THE TSCHETTER SITE: A STUDY OF A
LATE PREHISTORIC BISON KILL

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ABSTRACT

The location of the Tschetter site in the Aspen Parkland of Saskatchewan makes it unique among excavated bison drive sites on the Northern Plains. This Late Prehistoric kill site was determined to have been occupied during the winter, a time when bison foraged on the nutritive grasses of the Fescue prairie and sheltered in the aspen groves of the Aspen Parkland.

The features of the site include a partial pound structure, a heavy bone bed, charcoal concentrations and refuse pits. It was determined that bison were impounded, killed and butchered at the site and that some food processing also took place. Tool types and distributions confirmed these activities.

A use-wear analysis of a sample of the tools was useful in aiding the determination of the activities which took place at the site, although the sample was seen to have been skewed toward a predominance of scraping tools. The Tschetter site is seen to conform to the established pattern of Late Prehistoric bison driving on the Northern Plains when compared to three other sites in Saskatchewan, which were occupied during the same time period.

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CHAPTER 1: INTRODUCTION

The Tschetter site is located in the Aspen Parkland, northwest of Saskatoon, Saskatchewan. Although the presence of the site has been known by the Tschetter family since the 1920's, only a few collectors were aware of it until 1970. At that time, the reconstruction of a road which runs past the Tschetter farm, exposed the site in the new ditches. Test excavations were then conducted (Dyck 1972:15) and the site became the locale of the University of Saskatchewan archaeological field school from 1971 to 1976 (Urve Linnamae, personal communication). The Tschetter site is described here on the basis of the artifacts, faunal remains and features recorded during those excavations.

The objective of this thesis is to describe the Tschetter site. Each of the chapters represents an approach to the explanation of the events which took place there. Chapter two describes the biophysical environment which includes physiograhy, vegetation, soils, climate and faunal resources. Post-glacial processes in the Saskatchewan River Plains produced the Dunfermline Sand Hills in which the Tschetter site is located. The vegetation of the Dunfermiline Sand Hills is presently Aspen Parkland, which has developed on stabilized dunes. Evidence from the soils, vegetation, climate and palaeoclimate indicate that the environment of the Aspen Parkland ecotone has been stable for thousands of years. Prehistorically, the faunal resource potential of the Aspen Parkland, which is an ecotone between the southern grasslands and the northern boreal forest, was higher than either of these neighbouring zones during the autumn and winter because of the presence of bison herds sheltering in the aspen groves and grazing on the nutritive grasses of the Fescue Prairie.

Chapter three describes the physical remains of the site in terms of stratigraphy, faunal remains and features. Excavations at the site have determined that it represents a single component Late Prehistoric bison drive. Radio-carbon dates have confirmed the temporal assignation. The faunal resources of the Tschetter site are predominantly bison. Analysis of the bison bone has determined that at least 96 bison were killed, that the kill took place during the winter and that some food processing took place at the site. The ethnographic record provides descriptions of Late Prehistoric bison drives and is used to interpret the features of the site. The terrain of the site, the post hole features and the distribution of the bone bed, suggest that the bison were impounded and killed, while the charcoal and pit features suggest food processing.

In Chapter four, the artifact inventory of the Tschetter site is described. This inventory contains tools, lithic detritus and ceramic sherds which are similar to other Late Prehistoric bison kill sites. These tools are described by macro-morphological features with assumed functions, for means of comparison. Their distribution suggests that three loci of activity are recognized and defined as killing, butchering and food processing. The periphery of the site was also established by means of artifact distribution.

The application of a functional analysis to a sample of tools from the Tschetter site is described in chapter five. The initial reason for performing a functional analysis is to discover the range of activities engaged in by the prehistoric bison hunters at this site. Archaeologists cannot excavate a social system or an ideology, but they can excavate those material remains which represent these subsystems of culture. Artifacts, the data base of archaeology, are assumed to be indicative of all the subsystems of culture. This is based on the idea that culture is patterned - people do certain things in certain places, in a certain way and leave behind them the remains of these activities (e.g., artifacts, ecofacts and features). The importance of this assumption in the light of current archaeological theory, is that the artifact is not seen as an object to be measured, described and classified but rather it is an object that has relationships within the total artifact assemblage and has its primary functional context in one or more spheres of the total cultural system.

Within the past decade, functional analysis has gained popularity in the literature as one way in which culture change can be demonstrated by artifacts. According to Odell (1975:234) functional analysis can lead to the deduction of adaptational and economic patterns and pursue questions of culture process and change. The kind of functional analysis suggested is based on use-wear on tools which have been used in a certain way on a certain worked material. Tringham _et al_ (1974: 172) argue that information obtained through use-wear analysis adds the essential dimension of how an artifact was used, to the already over-worked information derived from macromorphology. Further, without this information from use-wear analysis, a wealth of computerized statistics is not meaningful in terms of culture change, because several sets of choices contribute to the overall appearance of an artifact, but none were made in isolation from the other sets.

Chapter six summarizes the data from the Tschetter site and compares it with other sites on the Northern Plains. The utility and results of the use-wear analysis are evaluated in terms of their contribution to an explanation of the events which took place at the Tschetter site.

CHAPTER 2: THE BIOPHYSICAL ENVIRONMENT

The Tschetter site is located near the northeastern edge of the Dunfermline Sand Hills, 16 km west and 10 km north of Saskatoon, Saskatchewan (Figure 2.1). It occupies the western edge of the NW¼ of 27 - 37 - 7 W3 and the eastern edge of the NE¼ of 28 - 37 - 7 W3 at 52° 13' 0" north latitude and 106° 55' 01" west longitude. As such, the site is found on the Saskatchewan River Plains. The biophysiographic region is described here in order to determine the resources available to, and the limitations placed upon, the prehistoric population of the Tschetter site.

2.1 The Physiography of the Saskatchewan Plains

The broadest physiographic division of Saskatchewan that can be made is between the Palaeozoic rocks of the Precambrian Shield and the Mesozoic-Cenozoic sediments of the prairies (Kupsch 1969:48). Their different characteristics are due to the responses of these two areas to the advance and retreat of the glaciers. The hard rocks of the Shield were affected by glacial erosion, while the unconsolidated shales and sands of the prairies show the effects of glacial deposition (Kupsch 1969:48).

The prairies of Saskatchewan lie within an area described as the Western Interior Plains of Canada (Bird 1972:116). These developed between the uplands of the Shield to the east and the mountains to the west. As opposed to the Shield, the topography of the plains is largely determined by the hundreds of feet of glacial drift deposited as a result of former glacial cover. Glacial drift is a comprehensive

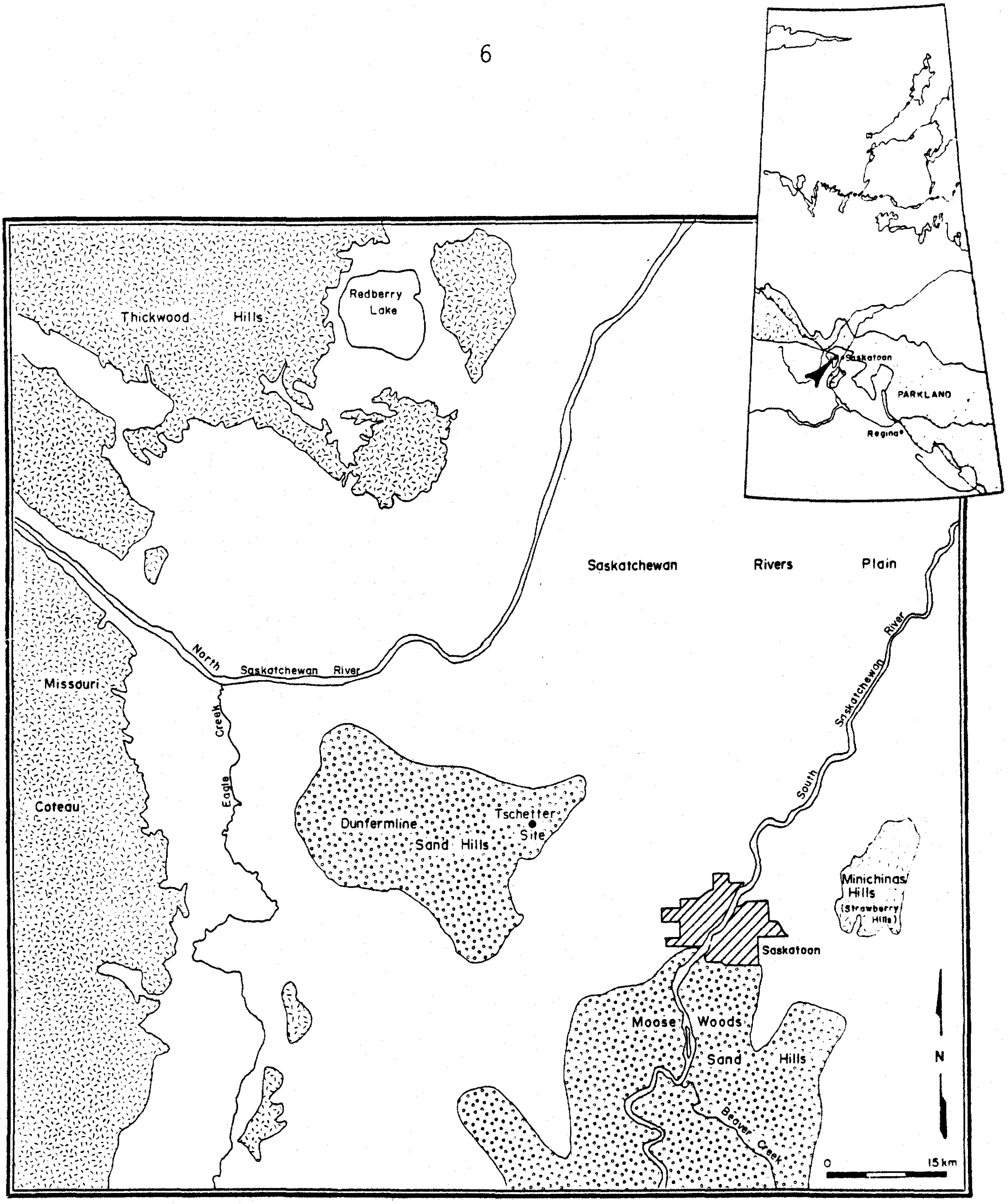


Figure 2.1 The Location of the Tschetter Site.

term denoting all materials deposited by glaciers but may be one of two kinds - till laid down by glacial ice or stratified drift laid down by water (Kupsch 1969:48). The bedrock, covered as it is by drift, rarely appears on the surface, but it does play some part in the development of the topography, to the extent that hills, plateaus and escarpments are located where the bedrock is close to the surface (Bird 1972:116).

The Interior Plains are divided into three regions or levels based on elevations above sea level. The first and lowest level is the Manitoba Lowland, between the edge of the Shield to the east and the Manitoba Escarpment. The Saskatchewan Plains, or second prairie level, lies between the Manitoba Escarpment and the Missouri Coteau. West of the Missouri Coteau and extending to the Rocky Mountain Frong, is the third prairie level, the Alberta Plains.

These boundaries of the Saskatchewan Plains, the Manitoba Escarpment and the Missouri Coteau, provide the greatest topographical relief in the area. The Manitoba Escarpment, as it is seen today, is actually a series of discrete upland units separated by the Assiniboine, Swan, Red Deer and Saskatchewan Rivers (Bird 1972:121). These upland units are known as the Pembina, Riding Mountain, Duck Mountain, Porcupine, Pasqua and Wapaweka Hills. The Missouri Coteau enters Saskatchewan from the United States and continues north in a series of hills as far as the south branch of the Saskatchewan River. North-west of the river, the Coteau is evident in the form of the Bear Hills and then disappears beneath glacial deposits in eastern Alberta.

Generally, the Saskatchewan Plains is an area of gentle relief which varies little over great distances (Kupsch 1969:41). Glacial activity here produced extensive, undulating plains of ground moraine, sandy ridges and kettle hollows (Bird 1972:123). Other glacial activity includes till plains worked over by proglacial lakes, the most conspicuous of which is the Regina Plains. Where sandy outwash and glacial lake sands have been blown by wind, dunes occur in extensive areas. The Tschetter site is located in such an area. Morainic debris deposited on the domes of the surface of the Cretaceous rocks on which the plains have developed causes slightly higher areas of terrain. Thus, the topography of the Saskatchewan Plains results from a combination of structural features and glacial modification.

2.2 The Dunfermline Sand Hills

The area of the Saskatchewan Plains which encompasses the north and south branches of the Saskatchewan River is the Saskatchewan River Plains. The Saskatchewan River Plains are underlain by lake deposits or water-washed till and its characteristic features are deep, terraced river valleys, dune areas and hummocky moraine. One of these dune areas, the Dunfermline Sand Hills, occupies the Saskatchewan River Plains between the North and South Saskatchewan Rivers, west of Saskatoon. They comprise an area approximately forty-two kilometres wide and thirty kilometres long. This is an area of stabilized sand dunes, surrounded by flat, lacustrine plains (Dyck 1977:16) (Figure 2.2).

The sand hills in this area were formed by post-glacial processes and have a deltaic origin. Glacial ice retreated from the research area 10,000 - 13,000 years ago (Hulett *et al* 1966:1308). The general

Figure 2.2 Aerial View of the Tschetter site (site circled)

inclination of the land surface being to the north and east, melt water was obstructed from flowing in that direction by the ice and so moved southeastward along the ice front until it was impounded in a glacial lake (Hulett et al 1966:1308). As the meltwater flowed into a glacial lake, its load capacity decreased and large particles like sand were deposited as deltas. After the retreat of the depositing waters, the sand of outwash areas was blown into dunes.

2.3 Vegetation of the Study Area

2.3.1 The Aspen Parkland

The vegetation of the research area has been described as Aspen Grove (Coupland and Rowe 1969:73) or Aspen Parkland (Gordon 1979:12). Such a region is found where conditions are sufficiently moist on the grasslands to support small stands of aspen (*Populus tremuloides*). Stands of aspen are most commonly found in and around moist depressions, in sandhills and in elevated areas. The Aspen Parkland is an ecotone between the southern grasslands and the northern boreal forest. An ecotone is an intergradational area between major continental biomes and contains flora and fauna from the adjoining biomes as well as species specific to the ecotone (Syms 1977:11).

In the grassland-forest transition zone, the most common associated grassland type is Fescue Prairie. The Fescue Prairie Association occupies black soils between clumps of *Populus tremuloides* in the Aspen Parkland region. The Aspen Parkland region is found along the northern edge of the Mixed Prairie from central Saskatchewan west to the foothills of the Rocky Mountains, and then south along the foothills contacting the western edge of the mixed prairie as far south as the forty-ninth parallel (Coupland 1961:145). *Festuca scabrella* contributes between sixty-five and seventy per cent of the foliage in the Aspen Parkland region (Coupland 1961:145). The vegetational transition in the Aspen Parkland region is represented by the dominance of F. *scabrella* near the forest edge to replacement by the *Stipa-Agropyron* faciation of the dark brown soils, near the edge of the Mixed Prairie.

2.3.2 Vegetation of Dune Sand Areas

As well as being located in the Aspen Parkland, the Tschetter site is also an area of stabilized sand dunes which do not show signs of recent erosion. The vegetation in dune sand areas is usually anomolous to that found in adjacent soils of finer texture (Hulett et al 1966:1307), The ability of a species to survive in sand depends on its resistance to burial and its capacity to obtain moisture. Therefore, many of the permanent species which occupy sand dunes are deeply rooted. Table 2.1 lists the vegetation found in stabilized sand dunes.

The varied vegetation of dune sand areas represents stages of succession towards stabilization which proceeds as follows (Hulett et al 1966:1329). On dunes and in dune depressions, grasses play the most important role in the development of vegetation. The first to appear are Indian rice grass, sand dropseed and wild rye. At a later stage, sand grass appears and is effective as a sand binder. These grasses are gradually replaced by spear grass. If the succession

Table 2.1 THE VEGETATION OF STABILIZED DUNES (after Hulett et. al. 1966:1313)

Stipa Comata (spear grass)	*Artemisia campestria* (sage)
Artemisia frigida (sage)	*Sporobolus cryptandrus* (sand dropseed)
Selaginella densa (Prairie selaginella)	*Arabis holboellii* (reflexed rock cress)
Koeleria cristata (June grass)	*Rosa woodsii* (rose)
Carex eleocharis (dwarf sedge)	*Solidago missouriensis* (golden rod)
Carex heliophilia (sedge)	*Carex fillifolia* (thread-leaved sedge)
Psoralea lanceolatea (narrow-leaved psoralea)	*Cerastium arvense* (field chickweed)
Chrysopsis villosa (golden aster)	*Lygodesmia juncea* (skeleton weed)
Calamovilfa longfolia (sand grass)	*Smilacina stellata* (star-flowered Solomon's seal)
Agropyron spp. (wheat grass)	*Petalostemen purpureus* (purple prairie-clover)
Phlox hoodi (moss phlox)	*Eleagnus commutata* (silverberry)
Bouteloua gracilis (blue grama grass)	*Populus tremuloides* (aspen)
Prunus virginiana (chokecherry)	*Salix spp.* (willow)
Symphoricarpos occidentalis	

continues before another erosion cycle, June grass, dwarf sedge and sage appear in association with spear grass. These last three species are less deeply rooted and less specialized and appear when the incorporation of organic matter has provided sufficient moisture-holding capacity in the surface layers to accommodate them. In dune depressions, the protection afforded by the depression permits the invasion of shrubs and trees. The first shrubby invader is juniper. Another shrub often found in association with juniper is bearberry. Taller shrubs which appear are rose, silverberry, chokecherry and saskatoon. The cover provided by these shrubs represents a further stage of succession. When trees are present they are most commonly aspen.

2.4 Soils of the Aspen Parkland

Just as the vegetation in the Aspen Parkland region represents a transition from grassland to forest, the soils represent a corresponding transition from chernozemic soils to luvisolic soils (Pettapiece 1969: 105). Chernozemic soils develop under a dominantly grass vegetation. Toward the boreal forest with a greater percentage of aspen, eluviated black and dark grey soils dominate. Since soil zones "...tend to be fairly homogenous within vegetation belts, ... the grey luvisol of the boreal forest grades into the black soils of the parkland which in turn, grades into a dark soil zone part of which underlies portions of the Fescue or long grass prairie" (Gordon 1979:12). Brown soils support the Mixed Grass Prairie.

Pettapiece's study of soils in the parkland transition zone indicates that this ecotone has been stable for a long time (1969: 109-111). Pettapiece states that vegetation changes from grassland to forest (or vice versa) can produce noticeable changes in the soil in less than one hundred years. However, it takes several hundreds or even thousands of years for the complete conversion of one soil type to another. Black soils form under a predominantly prairie vegetation with local aspen groves. Dark grey wooded soils are indicative of forest dominance. In the present day parkland transition zone, Pettapiece found that black chernozemic soils dominated.

The soils of the Dunfermline Sand Hills are regosolic. These soils are weakly developed and are composed only of the parent material or C Horizon (Moss and Clayton 1969:72). The parent material in this case is sandstone bedrock which has been re-worked by wind to form dune areas.

2.5 Climate

2.5.1 Present Day Climate

The development of soils is dependent to a large extent on the parent material, but vegetation and climate play an important role as well. The character of the vegetation, in turn, is dependant on the soils and the climate. A consideration of climate then, is instrumental in the description of the research area.

The sub-humid (or 'Cold Forest') climate of Saskatchewan corresponds roughly with areas of aspen grove vegetation and thus with dark brown and black soils (Chakavarti 1969:60). With this type of climate, summers are cool and the mean July temperature falling between 14 to 19 degrees C and the winters are cold with the mean daily January temperatures between +10 and -9 degrees C. There are approximately 80 frost-free days in this area.

Winds are moderate (i.e., not calm and not in excess of 49 km per hour) in the Saskatoon area (Maybank and Bergsteinsson 1970: 365). A very slight preference for winds from the northwest is noted, however, light winds are most commonly from the south or southwest and northeast, while brisk winds usually come from the northwest. The months in which the most wind has been recorded are April and May and February is the least windy month. The mean annual speed of the winds in this area is 18 km per hour.

During the winter months, the average precipitation measures 1.7 cm per month, most of which falls as snow. June is the wettest month, averaging 5.8 cm of precipitation, but this condition is highly variable. Snow falls in the Saskatoon area between the mean dates of October 20 and April 18 and the maximum snow accumulation is reached at the end of February.

2.5.2 Palaeoclimate

Pettapiece's evidence from the soils and the vegetation of the Aspen Parkland suggest that this environment has been stable for "hundreds or even thousands of years." This means then, that the climate too must have remained fairly stable (excluding minor fluctuations). Bryson and Wendland (1967:272-277) have proposed a scheme of major climatic episodes following the glaciation of North America, based on a correlation of climatic variables with major biotic zones. This scheme of climatic change is based on the assumption that climate is the ultimate ecological control and that "...within the past ten or fifteen millenia a mix of airmasses occuring in the same frequency and annual sequences as at the present would be associated with a similar biotic system to that which it is now associated" (Bryson and Wendland 1967:272). These climatic episodes are summarized in Table 2.2. The time period under consideration here, i.e., circa 1,000 B.P. when the Tschetter site was inhabited, corresponds to the Neo-Atlantic, a cool, dry, period. From the Atlantic episode on, variations in climate were small in terms of the present climate. Generally then, the climate and vegetation of the Aspen Parkland 1,000 years ago was as we see it today.

Another line of evidence used to reconstruct the palaeoclimate is the study of buried soil profiles in sand dune complexes. Townley-Smith (1980:12) and Syms (1977:36) report periods of dune activity in southern Manitoba which show six periods of major dune activity associated with major droughts. After the end of the dry Atlantic period, vegetation stabilized dune surfaces. An active phase between 3,700 and 2,500 B.P. followed, terminated by a more humid regional climate (Bryson and Wendland's Sub-Boreal Episode). Three more active periods occured during major changes of the regional climate at 1,500, 900 and 400 years B.P. These active periods correspond with Bryson and Wendland's warm, dry Scandic Episode, and the subsequent cool, dry Neo-Atlantic and Pacific I Episodes.

If we can apply this date to central Saskatchewan, it would appear as if the Tschetter site was occupied between two major periods of dune activity, and thus, between two periods of major droughts. It is possible then, that the Dunfermline Sand Hills were not active during the time of occupation and were in fact, stabilized, or in the process of stabilization. If this were the case, the site may have been located in an aspen grove as it is today.

Another consideration to emphasize is the sensitivity of the Aspen Parkland region to short-term climatic fluctuations. The oscillation of drier and wetter years changed the quantity of water and the area covered by trees. In the discussion of vegetation succession in dune sand areas, it was noted that in order for the succession to continue to the point where shrubs and trees appeared,

Table 2.2 POST-GLACIAL PALAEOCLIMATIC EPISODES (after Bryson and Wendland 1967, and Townley-Smith 1980)

Palaeoclimatic Period	Terminal Date	Climate	Vegetation (of the North western Plains)
Late Glacial	10,500 B.P.	Cool, Moist	Boreal Forest
Pre-Boreal	9,650 B.P.	Cool, but Drier	Parkland
Boreal	8,450 B.P.	Warming and Drying Trend	Parkland-Grassland
Atlantic	4,680 B.P.	Hot, Dry	Semi-Arid Grassland
Sub-Boreal	2,890 B.P.	Cooler, Moister	Grassland
Sub-Atlantic	1,690 B.P.	Warm, Dry	Grassland
Scandic	1,100 B.P.	Warm, Dry	Grassland
Neo-Atlantic	900 B.P.	Cool, Dry	Grassland
Pacific I	500 B.P.	Cool, Dry	Grassland
Pacific II	400 B.P.	Warm, Moist	Grassland

sufficient moisture was a prerequisite. Other factors to consider in relation to the relative presence/absence of aspen are fire and animal activity. Syms (1977:33) notes that:

> "Fire was one of the most important variables in the balance between grassland and forest in the aspen parkland. Frequent fires reduced the size of the brush-forest groves and enabled the early successional stage to persist."

A review of the literature by Archibold and Wilson concerning the natural vegetation of Saskatchewan prior to widespread settlement implies that:

> "...aspen groves have expanded since White settlement, supposedly because of the reduction in the number and extent of both natural and deliberately set fires" (1980:2033).

Archibold and Wilson collected data for the pre-settlement period from 2,500 township plats in Saskatchewan in an effort to reconstruct the natural vegetation, against which modern distributions could be compared. They concluded that generally, the grovelands have expanded southward and that this expansion is a recent phenomenon. That the determining factor was fire, could not be confirmed. Agricultural clearing is now the dominant factor and it:

> "...continues at such a rate as to make a modern map of relict natural vegetation extremely difficult to compile by means of statistical sampling" (Archibold and Wilson 1980:2042).

Large, grazing and browsing animals, like bison, played a role as well. They rubbed up against, uprooted and trampled trees (Gordon 1979:12). This activity allowed the extension of grassland, just as overgrazing and churning up the land by wallowing animals aided the extension of shrubs and aspen into areas covered with grass (Syms 1977:33).

Because of the sensitivity of the Aspen Parkland, it is not possible to state with certainty that the Tschetter site was located in an aspen grove at the time of occupation. The palaeoclimatic data and the evidence from the soils does suggest, however, that the site was located in the Aspen Parkland and that the Dunfermline Sand Hills were either stabilized or in the process of stabilization circa A.D. 915 - 945.

As it is seen today, the site lies in a slight depression which rises more sharply to the north than the south. It is important to note in this context that the protection afforded by a depression permits the invasion of shrubs and trees in dune sand (Hulett et. al. 1966:1329). This is certainly true in the present day situation where a dense stand of aspen now grows. It can be hypothesized then, that in the Late Prehistoric Period, the Tschetter site looked much as it does today in that it was within an aspen grove.

2.6 Faunal Resources of the Aspen Parkland

An examination of the fauna found in an area where prehistoric settlements have been recorded is important in terms of the resource potential available to the inhabitants of that area (Table 2.3). In his "multi-zonal resource potential model" for southwestern Manitoba, Syms (1977:29-32) assessed the faunal resource potential of a particular area by comparison with the resource potential of adjoining biomes and ecotones. Syms used this model to demonstrate the postulate that "The importance of the physical environment of a region can be understood only by comparing the resource potential of the region during any season against the resource potential of adjacent zones or areas" (Syms 1977: 32). This model is most applicable to the research area under consideration here, as it involves the boreal forest, the plains grasslands, and the Aspen Parkland ecotone. The faunal resource potential of the Aspen Parkland and the adjoining biomes during the seasons of the year is given as follows.

Spring in the Aspen Parkland saw concentrations of bison, birds and spawning fish and thus a higher resource potential than the boreal forest or the grasslands. In addition to these resources, lagomorphs, rodents, large and small carnivores and artiodactyls were scattered throughout the zone.

During the summer, bison moved onto the grassland, migratory water

Table 2.3 FAUNAL RESOURCES OF THE ASPEN PARKLAND (after Bird 1961)

Class:	Mammalia	
Order:	Artiodactyla	
	Family:	Bovidae
		Bison (*Bison bison*)
	Family:	Antilocapridae
		Pronghorn Antelope (*Antilocapra americanus*)
	Family:	Cervidae
		Elk (*Cervus canadensis*)
		Mule Deer (*Odocoileus hemonius*)
		White-tailed Deer (*Odocoileus virginianus*)
		Moose (*Alces alces*)
Order:	Carnivora	
	Family:	Canidae
		Buffalo Wolf (*Canis lupus nubilus*)
		Coyote (*Canis latrans*)
		Timber Wolf (*Canis lupus*)
		Red Fox (*Vulpes fulva regalis*)
	Family:	Mustelidae
		Weasel (*Mustela spp.*)
		Badger (*Taxidea taxus*)
		Skunk (*Mephitis mephitis*)
Order:	Lagomorpha	
	Family:	Leporidae
		White-tailed Jackrabbit (*Lepus townsendii*)
		Snowshoe Rabbit (*Lepus americanus*)
Order:	Rodentia	
	Family:	Sciuridae
		Richardson's Ground Squirrel (*Citellus richardsonii*)
		Thirteen-striped Ground Squirrel (*Citellus tridecemlineatus*)
		Chipmunk (*Eutamius minimus*)
		Franklin's Ground Squirrel (*Citellus franklinii*)
	Family:	Geomyidae
		Pocket Gopher (*Thomomys talpoides*)
	Family:	Cricetidae
		Red-backed Mouse (*Clethrionomys gapperi*)

birds continued northward and the resource potential of the Aspen Parkland dropped. The grasslands would have had the highest resource potential with the accumulation of bison herds there.

The season of maximum resource potential for the Aspen Parkland was autumn. The bison were returning to their winter habitat, both nesting and migratory birds congregated in great numbers and antelope migrated to the mixed woods-grasslands of the uplands. Rodents, carnivores and artiodactyls were found in greater numbers in the forest edges. The boreal forest resource potential also rose, but that of the grasslands dropped dramatically.

Winter brought further changes in all three zones. Scattered herds of bison in the forested areas again provided the Aspen Parkland with the highest resource potential, although migratory and nesting fowl were gone. Deer and antelope were scattered but could generally be found in sheltered areas. Except for the caribou and moose, the boreal forest, especially its southern edge, was low in resource potential. On the grasslands, faunal resources were confined to the river valleys and uplands.

Compared to the boreal forest, the Aspen Parkland had a higher resource potential during all seasons of the year. With the exception of the summer months, the resource potential of the grasslands compared to the Aspen Parkland was lower as well. Overall, spring and autumn and particularly autumn were the seasons of highest faunal resource potential in the Aspen Parkland.

2.7 Bison in the Aspen Parkland

Of particular interest to the site discussed here, is the presence/absence of bison in the Aspen Parkland during different seasons of the year. It is the presence of bison during the spring, autumn and winter which accounts for the high resource potential of the Aspen Parkland. When the bison move onto the grasslands for the summer, the resource potential of the Aspen Parkland drops and is surpassed by that of the grasslands. Essential to Syms' model is the assumption that bison migrate. That is, bison movements were seasonal and regular.

The works of Morgan (1979, 1980), Moodie and Ray (1976), Arthur (1975) and Gordon (1979) provide ample evidence to support the proposition of bison migration on the Canadian plains. According to Morgan:

> "The availability of superior forage appears to be the primary stimulus of major bison movement patterns. The geographic positioning of the vegetative communities that constitute the summer and winter ranges committed the movements of the Saskatchewan herds to a north-south orientation" (1980:14).

And further:

> "Movements to the winter range generally involve a gradual convergence and amalgamation of herds into specific localities suited for winter habitation. Movements to the summer range entail a gradual dispersal of small herds" (Morgan 1980:141).

Arthur, Moodie and Ray cite historical evidence from the journals of fur-trading posts, missionaries and others to support this thesis. Factors which disrupted "...general movements in and out of the parkland fringe of the northern plains...were winter temperature conditions, fires and hunting pressures" (Moodie and Ray 1976:49). Mild winters allowed the bison to remain on the open grasslands as did a lack of snow cover. The cultural factors were just as disruptive in that hunting pressures dispersed the herds over wide areas and the destruction of vast tracts of land by fire prevented the bison from reaching sections of the parkland. As well, historical documentation by Moodie and Ray (1976:50) shows that the grasslands around trading posts were sometimes deliberately set on fire by the Indians in order to enhance the value of their provisions. What is significant about these disruptions in the seasonal migrations, is that the "...causes were common knowledge and...(the) effects were in large degree predictable to the local inhabitants (Moodie and Ray 1976:50). Morgan (1980:145) adds that the erratic behaviour of bison in historic times could be attributed partly to the change of hunting techniques which accompanied the acquisition of the horse. Raiding parties to obtain horses also disrupted the bison. But, despite these disruptive factors, the bison retained a recognizable degree of seasonal regularity. And since these pressures (i.e., the cultural ones) were not present in the prehistoric past, bison movement patterns were even more regular and more predictable than they were in the historic period.

Morgan's evidence for seasonal migrations takes into account the fact that bison behaviour "...is a predictable response to a range of ecological influences" (1980:143). In the summer and early fall the bison herds can be found on the dry, Xeric Mixed Prairie or the summer range, comprised of *Stipa-Bouteloua, Bouteloua-Agropyron* and *Stipa-Bouteloua-Agropyron* vegetative types. During the late fall, winter and spring, bison are on their winter range - the more moist Mesic Mixed Prairie (comprised of *Agropyron-Koeleria* and *Stipa-Agropyron* vegetative types), the Fescue Prairie of the Aspen Parkland region, the transitional grasslands of the Aspen Parkland region and the River Valley Complexes. Movement into the winter range was stimulated by grasses which are still green (and thus highly nutritive) in the fall and by the availability of water. There, on the open grasslands of the winter range near adequate water supplies, the bison remained until the arrival of the first snow. With the coming of the snow, the sheltered areas of the Aspen Parkland region and the Valley Complexes offered the optimum forage potential. The grasslands of these regions have a forage capacity four to five times greater than the summer range and are able to accommodate the high density, sedentary herds which congregated there.

Syms' multi-zonal resource potential model and Morgan's ecological analysis of bison movement patterns demonstrate that, in terms of available resources, the Aspen Parkland was a good place to live during the greater part of the year. In the winter, large, sedentary herds of bison could be found on the grasslands of the Aspen Parkland and in the associated sheltered areas of aspen groves. Because of the presence of this single resource, the Dunfermline Sand Hills was a hospitable place to live.

CHAPTER 3: THE TSCHETTER SITE

In this chapter the results of the excavations at the Tschetter site are described. The stratigraphy, dating, faunal resources and features of the site demonstrate that it is a Late Prehistoric bison drive. The ethnographic record is used to reconstruct the events which took place at a prehistoric bison pound and to predict the kinds of material remains which represent these activities.

3.1 The Excavations

Over the past ten years, the Tschetter site has been periodically investigated by means of various research designs. These include: test excavations in 1971, University of Saskatchewan field school excavations from 1971 to 1976, a faunal analysis and further testing in 1979.

The purpose of the 1971 excavations by Dyck (1972), which consisted of three pits, was to examine what remained of the site which had been partially destroyed by road construction. The presence of a site was indicated by a bone bed more than 35 metres long and up to 30 cm thick, exposed in the ditch. Dyck's excavations identified an occupation layer in which bison bones were abundantly represented. The condition of the bones suggested extensive butchering. Lithic tools from the test excavations included Late Prehistoric side-notched projectile points, end scrapers, unifaces, bifaces and retouched flakes. An abundance of lithic debitage and bipolar core remnants, five small pottery sherds and gritty stones were also recovered.

The 1971 excavations revealed that the Tschetter site was a Late

Prehistoric bison kill and butchering site. The range of tools found were those commonly associated with such sites with projectile points being the predominant tool. Due to the nature of the terrain, it was speculated that a corral structure was used to impound bison.

Disturbance due to road construction at the site was confined to what appeared to be the main bone bed. Dyck (1972:25) noted that,

> "It is probable that features such as a corral structure and associated drive lanes and habitation area may still be buried intact. This makes the prospect of future investigations at the Tschetter site an inviting one."

The proximity of the site to Saskatoon also made it an ideal locale for the University of Saskatchewan's archaeological field school. The field school, under the direction of Dr. Urve Linnamae, was conducted from 1971 to 1976 for two consecutive weekends in the fall term and the material was catalogued and described by the students. A total of 82, two-by-one metre squares were excavated during that time, representing 174 square metres. The field school excavations were confined to the main bone bed on either side of the road. These excavations produced a prolific amount of whole and butchered bone, chipped stone tools and lithic detritus.

One of the major considerations in continued archaeological investigation at the site in 1979 was to determine the extent of the site. This goal was realized for the northern, southern and eastern extents. A surface survey of the area west of the known occupation, showed continuous occupation in the form of a surface scatter of bone and lithics. We know that the entire area which includes the Tschetter site was utilized in prehistoric times, and concluded that testing procedures would not be able to tell us the exact western limits of the site. We were able to determine, however, that the site extended for approximately 200 metres east-west on the west side of the road, 132 metres east-west on the east side of the road and 60 metres north-south. So, excluding the area west of the main bone bed, it is estimated that approximately two per cent of the total known area of the site has been excavated. An additional 180 square metres, or 2.2 per cent of the total known area of the site has been destroyed by road construction. The testing procedures also enabled us to confirm that the main bone bed was confined to a 12 metre strip paralleling both sides of the road. An additional five square metres were excavated in the form of two trenches in order to follow the bone bed to its eastern extent. Figure 3.1 is a plan of the site showing the areas of excavation.

3.2 Stratigraphy

The stratigraphy of the Tschetter site clearly represents a single component occupation sharply delineated above and below by sterile sand. Distinct colour changes in the soil made identification of the cultural layer obvious. Variations in the colour of the sterile layer below the occupations are attributed to leaching (see Figure 3.2). Rodent burrows and pot-hunters' pits are the only disturbances in the stratigraphy and these too are clearly defined and easily recognized.

