussion: This specimen is the blade portion of a left scapula from a small artiodactyl. It was recovered in unit 19S3E and may be associated with the pronghorn elements described previously. There are multiple cut marks present along the margins of the subscapular fossa. It also appears that the border has been chewed by a large carnivore. Calcium carbonate is present on the posterior surface.

Order Carnivora

Canis sp. (SC4)

Specimens identified: NISP=7; two cervical vertebrae (5786, 5792), left ulna (6408), right distal tibia (5778), distal metapodial (5795), second phalanx (5781).

Discussion: This small assemblage may represent two individuals. The cervical vertebrae include portions of the neural arch which have not fused to the centrum suggesting that at least one immature individual is present. The distal tibia appears to have been chewed by a large carnivore with evidence of pitting and scoring. None of the specimens shows signs of cultural modification. The metapodial is not covered with calcium carbonate and may have been secondarily redeposited.

Carnivore indeterminate

Specimens identified: NISP=1; indeterminate canine (5773).

Discussion: This specimen is a nearly complete un-socketed canine. Part of the crown is missing but all of the root is intact. It is a relatively large tooth and is likely from a badger, dog or coyote. The specimen is not culturally modified but is covered by a thin sheet of calcium carbonate.

Order Lagomorpha

Leporidae indeterminate

Specimens identified: NISP=1; right I^1 (5804).

Discussion: This specimen was fragmented and was reconstructed for identification purposes. Unfortunately the specimen is still too fragmented to be identified to the level of genus. Some calcium carbonate is present on the inner surface of the tooth. It does not appear to have been modified by cultural activity.

Order Rodentia

Spermophilus richardsonii

Specimens identified: NISP=4; right mandible with teeth (four fragments - 5785).

Distribution and habitat: See page 79.

Discussion: These four specimens are from the same mandible. The specimens are lightly coloured and are not coated by calcium carbonate. For these reasons the specimens are believed to be intrusive.

Spermophilus tridecemlineatus

Specimens identified: NISP=1; left maxilla and teeth (5998).

Distribution and habitat: Unlike most ground squirrels, *S. tridecemlineatus* prefers shrubby areas over open grassland. They are found throughout most of the northern Great Plains but are most numerous in the aspen parkland. They usually begin hibernation in September and emerge in early April (Banfield,1974: 122-124).

Discussion: These specimens exhibit lighter colouration than other bone specimens in the assemblage. Also, calcium carbonate deposits are not present suggesting that these specimens are intrusive.

Spermophilus sp.

Specimens identified: NISP=17; left maxilla (6190-1), right mandible (5801), right ramus (6149), left I^1 (6190-2), right P_4 (6160), indeterminate molar (5991), indeterminate vertebra (5916), sacrum (5791), right scapula (5790), right humerus (5806), left distal humerus (5992), right internal carpal (5989), right femur (5974), right tibia (5789), right proximal tibia (5793), right calcaneus (5993), left 3rd metatarsal (6157).

Discussion: At least one individual is represented by the identified specimens. A number of specimens are believed to be intrusive including: the scapula (5790), humerus (5806), femur (5974), and tibia (5789). They were found close to the specimen of *S. richardsonii* described previously and likely represent the same individual. The remaining specimens are coated with calcium carbonate and are not believed to be intrusive. None of the specimens appears to be culturally modified but several were found within unit 19S8E next to feature 6-2 (Figure 10.1).

Microtus pennsylvanicus

Specimens identified: NISP=2; right M^2 (6000), right M_2 (6161).

Distribution and habitat: See page 48.

Discussion: One individual is represented by the specimens identified. The specimens were found within adjacent excavation units and do not appear to be culturally modified. Some calcium carbonate is present on the specimens suggesting they may be part of the background fauna.

Clethrionomys cf. *gapperi*

Specimens identified: NISP=2; right M^2 (6131), left M^3 (6225).

Distribution and habitat: See page 151-152.

Discussion: These specimens likely represent one individual. One specimen was recovered from feature 6-2. Neither specimen is culturally modified but some

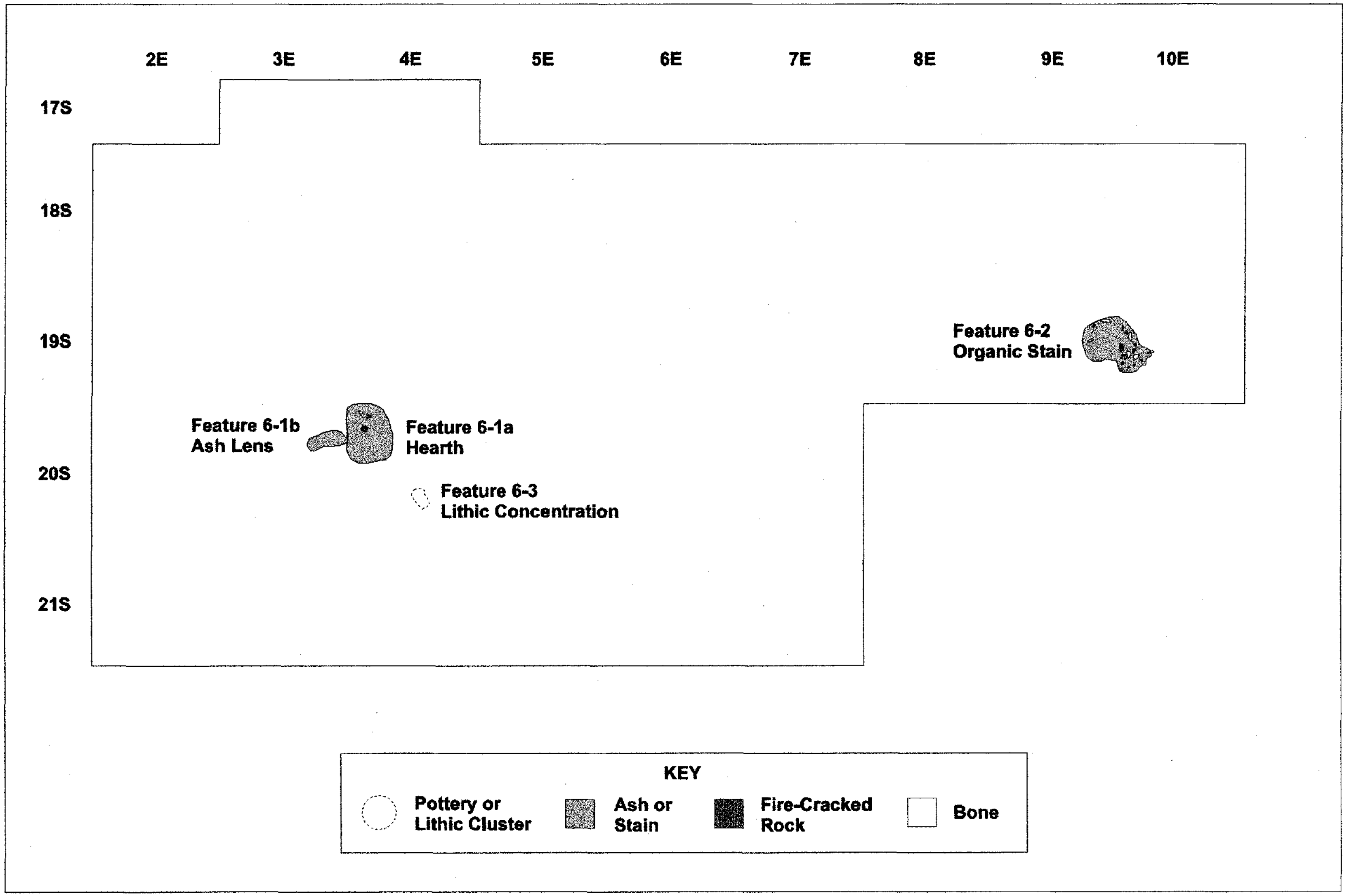

Figure 10.1 Layout and description of features from level six of the Thundercloud site.

calcium carbonate is present between the cusps.

Phenacomys intermedius

Specimens identified: NISP=1; indeterminate molar (6211).

Distribution and habitat: The heather vole is found throughout northern Canada. In Saskatchewan it is limited to areas north of the aspen parkland. It prefers the boreal forest but will inhabit any area with thick shrubs and wet meadows. It is a common prey species for most owls and is often recovered in owl pellets (Banfield 1974: 192-193).

Discussion: Most of the crown is missing from this specimen. The tooth can be identified to species because it represents the roots of a molar which are absent from most vole species. Also no cemetum is present between the cusps, another trait common to *Phenacomys*. The specimen was recovered within feature 6-2 but does not appear to be culturally modified.

Cricetidae indeterminate

Specimens identified: NISP=5; right I_1 (6354), right I^1 (6355), right humerus (5996), right femur (6223), right tibia (6209).

Discussion: All of these specimens were found within feature 6-2 and could represent any of the voles described previously. None of the specimens appears to be culturally modified.

Rodent indeterminate (SC2)

Specimens identified: NISP=1; indeterminate incisor (5990).

Discussion: This incisor is too fragmented to be further identified. It is from a small rodent (SC2), likely *Spermophilus*.

Order Passeriformes

Emberizidae indeterminate

Specimens identified: NISP=1; right proximal scapula (5832).

Discussion: This specimen is very small and matches several warbler-sized birds present in the comparative collection. The specimen is not culturally modified but is coated in calcium carbonate.

Miscellaneous Avians

Avia indeterminate (SC1)

Specimens identified: NISP=1; indeterminate vertebra (6212).

Discussion: This specimen is a vertebra from a micro-bird, likely a warbler. It was recovered from feature 6-2 but does not appear to be culturally modified.

Avia indeterminate (SC3)

Specimens identified: NISP=1; distal femur (5787).

Discussion: This specimen is highly fragmented and could not be classified beyond the category of size class. It is similar in size to several duck femora analyzed in the comparative collection. It was recovered from hearth feature 6-1a but does not appear to have been modified by cultural activity.

Order Caudata

Ambystoma tigrinum

Specimens identified: NISP=1; caudal vertebra (6035).

Distribution and habitat: The tiger salamander is found throughout most of southern North America. It prefers a variety of habitats from the boreal forest to the short-grass prairies. They are active from early spring until early fall (Russell and Bauer 1993: 56-58).

Discussion: This specimen was found just north of feature 6-2 and may be associated with the feature. It is not culturally modified but is covered by a thin layer of calcium carbonate.

Order Anura

Bufo sp.

Specimens identified: NISP=1; last lumbar vertebra (6037).

Discussion: This specimen was identified based on the morphology of the transverse processes. This specimen was found near feature 6-2 but is not burned.

Rana sp.

Specimens identified: NISP=1; last lumbar vertebra (6165).

Discussion: As with the previous specimen, this specimen was identified based on the morphology of the transverse processes. It is not culturally modified but is covered by a thin layer of calcium carbonate.

Anura indeterminate

Specimens identified: NISP=6; right innominate (6033), left innominate (6032), right humerus (6188), three longbone fragments (5831, 5987, 5988).

Discussion: Most of these specimens were recovered within feature 6-2. They were just south of the *Bufo* specimen described previously and could represent the same individual. None of the specimens is culturally modified. They are all thinly covered in calcium carbonate.

Order Basommatophora

Promenetus exacuous

Specimens identified: NISP=1; complete shell (6396).

Distribution and habitat: *P. exacuous* is common throughout most of Saskatchewan. It is common in many habitats including; lakes, ponds, streams, and swamps. It requires areas with abundant aquatic vegetation, usually growing on muddy substrates (Clarke 1981: 186-188).

Promenetus umbilicatellus

Specimens identified: NISP=4; four shells (6390, 6393, 6394-1, 6394-2).

Distribution and habitat: See page 108.

Stagnicola sp.

Specimens identified: NISP=37; 37 complete shells (multiple catalogue numbers, see Appendix V, Table 1).

Order Mesogastropoda

Valvata sincera

Specimens identified: NISP=24; 24 complete shells (multiple catalogue numbers, see Appendix V, Table 1).

Distribution and habitat: See page 52.

Discussion: The following discussion applies to all of the snails recovered in the level six assemblage. None of the specimens is believed to have been deposited as a result of cultural activity since most of the specimens are extremely small. All of the specimens exhibit light to moderate accumulations of calcium carbonate. The majority of the specimens were likely deposited during flood conditions but some could have also been deposited by predators.

Miscellaneous specimens

Specimens identified: NISP=16; see Table 10.4.

Discussion: The majority of specimens recovered in level six were identifiable. As a result only 16 specimens could not be identified past the category of size class. At least seven of the specimens were found in feature 6-2 including the two burned specimens.

Table 10.4. Summary of level six miscellaneous specimens by size class.

Size Class	NISP	Elements Represented	# Burned	Type burned
3 - Small/Med Mammal	1	First Phalanx	1	First Phalanx
2 - Small Mammal	10	Longbone, Phalanges, Vertebrae	1	Longbone Shaft
1 - Micro-mammal	2	Longbone, Metapodial	0	N/A
2 - Small Vertebrate	3	Longbone Shaft	0	N/A
1 - Microvertebrate	3	Longbone Shaft	0	N/A

10.2 Faunal Distribution Patterns

Distribution patterns are difficult to interpret in level six. Due to small numbers of faunal elements many of the maps have small patterns and in some cases maps could not be created. Unlike the previous levels, the majority of the concentrations in level six are not associated with described features.

Bison cranial distribution

Three concentrations of bison cranial elements were mapped in level six (Appendix III, Figure 43). The lightest concentration is present just north of hearth feature 6-1a. A medium concentration is shared between units 18S5E and 19S5E and does not appear to be associated with a feature. The heaviest concentration is north of feature 6-2 and runs into the wall of unit 18S9E.

Bison forelimb distribution

One heavy and three light accumulations of forelimb elements were recorded (Appendix III, Figure 44). Two of the light accumulations border unit 19S7E and do not appear to be associated with a visible feature. The other light accumulation is present within feature 6-2. The heavy concentration is located just north of feature 6-2 within unit 18S9E.

Bison hindlimb distribution

Hindlimb elements were concentrated in multiple areas of level six (Appendix III, Figure 45). Small accumulations are shared between units 20S5E and 20S6E, 20S7E and 21S7E, and 18S7E and 18E8E and do not appear to be associated with a visible feature. A medium concentration was recorded within feature 6-2 and another was located just north of hearth feature 6-1a. The heaviest concentration of hindlimb elements is noted within unit 21S3E which may be associated with feature 6-3.

Bison phalanx distribution

The majority of the bison phalanges are concentrated to the south west of hearth feature 6-1a (Appendix III, Figure 46). A second, smaller concentration is present in the corner of units 17S3E, 18S2E and 18S3E. It does not appear to be associated with a feature.

Rodent element distribution

A small concentration of rodent elements is associated with feature 6-2 and includes specimens of *Spermophilus*, *Clethrionomys gapperi*, *Phenacomys intermedius*, and indeterminate cricetid elements. The three remaining concentrations are centered around unit 18S7E and do not appear to be associated with a known feature.

Gastropod distribution

Gastropod distribution patterns were analyzed to aid in the interpretation of the depositional history of this level. The majority of the specimens are located in the northeastern units of the main excavation block. This situation is similar to the pattern displayed in the level five assemblage and suggests that the specimens were deposited during flood conditions. It seems that flood waters remained over the southwestern units for extended periods as the snails were being deposited at the flood margins. The fact that level six separated into two distinct occupation units (labeled 6a and 6b) in these southeastern units provides further evidence for this hypothesis.

10.2.1 Discussion

Few of the faunal materials in level six are associated with features. This is not evident in Table 10.5 but many of the elements recorded near features were limited to one or two specimens (especially those near feature 6-2) and some of these distributions may not be the result of cultural activities.

Table 10.5 Summary of level six features and associated distributions.

Feature #	Feature Description	Associated Element Distributions
6-1a and 6-1b	Hearth and Ash Stain	*Bison* crania *Bison* hindlimb *Bison* phalanges
6-2	Organic Stain	*Bison* crania *Bison* forelimb *Bison* hindlimb *Spermophilus* elements *Clethrionomys gapperi* elements *Phenacomys intermedius* elements Cricetid elements Micro-Avia (SC1) element *Ambystoma tigrinum* element *Bufo* element Anuran elements
6-3	Lithic Concentration	*Bison* crania
*19S7E	N/A	*Bison* forelimb *Bison* hindlimb *Spermophilus* elements *Microtus pennsylvanicus* elements

*Not a feature

Level six is comprised of at least two separate occupations. In the western excavation units the level was split by a thin layer of sterile sediments. All of the projectile points recovered from level six have been identified as Oxbow with the exception of a Duncan base which may have been recorded in the wrong level. If this is the case it seems that both occupations (labeled 6a and 6b) are Oxbow. Unfortunately, provenience data recorded for non-bison faunal material does not make the distinction between levels 6a and 6b so an analysis of these separate occupations is impossible.

Unlike the previous levels few faunal materials were found around the hearth feature recorded in level six. Bison hindlimb and cranial elements comprise the limited number of specimens found near the feature. Several more cranial elements were found near the lithic concentration (feature 6-3) just south of the hearth.

Organic stain feature 6-2 is associated with the greatest diversity of faunal species but many of the associations are limited to one or two elements. Even so, it appears that a number of bison elements were being processed in the area. A number of non-bison faunal elements were burned suggesting that some of the small species have been utilized but others show no sign of cultural modification. It is possible that the concentration of artifacts around the feature (especially the bison elements) caused the natural entrapment of some faunal elements during flood conditions.

A final accumulation of elements was recorded in unit 19S7E. A number of bison and rodent elements were recovered in the area. It is possible that a feature is present in units to the southeast which have not been excavated at this time.

The distribution patterns recorded in level six yield little evidence towards the nature of the occupation. Many of the specimens are believed to be part of the background fauna and are not part of the cultural occupation. The single hearth is relatively void of faunal materials. While it seems likely that fluvial transport is responsible for some of the artifact distributions it is also probable that the level six assemblage represents a small campsite. Unlike previous levels, evidence of large scale secondary processing is lacking. An examination of the %MAU for bison elements shows that vertebrae, sternebrae, and forelimb elements are under represented in the assemblage (Figure 10.2), in fact only hindlimb elements are well represented. Further evidence, provided by the analysis of the non-faunal cultural artifacts, will undoubtedly shed more light on the nature of the level six assemblage.

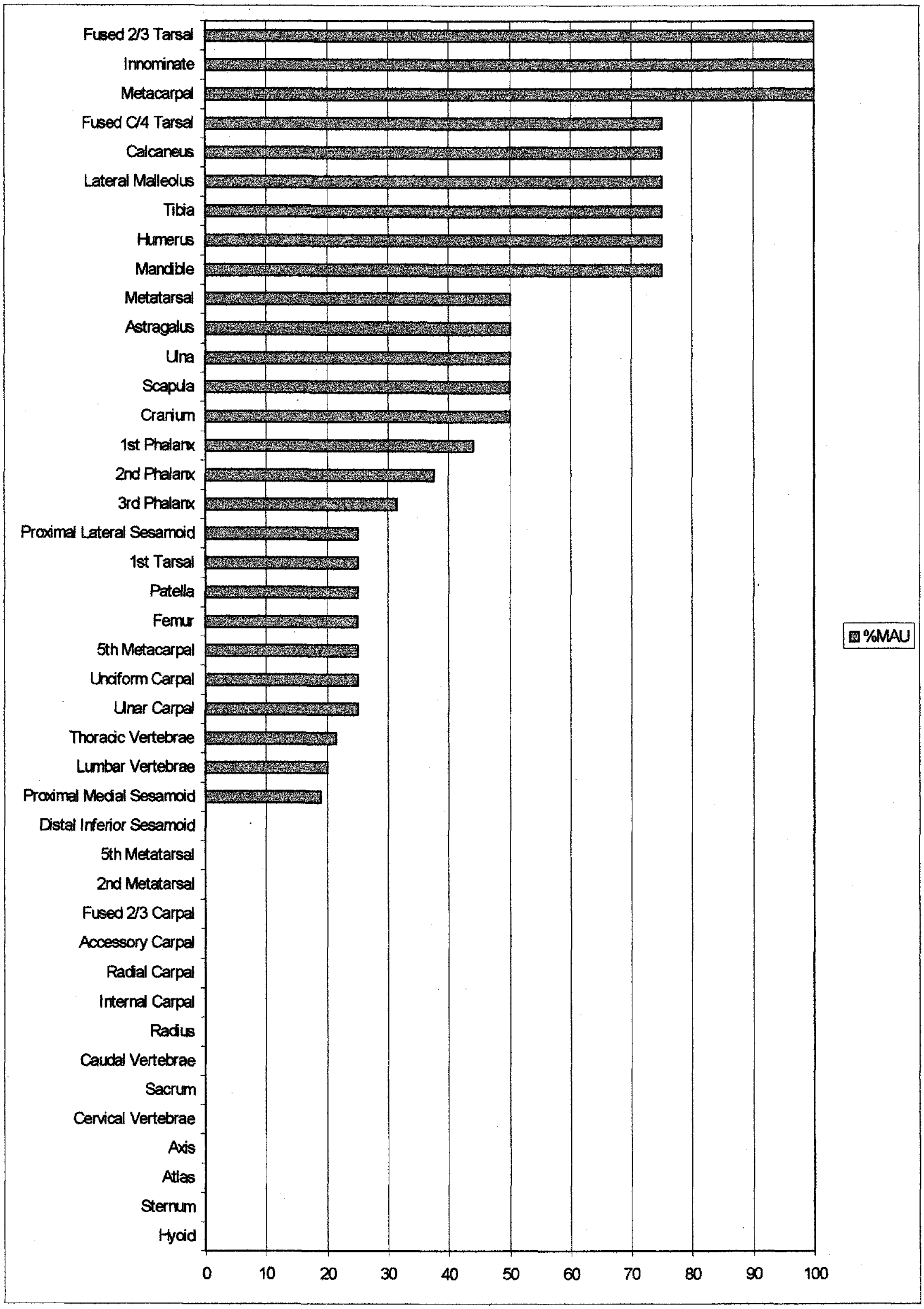

Figure 10.2 %MAU for bison elements in level six at the Thundercloud site.

10.3 Seasonality

No immature or foetal bison elements were identified in the level six assemblage. Furthermore, none of the non-bison specimens which were identified to species appears to have been culturally modified. Some of these elements were associated with a known feature but may have been present due to natural entrapment rather than being the result of cultural activities. For these reasons it is very difficult to determine the season of occupation for level six. Assuming that some species are actually part of the cultural assemblage, it would appear that the site could only have been occupied during the warmer months of the year.

10.4 Summary

The level six assemblage is quite small. At least three bison have been identified, represented for the most part by hindlimb elements. The majority of the bison elements are complete with no cut marks or burning present, although cut marks could be masked by the thin layer of calcium carbonate which covers most of the specimens. A pronghorn, a canid and several small mammals also appear to have been utilized.

Distribution maps show limited concentrations of bison elements around a hearth feature and a lithic concentration. More elements were found near an organic stain, well away from the hearth feature. Most of the bison elements are complete suggesting that marrow was not being removed for immediate consumption. The limited number of artifacts and features, as well as a limited number of processed bones, suggests that the occupation may represent a small campsite. An analysis of non-faunal cultural artifacts may provide further evidence regarding activities in level six.

Unfortunately no faunal materials were identified which could provide conclusive data regarding the season of occupation. Based on indirect evidence it appears that the level was occupied at least once during the warmer months of the year.

Chapter 11

The Level Seven Faunal Assemblage

11.1 The Level Seven Faunal Assemblage

A total of 1375 faunal specimens were recovered from level seven (Table 11.1). A very low number of specimens are unidentifiable (28.8%) but this is due to a large number of gastropods identified in the assemblage. Forty-six specimens are burned, represented entirely by mammalian elements. As in level six, all of the specimens from level seven are coated by a thin layer of calcium carbonate.

Table 11.1 Level seven faunal assemblage separated by degree of burning.

	Identified			Unidentified			Total	
	N	%N	Weight (g)	N	%N	Weight (g)	N	Weight (g)
Unburned	978	73.6	246.4	351	26.4	245	1329	491.4
Burned	1	2.9	0.1	34	97.1	21.3	35	21.4
Calcined	0	0	0	11	100	4.5	11	4.5
Total	**979**	**71.2**	**246.5**	**396**	**28.8**	**270.8**	**1375**	**517.3**

Ten taxa have been identified in level seven, half of which are gastropods (Table 11.2). At least one bison has been identified in the level which likely represents the majority of the burned and calcined elements present. Most of the unburned specimens represent gastropods, in fact 66.4% of the entire assemblage (913 specimens) is comprised of gastropods and gastropod shell fragments. None of the gastropods is believed to be cultural.

Table 11.2 Summary of level seven faunal remains by taxa.

Common Name	Taxon	NISP	MNI
Mammals			
Bison	*Bison bison*	61	1
Deer	*Odocoileus sp.*	1	1
Ground squirrel	*Spermophilus sp.*	1	1
Shrew	*Sorex sp.*	1	1
Amphibians			
Frogs and Toads	Anura	1	1
Invertebrates			
Fingernail Clams	*Sphaerium sp.*	1	1
Umbilicate promenetus	*Promenetus umbilicatellus*	11	11
Stagnicola	*Stagnicola sp.*	154	154
Valve snail	*Valvata sincera*	15	15
Three-keeled Valve Snail	*Valvata tricarinata*	1	1
Snails (shell fragments)	Gastropoda	731	-
Miscellaneous			
Micro-Mammal (SC1)		1	-
Total		**979**	**187**

Order Artiodactyla

Bison bison

Specimens identified: NISP=61; see Table 11.3 for a summary. The MNE and MAU values were calculated by landmark and are included within Table 11.3.

Distribution and habitat: See page 43.

Discussion: The majority of specimens identified as bison consist of mandible and scapula fragments. Only six elements are represented by the specimens recovered. The cervical vertebra was reconstructed for the purposes of identification. It is an unfused portion of the neural arch and could represent a separate immature individual. None of the identified specimens appears to have been culturally modified. The tibial crest exhibits teeth marks from a large carnivore.

Table 11.3 Summary of bison elements from level seven.

	NISP	MNI (Side)	Total MNE	Total MAU	%MAU
Axial Skeleton					
Mandible	26	1	1	0.5	100
Second molar	-	1	1	0.5	100
Coronoid process	-	1	1	0.5	100
Ramus	-	1	1	0.5	100
Cervical Vertebra (Arch)	1	1	1	0.14	28
Forelimb					
Scapula	28	1	1	0.5	100
Internal Carpal	1	1	1	0.5	100
Hindlimb					
Tibia (Anterior crest)	1	1	1	0.5	100
Miscellaneous					
Molar/Premolar Indeterminate	2	-	-	-	-
Rib Shaft	2	-	-	-	-

Odocoileus sp.

Specimens identified: NISP=1; right P_2 (5813).

Discussion: Two species of *Odocoileus* are residents of Saskatchewan; *O. virginianus* and *O. hemionus*. They are found in similar habitats and prefer wooded coulees, valleys, and aspen parkland. They do not commonly inhabit the boreal forest or the open grassland (Banfield 1974: 390-394). This specimen does not appear to be culturally modified but is coated in calcium carbonate.

Order Rodentia

Spermophilus sp.

Specimens identified: NISP=1; right proximal ulna (6132).

Discussion: This specimen likely represents *S. richardsonii* but could also be *S. tridecemlineatus*. Calcium carbonate is present on the specimen but it is not culturally modified.

Order Insectivora

Sorex sp.

Specimens identified: NISP=1; right tibia/fibula (5835).

Discussion: This specimen is very small but is complete and is similar in size and shape to tibia from the shrews in the comparative collection. It is larger than the tibia from a pygmy shrew (Genus *Microsorex*) and appears to be similar to the specimen of *Sorex cinereus*. Other species are common in Saskatchewan but are not available in the comparative collection. The specimen is not culturally modified and is likely part of the background fauna.

Order Anura

Anura indeterminate

Specimens identified: NISP=1; left innominate (6002).

Discussion: This specimen is not complete enough to determine genus. It is not believed to be cultural but is coated in calcium carbonate and is likely part of the background fauna.

Order Eulamellibranchia

Sphaerium sp.

Specimens identified: NISP=1; half shell with beak (5919).

Discussion: Six species of fingernail clams are common in Saskatchewan. All species are common in lakes, rivers and streams. They are found on a variety of substrates but prefer sandy bottoms (Clarke 1981). This specimen is not believed to be cultural. It was likely deposited by a flood or may have been secondarily redeposited during fluvial erosion.

Order Basommatophora

Promenetus umbilicatellus

Specimens identified: NISP=11; 11 complete shells (6392-1 to 6392-10, 6395).

Distribution and habitat: See page 108.

Stagnicola sp.

Specimens identified: NISP=154; 154 complete shells (multiple catalogue numbers, see Appendix V, Table 2).

Order Mesogastropoda

Valvata sincera

Specimens identified: NISP=15; 15 complete shells (multiple catalogue numbers, see Appendix V, Table 2).

Distribution and habitat: See page 52.

Valvata tricarinata

Specimens identified: NISP=1; complete shell (5889).

Distribution and habitat: The three-keeled valve snail is common throughout all of Saskatchewan. It occurs in vegetation in lakes, rivers, streams, and muskeg swamps (Clarke 1981: 52).

Discussion: The following discussion applies to all of the snails recovered in the level seven assemblage. None of the specimens described is believed to have been deposited as a result of cultural activity. All of the specimens exhibit light to moderate accumulations of calcium carbonate. The specimens may have been deposited during a flood, but they may also have been secondarily redeposited during fluvial erosion.

Miscellaneous specimens

Only one specimen was identified into the category of size class. It is a burned micro-mammal flatbone (perhaps an innominate fragment) which was found in unit 18S8E. It is lightly coated in calcium carbonate and appears to be part of the cultural assemblage.

11.2 Faunal Distribution Patterns

There were no features described in level seven. Also, no diagnostic artifacts were recovered. Some flakes and an endscraper were recovered suggesting that a cultural occupation is present in the level. Based on the stratigraphic history of the level (see Chapter 3) it appears that much of the occupation was eroded by fluvial processes. The presence of a large number of aquatic invertebrates seems to substantiate this claim. Several distribution maps were created to further analyze the depositional history of this level.

Bison element distribution

Due to the low number of bison elements recorded in level seven an analysis of the distribution pattern lends little to the interpretation of activity areas. Instead, the maps were created to determine if the patterns were the result of fluvial erosion. As shown on the map (Appendix III, Figure 49) all of the bison elements were found in the eastern portion of the main excavation block. In fact, all of the vertebrate elements identified in level seven were found in this area. It would appear that many of the elements have been displaced to the margins of the stream channel after the erosion of the cultural layer. Further examination of the distribution patterns for non-faunal cultural materials is needed, however, before any conclusions should be made.

Gastropod distribution

Close to half of all of the gastropods identified in level seven were found in the corner of units 17S4E, 18S4E, and 18S5E (Appendix III, Figure 50). It seems likely that a low spot existed in this area which led to the accumulation of a large number of shells. It is also possible that the low spot persisted once water level receded providing a temporary habitat for these species.

11.2.1 Discussion

The distribution patterns for level seven do not suggest any activity areas are present. No features were noted in this level. Furthermore, the distribution patterns do suggest that the specimens may have been displaced or secondarily redeposited by fluvial transport. If so any evidence of cultural activity would have been erased.

11.3 Seasonality

The immature bison vertebra is too fragmented to provide an accurate estimate of age. Unfortunately, since it appears that the level has been eroded it is also impossible to determine seasonality by the presence of other species.

11.4 Summary

The level seven assemblage is very small with over half of the specimens represented by gastropod shells and shell fragments. Even so, there is some evidence of a cultural occupation. At least one bison has been identified including a number of burned and calcined bone fragments. Other species which may be part of the cultural assemblage include a deer and a micro-mammal.

An examination of the distribution patterns of all elements, in combination with stratigraphic evidence, suggests that the level was eroded after the site was abandoned. These erosional forces have eliminated evidence needed to determine seasonality and cultural activity areas.

Chapter 12

The Importance of Fine Screen Analysis at the Thundercloud Site

12.1 Interpreting the Micro-Assemblage

Current archaeological research projects often include fine screen analyses as part of the overall research objective. The growth in this type of research is due, in part, to the inadequacies of coarse screening. There is an extensive amount of literature regarding differential recovery techniques and the comparison between coarse screening and fine screening (eg. Ball and Bobrowsky 1987; Barker 1975; Clason and Prummel 1977; French 1971; Gordon 1993; Muckle 1994; Payne 1975; Pearsall 1989; Pendleton 1983; Shaffer 1992; Shaffer and Sanchez 1994; Struever 1968; Wagner 1982,1988). Simply put, fine screen recovery methods dramatically increase the collection of small-scale archaeological remains, however, this is often dependant upon the location of the site and the type of environment in which it is found.

One of the initial goals of this project was to determine the value of fine screen analysis for sites in the Northern Plains following the procedures used at other sites within Wanuskewin Heritage Park (eg. Morlan 1987; Ramsay 1993). Collecting and processing soil samples can be very time consuming and identification of the specimens recovered is often difficult if not impossible. Furthermore, when compared to sites in the deserts and caves of the United States, preservation of small bones and seeds is relatively poor for Northern Plains sites unless water-logged sediments or clay is present. With these problems in mind, it was hoped that fine screen analysis of the

Thundercloud site sediment samples could provide data which would not have been available using standard coarse screening techniques.

Table 12.1 compares the total number of identified elements to the number of elements recorded in fine screen samples. Note that Gastropods are not included in this number since they are not believed to be part of the cultural assemblage. Only elements from animals categorized as size class three or smaller are compared to the total. Some elements from larger animals were found in the fine screen samples but it is believed that they would also have been recovered using a ¼ inch screen.

The results show that, with the exception of level seven, the number of elements identified in the fine screen samples remains consistent from one level to the next. On average 12.7% of the elements identified in each level belong to small animals. It is believed that most of these specimens would not have been collected using coarse screening methods. Furthermore, a comparison of the MNI represented by these elements suggests that on average 51.7% of the individuals identified in each level are categorized as size class three or smaller. In addition, none of the seeds and seed fragments are included in within Table 12.1. It is believed that the majority of the 165 seeds identified in the Thundercloud site assemblage would not have been recovered in a ¼ inch screen. Clearly then, the assemblage would appear to be markedly different had the fine screen samples not been analyzed.

This is not to say that all of the specimens identified in the fine screen samples are part of the cultural assemblage. On the contrary, some of the elements may represent animals which died during the time of occupation and are part of the background fauna. Still others may represent intrusive elements. The elements included in Table 12.1 refer to specimens which are burned, were found in or near hearths, or exhibit a state of preservation similar to other specimens found within the

Table 12.1 Comparison of total identified elements to elements from fine screen samples by number and MNI.