The first layer in the stratigraphy is an organic mat, a very

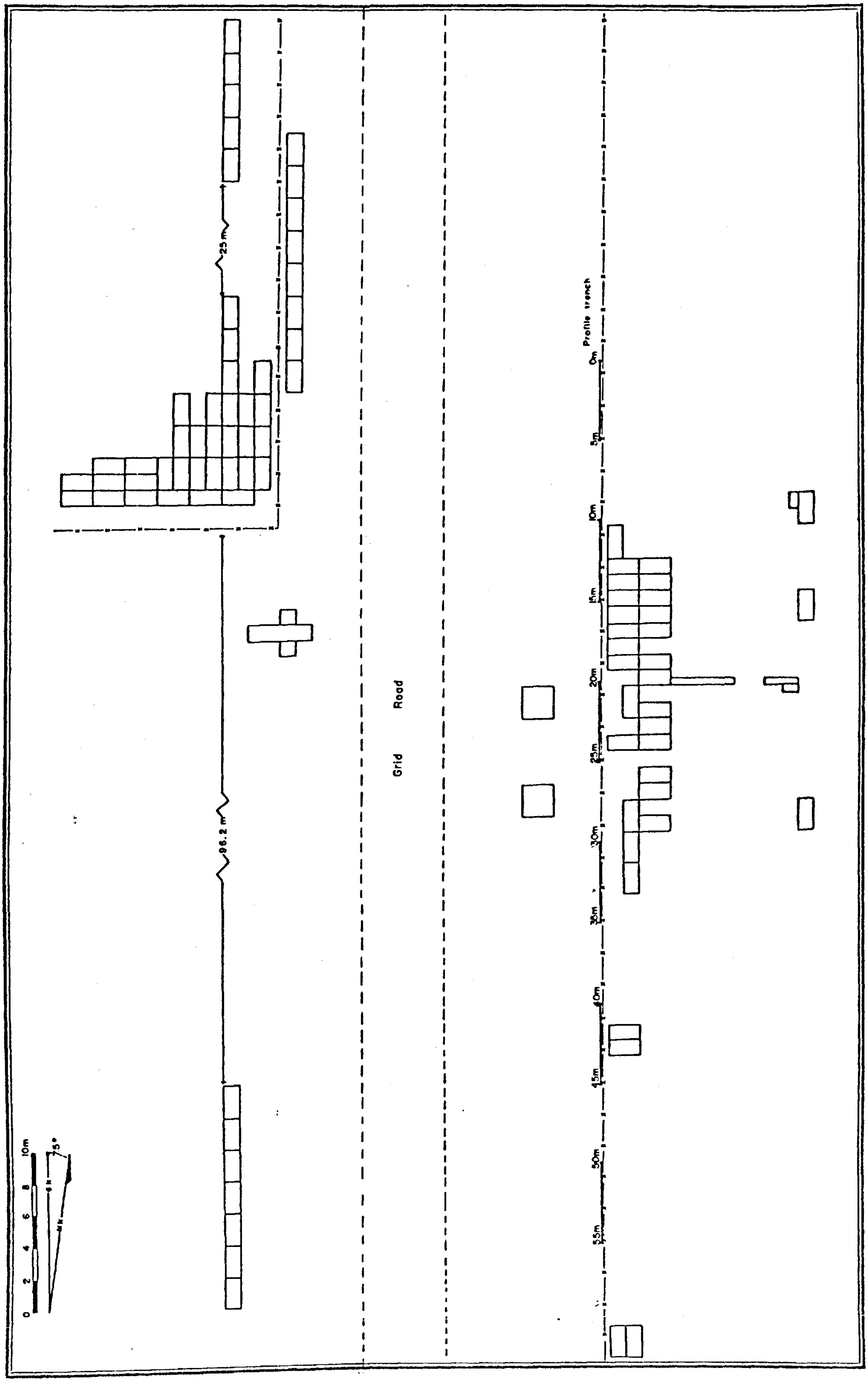


Figure 3.1 Planview of the Tschetter Site.

Figure 3.2 The stratigraphy of the Tschetter Site.

dark, humus-rich level varying from four to 20 cm in depth, with eight cm being an average thickness. Below this layer is a mineral horizon of tan coloured or tan/grey mottled, fine-textured sand. This horizon varied in depth from 20 to 30 cm on the east side of the site. A thin (10 cm) layer of tan coloured sand sometimes separated the mottled layer from the cultural stratum.

The culture-bearing matrix is easily identified throughout the site as a dark black/grey layer laden with occupational debris. Its depth also varied and was found from 20 to 45 cm below surface on the west half of the site, to 40 to 60 cm below the surface on the east site. The sterile layer was reached at varying depths depending on the location of the cultural material. This layer too was readily recognized as a mass of light-coloured sand, light coloured sand with bright yellow streaks or bright yellow sand.

Variations of the stratigraphy are mainly the thickness and depth below surface, of the cultural layer. In the area deemed to be the main bone bed, the cultural layer is thicker than that found at the northern and southern extremities of the site. This 'petering out' effect is demonstrated in Figure 3.3 which is a north-south profile through the bone bed. Also, it has been noted that the occupation layer on the eastern side of the site is more deeply buried than that on the west side. A less deeply buried occupation layer on the west side is accounted for by the fact that this is where the Tschetter farm is located. Disturbance due to farm activities and farm animals have contributed to denuding the surface of vegetation. Once the

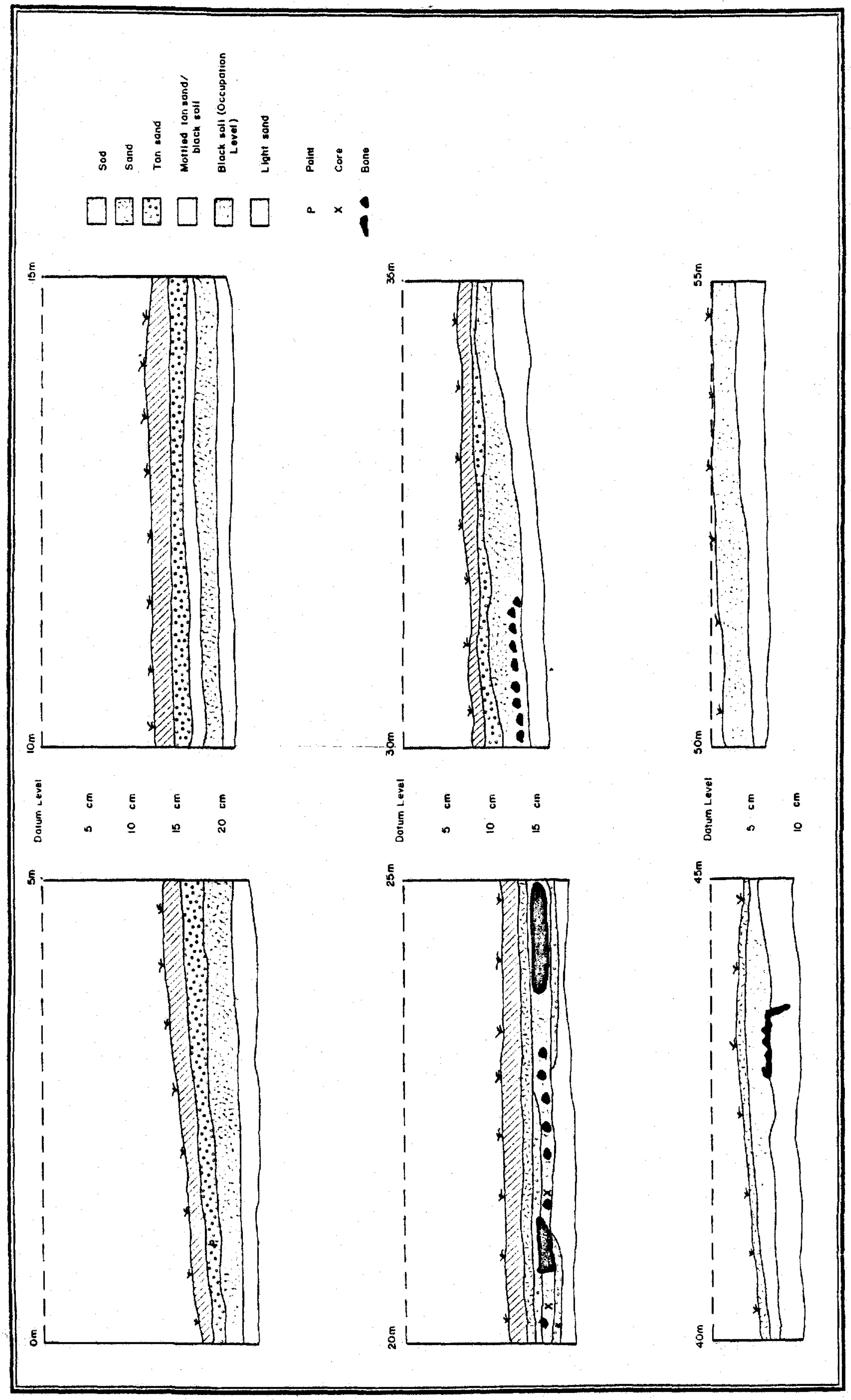


Figure 3.3 Profile of the Tschetter Site.

vegetation, especially trees and shrubs have been removed from the dune surface, erosion by wind degrades the surface. According to the depth below surface of the occupation layer, deflation in the range of 15 to 20 cm has occurred in this disturbed portion of the site.

3.3 Dating the Tschetter Site

Agricultural activities on the plains have disturbed many sites, so that relative dating methods are often the only means of temporal assignation available to archaeologists. Projectile point terminology, developed from undisturbed sites with clearly defined strata, is the major relative dating method on which plains archaeologists rely. Although the Tschetter site is not totally disturbed, the small, side-notched projectile points found there, as well as the small ceramic sherds first suggested that the site belonged to the Late Prehistoric Period which was present on the plains from A.D. 200 to historic times. Two side-notched projectile point varieties are recognized within the Late Prehistoric Period. These are the Prairie Side-Notched and the Plains Side-Notched types. The Tschetter site points were thought to correspond most closely to the former. On the northwestern plains, Prairie Side-Notched projectile points are dated as occuring from A.D. 700 to A.D. 1,300 (Kehoe 1966, 1973).

In order to conform this relative date, unburnt bone samples from the bone bed of the Tschetter site were submitted for radio-carbon analysis. The resultant dates were found to be 1005 ± 75 years: A.D. 845 (S - 669) and 914 ± 45 years: A.D. 1036 (S-1631). An additional date of 1020 ± 100 years: A.D. 970 (NMC - 1265) was obtained in 1981 from an area south of the bone bed (U. Linnamae, personal communication).

3.4 Faunal Resources of the Tschetter Site

A faunal analysis of the bone recovered from the Tschetter site excavations was conducted by Walker (1978) and by his students (Walker, personal communication). Walker's analysis determined that 99 per cent of the faunal material recovered represented the remains of *Bison bison*. Non-bison remains are presented in Table 3.1. The minimum number of animals killed at the site was calculated on the basis of the frequency of mandibular third molars, and was determined to be 96. Additional support for this calculation came from the frequencies of first and second cervical vertebrae and mandibular condyles.

As part of the faunal analysis, a determination of the individual age of the bison population at the site was calculated on the basis of dental eruption schedules and wear patterns. The range in age was found to be from seven month old calves to adults of 11 years or more. This information can be used to determine the time of year of the kill. That is, if calving occurs in late April or May, and calves at the site are at least seven months old, the kill would have occured somewhere between early November and late January. Some variation was displayed within each of the age groups. This oscillation in age grouping values suggested to Walker (1978:8) the possibility of "...a continuous series of limited kills over some period of time."

Of the 16 specimens considered to be suitable for the determination of sex, 75 per cent were classified as female. Only one specimen could reliably be considered a mature bull. The sex composition of the bison

Table 3.1 NON-BISON FAUNA FROM THE TSCHETTER SITE (after Walker 1978)

Class:	Mammalia	
Order:	Carnivora	
	Family:	Canidae
		Canis lupus
		Canis familiaris
		Canis sp.
	Family:	Mustelidae
		Taxidea taxus
		Mephitis mephitis
Order:	Lagomorpha	
	Family:	Leoporidae
		Lepus sp.
Order:	Rodentia	
	Family:	Scuridae
		Spermophilus richardsonii
	Family:	Muridae
		unidentified
Class:	Aves	
	unidentified	

population would appear to add support to a winter kill since mature bulls congregate as a separate group after the fall rutting season (Walker 1978: 8).

Walker also commented on the under-representation of limb bones in the Tschetter sample. The diaphyseal fragments of the limb bones that are represented show impact damage. Since these elements contain large amounts of bone marrow, Walker (1978:5) suggests that limb bones were utilized to their maximum extent.

3.5 Season of Occupation

Palaeoclimatic and ecological data, presented in the previous chapter, have determined that the Tschetter site was located in the

Aspen Parkland at the time of occupation and that large herds of bison congregated there only during the winter. A summer habitation of the Tschetter site is unlikely for two reasons: the absence of surficial water at this locale and the absence of a herd of bison of the magnitude as that represented in the faunal sample of the site. The age and sex composition of the bison population at the Tschetter site suggests that the kill took place during the winter months. This suggestion appears to be confirmed by the environmental data.

3.6 The Bison Drive

The archaeological record provides the material remains of an activity, "(it)...does not consist of behaviour but, at best, of the precedents and products of behaviour" (Wobst 1978:303). In order to describe the events of a prehistoric activity, archaeologists rely on ethnohistory. Both archaeology and ethnohistory rely, to some extent, on ethnology. Archaeology in particular has used ethnographic studies as analogs for archaeological interpretation. Analogy is:

> "...a form of reasoning whereby the identity of unknown items or relations may be inferred from those that are known...In archaeology, analogy is used to infer the identity of and relationships among archaeological data on the basis of comparison with similar phenomena documented in living human societies" (Sharer and Ashmore 1979:455).

When archaeological features are observed which are not similar to phenomena in living societies to which they may be compared, and thus interpreted, analogy becomes very much a form of reasoning and can lead to an erroneous reconstruction of past behaviour. Analogy can be a useful and accurate tool however, if certain prerequisites are met. These are: cultural continuity, comparability of environment and similarly of cultural form between the unknown and known phenomena (Sharer and Ashmore 1979:460).

The concern with cultural continuity in archaeology led to the development of 'the direct historical approach'. This method involves working from artifacts and sites identified with a historically known group, back through time to similar, but earlier artifacts and sites and is most applicable to reconstructing the protohistorical situation. Kehoe adopted this approach to describe the events leading up to, and taking place during, a Late Prehistoric bison drive. Unlike the direct historical approach, however, Kehoe used the written accounts of bison driving and "...interviews with elderly Indians who once knew the protohistorical culture" (1973:171). He calls this method the direct ethnographic approach. The use of the historic record to describe Late Prehistoric hunting techniques has also been used by Arthur who justifies the approach in the following statement:

> "Because of the late acquisition of the horse (on the Northern Plains) the early historic accounts of the use of the traditional hunting methods began early enough to show little, if any, change from pre-horse methods or the season when they were used" (1975:1-2).

Thus, the prerequisite of cultural continuity is seen to have been met in the case of bison kill sites, by the use of the direct ethnographic approach. The comparability of environment stipulation presents no problem in this context, as the historic record clearly describes the same northern plains on which bison kill sites are found. The final consideration is that of similarity of cultural form. This refers to the overall complexity of the culture described in the historic record and the complexity of the culture preserved in the archaeological record. That is, the culture must have been relatively free of external influences. The archaeological record has demonstrated that communal bison hunting is a tradition confined spatially through time. The external influences of concern in this respect are the acquisition of the horse and gun by Northern Plains tribes. Again, Arthur's statement quoted on the previous page assures us that the complexity of the culture in the archaeological record was the same as that described in the historic record. Therefore, in terms of communal bison procurement during the Late Prehistoric period on the Northern Plains, the direct ethnographic approach is seen as a reliable analog to describe prehistoric behaviour. A synthesis of the description of bison pound construction and use found in the historical record will be used to describe what may be expected to be found in the archaeological record and to interpret the features of the Tschetter site.

3.6.1 The Drive Complex

The bison jump and the bison pound may be referred to collectively as a bison drive, since both involved the collection of a bison herd at some predetermined locale and directing the herd into the kill. Actually, the lumping of the terms is more functional than convenient as the two methods may be used simultaneously and characteristics of one grade into the other. The bison jump, however, could only occur at a specific locale which is determined solely by topography. Pounds, on the other hand, are commonly found on the level prairie where no exorbitant demands are placed on landforms. However, the construction of the pound demands that local materials be available for its construction. The local materials were most commonly wood and stone. The construction of a pound or a jump, therefore, is not a function of preference or the skill required in their operation, but rather, a function of topography and of vegetation potentials (Reeves 1978:60).

The integral part of the drive complex are: the gathering basin, the drive lanes (or wings), a cliff or break in slope and its base, and the pound. The gathering basin refers to the area where a herd of bison were found grazing. There seems to be confusion as to whether the pound was built after a herd had been sighted, or whether the pound was built first and the bison brought to that locale. According to Kehoe, "A council of chiefs and hunters selected the site (for the pound) long before the buffalo grass was high and signal for building it was given by the poundmaker" (1973:180). Following four nights of ritual to ensure success, a runner was sent for, "...who could scout out a bison herd and decoy it to the pound" (Kehoe 1973:181). On the other hand, Arthur (1975:77) states that "Once bison were discovered in a given area, the location of the pound depended primarily on the natural terrain and wind direction." Quoting several sources, Gordon (1978:46) states that "...herd proximity to jumps and corrals was more important than selection for herd composition", and

"Corrals were also situated according to the type of herd desired." Furthermore, the historic record contains many instances of corral repair and re-use. The issue is probably not crucial. If a herd were sighted near an existing pound it would be a matter of convenience to repair the structure and re-use it. Knowledge of bison movements and their location at any given time would suggest pound construction prior to the actual sighting of a herd. Whereas a fortuitous sighting would suggest the construction of a pound for a specific herd.

Whatever the case, once the herd had been sighted, it was lured to the enclosure. This was accomplished by a runner, acting as a decoy, who brought the bison from the gathering basin into the drive lanes. Drive lanes were V-shaped lines or fences which converged at the pound entrance (Arthur 1975:75). The 'fences' were made of branches or underbrush and were not solidly constructed. Altenatively they were simply piles of dry dung or stones if no wood was available. The lines were one or two miles long with the distance between the stone or brush piles decreasing toward the pound. A more solid barrier closer to the entrance of the pound was needed because this was the crucial point where the herd may turn rather than entering the enclosure. Kehoe (1973:177) refers to that part of the drive lane closest to the pound as 'the chute'. The chute is distinguished from the remainder of the drive lane by its more solid construction. An abrupt turn of the chute just before it joined the pound was designed to hide the enclosure from the herd until the animals were upon it.

The pound itself is the quintessential element of the drive complex and its construction was undertaken with religious ceremony. An ideal location for a pound was at the base of a slope, so that the bison could easily go in but not so easily get out (Kehoe 1973: 176). If no such natural topographical feature was available, an artificial ramp was constructed. As opposed to the drive lanes, the corral walls had to be solidly built. They were made of stakes placed in the ground, or of a circle of trees left standing after the others had been cleared. Any holes in the walls were covered with hides, so that the wall had at least the appearance of being impenetrable. Most of the pounds were circular and the size varied. Kehoe (1973:176) gives the size of the pound as varying between 15 and 45 metres in diameter. The height of the walls was as low as 1.2 metres and as high as 2.4 metres. Hides were sometimes held up above the walls to give the appearance of added height. Once the herd was within the corral they stampeded and were shot with arrows.

The next event of significance here was the butchering process. The first and second divisions of the kill and skinning of the bison took place at the kill site. Most of the meat was left there and the choice portions were taken to the camp. The third and final division of the meat took place at the camp. Beyond this scanty information little else is available from the historic record which tells us how the butchering process proceeded.

From the ethnohistoric accounts we are able to reconstruct the events of the bison drive and to predict what material remains will be found at such a site. In the absence of agricultural activity or other forms of disturbance the piles of stone which made up the drive lanes would remain on the prairie. The remains of the pound itself would be visible only by the moulds of the posts which once formed the walls. A dense bone bed indicates the actual kill and stone and bone tools represent the butchering process. The various stages of bone disarticulation also indicate butchering. Presumably, some processing of the vast amount of procurred meat took place, as well as food preparation as the work progressed. The material remains of all these activities are represented by the features and artifacts preserved in an archaeological site.

The ethnohistoric record also provides the information that bison pounds were used during the winter months. In chapter two, it was demonstrated that large herds of bison were found in the Aspen Parkland during the winter. This point needs to be re-iterated here because the anthropological and archaeological literature contains statements to the effect that bison drives operated only during the summer and autumn months (Oliver 1963; Frison 1967, 1970, 1971, 1973). Also, although communal bison hunting may not occur during the winter months on the more arid regions of the Plains, the ethnohistoric evidence suggests that in the Aspen Parkland of the Northern Plains bison procurement during the winter was a common occurrence and further, that impounding was the method of winter bison procurement here.

Arthur states that:

> "Among the northern Plains tribes, dependant year round on the bison, the season of bison drive (jumps and pounds) use began in the fall of the year and continued throughout the winter" (1975:121).

In support of this statement, Arthur quotes the journals of early explorers who described bison pound use and construction in the winter months. Although Arthur states that both pounds and jumps were used thorughout the winter the eye-witness accounts describe only the use of pounds.

During the winter of 1772-1773, while visiting a tribe of Gros Ventre, Cocking makes several entries in his journal which refer to pounding bison (Arthur 1975:101-103):

> Dec. 7 to 12. Monday. The Natives pounded a few buffalo and presented to me my full share.
>
> Jan. 9, 1773. Saturday. We proceeded, intending to go to a Beast pound.
>
> Feb. 23. Tuesday. This morning the Indian arrived from those we intend to go to, with information that all the Natives were pitched further on, towards Waskesew - Wachee, intending to build a Beast-pound there...
>
> Feb. 27 to March 2. Saturday to Tuesday. Lay by: Hunters hath middling luck. Information from the Beast pound that they have middling success.

Kehoe (1973:172) considers that Cocking was between the Eagle Hills and the Alberta border in the winter of 1772-1773.

In January of 1770, Pink was in the area between the branches of the North and South Saskatchewan Rivers where he and his group joined a tribe of Blackfoot. He reported that they spent a month at a pound killing buffalo and trapping wolves (Dale Russel, personal communication).

With reference to eye-witness descriptions of pound construction, Kehoe (1973:173-175) quotes several sources which describe bison pounding during the winter months. These include: Alexander Henry the elder in February of 1776 near Melfort, Saskatchewan; Duncan M'Gillivary in November of 1794 near Lloydminster, Alberta; the younger Alexander Henry in December of 1809 in the same area; Captain John Franklin in February 1820 near Carlton House, Saskatchewan; artist Paul Kane in January of 1848 near Fort Pitt, Saskatchewan and Dr. James Hector in December of 1857 near Vermillion, Alberta.

An account of the Pallister Expedition in March of 1859, also makes reference to the use of a late winter pound:

> "About half-way to Fort Pitt they met some trappers who advised them to strike to the south where they would find a track to Fort Pitt, on which they had been hauling meat from a buffalo pound" (Spry 1963:201).

Aside from providing the evidence that pounds were used during the winter, it is interesting to note that all of these examples of winter pound use were observed in the Aspen Parkland. It is possible that there is a relationship between winter bison procurement, the Aspen Parkland and the use of pounds. The Tschetter site then, provides one example of an expression of this relationship.

3.6.2 The Features of the Tschetter Site

Four categories of features were recognized at the Tschetter site which represent the activities of a bison drive and kill. Two of these, the bone bed and the post holes, were distinctive and readily defined and interpreted. The third category is comprised of a group of less easily defined and interpreted features. The description of this group is complicated by the fact that they were not recorded as features at the time of their excavation. Their dimensions and shapes were gleaned from successive plan views and in some cases, wall profiles. The distinguishing feature of Category 3 is the presence of charcoal. Category 4 is comprised of two pit features. The distribution of these features is illustrated in Figure 3.4.

No evidence of drive lanes remain at the site, but a possible location of these, and of a gathering basin, is the extensive, flat plain to the east of the site (see Figure 2.2). This area is the most probable location for these features because as it is seen today, it is devoid of trees and the terrain is level. The remainder of the topography surrounding the site is strewn with clumps of trees and is hummocky.

Category 1: The Bone Bed

The most obvious and relevant feature at the Tschetter site is a heavy bone bed. This is considered to be a feature because its limits can be defined. A heavy bone bed as opposed to a light bone bed was deemed to be present in those excavated units which contained more than 25 bone elements per square metre. This designation does not take into account the presence of 25 bone fragments in one square metre. In other words, only whole bone and identifiable bone fragments are the criteria used to delimit a heavy bone bed.

The bone bed is comprised of a mass of complete and partially complete bison bone. A visual inspection of planviews and photographs provides the impression of a heavy bone bed surrounded by a light bone bed. Figure 3.5 illustrates a heavy and a light bone bed. This feature is interpreted as evidence of bison killing and butchering

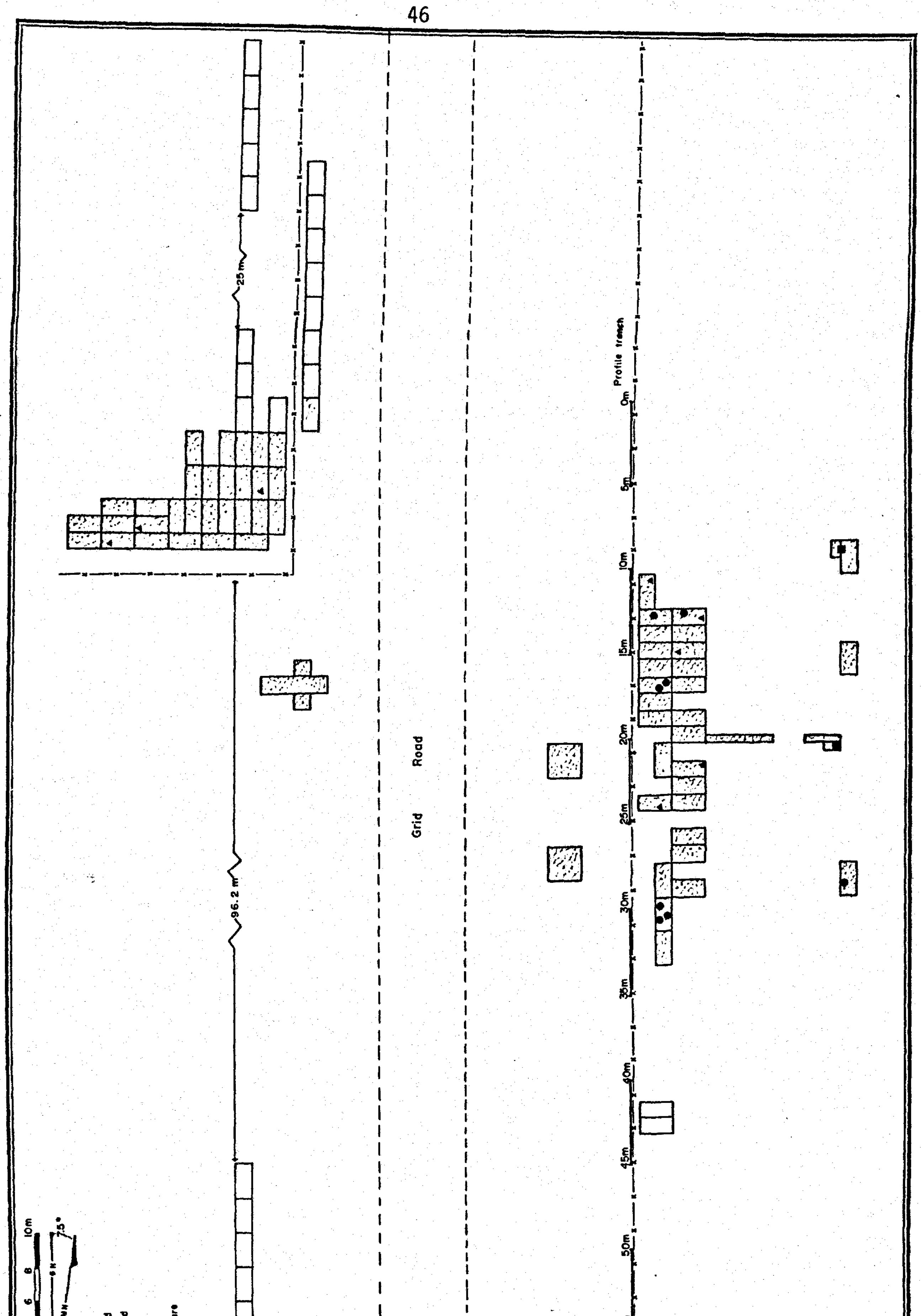


Figure 3.4 The Distribution of Features.

Figure 3.5 The Bone Bed.

within a confined area.

Category 2: Post Holes (n=8)

Of the eight post holes, three were found in a single one-by-one metre square, and two were found in another one-by-one metre square. All of these are circular and their diameters range from 15 - 20 cm. They were identified during excavation as being circular dark stains below the occupation layer, and obvious only by contrast to the surrounding sterile yellow sand. Three of the post holes contained bone, in one case a complete scapula and atlas, in another, articulating vertebrae and unidentified bone fragments. These bones were vertically oriented (see Figure 3.6).

Interpretation:

This category of features is reasonably definitive evidence to interpret the bison kill as having occured in a pound. Although this fact was suggested by the topography, the post holes provide more conclusive evidence. The presence of bones in the post holes is significant as well, in that they suggest that the pound was used more than once. That is, it is known that bones from the surface, representing a previous kill were used to steady the posts in their holes if the pound were being repaired for subsequent use. This would seem to confirm the evidence from the faunal analysis, that discrete age groupings of bison meant that more than one kill took place. Conversely, the presence of supports, in this case bison bones, in the post holes may reflect the difficulty of implanting an upright in sandy soil. Whatever the case, the fact remains that bison bones from the ground surface were available for this purpose.

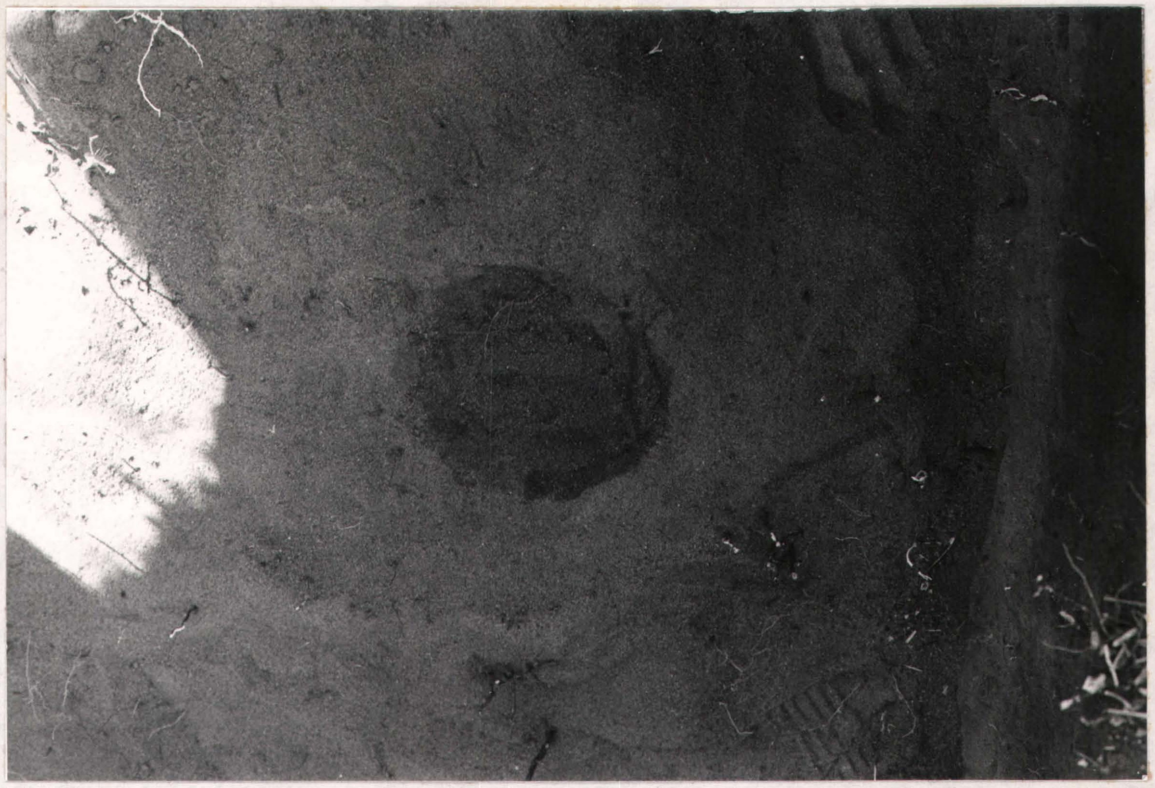


Figure 3.6 Profile of a Post Hole.

Category 3: Charcoal Features (n=11)

This group of features is so named because of the one thing common to all of them - the presence of charcoal. In other respects they vary widely. The location, shape, depth and contents of the charcoal features are listed in Table 3.2. None of these may be considered a hearth. They are essentially surface features which have not been prepared in any way.

Interpretation:

These features are not concentrated in any one particular area of the site. Although the presence of charcoal and burnt bone indicates that some burning took place in these features, they could not have been used for a prolonged period of time since there are no layers of ash or burnt earth in them. Fire cracked stone is dispersed throughout the site and is not confined exclusively to these features. Nonetheless, they are considered to represent small fires which may have been involved in some sort of food processing. If the kill took place during the winter these small fires may also have served as centres of warmth as the work progressed.

Category 4: Pit Features (n=2)

8E0N/7E1S

This feature first appears in the bone bed as a cluster of vertebrae with a diameter of 100 cm. This vertebrae continue for a depth of 20 cm in a circular arrangement. Below the vertebrae cluster is a 24 cm thick layer of powdery ash-grey soil, containing unburnt bone fragments. In profile the feature is basin shaped.

Table 3.2 CHARCOAL FEATURES

Square	Shape			Depth	Contents			
	Plan	Profile	Dimensions		FOR	BB	UB	Other
60	circular	basin	40 cm	4 cm	X	X	X	7 flakes
53	circular	?	5 cm	5 cm	X	X		
46	oval	?	35 x 50 cm	5 cm		X		
61	circular	conical	20 cm	20 cm		X	X	
28	circular	conical	30 cm	24 cm		X		
73	oval	basin	50 x 70 cm	30 cm		X	X	
40	oval	basin	30 x 25 cm	10 cm	X	X	X	
71	circular	basin	60 cm	8 cm	X	X	X	
25	circular	globular	50 cm	20 cm	X	X	X	pottery
66	?	basin	65 x 40 cm	10 cm		X	X	
69	circular	?	20 cm	10 cm		X		

FCR = Fire Cracked Rock

BB = Burnt Bone

UB = Unburnt Bone

X = Present

Interpretation:

This appears to be a vertebrae filled pit. The soil at the bottom of the feature has ash mixed in with it and is quite thick. There is no evidence of burnt soil in the feature however. A possible explanation is that this pit was used as a bone, i.e., vertebrae dump area. In this case, some sort of processing took place in this area which involved discarding vertebrae. The ash at the bottom of the pit may have been involved in an activity which had nothing to do with the vertebrae dump.

9E9N/8E10N

When first seen in planview, this feature is a concentration of bone, 80 cm in diameter, surrounded by a tan/yellow mottled sand. A prominent feature at this point is a complete scapula. Ten centimetres below this bone cluster, a longitudinal charcoal stain with dimensions of 35 cm by 10 cm appears in front of the bone. Below the charcoal stain, and continuing in the mottled area, is a skull fragment including the horn core as well as pottery sherds. More pottery and bone fragments continue for another 20 cm below the skull fragment. The depth of the feature is 38 cm and it is conical in profile.

Interpretation:

This feature too appears to be a pit filled with debris. In this case, whole bone and pottery sherds, as well as bone fragments. It can be speculated that the charcoal stain represents the remains of a burnt log, but there is no other evidence of fire in the feature.

Presumably, food processing, which involved the use of a ceramic pot took place in another area and the remains of both the food and the pot were tossed into the pit.

Comparisons:

The features described here are compared with features found at other bison kill sites on the Northwestern Plains. At the Ramillies site, hearths, excavated pits and some heat fractured stone as well as butchered bison bone and stone debitage are considered to represent a secondary processing area (Brumley 1976:21). An area at the same site consisting of bison bone, projectile points, bone tools and lithic debitage, is identified as the bison killing and primary butchering area. No features were recorded here. Compared with the Ramillies site, primary and secondary butchering were being performed in the same area at the Tschetter site.

Level II of the Estuary Bison Pound site is another comparable site on the Northwestern Plains. The features of this level are composed of large, prepared hearths, charcoal stains, post holes and a bone bed (Adams 1977:68-72). Adams interprets the materials of Level II as representing a bison kill where butchering took place on the spot. The charcoal concentrations are interpreted as scattered remains from various fires. Whereas one hearth is considered to have been involved in a ceremonial function, the others are inferred to indicate food preparation as well as a centre for food and warmth while work progressed.

Features described from the Saamis and Stampede sites include one category which compares with those described from the Tschetter site (Congram 1978:207). This cateogry is that of unprepared hearths or those that appear to be remnants of fires without any hearth preparation. They are interpreted as the remains of burning logs and debris dragged from larger hearths. Their contents include fire cracked rock, some lithics, fragmented and unidentifiable bones, pottery, charcoal and small amounts of ash. The depth of these features ranges from surface to eight cm below surface. Dimensions cluster around 20 cm in diameter. It is noted that these features are always found in close proximity to larger hearths.

At the Boarding School Bison Drive site, Kehoe (1967:34) identified two types of features comparable to those described here. The first are ash pits which contain charcoal and charred bone and are presumed to be ash dump pits or bone boiling pits which, after use, were filled with ashes. Scattered rocks throughout the site are the second feature noted and are postulated to be boiling stones.

In a description of the features from the Wardell site, Frison (1973:54) distinguishes between two kinds of pit features. Basin-shaped pits are interpreted as being used for heating stones and contain charcoal and fire cracked rock. Conical-shaped pits containing bison bone and fire cracked rock are those deemed to represent cooking or roasting pits. This distinction does not occur at the Tschetter site, where both conical-shaped and basin-shaped features contain fire cracked rock.

One category of features at the Vore site (Reher and Frison 1980: 18) are bone concentrations; specifically mandibles and skulls. These are presumed to be representative of a specialized aspect of butchering and are comparable to the vertebrae concentration described in feature 8E0N/7E1S;

The features described from the Tschetter site are those commonly found at bison kill sites on the Northwestern Plains. The fact that bison were impounded, killed and butchered is amply demonstrated by the presence of the bone bed and the post holes. Although the other features are not as easily identified, they do demonstrate that some form of meat processing was performed and that this activity took place near and/or at the butchering site. Total excavation of the site may reveal that some specialized (or secondary) processing occured at a specific locale, but this area has not yet been identifed. A consideration of the stone tools at the site will aid in the determination of events at the Tschetter site.

3.6.3 Distribution of Features

The heavy bone bed defined as consisting of more than 25 identifiable bone elements, is very obviously confined to one area. In contrast, the light bone bed is seen to surround it. This distribution suggests a petering out of the bone bed on the northern and southern extremeties of the excavated area. The known post holes are entirely confined to the east side of the site. This distribution, however, does not suggest an outline of the corral. This may be due to the fact that several kills may have taken place and therefore the location of the corral may have shifted from kill to kill. Alternatively, standing trees may have served as posts or the excavation may simply have failed to locate other post holes on the west side of the site. The double and triple occurrences of post holes in close proximity also tends to confirm the proposition that more than one kill took place here and that the corral had been repaired. The distribution of the charcoal and pit features tends to conform to the distribution of the heavy bone bed, with the exception of two such features at the southeastern perimeter. It would appear then, that there are two definable areas of the site. One of these, consisting of a heavy bone bed, post holes, charcoal and pit features represents the main activity area of the site while the other, consisting of a light bone bed represents the periphery of the site.

In this chapter, the results of the excavations have been described. The Tschetter site was found to have been occupied during the Prairie Side-Notched period of the Late Prehistoric Tradition. A faunal analysis determined that at least 96 animals were killed and butchered and that this event took place during the winter months. A series of limited kills is suggested, but the separation of these events is not discernable stratigraphically. Ethnohistoric accounts have provided a description of bison pounds and the material remains which may be expected to be found at sites where such an event took place. In addition, the ethnohistoric record has demonstrated that in the Aspen Parkland of Saskatchewan bison were procured in the winter by means of impounding. The features of the Tschetter site provide the evidence that a corral was built to impound bison, that the killing and butchering of these animals took place within a confined and identifiable area and that some food processing took place at the kill site. The distribution of these features does not suggest a processing area separate from the kill and butchering area. The excavations also produced a large amount of lithic tools and debitage. These artifacts and their distribution are discussed in the following chapter.

CHAPTER 4: THE CHIPPED STONE TOOL, DETRITUS, CERAMIC AND BONE TOOL ASSEMBLAGES

Metric and non-metric descriptions of the chipped stone tools and debitage are presented in this chapter. In addition, the ceramic assemblage is described and compared to other like assemblages in order to provide a temporal assignation. The raw material of the tools and debitage are discussed in terms of their availability and accessibility to prehistoric inhabitants. Finally, the distribution of the lithic and ceramic assemblages is determined and correlated with the distribution of the features at the site.

4.1 The Chipped Stone Tool Assemblage

The chipped stone tool assemblage of the Tschetter site is comprised of 488 tools which are divided into nine classes. The primary objective of the tool classification is to create order out of chaos. This objective is qualified by a recognition of the events which took place at a bison kill site and, for means of comparison, the classification used in the literature from comparable bison kill sites. In most cases, the classification is based on formal criteria which are implied by the name assigned to the tool and by the method of manufacture of the tool. Quantitive attributes provide a recognition of the range of variation with each class and also a means of comparison with other tool kits. The lithic technology of the Tschetter site is realized by the material type of tools, the chipping technique and some metric attributes, such as spine plane angle and edge angle. The method guiding the choice of attribute used in this classification then, is the taxonomic classification of

Kreiger (1944) and Spauling (1953). As such, it is subject to all of the problems inherent in such a classification. Given the objectives of the classification cited above, these problems are not considered important here. It is not my intent to devise an alternative classificatory system which in fact would be undesirable for the purpose of relating the Tschetter site tools to comparable samples. In the next chapter, an analytical classification is imposed on two classes of tools. The objective of this exercise, however, is not designed to test the formal classification used here or to criticize it.

4.1.1 Endscrapers

A total of 38 endscrapers were recovered from the Tschetter site excavations and surface collection (Figures 4.1 and 4.2). Endscrapers are unifacially modified tools with a steep edge located on the distal end. Occasionally the tool is worked on one or both lateral edges as well as on the distal edge. The endscrapers here are divided into two classes depending on the modification of the preform flake.

Class One: Marginally Retouched Endscrapers (n=9)

The dorsal surface cortex of these endscrapers is intact and retouch is restricted to one or more margins. These tools are made on primary decortication flakes or split pebbles. Two sub-divisions of this class are recognized.

A. Keeled (n=1)

This specimen is rectanguloid in general outline with triangular transverse and longitudinal cross-sections. The lateral edges are unmodified. The tool is made on a primary decortation flake and the

Figure 4.1 Endscrapers - Marginally Retouched a - i; j - s Modified Dorsal Surface - Keeled.

Figure 4.2 Endscrapers - Modified Dorsal Surface - Tabular a - d; Plano-Concave e; Plano-Convex f - s.

Table 4.1 METRIC ATTRIBUTES OF MARGINALLY RETOUCHED ENDSCRAPER

Attribute	Minimum	Maximum	Range	Mean	Mode	Median
Length (mm) n=7	17	35	18	22.71	20-23	21
Thickness (mm) n=9	4	7	3	5.22	4-5	5.5
Thickness Proximal End (mm) n=6	3	7	4	4.66	3	5
Thickness Distal End (mm) n=9	3	7	4	4.88	4	5
Width (mm) n=9	14	31	17	17.88	14-16-19	16.5
Angle of Distal End (degrees) n=8	30	80	50	56.5	-	57.5
Angle of Left Lateral Edge (degrees) n=3	55	60	5	58.33	60	57.5
Angle of Right Lateral Edge (degrees) n=1	45	45	0	45	-	-
Spine Plane Angle Left Lateral Edge (degrees) n=1	55	75	20	63.33	-	60
Spine Plane Angle Right Lateral Edge (degrees) n=1	53	53	0	53	-	-
Spine Plane Angle Distal End (degrees) n=8	45	75	30	59.88	58	61
Weight (gms) n=9	1.6	7.5	5.9	2.96	2.5	2.55

remnant of a striking platform is present on the proximal end.

B. Plano-Convex (n=8)

Complete n=6
Fragments n=2

This category is identified on the basis of the longitudinal cross-section of the tool. It is notable that all of these specimens with the exception of one are made on split pebbles. The shape of the pebble is responsible for the resulting plano-convex longitudinal cross-section. Of the complete specimens, three are oval in general form, one is elliptical, one is triangular and one is a rhomboid shape. Both lateral edges of the triangular endscraper are worked which probably accounts for its triangular shape. Two of the oval specimens, as well as the elliptical and the rhomboidal one have one lateral edge which is retouched along a portion of its length. The fragments are both distal halves each with one lateral edge retouched.

Class Two: Modified Dorsal Surface (n=29)

The endscrapers in this class have had the cortex on their dorsal surfaces partially or completely removed. The sub-divisions within this class are similar to those of the marginally retouched class with the exception that the keels or ridges are not naturally occuring.

A. Keeled (n=10)

The ridges on these endscrapers, which are responsible for their keeled appearance, have been deliberately produced in order to form a bevelled edge.

(1) Medial Ridge (n=5)

Within the medial ridge category, four of the endscrapers are triangular and two of them are unifacially retouched on both lateral edges while one has bifacial retouch on both lateral edges. The remaining triangular specimen is worked on the distal end only. The remaining endscraper is rectanguloid and worked on the distal edge only. Depending on the prominence of the ridge, the cross-sections of these tools are either plano-convex or triangular.

(2) Marginal Ridge (n=5)

The dorsal surface of these endscrapers have been modified so that beyond the distal, bevelled edge, the surface is essentially flat. Two of these are triangular and three are rectanguloid. On all of the marginal ridge endscrapers, the distal surface is the only working edge. Their cross-sections are either single or double bevelled.

B. Tabular (n=4)

The absence of any purposely formed ridge on these endscrapers results in a flat dorsal surface. Unlike the marginal ridge specimens, the cross-sections of this group are all bi-plano. The shapes of the tabular endscrapers include three rhomboids and one trianguloid tool. Two specimens in the group are noteworthy in that one is double-bitted and one has a haft element.

C. Plano-Concave (n=1)

This endscraper is unusual in that a flake from the dorsal surface has been removed resulting in a concave surface beyond the distal end.

Table 4.2 METRIC ATTRIBUTES OF MODIFIED DORSAL SURFACE ENDSCRAPERS

Attribute	Minimum	Maximum	Range	Mean
Length (mm) n=25	14	35	21	20.64
Thickness (mm) n=28	4	14	10	6.64
Thickness Proximal End (mm) n=25	2	7	5	4.04
Thickness Distal End (mm) n=29	3	9	6	5.79
Width (mm) n=29	11	26	15	19.58
Angle of Distal End (degrees) n=30	35	80	45	61.26
Angle of Left Lateral Edge (degrees) n=15	35	75	40	54.33
Angle of Right Lateral Edge (degrees) n=12	25	75	50	52.5
Spine Plane Angle Left Lateral Edge (degrees) n=15	21	64	43	41.66
Spine Plane Angle Right Lateral Edge (degrees) n=12	25	53	28	38.33
Spine Plane Angle Distal End (degrees) n=30	20	75	55	51.86
Weight (gms) n=29	1	14.5	13.5	3.55

Table 4.3 RAW MATERIAL OF ALL ENDSCRAPERS

	South Saskatchewan River Chalcedony	Swan River Chert	Pebble Chert	Chal-cedony	Chert	Petrified Wood	TOTAL
1. Marginally Retouched							
A. Keeled						1	1
B. Plano-Convex			7			1	8
2. Modified Dorsal Surface							
A. Keeled	1	2	3		4		10
B. Tabular	1		2	1			4
C. Plano-Concave		1					1
D. Plano-Convex	2	4	6		2		14
TOTAL	4	7	18	1	6	2	38

It is rhomboidal in shape and has a plano-concave transverse cross-section. One lateral edge is unifacially retouched.

D. Plano-Convex (n=14)

The dorsal surface of these endscrapers is completely modified and all have plano-convex longitudinal and transverse cross-sections. They are trianguloid (four), rhomboidal (four), rectanguloid (two), elliptical (one) and oval (one) in overall shape and there are two fragments in this group. Of the complete specimens, eight are worked on the distal end and both lateral edges, three are worked on the distal end and one lateral edge, and one is worked on the distal edge only. Four of those endscrapers have been flaked on the ventral surface as well as the dorsal. Haft elements are present on the two specimens.

4.1.2 Bifaces

Bifaces are described here as flake or core tools which exhibit primary flaking over most of or all of both faces. The following classification is based on formal edge configuration shapes (Figure 4.3).

Class One: Triangular Bifaces (n=6)

Complete n=4
Fragments n=2

Triangular bifaces have a pointed distal end and more or less symmetrical lateral edges. Of those tools with the proximal end intact, two of the bases are straight and two are skewed. Transverse cross-sections are bi-plano (four), and plano-convex (two). Longitudinal cross-sections are also bi-plano (three), plano-convex (two) and bi-convex (one). On none of these specimens is the primary retouching

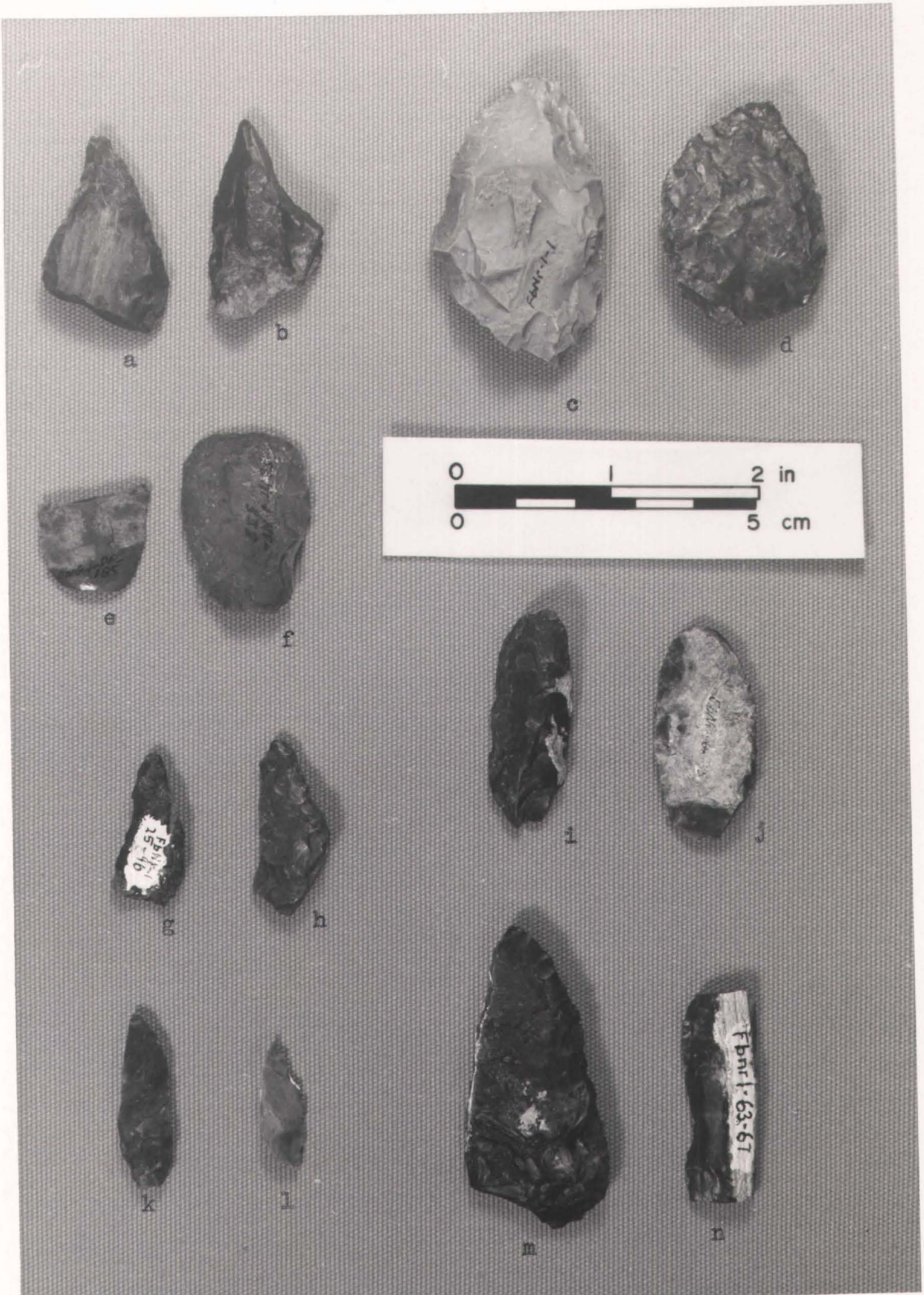


Figure 4.3 Bifaces Triangular a – b; Ovate c – d; Oval e – f; Crescentic g – h; Elliptical i – j; Lanceolate k – l; Backed Knives m – n.

Table 4.4 METRIC ATTRIBUTES OF TRIANGULAR BIFACES

Attributes	Minimum	Maximum	Range	Mean	Mode	Median
Length (mm) n=4	26	41	15	32	-	30.5
Thickness (mm) n=6	4	7	3	5.3	5	5.5
Width (mm) n=5	17	22	5	19	-	20
Angle of Left Lateral Edge - (degrees) n=3	50	62	12	57.3	-	60
Angle of Right Lateral Edge (degrees) n=5	60	75	15	64.8	60	64.5
Dorsal Spine Plane Angle Left Lateral Edge (degrees) n=3	20	40	20	33.3	40	30
Dorsal Spine Plane Angle Right Lateral Edge (degrees) n=5	20	35	15	28.2	-	28
Ventral Spine Plane Angle Left Lateral Edge (degrees) n=3	30	50	20	41.6	-	45
Ventral Spine Plane Angle Right Lateral Edge (degrees) n=5	18	40	22	30.2	-	30
Weight (gms) n=6	1.2	6.4	5.2	3.2	-	3

complete over both faces. Of the three broken tools, two are broken above their proximal end and one is broken laterally.

Class Two: Oval/Ovate Bifaces (n=19)

Complete n=5
Fragments n=14

Oval bifaces are those with rounded distal and proximal ends and excurvate lateral edges (five). An ovate biface is one which has a rounded i.e., convex proximal end, a pointed distal end and excurvate lateral edges which narrow toward the distal end (nine). Of the specimens so designated, two oval and three ovate are complete. The broken tools are broken across the mid-section so that, although it is possible to determine the shape of one end as convex, the absence of the opposite end precludes a designation of either oval or ovate. Ovate bifaces are bi-plano (four), bi-convex (three), and plano-convex (two) in transverse cross-section and bi-plano (five) and bi-convex (four) in longitudinal cross-section. Six of the ovate bifaces are completely flaked on one surface only, while three are flaked completely on both surfaces. Among the oval bifaces, four have plano-convex transverse and longitudinal cross-sections and one tool exhibits bi-plano transverse and longitudinal cross-sections. Only one of these tools is completely flaked on both surfaces. Transverse and longitudinal cross-sections of both specimens are bi-plano (four) and plano-convex (one). It may be that the thinness of these tools contributed to their having been broken. None of these are completely flaked on both surfaces. In the case of this group as a whole, the shape of the blank may have been the determining factor for their being chosen for manufacture into

Table 4.5 METRIC ATTRIBUTES OF OVAL, OVATE AND OVAL/OVATE BIFACES

Attribute	Minimum	Maximum	Range	Mean	Mode	Median
Length (mm) n=8	20	61	41	34.1	-	30
Thickness (mm) n=19	3	17	14	6.8	5	7
Width (mm) n=19	14	45	31	23.8	20	22
Angle of Left Lateral Edge (degrees) n=14	25	70	55	44.9	25-45	47.5
Angle of Right Lateral Edge (degrees) n=16	30	75	45	56.2	35	52
Dorsal Spine Plane Angle Left Lateral Edge (degrees) n=14	20	55	35	34.4	25	37.5
Dorsal Spine Plane Angle Right Lateral Edge (degrees) n=16	15	54	39	34.2	25-35	37.5
Ventral Spine Plane Angle Left Lateral Edge (degrees) n=13	15	45	30	28.9	15	32
Ventral Spine Plane Angle Right Lateral Edge (degrees) n=13	15	43	28	31.2	30	30
Weight (gms) n=19	.9	22.9	22	5.6	2.4	3

tools. Only four of the 19 tools are completely bifacially flaked.

Class Three: Elliptical Bifaces (n=6)

Complete n=5
Fragments n=1

Elliptical bifaces are longer than they are wide and have convex distal and proximal shapes. Only one of these specimens is incomplete. All are relatively thick and generally conform to each other in the metric attributes of length and width. Three of these elliptical bifaces are completely retouched on both faces. Two of the transverse cross-sections are bi-convex, two are bi-plano and two are plano-convex. Longitudinal cross-sections are bi-plano (two), plano-convex (two) and bi-convex (two).

Class Four: Crescentic Bifaces (n=5)

Complete n=4
Fragments n=1

These bifaces have pointed distal ends, relatively straight proximal ends, one excurvate or irregular lateral edge and one straight lateral edge. In two cases, primary retouching is complete on both faces and complete on only one surface on the remaining three bifaces. Transverse and longitudinal cross-sections are bi-plano, bi-convex and plano-convex.

Class Five: Lanceolate Bifaces (n=2)

Lanceolate bifaces are longer than they are wide and they are bi-pointed. Both of these specimens are complete and primary retouching is complete on both faces. Longitudinal cross-sections are bi-convex and bi-plano as are the transverse cross-sections. Compared to the other bifaces from the site, the lanceolate ones are small.

Table 4.6 METRIC ATTRIBUTES OF ELLIPTICAL BIFACES

Attributes	Minimum	Maximum	Range	Mean	Mode	Median
Length (mm) n=5	35	40	5	36.4	35-36	36
Thickness (mm) n=6	6	9	3	7.8	9	8
Width (mm) n=6	13	19	6	15.5	13	16
Angle of Left Lateral Edge (degrees) n=4	50	70	20	60	60	60
Angle of Right Lateral Edge (degrees) n=4	60	80	20	70	-	67.5
Dorsal Spine Plane Angle Left Lateral Edge (degrees) n-4	23	47	24	36.3	-	37.5
Dorsal Spine Plane Angle Right Lateral Edge (degrees) n=3	23	40	17	31	-	30
Ventral Spine Plane Angle Left Lateral Edge (degrees) n=4	25	60	35	38.8	-	35
Ventral Spine Plane Angle Right Lateral Edge (degrees) n=4	25	60	35	36.3	30	30
Weight (gms) n=6	2.5	7.2	4.7	4.9	-	4.6

Table 4.7 METRIC ATTRIBUTES OF CRESCENTIC BIFACES

Attributes	Minimum	Maximum	Range	Mean	Mode	Median
Length (mm) n=4	31	30	9	26.3	-	27
Thickness (mm) n=5	4	7	3	5.6	6	5.5
Width (mm) n=5	11	16	5	13.2	-	13
Angle of Left Lateral Edge (degrees) n=2	45	66	21	55.5	-	55.5
Angle of Right Lateral Edge (degrees) n=4	50	60	10	55	50-60	55
Dorsal Spine Plane Angle Left Lateral Edge (degrees) n=1	60	60	0	60	-	-
Dorsal Spine Plane Angle Right Lateral Edge (degrees) n=4	28	50	42	38.3	-	37.5
Ventral Spine Plane Angle Left Lateral Edge (degrees) n=2	45	51	6	48	-	48
Ventral Spine Plane Angle Right Lateral Edge (degrees) n=4	20	54	34	31	20	30
Weight (gms) n=5	1.3	3.4	2.1	2.1	-	2

Table 4.8 METRIC ATTRIBUTES OF LANCEOLATE BIFACES

Attributes	Minimum	Maximum	Range	Mean	Mode	Median
Length (mm) n=2	21	29	8	25	-	25
Thickness (mm) n=2	4	4	0	4	4	4
Width (mm) n=2	7	9	2	8	-	8
Angle of Left Lateral Edge (degrees) n=0	-	-	-	-	-	-
Angle of Right Lateral Edge (degrees) n=2	45	60	15	55	-	5
Dorsal Spine Plane Angle Left Lateral Edge (degrees) n=0	-	-	-	-	-	-
Dorsal Spine Plane Angle Right Lateral Edge (degrees) n=2	40	48	8	44	-	44
Ventral Spine Plane Angle Left Lateral Edge (degrees) n=2	25	57	32	41	-	41
Weight (gms) n=3	.8	1.4	.7	1.1	-	1.1

Class Six: Backed Knives (n=3)

Each of these bifaces has a different shape, one triangular, one elliptical and one rectangular. They are distinguished from the other groups, however, by virtue of the fact that one lateral edge on each is straight and unmodified. The straight or backed edge follows the cleavage line of the blank on which the tool was made. Transverse cross-sections are bi-plano (two) and bi-convex (one). Longitudinal cross-sections are also bi-plano (two) and bi-convex (one). None of these tools is completely retouched on either surface.

Class Seven: Unclassified Bifaces (n=43)

The specimens considered here are not classifiable into the formal outline categories due to their fragmentary nature. All are broken bifaces and in some cases, it is possible to determine whether the fragment is from the distal or proximal half of the tool. The sub-classes recognized here are; tip fragment (eight), distal fragments (sixteen) and mid-section fragments (nineteen).

4.1.3 Unifaces

Unifacial tools are flakes which exhibit primary flaking over most of or all of one face and retouch along one or more lateral edges (Figure 4.4). The tools are divided into categories on the basis of edge configuration shape.

Class One: Triangular Unifaces (n=2)

One of these unifaces is complete, the other is a distal fragment. Retouch is present along one lateral edge of both tools. Longitudinal and transverse cross-sections are triangular. On both of these unifaces, the face has been altered so that a longitudinal bevel is created along

Table 4.9 METRIC ATTRIBUTES OF BACKED KNIVES

Attribute	Minimum	Maximum	Range	Mean	Mode	Median
Length (mm) n=1	51	51	0	51	-	-
Thickness (mm) n=3	5	7	2	6	-	6
Width (mm) n=3	12	23	11	17.3	-	17
Angle of Left Lateral Edge (degrees) n=2	46	60	14	53	-	53
Angle of Right Lateral Edge (degrees) n=1	50	50	0	50	-	50
Dorsal Spine Plane Angle Left Lateral Edge (degrees) n=2	40	50	10	45	-	45
Dorsal Spine Plane Angle Right Lateral Edge (degrees) n=1	40	40	0	40	-	-
Ventral Spine Plane Angle Left Lateral Edge (degrees) n=2	34	37	3	35.5	-	35.5
Ventral Spine Plane Angle Right Lateral Edge (degrees) n=1	45	45	0	45	-	-
Weight (gms) n=3	3.3	9.2	5.9	5.3	-	3.5

Table 4.10 RAW MATERIAL - ALL BIFACES AND BIFACE FRAGMENTS

Class	SSRC	SRC	PC	PW	Chal.	Chert	SL	Jasper	Quartzite	TOTAL
1. Triangular	2	0	1	2	0	1	0	0	0	6
2. Oval	1	0	2	1	0	1	0	0	0	5
Ovate	4	3	0	0	1	1	0	0	0	9
Oval/Ovate	4	0	0	0	0	1	0	0	0	5
3. Elliptical	4	0	0	1	0	0	1	0	0	6
4. Crescentic	5	0	0	0	0	0	0	0	0	5
5. Lanceolate	0	0	0	0	1	1	0	0	0	2
6. Backed Knives	2	0	0	1	0	0	0	0	0	3
7. Unclassifiable	24	3	1	1	0	9	0	2	3	43
TOTAL	46	6	4	6	2	14	1	2	3	84

SSRC - South Saskatchewan River Chalcedony
SRC - Swan River Chert
PC - Pebble Chert
PW - Petrified Wood
Chal.- Chalcedony
SL - Silicified Limestone

Figure 4.4 Unifaces - Crescentic a; Triangular b - c; Rectanguloid d - s.

Table 4.11 METRIC ATTRIBUTES OF TRIANGULAR UNIFACES

Attributes	Minimum	Maximum	Range	Mean	Mode	Median
Length (mm) n=1	44	44	0	44	-	-
Width (mm) n=2	12	27	15	19.5	-	19.5
Thickness (mm) n=2	3	9	6	6	-	6
Angle of Left Lateral Edge (degrees) n=1	55	55	0	55	-	-
Angle of Right Lateral Edge (degrees) n=1	55	55	0	55	-	-
Dorsal Spine Plane Angle Left Lateral Edge (degrees) n=1	45	45	-	45	-	-
Dorsal Spine Plane Angle Right Lateral Edge (degrees) n=1	45	45	0	45	-	-
Weight (gms) n=2	.6	10.6	10	5.6	-	5.6

Table 4.12 METRIC ATTRIBUTES OF RECTANGULOID UNIFACES

Attributes	Minimum	Maximum	Range	Mean	Mode	Median
Length (mm) n=9	21	35	41	28.33	26	27.5
Width (mm) n=16	6	23	17	14.75	15	15.5
Thickness (mm) n=16	3	8	5	5.25	4-6	5.5
Angle of Left Lateral Edge (degrees) n=8	50	60	10	53.13	50	55
Angle of Right Lateral Edge (degrees) n=9	45	55	10	51.44	50	51.5
Dorsal Spine Plane Angle Left Lateral Edge (degrees) n=8	30	50	20	39.38	50	37.5
Dorsal Spine Plane Angle Right Lateral Edge (degrees) n=9	30	50	20	37.22	35	40
Weight (gms) n=16	.5	7.5	6.5	2.78	2.2-1.7	2.05

the working edge. Primary retouch is complete on one of the specimens.

Class Two: Rectanguloid Unifaces (n=16)

Complete n=11
Fragments n=5

All of these unifaces have lateral edge retouch along one edge only. The presence of bevel along that edge facilitates a moderately steep working edge. Primary retouching is complete on one surface on five of these tools. Longitudinal cross-sections are bi-plano (five), plano-convex (nine) and bi-convex (two). Transverse cross-sections are bi-plano (two), plano-convex (seven), bi-convex (four) and triangular (three).

Class Three: Crescentic Uniface (n=1)

This tool is large and crescent-shaped, with incomplete primary retouching and lateral secondary retouch along one edge. The transverse and longitudinal cross-sections are plano-convex.

Table 4.13 METRIC ATTRIBUTES OF CRESCENTIC UNIFACE

Length (mm):	80
Width (mm):	38
Thickness (mm):	10
Angle of Right Lateral Edge (degrees):	60
Dorsal Spine Plane Angle of Right Lateral Edge (degrees):	40
Weight (gms):	3.69

Table 4.14 RAW MATERIAL - ALL UNIFACES

Class	South Saskatchewan River Chalcedony	Swan River Chert	Pebble Chert	Petrified Wood	Chert	Quartzite	TOTAL
1. Triangular		1				1	2
2. Rectanguloid	4	5	3	2	1	1	16
3. Crescentic		1					1
TOTAL	4	7	3	2	1	2	19

4.1.4 Retouched Flakes

These tools are made on flakes, flake fragments and pieces of shatter. They exhibit unifacial or bifacial secondary retouch along one or more edges. Marginally retouched flakes are divided into two classes depending on the presence of secondary retouch on one or both faces. The third class, utilized flakes, have not been deliberately retouched but are retouched by use.

Class One: Unifacially Retouched Flakes (n=33) (Figures 4.5, 4.6)

This class is further sub-divided into two sub-classes on the basis of the steepness of the retouched edge. This attribute is considered to be indicative of a correlation between edge angle and function.

A. Bevelled Edge (n=21)

Complete n=11
Fragments n=10

Of the complete specimens, the striking platform of three of the flakes is not discernable. Three are made on pieces of shatter and five are made on flakes with discernable striking platforms. These tools exhibit a variety of shapes and sizes although the majority are longitudinal. Seven of the tools are made on decortication flakes. Retouch is present on one lateral edge of all of the specimens except one which exhibits distal retouch.

B. Unifacial Knives

These tools are flakes which have one unifacially retouched edge. They are distinguished from other unifacially retouched flakes by virtue of the fact that the retouched edge is very thin, and not

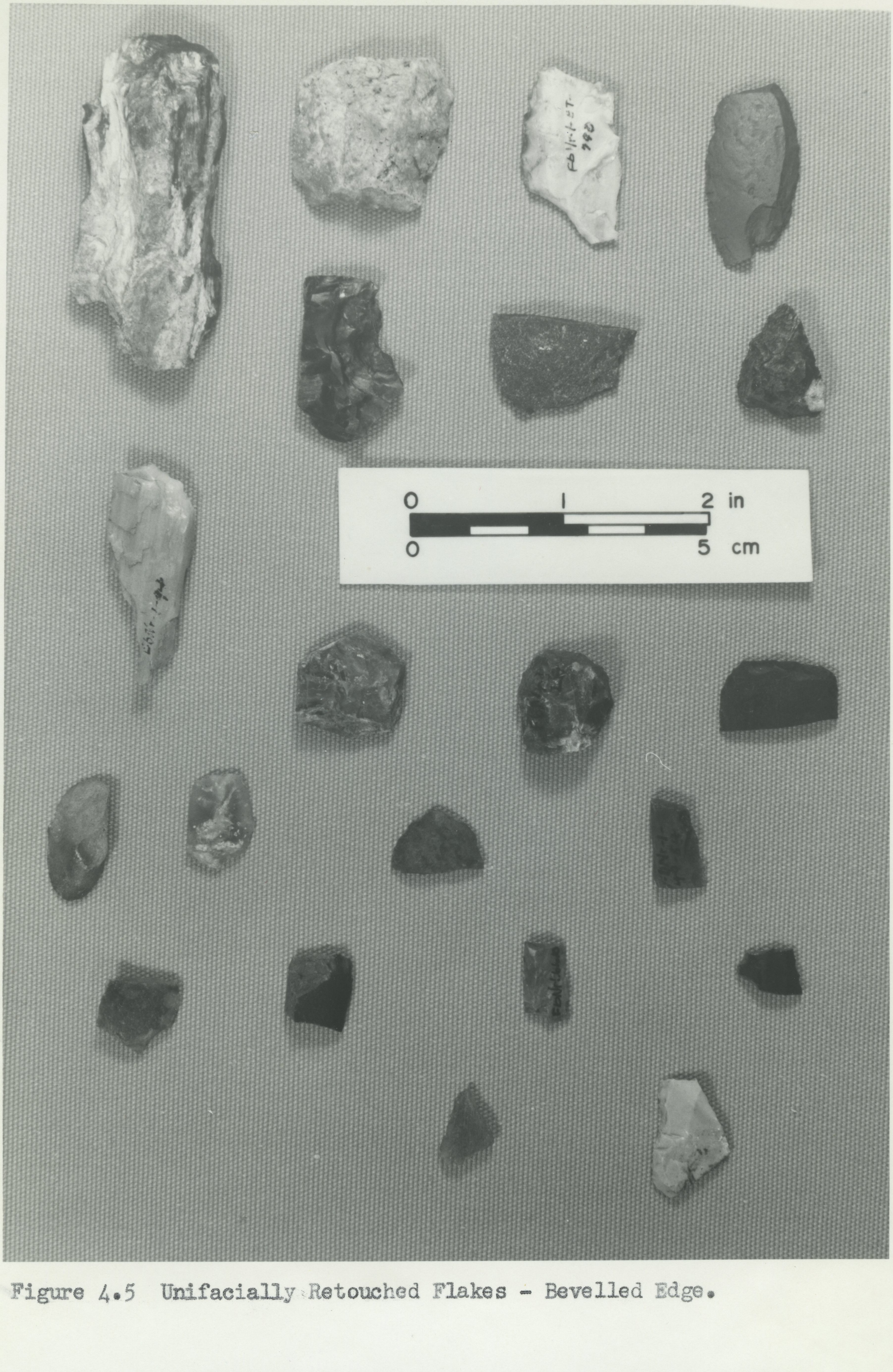


Figure 4.5 Unifacially Retouched Flakes - Bevelled Edge.

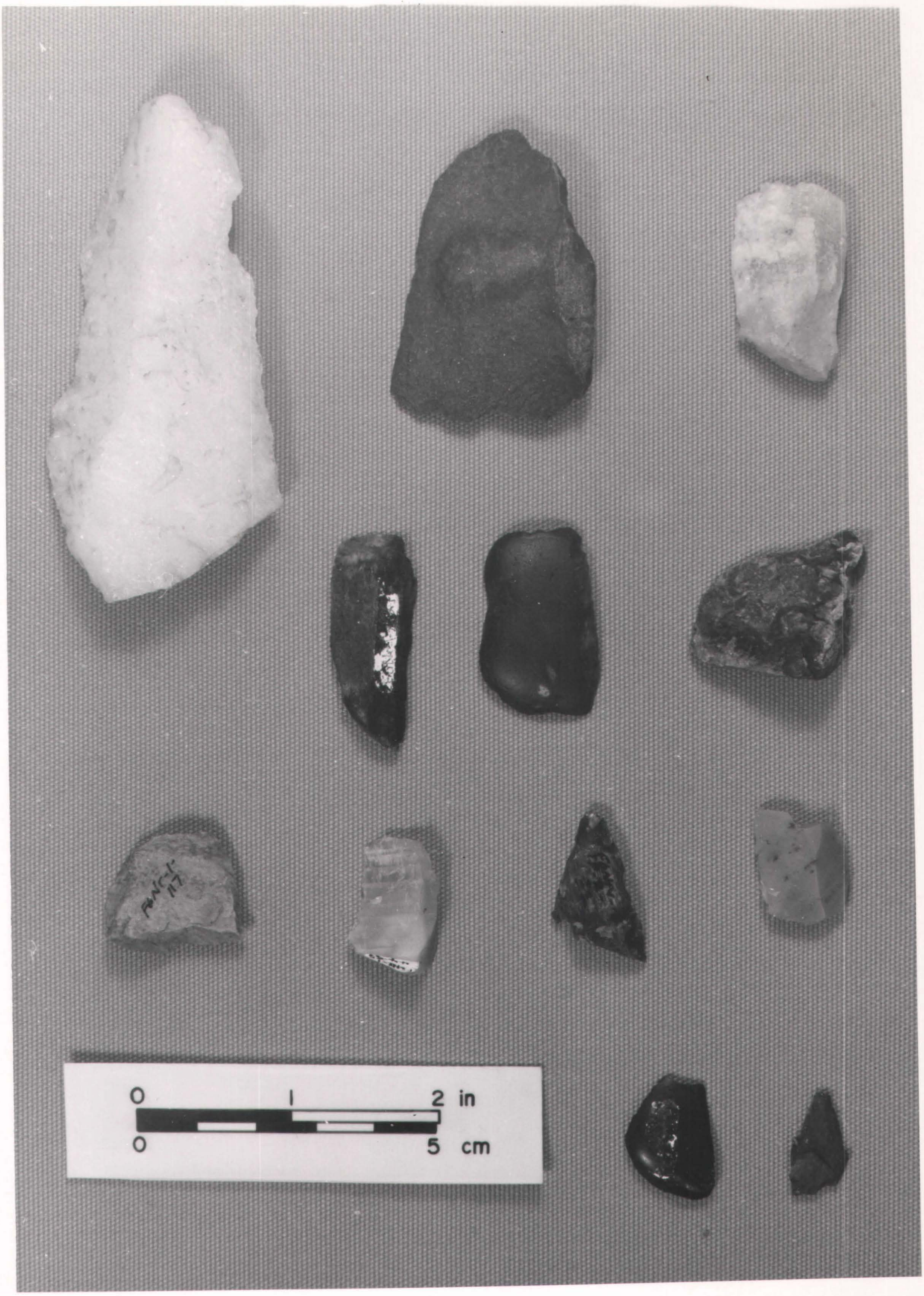


Figure 4.6 Unifacially Retouched Flakes - Unifacial Knives.