Level	Total of Identified Elements (Less Gastropods)	MNI Represented	Identified Elements of Size Class 3 or Smaller	MNI Represented	% Identified Elements Size Class 3 or Smaller	%MNI of Size Class 3 or Smaller
1	1450	22	165	7	11.4	31.8
2	732	18	74	6	10.1	33.3
3	839	21	133	10	15.9	47.6
4	560	16	58	8	10.6	50
5	3268	43	460	28	14.1	65.1
6	606	18	63	12	10.4	66.6
7	67	5	3	3	4.5	60
Total	**7522**	**143**	**956**	**74**	**12.7**	**51.7**

assemblage. Using these criteria it is hoped that the number of intrusive specimens has been minimized. Even so, it is still difficult to suggest that specimens have been culturally modified in the absence of cut marks or burning.

These problems are not isolated to the Thundercloud site and have prompted several discussions regarding the interpretation of archaeological micro-remains (eg., Morlan 1994; Stahl 1982,1996; Whyte 1991). Morlan (1994: 137) describes a set of variables useful in determining if bones are part of the assemblage. He suggests recording numerous modifications such as: bone completeness, fracture state, tooth marks, digestion, cut marks, burning, weathering, and rootlet etching. All of these variables were recorded for the Thundercloud assemblage when possible. Still, some of these variables cannot be used to separate individuals which are cultural from those which represent animals in the background fauna. The presence of one modification, such as burning, may not represent human utilization of small species. As an example, Morlan (1994: 137) notes that, "...small bones can become charred if a hearth was developed on sediment in which the bones have already been shallowly buried". He further suggests that to increase the confidence of the interpretation, "The combination of fracture, cut mark, burning and site context data are important for recognizing human use of animal resources" (Morlan 1994: 137).

Using a combination of these variables, the elements from fine screen samples were re-examined to determine patterns which are most likely the result of human utilization (Table 12.2). Specimens were only included if they matched two or more of the following criteria: they were burned, they had cut marks, they were fractured, or they were found within or near a hearth feature.

Table 12.2 Summary of small animal elements with possible evidence of human utilization from all levels at the Thundercloud site.

Level	# Burned	Taxa Represented (Common Name)
1	112	Voles, frogs/toads, small mammal, small vertebrate
2	34	Weasel, rabbit, voles, small mammal, micro-vertebrate
3	28	Ground squirrels, fish, small mammal, micro-mammal
4	11	Ground squirrels, mice/voles, frogs/toads, garter snake, small mammal
5	157	Cottontail, mice, voles, frogs, small bird, small mammal, micro-mammal
6	2	Small mammal, micro-mammal
7	1	Micro-mammal

The results suggest that a number of small vertebrate species have been utilized in all of the levels at the Thundercloud site. While these data provide important insights into the use of small animals it is difficult to interpret this data for the majority of the levels. Levels one, two, and three are too close together stratigraphically to effectively separate the multiple occupation sequences. Furthermore, levels six and seven appear to have been degraded and few faunal specimens were identified within these levels. Luckily, levels four and five have provided a relatively intact sequence of McKean Complex occupations. Since these levels provide a good record of occupations from a single cultural complex it is possible to use the data provided by the analysis of archaeological micro-remains to better understand the habitation of the Thundercloud site during the Middle Prehistoric period.

12.2 Interpreting McKean Subsistence in the Northern Plains

The origins and dispersal of the Mckean Complex have been debated ever since it was originally named and described (see Chapter 3). First noted at the McKean site in Wyoming (Mulloy 1954), occupations were soon described in other sites throughout Wyoming, Nebraska, Montana and the Dakotas (eg., Bliss 1950; Frison and Huseas 1968; Frison and Walker 1984; Keyser and Davis 1985; Reher et.al 1985; Wheeler 1985). The interpretation of McKean subsistence strategies has often played a considerable role in these debates. Interestingly, the majority of the sites revealed evidence which suggested that McKean peoples were utilizing an Archaic subsistence strategy that included the use of numerous plant species. Manos and metates are common in sites from these areas and are generally interpreted as evidence for plant preparation (Keyser 1986). Basin-shaped hearths are also numerous and are often lined with rock slabs. These hearths have been interpreted as roasting pits used in the preparation of seeds and small game (Frison 1991b).

McKean Complex occupations were also investigated at several sites throughout the Northern Plains including; the Cactus Flower site (Brumley 1975), the Crown site (Quigg 1986), the Sjovold site (Dyck and Morlan 1995), the Mortlach site (Wetlauffer 1955), and the Long Creek site (Wetlauffer and Mayer-Oakes 1960). The absence of manos and metates from these Northern Plains sites has led some researchers to suggest that, as the McKean population moved northward, they abandoned the Archaic lifestyle in favor of a reliance on bison (Brumley 1975: 102). Recent excavations at the Redtail (Ramsay 1993) and Thundercloud sites, both located within Wanuskewin Heritage Park, suggest that some aspects of the Archaic lifestyle may not have been abandoned. Instead it is believed that the lack of evidence regarding the use of plants and small animals may actually be due, in part, to inadequate sampling strategies.

The following section will compare the faunal assemblage from the Thundercloud site to the assemblages from the Cactus Flower (EbOp-16), Crown (FhNa-86), and Redtail (FbNp-10) sites. These sites were chosen because they contain multiple McKean complex occupations, have relatively good preservation, and have been reasonably well documented.

12.2.1 The Cactus Flower Site (EbOp-16)

The Cactus Flower site is located in the southeast corner of the Province of Alberta on a point bar of the South Saskatchewan River. Excavations conducted between 1972-1974 revealed a rich sequence of 10 cultural occupations (Brumley 1975). Occupations III through IX revealed diagnostic McKean complex projectile points with radiocarbon ages ranging from 2130±130 B.P. (S-783) to 4130±85 B.P. (S-782) (Brumley 1975:111). Level X did not contain diagnostic artifacts but is also believed to represent a McKean occupation.

Features were common in the McKean levels including a number of basin-shaped hearths, ash concentrations and earth pits (Brumley 1975: 116). None of the features is rock-lined, a common occurrence in pit features from the Central Plains (Frison 1991).

Faunal materials are well preserved and are summarized in Table 12.3. Note that bison represents the only species which was identified within every level.

Table 12.3. Summary of the Cactus Flower site faunal assemblage (from Wilson 1975).

Common Name	Taxon	Level	MNE	MNI
Bison	*Bison bison*	all	891	38
Pronghorn	*Antilocapra americana*	IV,VI,VIII,IX	56	6
Mule deer	*Odocoileus hemionus*	VI	3	1
Domestic dog	*Canis familiaris*	IV,VI,VIII	Unknown	5
Swift fox	*Vulpes velox*	VIII	1	1
Rabbits and Hares	Leporidae	VII	1	1
Hares	*Lepus sp.*	VIII	1	1
Nuttall's cottontail	*Sylvilagus nuttallii*	VIII,IX	2	2
Common grackle	*Quiscalus quiscula*	VIII	1	1
Small bird	Aves (SC2)	V	1	1
Micro-bird	Aves (SC1)	V	1	1
Bony fish	Osteichthyes	VIII	1	1
Clam	Pelecypoda	IV,VI,VII,IX	4	4
Human	*Homo sapiens*	VI	1	1

It is believed that the majority of the specimens are part of the cultural assemblage. Few comments are made regarding the cultural utilization of small species but it does not appear that any of the specimens are intrusive. Aside from bison, only pronghorn and dog are mentioned as showing evidence for butchery (Brumley 1975: 82-85). It is unknown if any of the specimens are burned.

Due to the large number of bison and pronghorn elements, the discussion of faunal utilization at the Cactus Flower site focuses largely around artiodactyls. The conclusions (Brumley 1978: 184-191) are summarized here as a comparison to the artiodactyl assemblage recovered at the Thundercloud site.

Based on the described faunal assemblage, Brumley suggests that the McKean occupants are not exploiting a variety of resources commonly found in the site area. Small rodents, birds, and fish would have been common and could have been easily captured but large numbers of these species are not reflected in the assemblage. Instead, bison and pronghorn comprise 99% of the edible meat weight (Brumley 1978: 186). Bison elements are well represented in the Cactus Flower assemblage. Only ribs and vertebrae are missing which may suggest a close proximity to the kill area. Marrow has been removed from the majority of the longbones including the distal limb elements.

Brumley (1978:192) suggests that the site is located next to a bison watering area but that hunting techniques of the Late Prehistoric period, such as pounds and bison jumps, would not have been effective. Even so, areas around the site were used in the Middle Prehistoric period to kill small numbers of bison. It appears that the cliffs surrounding the low areas were used to ambush small herds. Based on this evidence Brumley believes that the McKean occupants of the Cactus Flower site were well-adapted to hunting bison and had abandoned the Archaic lifestyle.

12.2.2 The Crown Site (FhNa-86)

The Crown site was discovered in 1976 as part of the Nipawin Reservoir Heritage Study (Quigg 1986: 7). The site, located near the town of Nipawin in east central Saskatchewan, is located at the mouth of a narrow creek just south of the Saskatchewan River. The cultural stratigraphy of the Crown site was difficult to interpret and consisted of three cultural units; an upper Late Prehistoric unit, a middle Hanna unit and a lower McKean unit. The Hanna unit was represented by three to four cultural occupations while the McKean unit was comprised of two to three occupations. Several "sterile" occupations are also described which did not contain diagnostic artifacts but are likely part of the McKean complex units (Quigg 1986). Radiocarbon dates from the occupations range from 4330±115 (S-2520) in the lowest McKean Lanceolate level to 3330±110 (S-2292) in the uppermost Hanna component (Quigg 1986: 32).

Features were present in both of the McKean complex cultural units. Three hearths and a bone pit were recorded in levels with Mckean Lanceolate points. The hearths are relatively thin (2-5 cm deep) with flat bottoms (Quigg 1986: 50). The Hanna unit produced a single hearth which was basin-shaped and much deeper than hearths described in the McKean levels (20 cm). A stone boiling pit and a burial were also found in the Hanna component (Quigg 1986: 113).

The majority of the occupation horizons were separated by sterile sediments deposited during flood conditions. The rapid burial of most levels led to excellent preservation of the organic materials and, as a result, a large number of faunal remains were recovered. All sediments were passed through a ¼ inch screen and it does not appear that any samples were submitted for fine-screen analysis.

The faunal assemblages from the Hanna and McKean components are summarized in Table 12.4. Element counts are given for most identified taxa, however, in some instances only the NISP was recorded. Estimates of MNI are also missing for some species. No floral remains were recovered from the Crown site assemblage.

Table 12.4. Summary of the Crown site faunal assemblages (from Quigg 1986).

		McKean Unit		Hanna Unit	
Common Name	**Taxon**	**MNE**	**MNI**	**MNE**	**MNI**
Bison	*Bison bison*	67	3	136	?
Moose	*Alces alces*	3	2	16	3
Elk	*Cervus elaphus*	8	2	53 (NISP)	?
Deer	*Odocoileus sp.*	N/A	N/A	1	1
Bear	*Ursus sp.*	N/A	N/A	1	1
Domestic dog	*Canis familiaris*	153	3	3	2
Skunk	*Mephitis mephitis*	2	1	N/A	N/A
Beaver	*Castor canadensis*	3	2	73 (NISP)	3
Rabbits and Hares	Leporidae	31	3	2	1
Small mammal	N/A	138	-	119	-
Sharp-tailed grouse	*Tympanuchus phasianellus*	1	1	N/A	N/A
Indeterminate Bird	Aves indeterminate	1	-	1	1
Sucker	*Catostomos sp.*	7	1	N/A	N/A
Indeterminate Fish	Osteichthyes indeterminate	138	?	6	?
Clam	Pelecypoda	30 (NISP)	?	26	?
Human	*Homo sapiens*	N/A	N/A	? (burial)	1

Unlike Brumley, Quigg provides detailed information regarding bone modification for all of the specimens identified. Burning is common but tends to be limited to bones from large artiodactyls. Cut marks are rare, limited in bison to only two elements. Bone in the McKean levels tends to be well preserved and is generally more complete than bone from the Hanna component. The majority of the bones are highly fractured and appear to have been processed for marrow.

Based on the large number of artiodactyls in both levels, Quigg suggests that ungulates provide the majority of the meat in the diet. Even so, several other species are noted as showing evidence for human utilization. In the McKean unit, bones from sharp-tailed grouse, a rabbit, and a fish are burned. Canid elements are numerous and several were associated with a hearth. In the Hanna unit, nine of the beaver elements are calcined and a deer element, located next to a hearth, showed signs of burning. Quigg suggests that these species were likely utilized but formed a minor part of the diet. He further suggests that the remaining elements, including some which appear to be associated with features, were likely not part of the cultural assemblage and may have been naturally deposited as part of the background fauna (Quigg 1986: 97,156). Most notable in this discussion are elements from fish and clams which Quigg suggests are likely deposited by birds or other carnivores (Quigg 1986: 87,147).

In his final summaries for both units, Quigg suggests that the McKean complex occupants of the Crown site represent small scale bison hunters. These occupants may have occasionally utilized smaller game, however, most species, "...are represented by so few elements that it is uncertain whether these were food resources" (Quigg 1986: 103).

12.2.3 The Redtail Site (FbNp-10)

The Redtail site is located within Wanuskewin Heritage Park, approximately 700 meters south of the Thundercloud site. It is located within a deep drainage basin on the west side of Opimihaw Creek which drains directly into the South Saskatchewan River. The site contains a rich sequence of occupations including at least seven McKean complex components. Levels 10, 11, and 12 produced a number of Hanna type projectile points. Level 13, which was split into 13(1), 13(2), 13(3), and 13(4), produced McKean Lanceolate type points with at least one Hanna-like biface (Ramsay,1993: 80). Six radiocarbon dates were obtained from the McKean levels. They range from 4280±80 (S-3009) in level 13(4) to 3480±90 (S-3372) in level 11 (Ramsay 1993: 90). No radiocarbon sample was submitted for the uppermost McKean occupation (level 10).

Features were recorded in all of the McKean levels. Shallow surface hearths were most common and were found in every level. Deeper basin-shaped hearths were found within levels 11 and 13(2) and a basin-shaped pit was noted in level 12. None of the pits was rock-lined but several contained significant quantities of fire-broken rock. Several circular debris scatters were recorded within levels 11 and 12 and are believed to delineate the borders of temporary living structures (Ramsay 1993: 312-313).

Like the Cactus Flower and Crown sites, the Redtail site faunal assemblage was quite well preserved. Sediment samples were collected during excavation, in the same manner as at the Thundercloud site, to be analyzed using fine-screen techniques. Unfortunately these samples have not yet been examined, however, careful excavation methods resulted in the recovery and identification of a variety of faunal species (Table 12.5). Also, seven hearth samples from the McKean levels were submitted for flotation analysis. The samples contained several elements from rodents and anurans, and more importantly revealed 38 complete seeds and 191 seed fragments (Ramsay 1993: 235-237). Identified taxa include: *Chenopodium*, *Potentilla*, *Prunus*, *Rosa*, and *Symphoricarpos*. It is believed that these represent the first seeds recorded for a McKean site located within the Northern Plains. No manos, metates, or other grinding implements were found at the site but all seeds were burned and are believed to represent the human utilization of various plant species.

With the exception of the micro-vertebrates, Ramsay believes that the majority of the specimens are part of the cultural assemblage. While he does suggest that several rodents may have died *in situ* or were deposited in owl pellets he does not rule out cultural utilization as a means of deposition (1993: 182). Much like the Thundercloud assemblage, few of the micro-remains from the Redtail site show signs of cultural modification. Further analysis of the fine-screen samples is needed before any conclusions can be made.

Table 12.5. Summary of the Redtail site faunal assemblages (from Ramsay 1993).

Common Name	Taxon	Level	NISP	MNI
Bison	*Bison bison*	all	1564	10
Deer	*Odocoileus sp.*	11	16	1
Dogs and Allies	*Canis sp.*	10,11,12,13(1),13(2),13(3)	61	7
Red fox	*Vulpes vulpes*	10,12	4	2
Skunk	*Mephitis mephitis*	11	3	1
Mink	*Mustela vison*	13(2)	1	1
Jackrabbit	*Lepus townsendii*	12,13(2)	11	2
Snowshoe hare	*Lepus americanus*	13(2)	1	1
Richardson's ground squirrel	*S. richardsonii*	10,11,12,13(3)	N/A*	4
13-lined ground squirrel	*S. tridecemlineatus*	11	N/A*	1
Northern pocket gopher	*Thomomys talpoides*	13(2)	N/A*	1
Gapper's red-backed vole	*C. gapperi*	10,13(2),13(4)	N/A*	3
Least chipmunk	*Eutamius minimus*	11,12,13(1),13(3)	N/A*	4
Prairie vole	*Microtus ochrogaster*	13(4)	N/A*	1
Voles	*Microtus sp.*	12	N/A*	1
Deer mouse	*P. maniculatus*	12,13(4)	N/A*	3
Western harvest mouse	*R. megalotis*	12	N/A*	1
Robin	*Turdus migratorius*	13(1)	7	1
Crow	*C. brachyrhynchos*	13(4)	2	1
Mallard	*Anas platyrhynchos*	13(4)	2	1
Frogs and Toads	Anura	11,12,13(2)	8	3
Bony Fish	Osteichthyes	12	3	2

*The total NISP for all rodents in the McKean levels is 147.

12.2.4 Site Similarities and Sampling Strategies

The Cactus Flower, Crown, Redtail, and Thundercloud sites share many similarities. They are all located near the Saskatchewan River and have been influenced by the riverine ecosystem. Also, they are all located within marginal environments which border two or more ecozones. The Cactus Flower site is near the Cypress Upland and is close to the transition between the short and mixed-grass prairie. The Thundercloud and Redtail sites are located within the Moist Mixed Grassland and are very close to the borders the Aspen Parkland. The Crown site is further north within the Boreal Transition ecozone which shares traits of both the Aspen Parkland and the Boreal Forest. The location of these sites, within marginal ecozones, allows for the possible utilization of species from all of the neighboring ecosystems.

Other similarities are noted at the site level. They are all multi-component sites which include several McKean Complex occupations. In general, all of the McKean occupations appear to represent secondary processing areas or temporary campsites. Based on radiocarbon assays, all of the sites appear to have been occupied during the same time period. Furthermore, all of the sites appear to have been occupied at the same time of year. All of the levels at the Cactus Flower site were occupied in the warmer months with no winter occupations. At Redtail, six of the seven McKean Complex levels were occupied in the spring and summer with one winter occupation (level 12). The Thundercloud site levels appear to have been occupied in early spring, again with one winter occupation. One late winter occupation was also noted at the Crown site but the majority of the levels were occupied in early spring and into the summer.

After reviewing these similarities, several general observations become apparent. Since all of the sites are located near marginal environments the site occupants should have had access to a greater diversity of floral and faunal species. Furthermore, the majority of these species would have been available because the sites were occupied during the warmer months of the year. If the McKean occupants were utilizing an Archaic subsistence strategy, similar to sites further south in the United States, we would expect to find evidence for the utilization of many species including plants and small animals. If that evidence does not exist we must try to explain why a subsistence strategy, which is so prevalent in the Northwestern Plains, was later abandoned in more northerly areas. The following discussion will suggest that the lack of evidence for the utilization of plants and small animals may not be due to changes in the subsistence strategy, but is instead the result of inadequate sampling strategies.

Table 12.6 compares the mammalian faunal assemblages from the McKean levels at the Cactus Flower, Crown, Redtail, and Thundercloud sites. Note that the assemblages from each site have been combined for comparison. Also note that the Cactus Flower and Crown assemblages include MNE values while the Redtail and Thundercloud site analyses were summarized using NISP.

The results show similar faunal assemblages for animals categorized as size class three or larger. Large artiodactyls form the majority of the diet at all four sites. The presence of moose and elk in the Crown site assemblage reflects the proximity of the site to the Boreal Forest and Aspen Parkland. Canids and leporids also appear to form an important part of the diet and were identified as food items in every site.

A large discrepancy exists, however, for mammals of size class two or smaller (small and micro-mammals). No mammals from the smaller size classes were identified in the Cactus Flower and Crown site assemblages. This does not suggest that the specimens were not present in the occupation layers. Nor was it likely due to poor preservation. Rather, it appears that the specimens were missed due to the application of coarse screening during excavation. At the Cactus Flower site all soil was screened through a ¼ inch mesh (Brumley 1975: 7). It does not appear that any material was fine-screened, nor were any samples submitted for flotation analysis, even though Brumley notes that, "A relatively large sample of excellently preserved skeletal material was obtained at the Cactus Flower site" (1975: 75). The recovery of fish vertebrae from the Crown site also suggests excellent preservation of bony elements but here too screening was limited to a ¼ inch mesh (Quigg 1986:9). A examination of soil samples from these sites would be useful in testing this hypothesis. Unfortunately, the Crown site was destroyed during the construction of the Nipawin reservoir, but a

Table 12.6. Comparison of mammalian faunal assemblages from McKean levels at the Cactus Flower, Crown, Redtail, and Thundercloud sites.

		Cactus Flower		Crown		Redtail		Thundercloud		
Common Name	Taxon	MNE	MNI	MNE	MNI	NISP	MNI	NISP	MNI	Size Class
Bison	*Bison bison*	891	38	203	?	1564	10	3175	12	
Moose	*Alces alces*	-	-	19	5	-	-	-	-	6
Elk	*Cervus elaphus*	-	-	?	3?	-	-	-	-	
Bear	*Ursus sp.*	-	-	1	1	-	-	-	-	
Pronghorn	*Antilocapra americana*	56	6	-	-	-	-	8	2	
Deer	*Odocoileus sp.*	3	1	1	1	16	1	-	-	4 & 5
Dogs and Allies	*Canis sp.*	?	5	156	5	61	7	72	4	
Badger	*Taxidea taxus*	-	-	-	-	-	-	44	1	
Lynx and Allies	*Lynx sp.*	-	-	-	-	-	-	1	1	
Red fox	*Vulpes vulpes*	-	-	-	-	4	2	-	-	
Swift fox	*Vulpes velox*	1	1	-	-	-	-	-	-	
Fox	*Vulpes sp.*	-	-	-	-	-	-	13	2	
Skunk	*Mephitis mephitis*	-	-	2	1	3	1	2	1	3
Jackrabbit	*Lepus townsendii*	-	-	-	-	11	2	-	-	
Snowshoe hare	*Lepus americanus*	-	-	-	-	1	1	-	-	
Hares	*Lepus sp.*	1	1	33	4	-	-	7	2	
Nuttall's cottontail	*Sylvilagus nuttallii*	2	2	-	-	-	-	20	1	
Beaver	*Castor canadensis*	-	-	?	5	-	-	-	-	
Mink	*Mustela vison*	-	-	-	-	1	1	-	-	
Richardson's ground squirrel	*Spermophilus richardsonii*	-	-	-	-	?	4	-	-	
13-lined ground squirrel	*Spermophilus tridecemlineatus*	-	-	-	-	?	1	-	-	2
Ground squirrel	*Spermophilus sp.*	-	-	-	-	-	-	12	3	
Northern pocket gopher	*Thomomys talpoides*	-	-	-	-	?	1	2	1	
Gapper's red-backed vole	*Clethrionomys gapperi*	-	-	-	-	?	3	4	2	
Least chipmunk	*Eutamius minimus*	-	-	-	-	?	4	-	-	
Prairie vole	*Microtus ochrogaster*	-	-	-	-	?	1	-	-	
Meadow vole	*Microtus pennsylvanicus*	-	-	-	-	-	-	40	5	1
Voles	*Microtus sp.*	-	-	-	-	?	1	4	-	
Deer mouse	*Peromyscus maniculatus*	-	-	-	-	?	3	79	3	
Western harvest mouse	*Reithrodontomys megalotis*	-	-	-	-	?	1	-	-	

re-examination of the Cactus Flower site fauna is being considered (Morlan, personal communication).

Differences between the assemblages are not limited to mammalian remains. Reptiles and amphibians were not identified in the Crown and Cactus Flower assemblages but are present in sites at Wanuskewin. Elements from these species are burned and associated with a number of hearths suggesting human utilization. More important was the identification of 38 seeds in hearth samples taken from the Redtail site. Several burned rodent and anuran elements were also recovered in the flotation samples, further evidence for the importance of fine-screen techniques.

12.2.5 Discussion

An examination of the faunal and floral assemblages from the Redtail and Thundercloud sites provides new evidence for interpreting McKean subsistence. This new evidence, coupled with existing data from the Cactus Flower and Crown sites, has been used to create the following generalizations about McKean subsistence in the Northern Plains:

(1) <u>Bison and other large artiodactyls form a large part of the diet</u>. Bison elements are numerous at all of the these sites and processing techniques appear to be consistent. In general, bison limb elements are heavily processed suggesting the removal of marrow for immediate consumption. At the Crown site artiodactyls such as moose and elk, which are more common in the Boreal forest, were also utilized.

(2) <u>Canids and leporids are utilized as a secondary food source</u>. Dogs appear to have been very important with numerous individuals identified at every site. In each assemblage, canid elements were described with evidence of cut marks or burning and a number of individuals were found in association with hearths. Leporids were also identified at every site including a number of specimens with direct evidence of

butchering.

(3) Faunal remains are associated with a number of features. Numerous hearths and basin-shaped pits were recorded within the McKean levels at all of the sites. Faunal remains are often associated with these features and are found inside and outside of the pits. None of the features is lined with rock slabs but they may serve a similar function in roasting meat and small game. Further analysis of the spatial distribution patterns at the Cactus Flower and Redtail sites may provide more information regarding the use of these features.

(4) Small animals may have been used to supplement the diet. Evidence for the consumption and utilization of small game is present in the Thundercloud and Redtail assemblages. Numerous rodents, birds, amphibians and a reptile were found in the Thundercloud assemblage in association with hearths or with evidence of burning. Many of the rodents, particularly ground squirrels, were represented by burned phalanges and distal limb elements. A similar assemblage was described by Morlan (1994: 139) at the Tipperary Creek site (FbNp-1). He suggests that these elements represent animals which were roasted since bones of the extremities would be exposed to the heat during cooking. Other elements, protected by the flesh and skin, would not be burned by this process. It is interesting that some small birds, fish, and clams were discovered at the Cactus Flower and Crown sites but were interpreted as part of the background fauna. A re-examination of these faunal remains may suggest that they are actually part of the cultural assemblage.

(5) Plants have been utilized at McKean sites in the Northern Plains. Evidence for plant utilization is present at the Redtail site. In total, 38 complete seeds and 191 seed fragments were identified from flotation samples. All of the seeds are burned and were directly associated with hearths. To date, only 7 of 50 hearths samples have been

submitted for flotation. If the remaining samples contain as many seeds the potential exists for the recovery of over 270 complete seeds and thousands of seed fragments. This data would be invaluable in interpreting the human utilization of plants in the Northern Plains during the Middle Prehistoric period.

It has been suggested that peoples of the McKean complex were generalists who readily adapted to the changing environments of the post-Altithermal period (Kornfeld and Frison 1985: 44). Over such a large geographic area and time span they adapted to bison hunting in the Northern Plains and abandoned most of the Archaic lifestyle. This interpretation appears to fit well with biological models which suggest that, "the optimal [foraging] strategy is achieved by maximizing the net rate of energy intake per unit time" (Bayham 1979). By changing the subsistence base to large artiodactyls, which were readily available on the Northern Plains, the maximum amount of energy was achieved. This pattern of utilization is noted at four sites in the Northern Plains, but it appears that the diet was also supplemented by a variety of plants and small animals. It may be that these animals represent species which were utilized when bison numbers were low or herds were absent from the site area. The pattern may also reflect seasonal occupations and the utilization of small game throughout the winter, early spring, and late fall when bison have migrated from the area. An examination of the faunal assemblages from occupation layers with good seasonal data may further substantiate this claim.

12.3 Environmental Reconstruction

The reconstruction of past environments plays an important role in any archaeological interpretation. Changing environmental conditions can result in shifts in plant and animals populations which, in turn, cause changes in the habitation patterns of the cultures occupying those environments. Clearly then, recognizing these environmental conditions is an important component in the analysis of the cultural assemblage. Luckily, these environmental conditions are often easily detected. The faunal and floral communities which inhabit the site area will readily adapt to prolonged environmental change. These changes can be detected in the archaeological record by identifying the various plant and animal species which make up each faunal and floral assemblage.

Methods for reconstructing past environments vary depending upon the type of floral or faunal remains being analyzed. Only the methods which focus on mammalian remains will be discussed in this thesis. Other methods have been well described elsewhere and include; the analysis of phytoliths (eg. Piperno 1988; Pearsall 1989: 311-428; Rovner 1983), seeds (eg. Shackley 1985; Miller 1988; Pearsall 1989: 15-231; Popper 1988), pollen (eg. Adam and Mehringer,Jr. 1985; Bryant,Jr. and Hall 1993; Dimbleby 1985), insects (eg. Elias 1994; Kenward 1976), and molluscs (eg. Baerreis 1980; Jaehnig 1971; Ashworth et.al 1972).

The most common method used in the analysis of mammal data is the area sympatry approach. A sympatry is created when the distribution of several species are plotted on the same map. Generally, these distributions create a region of overlap which represents an environmental niche capable of sustaining all specimens plotted in the sympatry (Graham and Semken, Jr. 1987). If the location of the site does not fall within the area of sympatry it is assumed that some form of environmental change has occurred.

Wilson (1975: 234) created a simple sympatry for several mammal species identified in the McKean levels at the Cactus Flower site (Figure 12.1). The resulting map positions the Cactus Flower site on the northernmost periphery of the area of sympatry. Wilson (1975: 221) notes that, "The peripheral position of the site suggests that conditions 4,500 to 3,000 years ago could have been warmer and/or drier than those of today but not significantly cooler and/or wetter."

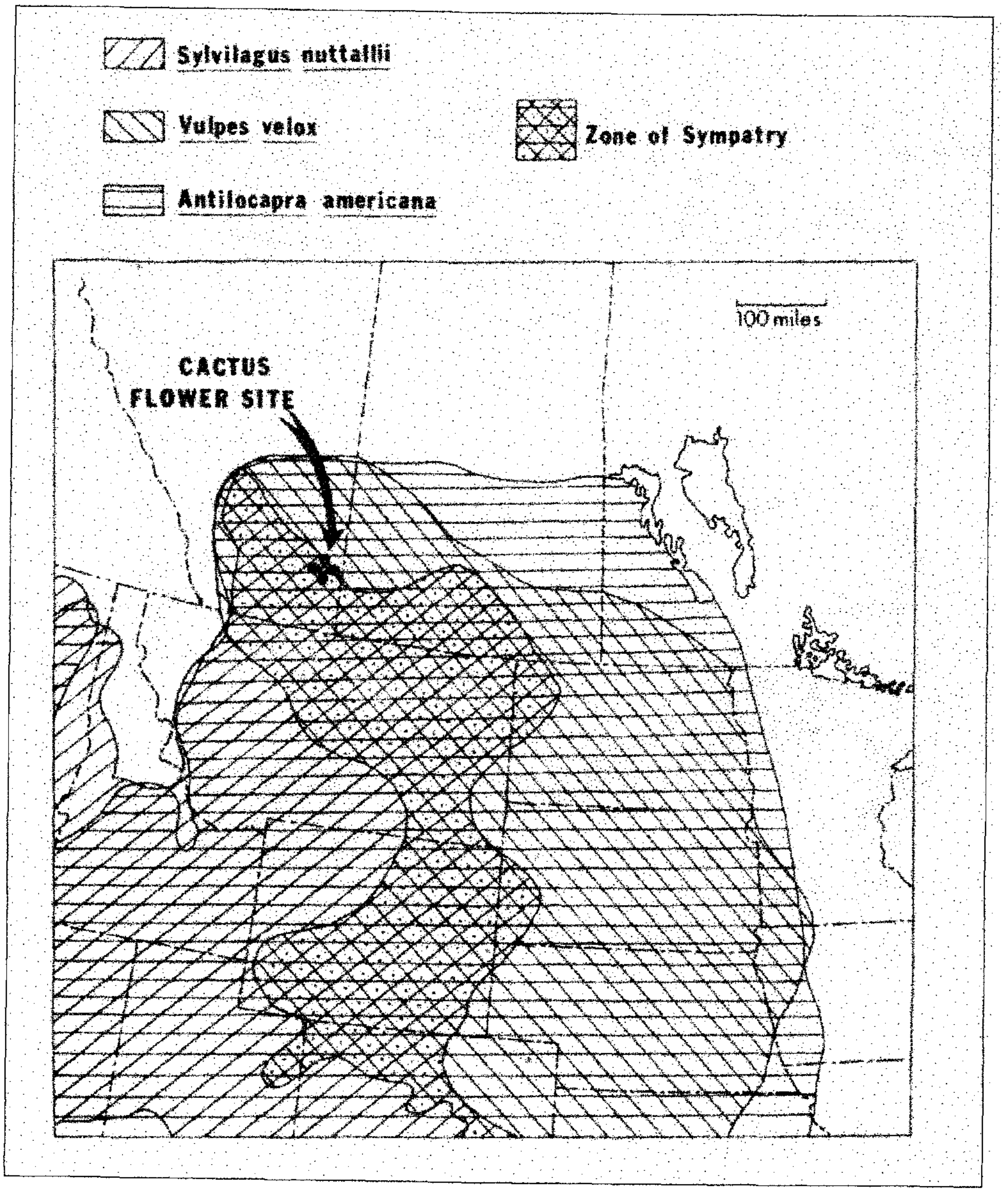

Figure 12.1 Area sympatry from McKean levels at the Cactus Flower site (reproduced from Wilson 1975: 234).

It is well documented that the environmental conditions during the Early Middle Prehistoric period (also known as the Altithermal period) were warmer and drier than present (eg. Bryson 1987; Frison 1991; Hurt 1966; Reeves 1973; Walker 1992; Wendland 1978). It has also been suggested that the Altithermal period ended approximately 5,000 years ago with the onset of the Sub-Boreal, a period of wetter and cooler climactic conditions. Based on the sympatry from the Cactus Flower site it would appear that this new climactic episode had not yet effected the range of some animal species.

Based on radiocarbon dates, the Thundercloud and Redtail sites were occupied during the time frame of Wilson's sympatry. As a result, a sympatry of mammalian species from the sites in Opimihaw Valley could reveal evidence to support Wilson's data. Unfortunately the majority of the mammals identified at the Thundercloud and Redtail sites inhabit a wide variety of environmental zones and do not provide the tight distributions needed for sympatry analysis. Several species were present, however, which were outside of their known range. These include *Sylvilagus nuttallii* (Nuttall's cottontail), *Lagurus curtatus* (Sagebrush vole), and *Reithrodontomys megalotis* (Western harvest mouse). These are typical grassland species which are currently limited to the southwestern part of the Province.

The sympatry from these three species is included as Figure 12.2. The sympatry is strikingly similar to Wilson's sympatry for the Cactus Flower site. The current location of the Thundercloud and Redtail sites, within Opimihaw Valley, is well northeast of the area of overlap. It would appear that the environmental conditions in the Opimihaw Valley were markedly different 4,000 years ago. Other taxa, identified within the Thundercloud assemblage, may also suggest the presence of a grassland environment. Several specimens were identified as *Vulpes* which could represent

Vulpes velox (Swift fox) and a *Lynx* premolar is believed to be from *Lynx rufus* (Bobcat). These are both grassland species which are limited in range to the southwestern part of the Province.