Table 4.15 METRIC ATTRIBUTES OF BEVELLED EDGE RETOUCH FLAKES

Attributes	Minimum	Maximum	Range	Mean	Mode	Median
Length (mm) n=9	16	58	42	28.22	-	24.5
Width (mm) n=18	7	26	19	15.88	16	16.5
Thickness (mm) n=22	2	18	16	5.48	3	5.5
Angle of Left Lateral Edge (degrees) n=7	50	65	15	54.29	50	57.5
Angle of Right Lateral Edge (degrees) n=10	45	60	15	54	50-55-60	52.5
Dorsal Spine Plane Angle Left Lateral Edge (degrees) n=5	45	60	15	50	-	50
Dorsal Spine Plane Angle Right Lateral Edge (degrees) n-10	30	60	30	46.5	50	47.5
Ventral Spine Plane Angle Left Lateral Edge (degrees) n=1	40	40	0	40	-	-
Ventral Spine Plane Angle Right Lateral Edge (degrees) n=1	35	35	0	35	-	-
Angle of Distal Edge (degrees) n=6	50	70	20	59.16	55	60
Spine Plane Angle Distal Edge (degrees) n=6	35	55	20	45	45	45
Weight (gms) n=21	.3	20	17.7	2.31	.5	1.2

Table 4.16 METRIC ATTRIBUTES OF UNIFACIAL KNIVES

Attributes	Minimum	Maximum	Range	Mean	Mode	Median
Length (mm) n=10	17	84	67	32.4	30	30
Width (mm) n=12	10	49	39	21.92	14-15	20.5
Thickness (mm) n=12	2	15	13	7.25	5	8.5
Angle of Left Lateral Edge (degrees) n=2	45	50	5	47.5	-	47.5
Angle of Right Lateral Edge (degrees) n=9	35	55	20	44.4	50	45
Dorsal Spine Plane Angle Left Lateral Edge (degrees) n=1	30	30	0	30	-	-
Dorsal Spine Plane Angle Right Lateral Edge (degrees) n=9	20	35	15	31.1	30-35	30
Ventral Spine Plane Angle Left Lateral Edge (degrees) n=1	35	35	0	35	-	-
Angle of Distal End (degrees) n=1	40	40	0	40	-	-
Spine Plane Angle of Distal End (degrees) n=1	30	30	0	30	-	-
Weight (gms) n=12	.4	46.9	46.5	7.3	-	2.9

bevelled. This results in a lower edge angle than the other retouched flakes. These tools exhibit a variety of shapes, sizes and cross-sections. On only one specimen is the working edge located on the distal end of the flake; the others are all retouched laterally. Three of the unifacial knives are made on primary decortication flakes. One of the tools is a piece of shatter. On two tools the striking platform is not discernable while the remaining 10 have intact striking platforms.

Class Two: Bifacially Retouched Flakes (n=17) (Figure 4.7)

Complete n=11
Fragments n=6

Of the 11 complete tools, three are made on pieces of shatter, on five tools the striking platform of the flake is discernable and the remaining three specimens do not have a discernable striking platform. These flakes and shatter also exhibit a variety of shapes and sizes, although as a group they are generally thin. Six tools within the sample are primary decortication flakes. Without exception, retouch is present along one lateral edge of these tools.

Class Three: Utilized Flakes (n=12) (Figure 4.7)

These flakes are considered tools because although they do not exhibit any prior modification of an edge, localized wear is discernable macroscopically. It is interesting to note that without exception these flakes are all made of pebble chert. All exhibit use wear on the dorsal surface, on one edge (four), on two edges (five) or on three edges (three).

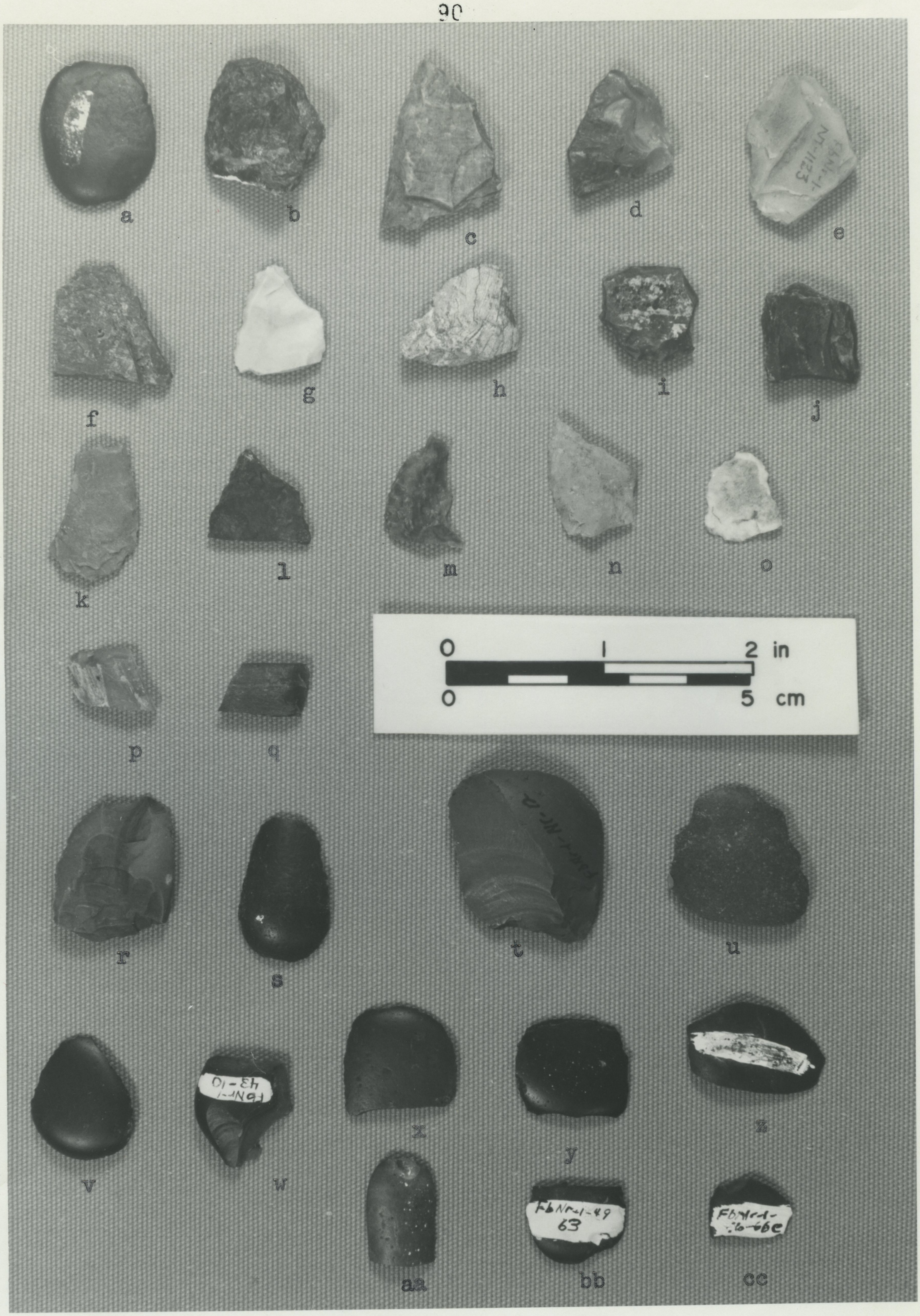


Figure 4.7 Bifacially Retouched Flakes a - q; Utilized Flakes r - cc.

Table 4.17 METRIC ATTRIBUTES OF BIFACIALLY RETOUCHED FLAKES

Attributes	Minimum	Maximum	Range	Mean	Mode	Median
Length (mm) n=8	14	24	10	19	22	17.5
Width (mm) n=17	12	21	9	16.6	15-20	16
Thickness (mm) n=17	2	6	4	3.5	3	4
Angle of Left Lateral Edge (degrees) n=7	35	60	25	48	47-50	50
Angle of Right Lateral Edge (degrees) n=7	35	60	25	47.1	40-60	45
Dorsal Spine Plane Angle Left Lateral Edge (degrees) n=13	15	60	45	33.8	35	32.5
Dorsal Spine Plane Angle Right Lateral Edge (degrees) n=7	20	35	15	27.1	25	27.5
Ventral Spine Plane Angle Left Lateral Edge (degrees) n=12	10	50	40	28.8	30	25
Ventral Spine Plane Angle Right Lateral Edge (degrees) n=6	20	45	25	30	25	32.5
Weight (gms) n=17	.4	3.5	3.1	1.4	.5	1.6

Table 4.18 METRIC ATTRIBUTES OF UTILIZED FLAKES

Attribute	Minimum	Maximum	Range	Mean	Mode	Median
Length (mm) n=9	17	27	10	21.4	18-23	22
Width (mm) n=12	9	23	14	16.4	15-16-23	16
Thickness (mm) n=12	2	5	3	3.8	3	4
Weight (gms) n=12	.3	6.5	6.2	1.4	1-1.2-1.5	1.5

Table 4.19 RAW MATERIALS OF RETOUCHED FLAKES

Class	SSRC	SRC	PC	PW	Chert	Chal.	Quartz	Basalt	TOTAL
1. Unifacially Retouched Flakes									
A. Bevelled Edge	5	1	6	5	1	3	0	0	21
B. Unifacial Knife	4	1	2	2	1	0	1	1	12
2. Bifacially Retouched Flakes	5	1	4	4	2	1	0	0	17
3. Utilized Flakes	0	0	12	0	0	0	0	0	12
TOTAL	14	3	24	11	4	4	1	1	62

SSRC = South Saskatchewan River Chalcedony
SRC = Swan River Chert
PC = Pebble Chert
PW = Petrified Wood
Chal. = Chalcedony

4.1.5 Drills and Perforators

Six tools in the sample are described as drills and/or perforators (Figure 4.8). This description is made on a purely morphological basis. The distinguishing feature of all of these tools is that they have unifacial retouch on either the distal end (four) or one lateral edge (two) which results in the presence of a point or tip. Kehoe (1973:110) distinguishes between the two by stating that on hard materials the initial hole was made by a perforator and then enlarged by a drill. Based on this distinction, it would appear as if the perforators would require a sharper tip than the drills. If this were the case, three of the tools under discussion here would be classed as drills and three as perforators. The dull-tipped specimens are longitudinal, conical and rectangular in shape. One has bifacial primary flaking, one is unifacially flaked and the remaining tool is unifacially retouched on two lateral edges. The sharper tipped perforators exhibit unifacial primary flaking on two specimens and bifacial primary flaking on one specimen. The overall forms of these are conical (two) and oval (one).

4.1.6 Spokeshaves

These three tools are distinguished by the fact that they exhibit a concavity or a notch on one edge (Figure 4.8). They are believed to have functioned as scraping tools for scraping and straightening arrow shafts.

The largest of the three spokeshaves in the sample is made on a broke decortication flake. The notch is unifacially retouched and is found on a lateral edge. Another spokeshave is made of a thin,

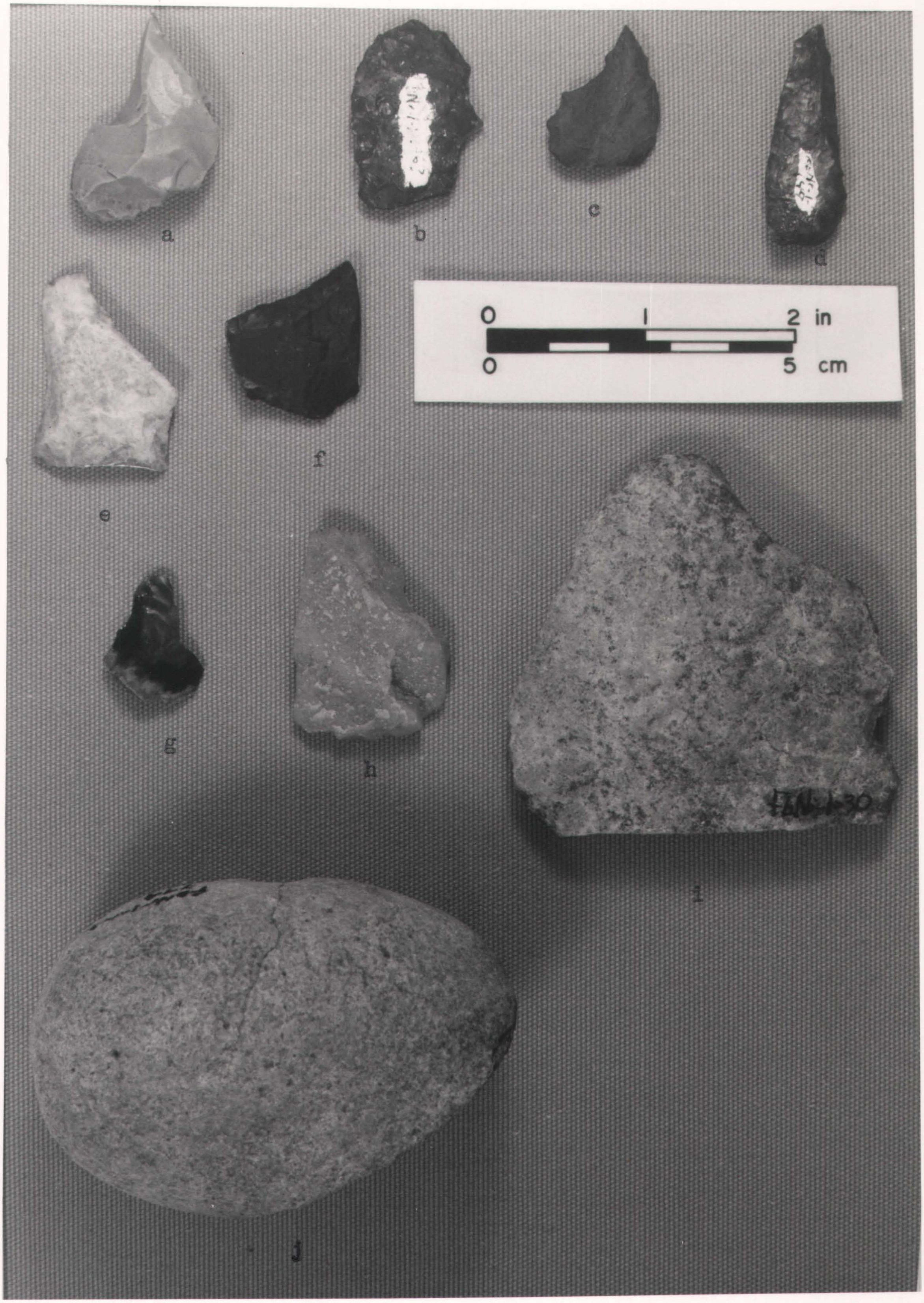


Figure 4.8 Drills and Perforators a - f; Spokeshaves g - i; Partally Grooved Maul j.

secondary decortication flake and the wide rather shallow notch is also unifacially retouched and located on the left lateral edge. The third tool is made on a tertiary flake which has primary unifacial flaking. The notch is located on the right lateral edge and is unifacially retouched.

Table 4.20 METRIC ATTRIBUTES OF DRILLS AND PERFORATORS

Attribute	Minimum	Maximum	Range	Mean	Mode	Median
Length (mm) n=5	23	35	12	29	0	30
Width (mm) n=6	13	23	10	20	23	21
Thickness (mm) n=6	3	11	8	5.6	5	5
Weight (gms) n=6	1.4	6	4.6	3.6	0	3.4

Table 4.21 METRIC ATTRIBUTES OF SPOKESHAVES

Attribute	Minimum	Maximum	Range	Mean	Mode	Median
Length (mm) n=1	19	19	0	0	0	0
Width (mm) n=3	16	63	47	37.6	0	34
Thickness (mm) n=3	3	12	9	7.6	0	8
Weight (gms) n=3	.6	56.9	56.3	21.9	0	8.3

4.1.7 Heavy Chipped Stone Tools

These specimens are all large, heavy, core (four) and flake (one) tools (Figure 4.9). Four of them exhibit bifacial flaking while unifacial flaking is present on the remaining tool. They are grouped here because of their size. All of them have been flaked so that a sharp edge is produced but none exhibit any secondary retouch. These 'tools' may actually represent cores to which no further modification was made after the flakes were removed.

Table 4.22 METRIC ATTRIBUTES OF HEAVY CHIPPED STONE TOOLS

Attribute	Minimum	Maximum	Range	Mean	Mode	Median
Length (mm) n=5	37	81	44	67.2	0	72
Width (mm) n=5	40	71	31	58.2	0	60
Thickness (mm) n=5	16	38	12	21.4	0	20
Weight (gms) n=5	32.2	160	127.8	105.1	0	120.8

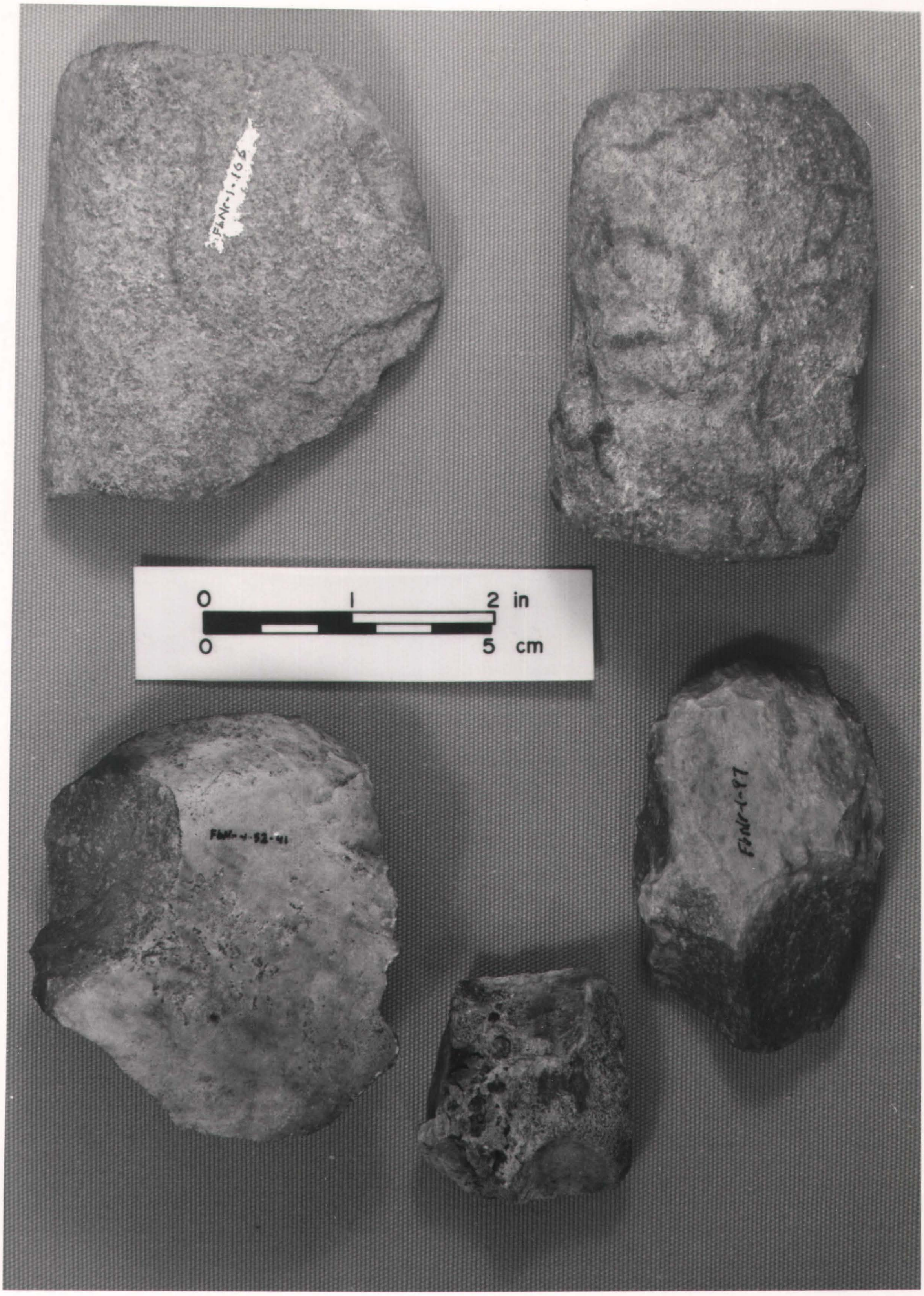


Figure 4.9 Heavy, Chipped Stone Tools.

4.1.8 Partially Grooved Maul

Only maul was found at the Tschetter site and it was found on the surface (Figure 4.8). The tool is broke diagonally below the groove so that only approximately one half of the tool remains. The groove is present on the lateral edge, that is, it is not a fully grooved maul. The dimensions of the groove are; 20 mm long, 12 mm wide and approximately 2 mm deep. The remaining end of this oval, quartzite cobble shows signs of battering.

Table 4.23 METRIC ATTRIBUTES OF PARTIALLY GROOVED MAUL

Length	= undetermined
Width	= 53 mm
Thickness	= 39 mm
Weight	= 221 gms

Table 4.24 RAW MATERIAL OF DRILLS/PERFORATORS, SPOKESHAVES, MAUL AND HEAVY CHIPPED STONE TOOLS

	SSRC	SRC	Chert	Pebble Chert	Quartzite	TOTAL
Drills/Perforators	2	0	2	2	0	6
Spokeshaves	1	0	0	0	2	3
Maul	0	0	0	0	1	1
Heavy Chipped Stone Tools	0	1	0	0	4	5
TOTAL	3	1	2	2	7	15

SSRC = South Saskatchewan River Chert
SRC = Swan River Chert

4.1.9 Projectile Points

The projectile points recovered from the Tschetter site conform to the metric and non-metric attributes of the type known as Prairie Side-Notched (Figures 4.10, 4.11). These projectile points were first described by MacNeish based on his work in southeastern Manitoba. MacNeish's description of the Prairie Side-Notched type is:

> "...roughly triangular in outline but have small side-notches above their irregular convex bases. They range from 19 to 33 mm in length, from 15 to 30 cm in width and are between four and six mm in maximum thickness. The side-notches are from two to four mm deep and wide" (1958:104).

In 1962, Forbis described the projectile points from the Old Woman's Buffalo Jump within a framework that differed from that of MacNeish. Forbis (1962:94) was interested in isolating attributes of the projectile points which were sensitive to change through time. He thus defined seven types of points including Washita, Pekisko, Nanton, Lewis, Irvine and High River. These types cross-cut MacNeish's description of Plains and Prairie side-notched and were defined on the basis of three features of chronological significance: base-body index, height of basal edge and index of base shape.

Shortly after Forbis' work, Kehoe analyzed the projectile points from the Boarding School Bison Drive in Montana and thus derived a new typology for late side-notched projectile points (Kehoe 1967). Kehoe's scheme was later applied to the projectile points from the Gull Lake site. The typology used MacNeish's original terminology for type names and Forbis' type names for varieties. He thus

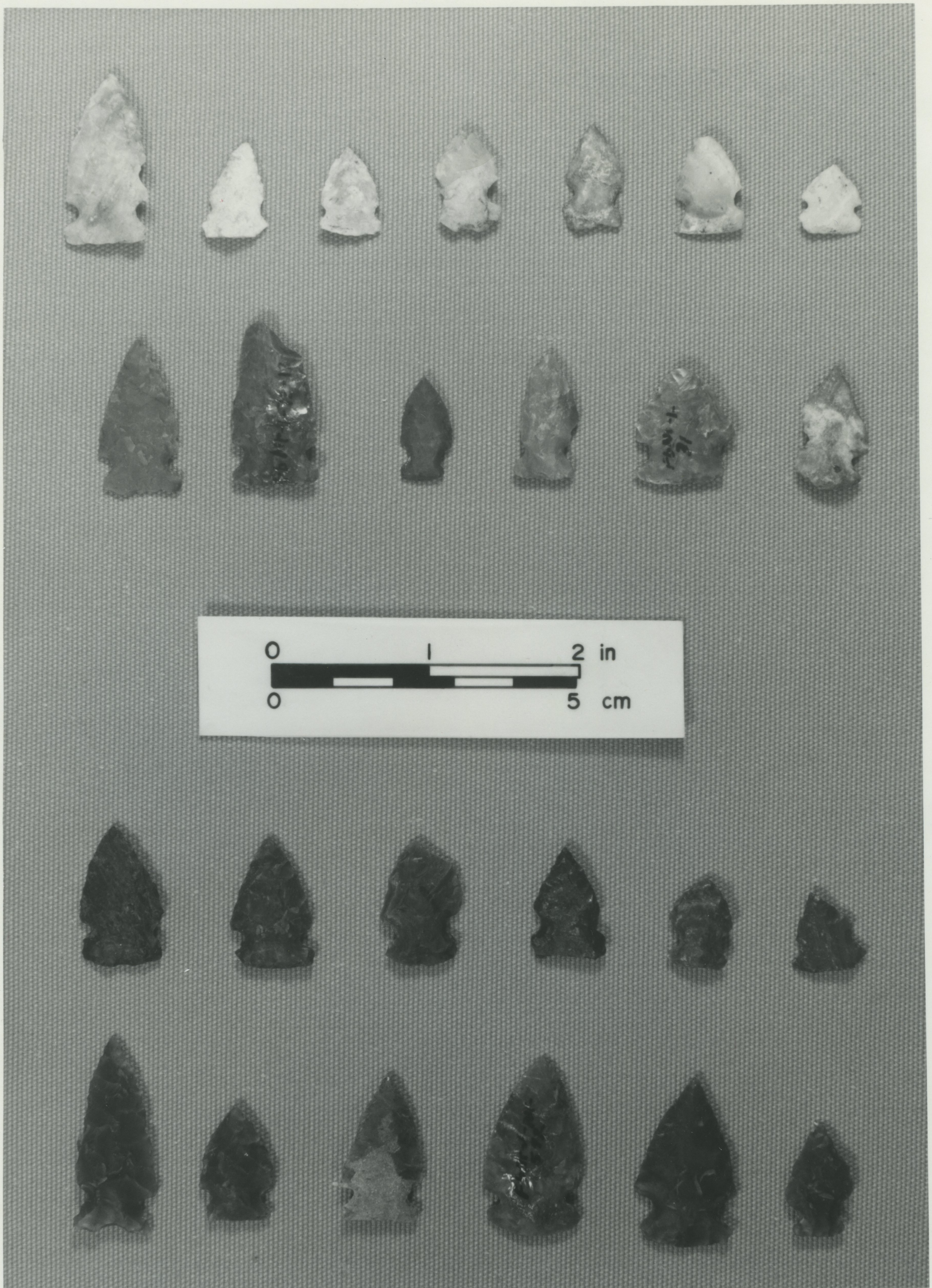


Figure 4.10 Some Complete Projectile Points.

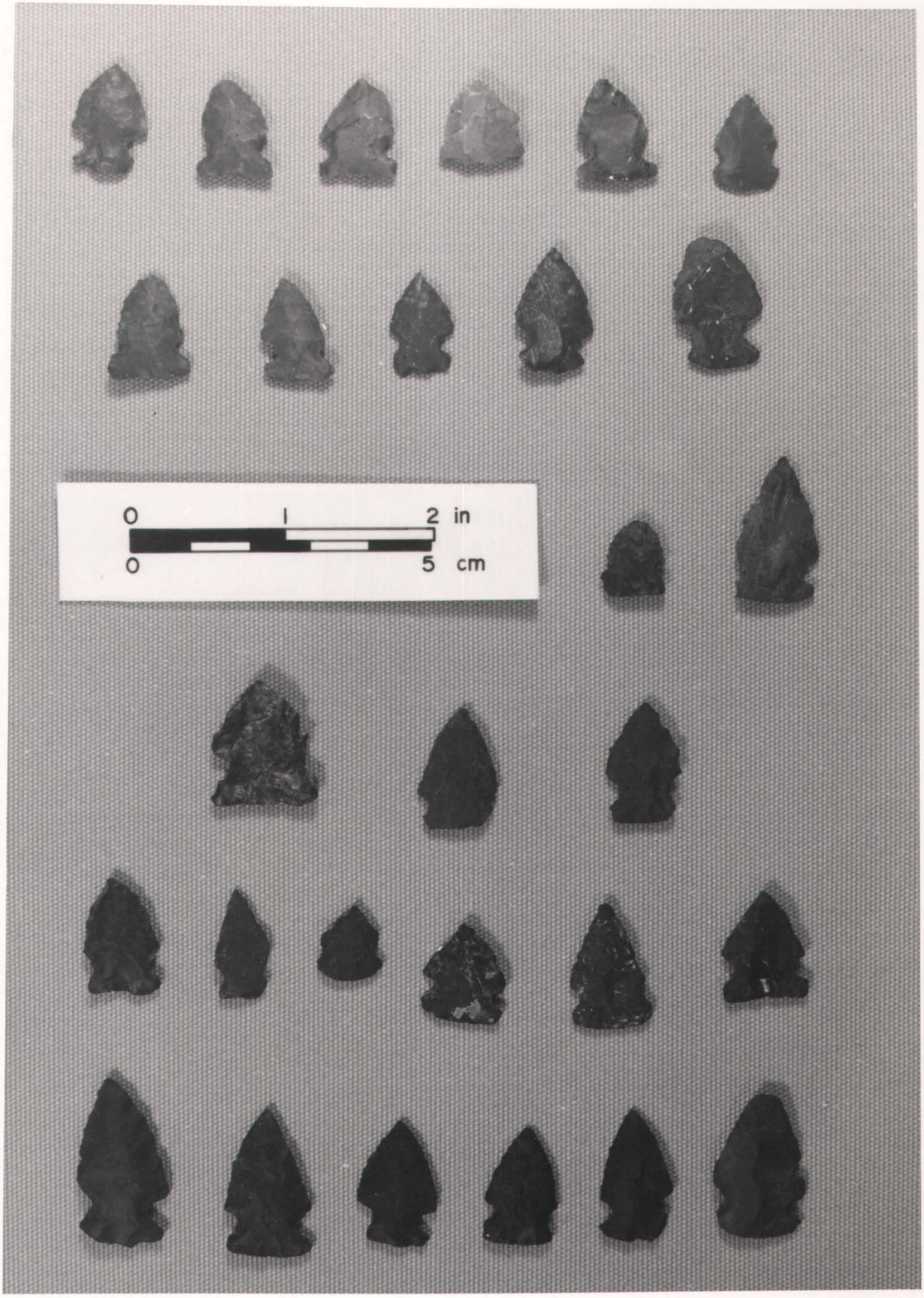


Figure 4.11 Some Complete Projectile Points.

described the Prairie Side-Notched type as having the following characteristics (1973:58):

> irregular outline
> mediocre flaking
> lack of symmetry
> wide, shallow notches placed low on the blade
> bases usually narrower than the proximal
> end of the blade
> usually rounded base corners, but some sharp
> ususally straight bases

Based on seven attributes found to be significant, seven type varieties (Irvine Narrow; Square Base, Lewis Narrow, Rounded Base; Tompkins Side-Corner Notched; Nanton Wide, Rounded Base; Swift Current Fish Tail; Shaunavon Truncated Base; and High River Small Corner-Notched) were defined.

Although the typologies of the late side-notched points of Forbis and Kehoe have been criticized (most recently by Whelan 1976) and although researchers have found that their samples do not fit neatly into either scheme, the fact remains that either one or the other of these schemes is still used by Northern Plains archaeologists. It is not my intent to argue the validity of either typology or to apply either to the Tschetter site sample. Rather, the metric and non-metric attributes will be described and the sample referred to in the broadest sense as Prairie Side-Notched.

The 270 complete and incomplete projectile points from the Tschetter site were coded according to their metric and non-metric attributes. A list of the attributes is found in Tables 4.25 and 4.26.

Table 4.25 NON-METRIC ATTRIBUTES OF PROJECTILE POINTS

1. Completeness of Form
2. Material
3. Total Form Outline
4. Body Edge Shape - Left
5. Body Edge Shape - Right
6. Primary Retouching
7. Tip Form
8. Body Symmetry
9. Transverse Section Shape
10. Longitudinal Section Shape
11. Shoulder Shape - Left
12. Shoulder Shape - Right
13. Notch Form - Left
14. Notch Form - Right
15. Notch - Basal Edge Juncture Configuration - Left
16. Notch - Basal Edge Juncture Configuration - Right
17. Basal Edge Shape - Left
18. Basal Edge Shape - Right
19. Basal Edge - Base Juncture Configuration - Left
20. Basal Edge - Base Juncture Configuration - Right
21. Base Shape
22. Base Symmetry
23. Modification of Base

Non-Metric Attributes of Projectile Points

Since so many variables are present for any one attribute, the non-metric attributes are most conveniently described in detail in numeric form followed by groups of attributes summarized in written form.

Attribute: Completeness of Form

Variable	Number	Frequency
Complete	66	24.4
Base/Shoulder (tip missing)	39	14.4
Soulder/Tip	33	12.2
Base/Notch	33	12.2
Body Segment	31	11.5
Part of Base Missing	31	11.5
Base/Shoulder (above shoulder missing)	20	7.4
Point Blank	13	4.8
Notch/Tip	4	1.5
	270	100.0

Attribute: Material

Variable	Number	Frequency
Pebble Chert	67	24.8
South Saskatchewan River Chalcedony	66	24.4
Chert	52	19.3
Swan River Chert	33	12.2
Petrified Wood	24	8.9
Chalcedony	10	3.7
Quartzite	6	2.2
Quartz	4	1.5
Jasper	3	1.1
Basalt	3	1.1
Knife River Flint	1	.4
Obsidian	1	.4
	270	100.0

Summary: Although there are only 66 complete points in the sample, several others were partially complete so that all (or the majority) of the non-metric attributes were observable. No particular breakage pattern is observable. When the points broke, the location of the break is approximately equal for the base, the tip and the body. A slightly smaller percentage broke above the notches and a very small percentage of the points broke below the notches. The material breakdown of the projectile points shows that the majority of these tools were made of either pebble chert or South Saskatchewan River Chalcedony. This is generally true of all the tool categories at the site with the exception of the endscrapers which also indicate a preference for pebble chert. The obsidian specimen is the only example of this material used for tool manufacture at the site. With the exception of one obsidian point and one Knife River Flint point, all of the materials are available locally.

Attribute: Total Form Outline

Variable	Number	Frequency
Triangular	102	53.4
Lanceolate	46	24.1
Oval	35	18.3
Pentagonal	5	2.6
Bi-Pointed	3	1.6
	191	100.0

Attribute: Body Edge Shape - Left

Variable	Number	Frequency
Triangular	108	56.0
Ovate	38	19.7
Excurvate	35	18.1
Incurvate	77	3.6
Parallel - Ovate	2	1.0

Attribute: Body Edge Shape - Left (continued)

Variable	Number	Frequency
	1	.5
Expanding - Ovate	1	.5
	1	.5
	193	100.0

Attribute: Body Edge Shape - Right

Variable	Number	Frequency
Triangular	112	57.2
Excurvate	45	23.0
Ovate	27	13.8
Incurvate	3	1.5
Parallel - Ovate	3	1.5
Expanding - Ovate	2	1.0
	2	1.0
Excurvate - Incurvate	1	.5
Contracting - Ovate	1	.5
	196	100.0

Attribute: Primary Retouching

Variable	Number	Frequency
Bifacial - Both Surface Incomplete	117	47.4
Bifacial - Complete	63	25.5
Bifacial - Dorsal Complete	48	19.4
Bifacial - Ventral Complete	8	3.2
Unifacial - Dorsal Complete	5	2.0
Unifacial - Dorsal Incomplete	5	2.0
Unifacial - Ventral Incomplete	1	.4
	247	100.0

Attribute: Tip Form

Variable	Number	Frequency
Sharp	64	53.8
Rounded	27	22.7
Blunted	22	18.5
Damaged	6	5.0
	119	100.0

Attribute: Body Symmetry

Variable	Number	Frequency
Symmetrical - Symmetrical	118	59.0
Asymmetrical - Symmetrical	11	5.5
Symmetrical - Asymmetrical	54	27.0
Asymmetrical - Asymmetrical	16	8.0
	200	100.0

Attribute: Transverse Section Shape

Variable	Number	Frequency
Plano-Convex	76	29.8
Bi-Plano	68	26.7
Bi-Convex	48	18.8
Plano-Triangular	31	12.2
Convexo-Triangular	15	5.9
Asymmetrical - Bitriangular	9	3.5
Bi-Triangular	6	2.4
Asymmetrical - Biconvex	2	.8
	255	100.0

Attribute: Longitudinal Section Shape

Variable	Number	Frequency
Bi-Plano	82	33.9
Plano-Convex	74	30.6
Bi-Convex	34	14.0
Concave-Convex	19	7.9
Ovate	12	5.0
Plano - Triangular	5	2.1
Triangular	4	1.7
Plano - Concave	3	1.2
Excurvate	1	.4
	242	100.0

Summary: This group of attributes describes some very general characteristics of the shape of the projectile points. Although the majority are triangular in total form outline, the presence of the other attributes as well as the diverse section shapes serves to illustrate the mediocrity of the flaking. This feature is highlighted by the lack of completeness of the primary retouching. By far the majority of the projectile points are incompletely flaked on both surfaces, while only one-quarter of the sample are completely flaked on both surfaces. The tip form attribute corresponds fairly closely with the total form outline. For example, when the outline is triangular, the tips are sharp and when the outline is lanceolate the tips are rounded. Likewise, the body edge shape variables conform to the variety of outline shapes. The fact that the left and right edge shapes do not correspond closely to each other only serves to emphasize that a large percentage of the points are asymmetrical. In fact, only slightly more than one-half of the sample are symmetrical.

Attribute: Notch - Basal Edge Juncture Configuration - Left

Variable	Number	Frequency
Acute Angle - Sharp	40	25.8
Obtuse Angle - Rounded	27	17.4
Right Angle - Rounded	21	13.5
Right Angle - Sharp	18	11.6
Acute Angle - Rounded	18	11.6
Obtuse Angle - Sharp	17	11.0
Convex	14	9.0
	155	100.0

Attribute: Notch - Basal Edge Juncture Configuration - Right

Variable	Number	Frequency
Acute Angle - Sharp	44	28.6
Obtuse Angle - Sharp	31	20.1
Obtuse Angle - Rounded	30	19.5
Right Angle - Rounded	16	10.4
Acute Angle - Rounded	14	9.1
Right Angle - Sharp	9	5.8
Convex	9	5.8
Indeterminate	1	.6
	154	100.0

Summary: The above attributes are combined in this discussion by virtue of the fact that they all contribute to a description of the form of the notch. Shoulder shapes are predominantly obtuse angle - rounded. The rounded shoulders of the Prairie Side-Notched type contrast vividly with the sharp angles at the base and notches of the Plains Side-Notched type (Kehoe 1973:60). If all of the 'rounded' variables were combined, more than one-half of the sample demonstrates rounded shoulders. Sharp angled forms are within the range of variability of the Prairie Side-Notched type and are most obviously present in the Swift-Current Fish-Tail Variety as defined by Kehoe (1973:57). Notch forms, however, are strikingly rounded although the percentage of shallow notches as opposed to deep notches is minimal. A third measure of roundness is exhibited

Attribute: Basal Edge Shape - Left

Variable	Number	Frequency
Straight - Constricting toward Base	64	41.6
Straight - Parallel	52	33.8
Convex	24	15.6
Straight - Expanding toward Base	13	8.4
Indeterminate	1	.6
	154	100.0

Attribute: Basal Edge Shape - Right

Variable	Number	Frequency
Straight - Constricting toward Base	63	40.6
Straight - Parallel	49	31.6
Convex	20	12.9
Straight - Expanding toward Base	17	11.0
Indeterminate	4	2.6
Unfinished - Contracting	2	1.3
	155	100.0

Attribute: Basal Edge - Base Juncture Configuration - Left

Variable	Number	Frequency
Convex	39	26.2
Right Angle - Rounded	27	18.1
Right Angle - Sharp	24	16.1
Obtuse Angle - Rounded	21	14.1
Obtuse Angle - Sharp	19	12.8
Acute Angle - Sharp	13	8.7
Acute Angle - Rounded	6	4.0
	149	100.0

by the notch - basal edge juncture configuration. In this case, however, rounded versus acute angles are equally represented although far less than one-quarter of the junctures are right angled.

Attribute: Basal Edge - Base Juncture Configuration - Right

Variable	Number	Frequency
Right Angle - Rounded	27	18.2
Obtuse Angle - Rounded	26	17.6
Obtuse Angle - Sharp	25	16.9
Convex	24	16.2
Right Angle - Sharp	21	14.2
Acute Angle - Rounded	13	8.8
Acute Angle - Sharp	10	6.8
Indeterminate	2	1.4
	148	100.0

Attribute: Base Shape

Variable	Number	Frequency
Straight	55	36.7
Convex	43	28.7
Sub-Convex	22	14.7
Trivectorial	13	8.7
Concave	9	6.0
Concave	3	2.0
Bivectorial	3	2.0
Triangular - Concave	2	1.3
	150	100.0

Attribute: Base Symmetry

Variable	Number	Frequency
Symmetrical	127	88.8
Asymmetrical - Left Skew	11	7.7
Asymmetrical - Right Skew	5	3.5
	143	100.0

Attribute: Modification of Base

Variable	Number	Frequency
Thinned - Both Surfaces Unground	67	40.6
Unthinned - Unground	55	33.3
Thinned Dorsal Surface - Unground	18	10.9
Thinned Ventral Surface - Unground	11	6.7
Thinned - Both Surfaces Unground	9	5.5
Unthinned - Unground	2	1.2
Indeterminate	2	1.2
Thinned Ventral - Ground	1	.6
	165	100.0

Summary: The shape, symmetry and modification of the base are described in these attributes. The basal edge shapes are overwhelmingly straight (over 80 per cent), but only slightly more than 25 per cent of the edges are parallel. Likewise, the same percentage of the basal edge - base junctures are right-angled, while the majority are obtuse angled and convex. Bases exhibit a variety of shapes, 36.7 per cent of which are straight. Surprisingly, considering the general asymmetrical form of the point, 88.8 per cent of the bases are symmetrical. By far the majority (91.5 per cent) of the bases are unground and less than half are unthinned.

Metric Attributes of Projectile Points

The Tschetter site projectile points conform fairly closely to the Prairie Side-Notched type as identified by MacNeish (1958:104). The length of the Tschetter points are slightly shorter and they are not quite as wide as the point type but are well within the range of variation. The depth and width of the notches compares favourably with the point type as well.

Table 4.26 METRIC ATTRIBUTES OF PROJECTILE POINTS

Attributes	Minimum	Maximum	Range	Mean	Mode	Median
Length of Point (mm) n=104	11	32	21	19.9	20	19.8
Length of Shoulder to Base (mm) n=165	4	11	7	6.7	6	6.6
Length-Body (mm) n=134	5	25	20	13.6	11	13.2
Width of Body (mm) n=225	2	17	15	11.8	13	11.9
Distance Maximum Body Width From Base (mm) n=157	5	18	13	10	10	9.9
Width of Shoulder (mm) n=183	7	17	10	12.6	13	12.7
Width of Neck (mm) n=175	5	13	8	8.9	8	8.8
Width of Basal Edge (mm) n=136	3	17	14	12.1	11	12.1
Width of Base (mm) n=137	6	16	10	10.8	10	10.7
Thickness (mm) n=265	1	7	6	3.3	3	3.2
Length of Left Notch (mm) n=155	1	6	5	3.3	3	3.3
Length of Right Notch (mm) n=152	1	6	5	3.2	3	3.2
Depth of Left Notch (mm) n=163	1	3	2	1.5	1	1.4
Depth of Right Notch (mm) n=154	1	3	2	1.4	1	1.4
Length of Left Basal Edge (mm) n=144	1	4	3	2.4	2	2.3
Length of Right Basal Edge (mm) n=142	1	5	4	2.6	3	2.7
Weight (gms) n=270	.2	3.3	3.1	.92	.8	.85

Compared to the Gull Lake sample, and the point type as defined by Kehoe (1973:57), the Tschetter points are very similar in width, thickness, weight and width and depth of the notches. Again, they are not quite as long as the Gull Lake samples.

Summary of Chipped Stone Tools

The classes of artifacts described here are those commonly found at bison kill sites. The predominance of projectile points, then, is not surprising (see Table 4.27). In terms of frequency of occurrance, bifaces rank second in predominance. It is assumed that bifacial tools figured predominantly in the butchering process as did marginally retouched flakes. Endscrapers and unifaces occur less frequently. Unifaces may function as either scraping or cutting tools. Assuming for the moment that the functional implication is correctly applied to the endscrapers, hide scraping was performed at the site but to a relatively lesser extent.

Table 4.27 FREQUENCY OF CHIPPED STONE TYPES

1.	Projectile Points	n=270
2.	Bifaces	n=84
3.	Retouched Flakes	n=62
4.	Endscrapers	n=38
5.	Unifaces	n=19
6.	Drills/Perforators	n= 6
7.	Core Tools	n= 5
8.	Spokeshaves	n= 3
9.	Maul	n= 1
	TOTAL	488

More specialized tools such as the drills/perforators and spokeshaves occur infrequently as to be expected at a site where large amounts of meat are butchered and processed. These frequencies of occurrence compare favourably with other late prehistoric bison drive sites on the Northern Plains. It should be noted, however, that some of these sites have been divided into kill and processing areas. In these terms, projectile pointes, bifaces and retouched flakes occur most frequently in the kill area while endscrapers, unifaces, drills, perforators and spokeshaves are most frequent in the processing area. As has been noted, no such distinction between activity areas was made at the Tschetter site on the basis of feature distribution. This topic will be discussed again with reference to the tool and debitage distribution at the end of this chapter.

4.2 Chipping Detritus

Chipping detritus is composed of three categories; cores, flakes and shatter. Approximately 1,402 pieces of lithic debitage were examined from the Tschetter site. This total is comprised of 97 cores, 1,278 flakes and 27 pieces of shatter.

4.2.1 Cores (n=97)

For purposes of description, the cores were separated into categories based on the method of flake manufacture. Two categories were recognized, bipolar cores and percussion cores.

A. Bipolar Cores

These cores are those which show evidence of crushing or battering on one or both ends. The bipolar reduction of a core involves the use of an anvil. One end of a pebble or a cobble is placed on the anvil and held there while being struck from the opposite end with a hammerstone. These cores are linear and in those cases where both poles are absent, a bipolar core is recognized by its shape and by the linear, parallel flake scars on its surface. Bipolar cores resemble what is referred to in the literature as pièces esquillées, or wedges (Forsman 1976:17). These tools have been assigned a plethora of functions. Whether they did function as tools is not under question here. The important fact is that this category of lithics is the product of bipolar reduction. Forsman (1976:17) describes six varieties of the shape of the percussion surface at the poles of the cores based on the 1963 classification of Binford and Quimby. These varieties are; opposing point, opposing area, opposing ridge, ridge opposed by area, ridge opposed by point and point opposed by area. This classification is used here.

Also, within the bipolar category, two divisions are recognized. Pebble cores are those which are pebble size and retain at least 50 per cent of the original cortex. This category is sometimes called wedges or simply, split pebbles. The second division, micro-cores, resemble pebble cores in platform surface characteristics. They differ from the latter, however, in that little or no cortex remains on their surface. These cores are called micro-cores because the lateral edges contain parallel-sided flake scars. Although they superficially resemble micro-blade cores, they should not be confused with them (Brumley 1978:

96). They are rectangular in shape with triangular or rectangular cross-sections. Like the pebble core category, these cores are described according to the shape of the percussion surface at either pole.

Discussion

Generally, the metrics of the pebble cores and the micro-cores are very similar. The micro-cores are slightly longer, slightly thicker and not quite as wide as the pebble cores. This may be a function of the size of the pebbles chosen for reduction. But, because the two are essentially alike in metric attributes, it may be that pebbles and cobbles were chosen for bi-polar reduction because of their similar size. No anvil stones were identified from the site.

B. Percussion Cores

These cores exhibit little or no cortex and are considered to have been used to their fullest extent (i.e., they are exhausted). They are irregularly shaped; the result of flakes having been removed from several faces.

Discussion

In all metric attributes, the percussion cores are larger and almost twice as thick as the bipolar cores. This of course, is due to the fact that unlike the pebbles chosen for bipolar reduction, percussion cores were cobbles which could be (and were) any size. It is interesting to note, however, that all of the percussion cores are exhausted. Raw material, with exception of pebble chert, may have been rare at the site.

Table 4.28 BIPOLAR PEBBLE CORE TYPES

Blank Type	Form	Number
Both Poles Remnant	Opposing Area	11
	Opposing Ridge	6
	Opposing Point	1
	Point Opposed by Area	5
	Ridge Opposed by Area	7
Single Pole Remnant	Area	6
	Point	5
	Ridge	3

Table 4.29 METRIC ATTRIBUTES OF BIPOLAR PEBBLE CORES

	Mean	Range
Length (mm) n=30	25.53	19 - 38
Width (mm) n=44	17.22	9 - 28
Thickness (mm) n=44	6.25	3 - 12
Weight (gms) n=44	3.17	.5- 10.3

Table 4.30 BIPOLAR MICRO-CORE TYPES

Blank Type	Form	Number
Both Poles Remnant	Opposing Area	2
	Opposing Ridge	5
	Opposing Point	1
	Ridge Opposed by Area	5
	Ridge Opposed by Point	4
	Point Opposed by Area	3
Single Pole Remnant	Ridge	6
	Area	2
	Point	2
Neither Pole Remnant		4
TOTAL		34

Table 4.31 METRIC ATTRIBUTES OF BIPOLAR MICRO-CORES

	Mean	Range
Length (mm) n=20	29.35	27 - 42
Width (mm) n=34	11.85	8 - 37
Thickness (mm) n=35	2.88	.9- 5.3

Table 4.32 METRIC ATTRIBUTES OF PERCUSSION CORES

	Mean	Range
Length (mm) n=19	36.15	24 - 53
Width (mm) n=19	24.31	13 - 48
Thickness (mm) n=19	14.68	8 - 24
Weight (gms) n=19	13.74	2.3-27.8

Table 4.33 RAW MATERIAL OF CORES

Core Type	SSRC	SRC	Pebble Chert	Chert	Quart.	Quart-zite	PW	Ba.	TOTAL
Bipolar Cores									
1. Pebble Cores	0	0	44	0	0	0	0	0	44
2. Microcores	16	8	1	7	0	1	1	0	34
Percussion Cores	12	3	0	1	2	0	0	1	19
TOTAL	28	11	45	8	2	1	1	1	97

SSRC = South Saskatchewan River Chert; SRC = Swan River Chert; Quart. = Quartzite; PW = Petrified Wood; Ba. = Basalt.

4.2.2 Flakes (n=1,278)

Flakes comprise the greatest amount of chipping detritus (91.15 per cent). The flakes were separated into material types and then divided into three categories; decortication flakes (n=135), internal flakes (n=549) and retouch flakes (n=594). Each of the flakes was measured. The single measurement recorded was that of the greatest linear dimension. The most interesting thing about this breakdown is the amount of retouch flakes (46.47 per cent of all flakes). Obviously, more tool sharpening than tool manufacturing was being done. The comparatively small number of decortication flakes (10.56 per cent of all flakes) would suggest that not much primary knapping was performed at the Tschetter site. This statement would seen inconsistent when the relatively large number of cores is considered. It must be remembered, however, that majority of the cores were bipolar cores and once the pebbles were split, they could be used 'as is' when retouched as tools. This is particularly true of endscrapers and projectile points. In this context, it should be noted that only 31 pebble chert decortication flakes were removed. When only the micro-cores and the percussion cores were considered (3.78 per cent of total detritus), the correlation between the number of cores and the number of decortication flakes does not appear to be at odds. Furthermore, no large cobbles were being knapped for the production of flakes and presumably, since fairly small pebble sized cores were being reduced by the bipolar method, it would only take a few blows to remove the cortex. This would support the contention that relatively little knapping was being performed and that perhaps most of the tools were brought to the site.

The category of internal flakes includes all flakes that are not either decortication or retouch flakes. They comprise 42.95 per cent of the total flake count. Within this category, one distinguishable type of flake was noted. These were the prismatic flakes. Prismatic flakes are linear and thin with triangular or rectangular cross-sections and would appear to have been those flakes struck from the bipolar micro-cores. Forty-two prismatic flakes were recorded. They come in all sizes, but the majority of them clustered around the 20 mm length range with a mean of 20.2 mm. The 34 micro-cores were comprised predominantly of the same material as the prismatic flakes and were roughly the same size. These cores have a mean length of 29.35 mm.

The remainder of the internal flakes number 507 or 39.67 per cent of the total flake count. The majority of these flakes clustered in the 11 - 20 mm size range. The decortication flakes were larger, clustering from 16 - 30 mm, while the retouch flakes were all less than or equal to 6 mm in size. Considering the small amount of retouched flakes at the site (n=62), it would appear as if flakes generated for the purpose of use 'as is' were not prevalent at the site. The majority of the internal flakes were too small to be used as tools. Dyck (1977: 253) interprets the low number of flakes in the size category or over 30 mm at the nearby Harder site as meaning that the inhabitants carefully sorted through chipping detritus in order to remove the large flakes intended for tool manufacture. Perhaps the same principle was in operation at the Tschetter site.

4.3 Gritty Stone and Stone

Fragments of stone, referred to here as gritty stone, were found throughout the site. It has been suggested (Dyck 1972: 21) that these disintegrated stones represent what remains of the stones used for stone boiling. Although the Tschetter site, as it is known at present, does not contain a camp area, presumably some meat cooking or processing was being done as the butchering progressed.

The stones recovered from the excavations were described by material type and weighed. The majority of the gritty stone was granite. It has also been suggested in this context that pottery temper was derived from disintegrated granite stones (Dyck 1972:21). This is certainly true of the temper in the Tschetter site pottery sample. The numbers and weights of the stones are tabulated below.

Table 4.34 MATERIAL TYPE, WEIGHT AND FREQUENCY OF GRITTY STONE AND STONE

Material	Weight (kg)	Number	Frequency
Granite (gritty)	28.68	172	74.42
Sandstone	2.40	36	6.24
Basalt	2.20	14	5.70
Limestone	1.94	3	5.02
Schist	1.82	10	4.72
Unidentified Fragments	1.48	?	3.84
Pebbles	.024	2	.06
TOTAL	38.544	237	100.00

4.4 Raw Material

Eight categories of raw, lithic material were recognized in the Tschetter site artifact sample. These categories are described below.

1. Chalcedony. This is a micro-crystalline siliceous rock. Its most obvious characteristic is its translucency and vitreous lustre. Three varieties of chalcedony are identified.

(a) White Chalcedony

(b) Knife River Flint - also known as brown chalcedony. The source of this material is a quarry in North Dakota.

(c) South Saskatchewan River Chalcedony - this material was originally described and named by Eldon Johnson (personal communication) from the Douglas Park area of Saskatchewan. Johnson's description of the material is used here. It is also called petrified bog and is often confused with petrified wood. This material comes in a variety of shades of a brown colour and has a dull lustre in its natural condition which may become waxy when heat treated. South Saskatchewan River Chalcedony contains pseudomorphs of organic material and has irregular fracture planes. A small percentage of the nodules contain chalcedony similar to Knife River Flint. Based on his personal experience, Johnson notes that this is not an easy material to knap, but that knapping is facilitated by heating the stone to 295°C. The source of South Saskatchewan River Chalcedony is the Lake Diefenbaker area. Although it has also been found in southern Alberta, additional sources are not known. Prehistorically, the source would have been along the banks of the South Saskatchewan River.

2. Chert. Like chalcedony, chert is also a micro-crystalline rock made of silicates. This fine-grained, opaque material appears in a range of colours and has a dull to vitreous lustre. Within this category, four varieties are identified.

(a) Jasper - this chert is identified by its colour which ranges from yellow to red. It is separated from the above by virtue of the common practice in the literature of distinguishing red chert as jasper.

(b) Pebble Chert - This variety was distinguished mostly in order to describe the bipolar cores from the site. It refers to small, oval, black pebbles commonly found in the beds of the South Saskatchewan River. The interiors of the pebbles are usually black, but may also be brown, yellow or green.

(c) Swan River Chert - Swan River Chert is commonly found on the northern fringes of the plains in Saskatchewan, Alberta and Manitoba (Campling 1980:291-301). It varies in colour from white to grey to pink and red, but at the Tschetter site it is usually white. Swan River Chert has a dull lustre and a readily identifiable texture, which exhibits cracks and cavities. This vuggy appearance was used as the distinguishing characteristic of this chert variety.

(d) Chert - This category is composed of all cherts other than those three specified above.

3. Petrified Wood. A very common lithic material on the prairies, petrified wood comes in a variety of colours but was generally brown and occasionally banded. The very obvious, regular, internal laminations which follow tree ring growth lines were the identifying characteristic. The poorly developed cleavage planes of petrified wood result in a tendency for the material to fracture in sheets. The lustre is dull to glassy.

4. Quartzite. A granular appearance and a dull lustre were the criteria used to define quartzite. The quartzite specimens at the Tschetter site were white, grey and brown. It is obtained locally from river gravels and till deposits.

5. Quartz. The glassy lustre, transluscency and crystal appearance of this mineral served as the identifying characteristics. This material is also available locally.

6. Basalt. Usually black in colour, basalt is defined as a material with a smooth but grainy appearance and is opaque. Unlike the finer grained materials, basalt has a consistently dull sheen.

7. Obsidian. The glassy texture, transluscency and black colour of obsidian were sufficient to identify this material. Obsidian is often found in small amounts on sites on the Saskatchewan Plains. The source of the obsidian on the Canadian Plains is usually Yellowstone National Park although the source of this particular sample is not known.

8. Unidentified. This category of material is coarse-grained and has a dull lustre. It vaguely resembles quartzite, but is not granular. Colours range from brown to grey.

Discussion

The raw material of all tools and detritus is listed in Table 4.35 and the frequency of occurrences of each raw material category is listed in Table 4.36. Chalcedony is the most commonly occuring raw material at the Tschetter site. The locally available South Saskatchewan River Chalcedony variety occurs most frequently in all the tool and detritus classes. To a slightly lesser extent, cherts also occur frequently. Pebble chert figures predominantly in tool manufacture especially in the projectile point, endscraper and retouched flake categories. Swan River Chert is not as common for tool manufacture, but it is commonly found at the site in the form of flakes. Petrified wood and quartzite occur with near equal frequency although more tools are made of petrified wood than quartzite while the reverse is true of the detritus.

The exotic materials including Knife River Flint and obsidian are present in the form of two projectile points. This would suggest that these tools were not manufactured at the site. On the whole, the Tschetter site people used local material for tool manufacture, even

Table 4.35 RAW MATERIAL OF ALL TOOLS AND DETRITUS

	SSRC	SRC	Jasper	Pebble Chert	Chert	Quartzite	Quartz	PW	Chal.	KRF	Basalt	Obsidian	?	TOTAL
Tools														
Enscrapers	4	7	0	18	6	0	2	0	1	0	0	0	0	38
Bifaces	46	6	2	4	15	3	0	6	2	0	0	0	0	85
Unifaces	4	7	0	3	1	2	0	2	0	0	0	0	0	19
Retouched Flakes	14	3	0	24	4	0	1	11	4	0	1	0	0	62
Spokeshaves	1	0	0	0	0	2	0	0	0	0	0	0	0	3
Drills/Perforators	2	0	0	2	2	0	0	0	0	0	0	0	0	6
Core Tools	0	1	0	0	0	4	0	0	0	0	0	0	0	5
Maul	0	0	0	0	0	1	0	0	0	0	0	0	0	1
Projectile Points	66	33	3	67	52	6	4	24	10	1	3	1	0	270
TOTAL	137	57	5	118	80	18	7	43	17	1	4	1	0	488
Detritus														
Flakes	723	150	16	31	259	33	16	21	0	0	15	0	14	1,278
Cores	29	11	0	45	7	2	1	1	0	0	0	0	1	97
Shatter	12	5	1	0	9	0	0	0	0	0	0	0	0	27
TOTAL	764	166	17	76	275	35	17	22	0	0	15	0	15	1,402
Total Tools and Detritus	901	223	22	194	354	53	24	65	17	1	19	1	15	1,890

SSRC = South Saskatchewan River Chalcedony; SRC = Swan River Chert; PW = Petrified Wood; Chal. = Chalcedony; KRF = Knife River Flint though some of that material was not aesthetically pleasing nor easily workable. The result was a tool kit of less-than-perfect form and symmetry but which was probably functionally adequate.

Table 4.36 FREQUENCY OF THE RAW MATERIAL

Material	Number	Frequency
Chalcedony		
South Saskatchewan River	901	47.67
White	17	.90
Knife River Flint	1	.05
TOTAL	919	48.62
Chert		
Chert	355	18.78
Swan River	223	11.80
Pebble	194	10.26
Jasper	22	1.16
Total	794	42.00
Petrified Wood	65	3.44
Quartzite	53	2.80
Quartz	24	1.27
Basalt	19	1.01
Obsidian	1	.05
Unidentified	15	.79
TOTAL	1,890	99.98

4.5 The Ceramic Assemblage

Ninety-two ceramic sherds were recovered from the Tschetter site. The majority of these are body sherds but rim and base sherds are also represented. On the basis of rim sherd counts there are at least four vessels represented (Figure 4.12).

Vessel 1

Sample: 5 rim sherds, 1 rim/body sherd, 1 base/body, 2 base sherds, minimum of 36 body sherds.

Paste: Temper: Coarse, crushed granite (1 - 3 mm in diameter)
Texture: Laminated

Colour: Rim - (a) exterior very pale brown - pale brown - dark grey (Munsell 10 YR 7/3 - 6/3 - 4/1)

(b) interior light brownish grey - greyish brown - dary grey (Munsell 10 YR 6/2 - 5/2 - 4/1)

(c) core grey - dark grey (Munsell 10 YR 5/1 - 4/1)

Body -(a) exterior very pale brown - yellow (Munsell 10 YR 7/4 - 7/6)

(b) interior pale brown - greyish brown (Munsell 10 YR 7/4 - 5/2)

(c) core dark grey (Munsell 10 YR 4/1)

Base -(a) exterior very pale brown - yellow (Munsell 10 YR 7/4 - 7/6)

(b) interior very pale brown (Munsell 10 YR 7/4)

(c) core very dark grey - very pale brown (Munsell 10 YR 7/4 - 3/1)

Vessel Form: This vessel had been partially reconstructed and is globular in shape (Figure 4.13). The lip is flat and the inner corner is somewhat thickened. The potter's finger impressions are visible on the inside of the lip creating an almost scalloped appearance in places. The rim is straight, sloping very slightly

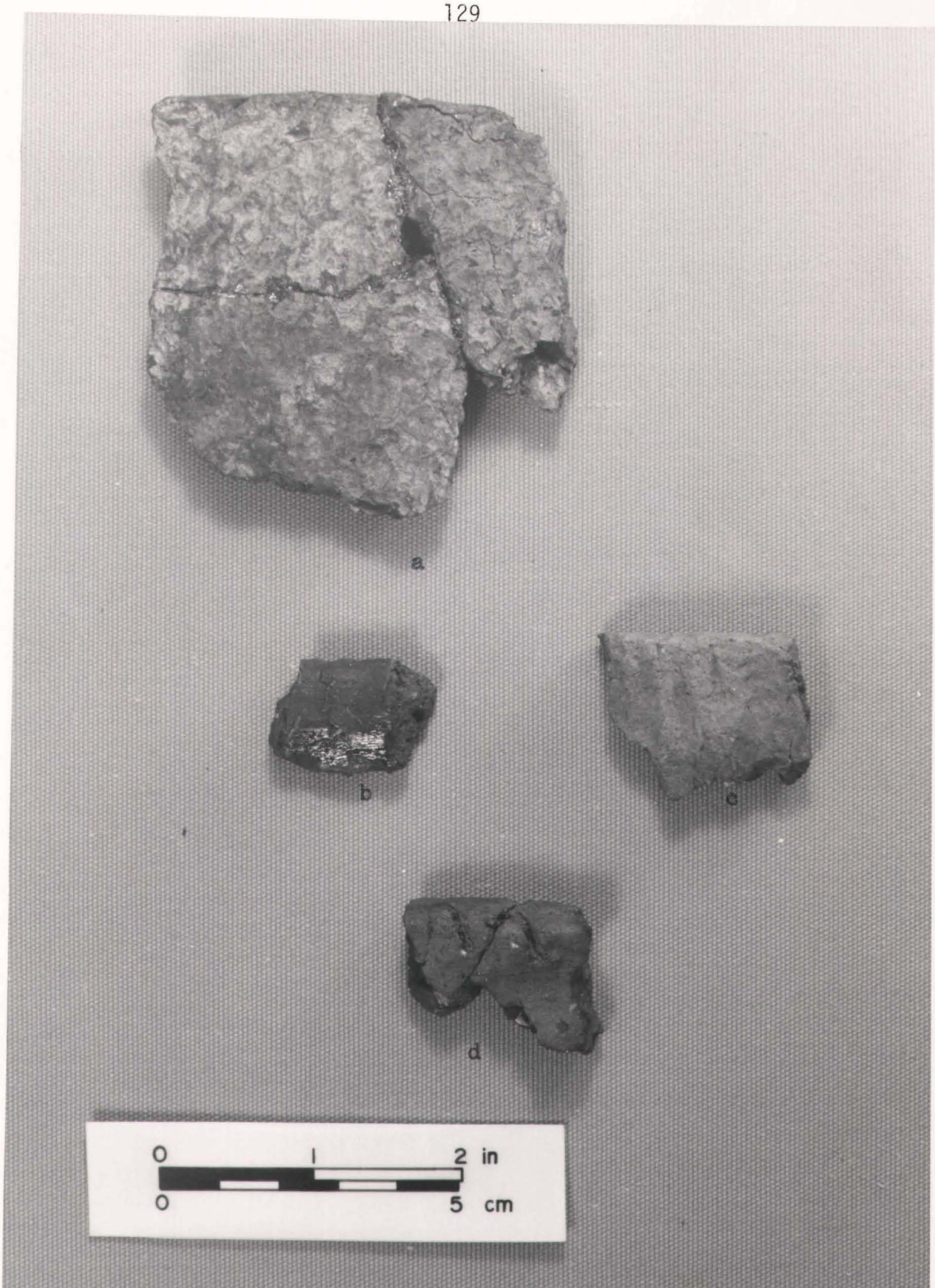


Figure 4.12 Rimsherds Vessel One - a; Vessel Four - b; Vessel Three - c; Vessel Two - d.

Figure 4.13 Vessel 1 - Partially Reconstructed

toward the interior of the vessel. There is no neck or shoulder on this vessel and the base is rounded.

Thickness: Lip - 13-14 mm
Rim - 10 mm
Body - 11-13 mm
Base - 12-18 mm

Vessel Dimensions: Orifice Diameter - 22 cm
Height - 22 cm

Surface Finish: Exterior - smoothed fabric-impressed
Interior - smoothed, some vertical striae

Decoration: The decoration on this vessel is restricted to the rim. This decoration consists of obliquely oriented wrapped tool impression extending across the lip to its outer corner. The impressions are 14-16 mm long, 3 mm wide and 2-3 mm deep.

Vessel 2

Sample: 1 rim/neck sherd

Paste: Temper: crushed quartz and feldspar, with grains up to 4 mm in diameter
Texture: Coarse
Colour: (a) exterior dark grey (Munsell 10 YR 4.1)
(b) interior brown (Munsell 10 YR 5/3)
(c) core dark grey (Munsell 10 YR 4/1)

Vessel Form: The lip of this vessel slopes to the exterior and is flat. The rim is constricted at the rim/neck juncture.

Thickness: Lip - 12 mm
Rim - 8 mm
Neck - 7 mm

Vessel Dimensions: Intermediate

Surface Finish: Exterior - smooth
Interior - smooth

Decoration: Two obliquely oriented impressions comprise the decoration on this vessel. They are confined to the outer corner of the lip and are 8 mm long, 1 mm wide and 2 mm deep. They are spaced at 10 mm intervals.

Vessel 3

Sample: One rim sherd
Paste: Temper: crushed quartz and feldspar, 1 x 2 mm in dimension
Texture: laminated
Colour: (a) exterior yellow (Munsell 10 YR 7/6)
(b) interior very dark grey (Munsell 10 YR 3/1)
(c) core very dark grey (Munsell 10 YR 3/1)

Vessel Form: This sherd has a flat lip and a vertical rim. The size of the sherd (27 mm in length) suggests that the vessel to which it belongs does not have a neck.

Thickness: Lip - 10 mm
Rim - 8 mm

Vessel Dimensions: Indeterminate

Surface Finish: Exterior - smoothed, fabric-impressed which extends over the lip
Interior - smoothed, with horizontal striae

Decoration: Absent

Vessel 4

Sample: One rim sherd

Paste: Temper: crushed quartz up to 2 mm in diameter
Texture: laminated
Colour: (a) exterior not present
(b) interior very dark grey (Munsell 10 YR 3/1)
(c) core very dark grey (Munsell 10 YR 3/1)

Vessel Form: The exterior of this sherd is missing, but the lip is rounded on the interior.

Thickness: Lip - ?
Rim - ?

Surface Finish: The interior of the vessel is smooth and has horizontal striae suggesting that the interior may have been smoothed with grass.

Decoration: Indeterminate

Miscellaneous: All of the 65 body sherds exhibit smoothed fabric-impressed exteriors and smooth interiors. They range in thickness from 7 - 13 mm. On this criteria, it is suggested that they are representative of Vessel 1.

Discussion

The ceramics described from the Tschetter site conform in most characteristics to what Byrne (1973) has defined as the Saskatchewan River Basin Complex - Early Variant. This complex has been dated and is determined to extend from A.D. 150 - 250 to A.D. 1,150.

For purposes of comparison, the characteristics of the Saskatchewan River Basin Complex as defined by Byrne are presented in the same format as the vessel description from the Tschetter site.

Paste: Temper: usually crushed granite, small to gross (up to 15 mm in size)
Texture: coarse as a result of lamination
Colour: (a) interior - black to medium grey/black
(b) exterior - somewhat lighter
(c) core - black to medium grey/black

Vessel Form: rounded or occasionally flat base
globular bodies with a tendency to elongation
shoulders common and pronounced
rim frequently insloping
lips generally flat and frequently thickened

Thickness: 6 - 15 mm

Decoration: frequently absent
punctates common
incisions and impressions seen in the form of broad, short markings in a linear band
impressions sometimes reveal coarse cord mark motifs simple and restricted in area, oblique motifs across the lip and/or edge very common

Byrne's scheme of ceramic classification was developed for and based upon ceramics from southern Alberta. The distribution of the Early Variant of the Saskatchewan River Basin Complex in southern Alberta is based on its presence at four sites in Alberta; in the Upper Old Man River drainage area, the Porcupine Hills, the Central Bow River and the Central Red Deer River.

In Saskatchewan, Byrne (1973:373-376) sees similarities to the Saskatchewan River Basin Complex - Early Variant with the pottery from Level 6 of the Garratt site, Level 2 at the Long Creek site, the Lumsden site, and two surface sites near Dundurn and one near Saskatoon.

Level 6 at the Garratt site produced Avonlea projectile points and net-pressed pottery with bands of punctates below the lip and oblique cord impressions across the lip (Morgan 1979:350-365). Avonlea projectile points in Level 2 at the Long Creek site were associated with fabric/net impressed pottery with oblique cord-wrapped tool impressions on the lip and a punctate below the lip (Wettlaufer 1960: 39). The Dundurn (EjNq-1, EjNq-3) and Saskatoon (FaNq-2) sites and the Lumsden site, produced rim sherds with indeterminate surface finishes but with cord-wrapped stick impressions on the lip (Byrne 1973:375).

The ceramic assemblage from the Tschetter site compares favourably with those from other Late Prehistoric sites on the Northern Plains. This ceramic type has provided further conformation of the temporal placement of the site within the Prairie Side-Notched period. The presence of pottery at comparable bison drive sites is noted in many cases, but is often minimal in occurrance. Kehoe (1973:198) finds this situation unusual in that he would expect to find a large number of vessels to have been used for food processing. The distribution of the ceramics at the Tschetter site will be discussed in conjunction with the tool distribution at the end of the chapter.

4.6 The Bone Tool Assemblage

A faunal analysis of the Tschetter site by Walker (1978, 1979) included the recognition of 139 bone tools. Ten categories of tools were identified. Comparative data from other Late Prehistoric bison kill sites as well as microscopic analysis, provided probable functions for these tools. The functional categories and the frequencies of these tools are listed in Table 4.37.

4.7 The Distribution of Chipped Stone Tools, Detritus, Ceramics and Bone Tools

The excavated units of the Tschetter site were divided into six arbitrary areas based on geographical location and bone density (see Figure 4.14). These areas were lettered alphabetically A through F. The distribution of bone across the site suggested the discreteness of only two areas, one containing a high bone element density, and one of low bone density. Bone and feature distribution combined confirmed the presence of two activity areas. One of these was comprised of a high bone density and all of the features and suggested the main activity area. The second suggested a peripheral area of low bone density and an absence of features. The distribution of tools, ceramics and detritus was imposed upon this configuration in order to confirm or refute their distinctiveness and to determine the activities which took place in each.

Since each of the six geographical areas are of greatly disparate sizes, the frequency of tools, detritus and ceramics was calculated per square meter for each area. These frequencies are presented graphically in Figure 4.15. At first glance, these distributions would appear to confirm the reality of a peripheral area comprised of Areas A and C and a dense activity locus comprised of all other areas.