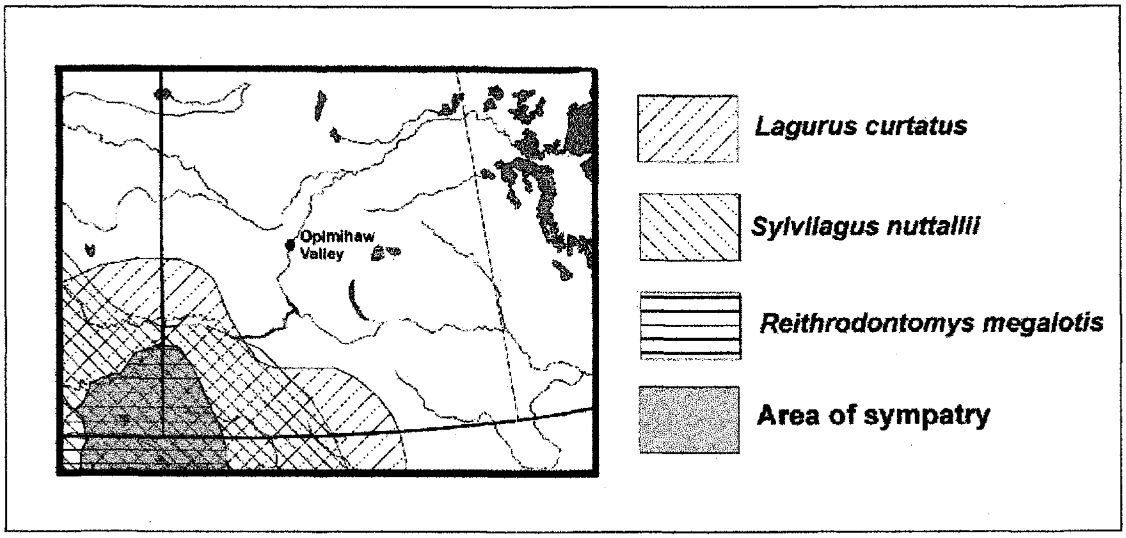

Figure 12.2 Area sympatry of three mammals from McKean levels at the Redtail and Thundercloud sites (Opimihaw Valley).

While these data provide some insight into the environmental conditions of the Middle Prehistoric period, it is important to remember that the range for each species is based on historical records. It is difficult to determine if the range of some species has changed due to environmental conditions or from changes in ecosystems caused by human interference. Further analysis, using phytolith and seed data, would be useful in testing this hypothesis.

12.4 Summary

The analysis of fine-screen samples at the Thundercloud site led to the recovery and identification of numerous small animal remains. Many of the specimens were burned or were associated with hearth features suggesting that small animals were often utilized at the site. Other specimens, such as snail shells, were useful in interpreting the depositional history of the site sediments. Still other specimens were useful in reconstructing past environmental conditions. It is believed that the majority of these specimens would not have been recovered using coarse screening techniques.

An analysis of the assemblage from levels four and five revealed new evidence regarding McKean subsistence on the Northern Plains. While it appears that McKean complex hunters are efficient at hunting large artiodactyls, various plants and mammals still play a minor role in the overall subsistence strategy.

Finally, sympatric analysis of mammals identified in the McKean levels at the Cactus Flower, Redtail, and Thundercloud sites may suggest that the environmental conditions of the Middle Middle Prehistoric Period were quite different than the conditions present today. These findings may contradict the suggestion that this period marked a return to the wetter and cooler conditions of the Sub-Boreal but more likely reflects the problems in using modern faunal distribution maps.

Chapter 13

Summary and Conclusions

This thesis was designed to examine the faunal and floral assemblage from the Thundercloud site (FbNp-25), a large multi-component processing area/camp site in the Northern Plains. Located within Wanuskewin Heritage Park, the site is nestled in a shallow valley surrounded by a rich diversity of flora and fauna. During excavation, the site revealed a minimum of ten occupation layers dating back to at least 4,000 years BP. As part of the Park's commitment to paleoenvironmental research, soil samples were collected from all excavation units and were later processed using fine-screen techniques. By water-screening sediment samples a greater number of archaeological micro-remains were recovered. The analysis of those remains, in combination with the analysis of the faunal assemblage recovered during excavation, forms the basis for this thesis.

By examining the data from the analysis it was hoped that the project could fulfill the following objectives:

1. to determine some aspects of the subsistence practices of the site occupants,
2. to analyze the distribution patterns of the artifacts in an attempt to discover activity areas,
3. to determine seasonal patterns of occupation, and
4. to determine the importance of fine screen analysis with suggestions on how data obtained from these analyses can improve archaeological interpretations.

With regard to subsistence strategies, the majority of the levels appear to represent small-scale bison hunters. Bison elements are numerous in all levels and are usually incomplete. Bison longbones are highly fragmented suggesting that marrow forms an important part of the diet. The presence of heavily processed bone, within the first three levels, may also suggest that site inhabitants were involved in the production of pemmican. Other large mammals, such as pronghorn and canids, are also common in most of the levels and often reveal evidence of processing. Furthermore, the analysis of the micro-assemblage suggests that smaller animals, such as mammals, birds, reptiles and clams have also been utilized by the site occupants.

The analysis of faunal and floral distribution maps suggests that activities in all levels are centred around features. In the first three levels activities are centered around hearths and stone boiling pits. This further confirms the suggestion that activities within these levels are focused on the production of pemmican. Activities in levels four to six tend to be centered around a number of shallow pits and basin-shaped hearths but no stone boiling pits were recorded. It appears likely that activities in the lower levels are related to cooking food and not in the production of pemmican.

Estimating seasonal patterns of occupation was difficult because few immature bison specimens were identified and most teeth were too fragmented for metric analysis. An examination of the limited number of immature specimens, combined with data on the behavioral patterns of various species, suggests that the majority of the occupations occurred during the spring. Only two winter occupations were confirmed, one in level two and another in level five.

By far, the most important contribution of this thesis is the evidence revealed by the analysis of fine-screened samples. The data obtained by the examination of the micro-assemblage was important to every aspect of this project. A number of specimens which are not part of the cultural assemblage were useful in recovering paleobiological data. These data were then used in a variety of discussions including; the determination of seasonal occupation, the depositional history of some levels, and in the reconstruction of past environmental conditions. More importantly, by examining elements found in hearths, suggestions were made regarding the human utilization of small animals and a realization that small animals have played a minor role in the subsistence strategies of all cultures represented at the Thundercloud site. This discussion was expanded into an examination of McKean subsistence on the Northern Plains. Data from this project, in conjunction with data from the Redtail site, forms the basis for a closer look at McKean subsistence, and a re-examination of Northern Plains subsistence in general.

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Appendix I

The Flora and Fauna of Opimihaw Valley, Wanuskewin Heritage Park

Table 1. Flora of Opimihaw Valley (After Rogal 1982, additional reference Looman and Best 1987).

Latin Name	Common Name
Equisetaceae	**Horse-Tail Family**
Equisetum arvense	Common Horsetail
Equisetum hyemale	Common Scouring-Rush
Cupressaceae	**Cypress Family**
Juniperus communis	Low Juniper
Juniperus horizontalis	Creeping Juniper
Typhaceae	**Cattail Family**
Typha latifolia	Common Cattail
Selaginellaceae	**Spike-Moss Family**
Selaginella densa	Prairie Selaginella
Sparganiaceae	**Bur-Reed Family**
Sparganium eurycarpum	Broad-Fruited Bur-Weed
Juncaginaceae	**Arrow-Grass Family**
Triglochin maritima	Seaside Arrow-Grass
Alismataceae	**Water-Plantain Family**
Sagittaria cuneata	Arum-Leaved Arrowhead
Gramineae	**Grass Family**
Agropyron dasystachyum	Northern Wheatgrass
Agropyron smithii	Western Wheatgrass
Agropyron trachycaulum	Slender Wheatgrass
Agrostis scabra	Rough Hair Grass
Andropogon scoparius	Little Bluestem
Beckmannia syzigachne	Slough Grass
Bouteloua gracilis	Blue Grama
Calamogostris canadensis	Marsh Reed Grass
Calamovilfa longifolia	Sand Grass
Elymus canadensis	Canada Wild Rye
Festuca hallii	Plains Rough Fescue
Helictotrichon hookeri	Hooker's Oat Grass
Hierochloe odorata	Sweet Grass
Hordeum jubatum	Wild Barley
Koeleria gracilis	June Grass
Muhlenbergia cuspidata	Prairie Muhly
Muhlenbergia racemosa	Marsh Muhly
Muhlenbergia richardsonis	Mat Muhly
Oryzopsis hymenoides	Indian Rice Grass
Phalaris arundinacea	Reed Canary Grass
Poa palustris	Fowl Blue Grass
Puccinellia nuttalliana	Nuttall's Salt-Meadow Grass

Gramineae continued	
Spartina pectinata	Prairie Cord Grass
Sporobolus cryptandrus	Sand Dropseed
Stipa viridula	Green Needle Grass
Stipa spartea	Porcupine Grass
Cyperaceae	**Sedge Family**
Carex aquatilis	Water Sedge
Carex lanuginosa	Wooly Sedge
Carex rostrata	Beaked Sedge
Carex stenophylla	Low Sedge
Carex filifolia	Thread-Leaved sedge
Eleocharis acicularis	Needle-Spike Rush
Scirpus americanus	Three-Square Bulrush
Scirpus acutus	Great Bulrush
Scirpus paludosus	Prairie Bulrush
Scirpus validus	Common Great Bulrush
Lemnaceae	**Buckweed Family**
Lemna minor	Lesser Buckweed
Lemna trisulca	Ivy Buckweed
Juncaceae	**Rush Family**
Juncus balticus	Baltic Rush
Juncus alpinus	Alpine Rush
Juncus nodosus	Knotted Rush
Liliaceae	**Lily Family**
Allium textile	Prairie Onion
Lilium philadelphicum	Western Red Lily
Maianthemum canadense	Two-Leaved Solomon’s Seal
Smilacina stellata	Star-Flowered Solomon's Seal
Smilax lasioneura	Carrion Flower
Iridaceae	**Iris Family**
Sisyrinchium montanum	Common Blue-Eyed Grass
Orchidaceae	**Orchid Family**
Habenaria hyperborea	Green-Flowered Bog-Orchid
Salicaceae	**Willow Family**
Populus balsamifera	Balsam Poplar
Populus deltoides	Cottonwood
Populus tremuloides	Trembling Aspen
Salix bebbiana	Beaked Willow
Salix interior	Sandbar Willow
Salix lutea	Yellow Willow
Salix petiolaris	Basket Willow
Urticaceae	**Nettle Family**
Urtica dioica	Common Nettle

Betulaceae	**Birch Family**
Alnus tenuifolia	Speckled Alder
Betula occidentalis	River Birch
Betula papyrifera	White Birch
Corylus cornuta	Beaked Hazelnut
Santalaceae	**Sandalwood Family**
Comandra umbellata	Pale Comandra
Polygonaceae	**Buckwheat Family**
Eriogonum flavum	Yellow Umbrellaplant
Polygonum amphibium	Swamp Persicaria
Rumex occidentalis	Western Dock
Caryophyllaceae	**Pink Family**
Arenaria lateriflora	Blunt-Leaved Sandwort
Cerastium arvense	Field Chickweed
Ranunculaceae	**Crowfoot Family**
Actea rubra	Baneberry
Anemone canadensis	Canada Anemone
Anemone cylindrica	Long-Fruited Anemone
Anemone multifida	Cut-Leaved Anemone
Anemone patens	Crocus
Caltha palustris	Marsh Marigold
Ranunculus cymbalaria	Seaside Buttercup
Ranunculus glaberrimus	Shiny-Leaved Buttercup
Ranunculus gmelinii	Small Yellow Watercrowfoot
Ranunculus macounii	Macoun's Buttercup
Thalictrum venulosum	Veiny Meadow-Rue
Saxifragaceae	**Saxifrage Family**
Heuchera richardsonii	Alumroot
Grossulariaceae	**Currant Family**
Ribes hudsonianum	Northern Black Currant
Ribes oxyacanthoides	Northern Gooseberry
Rosaceae	**Rose Family**
Amelanchier alnifolia	Saskatoon
Crateagus rotundifolia	Round-Leaved Hawthorn
Fragaria virginiana	Smooth Wild Strawberry
Geum triflorum	Three-Flowered Avens
Potentilla anserina	Silverweed
Potentilla pensylvanica	Prairie Cinquefoil
Prunus pensylvanica	Pin Cherry
Prunus virginiana	Choke Cherry
Rosa acicularis	Prickly Rose
Rosa arkansana	Prairie Rose
Rosa woodsii	Wood's Rose
Rubus ideaus	Wild Red Raspberry

Leguminosae	**Pea Family**
Astragalus americanus	American Milk-Vetch
Astragalus crassicarpus	Ground-Plum
Astragalus gilviflorus	Cushion Milk-Vetch
Astragalus missouriensis	Missouri Milk-Vetch
Astragalus pectinatus	Narrow-Leaved Milk-Vetch
Glycyrrhiza lepidota	Wild Licorice
Lathyrus ochroleucus	Cream-Colored Vetchling
Oxytropis sericea	Early Yellow Locoweed
Oxytropis splendens	Showy Locoweed
Petelostemon candidum	White Prairie-Clover
Petelostemon purpureum	Purple Prairie-Clover
Psoralea agrophyllum	Silverleaf Psoralea
Psoralea lanceolata	Lance-Leaved Psoralea
Psoralea esculenta	Indian Breadroot
Thermopsis rhombifolia	Golden-Bean
Vicia americana	American Vetch
Linaceae	**Flax Family**
Linum lewisii	Lewis Wild Flax
Linum rigidum	Yellow Flax
Polygalaceae	**Milkwort Family**
Polygala senega	Seneca Snakeroot
Anacardiaceae	**Sumach Family**
Rhus radicans	Poison Ivy
Aceraceae	**Maple Family**
Acer Negundo	Manitoba Maple
Malvaceae	**Mallow Family**
Sphaeralcea coccinea	Scarlet Mallow
Violaceae	**Violet Family**
Viola adunca	Early Blue Violet
Viola canadensis	Western Canada Violet
Viola nuttallii	Nuttall's Yellow Violet
Elaeagnaceae	**Oleaster Family**
Elaeagnus commutata	Silverberry
Shepherdia argentea	Buffaloberry
Shepherdia canadensis	Canada Buffaloberry
Onagraceae	**Evening-Primrose Family**
Gaura coccinea	Scarlet Gaura
Haloragaceae	**Mare's-Tail Family**
Hippurus vulgaris	Mare's-Tail
Araliaceae	**Ginseng Family**
Aralia nudicaulis	Wild Sarsaparilla

Umbelliferae	**Parsley Family**
Cicuta Maculata	Water-Hemlock
Heracleum lanatum	Cow-Parsnip
Lonatium macrocarpus	Long-Fruited Parsley
Sanicula marilandica	Snakeroot
Sium suave	Water Parsnip
Zizia aptera	Heart-Leaved Alexanders
Cornaceae	**Dogwood Family**
Cornus canadensis	Bunchberry
Cornus stolonifera	Red-Osier Dogwood
Pyrolaceae	**Wintergreen Family**
Orthilia secunda	One-Sided Wintergreen
Pyrola asarifolia	Pink Wintergreen
Ericaceae	**Heath Family**
Arctostaphylos uva-ursi	Bearberry
Primulaceae	**Primrose Family**
Androsace septentrionalis	Pygmyflower
Lysimachia ciliata	Fringed Loosestrife
Oleaceae	**Olive Family**
Fraxinus pennsylvanica	Green Ash
Gentianaceae	**Gentian Family**
Gentianella amarella	Northern Gentian
Apocynaceae	**Dogbane Family**
Apocynum androsaemifolium	Spreading Dogbane
Apocynum cannabinum	Indian-Hemp
Asclepiadaceae	**Milkweed Family**
Asclepias ovalifolia	Dwarf Milkweed
Polemoniaceae	**Phlox Family**
Phlox hoodii	Moss Phlox
Boraginaceae	**Borage Family**
Cryptantha nubigena	Clustered Oreocarya
Lithospermum canescens	Hoary Puccoon
Lithospermum incisum	Narrow-Leaved Puccoon
Labiatae	**Mint Family**
Monarda fistulosa	Western Wild Bergamot
Mentha arvensis	Wild Mint
Physostegia virginiana	False Dragonhead
Scutellaria galericulata	Marsh Skullcap
Campanulaceae	**Bluebell Family**
Campanula rotundifolia	Harebell

Scrophulariaceae	**Figwort Family**
Orthocarpus luteus	Owl's-Clover
Pentstemon gracilis	Lilac-Flowered Beardtongue
Pentstemon nitidus	Smooth Blue Beardtongue
Lentibulariaceae	**Bladderwort Family**
Utricularia vulgaris	Common Bladderwort
Plantaginaceae	**Plantain Family**
Plantago major	Common Plantain
Rubiaceae	**Madder Family**
Galium boreale	Northern Bedstraw
Galium triflorum	Sweet-Scented Beadstraw
Caprifoliaceae	**Honeysuckle Family**
Lonicera dioica	Twining Honeysuckle
Symphoricarpos albus	Snowberry
Symphoricarpos occidentalis	Western Snowberry
Viburnum edule	Low Bush-Cranberry
Viburnum opulus	High Bush-Cranberry
Compositae	**Composite Family**
Achillea millefolium	Milfoil Yarrow
Agoseris glauca	Large-Flowered False Dandelion
Antennaria rosea	Rosy Everlasting
Antennaria neglecta	Common Pussy-Toes
Antennaria parvifolia	Pussy-Toes
Artemesia campestris	Plains Wormwood
Artemesia frigida	Pasture Sage
Artemesia ludoviciana	Prairie Sage
Aster ericoides	Many-Flowered Aster
Aster falcatus	White Prairie Aster
Aster hesperius	Willow Aster
Aster laevis	Smooth Aster
Crepis runcinata	Scapose Hawk's-Beard
Erigeron canadensis	Canada Fleabane
Erigeron glabellus	Smooth
Erigeron philadelphicus	Philadelphia Fleabane
Gaillardia aristata	Great-Flowered Gaillardia
Grindelia squarrosa	Gumweed
Guterrezia sarothrae	Broomweed
Heterotheca villosa	Hairy Golden-Aster
Liatris punctata	Dotted Blazingstar
Lygodesmia juncea	Skeletonweed
Petasites sagittatus	Arrow-Leaved Colt's-Foot
Ratibida columnifera	Prairie Cone-Flower
Rudbeckia hirta	Black-Eyed Susan
Senecio canus	Silvery Groundsel
Senecio congestus	Marsh Ragwort
Solidago canadensis	Graceful Goldenrod
Solidago missouriensis	Low Goldenrod

Table 2. Vertebrates of Opimihaw Valley (After Walker 1983) E = Extirpated

Latin Name	Common Name
MAMMALS	
Bovidae	**Antelopes, Cattle, Sheep and Goats**
Bison bison E	American Bison
Antilocapridae	**Pronghorns**
Antilocapra americana E	Pronghorn
Cervidae	**Deer**
Cervus elaphus E	Elk
Odocoileus virginianus	White-Tailed Deer
Odocoileus hemionus	Mule Deer
Felidae	**Cats**
Lynx lynx	Lynx
Felis concolor E	Mountain Lion
Ursidae	**Bears**
Ursus americanus E	American Black Bear
Ursus arctos E	Grizzly Bear
Canidae	**Dogs**
Canis lupus nubilis E	Buffalo Wolf
Canis latrans	Coyote
Canis familiaris	Domestic Dog
Vulpes vulpes	Red Fox
Vulpes velox E	Swift Fox
Mustelidae	**Weasels and their Allies**
Gulo gulo E	Wolverine
Taxidea taxus	American Badger
Mephitis mephitis	Striped Skunk
Lutra canadensis E	River Otter
Mustela ermina	Ermine
Mustela frenata	Long-Tailed Weasel
Mustela vison	American Mink
Mustela nivalis	Least Weasel
Procyonidae	**Raccoons and their Allies**
Procyon lotor	Raccoon
Leporidae	**Rabbits and Hares**
Lepus americanus	Snowshoe Hare
Lepus townsendii	White-Tailed Jack Rabbit
Sylvilagus nuttallii	Nuttall's Cottontail
Erethizontidae	**New World Porcupines**
Erethizon dorsatum	Porcupine

Castoridae	**Beavers**
Castor canadensis	American Beaver
Dipodidae	**Jumping Mice and Jerboas**
Zapus princeps	Western Jumping Mouse
Heteromyidae	**Pocket Mice and Kangaroo Rats**
Perognathus fasciatus	Olive-Backed Pocket Mouse
Geomyidae	**Pocket Gophers**
Thomomys talpoides	Northern Pocket Gopher
Muridae	**Rats, Mice and Voles**
Ondatra zibethicus	Muskrat
Microtus pennsylvanicus	Meadow Vole
Microtus ochrogaster	Prairie Vole
Cleithrionomys gapperi	Gapper's Red-Backed Vole
Onchomys leucogaster	Northern Grasshopper Mouse
Peromyscus maniculatus	Deer Mouse
Peromyscus leucopus	White-Footed Mouse
Sciuridae	**Ground Squirrels**
Spermophilus franklinii	Franklin's Ground Squirrel
Spermophilus richardsonii	Richardson's Ground Squirrel
Spermophilus tridecemlineatus	Thirteen-Lined Ground Squirrel
Marmota monax	Woodchuck
Eutamius minimus	Least Chipmunk
Soricidae	**Shrews**
Sorex cinereus	Masked Shrew
Microsorex hoyi	Pygmy Shrew
Vespertillionidae	**Bats**
Lasiurus cinereus	Hoary Bat
Lasiurus borealis	Red Bat
Eptesicus fuscus	Big Brown Bat
Lasionycteris noctivagans	Silver Haired Bat
Myotis lucifugus	Little Brown Bat

BIRDS

Podicipedidae	**Grebes**
Podiceps nigricollis	Eared Grebe
Podiceps auritis	Horned Grebe
Podylimbus podiceps	Pied-Billed Grebe
Aechmophorus occidentalis	Western Grebe
Pelecanidae	**Pelicans**
Pelecanus erythrorhynchos	White Pelican

Phalacrocoracidae	**Cormorants**
Phalacrocorax auritis	Double-Crested Cormorant
Anatidae	**Swans, Geese and Ducks**
Cygnus buccinator	Trumpeter Swan
Branta canadensis	Canada Goose
Chen caerulescens	Snow Goose
Anser albifrons	White-Fronted Goose
Anas strepera	Gadwall
Anas platyrhynchos	Mallard
Anas clypeata	Northern Shoveler
Anas acuta	Pintail
Anas crecca	Green-Winged Teal
Anas americana	American Wigeon
Anas discors	Blue-Winged Teal
Bucephala albeola	Bufflehead
Bucephala clangula	Common Goldeneye
Mergus merganser	Common Merganser
Mergus serrator	Red-Breasted Merganser
Aythya valisineria	Canvasback
Aythya affinis	Lesser Scaup
Aythya americana	Redhead
Aythya collaris	Ring-Necked Duck
Oxyura jamaicensis	Ruddy Duck
Cathartidae	**American Vultures**
Cathartes aura	Turkey Vulture
Accipitridae	**Ospreys, Eagles, Hawks and Allies**
Haliaeetus leucocephalus	Bald Eagle
Aquila chrysaetos	Golden Eagle
Accipiter cooperii	Cooper's Hawk
Accipiter gentilis	Goshawk
Accipiter striatus	Sharp-Shinned Hawk
Buteo platypterus	Broad-Winged Hawk
Buteo jamaicensis	Red-Tailed Hawk
Buteo lagopus	Rough-Legged Hawk
Buteo swainsoni	Swainson's Hawk
Circus cyaneus	Northern Harrier
Pandion haliaetus	Osprey
Falco sparverius	American Kestrel
Falco columbarius	Merlin
Falco peregrinus	Peregrine Falcon
Strigidae	**Typical Owls**
Athene cunicularia	Burrowing Owl
Bubo virginianus	Great Horned Owl
Asio otus	Long-Eared Owl
Asio flammeus	Short-Eared Owl
Aegolius acadicus	Northern Saw-Whet Owl
Nyctea scandiaca	Snowy Owl

Phasianidae	**Partridges, Pheasants and Grouse**
Bonasa umbellus	Ruffed Grouse
Tympanuchus phasianellus	Sharp-Tailed Grouse
Gruidae	**Cranes**
Grus americana	Whooping Crane
Grus canadensis	Sandhill Crane
Rallidae	**Rails and Coots**
Fulica americana	American Coot
Porzana carolina	Sora
Rallus limicola	Virginia Rail
Coturnicops noveboracensis	Yellow Rail
Charadriidae	**Plovers**
Pluvialis dominica	Lesser Golden Plover
Charadrius vociferus	Killdeer
Scolopacidae	**Sandpipers, Phalaropes and Allies**
Recurvirostra americana	American Avocet
Gallinago gallinago	Common Snipe
Tringa melanoleuca	Greater Yellowlegs
Tringa flavipes	Lesser Yellowlegs
Tringa solitaria	Solitary Sandpiper
Limosa haemastica	Hudsonian Godwit
Limosa fedoa	Marbled Godwit
Calidris melanotos	Pectoral Sandpiper
Calidris alba	Sanderling
Actitis macularia	Spotted Sandpiper
Catoptrophorus semipalmatus	Willet
Phalaropus tricolor	Wilson's Phalarope
Laridae	**Gulls, Terns and Skimmers**
Chlidonias niger	Black Tern
Sterna hirundo	Common Tern
Sterna forsteri	Forster's Tern
Larus californicus	California Gull
Larus pipixcan	Franklin's Gull
Larus delawarensis	Ring-Billed Gull
Columbidae	**Doves and Pigeons**
Zenaida macroura	Mourning Dove
Cuculidae	**Cuckoos**
Coccyzus erythropthalmus	Black-Billed Cuckoo
Caprimulgidae	**Goatsuckers**
Chordeiles minor	Common Nighthawk
Trochilidae	**Hummingbirds**
Archilochus colubris	Ruby-Throated Hummingbird

Alcedinidae	**Kingfishers**
Ceryle alcyon	Belted Kingfisher
Picidae	**Woodpeckers**
Colaptes auratus	Northern Flicker
Picoides pubescens	Downy Woodpecker
Picoides villosus	Hairy Woodpecker
Sphyrapicus varius	Yellow-Bellied Sapsucker
Tyrannidae	**Tyrant Flycatchers**
Tyrannus tryannus	Eastern Kingbird
Tyrannus verticalis	Western Kingbird
Sayornis phoebe	Eastern Phoebe
Myiarchus crinitus	Great Crested Flycatcher
Empidonax alnorum	Alder Flycatcher
Empidonax minimus	Least Flycatcher
Contopus borealis	Olive-Sided Flycatcher
Alaudidae	**Larks**
Eremophila alpestris	Horned Lark
Hirundinidae	**Swallows**
Riparia riparia	Bank Swallow
Hirundo rustica	Barn Swallow
Tachycineta bicolor	Tree Swallow
Corvidae	**Jays, Magpies and Crows**
Pica pica	Black-Billed Magpie
Cyanocitta cristata	Blue Jay
Corvus brachyrhynchos	Common Crow
Corvus corax	Common Raven
Paridae	**Titmice**
Parus atricapillus	Black-Capped Chickadee
Sittidae	**Nuthatches**
Sitta canadensis	Red-Breasted Nuthatch
Sitta carolinensis	White-Breasted Nuthatch
Certhiidae	**Creepers**
Certhia americana	Brown Creeper
Troglodytidae	**Wrens**
Troglodytes aedon	House Wren
Cistothorus palustris	Marsh Wren
Cistothorus platensis	Sedge Wren
Mimidae	**Mockingbirds and Thrashers**
Toxostoma rufum	Brown Thrasher
Dumetella carolinensis	Gray Catbird

Musciapidae	**Thrushes and Allies**
Turdus migratorius	American Robin
Sialia sialis	Eastern Bluebird
Sialia currucoides	Mountain Bluebird
Catharus minimus	Gray-Cheeked Thrush
Catharus guttatus	Hermit Thrush
Catharus ustulatus	Swainson's Thrush
Catharus fuscescens	Veery
Regulus calendula	Ruby-Crowned Kinglet
Motacillidae	**Pipits and Wagtails**
Anthus spragueii	Sprague's Pipit
Bombycillidae	**Waxwings**
Bombycilla garrulus	Bohemian Waxwing
Bombycilla cedrorum	Cedar Waxwing
Laniidae	**Shrikes**
Lanius ludovicianus	Loggerhead Shrike
Lanius excubitor	Northern Shrike
Verionidae	**Vireos**
Vireo olivaceus	Red-Eyed Vireo
Vireo gilvus	Warbling Vireo
Emberizidae	**Warblers, Sparrows and Allies**
Setophaga ruticilla	American Redstart
Dendroica castanea	Bay-Breasted Warbler
Dendroica striata	Blackpoll Warbler
Dendroica virens	Black-Throated Green Warbler
Dendroica pennsylvanica	Chestnut-Sided Warbler
Dendroica palmarum	Palm Warbler
Dendroica magnolia	Magnolia Warbler
Dendroica coronata	Yellow-Rumped Warbler
Dendroica petechia	Yellow Warbler
Geothlypis trichas	Common Yellowthroat
Vermivora celata	Orange-Crowned Warbler
Vermivora peregrina	Tennessee Warbler
Wilsonia canadensis	Canada Warbler
Wilsonia pusilla	Wilson's Warbler
Seiurus aurocapillus	Ovenbird
Mniotilta varia	Black-and-White Warbler
Icteria virens	Yellow-Breasted Chat
Dolichonyx oryzivorus	Bobolink
Molothrus ater	Brown-Headed Cowbird
Quiscalus quiscula	Common Grackle
Icterus galbula	Northern Oriole
Euphagus cyanocephalus	Brewer's Blackbird
Euphagus carolinus	Rusty Blackbird
Agelaius phoeniceus	Red-Winged Blackbird
Sturnella neglecta	Western Meadowlark
Xanthocephalus xanthcephalus	Yellow-Headed Blackbird

Emberizidae continued	
Carduelis tristis	American Goldfinch
Calcarius ornatus	Chestnut-Collared Longspur
Junco hyemalis	Dark-Eyed Junco
Coccothraustes vespertinus	Evening Grosbeak
Carduelis flammea	Common Redpoll
Carduelis hornemanni	Hoary Redpoll
Carduelis pinus	Pine Sisken
Pinicola enucleator	Pine Grosbeak
Carpodacus purpureus	Purple Finch
Pheucticus ludovicianus	Rose-Breasted Grosbeak
Pipilo erythrophthalmus	Rufous-Sided Towhee
Spizella arborea	Tree Sparrow
Spizella passerina	Chipping Sparrow
Spizella pallida	Clay-Coloured Sparrow
Ammodramus bairdii	Baird's Sparrow
Ammodramus leconteii	LaConte's Sparrow
Melospiza lincolnii	Lincoln's Sparrow
Melospiza melodia	Song Sparrow
Passerella iliaca	Fox Sparrow
Pooecetes gramineus	Vesper Sparrow
Zonotrichia querula	Harris' Sparrow
Zonotrichia leucophrys	White-Crowned Sparrow
Zonotrichia albicollis	White-Throated Sparrow
Passerculus sandwichensis	Savannah Sparrow
Plectrophenax nivalis	Snow Bunting
Loxia curvirostra	Red Crossbill
Loxia leucoptera	White-Winged Crossbill

AMPHIBIANS AND REPTILES

Ambystomidae	**Mole Salamanders**
Ambystoma tigrinum	Tiger Salamander
Bufonidae	**True Toads**
Bufo hemiophrys	Canadian Toad
Hylidae	**Treefrogs and Relatives**
Pseudacris triseriata	Boreal Chorus Frog
Ranidae	**Typical Frogs**
Rana pipiens	Leopard Frog
Rana sylvatica	Wood Frog
Colubridae	**Typical Snakes**
Thamnophis sirtalis	Red-Sided Garter Snake
Thamnophis radix	Plains Garter Snake

FISH

Acipenseridae	**Sturgeons**
Acipenser fulvescens	Sturgeon
Esocidae	**Pikes**
Esox lucius	Northern Pike
Percidae	**Perches**
Perca flavescens	Yellow Perch
Stizostedion vitreum	Walleye
Stizostedion canadense	Sauger
Etheostoma exile	Iowa Darter
Catostomidae	**Suckers**
Catostomus commersonii	White Sucker
Catostomus catostomus	Longnose Sucker
Moxostoma macrolepidotum	Shorthead Redhorse
Moxostoma anisurum	Silver Redhorse
Carpiodes cyprinus	Quillback
Hiodontidae	**Mooneyes**
Hiodon alosoides	Goldeye
Cyprinidae	**Minnows and Carps**
Notropis atherinoides	Emerald Shiner
Notropis blennius	River Shiner
Notropis hudsonius	Spottail Shiner
Platygobio gracilis	Flathead Chub
Rhinichthys cataractae	Longnose Dace
Semotilus margarita	Pearl Dace
Gasterosteidae	**Sticklebacks**
Culaea inconstans	Brook Stickleback
Cottidae	**Sculpins**
Cottus ricei	Spoonhead Sculpin

Additional References: Banfield 1974 (Mammals),Godfrey 1986 (Birds),
Stejneger and Barbour 1939 (Reptiles and Amphibians),
Harding 1997 (Reptiles and Amphibians),
Scott and Crossman 1973 (Fish)

Table 3. **Molluscs of Opimihaw Valley**

Latin Name	Common Name
Valvatidae	**Valve Snails**
Valvata sincera sincera	Ribbed Valve Snail
Valvata tricarinata	Three-Keeled Valve Snail
Hydrobiidae	**Spire Snails**
Probythinella lacustris	Flat-Ended Spire Snail
Amnicola limosa	Ordinary Spire Snail
Lymnaeidae	**Pond Snails**
Fossaria modicella	Modest Fossaria
Fossaria parva	Amphibious Fossaria
Bakerilymnaea bulimoides	Prairie Pond Snail
Bakerilymnaea dalli	Small Pond Snail
Lymnaea stagnalis jugularis	Great Pond Snail
Stagnicola caperata	Blade-Ridged Stagnicola
Stagnicola catascopium catascopium	Lake Stagnicola
Stagnicola elodes	Common Stagnicola
Stagnicola reflexa	Striped Stagnicola
Physidae	**Tadpole Snails**
Physa gyrina gyrina	Tadpole Snail
Physa jennessi skinneri	Blunt Prairie Physa
Aplexa hypnorum	Polished Tadpole Snail
Planorbidae	**Ramshorn Snails**
Gyraulus circumstriatus	Flatly Coiled Gyraulus
Gyraulus deflectus	Irregular Gyraulus
Gyraulus parvus	Modest Gyraulus
Armiger crista	Tiny Nautilus Snail
Promenetus exacuous exacuous	Keeled Promenetus
Promenetus exacuous megas	Broad Promenetus
Promenetus umbilicatellus	Umbilicate Promenetus
Planorbula armigera	Say's Toothed Planorbid
Planorbula campestris	Prairie Toothed Planorbid
Helisoma anceps anceps	Two-Ridged Ramshorn
Helisoma trivolis subcrenatum	Larger Prairie Ramshorn
Unionidae	**Pearly Mussels**
Lasmigona complanata	White Heel Splitter
Lasmigona compressa	Brook Lasmigona
Anodonta grandis grandis	Common Floater
Lampsilis radiata siliquoidea	Fat Mucket

Sphaeriidae	**Fingernail Clams and Pea Clams**
Sphaerium nitidum	Arctic-Alpine Fingernail Clam
Sphaerium rhomboideum	Rhomboid Fingernail Clam
Sphaerium simile	Grooved Fingernail Clam
Sphaerium striatinum	Striated Fingernail Clam
Sphaerium lacustre	Lake Fingernail Clam
Sphaerium securis	Pond Fingernail Clam
Sphaerium transversum	Long Fingernail Clam
Pisidium casertanum	Ubiquitous Pea Clam
Pisidium compressum	Ridge-Beak Pea Clam
Pisidium fallax	River Pea Clam
Pisidium ferrugineum	Rusty Pea Clam
Pisidium lilljeborgi	Lilljeborg's Pea Clam
Pisidium milium	Quadrangular Pea Clam
Pisidium nitidum	Shiny Pea Clam
Pisidium rotundatum	Fat Pea Clam
Pisidium subtruncatum	Short-Ended Pea Clam
Pisidium variabile	Triangular Pea Clam
Pisidium ventricosum	Globular Pea Clam
Pisidium punctatum	Perforated Pea Clam

Reference: Clarke 1981

Appendix II

Calculations of Animal Units by Landmark

Table 1. Animal Units by Landmark for Levels One, Two, and Three of the Thundercloud Site (FbNp-25).