Table 4.37 FUNCTIONAL CATEGORIES AND FREQUENCY OF BONE TOOLS (after Walker 1979)

Category	Function	Number	&	Bone Utilized	Number per bone
Awls, Punches, Needles	Perforators	48	34.53	Scapula Fragments	1
				Rib Fragments	15
				Unidentified	32
Bone Handles	Handle	23	16.54	Rib Fragments	22
				Unidentified	1
Scraping Tools	Removing flesh or bone marrow	22	15.82	Distal Tibia	3
				Proximal Metatarsal	1
				Proximal Radius	1
				Proximal Ulna	1
				Rib Fragments	6
				Innominate	1
				Unidentified	9
Knapping Tools	Knapping	12	8.63	Proximal Radius	1
				Proximal Ulna	1
				Rib Fragments	4
				Scapula Fragment	1
				Mandible Fragment	1
				Unidentified	4
Scalloped Edge Tools	Scraping	8	5.75	Scapula Fragments	2
				Proximal Radius	2
				Distal Radius	2
				Proximal Humerus	1
				Unidentified	1
Knives	Cutting	6	4.31	Scapula Fragments	2
				Rib Fragment	1
				Unidentified	3
Chopping Tools	Chopper	5	3.59	Ulna	1
				Scapula	1
				Proximal Radius	1
				Rib Fragment	1
				Proximal Tibia	1
Polishing Tools	Hide Dressing	4	2.87	Scapula	1
				Rib Fragment	1
				Unidentified	2
Spatulas	Spatula	2	1.43	Unidentified	2
Miscellaneous	Bead Blanks Gaming Pieces Unidentified Fragments showing wear	9	6.47	Unidentified	8
				Metapodial Fragment	1
TOTAL		139	100.0		139

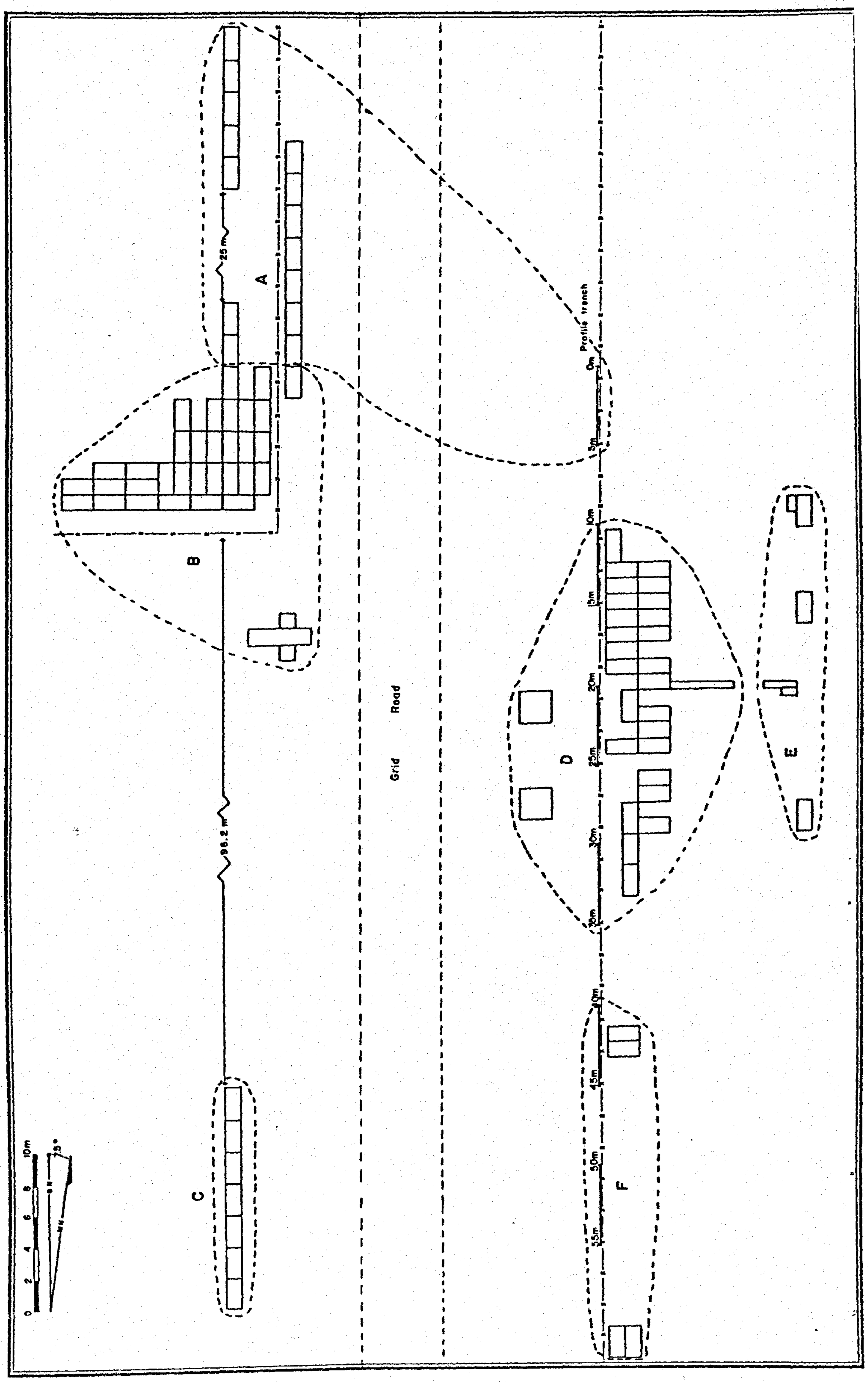


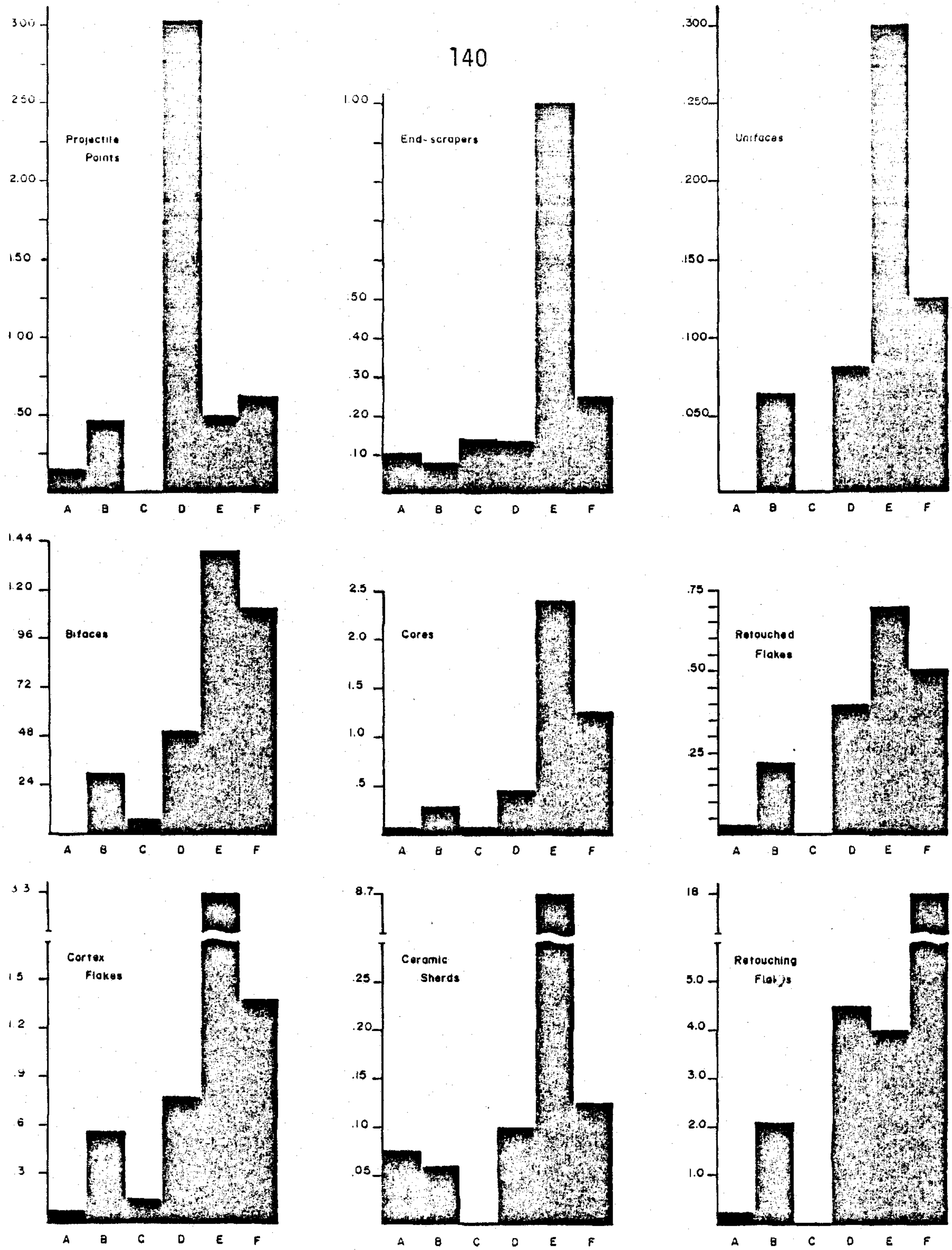
Figure 4.14 Tschetter Site Delineated on the Basis of Geographical Location and Bone Density.

When individual tool and detritus types are considered, however, it becomes apparent that within the dense activity locus there are three distinct loci whose artifact types suggest separate activities. When combined with bone and feature distribution, four activity areas are defined. These are described below.

Areas A and C are considered to be peripheral to the kill area of the site. This is first suggested by the low bone density and the absence of features and is confirmed by the distribution of tools, ceramics and detritus across the site. The frequencies of tool and detritus types and the ceramics in both of these areas is very low and in most cases similar.

In terms of tool and ceramic frequencies, Area B also resembles the peripheral area although tool frequencies are slightly higher. Here the resemblance ends, however, as detritus frequencies, especially retouch flakes, are much higher in Area B. Area B also contains a high bone density and two charcoal features. This is considered to represent an area where butchering activities were prominent although as will be seen, the actual kill did not take place here.

Area D resembles Area B in most respects such as in tool, detritus and ceramic frequencies. There is one important exception, however. This exception is in projectile point and retouch flake frequencies. The high frequency of projectile points here was the highest of all areas, which suggests that this area was the centre of bison killing at the site. Retouch flakes are also numerous here although there isn't a corresponding high frequency of any one tool type which could have been resharpened. The bone bed at this locus is dense and all of



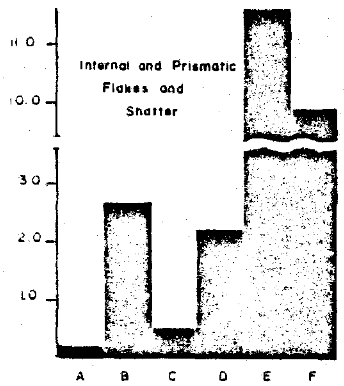


Figure 4.15 Average Frequency of Tools, Detritus and Ceramics for Area A - F.

the post holes with the exception of one and the majority of the charcoal features were found here. Area D may represent the inside of the pound structure where killing and butchering took place.

To the east of Area D is Area E and here the characteristics change dramatically. Distinguishing Area E is the overwhelmingly high frequency of ceramic sherds and endscrapers. Area E contains higher frequencies of all tool types than Area D with the exception of projectile points which are relatively scarce here. In terms of detritus, cores and cortex flakes are prominent, while retouch flakes are less frequent than in Area D. Obviously, different activities are represented here. Whereas killing was the major activity in Area D, Area E represents an area of food processing. Only one post hole was found here and both of the pit features. The bifaces and retouched flakes suggest that this was an area of butchering, but the endscrapers, unifaces and ceramic sherds further suggest some form of food processing. Furthermore, high frequencies of cortex flakes and cores distinguish Area E as being a centre of tool manufacture.

These same characteristics of tool manufacture are representative of Area F but this area is further distinguished by the highest frequency of retouch flakes. In all other tool frequencies, Area F contains the second greatest number and is very likely Area D. The bone bed here is light and two charcoal features are present. The retouch flakes are associated with these features. In terms of tool types and features, Area F most closely resembles Area D. There are two important exceptions. There are far fewer projectile points in Area F and far fewer retouch flakes in Area D. This is a very small area, comprising only eight square metres. I think that the activities here are the same as Area D except that tool re-sharpening took place in Area F around two small fires.

Locational data for all the bone tools is not available. However, the data that is available shows that the majority of the bone tools were found in Areas B and D. The high frequency of bone tools in Area D is due to the presence of 33 such tools in one, one metre by two metre unit. It has been suggested that this unit may represent a bone tool repository (Walker 1979:55). Butchering activities are considered to have been prominent in Areas B and D. The bone tool distribution suggests that these tools were used predominantly in the butchering process.

The overall effect suggested by artifact and feature distribution at the site is one of concentric circles. The outer circle represents the periphery of the site. Inside is an area of primary butchering on the west side and food processing on the east side. These two areas surround the centre of the site where the corral was located and where killing and butchering took place. It is not suggested that these areas are sharply defined. On the contrary, the impression is that killing and butchering took place in the same area but with a greater or lesser frequency in one area than another.

CHAPTER 5: USE-WEAR ANALYSIS

In Chapter 4 a taxonomic classification was used to order the tools from the Tschetter site which was a combination of morphological attributes, techniques of tool manufacture and implied function. Based on these attributes alone, the functions of the tools could not be established. Although some generalizations could be made, a more accurate definition of the activities at the Tschetter site could be described if more precise functions were assigned to the tools. In order to do this, a use-wear study on a sample of the tools was conducted to determine function.

Use-wear is a branch of functional analysis which is concerned with the minute traces of wear on the edges of stone tools. Because these traces of wear are not always macroscopically observable, use-wear is also referred to as micro-wear. It is a functional study because the desirable end-product of a micro-wear study is to be able to state that the use traces on a particular tool were caused by that tool being used in a certain way on a certain worked material. The field of use-wear may be said to be based on a hypothesis which is summed up in the following statement:

> "A tool made of a specific raw material, whose edge is activated in a specific direction across a specific worked material will develop a distinctive pattern of edge-damage of a kind that is recognizable on the edges of prehistoric tools" (Tringham _et al_ 1974:178).

In this chapter a brief history of use-wear, as a functional analysis, is presented in which the pros and cons of various methods are discussed. The method chosen for this study is the low-power magnification approach. The results of this type of approach have been considered favourable in the literature and this is the approach that is most amenable to the sample and the equipment available to me. The procedures and results of the study, in terms of working action, worked material, edge angle, raw material and non-use damage are described. The distributions of the used edges in the various site areas are then compared with the tool distributions in these same areas as described in chapter four.

5.1 The Method of Use-Wear Analysis

Like many other archaeological techniques, use-wear analysis had its beginnings in the nineteenth century. A very common method of ordering collections at that time was by tool function. Having little else to draw on, archaeologists relied on analogy to identify stone tool function. The analogies came from their own culture where similar metal tools were used and from contemporary pre-industrial societies such as Eskimos, Australian aborigines and American Indians (Hayden and Kaminga 1979:2). One late nineteenth century work is an outstanding example of this concern with functional classification and is the first major publication in the literature of a use-wear study. This was John Evans' The Ancient Stone Implements, Weapons and Ornaments of Great Britain published in 1870. Evans based his classofication of stone tools entirely on function and more importantly, he observed use-wear and commented on the different kinds of wear produced by different worked materials (Tringham *et al* 1974: 172).

At the beginning of the twentieth century, functional analysis fell out of favour with archaeologists because the validity of some of the functional terms was questioned. As a result, morphological attributes and general techniques of tool manufacture gained popularity in the description of lithic artifacts. Contemporary tool classifications are the result of a combination of morphological and functional attributes as for example the term 'scraper' which is applied to any number of tools with retouched edges, but which has little functional integrity (Hayden and Kaminga 1979:2).

The next major development was one which can be seen to be a logical outcome of the observation of use-wear traces, that is, experimentation. The early experiments were designed to test the function of tools, as for example, the suitability of a particular tool for a particular task. A replica of the tool was made and the method of its use was based on ethnographic observation of like tools. Use-wear in these experiments received little attention however, and in most cases was observed macroscopically. There was one exception.

Toward the end of the nineteenth century and at the beginning of the twentieth, one type of wear in particular stimulated debate and a flurry of experimentation. This was sickle gloss found on blades from European and near Eastern Neolithic sites. The experiments performed by Spurell (1892), Vayson (1919) and Curwen (1930) consisted of using replicas of sickles to cut various materials in an effort to illustrate that different worked materials produced different kinds of polish (Ascher 1961:794). The pinnacle of sickle gloss experiments was reached in 1935 by Curwen who refined his experiments so that the amount and kind of work performed by his sickle replicas more closely approximated the prehistoric situation. As a result, Curwen was able to demonstrate by the use of low-power magnification that wood, bone and grass produced different and distinguishable kinds of lustre. These imitative experiments which involved making a replica of a tool using that tool in various ways and on various worked materials and then examining the resulting use traces, are the basis of micro-wear studies being performed today.

At the same time that Curwen was microscopically recording polish on sickle blades, Sergei Semenov began his experimental work in the Soviet Union. Twenty-three years of work by Semenov culminated in the publication of his Prehistoric Technology in 1957. Like Curwen and others, Semenov made replicas of prehistoric tools and used them in a manner based on ethnographic analogy. Unlike any previous investigators, however, Semenov systematically observed use-wear microscopically. More importantly, he was the first to define the different kinds of micro-wear, to record the wear by magnified photographs and to suggest that the evidence of micro-wear was applicable to discovering the function of prehistoric stone tools.

To the Western World, Semenov's work represented an entirely new approach to lithic analysis despite the fact that microscopic analysis had been performed in North America by Witthoft (1955) and Sonnenfeld (1962) before Semenov's translation appeared. It was the scope and the results of Semenov's work which impressed archaeologists with the possibilities of lithic use-wear.

Although Prehistoric Technology was well received outside the Soviet Union and was in fact responsible for reviving micro-wear studies, it was not without critics. Semenov was criticized particularly for his experimental methods which were said to be unsystematic and inexplicit. One of the critics of Prehistoric Technology was its translator. Thompson (1964) noted that Semenov's choice of samples was biased in favour of tools which showed pronounced wear. The implication is that the tools analyzed were those which Semenov considered to demonstrate use-wear before they were analyzed, and thus, Semenov had preconceived ideas of what constituted use-wear (Brink 1977:13). A second criticism which had further repercussions, was that Semenov emphasized the formation and identification of striations to the exclusion of other types of wear. He distinguished three types of wear: polishing, abrasion and chipping, and concluded that abrasion, in the form of striations, was the most important key to the discovery of function. A final criticism was that the Russian methodology results only in the pronouncement of the function of a particular tool (Brink 1977:14-15). Although this is certainly the goal of all use-wear analyses, the critics considered that the priority should be on gathering information on the nature of use-wear which is available and applicable to all researchers and not on the interpretation of individual prehistoric samples.

Whatever the criticisms, Semenov's work still stands out today as the most significant use-wear study ever performed. The enthusiasm generated by Semenov's work led to a plethora of experimental micro-wear analyses. Some of these were designed to conclude the function of a certain tool or groups of tools based on Semenov's work. Others were designed to experimentally produce and interpret use-wear patterns which showed the kinds of wear produced on tools when used under specific conditions. Some of these studies combined the above approaches by examining wear patterns found on a sample of tools and using evidence from experimental conditions to enable the identification of wear patterns resulting from specific uses. The latter is the most common type of study found in the literature at the present time and it is designed to correct the shortcomings which were criticized in Semenov's work. The repercussions of all this work have been two-fold. First of all, the inappropriate extrapolation of Semenov's interpretation of wear patterns led to skepticism about the value of use-wear. Secondly, archaeologists who were unable to find and identify the all important striations as touted by Semenov rejected this form of wear and concentrated on the formation of micro-chipping as the key to the determination of stone tool function.

After a decade of micro-wear analysis in the western world, Keeley (1974:323-336) critically reviewed these efforts. He criticized the technique and methodology of virtually all major reports published in western journals up to 1974 in an attempt to improve the quality of micro-wear analysis. His major criticism of technique was the "failure to maintain the high technical standards of Semenov has...accounted for the relatively poor results obtained by most recent micro-wear studies" (1974:324). The technical deficiencies identified were: the failure to use stereoscopic microscopy up to 180 X and higher, the absence of photographs for recording observations, and the lack of use of colorizers or metalization on the surfaces to be examined. Methodological inadequacies included the lack of representative samples and the lack of controls which established that the traces to be interpreted are the result of utilization.

Written with the intent of being a 'sympathetic response', Odell (1975:226-240) expanded Keeley's criticisms to include "...the goals and purposes of micro-wear analyses, their foundations and substance and the factors which govern the variation in edge damage patterns." Odell set out the experimental variables which must be published in any micro-wear analysis, stressed the importance of all forms of use damage, not only striations, and argued for the separation of function from morphology and technology.

> "I would argue for an approach to functional analysis which attempts to examine questions of culture process and change by way of prehistoric activities, rather than the erection of another typological construct which would both debilitate extant morphological systems and possess none of the advantages of modern techniques" (1975:237).

These critiques of Keeley and Odell are important for several reasons. In an historical sense, they are indicative of the state of the art in the mid-1970's. Obviously, the enthusiastic plunge into use-wear in North America had produced some questionable results. However, the foundations were being laid for a standardized and systematic technique which had implications far beyond a functional analysis of stone tools. The appearance of these articles also produced a major technical debate and questioned the goals of use-wear studies.

The technical debate is comprised of a fundamental difference in opinion as to what use traces researchers should look for and how they should be observed. As mentioned, one of the criticisms of Semenov's work was his concentration on the formation and identification of striations. When researchers looked for striations as defined by

Semenov and could not find them, the emphasis switched to the other forms of use-wear, namely abrasion and micro-flaking. Micro-flaking refers to the removal of minute flakes from a portion of the tool which is under pressure and in contact with another object. The mechanical basis of micro-flaking is similar to the intentional flaking of tools during manufacture. Abrasion, or rounding, is a process of attrition by the removal of particles from a portion of the tool's edge. A reduction in the angularity of an edge or of ridges of flake scars indicates abrasion. The debate surrounding striations and polish versus micro-flaking and abrasion, can be translated into a controversy of methodology, that is, the high-power magnification necessary to identify polish and striations versus the low-power magnification adequate for micro-flaking and abrasion identification.

The high-power magnification approach is championed by Keeley, Newcomer and Semenov and his Russian colleagues. Keeley and Newcomer stress polish as the diagnostic element of wear while the Russian school continues to emphasize striations as first propounded by Semenov. Notable adherents of the low-power approach are Keller, Tringham and Odell who claim that micro-flaking and abrasion, but particularly micro-flaking, are indicative of tool function.

The major criticisms of the low-power approach as stated by Keeley and Newcomer (1977:35) are:

(1) it is difficult or impossible to distinguish between the small components of deliberate retouch and utilization damage.

(2) it is difficult or impossible to distinguish between spontaneous retouch and utilization damage.

(3) the scars and straitions resulting from soil movements cannot be distinguished from utilization scars and striations at low magnification.

(4) none of the large number of variables to which utilization damage responds (worked material, method of use, method of prehension, edge angle, edge thickness, force exerted and artifact raw material) are regularly dominant in determining any particular features of edge damage pattern.

Criticism of the high-power approach is essentially an attack on the importance of striations. That is, striation is probably accidental and will not occur at all times and in all situations (Odell 1975:240). Further, the equipment necessary for high-power magnification is costly. The preparation of artifacts such as vacuum metallization or coating, advocated by Semenov and Keeley, are not only time-consuming but could obscure other traces of wear. And finally, polish and striations lack internal variability and therefore cannot provide fine distinctions among the various activities and worked materials. In actuality, while the two schools advocate their own particular methodology and raise criticisms of the other, they both stress that a multi-variate approach should be used.

An interesting case in point is a study by Keeley and Newcomer (1977:29-62) in which one of the authors made replicas of stone tools, used them in various ways and on various worked materials, then presented them to the other author for micro-wear analysis. Thus, a test was constructed for the analyst. It was concluded that a high degree of agreement between inferred and actual use was achieved by the use of high-power magnification. In response, Odell and Odell-Vereecken (1980: 87-120) replicated the test experiment with the important exception that they used low-power magnification and concentrated on micro-flaking as the distinctive component of use-wear. They concluded that an equally high degree of agreement between inferred and actual use was achieved by the use of low-power magnification.

Presently, there is an impasse in the debate. The important thing is that it is through such a controversy the technical and methodological standards for use-wear analysis have been established. The experiments of independent researchers, using one or both of the approaches, have produced results which are convincing in the consistency of their ability to interpret use-wear traces on any sample of prehistoric stone tools.

5.2 Procedures

A sample of 100 tools was chosen from the Tschetter site tool inventory for a use-wear analysis. These tools consisted of two morphological classes; endscrapers and retouched flakes. All tools recovered from the surface were immediately rejected from the sample with the result that 80 tools were examined for use traces.

The choice of these tools was not random. Although originally having considered the possibility of a use-wear analysis on all the Tschetter site tools, it soom became apparent that this objective was too time consuming. For some reason, the literature contains more detailed studies of use-wear on endscrapers than on other tools. This may be due to the fact that this class of tools had long ago been assigned a functional appelation with no analytical evidence to confirm that function. There was, however, a considerable amount of ethnographic evidence which described the steeply bevelled-edge tools as having been used to scrape hides. Use-wear analysts then set themselves to design studies by which to either confirm or refute the function suggested by the name of these tools. The result was a body of literature which precisely defined scraping wear and scraping wear resulting from a variety of worked materials. The most convincing thing about the literature is that the results of these studies are more or less consistent among researchers. This fact made me confident that, whatever the sample, scraping wear could be identified without having to perform an independent series of experiments. A slightly lesser degree of confidence was apparent concerning worked materials, although in this respect data other than use-wear could be incorporated to achieve an identification of worked materials.

The literature on wear patterns on retouched flakes is equally abundant since this type of tool is that which is most often manufactured for experimental tasks. A retouched flake has the advantage of presenting a relatively clean edge uncomplicated by flake scars removed for the purpose of shaping the tool.

All of the tools in the sample had been cleaned in water upon their recovery and a catalogue number written on them in ink and sealed with clear nail polish. The first step was to clean the tools of extranous dirt, dust and fingerprints and to remove the nail polish and ink. This was accomplished by soaking the tools in acetone for at least two hours, and preferably overnight. A conscious effort was made to handle the tool by the edges not being examined at the time and to wipe the tool with acetone after each edge had been examined in order that grease and dirt from my hands was removed.

The tools were then mounted on a piece of plasticene under the lens of the microscope. All edges and both faces of each tool were examined. Two microscopes were used in the study. Both were NIKON stereoscopes with incident light transformers. One of these had an objective of 40X and the other an objective of 80X. Each edge was scanned at an objective of 8X and wear was usually recorded at an objective of 20X and in some cases 40X. Each tool was examined twice at intervals of several days and sometimes several weeks.

All types of observable wear which occurred 2 mm from the tool edge were recorded on a standard recording sheet. In addition, each recording sheet was accompanied by diagrams of the tool on its dorsal and ventral faces. The location of wear traces was oriented on a polar co-ordinate grid which divided each face of the tool into eight equal segments.

Two major divisions of use-wear were recorded. These were fracture and abrasive wear. Two arrangements of fracture wear, nibbling and crushing were recognized. Nibbling refers to an orderly, parallel arrangement of scars while crushing is a dense concentration of over-lapping scars. In addition, three types of scar terminations were distinguished: feather, step and hinge. When possible, the dimensions of each scar and the orientation of the scar in relation to the edge were recorded.

Abrasive wear consists of rounding, polish and striations. Rounding was recorded as being either smooth or pitted and its invasiveness onto the face of the tool was measured. Polish was simply noted as being present or absent, although if it were particularly intense, a note was made to that effect. The invasiveness of the polish was also measured.

Striations, in the form of true scratches were not observed although the recording sheet provided for their presence, length and orientation. Abrasion tracks were observed and their presence and orientation were recorded. This type of wear is described under the worked materials section.

5.3 Results

The premise on which this study proceeded was that working action and worked material could be identified by an examination of use-wear patterns on a sample of prehistoric stone tools and that these two variables provide a direct representation of the function of the tools. A search of the literature provided the data by which these variables were identified.

5.3.1 Working Action

One of the premiere experimental studies of low-power magnification use-wear was conducted by Tringham *et al* who defined patterns of wear resulting from two modes of action, longitudinal and transverse. According to them:

> "The mode of action is indicated by the distribution of the micro-flake scars on the two surfaces of the flake and along the flakes' edge. This is the result of the fact that the amount, regularity and direction of pressure, which varies with each action, will be directly related in the detachment of the micro-flakes" (1974:187-188).

Longitudinal actions include cutting involving a one-way motion and sawing involving a two-way motion. The pressure and therefore the scarring, will be greater on one surface of the tool than the other when a longitudinal motion is used, although sawing produces a greater density of scars than cutting. The most distinctive clue of a longitudinal action is that scarring and abrasion occur on both surfaces of an edge. A transverse action, such as scraping, shaving or planing, results in one surface of a flake receiving pressure from the worked material and micro-flakes are detached from one surface only and that surface is the one opposite the surface in direct contact with the worked material. Furthermore, the distribution of the flakes is confined to a smaller part of the edge than that exhibited on an edge used in a longitudinal action.

These characteristics of working motion are re-iterated and expanded upon by Odell and Odell-Vereecken (1980:98-100). They caution that the traits listed for any particular mode of action are averages and not mutually discrete characteristics. Motions longitudinal to the working edge include cutting, sawing, slicing and carving. Cutting will produce scarring on both faces of an edge which alternates from side to side. If the edge is used long enough, it will become denticulated. Striations are parallel to the edge and if abrasion occurs it will be confined to the projections. A sawing motion produces the same traits, although unidirectionality of the scars is not evident as sawing is a two-way motion. Transverse and longitudinal motions are involved in slicing and carving. The scars will be located more on one surface than the other with these actions and striations are unifacial and diagonal to the edge.

Motions transverse to the working edge include scraping, planing and whittling. Exclusive unifacial scarring is characteristic of a scraping motion. In addition, striations are perpendicular to the edge, on the surface opposite the scarring and abrasion occurs most extensively on projections. Planing wear is similar although the abrasive wear on the surface in contact with the worked material is more extensive. Unifacial scarring is also characteristic of whittling.

The wear produced on a graving tool occurs on a tip rather than an edge and may be unifacial or bifacial depending on whether the tool was used transversely or longitudinally. The same may be said for boring. That downward pressure was exerted on these tools is ascertained by the scarring which emanates from the tip of the tool.

Bifacial damage is characteristic of chopping tools. The heavy impact involved in the use of such a tool results in hinge and step terminated scars. If striations occur, they are oblique to the edge. A projectile is identified by scarring with well-defined terminations and striations are parallel to the long axis of the tool. Either abrasion or scarring or both are the products of hafting the tool.

Abrading activities, such as grinding and polishing, produces abrasive wear on the surface of the tool and not the edge. Cracking and pitting of the surface of the tool is produced by a pounding action.

The fundamental differences between longitudinal and transverse action use-wear is confirmed in another study by Lawrence (1979). One of the variables which Lawrence considered in his experimental study was the manner of utilization, in this case, cutting and scraping. He states: "...the implication (of the manner of utilization) for edge damage is that the orientation of use-flakes will be the same as the direction of the force applied to the edge" (1979:118). Thus, a scraping motion will result in flake scars which are perpendicular to the edge and unifacial. The flake scars on an edge used in a cutting motion should be oriented obliquely to the edge and extending onto both faces.

In a study with a somewhat different orientation than those cited above, Hayden (1979:207) considered that "...use-wear characteristics of specific activities can be determined from the examination of ethnographically documented stone tools." He chose a sample of tools which had been described ethnographically as having been used to scrape hides. The objective of the study was to find "...use-wear patterns that were distinctive enough to identify a skin-working activity beyond reasonable doubt when encountered in archaeological contexts" (1979:207). Among other distinctive characteristics listed by Hayden as being characteristics of skin scraping, two are pertinent here. They are, dorsal abrasion and the almost complete absence of abrasive wear on the ventral face. In fact, Hayden was surprised to find that the face with the most wear is not the face used against the skin in scraping.

Although each of the studies mentioned here was performed with varying objectives, it is important that one characteristic of use-wear was confirmed by all of them. That is, the mode of action could be identified by the distribution of wear (either fracture or abrasive) on the edge of the flake. The modes of action considered are longitudinal and transverse. Although these two modes do not take into account all of the possible actions of prehistoric tools, they are considered to be the most pertinent for the sample considered here.

Of the 109 edges which exhibited use-wear, 16 edges are considered to have been used in a longitudinal motion. The single piece of evidence used to assign a longitudinal working motion to these tools is the presence of patterned and/or continuous bifacial use-wear. The occurrence of single or randomly distributed fractures was not considered representative of use-wear. Eleven of the edges exhibited alternating wear on a single edge, while the remainder exhibited continuous wear on both edges. Abrasion is present on 12 of the edges and is confined to the projections on nine of these. The three edges with invasive abrasion, however, are considered to have been used longitudinally due to the presence of the extensive bifacial wear which they exhibit.

Eighty edges in the sample are characterized by unifacial use-wear and are considered to have been used in a transverse working motion. Abrasion was observed on 31 edges and was confined to the projections on 19 edges. As will be discussed in the next section, the relative invasiveness of abrasion is considered to be indicative of worked material. The distribution of wear is considered here to indicate working action.

A working action has not been assigned to 12 edges in the sample. The reason for this was confusion over the meaning of the bifacial wear on these edges. These 12 edges are described more completely in the next section.

5.3.2 Worked Material

Unlike working action, the kinds of worked material available to a prehistoric population are numerous and diverse. Experimental studies may not have come close to discerning the kinds of material to test. However, a consideration of the context of the site is essential to compiling a list of worked materials. Thus, in the literature the worked materials most often tested are; hide (skin), wood, antler, bone, meat and vegetal material. Sometimes worked materials are simply divided into categories of relative hardness. Also, unlike working actions, the kinds of use-wear resulting from different worked materials are not consistent among researchers. The most obvious differences are those which reflect the analysts' bias of which kind of wear is characteristic; fracture wear, abrasive wear, polish or striations. This bias was discussed in a previous section describing the high-power approach versus the low-power approach. The problem in this study was which type of wear to consider characteristic. Since this study is essentially a low-power approach, although polish was sometimes observed and duly recorded, the distinction among different kinds of polish associated with different worked materials was not considered possible. For this reason, I do not consider here those studies which stressed diagnostic polishes observed at magnifications greater than 100X.

The champions of the low-power magnification approach, Tringham _et al_ state that:

> "The nature of the worked material is indicated by the morphological characteristics of the micro-flake scars. The experimental tests showed that variation in hardness, friction and resistance of the different worked materials is correlated with variation in size, shape and sharpness of the edge of the micro-flake scars" (1974:188).

These researchers ranked worked materials in the order of hardness. A soft material included skin and flesh and produces scalar-shaped scars in a light nibbling pattern. Antler and bone comprised the hard material category and they produced step scars. The sides of these scars were abraded and crushed. Bone produced larger and more invasive scars than antler. The medium materials are hard and soft woods. They produced scalar scars and trapezoidal scars which were not observed after working any other material. Abrasion was confined to the edges of scars but was more invasive than the abrasion which resulted from working bone. Finally, although there are differences in the rate of formation of edge damage, Tringham _et al_ conclude that no matter how long the tool is used, all worked materials will not produce the same wear pattern (1974:191).

Again, Odell and Odell-Vereecken (1980:101) repeat much of what has just been said, with some elaboration. Soft materials include meat, skin, fat and soft vegetal substances. Small, feather-terminated scars, faint striations and polish, are characteristic of a soft worked material. Wood is defined as a soft-medium material and will produce large, feather terminated scars. Hard-medium worked materials are hard woods, soaked antler and fresh bone. The scars produced by working these materials are medium to large in size and hinge-terminated. Striations and polish do occur. Bone and antler are hard materials which produce step-terminated scars which are medium to large in size and which may undercut the lateral margin. Striations and polish will occur but are frequently removed by the scarring. If the tool is used long enough, the edge will be abraded.

According to Lawrence (1979:118), "the effect of objective material on edge-damage development is primarily a function of the size of the contact area." In his study, Lawrence divided the objective or worked materials into two categories, soft and hard. Soft materials were those "...that deform and allow a relatively broad contact area" while "those less likely to deform and cause a concentration of force on a relatively small area" are referred to as hard materials (1979:118). He also found that soft materials are more likely to cause smooth abrasive wear with a polished appearance and hard materials cause coarser abrasive wear to form.

Hayden's study of ethnographically documented skin scrapers was also a low-power approach but he did not find fracture wear to be characteristic of this activity on this kind of worked material. On the contrary, he found that "the principle factor responsible for modification" is abrasive wear (1979:211). His summary of the characteristics of skin scraping include: a pronounced rounding of edge prominences and edge arcs, abrasive, moderately high reflective, semi-matte smoothing which does not attain a high polish; the presence of faint linear depressions and scratch striations along the edge and on the dorsal face that tend to converge either toward the centre of the dorsal or ventral face are sub-parallel and occur at approximately a 90° orientation. Although he did observe patterned fracture wear, Hayden did not consider it to be diagnostic of skin scraping (1979:217).

An experimental study was conducted by Brink (1977) in which endscrapers were manufactured and used to scrape various materials. The resulting use-wear was then used as the basis for identifying the materials worked by a comparable prehistoric sample of endscrapers.