	L1			L2			L3		
	Total MNE	Total MAU	%MAU	Total MNE	Total MAU	%MAU	Total MNE	Total MAU	%MAU
Cranium									
Frontal	0	0	0	1	0.5	11.1	1	0.5	12.5
Horn core	1	0.5	9.1	0	0	0	0	0	0
Parietal	0	0	0	0	0	0	0	0	0
Occipital	0	0	0	0	0	0	0	0	0
Occipital condyle	0	0	0	0	0	0	0	0	0
Squamous temporal	1	0.5	9.1	0	0	0	0	0	0
Petrous temporal	3	1.5	27.3	9	4.5	100	8	4	100
Zygomatic temporal	0	0	0	0	0	0	0	0	0
External auditory meatus	0	0	0	0	0	0	0	0	0
Zygomatic	2	1	18.2	1	0.5	11.1	0	0	0
Nasal	2	1	18.2	1	0.5	11.1	0	0	0
Maxilla	0	0	0	0	0	0	0	0	0
Premaxilla	0	0	0	0	0	0	0	0	0
2nd premolar	3	1.5	27.3	2	1	22.2	0	0	0
3rd premolar	0	0	0	1	0.5	11.1	0	0	0
4th premolar	3	1.5	27.3	1	0.5	11.1	4	2	50
1st molar	6	3	54.5	1	0.5	11.1	0	0	0
2nd molar	5	2.5	45.5	2	1	22.2	1	0.5	12.5
3rd molar	3	1.5	27.3	1	0.5	11.1	0	0	0
Mandible									
Articular condyle	1	0.5	9.1	0	0	0	0	0	0
Coronoid process	2	1	18.2	1	0.5	11.1	0	0	0
Ramus	4	2	36.4	2	1	22.2	2	1	25
Mandibular foramen	1	0.5	9.1	0	0	0	0	0	0
Lower border	0	0	0	1	0.5	11.1	1	0.5	12.5
Mental foramen	0	0	0	0	0	0	0	0	0
Diastema	1	0.5	9.1	0	0	0	0	0	0
Symphysis	0	0	0	1	0.5	11.1	0	0	0
Incisor/Canine	12	1.5	27.3	1	0.13	2.9	2	0.25	6.3
2nd premolar	8	4	72.7	0	0	0	1	0.5	12.5
3rd premolar	6	3	54.5	1	0.5	11.1	0	0	0
4th premolar	1	0.5	9.1	0	0	0	1	0.5	12.5
1st molar	1	0.5	9.1	1	0.5	11.1	3	1.5	37.5
2nd molar	6	3	54.5	0	0	0	2	1	50
3rd molar	2	1	18.2	1	0.5	11.1	0	0	0
Deciduous incisor/canine	0	0	0	0	0	0	0	0	0
Deciduous 2nd premolar	1	0.5	9.1	2	1	22.2	0	0	0
Deciduous 3rd premolar	1	0.5	9.1	2	1	22.2	0	0	0
Deciduous 4th premolar	2	1	18.2	1	0.5	11.1	0	0	0
Hyoid	3	1.5	27.3	0	0	0	0	0	0
Atlas									
Prezygopophysis	0	0	0	1	0.5	11.1	0	0	0
Postzygopophysis	1	0.5	9.1	0	0	0	0	0	0
Neural arch	0	0	0	0	0	0	0	0	0
Neural spine	0	0	0	0	0	0	0	0	0
Centrum	0	0	0	0	0	0	0	0	0
Axis									
Prezygopophysis	0	0	0	0	0	0	0	0	0
Postzygopophysis	0	0	0	0	0	0	0	0	0
Neural arch	0	0	0	0	0	0	0	0	0
Neural spine	0	0	0	0	0	0	0	0	0
Transverse process	0	0	0	0	0	0	0	0	0
Centrum	0	0	0	0	0	0	0	0	0
Odontoid	0	0	0	0	0	0	0	0	0

Cervical									
Prezygopophysis	1	0.08	1.5	2	0.29	6.4	0	0	0
Postzygopophysis	1	0.08	1.5	1	0.14	3.1	0	0	0
Neural arch	0	0	0	0	0	0	0	0	0
Neural spine	2	0.29	5.3	2	0.29	6.4	0	0	0
Transverse process	0	0	0	0	0	0	0	0	0
Centrum	0	0	0	0	0	0	0	0	0
Thoracic									
Prezygopophysis	1	0.04	0.7	1	0.04	0.9	0	0	0
Postzygopophysis	0	0	0	1	0.04	0.9	0	0	0
Neural arch	0	0	0	0	0	0	0	0	0
Neural spine	2	0.14	2.5	4	0.29	6.4	5	0.38	9.5
Transverse process	0	0	0	0	0	0	0	0	0
Centrum	1	0.07	1.3	2	0.14	3.1	0	0	0
Lumbar									
Prezygopophysis	1	0.08	1.5	0	0	0	0	0	0
Postzygopophysis	1	0.08	1.5	0	0	0	0	0	0
Neural arch	1	0.17	3.1	0	0	0	0	0	0
Neural spine	0	0	0	0	0	0	0	0	0
Transverse process	1	0.08	1.5	0	0	0	0	0	0
Centrum	0	0	0	0	0	0	0	0	0
Sacrum	1	1	18.2	0	0	0	1	1	25
Caudal	0	0	0	1	0.07	1.6	0	0	0
Scapula									
Glenoid cavity	2	1	18.2	0	0	0	2	1	25
Corocoid process	0	0	0	0	0	0	1	0.5	12.5
Acromion	0	0	0	0	0	0	0	0	0
Acromial spine	0	0	0	2	1	22.2	0	0	0
Neck	0	0	0	1	0.5	11.1	1	0.5	12.5
Blade	1	0.5	9.1	2	1	22.2	2	1	25
Superior border	0	0	0	0	0	0	0	0	0
Inferior border	2	1	18.2	0	0	0	0	0	0
Humerus									
Head	1	0.5	9.1	0	0	0	2	1	25
Lateral tuberosity	0	0	0	0	0	0	1	0.5	12.5
Medial tuberosity	0	0	0	0	0	0	1	0.5	12.5
Proximal shaft	4	2	36.4	1	0.5	11.1	3	1.5	37.5
Deltoid tuberosity	7	3.5	63.6	0	0	0	5	2.5	62.5
Teres major tuberosity	0	0	0	2	1	22.2	1	0.5	12.5
Teres minor tuberosity	0	0	0	0	0	0	0	0	0
Posterior lateral foramen	2	1	18.2	0	0	0	1	0.5	12.5
Olecranon fossa	3	1.5	27.3	0	0	0	1	0.5	12.5
Radial fossa	5	2.5	45.5	0	0	0	1	0.5	12.5
Lateral epicondyle	4	2	36.4	0	0	0	1	0.5	12.5
Medial epicondyle	6	3	54.5	0	0	0	1	0.5	12.5
Lateral condyle	3	1.5	27.3	0	0	0	0	0	0
Medial condyle	5	2.5	45.5	0	0	0	0	0	0
Distal Shaft	3	1.5	27.3	2	1	22.2	0	0	0
Radius									
Lateral glenoid cavity	2	1	18.2	1	0.5	11.1	3	1.5	37.5
Medial glenoid cavity	4	2	36.4	0	0	0	5	2.5	62.5
Radial tuberosity	0	0	0	0	0	0	0	0	0
Posterior lateral foramen	2	1	18.2	2	1	22.2	0	0	0
Proximal posterior shaft	5	2.5	45.5	1	0.5	11.1	2	1	25
Proximal anterior shaft	2	1	18.2	0	0	0	1	0.5	12.5
Distal posterior shaft	5	2.5	45.5	0	0	0	2	1	25
Distal anterior shaft	6	3	54.5	0	0	0	3	1.5	37.5
Radial carpal facet	7	3.5	63.6	5	2.5	55.6	5	2.5	62.5
Internal carpal facet	6	3	54.5	4	2	44.4	6	3	75

Ulna									
Olecranon process	2	1	18.2	1	0.5	11.1	0	0	0
Anconeal process	6	3	54.5	1	0.5	11.1	3	1.5	37.5
Semilunar notch	4	2	36.4	1	0.5	11.1	1	0.5	12.5
Coronoid process	1	0.5	9.1	1	0.5	11.1	0	0	0
Shaft	8	4	72.7	5	2.5	55.6	5	2.5	62.5
Styloid process	3	1.5	27.3	2	1	22.2	3	1.5	37.5
Radial carpal	6	3	54.5	2	1	22.2	3	1.5	37.5
Internal carpal	9	4.5	81.8	1	0.5	11.1	5	2.5	62.5
Ulnar carpal	9	4.5	81.8	2	1	22.2	5	2.5	62.5
Unciform carpal	7	3.5	63.6	1	0.5	11.1	5	2.5	62.5
Fused 2/3 carpal	6	3	54.5	3	1.5	33.3	1	0.5	12.5
Accessory carpal	2	1	18.2	1	0.5	11.1	0	0	0
Metacarpal									
Carpal 2/3 facet	11	5.5	100	1	0.5	11.1	2	1	25
Unciform carpal facet	10	5	90.9	2	1	22.2	1	0.5	12.5
Proximal anterior foramen	8	4	72.7	0	0	0	1	0.5	12.5
Proximal posterior foramen	8	4	72.7	0	0	0	0	0	0
Anterior shaft	5	2.5	45.5	0	0	0	0	0	0
Posterior shaft	1	0.5	9.1	0	0	0	0	0	0
Distal anterior foramen	1	0.5	9.1	0	0	0	0	0	0
Distal posterior foramen	1	0.5	9.1	0	0	0	0	0	0
Medial condyle	2	1	18.2	1	0.5	11.1	0	0	0
Lateral condyle	2	1	18.2	1	0.5	11.1	0	0	0
5th metacarpal	1	0.5	9.1	0	0	0	1	0.5	12.5
Innominate									
Ilium blade	1	0.5	9.1	0	0	0	0	0	0
Ilium shaft	2	1	18.2	0	0	0	0	0	0
Ilio-ischial border	1	0.5	9.1	0	0	0	0	0	0
Ischium shaft	0	0	0	0	0	0	0	0	0
Ischium blade	0	0	0	0	0	0	0	0	0
Ischial tuber	0	0	0	0	0	0	0	0	0
Pubis shaft	0	0	0	0	0	0	0	0	0
Pubic symphysis	0	0	0	0	0	0	0	0	0
Pubis acetabulum	1	0.5	9.1	2	1	22.2	0	0	0
Ilium acetabulum	1	0.5	9.1	1	0.5	11.1	0	0	0
Ischium acetabulum	2	1	18.2	0	0	0	1	0.5	12.5
Femur									
Head	3	1.5	27.3	1	0.5	11.1	2	1	25
Greater trochanter	0	0	0	0	0	0	0	0	0
Lesser trochanter	2	1	18.2	1	0.5	11.1	1	0.5	12.5
Anterior shaft	1	0.5	9.1	0	0	0	2	1	25
Posterior medial foramen	3	1.5	27.3	1	0.5	11.1	1	0.5	12.5
Linea aspera	4	2	36.4	0	0	0	2	1	25
Supracondyloid fossa	8	4	72.7	1	0.5	11.1	1	0.5	12.5
Trochlea	1	0.5	9.1	0	0	0	0	0	0
Medial condyle	0	0	0	0	0	0	1	0.5	12.5
Lateral condyle	0	0	0	0	0	0	1	0.5	12.5
Medial epicondyle	0	0	0	0	0	0	1	0.5	12.5
Patella	1	0.5	9.1	0	0	0	0	0	0
Tibia									
Medial condyle	1	0.5	9.1	0	0	0	1	0.5	12.5
Lateral condyle	1	0.5	9.1	0	0	0	0	0	0

Tibia continued									
Tibial tuberosity	2	1	18.2	0	0	0	0	0	0
Anterior crest	7	3.5	63.6	0	0	0	2	1	25
Posterior lateral foramen	7	3.5	63.6	3	1.5	33.3	8	4	100
Proximal posterior shaft	5	2.5	45.5	2	1	22.2	4	2	50
Distal posterior shaft	7	3.5	63.6	1	0.5	11.1	2	1	25
Distal anterior shaft	10	5	90.9	2	1	22.2	3	1.5	37.5
Medial groove	7	3.5	63.6	3	1.5	33.3	2	1	25
Leteral groove	6	3	54.5	3	1.5	33.3	2	1	25
Fibular facet	6	3	54.5	2	1	22.2	2	1	25
Lateral malleolus	11	5.5	100	4	2	44.4	8	4	100
Fused C/4 tarsal	5	2.5	45.5	1	0.5	11.1	6	3	75
Fused 2/3 tarsal	9	4.5	81.8	5	2.5	55.6	3	1.5	37.5
Calcaneus									
Epiphysis	0	0	0	0	0	0	0	0	0
Tuber calis	2	1	18.2	1	0.5	11.1	4	2	50
Tarsal C/4 facet	4	2	36.4	0	0	0	1	0.5	12.5
Fibular facet	4	2	36.4	0	0	0	1	0.5	12.5
Sustentaculum	4	2	36.4	1	0.5	11.1	1	0.5	12.5
Astragalus									
Proximal condyle	3	1.5	27.3	0	0	0	1	0.5	12.5
Distal condyle	3	1.5	27.3	0	0	0	2	1	50
1st tarsal	1	0.5	9.1	0	0	0	1	0.5	12.5
Metatarsal									
Tarsal C/4 facet	7	3.5	63.6	2	1	22.2	4	2	50
Tarsal 2/3 facet	4	2	36.4	3	1.5	33.3	2	1	25
Proximal anterior foramen	3	1.5	27.3	1	0.5	11.1	1	0.5	12.5
Proximal posterior foramen	5	2.5	45.5	0	0	0	1	0.5	12.5
Anterior shaft	3	1.5	27.3	0	0	0	0	0	0
Posterior shaft	3	1.5	27.3	0	0	0	0	0	0
Distal anterior foramen	2	1	18.2	1	0.5	11.1	0	0	0
Distal posterior foramen	2	1	18.2	1	0.5	11.1	0	0	0
Medial condyle	2	1	18.2	1	0.5	11.1	0	0	0
Lateral condyle	2	1	18.2	1	0.5	11.1	0	0	0
2nd metatarsal	2	1	18.2	0	0	0	0	0	0
5th metatarsal	1	0.5	9.1	0	0	0	0	0	0
1st phalanx									
Proximal	18	2.25	40.9	10	1.25	27.8	7	0.88	22
Distal	18	2.25	40.9	9	1.13	25.1	7	0.88	22
2nd phalanx									
Proximal	18	2.25	40.9	7	0.88	19.6	10	1.25	31.3
Distal	20	2.5	45.5	6	0.75	16.7	10	1.25	31.3
3rd Phalanx									
Proximal	20	2.5	45.5	1	0.13	2.9	3	0.38	9.5
Distal	10	1.25	22.7	1	0.13	2.9	1	0.13	3.3
Proximal lateral sesamoid	8	1	18.2	3	0.38	8.4	4	0.5	12.5
Proximal medial sesamoid	6	0.75	13.6	1	0.13	2.9	2	0.25	6.3
Distal Inferior sesamoid	10	1.25	22.7	0	0	0	4	0.5	12.5

Table 2. Animal Units by Landmark for Levels Four, Five, and Six of the Thundercloud Site (FbNp-25).

	C4			C5			C6		
	Total MNE	Total MAU	%MAU	Total MNE	Total MAU	%MAU	Total MNE	Total MAU	%MAU
Cranium									
Frontal	0	0	0	1	0.5	7.1	1	0.5	25
Horn core	0	0	0	0	0	0	1	0.5	25
Parietal	0	0	0	1	0.5	7.1	1	0.5	25
Occipital	1	1	66.7	2	2	28.6	1	1	50
Occipital condyle	0	0	0	0	0	0	0	0	0
Squamous temporal	2	1	66.7	0	0	0	2	1	50
Petrous temporal	3	1.5	100	9	4.5	64.3	2	1	50
Zygomatic temporal	0	0	0	0	0	0	0	0	0
External auditory meatus	2	1	66.7	0	0	0	0	0	0
Zygomatic	1	0.5	33.3	0	0	0	1	0.5	25
Nasal	0	0	0	0	0	0	2	1	50
Maxilla	0	0	0	0	0	0	0	0	0
Premaxilla	0	0	0	1	0.5	7.1	0	0	0
2nd premolar	0	0	0	5	2.5	35.7	0	0	0
3rd premolar	1	0.5	33.3	2	1	14.3	0	0	0
4th premolar	0	0	0	5	2.5	35.7	0	0	0
1st molar	1	0.5	33.3	6	3	42.9	0	0	0
2nd molar	1	0.5	33.3	7	3.5	50	0	0	0
3rd molar	1	0.5	33.3	4	2	28.6	1	0.5	25
Mandible									
Articular condyle	0	0	0	5	2.5	35.7	2	1	50
Coronoid process	0	0	0	5	2.5	35.7	3	1.5	75
Ramus	1	0.5	33.3	12	6	85.7	0	0	0
Mandibular foramen	0	0	0	3	1.5	21.4	0	0	0
Lower border	0	0	0	2	1	14.3	0	0	0
Mental foramen	0	0	0	2	1	14.3	0	0	0
Diastema	0	0	0	6	3	42.9	0	0	0
Symphysis	0	0	0	6	3	42.9	1	0.5	25
Incisor/Canine	3	0.38	25.3	22	2.75	39.3	9	1.13	56.5
2nd premolar	0	0	0	4	2	28.6	0	0	0
3rd premolar	0	0	0	6	3	42.9	0	0	0
4th premolar	0	0	0	3	1.5	21.4	0	0	0
1st molar	0	0	0	4	2	28.6	1	0.5	25
2nd molar	0	0	0	3	1.5	21.4	1	0.5	25
3rd molar	0	0	0	4	2	28.6	0	0	0
Deciduous incisor/canine	0	0	0	0	0	0	0	0	0
Deciduous 2nd premolar	0	0	0	0	0	0	1	0.5	25
Deciduous 3rd premolar	0	0	0	0	0	0	1	0.5	25
Deciduous 4th premolar	0	0	0	1	0.5	7.1	1	0.5	25
Hyoid	0	0	0	5	2.5	35.7	0	0	0
Atlas									
Prezygopophysis	0	0	0	1	0.5	7.1	0	0	0
Postzygopophysis	0	0	0	0	0	0	0	0	0
Neural arch	0	0	0	0	0	0	0	0	0
Neural spine	0	0	0	0	0	0	0	0	0
Centrum	0	0	0	0	0	0	0	0	0
Axis									
Prezygopophysis	0	0	0	2	1	14.3	0	0	0
Postzygopophysis	0	0	0	0	0	0	0	0	0
Neural arch	0	0	0	0	0	0	0	0	0
Neural spine	0	0	0	0	0	0	0	0	0
Transverse process	0	0	0	0	0	0	0	0	0
Centrum	0	0	0	0	0	0	0	0	0
Odontoid	0	0	0	1	1	14.3	0	0	0

Cervical									
Prezygopophysis	1	0.07	4.7	3	0.21	3	0	0	0
Postzygopophysis	1	0.07	4.7	4	0.29	4.1	0	0	0
Neural arch	0	0	0	2	0.29	4.1	0	0	0
Neural spine	0	0	0	2	0.29	4.1	0	0	0
Transverse process	0	0	0	0	0	0	0	0	0
Centrum	0	0	0	0	0	0	0	0	0
Thoracic									
Prezygopophysis	0	0	0	0	0	0	3	0.11	5.5
Postzygopophysis	0	0	0	1	0.04	0.6	3	0.11	5.5
Neural arch	0	0	0	0	0	0	2	0.14	7
Neural spine	2	0.14	9.3	9	0.64	9.1	6	0.43	21.5
Transverse process	0	0	0	0	0	0	2	0.07	3.5
Centrum	0	0	0	0	0	0	3	0.21	10.5
Lumbar									
Prezygopophysis	1	0.08	5.3	2	0.17	2.4	4	0.33	16.5
Postzygopophysis	0	0	0	2	0.17	2.4	2	0.17	8.5
Neural arch	0	0	0	2	0.33	4.7	1	0.17	8.5
Neural spine	1	0.17	11.3	0	0	0	1	0.17	8.5
Transverse process	1	0.08	5.3	2	0.17	2.4	2	0.17	8.5
Centrum	1	0.17	11.3	3	0.5	7.1	1	0.17	8.5
Sacrum	0	0	0	3	3	42.9	0	0	0
Caudal	0	0	0	1	0.7	10	0	0	0
Scapula									
Glenoid cavity	0	0	0	7	3.5	50	0	0	0
Corocoid process	0	0	0	5	2.5	35.7	0	0	0
Acromion	0	0	0	1	0.5	7.1	2	1	50
Acromial spine	0	0	0	1	0.5	7.1	1	0.5	25
Neck	0	0	0	5	2.5	35.7	0	0	0
Blade	0	0	0	3	1.5	21.4	1	0.5	25
Superior border	0	0	0	3	1.5	21.4	1	0.5	25
Inferior border	1	0.5	33.3	3	1.5	21.4	1	0.5	25
Humerus									
Head	0	0	0	2	1	14.3	0	0	0
Lateral tuberosity	0	0	0	0	0	0	0	0	0
Medial tuberosity	0	0	0	0	0	0	0	0	0
Proximal shaft	0	0	0	6	3	42.9	1	0.5	25
Deltoid tuberosity	0	0	0	4	2	28.6	3	1.5	75
Teres major tuberosity	0	0	0	3	1.5	21.4	1	0.5	25
Teres minor tuberosity	0	0	0	0	0	0	0	0	0
Posterior lateral foramen	0	0	0	2	1	14.3	1	0.5	25
Olecranon fossa	1	0.5	33.3	5	2.5	35.7	1	0.5	25
Radial fossa	0	0	0	3	1.5	21.4	1	0.5	25
Lateral epicondyle	0	0	0	5	2.5	35.7	1	0.5	25
Medial epicondyle	0	0	0	4	2	28.6	1	0.5	25
Lateral condyle	0	0	0	3	1.5	21.4	2	1	50
Medial condyle	1	0.5	33.3	5	2.5	35.7	3	1.5	75
Distal Shaft	0	0	0	7	3.5	50	0	0	0
Radius									
Lateral glenoid cavity	2	1	66.7	3	1.5	21.4	0	0	0
Medial glenoid cavity	1	0.5	33.3	3	1.5	21.4	0	0	0
Radial tuberosity	1	0.5	33.3	2	1	14.3	0	0	0
Posterior lateral foramen	1	0.5	33.3	2	1	14.3	0	0	0
Proximal posterior shaft	1	0.5	33.3	4	2	28.6	0	0	0
Proximal anterior shaft	0	0	0	0	0	0	0	0	0
Distal posterior shaft	0	0	0	2	1	14.3	0	0	0
Distal anterior shaft	0	0	0	2	1	14.3	0	0	0
Radial carpal facet	0	0	0	6	3	42.9	0	0	0
Internal carpal facet	0	0	0	7	3.5	50	0	0	0

Ulna									
Olecranon process	0	0	0	1	0.5	7.1	0	0	0
Anconeal process	1	0.5	33.3	3	1.5	21.4	0	0	0
Semilunar notch	1	0.5	33.3	3	1.5	21.4	0	0	0
Coronoid process	1	0.5	33.3	4	2	28.6	0	0	0
Shaft	0	0	0	8	4	57.1	2	1	50
Styloid process	1	0.5	33.3	2	1	14.3	0	0	0
Radial carpal	0	0	0	8	4	57.1	0	0	0
Internal carpal	1	0.5	33.3	9	4.5	64.3	0	0	0
Ulnar carpal	1	0.5	33.3	7	3.5	50	1	0.5	25
Unciform carpal	1	0.5	33.3	5	2.5	35.7	1	0.5	25
Fused 2/3 carpal	2	1	66.7	8	4	57.1	0	0	0
Accessory carpal	2	1	66.7	3	1.5	21.4	0	0	0
Metacarpal									
Carpal 2/3 facet	2	1	66.7	6	3	42.9	1	0.5	25
Unciform carpal facet	1	0.5	33.3	5	2.5	35.7	3	1.5	75
Proximal anterior foramen	1	0.5	33.3	5	2.5	35.7	2	1	50
Proximal posterior foramen	1	0.5	33.3	3	1.5	21.4	3	1.5	75
Anterior shaft	1	0.5	33.3	1	0.5	7.1	3	1.5	75
Posterior shaft	0	0	0	0	0	0	2	1	50
Distal anterior foramen	1	0.5	33.3	5	2.5	35.7	2	1	50
Distal posterior foramen	1	0.5	33.3	6	3	42.9	2	1	50
Medial condyle	1	0.5	33.3	8	4	57.1	3	1.5	75
Lateral condyle	1	0.5	33.3	6	3	42.9	3	1.5	75
5th metacarpal	1	0.5	33.3	1	0.5	7.1	1	0.5	25
Innominate									
Ilium blade	2	1	66.7	4	2	28.6	3	1.5	75
Ilium shaft	1	0.5	33.3	3	1.5	21.4	1	0.5	25
Ilio-ischial border	0	0	0	1	0.5	7.1	0	0	0
Ischium shaft	0	0	0	4	2	28.6	0	0	0
Ischium blade	1	0.5	33.3	1	0.5	7.1	1	0.5	25
Ischial tuber	0	0	0	0	0	0	0	0	0
Pubis shaft	0	0	0	2	1	14.3	0	0	0
Pubic symphysis	0	0	0	0	0	0	0	0	0
Pubis acetabulum	1	0.5	33.3	3	1.5	21.4	3	1.5	75
Ilium acetabulum	1	0.5	33.3	2	1	14.3	2	1	50
Ischium acetabulum	2	1	66.7	5	2.5	35.7	1	0.5	25
Femur									
Head	0	0	0	0	0	0	0	0	0
Greater trochanter	0	0	0	0	0	0	0	0	0
Lesser trochanter	0	0	0	3	1.5	21.4	1	0.5	25
Anterior shaft	1	0.5	33.3	5	2.5	35.7	1	0.5	25
Posterior medial foramen	1	0.5	33.3	5	2.5	35.7	0	0	0
Linea aspera	2	1	66.7	12	6	85.7	0	0	0
Supracondyloid fossa	3	1.5	100	8	4	57.1	0	0	0
Trochlea	0	0	0	0	0	0	0	0	0
Medial condyle	1	0.5	33.3	1	0.5	7.1	0	0	0
Lateral condyle	1	0.5	33.3	1	0.5	7.1	0	0	0
Medial epicondyle	1	0.5	33.3	2	1	14.3	0	0	0
Patella	0	0	0	2	1	14.3	1	0.5	25
Tibia									
Medial condyle	0	0	0	1	0.5	7.1	0	0	0
Lateral condyle	0	0	0	2	1	14.3	0	0	0
Tibial tuberosity	0	0	0	7	3.5	50	1	0.5	25

Tibia continued									
Anterior crest	0	0	0	12	6	85.7	3	1.5	75
Posterior lateral foramen	0	0	0	3	1.5	21.4	2	1	50
Proximal posterior shaft	1	0.5	33.3	11	5.5	78.6	2	1	50
Distal posterior shaft	0	0	0	8	4	57.1	2	1	50
Distal anterior shaft	2	1	66.7	3	1.5	21.4	3	1.5	75
Medial groove	1	0.5	33.3	12	6	85.7	1	0.5	25
Leteral groove	1	0.5	33.3	10	5	71.4	1	0.5	25
Fibular facet	1	0.5	33.3	9	4.5	64.3	1	0.5	25
Lateral malleolus	2	1	66.7	14	7	100	3	1.5	75
Fused C/4 tarsal	2	1	66.7	7	3.5	50	3	1.5	75
Fused 2/3 tarsal	3	1.5	100	4	2	28.6	4	2	100
Calcaneus									
Epiphysis	0	0	0	2	1	14.3	0	0	0
Tuber calis	1	0.5	33.3	4	2	28.6	2	1	50
Tarsal C/4 facet	0	0	0	6	3	42.9	2	1	50
Fibular facet	1	0.5	33.3	9	4.5	64.3	3	1.5	75
Sustentaculum	0	0	0	6	3	42.9	2	1	50
Astragalus									
Proximal condyle	0	0	0	9	4.5	64.3	0	0	0
Distal condyle	0	0	0	9	4.5	64.3	0	0	0
1st tarsal	1	0.5	33.3	3	1.5	21.4	1	0.5	25
Metatarsal									
Tarsal C/4 facet	2	1	66.7	8	4	57.1	2	1	50
Tarsal 2/3 facet	2	1	66.7	9	4.5	64.3	2	1	50
Proximal anterior foramen	1	0.5	33.3	5	2.5	35.7	1	0.5	25
Proximal posterior foramen	1	0.5	33.3	7	3.5	50	0	0	0
Anterior shaft	1	0.5	33.3	10	5	71.4	1	0.5	25
Posterior shaft	0	0	0	5	2.5	35.7	0	0	0
Distal anterior foramen	0	0	0	7	3.5	50	0	0	0
Distal posterior foramen	0	0	0	5	2.5	35.7	0	0	0
Medial condyle	0	0	0	5	2.5	35.7	0	0	0
Lateral condyle	0	0	0	5	2.5	35.7	0	0	0
2nd metatarsal	0	0	0	0	0	0	0	0	0
5th metatarsal	0	0	0	0	0	0	0	0	0
1st phalanx									
Proximal	5	0.63	42	19	2.38	34	6	0.75	37.5
Distal	5	0.63	42	18	2.25	32.1	7	0.88	44
2nd phalanx									
Proximal	3	0.38	25.3	26	3.25	46.4	6	0.75	37.5
Distal	2	0.25	16.7	22	2.75	39.3	6	0.75	37.5
3rd Phalanx									
Proximal	3	0.38	25.3	20	2.5	35.7	5	0.63	31.5
Distal	1	0.13	8.7	8	1	14.3	4	0.5	25
Proximal lateral sesamoid	2	0.25	16.7	12	1.5	21.4	4	0.5	25
Proximal medial sesamoid	2	0.25	16.7	7	0.88	12.6	3	0.38	19
Distal Inferior sesamoid	0	0	0	6	0.75	10.7	0	0	0

Appendix III

Faunal and Floral Distribution Maps

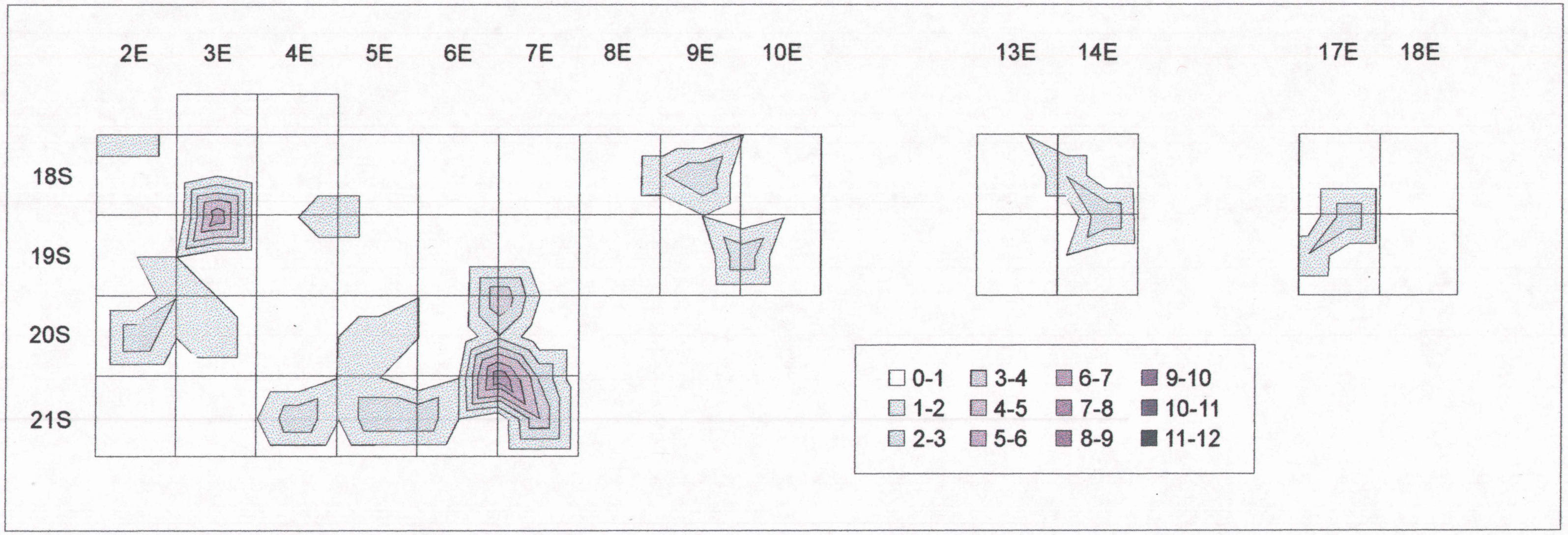

Figure 1. Distribution of bison cranial elements in level one at the Thundercloud site.