Some distinctive types of fracture and abrasive wear associated with different worked materials were determined by this study. Wood-working produced large micro-flakes which could not be distinguished from manufacture scars and smooth-textured rounding which was always associated with polish and which extended for .5 mm up the face of the tool. The latter is considered diagnostic. Rounding and polish were also considered the most useful indices of wear on tools used to scrape antler. The rounding in this case, however, was rugged or pitted and the polish was not as invasive as on the wood working tools. Scraping soaked bone produced large, step-terminated scars which were considered diagnostic as well as the absence of abrasion and polish. Furthermore, tools used to scrape bone exhibited ventral microflaking. This was the only instance of ventral microflaking observed by Brink in his study. The addition of silt to the bone produced radically different wear patterns. Although micro-flaking was present, the frequency of this wear type was greatly reduced compared to scraping clean bone and a pronounced abrasion was evident on the tool's edge and dorsal face. A poorly developed, moderately bright polish was associated with the abraded area.

Scraping dried hide resulted in rare occurrences of micro-flaking and rounding and polish which were very similar to those which resulted from scraping antler. However, the greater flexibility of hide as opposed to antler was responsible for the greater distribution of the abrasive wear associated with the former. When silt was added to the dried hide, the edge and dorsal face of the tool exhibited extensive abrasion. This abrasion, however, was in the form of multiple linear striation-like tracks running parallel to the edge. It is interesting to note that these linear tracks are similar to what Hayden described as characteristic of scraping hide. Neither Brink nor Hayden refer to these as striations which are defined as definite scratches. Although the convergence of the linear tracks is not mentioned by Brink, Hayden considers that "this convergence and the abrasive wear complex is perhaps one of the most distinctive use-wear characteristics of the skin scrapers that I analyzed" (1979:213). He considers that this phenomenon is due to "...the mechanics of working a semi-plastic material such as skin, which tends to fold in along the side extremeties when subjected to pressure" (1979:213). In another publication, Brink (1978:371) comments on the drastic changes in the use-wear resulting from the addition of silt to the worked material. The most obvious change being that wear patterns on tools used on silty surfaces were characterized by linear abrasion of the distal edges. Furthermore, silty dried hide abrasion can be distinguished from silty bone abrasion in that the abrasion has a greater distribution on the tools used on the former and the distal edges of the hide scraping tools are rounded while those of the bone scraping tools develop a flattened, abraded distal edge. Brink concluded that rounding and polish were the most useful functional indices in his study, the results of which do not support the existence of micro-flaking patterns as purported by Tringham et al and Odell and Odell-Vereecken.

The studies cited above provide some very explicit information on what use-wear patterns look like when various materials are subjected to a transverse working motion. What is not so clear is whether a longitudinal motion on the same worked materials will produce the same patterns. And although Brink and Hayden provide good evidence to suggest that micro-flaking is not a reliable indicator of wear for scraping tools, no such body of evidence exists which states that micro-flaking is an equally unreliable index of other modes of action. This statement is true with the exception of the high-power magnification approach adherents. Due to this situation, I am forced to assume that the wear patterns resulting from scraping various worked materials will be the same as those found on tools used to work the same materials, with the exception of the characteristics already cited, which distinguish mode of action. Furthermore, I must rely heavily on micro-flaking characteristics to distinguish any mode of action than scaping. Whether the situation thus created is real or whether it simply reflects gaps in the literature is not known.

At a very general level, worked materials were defined as soft, medium-hard and hard. Within these categories, and due to the amount and specificity of the literature, the worked materials of dried hide, bone and wood were distinguished. Dried hide is considered to be a medium-hard material and bone and wood are considered hard materials. Most researchers admit that their experiments could not take into account all of the worked materials which may have been available to prehistoric man. However, a reasonable guess may be made concerning a range of possible worked materials. For example, although there may be differences in the wear exhibit on an edge used to scrape a walrus hide as opposed to a bison hide, the literature relating to walrus hides (even if it does exist) has no bearing on the Tschetter site sample. Those studies which concerned themselves with meat, cow hide, bone, antler and deciduous wood are applicable to the sample discussed here.

Odell and Odell-Vereecken (1980:102) note that:

> "...even if exact worked material cannot be ascertained on a particular tool, but the material worked was soft and a tool movement can be determined to have been longitudinal to the utilized edge, then it is likely that the implement was engaged in the processing of food."

They also add that "functional deducations must, of course, take into account all known factors relevant to the cultural group being assessed" and "if a large number of these (cultural) factors are known they provide a body of information within which the micro-wear data can be interpreted" (1980:102).

One fundamental problem was encountered when assingning worked material. This was the absence of a concensus in the literature concerning certain worked materials. Consequently, I found myself relying on one set of literature more than the others for certain purposes. For example, when abrasive wear was the predominant form of wear, the works of Brink (1977, 1978) and Hayden (1979) were the most pertinent. Alternately, the experimental studies of Odell and Odell-Vereecken (1980) and Tringham et al (1974) were most applicable to fracture wear patterns. The result was that the conclusions were drawn from whatever source fitted the Tschetter sample the best. One further problem may be mentioned and that was interpreting linear abrasion features. The literature on this form of wear was conflicting in terms of worked material. In this case as well, I relied on the 'best fit' solution.

Twelve edges were characterized by an invasive ($\geq$ .5 mm) pitted abrasion (Figure 5.1). These edges are considered to have worked dried hide. A predominant pattern of pitted abrasion, which was either confined to the edge projections or was non-invasive ($\leq$ .5 mm) was observed on 16 edges (Figure 5.2). The worked material assigned to these edges was medium-hard. Within this category, two distinctions could be made; medium-hard and medium-hard (antler?). The medium-hard (antler?) category was characterized by non-invasive abrasion and polish, while the medium-hard category was distinguished by abrasion alone. The limited distribution of the abrasion on these edges suggests a worked material harder than hide but the absence of fracture wear precludes the possibility of bone as the worked material. It should be noted that the non-invasive abrasion and polish are characteristic of working soaked antler (Brink 1977:72). Brink included soaked antler in his experiments because working fresh antler was not an efficient task. Odell and Odell-Vereecken (1980:82) also note that soaking antler makes it a hard-medium material while fresh antler is a very hard material. They further add that they are not aware of any ethnographic accounts of soaking antler. The fact remains that the use-wear by medium-hard materials is radically different from that by hard materials and the two cannot be lumped together in one cateogyr.

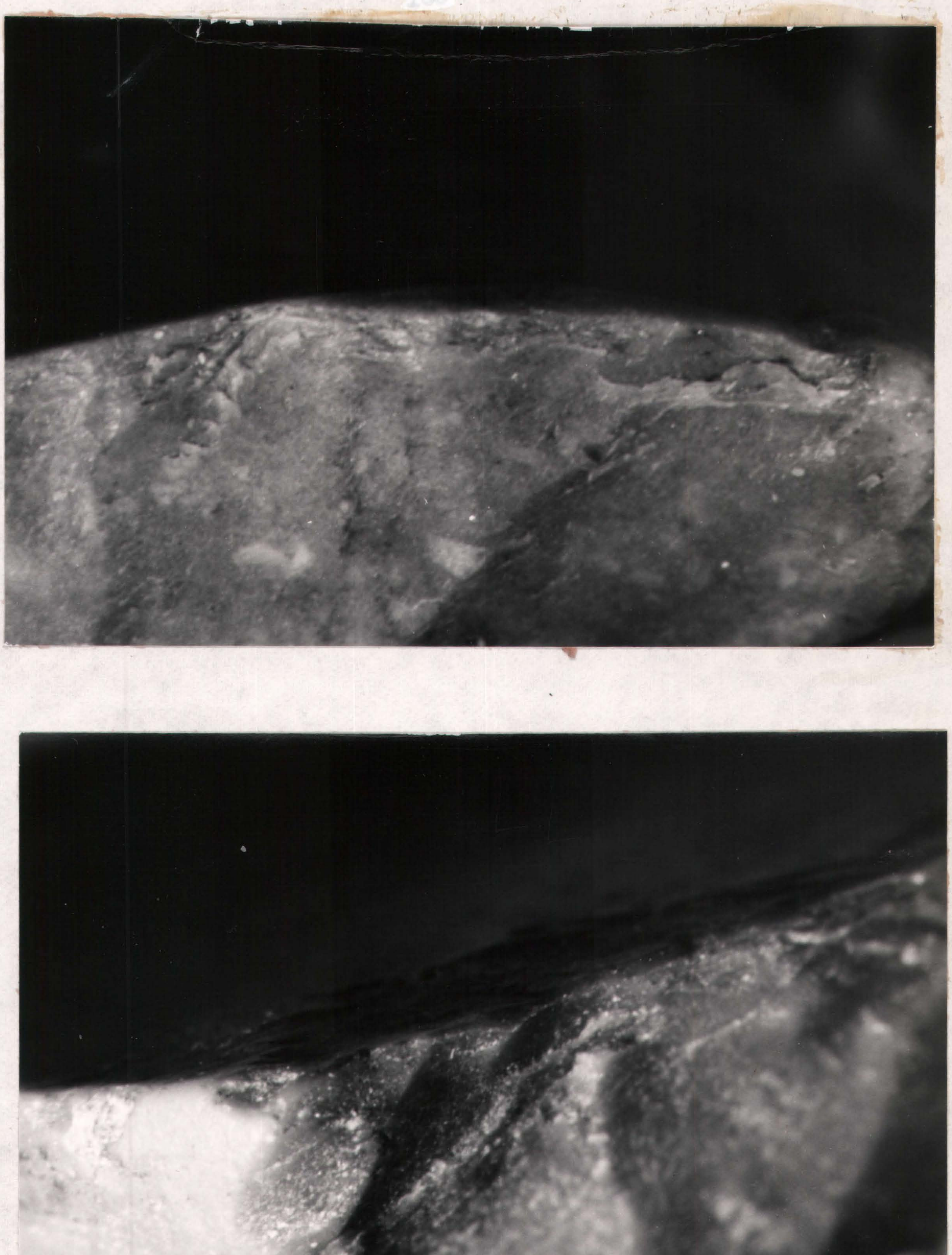


Figure 5.1 Edges Used to Work Dry Hide, 20.5X.

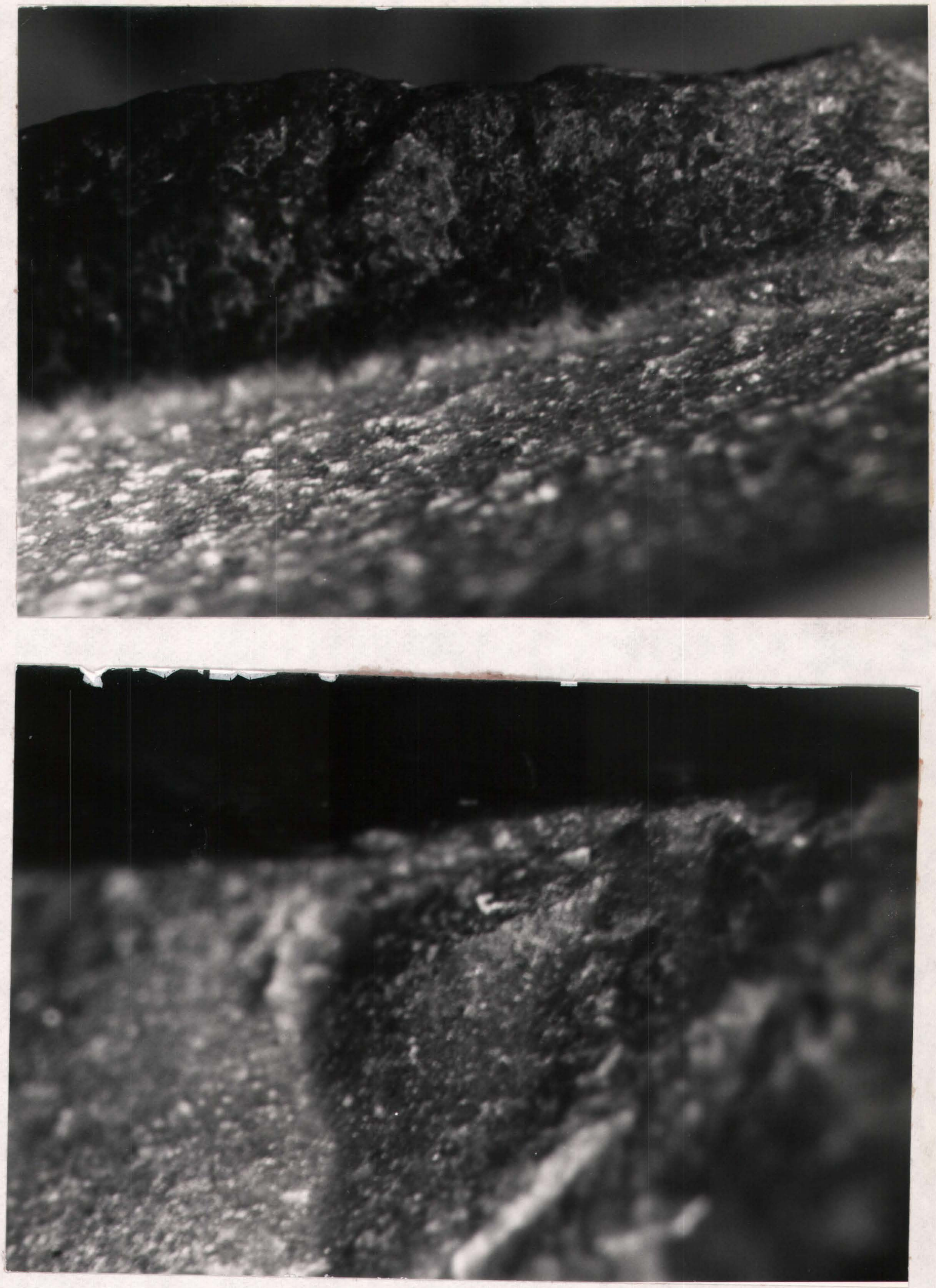
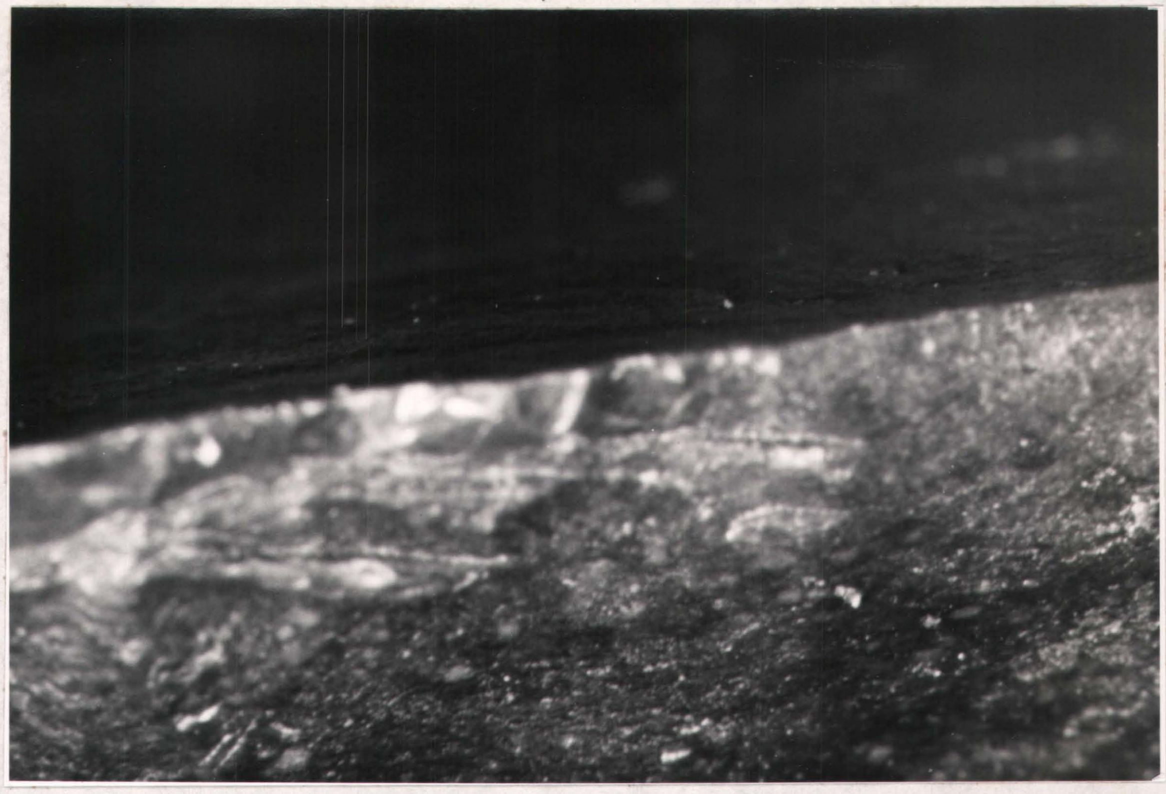


Figure 5.2 Edges Used to Work Medium-Hard Materials, 20.5X.

It may be more useful to reject antler from the list of worked materials and refer only to medium-hard materials. A similar situation exists with reference to fresh hide which is soft and dried hide which is medium-hard. Dried hide can be distinguished from other materials in that category by virtue of the inveasiveness of the abrasion caused by the greater pliability of dried hide compared to either wood or antler. Wood is distinguished from dried hide and antler by the presence of smooth, non-invasive abrasion and polish. This pattern of wear was observed on three edges (Figure 5.3).

A nibbling pattern of small, feather-terminated scars was observed on 23 edges (Figure 5.4). This pattern of wear is consistent with that described on tools used to work soft materials. Abrasion in conjunction with the fracture wear did occur. This pattern is distinguished from the abrasive wear pattern by the fact that the micro-flaking was distributed consistently across an edge on the former and not on the latter.

A hard worked material was assigned to those edges dominated by fracture wear with step and/or hinge terminated scars. The wear occurred in the form of a nibbling pattern (n=15) and a crushing pattern (n=30). Within the hard category, two divisions were recognized, Hard (bone) (Figure 5.5) (n=12) and Hard (n=33) (Figure 5.6). Either a crushing or a nibbling step fracture pattern which occured on both faces on an edge is considered to be representative of working bone. The problem then arises, does this wear pattern represent working a hard material in a longitudinal motion? Although



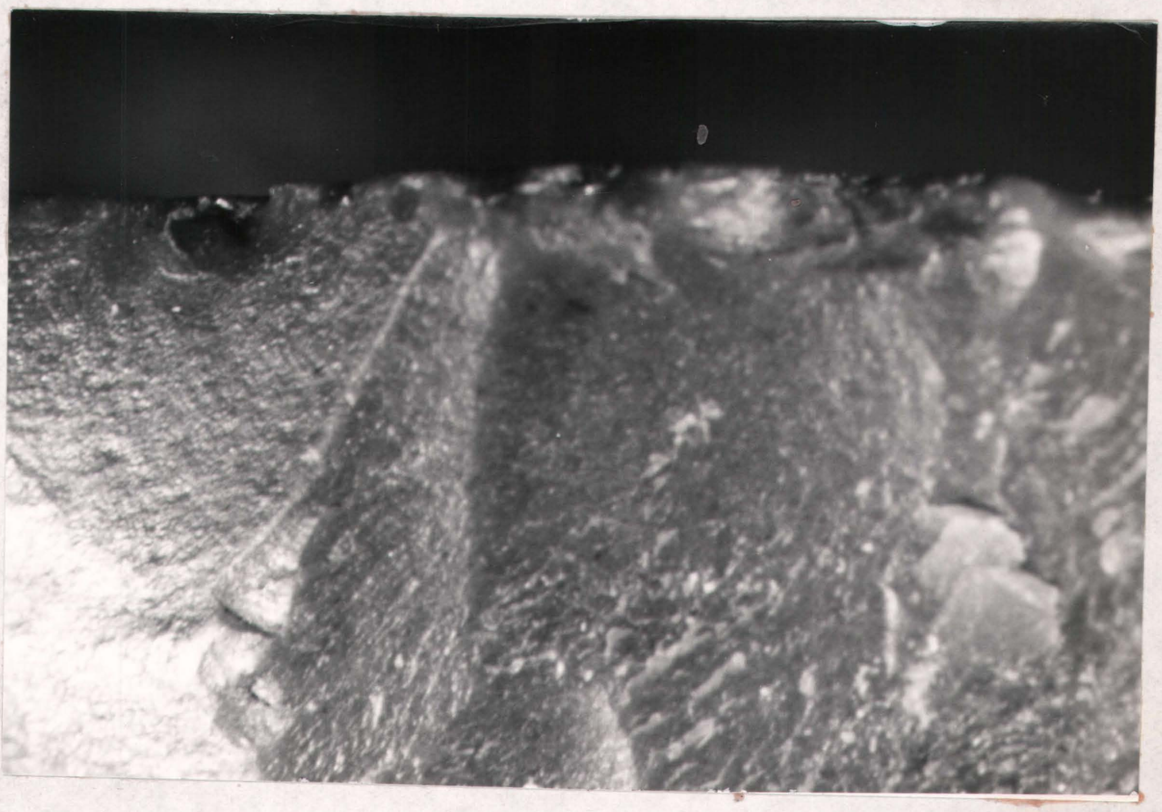


Figure 5.3 Edges Used to Work Wood (top) and Edge Used to Work Silty Bone (bottom), 20.5X.

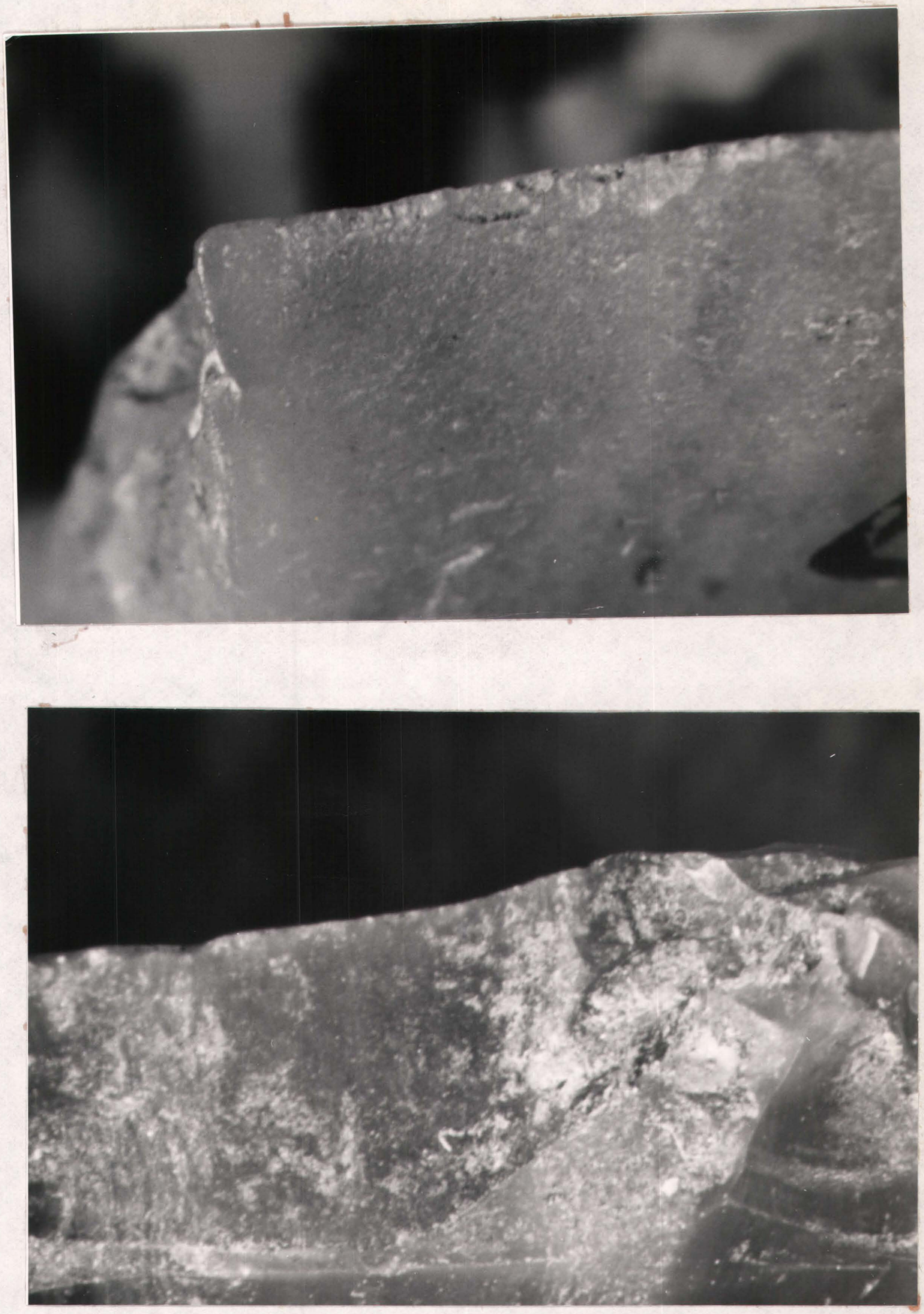


Figure 5.4 Edges Used to Work Soft Materials, 20.5X.

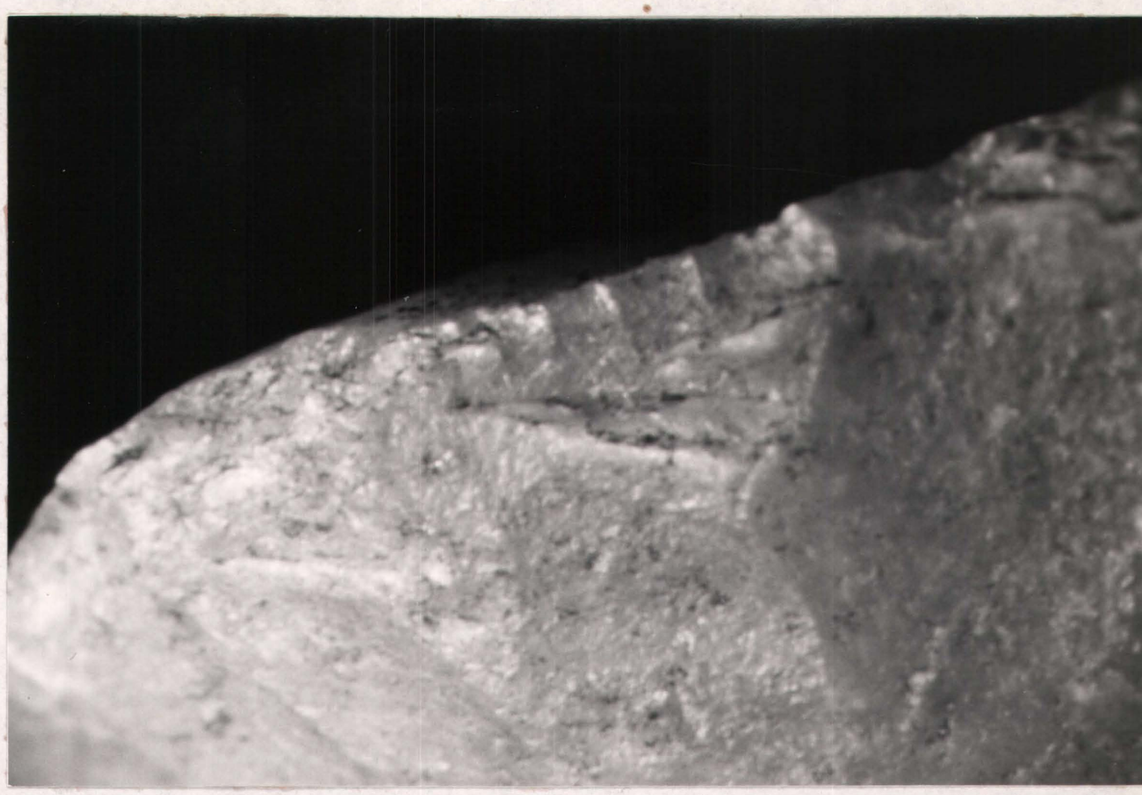


Figure 5.5 Edges Used to Work Hard Materials, 20.5X.

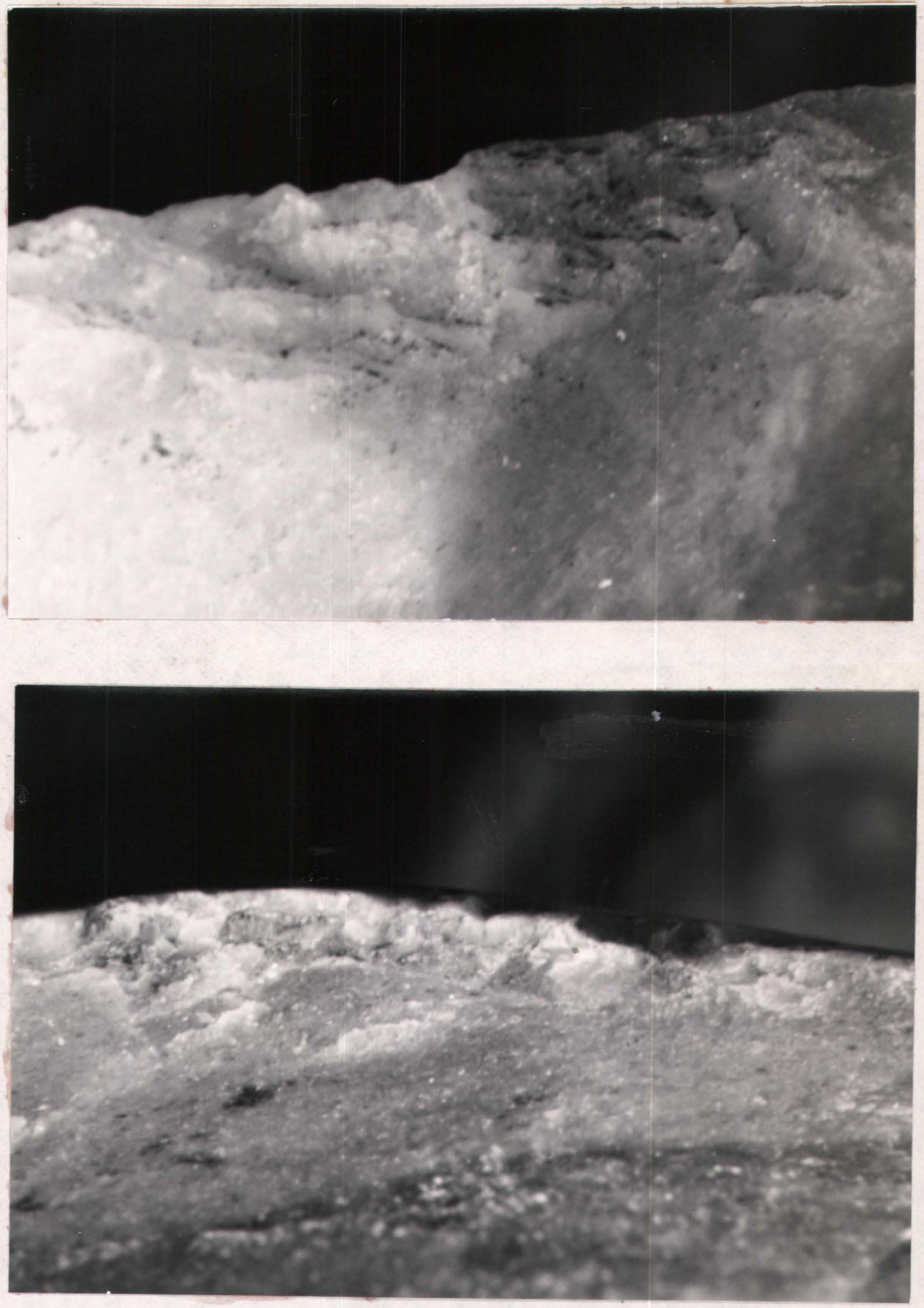
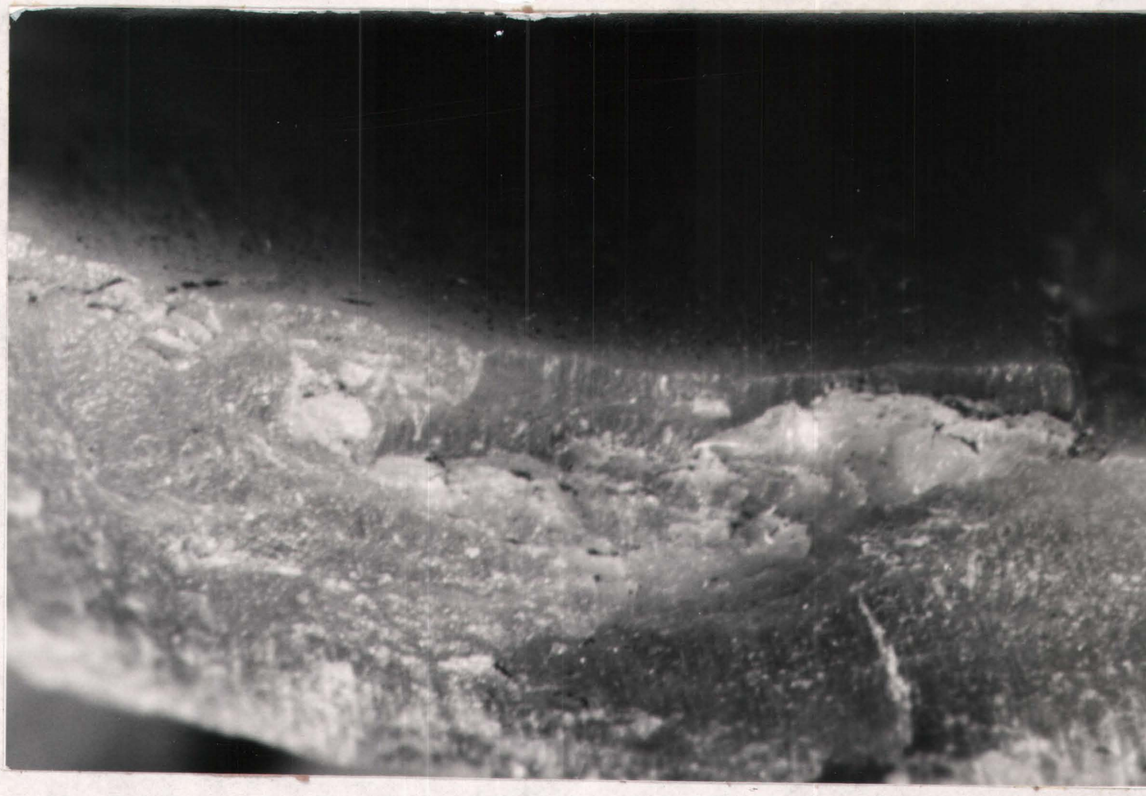


Figure 5.6 Edges Used to Work Hard (Bone?) Materials, 20.5X.

dorsal and ventral wear is cited as being distinctive of working bone (Brink 1978:87) it is not clear what form of wear this takes. If it were a patterned fracture wear on both surfaces, that could indicate a longitudinal working motion. If it were isolated scars on the ventral surface, that could mean non-use damage. Because at least one face exhibited patterned fracture wear, I can state that the edge was used on a hard worked material. The working action remains questionable.

Linear abrasion was present on nine edges. These edges are considered to have been used to work silty materials. The linear abrasion on all specimens is in the form of several tracks which are parallel to one another and perpendicular to the edge. On one specimen, the abrasion was seen to converge on the dorsal face. According to Hayden (1979:224), abrasion in conjunction with linear tracks is diagnostic of working hide. Brink's experimental work with endscrapers, however, led him to believe that linear abrasion occurred as a result of working materials to which silt had been added. My evidence tends to agree with that of Brink in that the dominant wear patterns associated with the linear features is not always associated with working hide. An invasive abrasion in conjunction with linear tracks was observed on four edges and is considered to represent working silty hides (Figure 5.7). Non-invasive abrasion and some micro-flaking in conjunction with linear tracks was present on four edges. This wear pattern is indicative of working silty bone (Figure 5.3). It is notable that the addition of silt to bone drastically changed the wear pattern. Whereas working clean bone is characterized by extensive micro-flaking, this



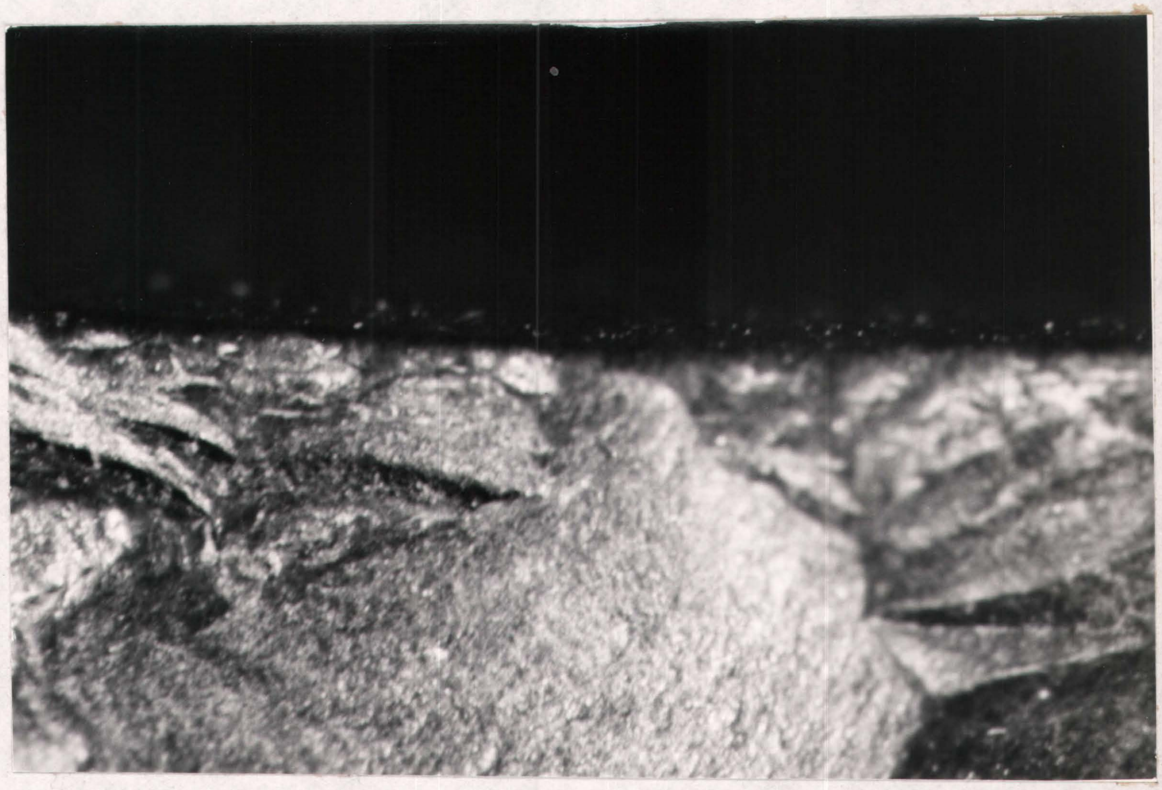


Figure 5.7 Edges Used to Work Silty Hide, 20.5X.

trait is greatly reduced when silt is added and abrasion becomes the dominant feature.