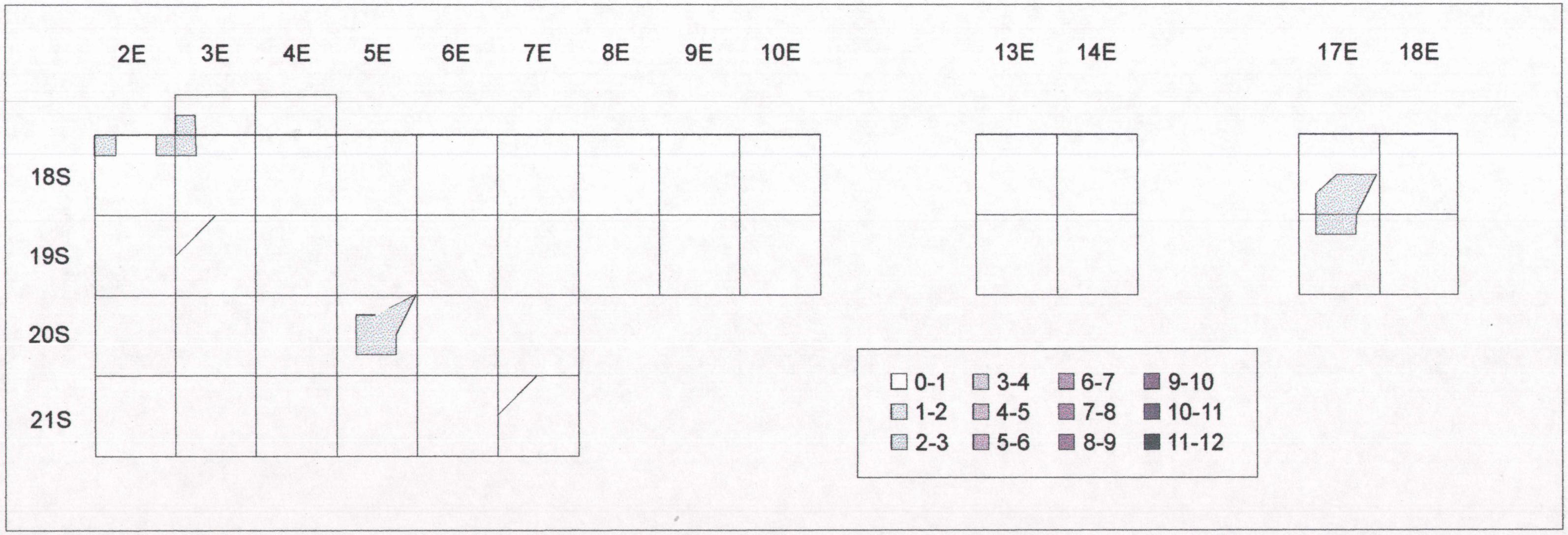

Figure 2. Distribution of bison vertebral elements in level one at the Thundercloud site.

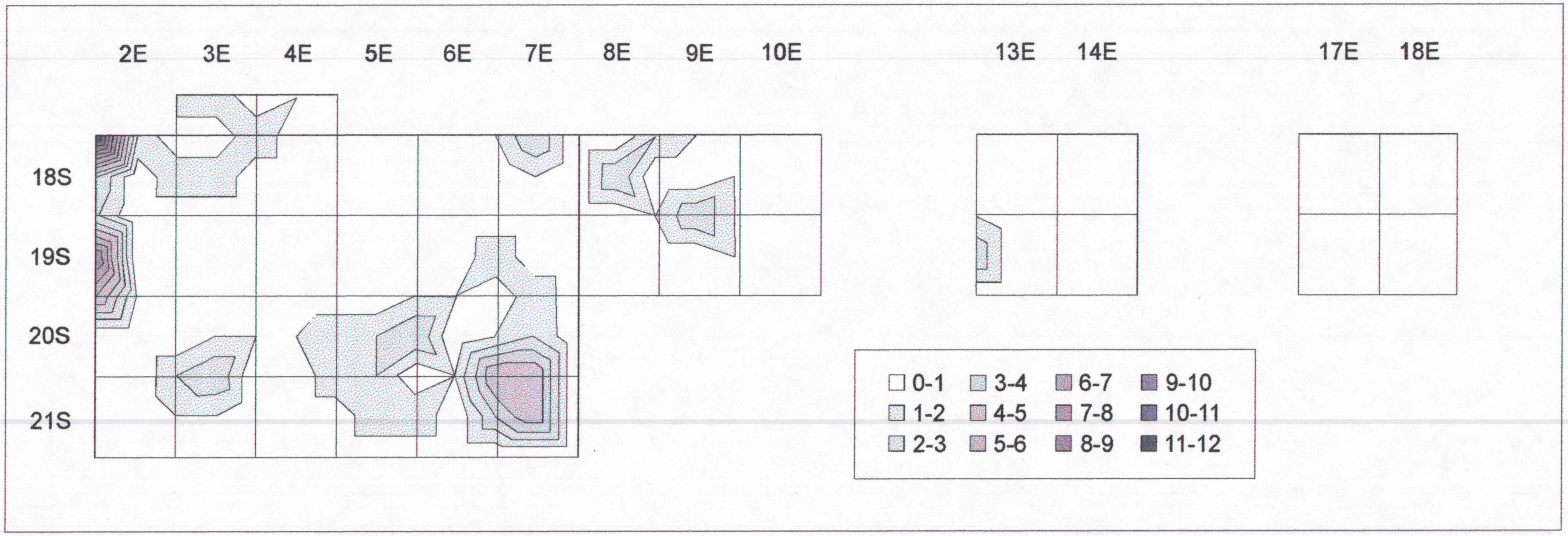

Figure 3. Distribution of bison forelimb elements from level one at the Thundercloud site.

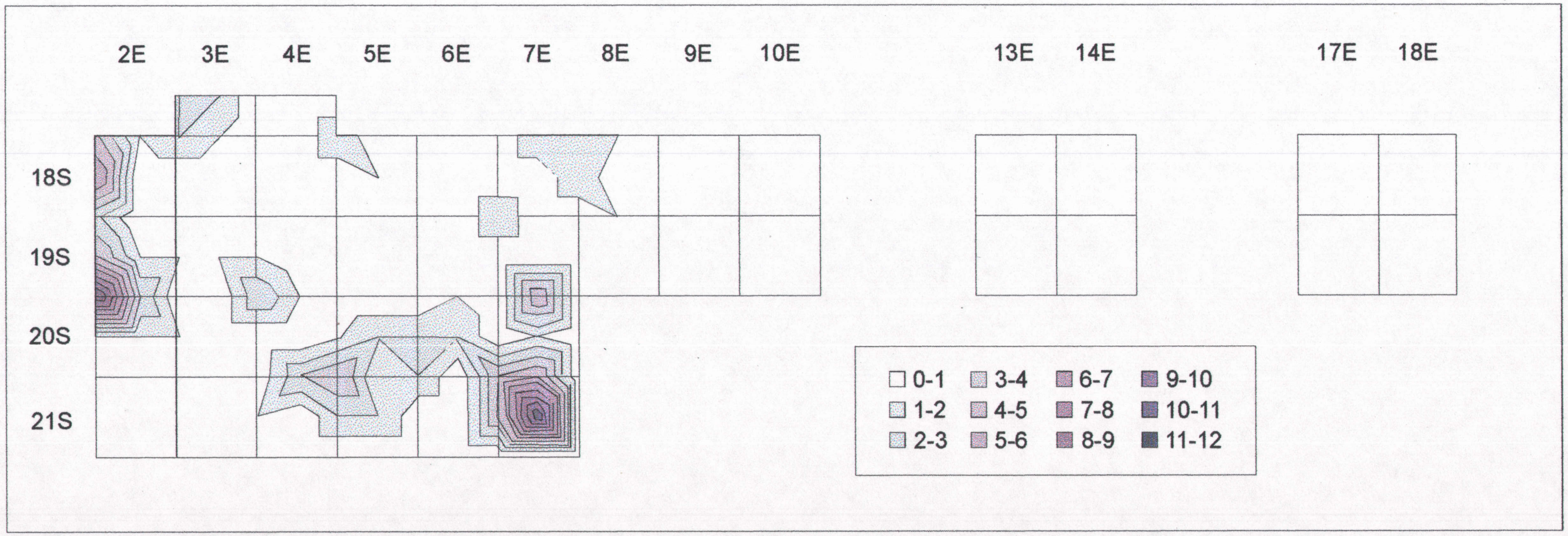

Figure 4. Distribution of bison hindlimb elements in level one at the Thundercloud site.

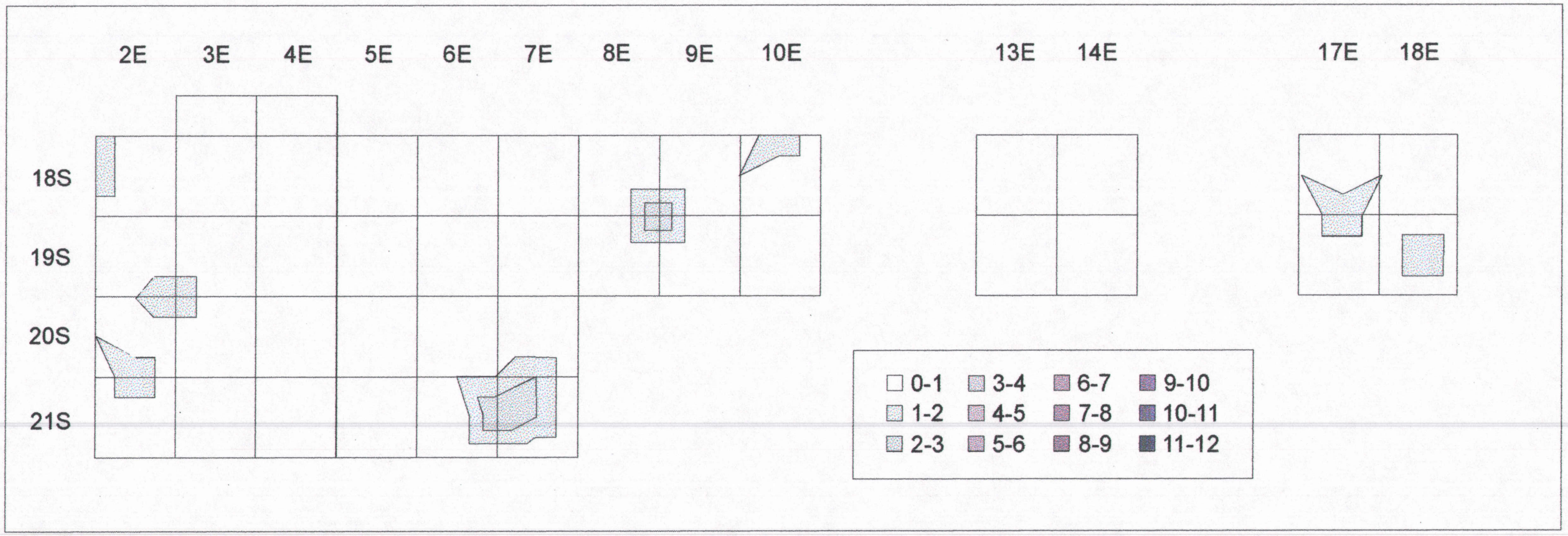

Figure 5. Distribution of bison phalanges from level one at the Thundercloud site.

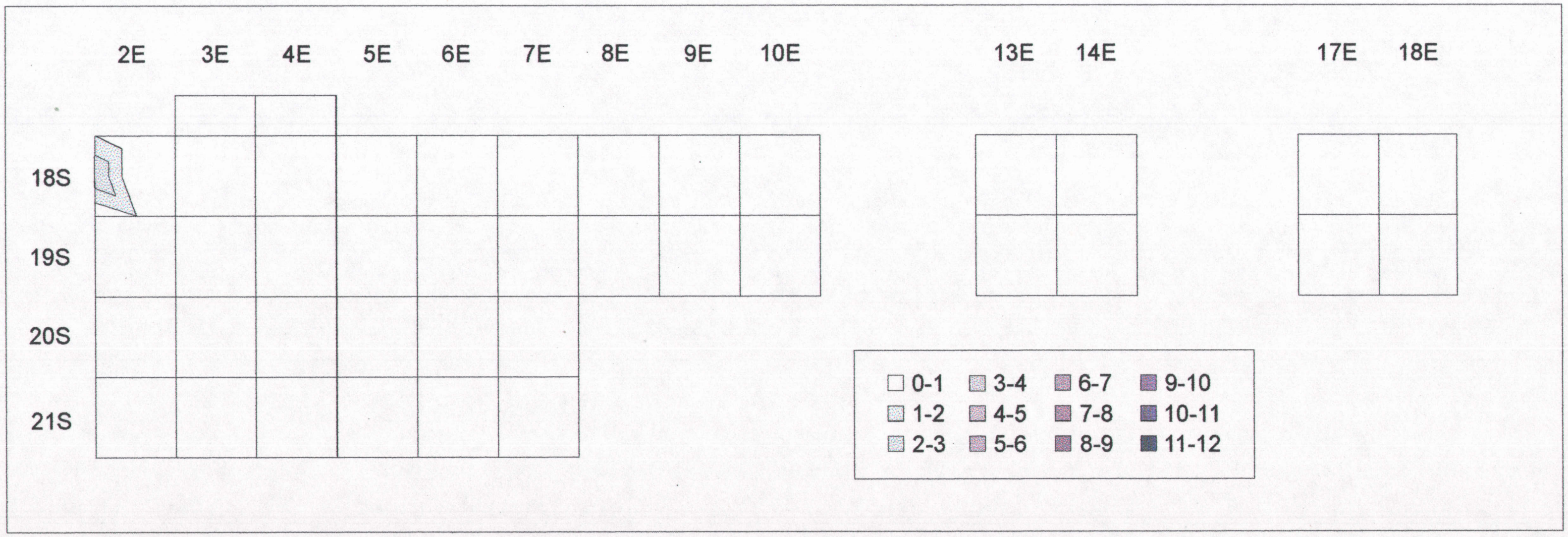

Figure 6. Distribution of all pronghorn elements from level one at the Thundercloud site.

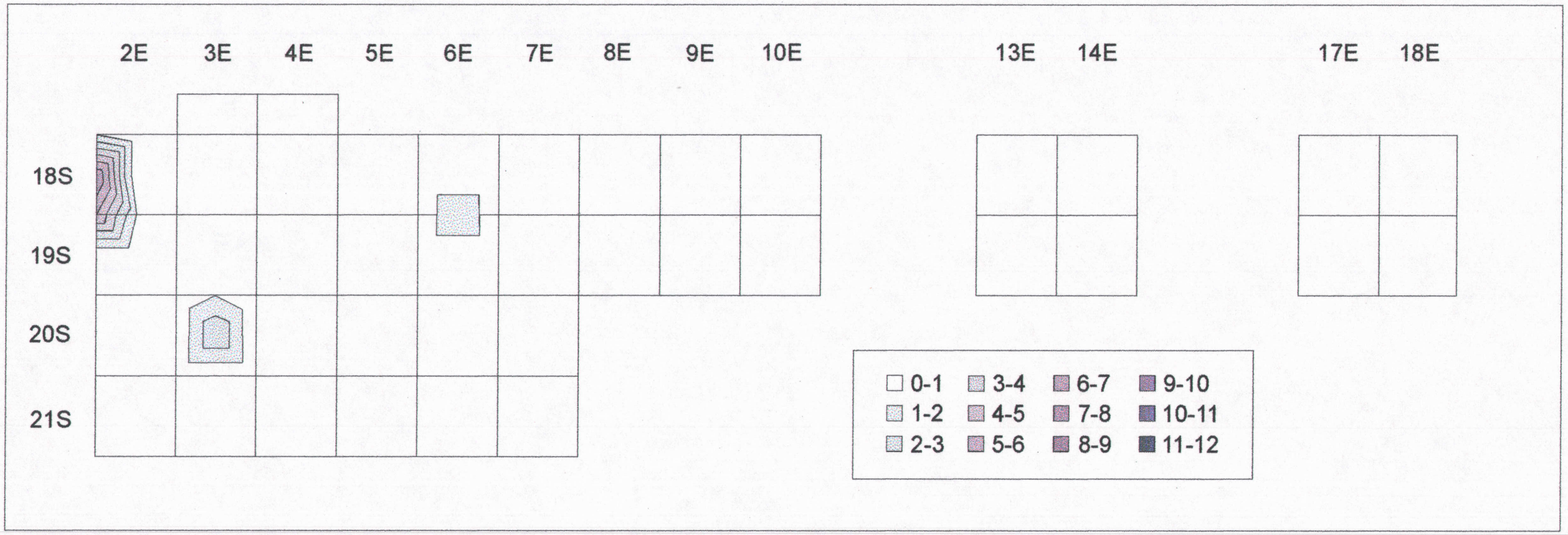

Figure 7. Distribution of all canid elements from level one at the Thundercloud site.

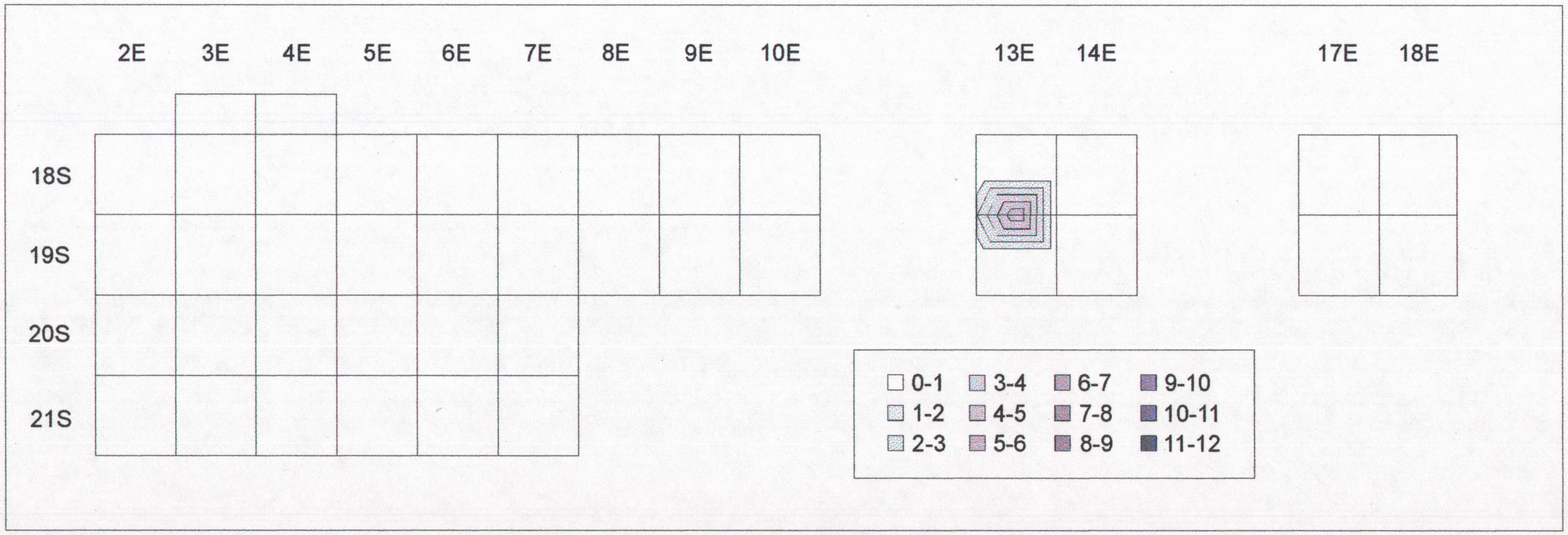

Figure 8. Distribution of all rodent elements from level one at the Thundercloud site.

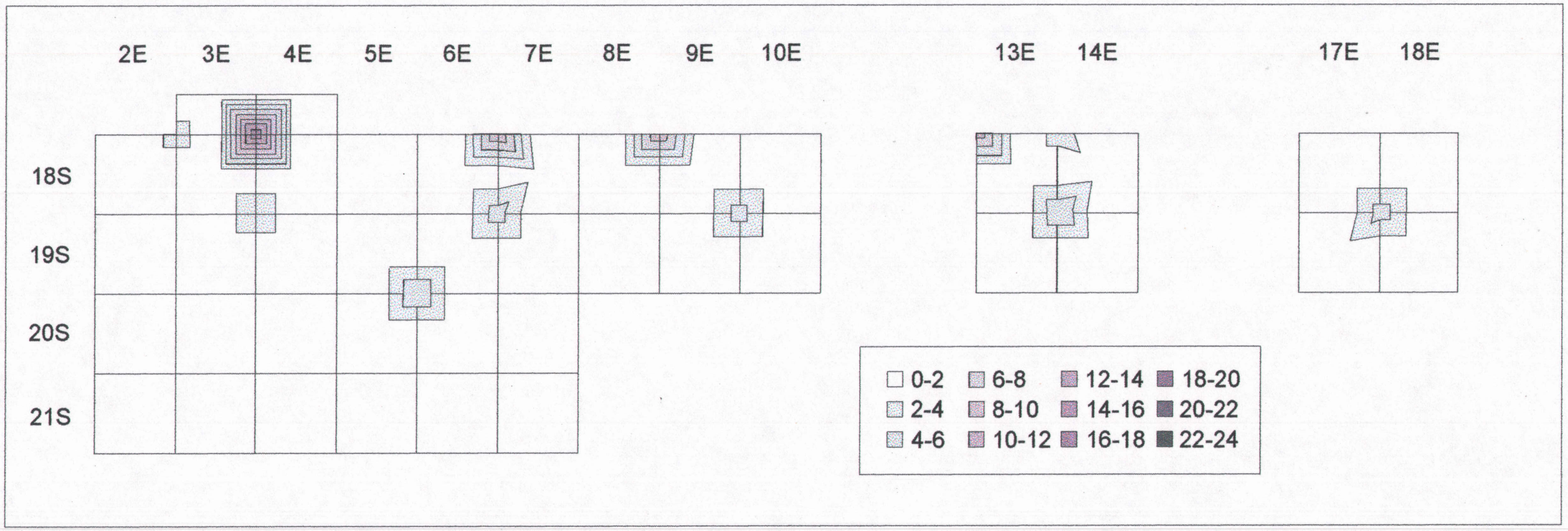

Figure 9. Distribution of seeds from level one at the Thundercloud site.

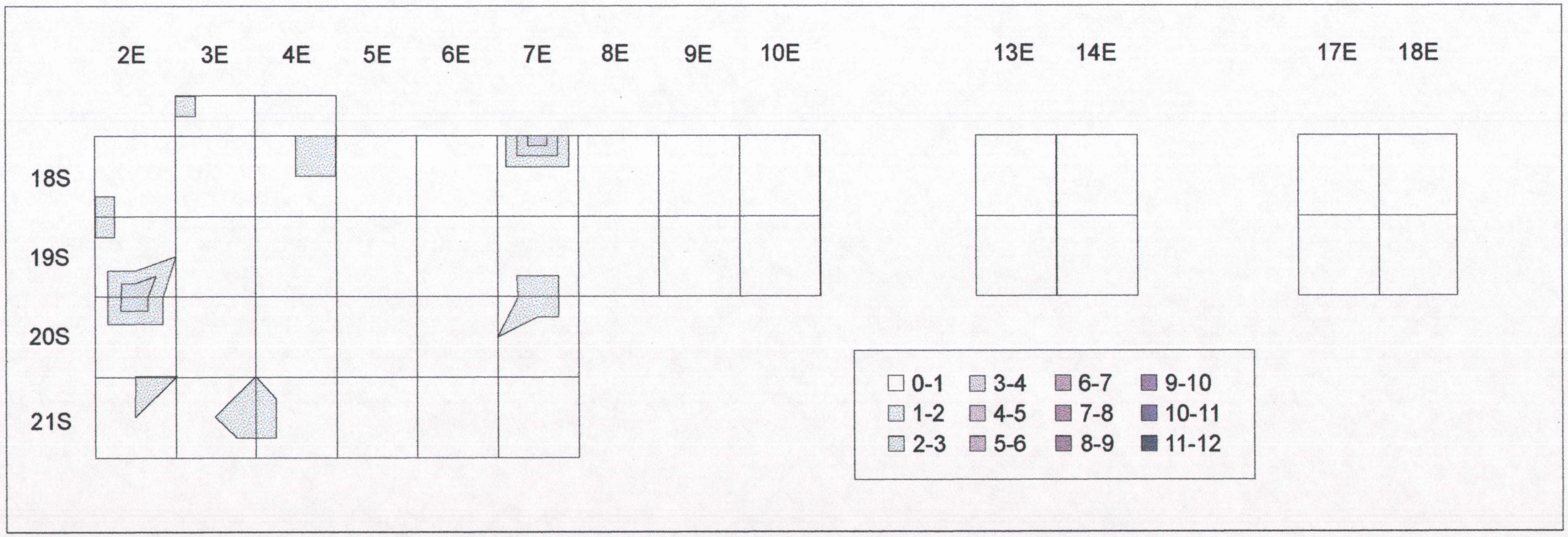

Figure 10. Distribution of bison cranial elements from level two at the Thundercloud site.

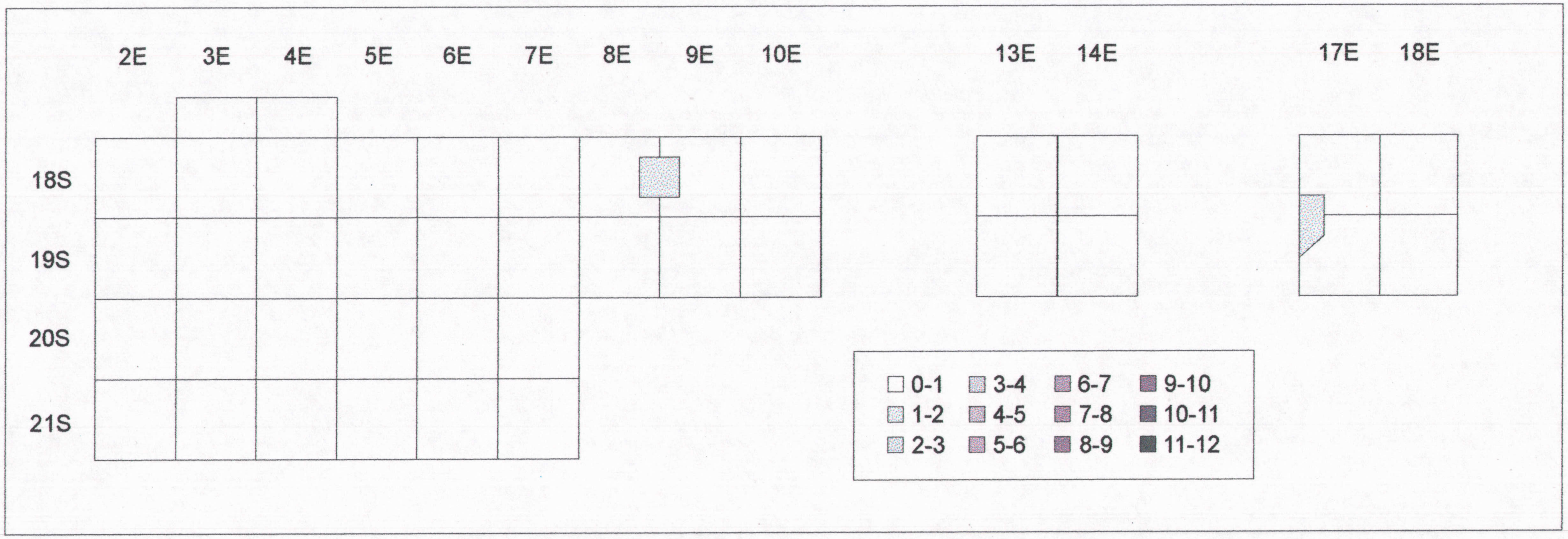

Figure 11. Distribution of bison vertebral elements from level two at the Thundercloud site.

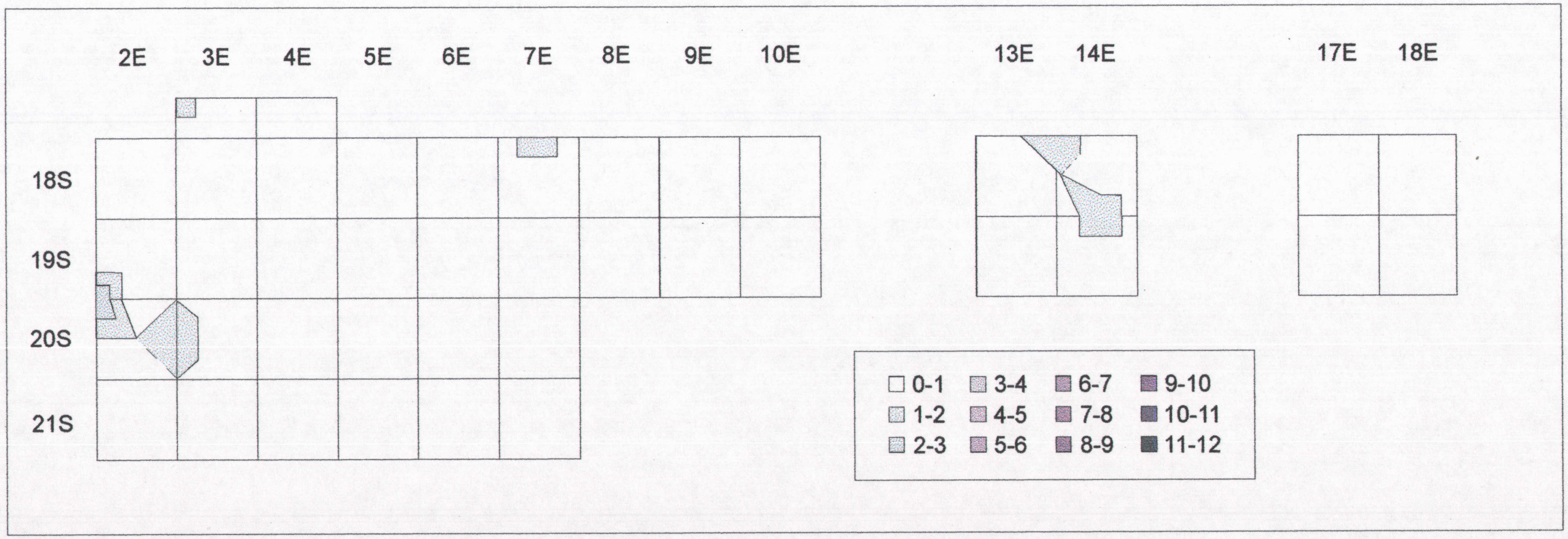

Figure 12. Distribution of bison forelimb elements from level two at the Thundercloud site.

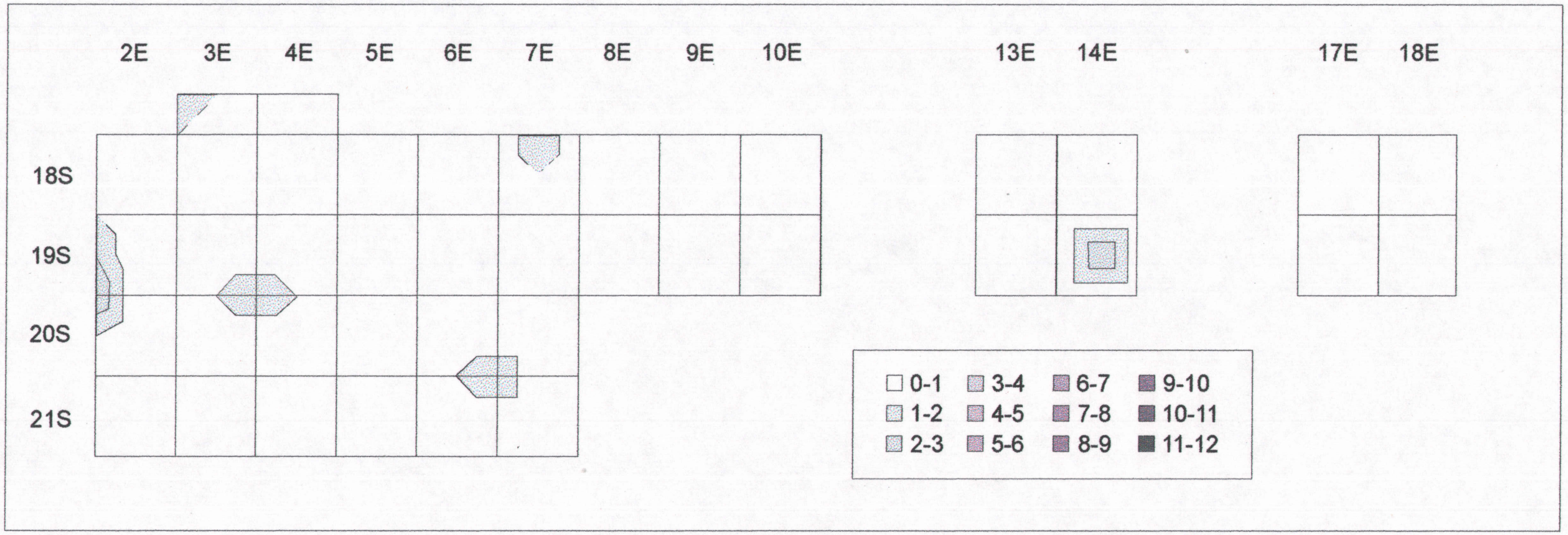

Figure 13. Distribution of bison hindlimb elements from level two at the Thundercloud site.

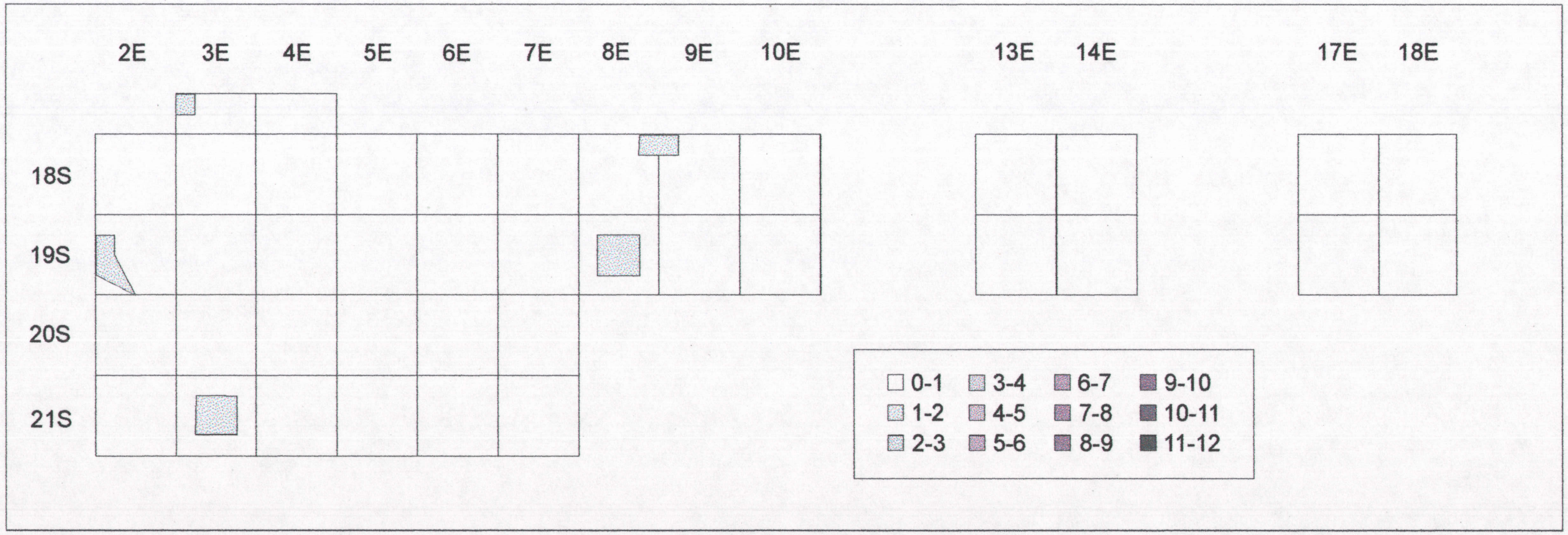

Figure 14. Distribution of bison phalanges from level two at the Thundercloud site.

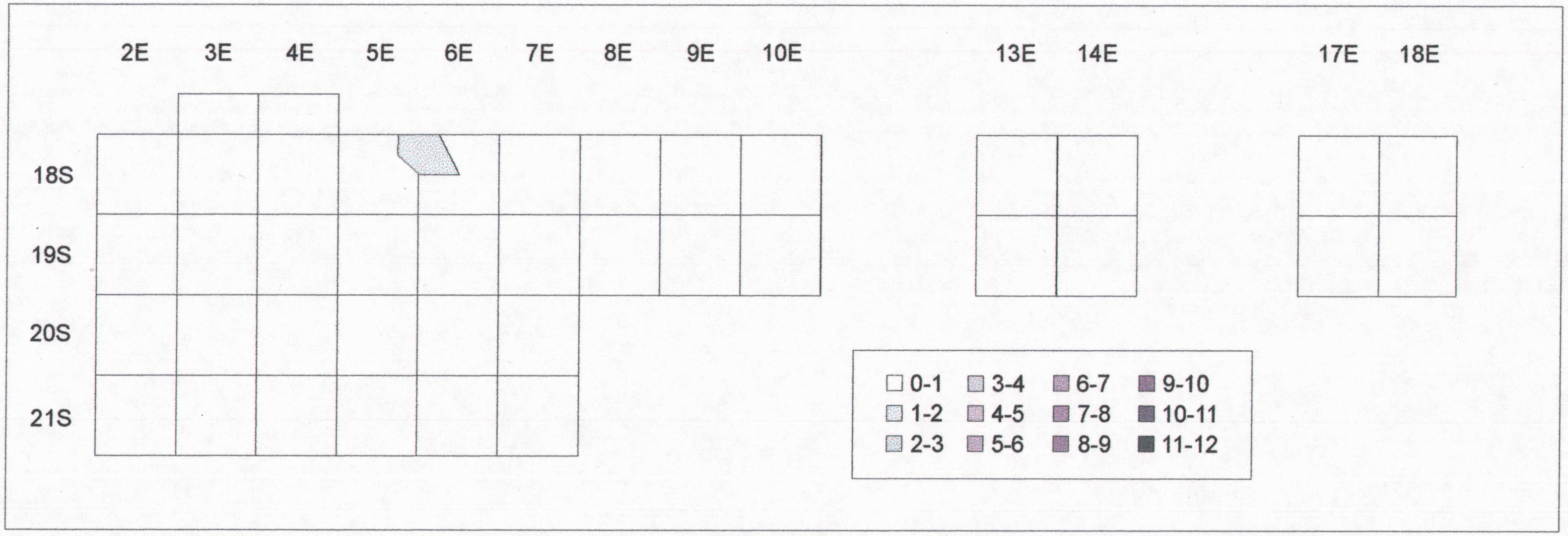

Figure 15. Distribution of all canid elements from level two at the Thundercloud site.

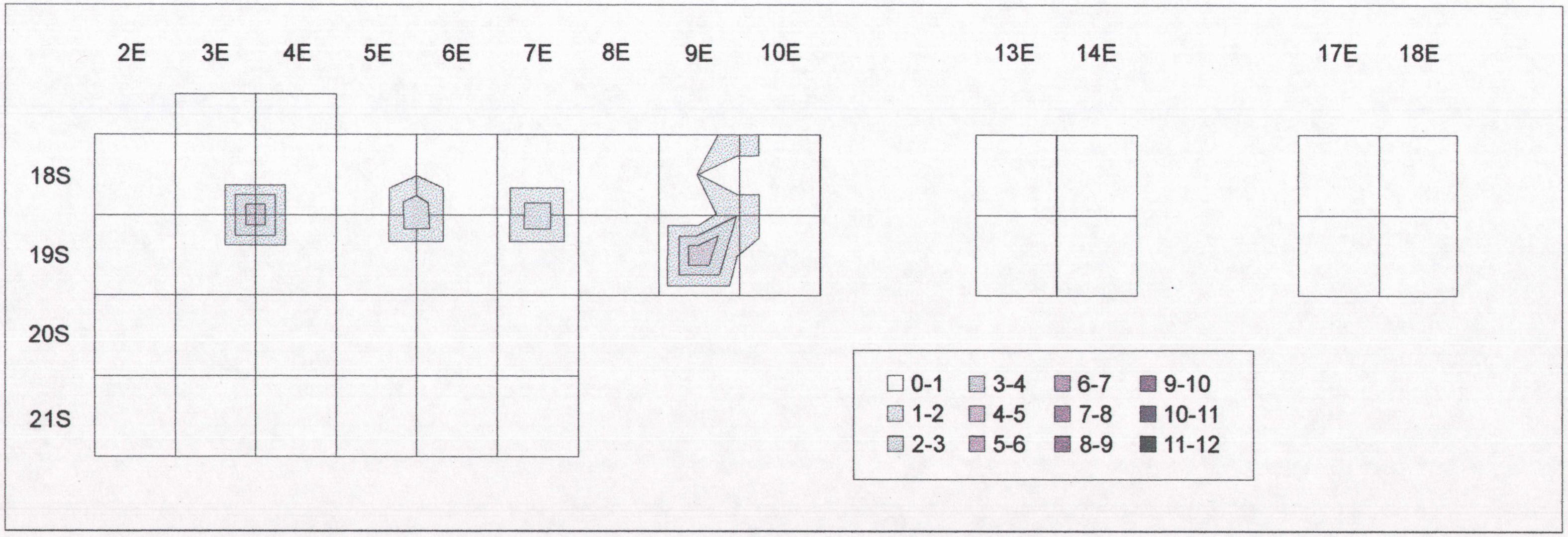

Figure 16. Distribution of all rodent elements from level two at the Thundercloud site.

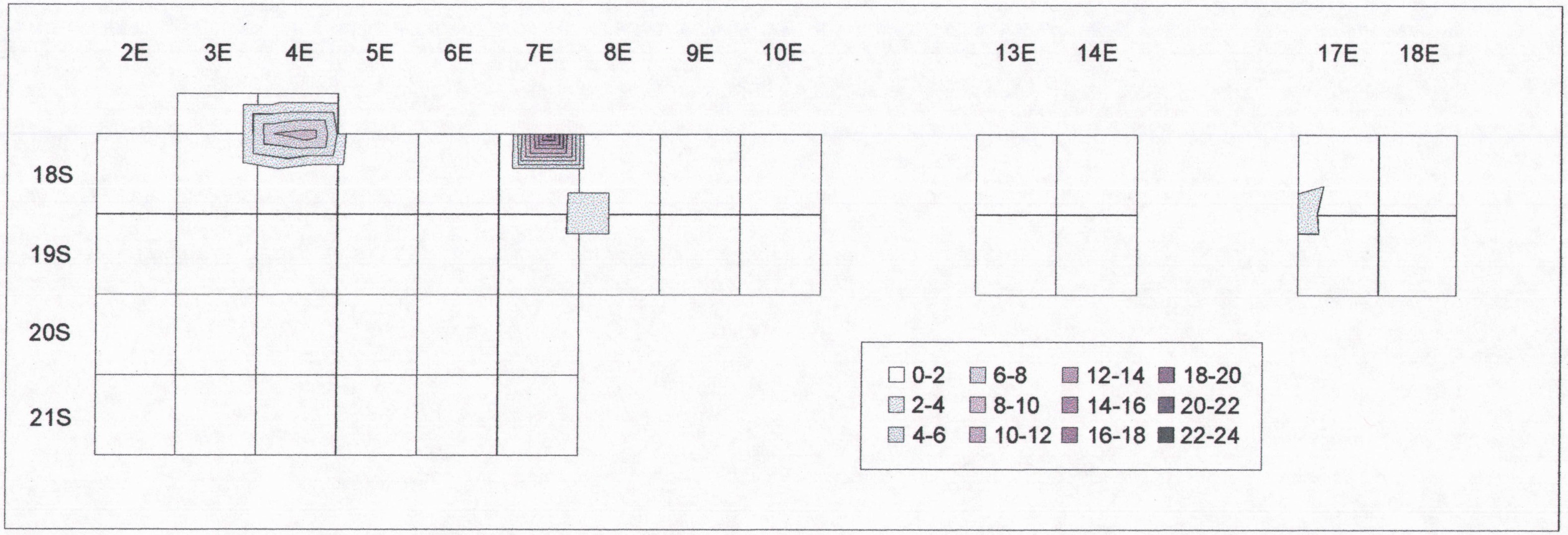

Figure 17. Distribution of seeds from level two at the Thundercloud site.

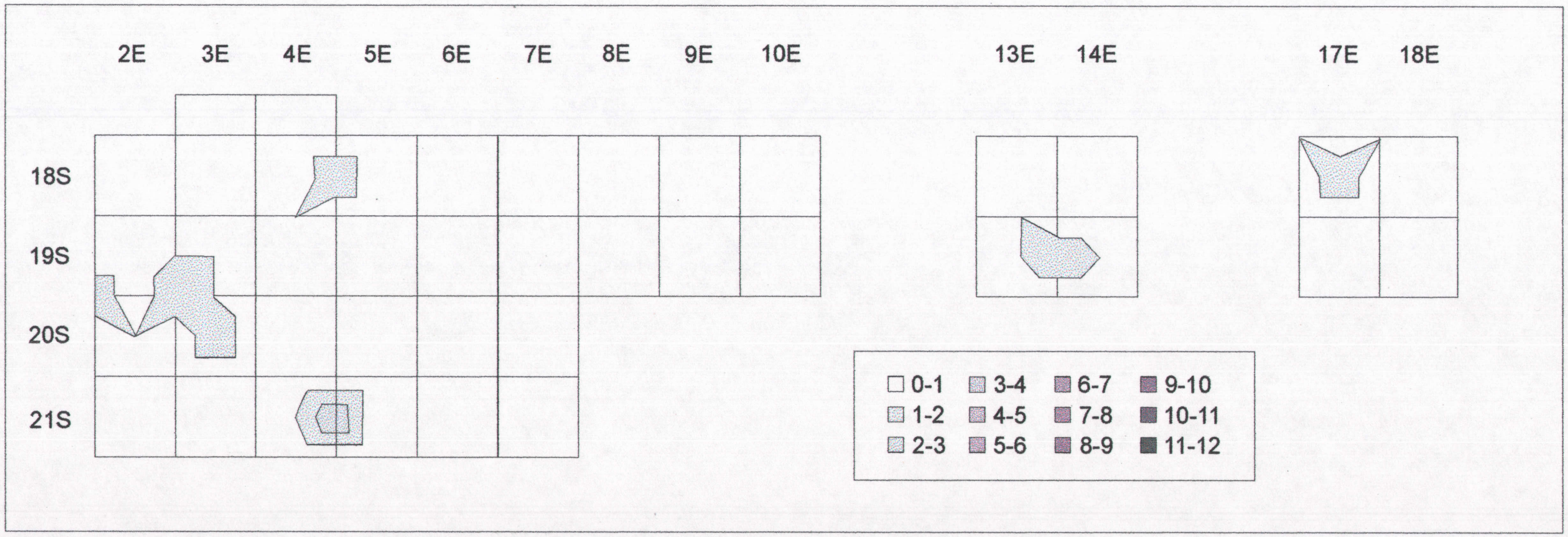

Figure 18. Distribution of bison cranial elements from level three at the Thundercloud site.

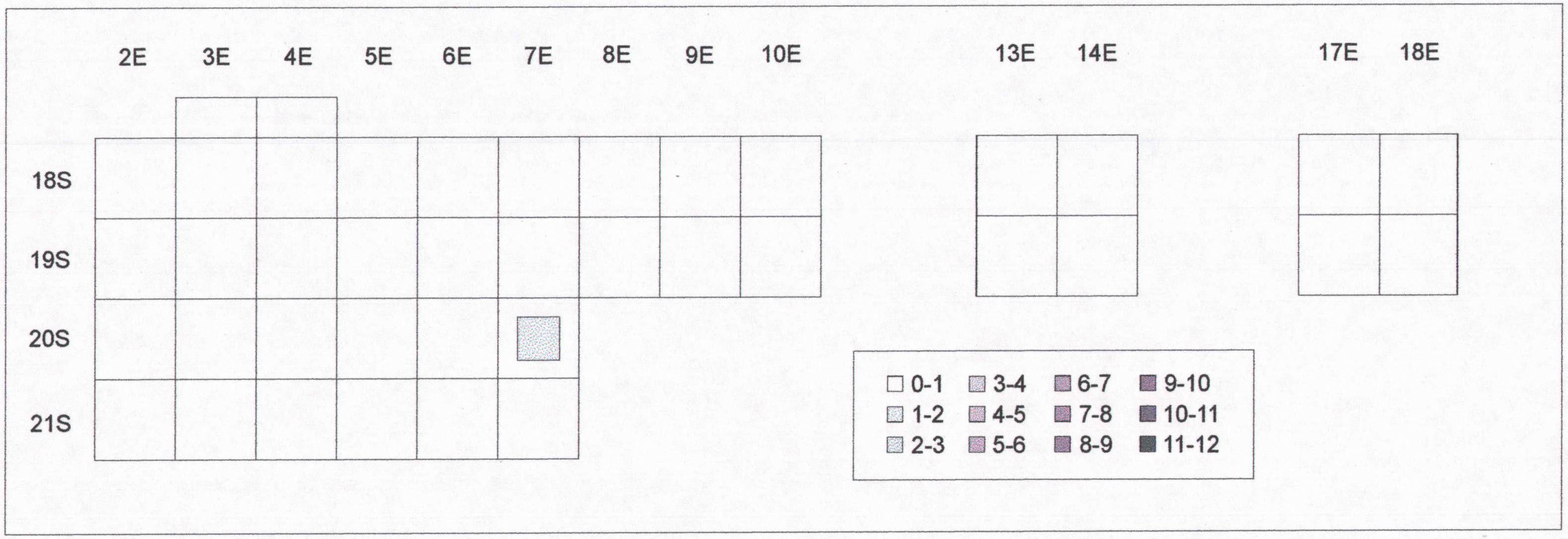

Figure 19. Distribution of bison vertebral elements from level three at the Thundercloud site.

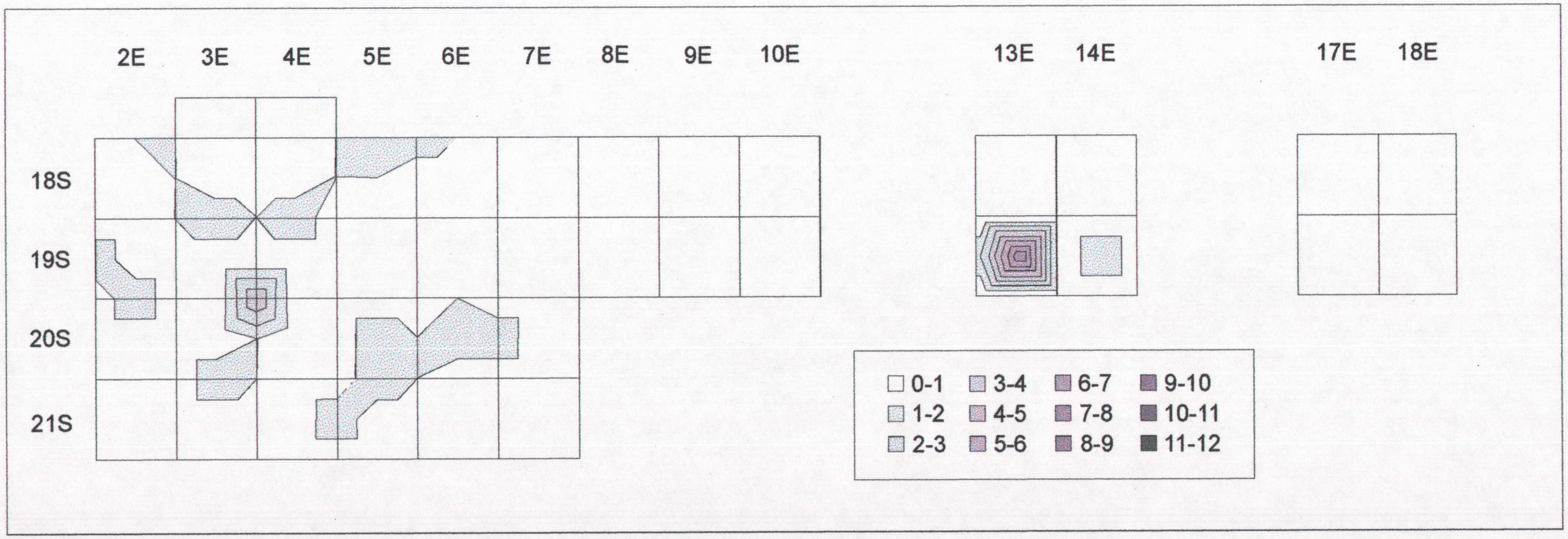

Figure 20. Distribution of bison forelimb elements from level three at the Thundercloud site.

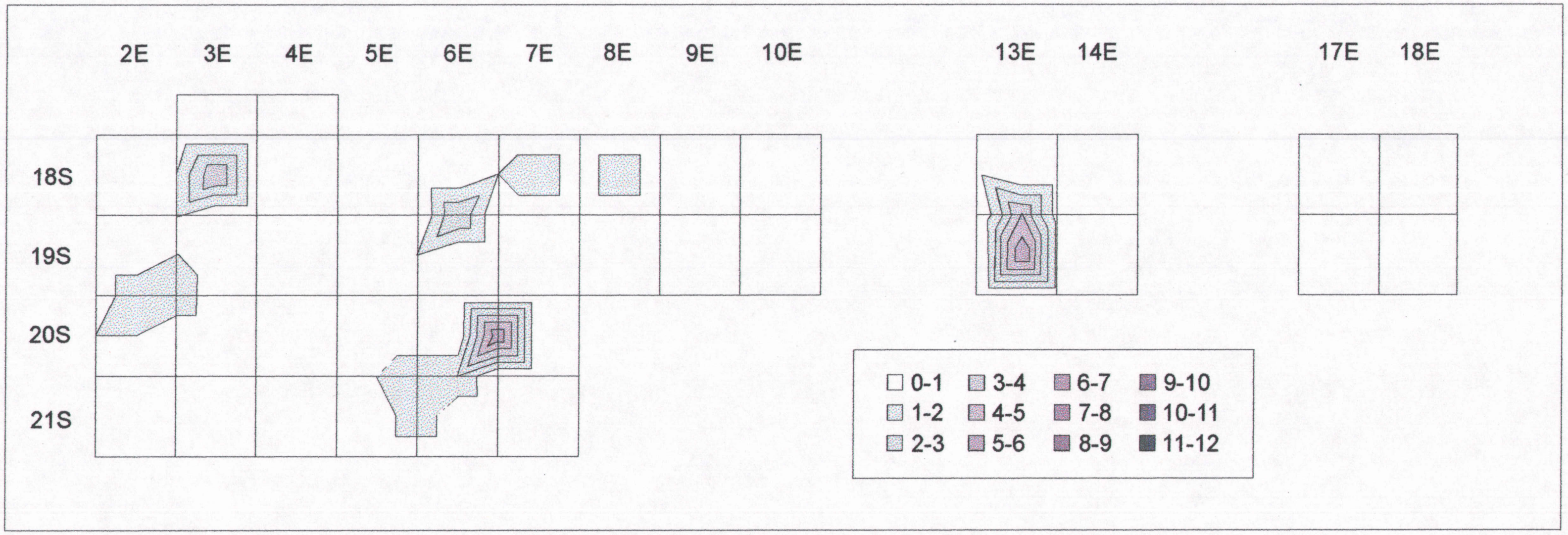

Figure 21. Distribution of bison hindlimb elements from level three at the Thundercloud site.

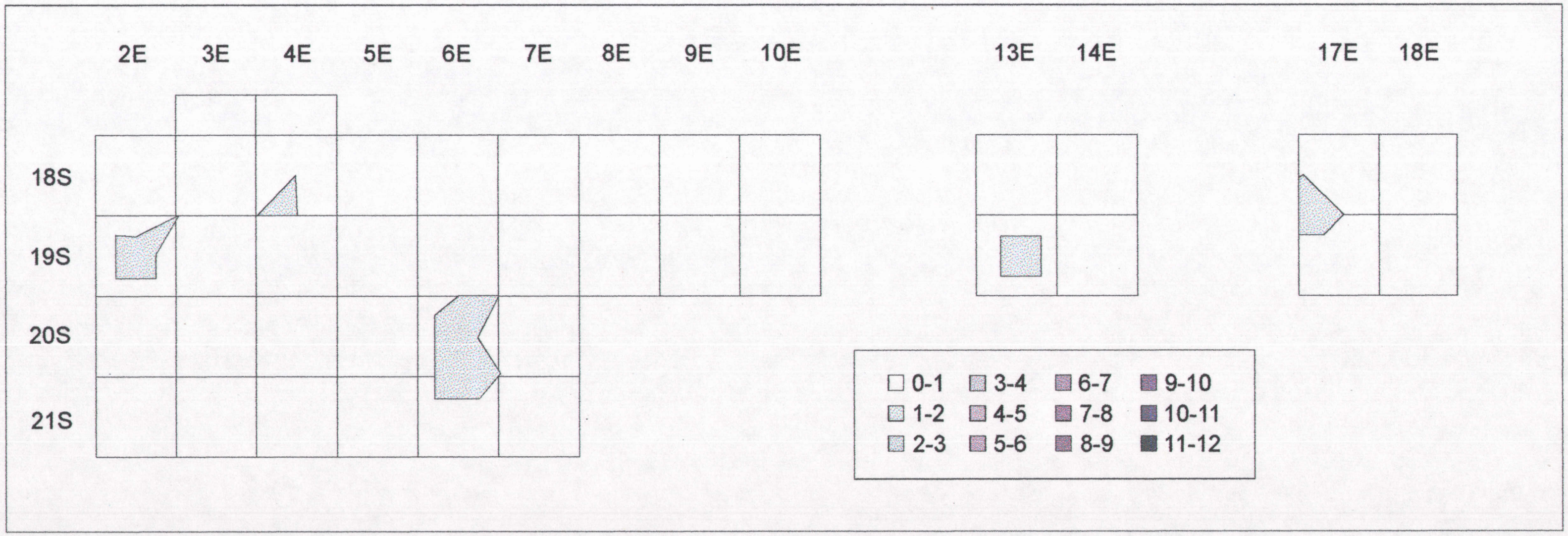

Figure 22. Distribution of bison phalanges from level three at the Thundercloud site.

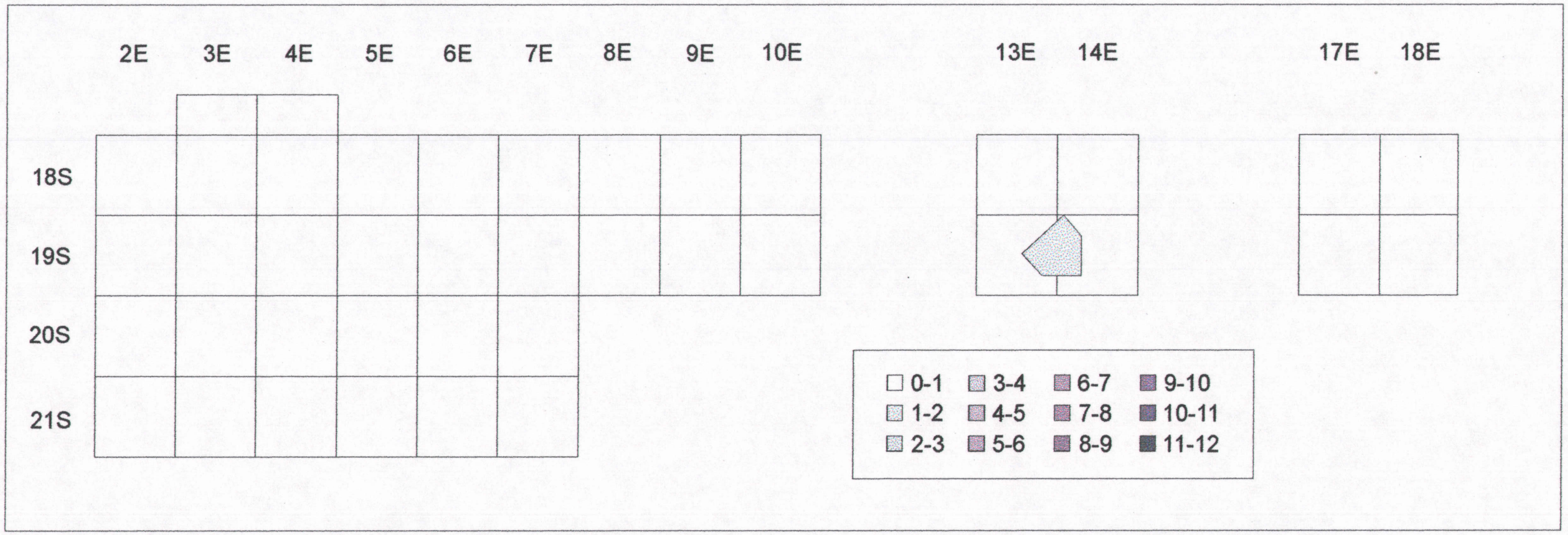

Figure 23. Distribution of all canid elements from level three at the Thundercloud site.

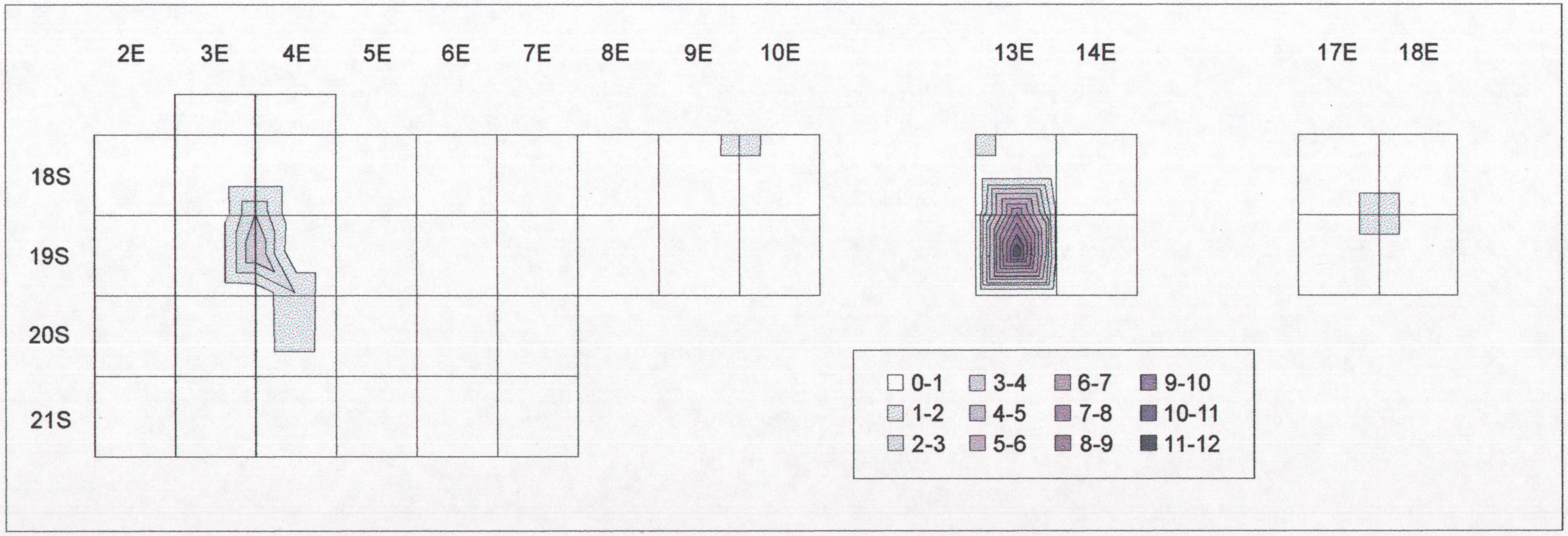

Figure 24. Distribution of all rodent elements from level three at the Thundercloud site.

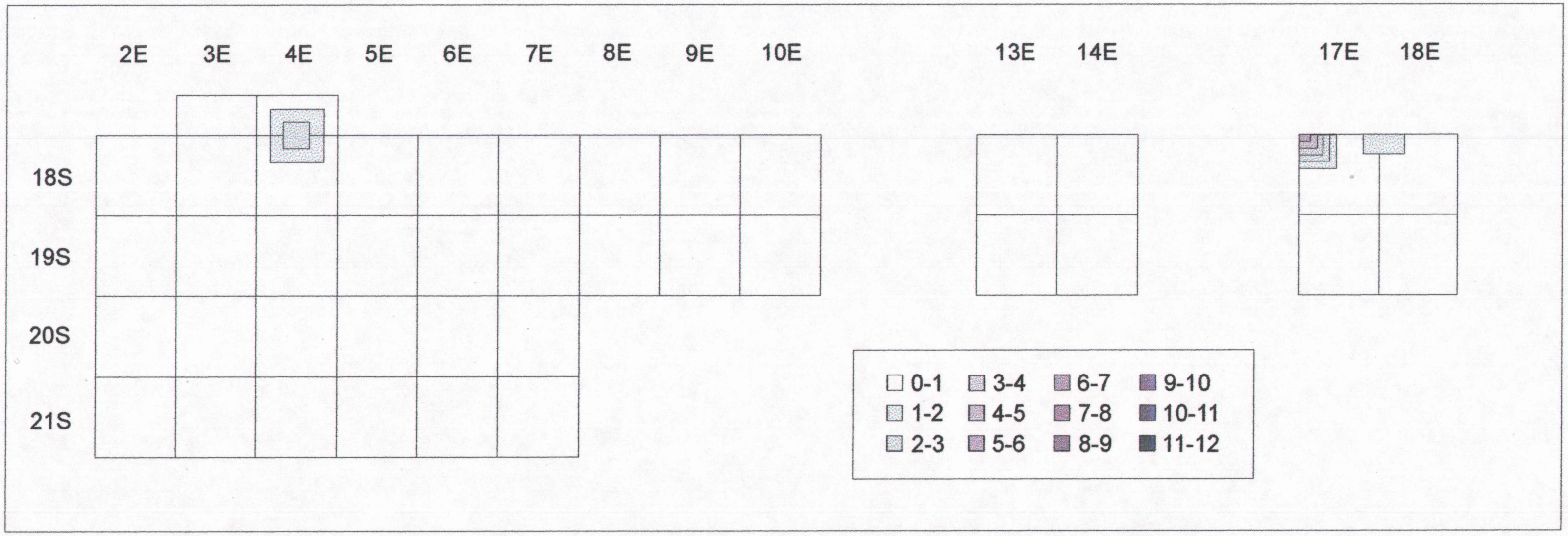

Figure 25. Distribution of seeds from level three at the Thundercloud site.

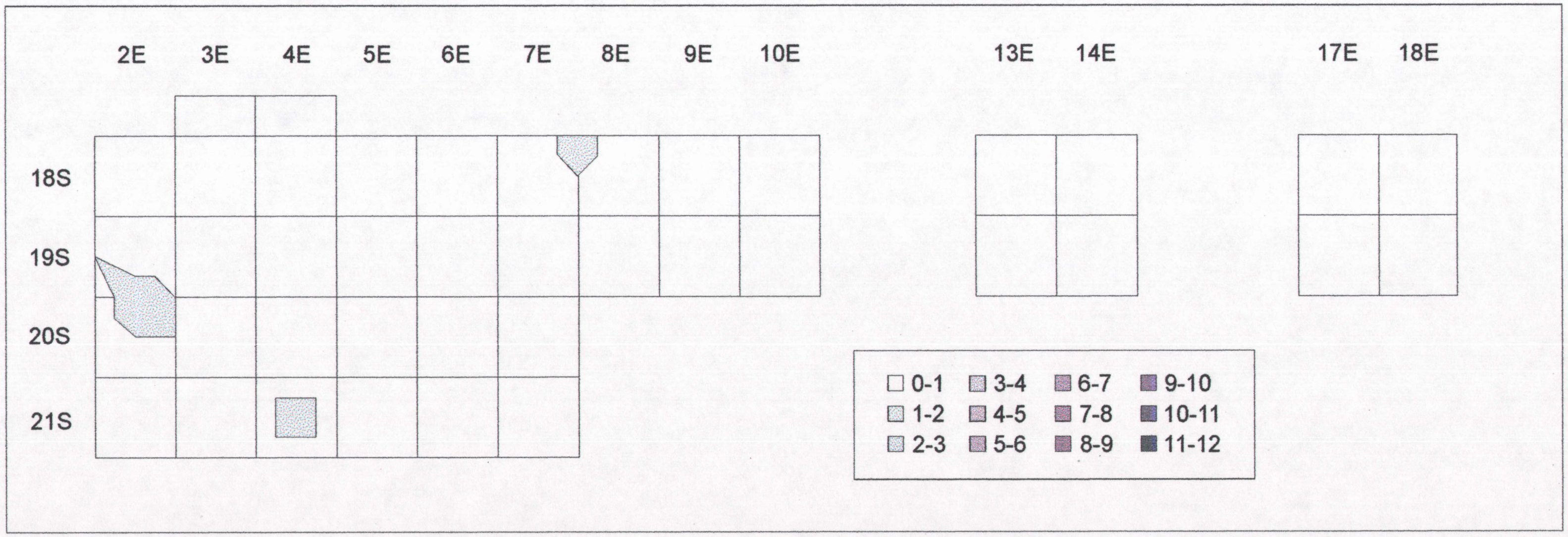

Figure 26. Distribution of bison cranial elements from level four at the Thundercloud site.

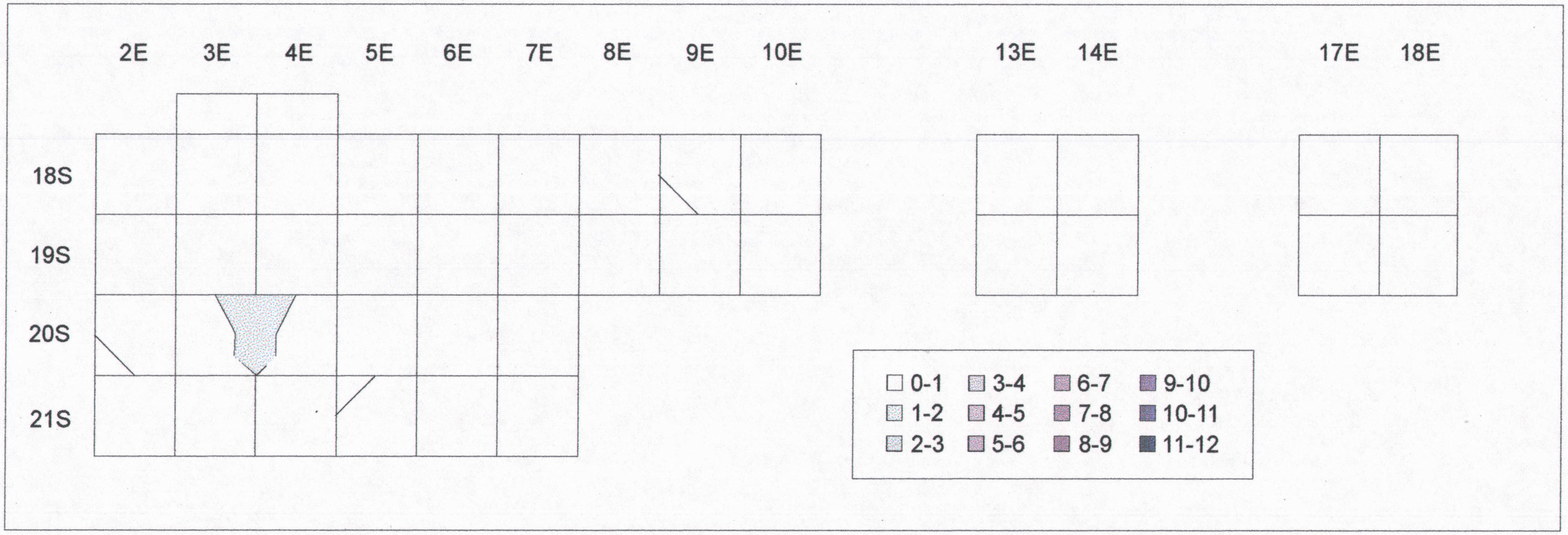

Figure 27. Distribution of bison forelimb elements from level four at the Thundercloud site.

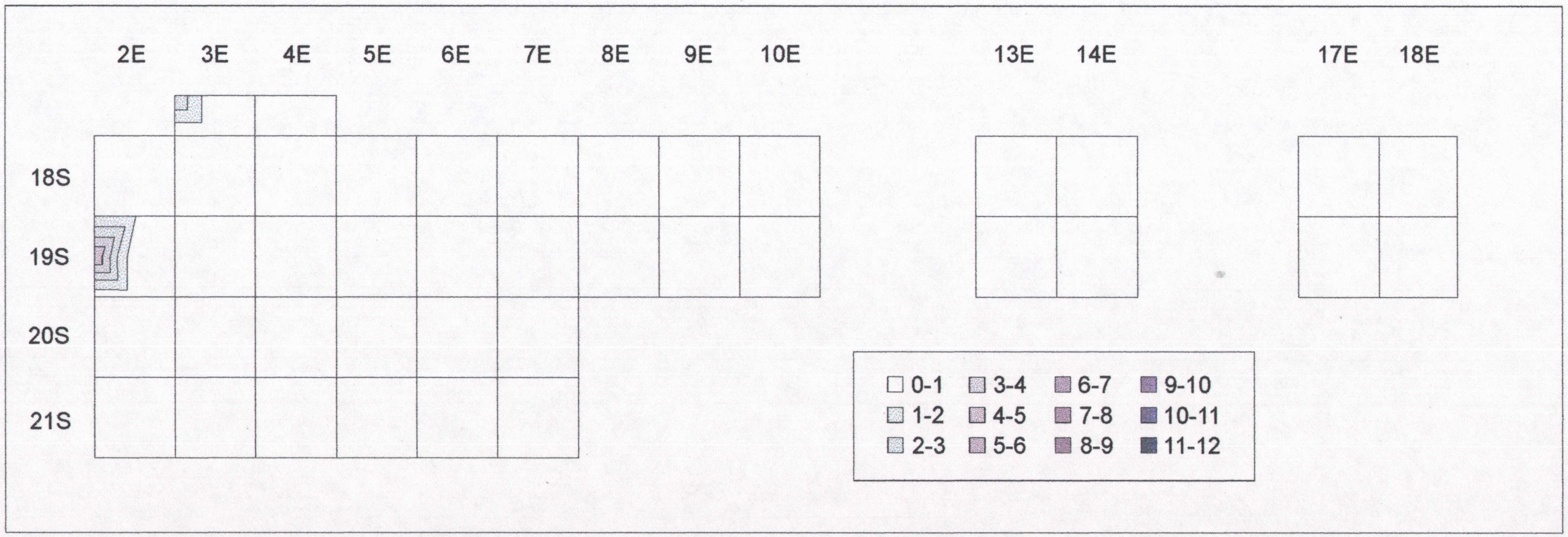

Figure 28. Distribution of bison hindlimb elements from level four at the Thundercloud site.

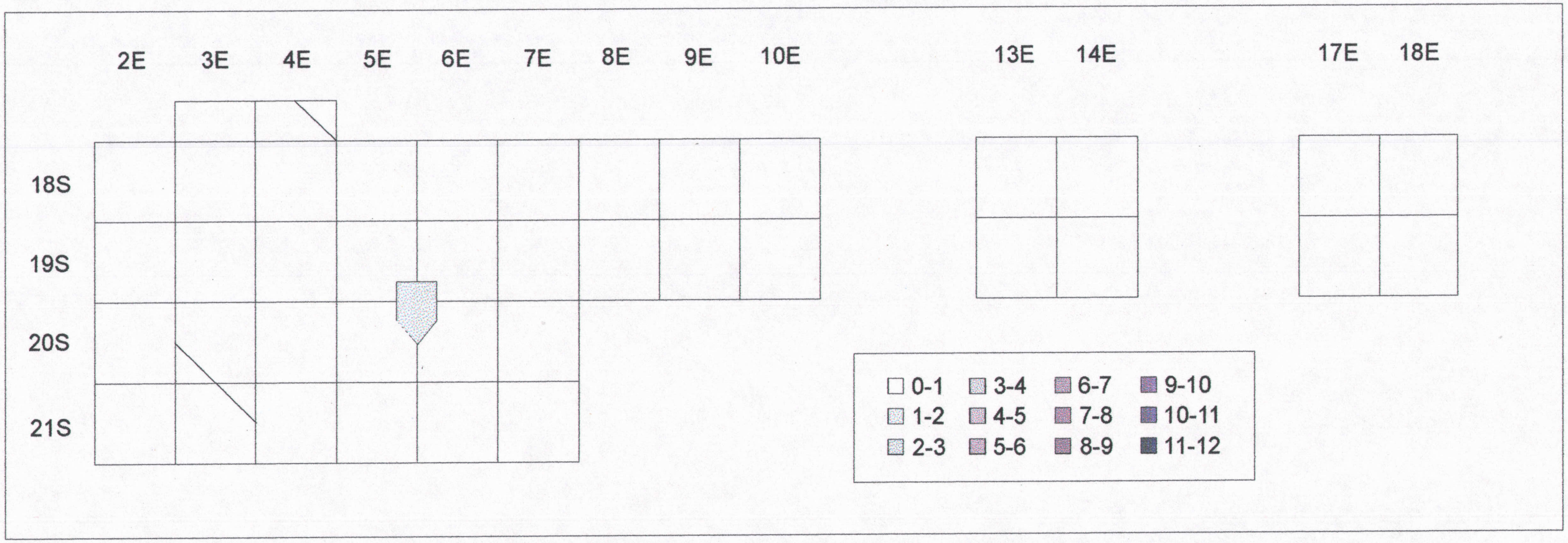

Figure 29. Distribution of bison phalanges from level four at the Thundercloud site.

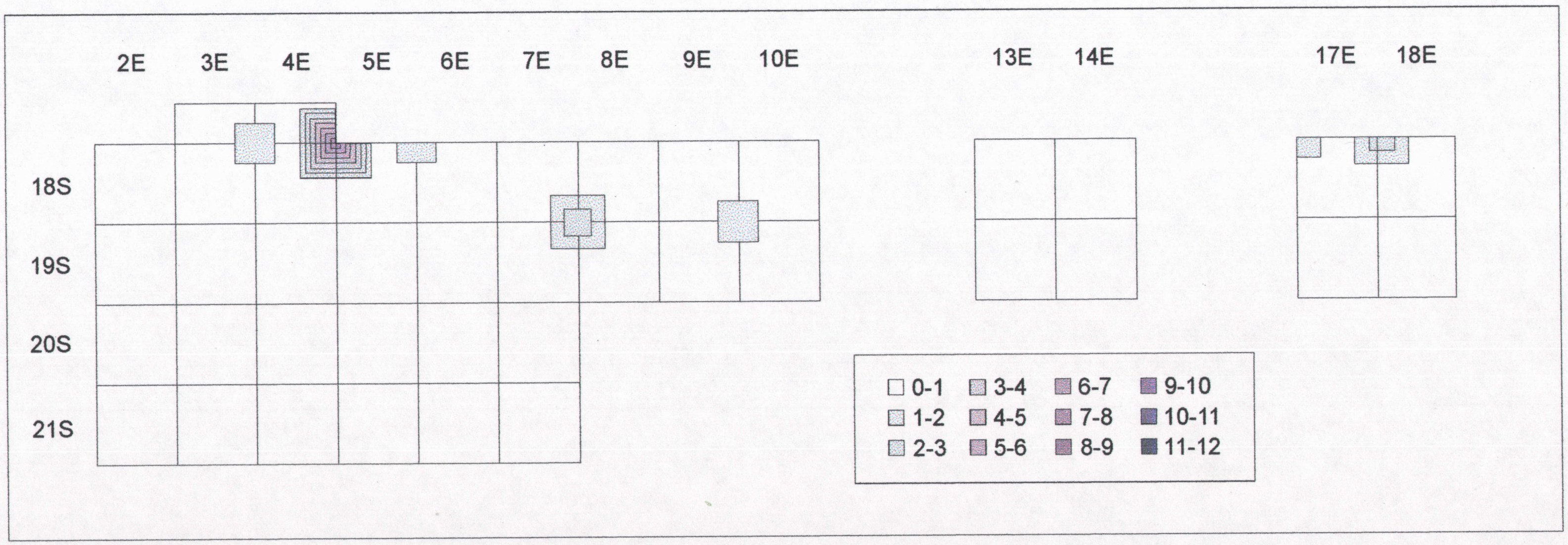

Figure 30. Distribution of all rodent elements from level four at the Thundercloud site.

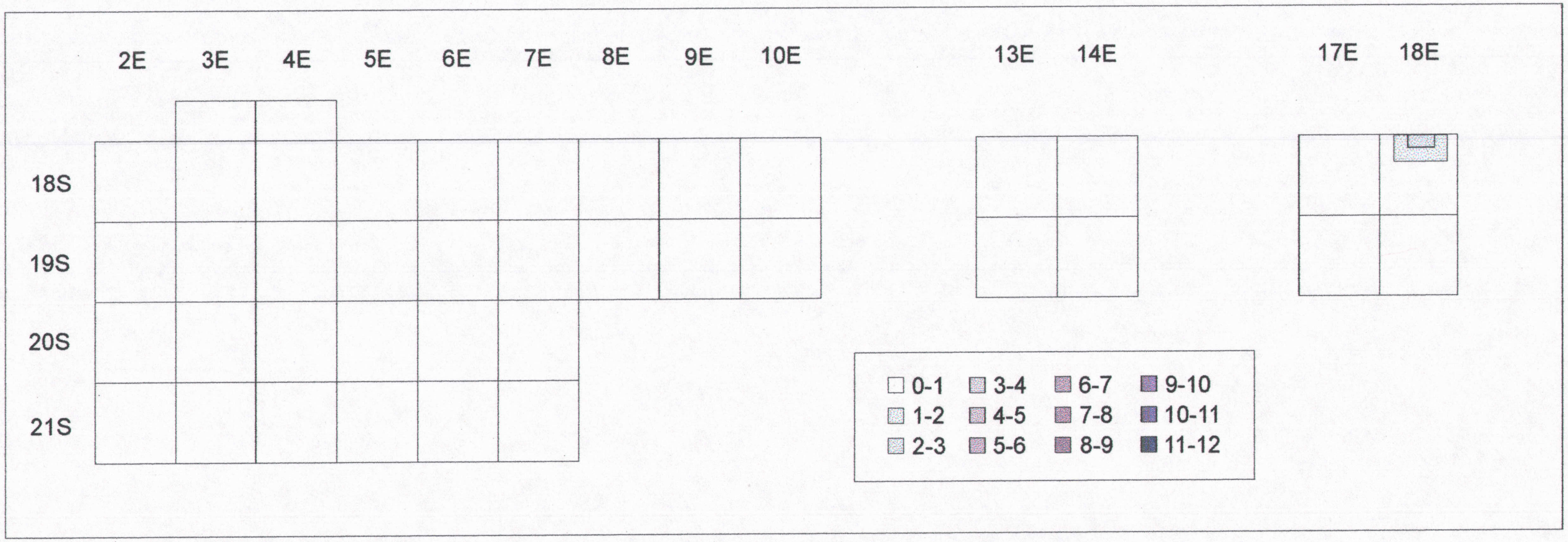

Figure 31. Distribution of all pronghorn elements from level four at the Thundercloud site.

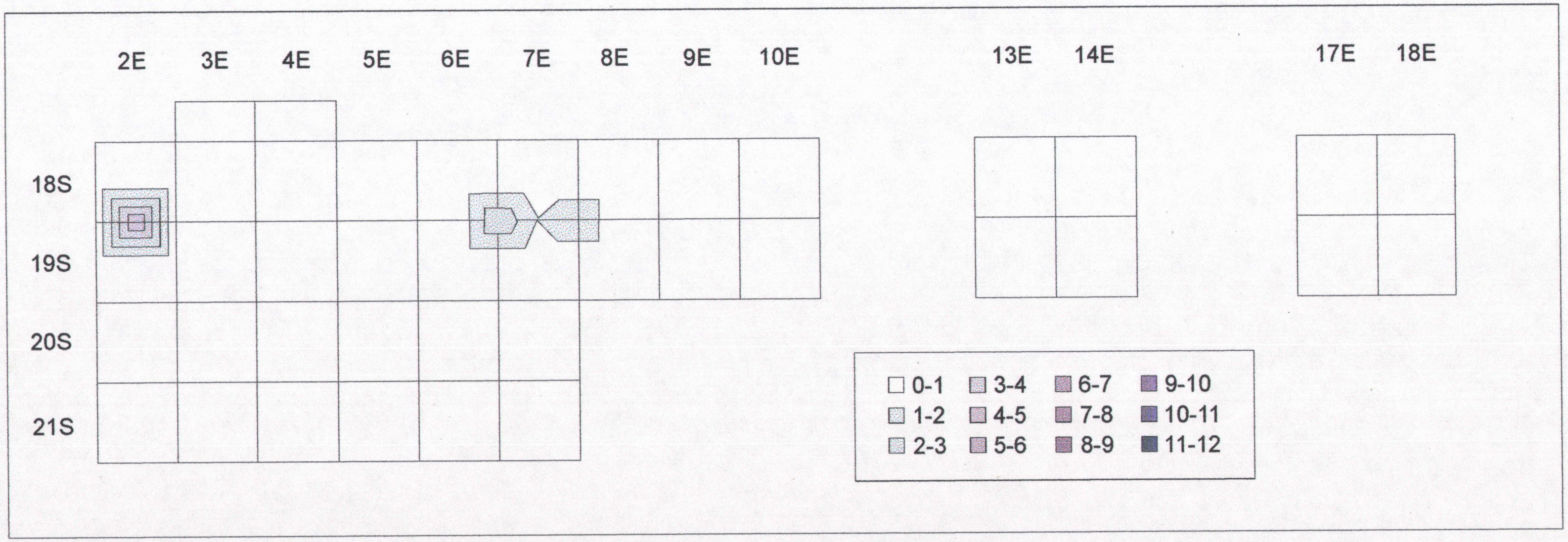

Figure 32. Distribution of snake vertebrae from level four at the Thundercloud site.

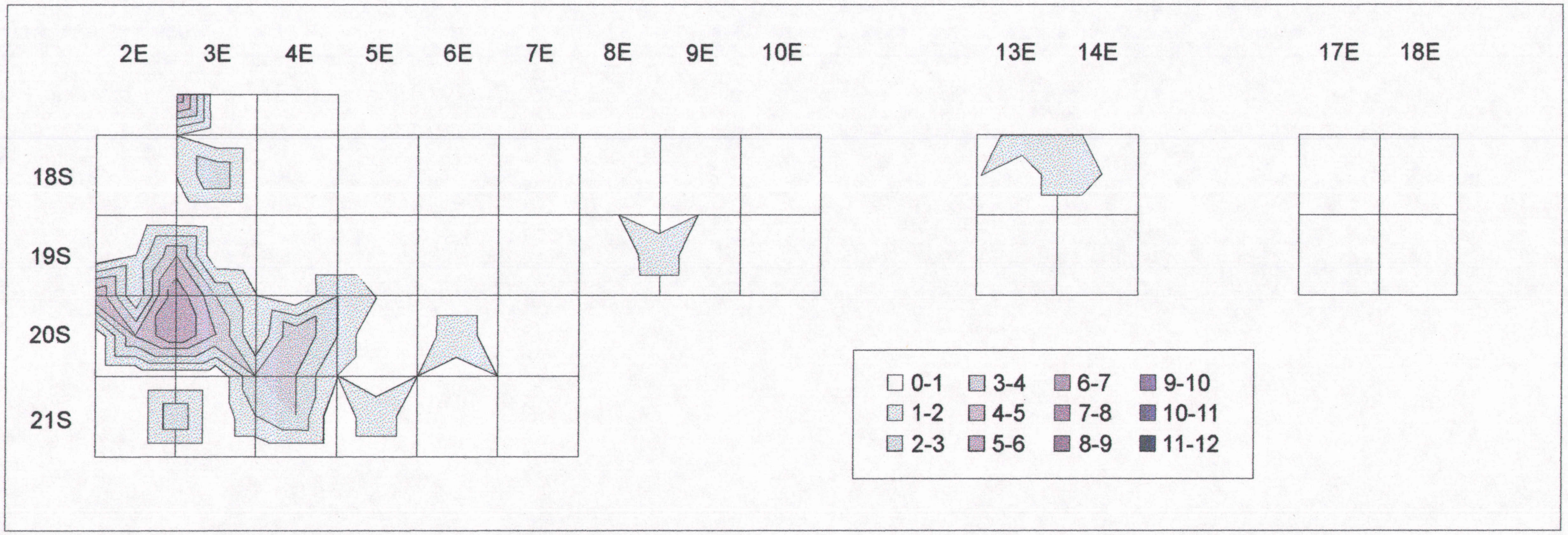

Figure 33. Distribution of bison cranial elements from level five at the Thundercloud site.

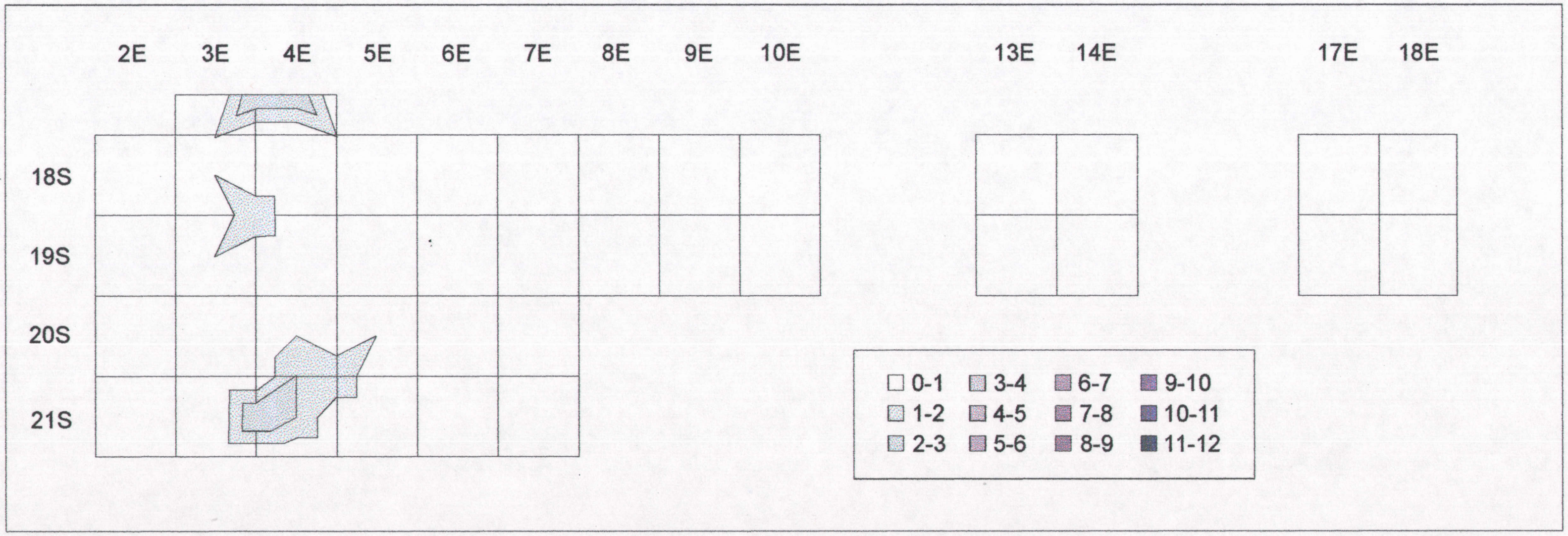

Figure 34. Distribution of bison vertebral elements from level five at the Thundercloud site.

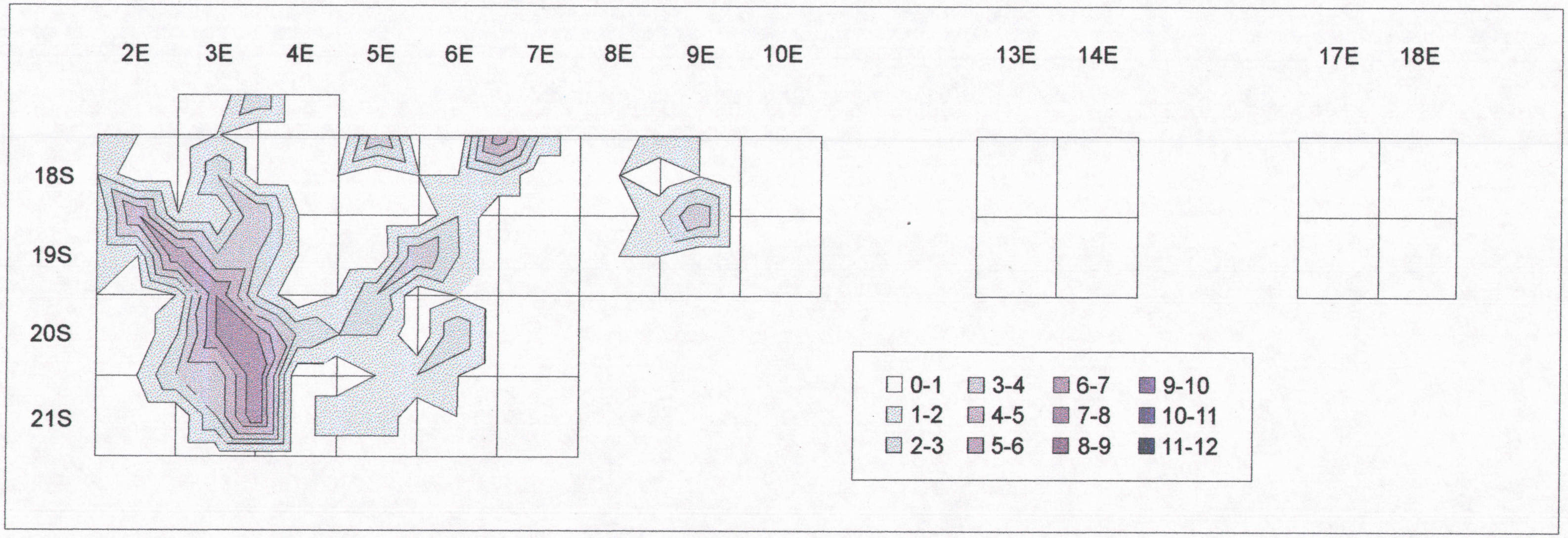

Figure 35. Distribution of bison forelimb elements from level five at the Thundercloud site.

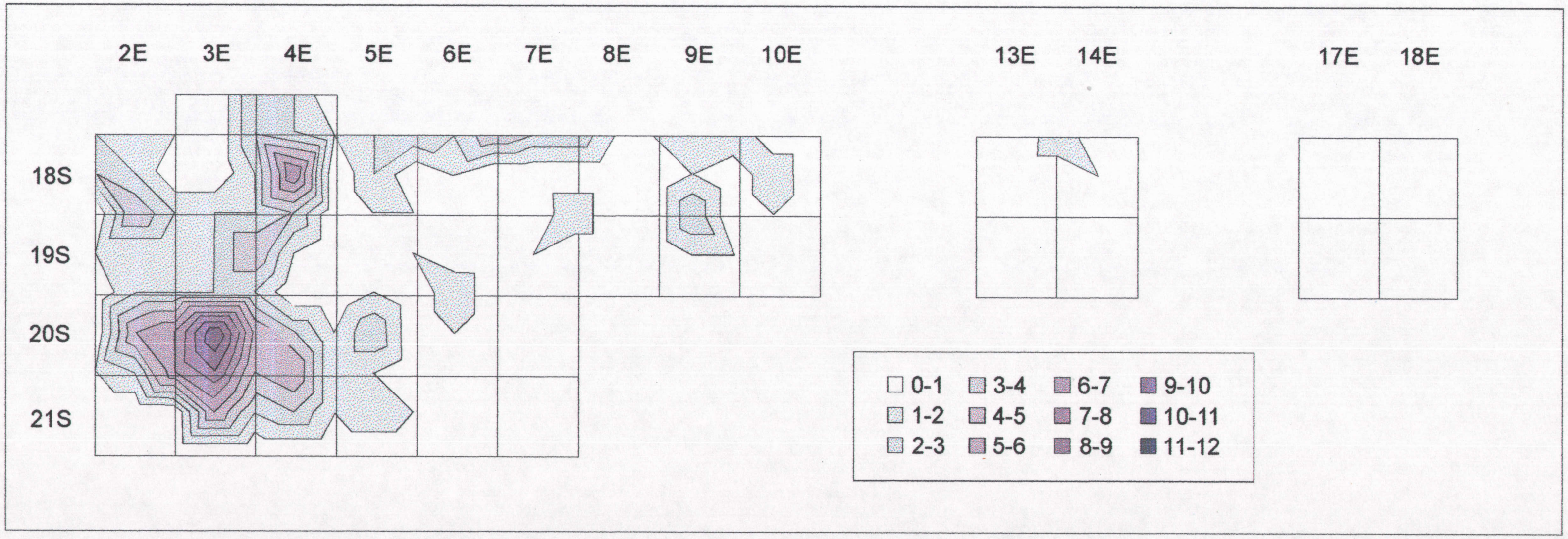

Figure 36. Distribution of bison hindlimb elements from level five at the Thundercloud site.

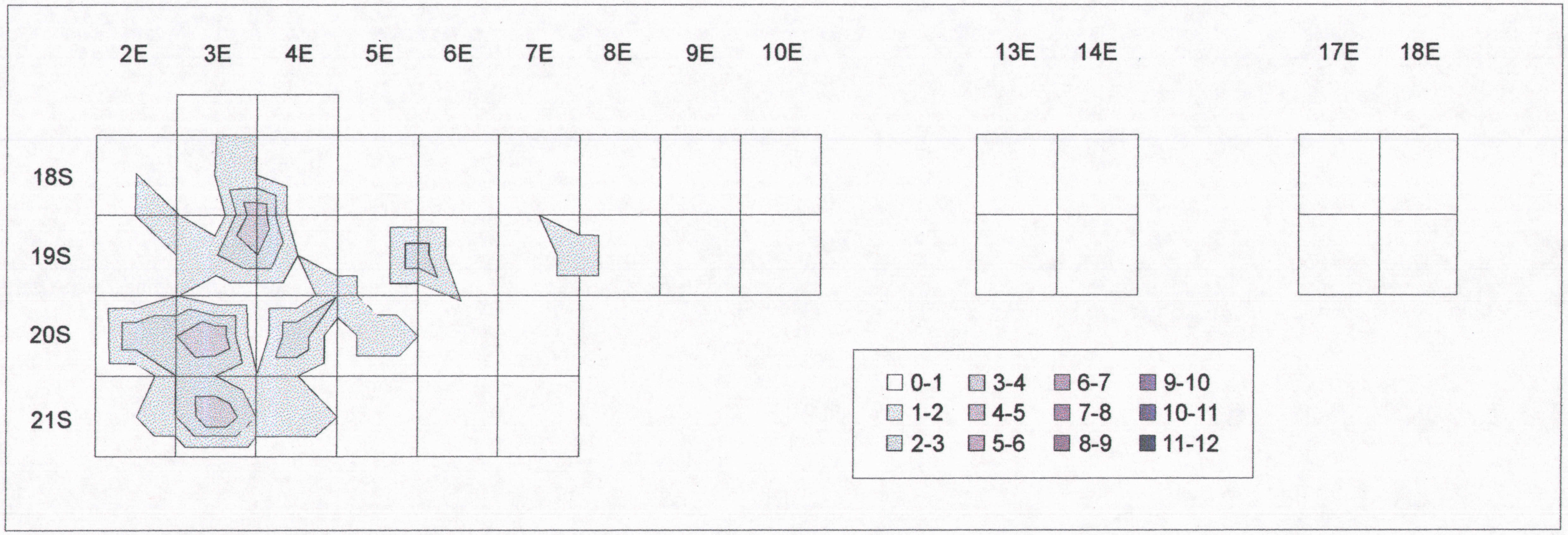

Figure 37. Distribution of bison phalanges from level five at the Thundercloud site.

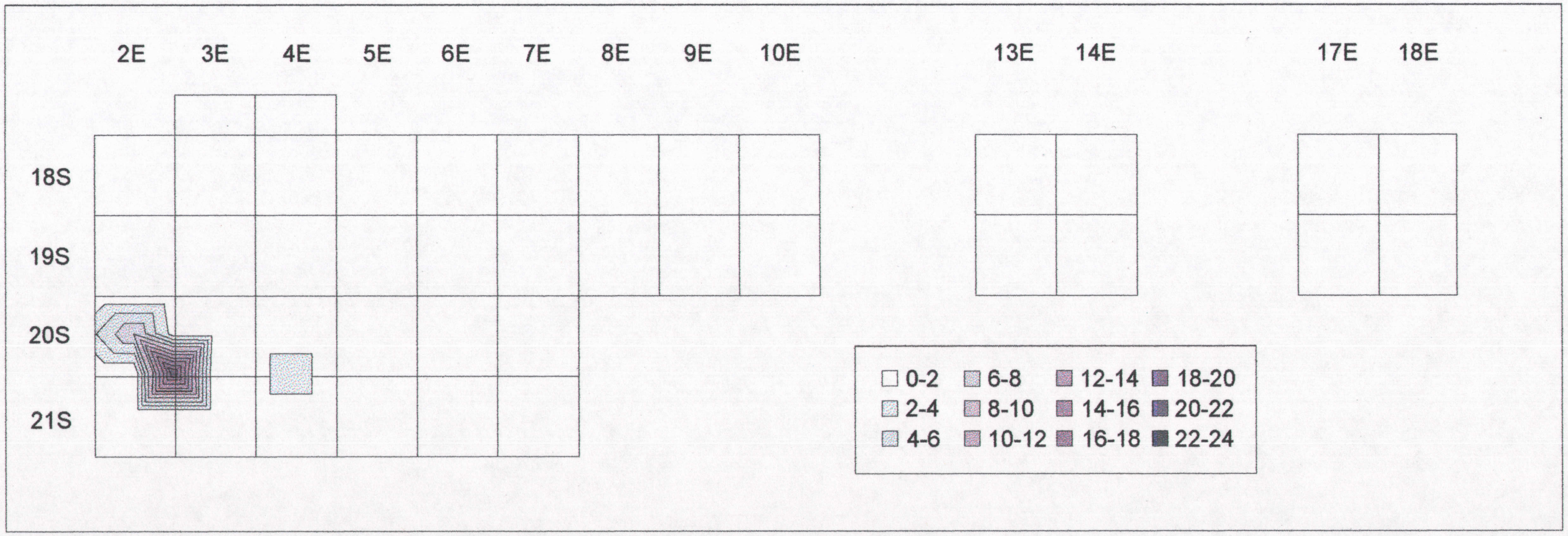

Figure 38. Distribution of all canid elements from level five at the Thundercloud site.

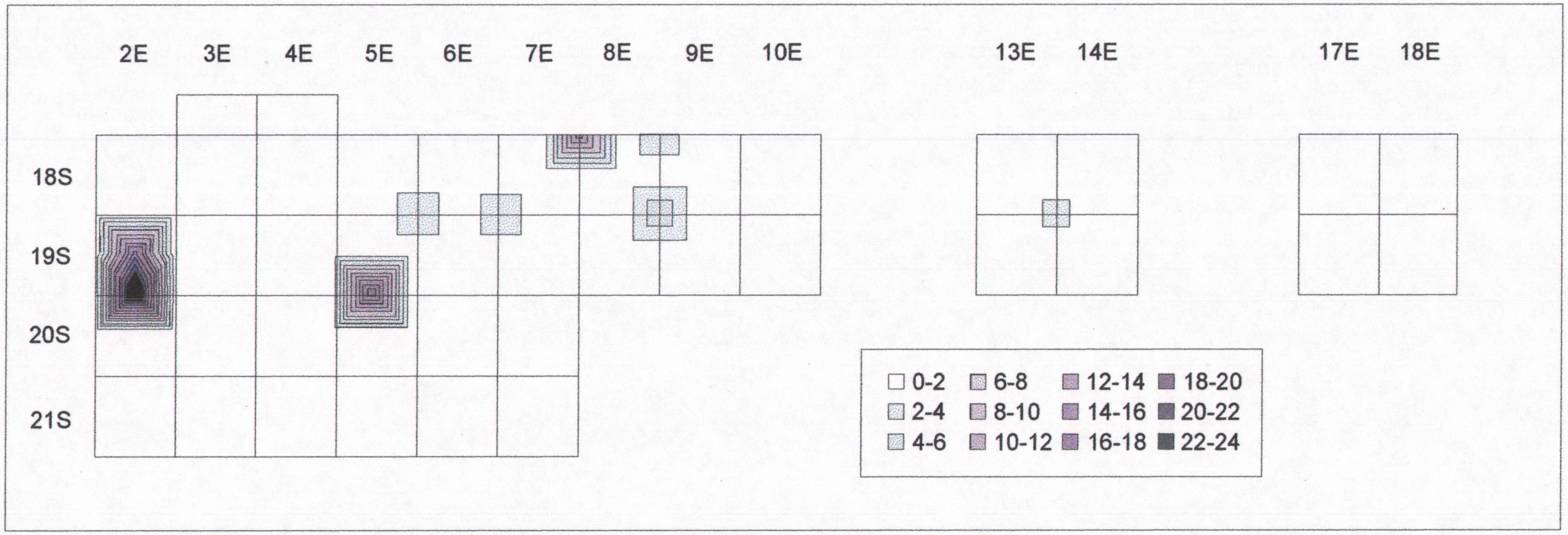

Figure 39. Distribution of all rodent elements from level five at the Thundercloud site.

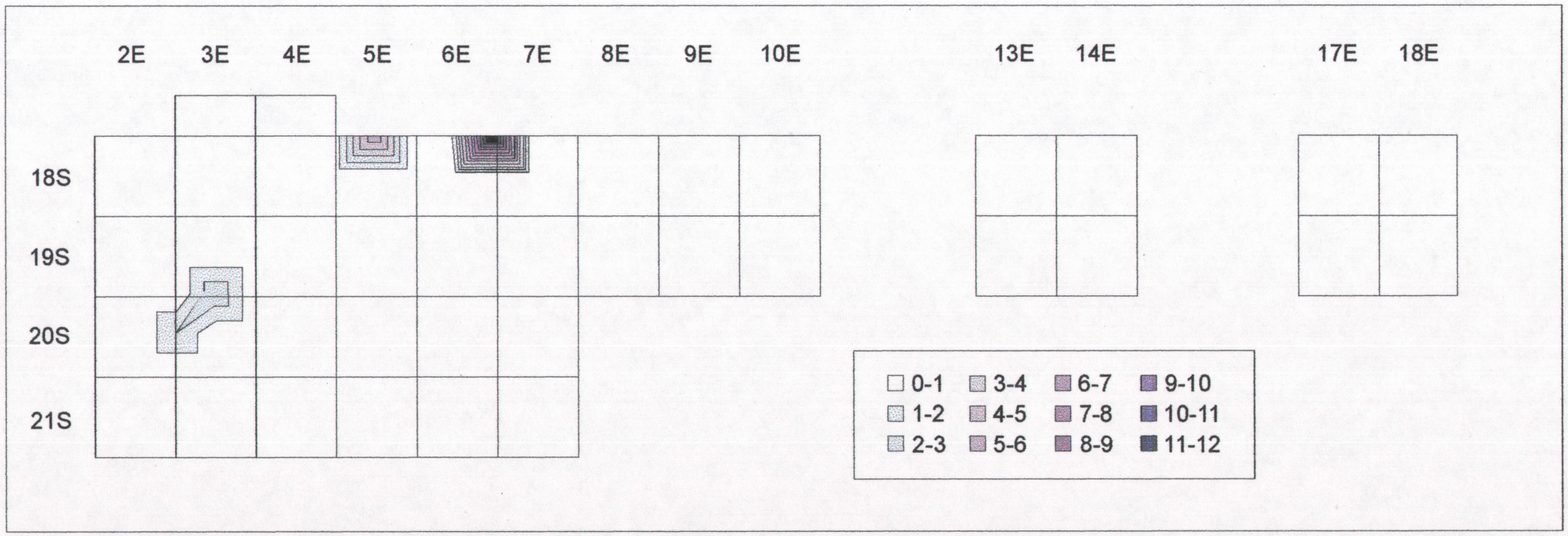

Figure 40. Distribution of all leporid elements from level five at the Thundercloud site.

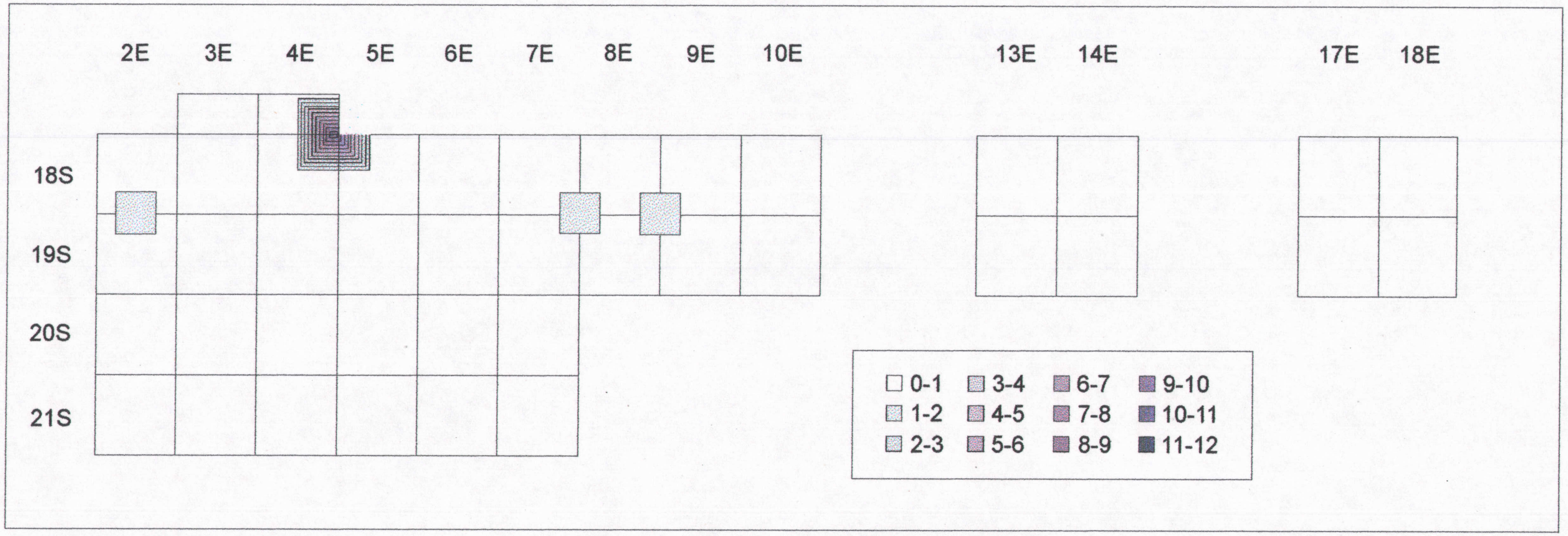

Figure 41. Distribution of all anuran elements from level five at the Thundercloud site.

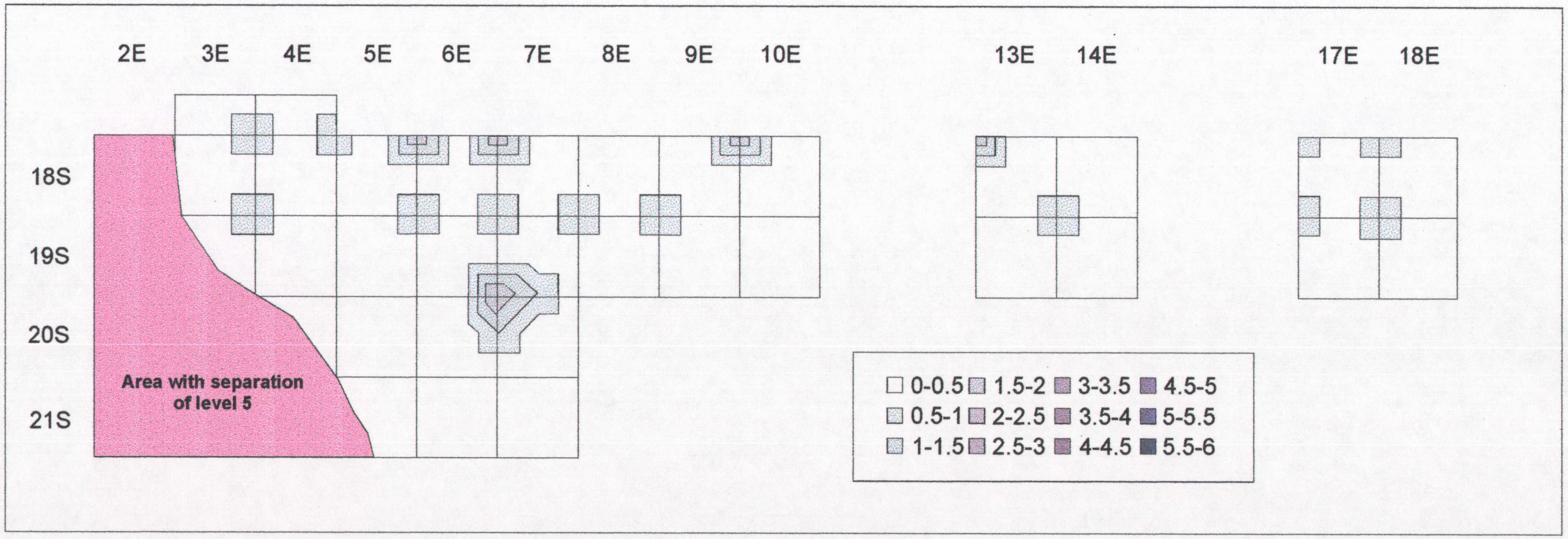

Figure 42. Distribution of all gastropods from level five at the Thundercloud site.

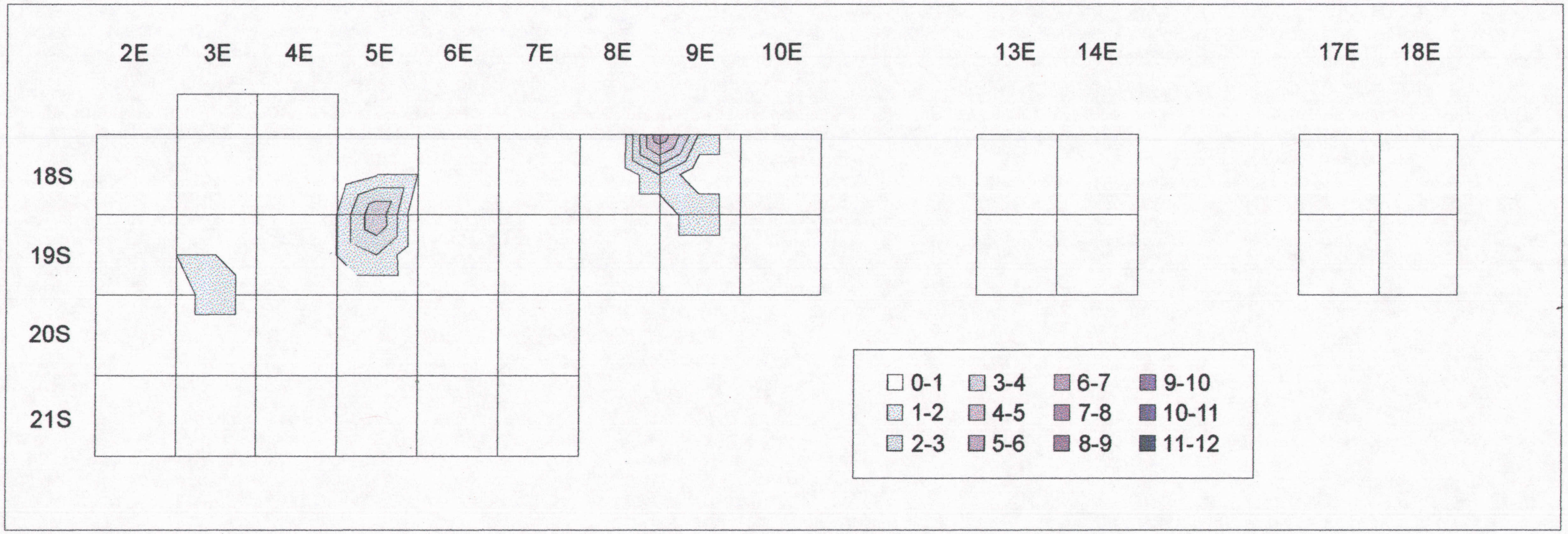

Figure 43. Distribution of bison cranial elements from level six at the Thundercloud site.

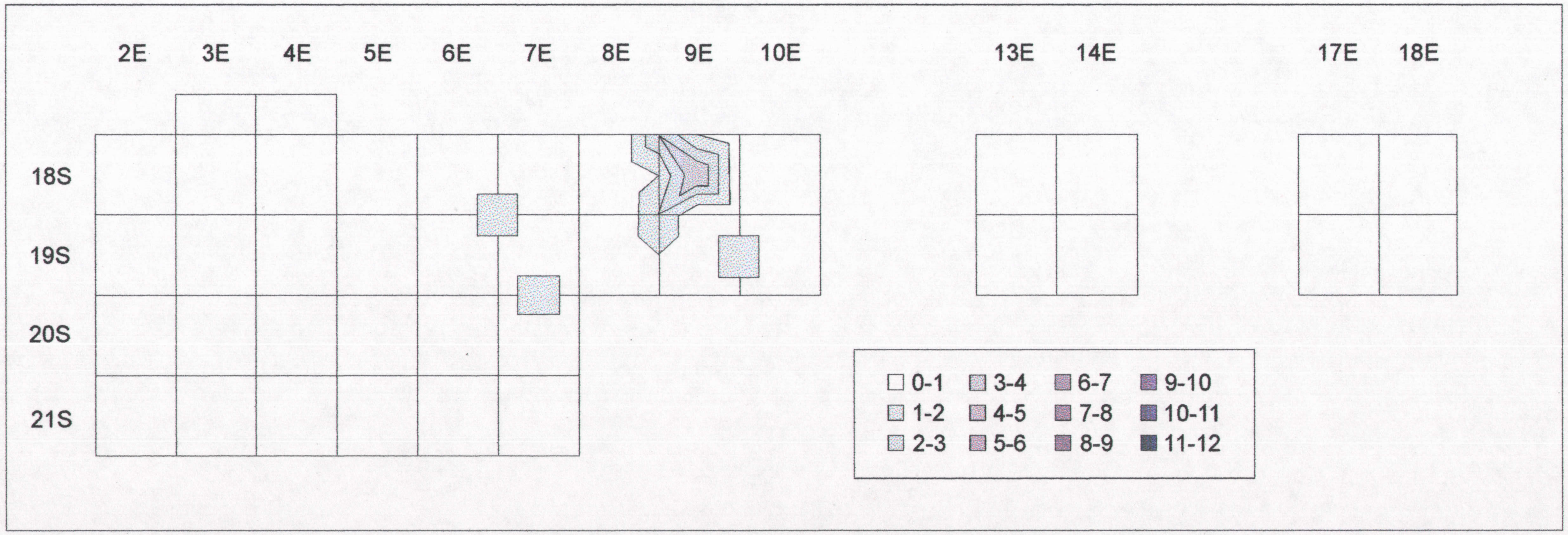

Figure 44. Distribution of bison forelimb elements from level six at the Thundercloud site.

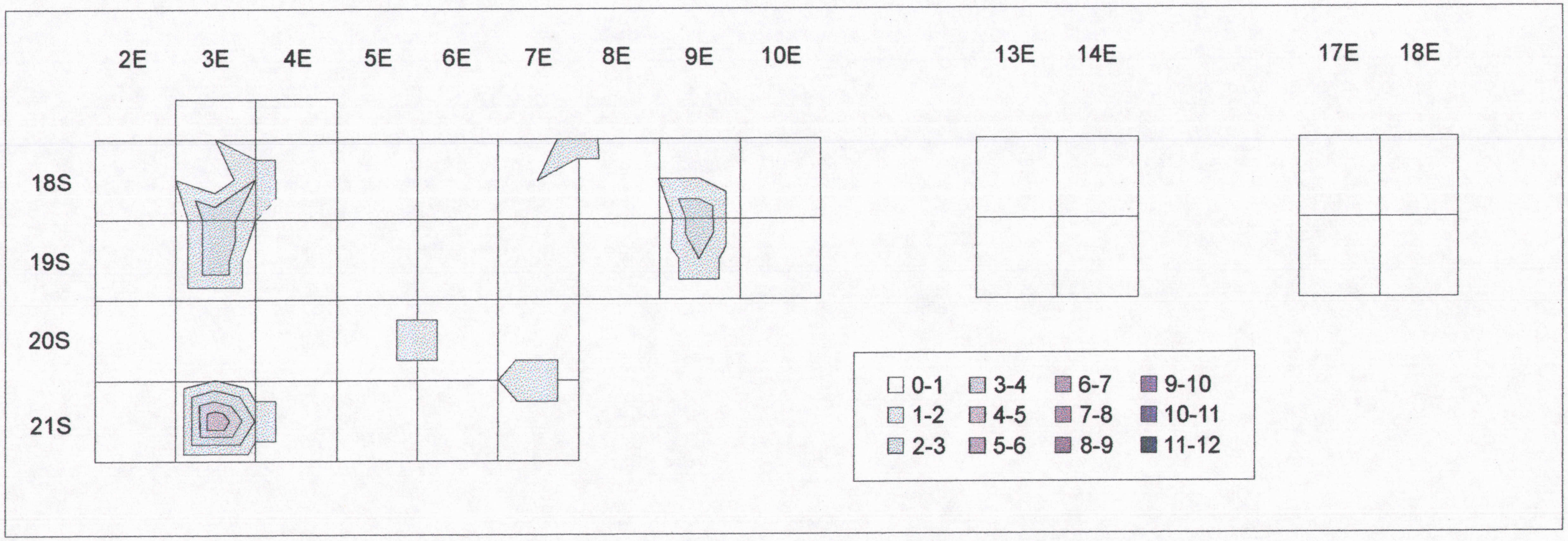

Figure 45. Distribution of bison hindlimb elements from level six at the Thundercloud site.

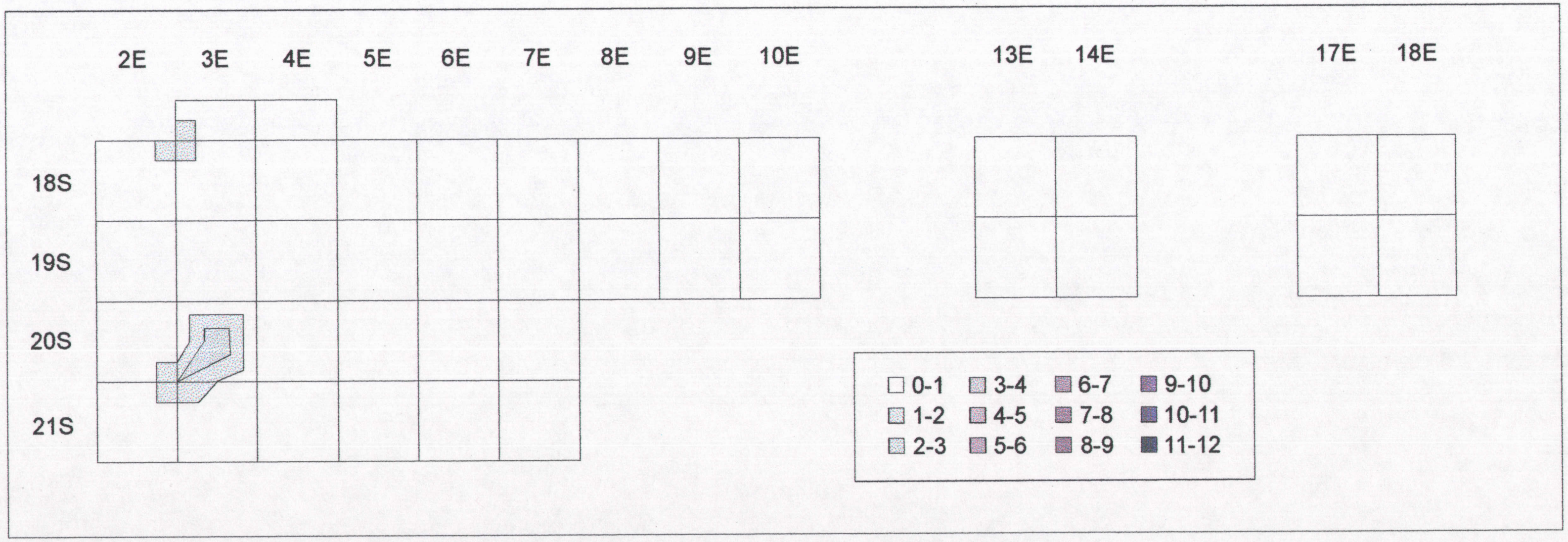

Figure 46. Distribution of bison phalanges from level six at the Thundercloud site.

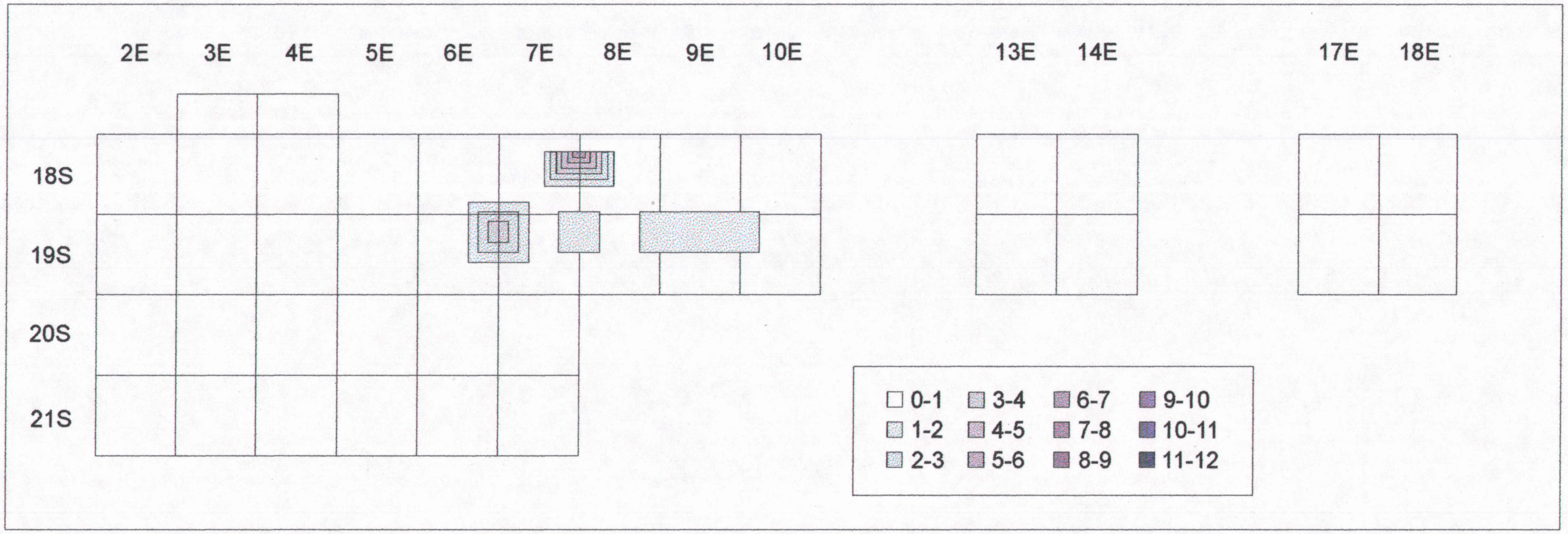

Figure 47. Distribution of all rodent elements from level six at the Thundercloud site.

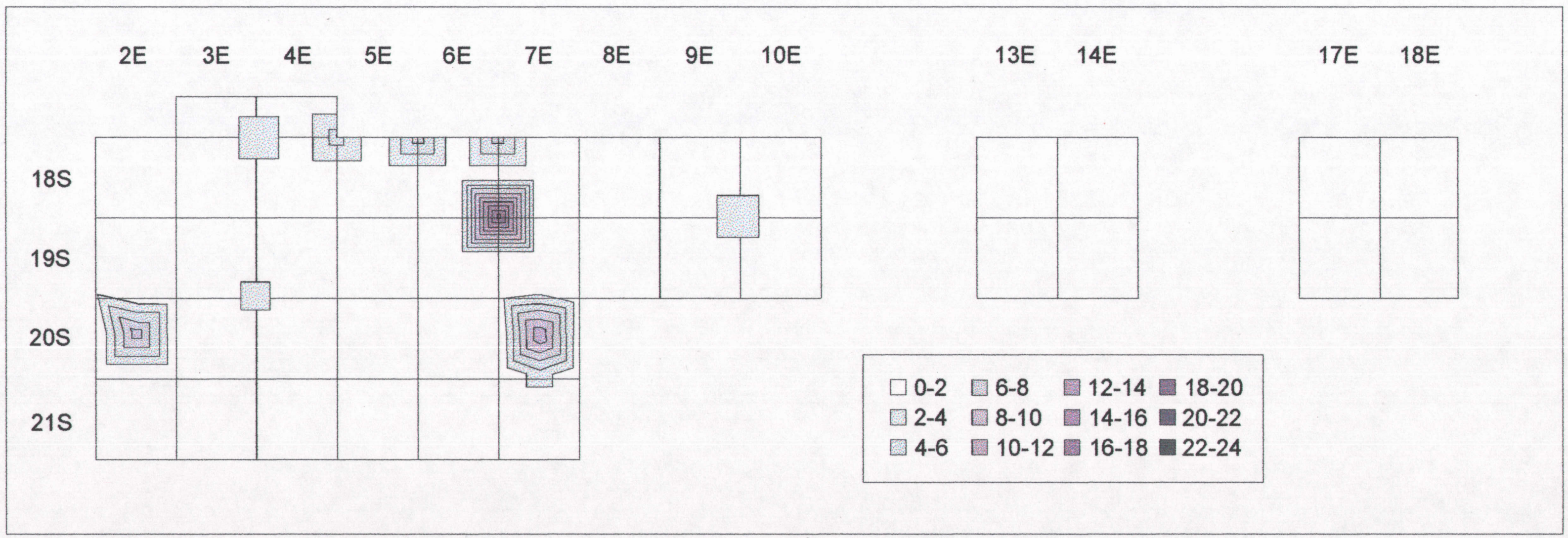

Figure 48. Distribution of gastropods from level six at the Thundercloud site.

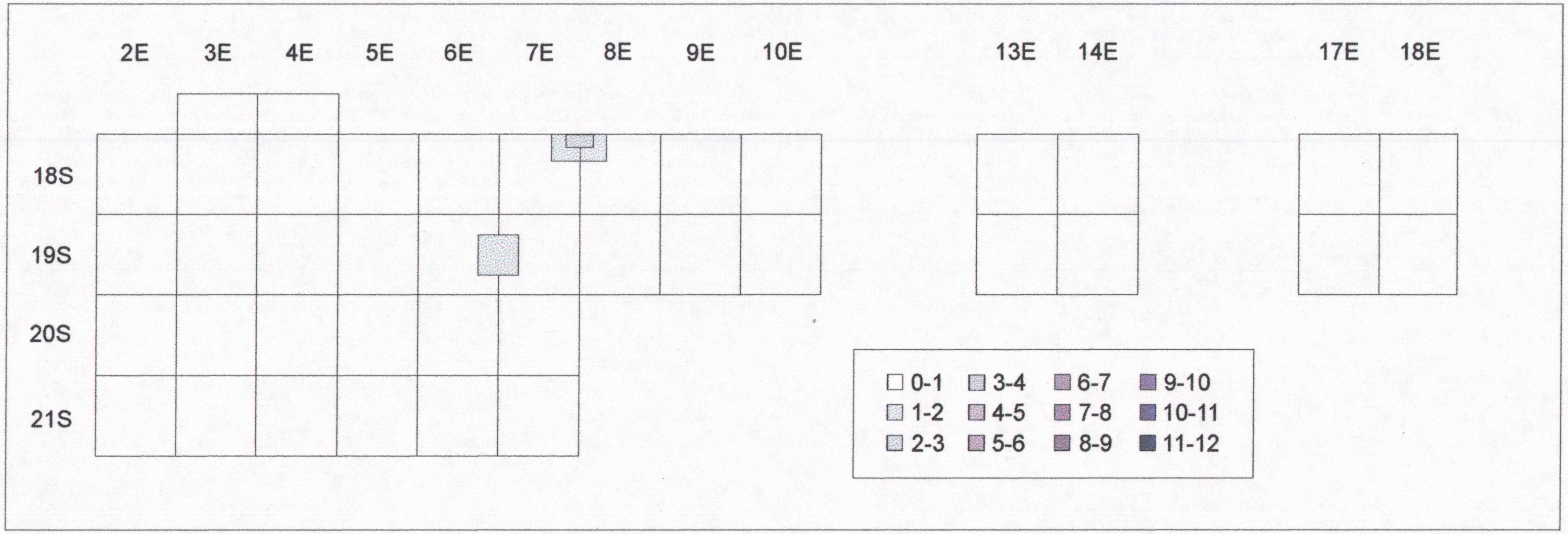

Figure 49. Distribution of all bison elements from level seven at the Thundercloud site.

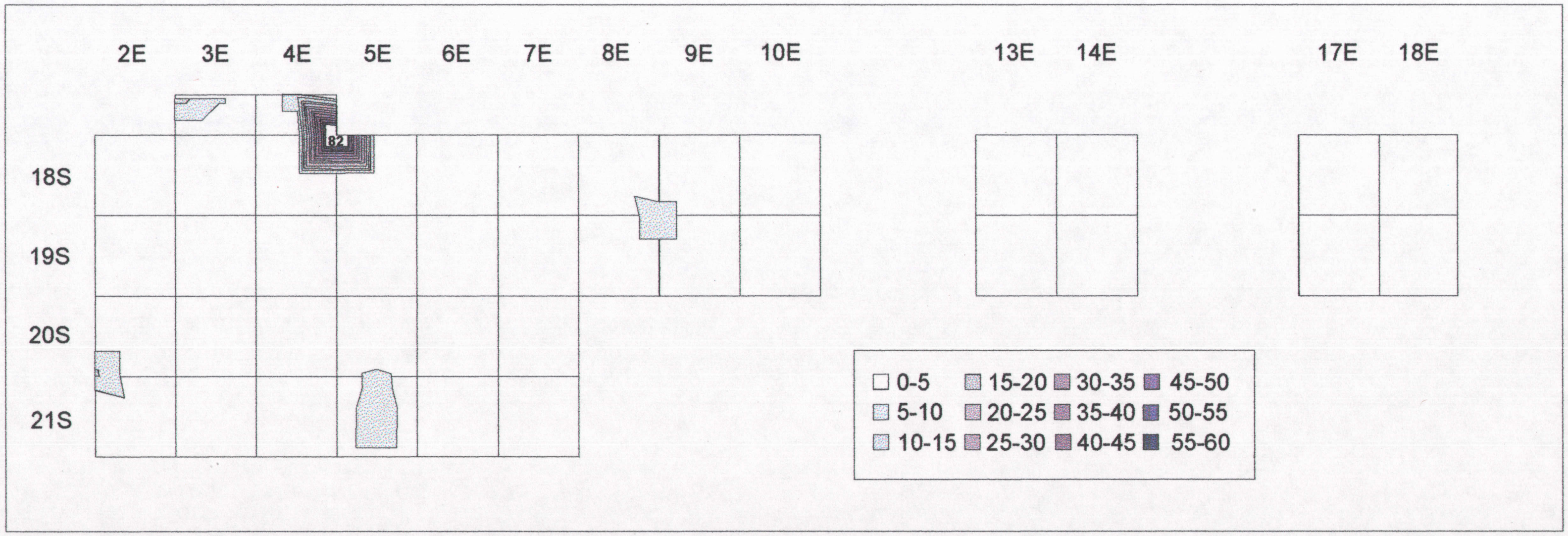

Figure 50. Distribution of gastropods from level seven at the Thundercloud site.

Appendix IV

Measurements of Leporid Elements From Archaeological Specimens in Level Five and Comparative Specimens from the University of Saskatchewan

Table 1. Comparison of element measurements from archaeological specimens, *Sylvilagus nuttallii* and *Lepus americanus* (S. nuttallii and L. americanus specimens from the comparative collection at the University of Saskatchewan, all measurements in millimetres).

Element	*Arch. Specs.	S. nuttallii	** L.a.	L.a.	L.a.	L.a.	L.a. (male)	L.a. (male)
proximal second metatarsal	5.6	NA	5.85	5.85	6.35	6.55	6	6.25
proximal third metatarsal	5.2	4.8	6.35	6.2	6.75	6.3	6.25	6.45
proximal fourth metatarsal	4.95	4.65	5.95	5.6	5.95	5.75	5.75	5.5
proximal second metacarpal	3.65 & 3.7	3.2	4.3	4	4.8	4.7	4.4	4.85
proximal third metacarpal	3.3 & 3.75	3.2	4.1	3.85	4.3	4.15	3.85	4.8
proximal fourth metacarpal	3.75	3.15	4	3.9	4	3.9	3.75	4.05
proximal fifth metacarpal	3.45	2.65	3.75	3.95	3.9	3.9	3.6	3.85

* Archaeological specimens ** *Lepus americanus*

Appendix V

Level Six and Seven Gastropod Catalogue Numbers

Table 1. Catalogue numbers for some level six Gastropods.

Taxa	Catalogue Number(s)	Number of Specimens
Stagnicola sp.	5783-1 to 5783-9	9
	5784-1 to 5784-2	2
	5796	1
	5797-1 to 5797-2	2
	5798-1 to 5798-12	12
	5803	1
	5805-1 to 5805-3	3
	5914	1
	5957	1
	6162-1 to 6162-3	3
	6167-1 to 6167-2	2
Valvata sincera	5851	1
	5882	1
	5886	1
	5915	1
	5955	1
	5958-1 to 5958-2	2
	6058	1
	6130	1
	6166-1 to 6166-10	10
	6169	1
	6226-1 to 6226-2	2
	6352-1 to 6352-2	2

Table 2. Catalogue numbers for some level seven Gastropods.

Taxa	Catalogue Number(s)	Number of Specimens
Stagnicola sp.	5807-1 to 5812	26
	5814 to 5830-2	57
	5891-1 to 5891-58	58
	5920-1 to 5920-2	2
	6001	1
	6214-1 to 6214-6	6
Valvata sincera	5890-1 to 5890-12	12
	6005	1
	6213-1 to 6213-2	2