The final edge displayed a pattern of linear tracks and abrasion which was restricted to projections with no micro-flaking. This pattern does not fit either of those described for silty bone or hide. However, the non-invasive abrasion suggests a material harder than hide while the absence of any micro-flaking suggests a material softer than bone. For these reasons I have assigned the worked material as silty, medium-hard.

Only one specimen in the sample could not be assigned a worked material. This edge exhibited linear tracks in the absence of any form of wear. It is possible that the linear tracks were caused by some process other than use.

5.3.3 Use-Wear and Edge Angle

It has been postulated that one indicator of tool function other than micro-wear, is the edge angle of the tool (Semenov; Wilmsen; Gould; Koster and Sontz; Hester; Gilbow and Albee). Edge angle (also referred to as spine plane angle) reflects the cross-section of the flake, the strength and thickness of its edge (Tringham et al 1974:179).

Wilmsen (1968:159) suggests that different angle sizes are related to different functions and he found that wear patterns provided evidence to support that contention. The results of his work indicated that a cutting motion is associated with edge angles in the range of 20° to 35°, a range of 46° to 55° indicates skinning and hide scraping, sinew and plant firbre shredding, heavy cutting and tool back blunting and that wood working, bone working, skin softening and heavy shredding activities are correlated with edge angles of 66° to 75°. On the basis of the wear on a sample of Eskimo endscrapers he suggested that an acute bit is associated with the preparation of hides and a steeper bit with wood working and bone working. The work of Hester, Gilbow and Albee (1973) and of Gould, Koster and Sontz (1971) supported Wilmsen's data. A comparison of edge angle and wear pattern by Cantwell (1978) on hide and hardwood scrapers resulted in the contention that hide scrapers most often have edge angles of 65° or less and that hardwood scrapers most often have edge angles greater than 65°.

One of the variables that Tringham et al (1974:180) considered in their experiments was edge angle. They found that the degree of damage to an edge was correlated with the spine plane angle of that edge in both scarring and abrasion. The micro-morphology of the scarring, however, remained task-specific and was not affected by the spine-plane angle. Their results suggested that an edge with an acute spine plane angle was more likely to be heavily damaged than one with a more obtuse angle performing the same task.

Lawrence (1979:199) found that edge angle has a more direct effect on the development of fracture damage than abrasive wear because thin edges break more easily than thick edges. Fractures on thick edges tend to terminate in a hinge or step. This is due to the fact that a relatively greater mass is encountered on a thick edge thereby inhibiting fractures from continuing uninterrupted to a feather termination. An additional effect of edge angle is that on those edges where feather terminated flakes are removed, this very removal increased the edge angle and therefore later flakes have hinge terminations.

Table 5.1 correlates working action with edge angle. Over 60 per cent of the edge angles associated with a transverse working action are greater than or equal to 50°. Edge angles associated with a longitudinal working motion are slightly more acute and none are greater than the 70° to 79° range. The unknown working action category corresponds most favourably with the transverse category in terms of edge angle steepness. Generally, the differences among the categories are not exceptional. It is perhaps notable, however, that while 32 per cent of the transverse working action edge angles are greater than or equal to 60°, only 12 per cent of the edge angles in the longitudinal category are equally steep.

When edge angles are correlated with worked materials (Table 5.2) the distributions show that the majority of angles greater than or equal to 50° occur with all worked materials. Within each category of worked material, however, some differences are apparent. Edges associated with working hide most frequently have angles of 70° - 79°. Other medium-hard worked materials are associated with slightly lower edge angles while edge angles associated with soft materials are even lower. Higher edge angles appear again with hard worked materials and it is in this category that the highest edge angles in the sequence appear. Wood working edges are so few (n=3) that not much can be said about thim except that two of the three edges have steep edge angles.

The three variables, edge angle, worked material and working action are correlated in Table 5.3. Because there are so few edges associated with a longitudinal motion it is difficult to compare it with the other variables. This is particularly true in all categories except that of medium-hard worked materials. In this case, there is no difference in edge angles between a longitudinal and transverse working motion. One observation is notable. Edges used to work hide and hard materials are consistently higher when used in a transverse motion than they are when used in a longitudinal motion. This information would suggest that the angle of any particular edge is related not only to the action of that edge but to the worked material as well.

Table 5.1 EDGE ANGLE AND WORKING MOTION

Edge Angle	Working Action			
(in degrees)	Transverse	Longitudinal	?	Total
0 - 29	13	3	1	17
30 - 39	4	1	1	6
40 - 49	11	3	4	19
50 - 59	24	7	2	33
60 - 69	16	2	4	22
70 - 79	8	0	0	8
80 - 89	2	0	0	2
?	2	0	1	3
TOTAL	80	16	12	108

Table 5.2 EDGE ANGLE AND WORKED MATERIAL

Edge Angle	Worked Material					
(in degrees)	Hide	Medium-Hard	Soft	Hard	Wood	TOTAL
0 - 29	0	5	4	7	1	17
30 - 39	2	0	1	3	0	6
40 - 49	3	3	3	9	0	18
50 - 59	4	5	11	13	0	33
60 - 69	2	3	3	13	1	22
70 - 79	5	1	0	1	1	8
80 - 89	0	0	0	2	0	2
?	0	0	1	1	0	2
TOTAL	16	17	23	49	3	108

Table 5.3 EDGE ANGLE, WORKING ACTION AND WORKED MATERIAL

Working Action/ Edge Angle	Worked Material: Soft			Medium-Hard			Hide			Wood			Hard			TOTAL
	T	L	?	T	L	?	T	L	?	T	L	?	T	L	?	
0 - 29	3	1	0	3	2	0	0	0	0	1	0	0	6	0	1	17
30 - 39	1	0	0	0	0	0	1	1	0	0	0	0	2	0	1	6
40 - 49	3	0	0	2	1	0	1	2	0	0	0	0	5	0	4	18
50 - 59	9	2	0	2	3	0	3	1	0	0	0	0	11	1	2	34
60 - 69	3	0	0	1	2	0	2	0	0	1	0	0	8	0	4	21
70 - 79	0	0	0	1	0	0	5	0	0	1	0	0	1	0	0	8
80 - 89	0	0	0	0	0	0	0	0	0	0	0	0	2	0	0	2
?	1	0	0	0	0	0	0	0	0	0	0	0	1	0	0	2
TOTAL	20	3	0	9	8	0	12	4	0	3	0	0	36	1	12	108

T = Transverse
L = Longitudinal
? = Mode of Action Unknown

5.3.4 Use-Wear and Raw Material

Raw material is considered to be one of the variables affecting use-wear traces (Keeley and Newcomer 1977:35). Researchers sometimes caution that although they used a certain raw material and observed a certain wear pattern resulting from a specific working action and worked material, those using a different raw material may observe different results. What these researchers often do not say is what the effect of raw material is on use-wear, except for a general consensus that wear patterns are hard and/or impossible to see on quartz tools. One study is an exception. Greiser and Sheets (1979: 289) oriented their experiments to "...the question of whether wear patterns are distinct depending on the type of raw material being used while keeping other factors constant." They concluded that the kind of attrition demonstrated as use-wear depended on the structure of the raw material. The kinds of attrition are grain removal (rounding) and micro-flaking. Isotropic and microcrystalline materials have a low resistance to micro-flaking while granular materials have a low resistance to grain removal and/or wearing down of individual grains. Further, they claim that "...the deliberate selection of one raw material over another commonly occurred for reasons beyond 'flakability'. Functional demands also influenced selection" (Greiser and Sheets 1979: 295).

The raw materials of the edges examined for use-wear in this study are listed in Table 5.4. Of these materials, only one - quartzite can be considered a granular material. This material accounts for only one edge in the sample and displayed an abrasive wear pattern. Fracture

Table 5.4 USED EDGES AND RAW MATERIAL

Working Action							Raw Material			
TRANSVERSE	PC	Chert	SRC	PW	SSRC	KRF	Basalt	Quartzite	Chal.	TOTAL
Worked Material										
Hide	4	4	1	0	1	0	0	0	0	10
Medium-Hard	8	1	0	1	1	0	0	0	0	11
Soft	8	4	1	0	5	2	0	0	0	20
Hard	25	2	3	3	3	0	0	0	0	36
Wood	1	0	2	0	0	0	0	0	0	3
LONGITUDINAL										
Worked Material										
Hide	1	0	0	1	1	0	1	0	0	4
Medium-Hard	3	0	1	1	2	0	0	1	0	8
Soft	2	0	0	0	1	0	0	0	0	3
Hard	0	0	0	0	1	0	0	0	0	1
?										
Worked Material										
Hard	4	0	3	1	3	0	0	0	1	12
TOTAL	56	11	11	7	18	2	1	1	1	108

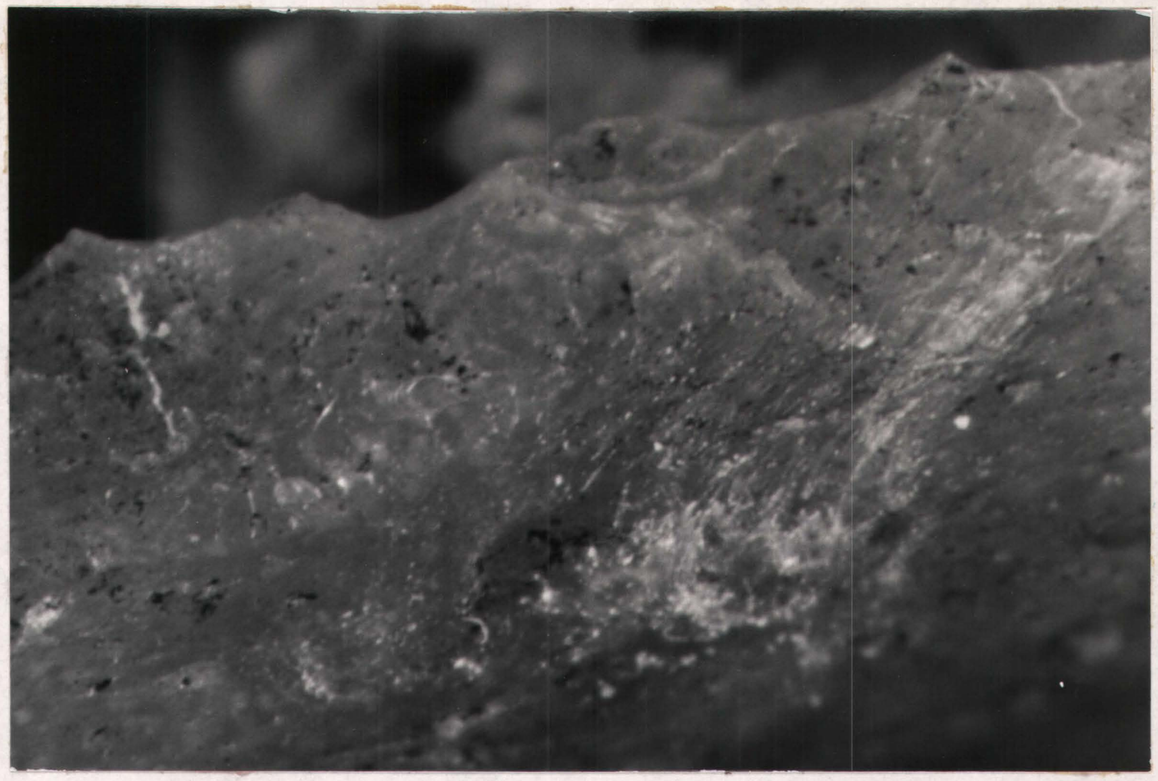
PC = Pebble Chert; SRC = Swan River Chert; PW = Petrified Wood; SSRC = South Saskatchewan River Chalcedony; KRF = Knife River Flint; Chal. = Chalcedony wear is consistently higher in proportion to abrasive wear on all raw materials. Greiser and Sheets' theory may explain why this is so. On the other hand, the most common raw materials for all flakes and tools at the site are those with a microcrystalline structure. It is notable that one quartz specimen in the sample was rejected when no wear was observed on its edge.

5.3.5 Non-Use Damage

Non-use damage may result from natural forces (hill wash, solifluction, stream rolling and frost heaving), from post-depositional factors (trampling by prehistoric occupants, archaeological discovery and storage techniques or 'bag wear') and from the manufacture of the tool and the deliberate retouch of an edge. The proponents of the low-power magnification school are convinced that non-use damage can be distinguished from use-wear damage. Generally, non-use damage is characterized by micro-flaking and is distinguished by irregular spacing along an edge and a lack of patterning (Odell and Odell-Vereecken 1980:96). Deliberate retouch is larger, more invasive and more regularly spaced than use-wear fracture patterns. Damage from manufacture is referred to as 'spontaneous retouch' (Newcomer 1976:62). This kind of retouch occurs if the flake is restricted as it is being struck from the core. As the flake flies from the core, part of its edge pivots against the core "...with enough force to cause a series of small, retouch-like scars" (Keeley 1980:25). Most of these scars occur at the distal end of a flake scar but they may also occur along the edge of a unifacial tool.

In order to avoid confusing use-wear with non-use damage, certain precautions were taken when recording fracture wear. Only those fractures 2 mm from the edge were counted as use-wear. Any fracture pattern larger than that was considered to be deliberate retouch. Also, random unoriented fractures were not counted as wear. In other words, the fractures had to be continuous along an edge and patterned in order for them to be considered use-wear. Although these measures may not have been sufficient to exclude all non-use damage, I am confident that in the majority of cases they were. The problem arose only when abrasion, polish and linear tracks were not observed. Eleven edges were rejected from the sample on the basis that they displayed non-use damage (Figure 5.8) and in one case, no wear. Two of these tools were broken. If they were broken after being manufactured this would explain why no wear was observed. No wear was observed on a single quartz tool in the sample. Five edges were worked but not used. All of these were located on tools with one or more other used edges. One edge contained linear abrasion tracks in the absence of any other wear pattern and was also rejected.

Of the 13 deliberately retouched edges in the sample, nine are dominated by fracture wear. This could mean that use-wear has been confused with deliberate retouch. The other four edges were definately used because of the presence of abrasion. However, of the nine fracture wear edges, four display ventral and dorsal wear which makes it less likely that the fracture patterns are a result of spontaneous or deliberate retouch. The remaining five edges contain only dorsal wear and on these grounds are the most suspect.



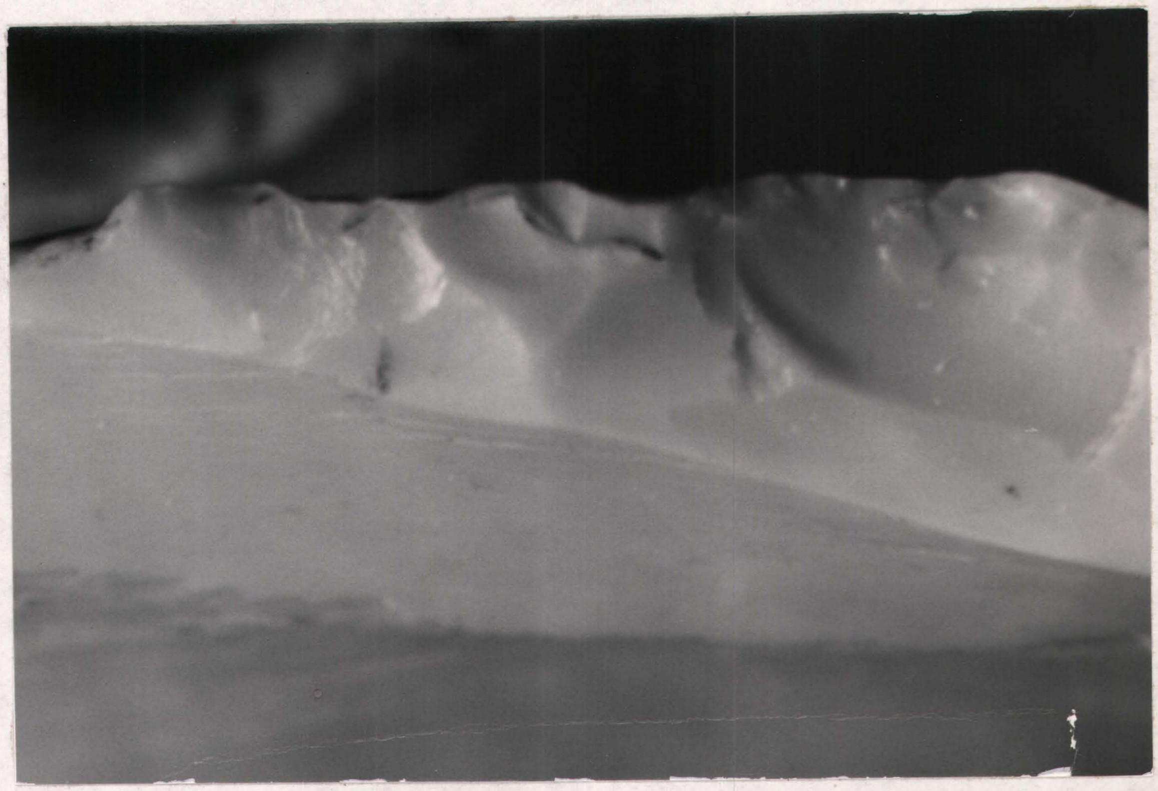


Figure 5.8 Non-Use Damage, 20.5X.

5.3.6 Use-Wear and Macromorphology

The tools to which the used edges belong were divided into two classes based on morphological attributes. The morphological classes and the use-wear results are correlated in Table 5.5. Forty-five of the endscrapers were used in a transverse motion and on all worked materials. The remaining seven endscrapers were all used to work a hard material but the working action of these is unknown. The majority of the bevel-edged retouched flakes were used in a transverse working motion on both hard and soft materials. Those used in a longitudinal motion were also used on hard and soft materials. Unifacial knives were used predominantly in a transverse motion on hard and soft materials, while those used in a longitudinal motion worked medium-hard materials. The working action of one of these is unknown. Bifacially retouched flakes were used predominantly in a longitudinal motion on all materials. Those that were used in a transverse motion worked soft and medium-hard materials. The working action of three bifacially retouched flakes is unknown. The majority of the utilized flakes were used in a transverse motion on all materials except hide, while those used in a longitudinal motion worked only soft and medium-hard materials.

The use-wear analysis confirmed that the endscrapers were used in a scraping motion. What is surprising is that the majority of these were used to scrape a hard material, like bone. All of the retouched flakes with the exception of those with bifacial edges were also used most often in a transverse or scraping motion.

Table 5.5 USED EDGES AND MORPHOLOGICAL CLASS

Worked Material	Morphological Class															
	Endscrapers						Retouched Flakes									
				Bevelled Edge			Unifacial Knife			Bifacially Retouched			Utilized Flake			TOTAL
Working Motion	T	L	?	T	L	?	T	L	?	T	L	?	T	L	?	
Soft	8	0	0	4	1	0	4	0	0	1	1	0	3	1	0	23
Medium-Hard	3	0	0	0	1	0	0	1	1	3	0	0	3	2	1	13
Hide	12	0	0	0	0	0	0	1	0	0	3	0	0	0	0	16
Wood	2	0	0	0	0	0	0	0	0	0	0	0	1	0	0	3
Hard	20	0	7	5	1	0	5	0	1	0	3	3	6	0	1	52
?	0	0	0	0	0	0	0	0	0	0	0	1	0	0	0	1
TOTAL	45	0	7	9	3	0	9	2	1	4	7	4	13	3	1	108

T = Transverse
L = Longitudinal
? = Unknown Mode of Action

5.3.7 The Distribution of Used Edges

The distribution of the used edges was plotted in an effort to determine whether use-wear patterns corresponded with the bone, tool and detritus frequency distributions. Areas A to C were considered peripheral to the main activities of the site. Only one used edge was assigned to Area C and it was used in a transverse motion on a hard material. Area A, however, contained six edges, all used in a transverse motion and all on soft worked materials. Butchering was considered to be the main activity in Area B which contained 21 edges. The majority of these were used in a transverse motion on hard, medium-hard and soft materials although three longitudinal motion edges were also found there. The actual kill and primary butchering was suggested to have taken place in Area D. Thirty-one edges were found here, although the majority of these were used in a transverse motion, the majority of longitudinal motion edges were also found in Area D. The majority of worked materials were hard and medium-hard.

Area E contained artifacts and features which suggested food processing activities. Here again, transverse motion edges predominated as did a nearly equal number of medium-hard and hard materials. The final activity Area F was distinguished on the basis of a predominance of retouch flakes associated with two small charcoal features. No longitudinal motion edges were found here and the majority of worked materials were hard, including two of the three edges considered to have been used to work wood.

Several observations are notable. Longitudinal motion edges were found only in Areas B, D and E and the majority of these in Area D.

All of these areas are considered to have been associated with butchering, the locus of which perhaps was Area D. The majority of worked materials associated with these edges were hide and medium-hard and to a slightly lesser extent soft. I think that the use-wear confirms that cutting meat and hides during the butchering process took place in these areas. Also, the pronounced lack of cutting tools in the use-wear sample suggests that most of this butchering was performed by tools other than those in the sample. Further, the use-wear data shows that there is a marked correlation between a cutting action and a bifacial edge. The bifaces in the Tschetter sample probably figured predominantly in butchering and also occur most frequently in Area D. Conversely, I would suggest that the majority of scraping was performed by the tools in the use-wear sample. Most of the scraping activity was performed by endscrapers in Area E and by a near equal amount of endscrapers and retouched flakes in Areas B and D. Scraping was performed solely by endscrapers in Area A and only by retouched flakes in Area F. More endscrapers were used to scrape hides and soft and medium-hard materials than retouched flakes while there is only a slight preference for endscrapers as opposed to retouched flakes when working hard materials.

The use-wear patterns have been described as occurring on the edges of the tools in the sample. Worked materials and working actions have been assigned to edges of the tools even though a certain tool may contain more than one edge which displays user-wear. The sample contained 24 tools with use-wear on more than one edge. Thirteen of these tools have edges which have been assigned different worked materials and/or different working actions. Identical actions but different worked materials were assigned to five tools. Different activities but identical materials characterize two tools and the edges of six tools were assigned different activities and different materials.

Although it could be suggested that one tool had more than one function, other explanations are equally plausable. Those edges with unknown working actions are all found on tools with one or more edge(s) assigned to a transverse working action. The activity was unknown because of the confusion over the meaning of the ventral wear which they all contained. I think that they can be assigned a transverse working action as well which would then mean that the worked material was bone. The edge angles of the edges with an unknown working action corresponded most closely with those assigned to transverse working actions. That the worked material is bone is consistent with all other edges in the case of three tools. In the other two cases I think that both working action and worked material remain unknown.

Two tools have transverse working actions and worked materials assigned as hide on one edge and soft material on the other edge. It is possible that the edges assigned to soft materials were not used long enough on hide to develop the characteristic abrasion associated with that worked material. In that case, these tools would represent a continuum of wear.

These suggestions are mostly speculative and although five tools may be explained this way; the others remain problematic. They may have been multi-functional or the use-wear may have been incorrectly interpreted. It is encouraging, however, that in some cases at least, the edges of the same tool have been assigned identical working actions and worked materials.

The use-wear analysis is considered to have been successful in determining the functions of a sample of the Tschetter site tools. From the sample of 108 edges which were considered to display use-wear, 95 were assigned a working action while a worked material was defined for 107 edges. Neither the worked material nor the working action could be identified on the basis of assumed wear traces on one edge. This information can contribute to, but cannot determine, the definition of activity areas at the site since the sample chosen was seen to have been skewed toward a predominance of scraping tools.

By far the majority of edges in the sample were considered to have been used in a transverse motion and the most common worked material was hard. Working a hard material in a transverse motion suggests scraping bone. In the context of a kill and butchering site, this activity seems somewhat out of place. There are, however, 139 bone tools in the Tschetter tool inventory. It is suggested that these scraping tools were used to manufacture bone tools which were then used in a variety of ways during the butchering process.

CHAPTER 6: SUMMARY, COMPARISONS AND CONCLUSIONS

Introduction

This chapter synthesizes the data from the preceeding chapters and compares it with three Late Prehistoric bison drives in Saskatchewan. In some ways, the Tschetter site is seen to be unique among kill sites of the same time period. At the same time, it fits the well-established pattern of bison driving on the Northern Plains and confirms very closely in terms of tool kit and features to other sites.

6.1 Summary

The Tschetter site is located on the Northern Plains, in the Aspen Parkland ecotone. The environment of this ecotone has been stable for thousands of years so that the soils, vegetation and climate of the area are essentially the same today as they were circa 1,000 years ago when the Tschetter site was occupied.

The site is a single component, Late Prehistoric bison drive where the bison were impounded, killed and butchered. The terrain and the post holes found at the site indicate that a pound had been constructed although its exact location and size could not be determined. Some form of food processing also took place here as evidenced by the features, which include charcoal concentrations and refuse pits, and by the condition of the butchered bone. Ninety-six animals were killed during several episodes of driving but individual drives were not discernable stratigraphically. The age and sex distribution of the bison population suggests that the kill took place during the winter months. The absence of a nearby water supply at the site also suggests that the site was utilized during the winter. Separate kill and processing areas could not be discerned at the site but the distribution of tool types and bone elements suggests that the kill and some butchering took place within the pound structure and the remainder of the butchering and the food processing took place immediately outside the structure. No associated campsite was found.

The projectile points from the Tschetter site are of the type known as Prairie Side-Notched. These points compare favourably in metric and non-metric attributes to Prairie Side-Notched points from other sites on the Northern Plains. The remainder of the tool kit is composed of a variety of formed bifaces, endscrapers, unifaces, drills, perforators, spokeshaves, retouched flakes and bone tools. These tools are made predominantly of locally available raw materials. An analysis of the lithic detritus determined that more tool sharpening than tool manufacture was performed here and that bipolar reduction of pebbles was a common method of the lithic industry. Ceramic sherds were also found which must have been involved in the processing of food. These ceramics belong to the Saskatchewan River Basin Complex - Early Variant, found in southern Saskatchewan and Alberta.

A micro-wear analysis was performed on a sample of the Tschetter site tools in an effort to determine function. The exercise was particularly useful for determining the function of retouched flakes and utilized flakes. It was also illuminating in that the endscrapers were seen to have scraped both hides and hard materials such as bone. The sample chosen was seen to have been skewed toward a predominance of scraping or transverse motion tools. By association then, it is assumed that the formed bifaces, none of which were included in the sample, performed the majority of the longitudinal or cutting motions along with the bifacially retouched flakes. It is suggested that some of the scraping tools were used to fashion bone tools of which there were many at the site. These bone tools figured predominantly in the butchering process. Some of the scraping tools were used to scrape hides but butchering was the predominant activity at the site.

6.2 Comparisons

In terms of its location in the Aspen Parkland, sites comparable to the Tschetter site have not been excavated. There are several bison pound sites in southern Saskatchewan and Alberta and in Montana. Some of these, however, have not been excavated to the extent of the Tschetter site thus making the recovered tools and faunal samples. non-comparable. Also, the reports on some of these excavations have not been published or the reports do not contain the kinds of information which make them suitable to an adequate comparison with the Tschetter site. For these reasons, a list of sites to compare with the Tschetter site was difficult to compile. However, three bison kill sites, all located in southern Saskatchewan, were chosen as being more or less comparable to the Tschetter site in terms of their function, the date they were occupied, the size of the excavations, the bone bed, tools and features. These are the Gull Lake, Bakken-

Wright and Estuary sites.

The Gull Lake site is situated in southwestern Saskatchewan 9.6 km from the town of Gull Lake (Kehoe 1973:191). The pound at this site consists of a deep depression formed by slumping along the sides of the Missouri Coteau. Between the Coteau and the Plains is a knob-and-kettle country. The site is on one side of a deep coulee. Bison were driven down the coulee side onto the landslide slump which forms a fault bench. The depression formed between the slump block and the hillside served as a natural corral.

The site extends for 11,000 square metres along the fault bench. Tipi rings and the occupational material of the campsite were found 400 metres away from the kill site. Approximately 115 square metres were excavated at the Gull Lake site in the form of a trench and two large units. These units were dug to a depth of over six metres below the surface.

The Gull Lake site is deep and stratigraphically complex. Fifty-two natural and cultural layers were defined here (Kehoe 1973:192). The layers were grouped in Zones, four and five of which are representative of the Late Prehistoric Period. Zone Four contains 10 levels in which four bone layers were defined. Levels 24, 21 and 15 were radiocarbon dated and found to have been occupied at A.D. 730 ± 80, A.D. 785 ± 80 and A.D. 1,200 respectively. These levels contained Prairie Side-Notched projectile points.

The Bakken-Wright site is also located in southwestern Saskatchewan, 25.6 km north and 3.2 km east of Bracken, Saskatchewan, approximately .8 km from the Frenchman River (Adams 1975:139). It is situated on a terrace of a large drainage basin. Above the basin is rolling glacial coteau terrain.

Excavations at the Bakken-Wright site were conducted predominantly for salvage purposes and 21 square metres were excavated (Adams 1975: 177). However, the site is considered to occupy 12,000 square metres which, at the time of excavation was being destroyed at a rate of 20 - 30 metres per year by collectors (Adams 1975:135).

This site also represents a multiple component occupation. Components C, D, E and F contain Prairie Side-Notched points. These components are considered to represent bison drives which were run into the drainage channel. Although no evidence of a corral was found, it is considered that the open end of the channel was fenced. By the end of the Prairie Side-Notched time the site was no longer conducive to bison driving and was abandoned. Some evidence suggested that a campsite was located below the jump (Adams 1975:176).

The Estuary Bison Pound site is also located in southwestern Saskatchewan, 14 km west and 3.5 km north of the town of Leader (Adams 1977:2). It is also situated at the head of a drainage channel, 2 km from the South Saskatchewan River. Immediately to the south of the site is a band of undulating grassland and south of that are the Great Sand Hills.

Seventy-three square metres were excavated at the Estuary site although it is estimated that approximaly 100 square metres of the site have been destroyed by collectors and by erosion (Adams 1977: 3). Two levels of occupation were discovered at the site, both containing Prairie Side-Notched projectile points. Radiocarbon dates from Level I are A.D. 930 and A.D. 880, while a single Level II date was determined to be A.D. 760. Level II contained a pound feature and butchering area. Level I is considered to be a butchering area (Adams 1977:117).

The three sites discussed here have many features of topography in common. Unlike the Tschetter site, they are all associated with drainage channels and have nearby water sources either in the form of a river or spring. The topography of the Tschetter site reflects the utilization of a different ecological zone and a difference in the season of occupation, as discussed in chapter three.

Bison were considered to have been impounded at all three sites although the remains of the pound and drive lanes were found only at the Estuary site. In all three cases, a natural drop was incorporated in the drive complex. No such natural drop of the magnitude as that at these sites is found at the Tschetter site, although it is located in a dune depression. A downgrade leading to the corral entrance was beneficial in that it provided a means by which the bison could easily go into the pound but could not return. The construction of a ramp as a substitute for the natural drop has been noted in the ethnographic record (Kehoe 1973:176). No such structure was observed at the Tschetter site, probably because if it were present it would have been made of dirt, mud or snow.

In terms of the functions of these sites and their period of occupation, the Tschetter site compares favourably with all three. They were all communal bison kills, which took place roughly during the same time period. A comparison of bone beds, features and artifact inventories of these sites will provide a more detailed measure of comparison with the Tschetter site and a definition of bison driving and utilization in the Prairie Side-Notched period.

Aside from providing the evidence that a kill took place, the bone bed can contribute to a determination of bison population dynamics, seasonality of kill and butchering techniques. On a further level of inference, the bone bed is a potential indicator of social organization and the organization of the labour force.

Zone Four at the Gull Lake site yielded Prairie cultural material and consists of 10 natural layers and four bone layers (Kehoe 1973: 32-37). Throughout the entire stratigraphy at the site, including Zone Four, a pattern of unburned whole bone overlying charcoal and heavily butchered bone was observed. Kehoe interprets this pattern as burning off the remains of one drive in preparation for a future drive. Occasionally a hiatus occurred which allowed the last, or unburned layer, to be buried before another drive took place. He also adds that each bone layer may represent a series of occupations close in time.

The fifth bone layer contains a minimum of 28 butchered bison. The majority of these bones are whole and distal metapodia and rear lower limbs are the most numerous. Entirely smashed and burnt bone characterize the fourth bone layer and number of animals killed could not be determined. The condition of the bone suggested that it had been boiled (Kehoe 1973:151). The presence of 16 complete bison skulls in the third bone layer provided the evidence of the number of animals killed at this time. It also suggests that the skulls were accumulated in one place for the removal of the brains or that the skulls were piled out of the way. The second bone layer contained a minimum of 14 bison. Extreme butchering in this layer is suggested by the large amount of bone scraps and the fragmented long bones. In addition, the sex composition of the bison bone in this layer suggested that it was a herd consisting of cows, calves and young bulls (Kehoe 1973:151).

Since the bone preservation at the Bakken-Wright site was so poor, very few interpretations could be made (Adams 1975:170). All bone elements were present although most of the long bones and skulls were broken and fragmentary. Adams notes one area of bone that was atypical in that the bone was badly burned. The bone of the hind quarters of the bison were present, and the long bones were seldom broken or split. He suggests that only the choice cuts of meat were removed from these bison and the rest of the carcasses were burned (Adams 1975:170).

Level I at the Estuary site contained the remains of a minimum of four bison. The bone was primarily small, undiagnostic fragments which were seldom burned. Identifiable bones included lower limb segments and skull fragments.

The minimum number of bison killed in Level II at the site was 29, and the remains were fragmentary and burned (Adams 1977:98). Nine immature mandibles were examined for aging on the basis of tooth eruption and wear. Five of these were found to be one year old and four were half a year old. This suggested that the season of the kill was either late summer or early winter (Adams 1977:92). The presence of nine foetal bones argued for a late winter kill, between early February and late April (Adams 1977:96). The butchering process was reconstructed to determine that the hide was removed in the pound. The large portions of the animals were removed to other areas while the remaining sections had the meat removed from them and were broken for marrow (Adams 1977:100).

The bone beds of these sites, with the exception of the Bakken-Wright site, compare favourably with the Tschetter bone bed. The most obvious similarity is the near exclusive presence of bison bone. Secondly, the bone is extensively butchered and limb bones in particular almost always show evidence of impact damage. At all of these sites, more than one kill took place. The number of animals killed in all of the episodes may be fairly similar at each site if the amount of burnt bone at the Gull Lake site could be determined. Unlike the Gull Lake site and the Estuary site, the Tschetter site did not contain layers of burnt bone. Also, unlike the Gull Lake site, the Tschetter and the Estuary sites were abandoned after the Prairie Side-Notched time of occupation and were not used by successive cultures. The sex composition of the bison killed at the Tschetter site is very like that of the second bone layer at the Gull Lake site. Both the Tschetter site and Level II at the Estuary site were considered to represent winter kills.

No features were documented as having been found at the Gull Lake site. This is probably due to the nature of the excavations which concentrated on the vertical extent and nature of the stratigraphy.

The features of the Bakken-Wright site consist of tipi rings, refuse pits, hearths and post holes (Adams 1975:145-146). Two of the tipi rings are considered to represent temporary shelters which were erected as work progressed at the site. Testing confirmed the presence of seven refuse pits, only one of which was partially excavated. This feature was composed of bone, sand, clay, dust, ash, rocks and charcoal. One hearth was bowl-shaped and 6 cm thick. The other was a possible hearth characterized by white and red stains. Although it is suggested that a pound was not constructed at the Bakken-Wright site, one feature is considered to be a post hole. It is conical, 9 cm deep and 16 cm in diameter.

The features from the Estuary site have been listed in chapter three. These features included six hearths and three charcoal concentrations in Level I, as well as 30 features in Level II comprised of hearths, carbon stains, red discolourations of the soil and post holes. The hearths of Level I were all flat, ovate and used wood for fuel. Some of these, however, are considered to have had specialized functions. One was used as a roasting pit and another was used in conjunction with knapping activities (Adams 1977:64). Two hearths are considered to have been used to heat stones. The charcoal concentrations represent scatter from the hearths. Level II hearths were similar to those of Level I with one exception. One hearth is considered to have been prepared. It was filled with white ash, charcoal and burned bone. The post holes represent one wall of the pound and a separate structure which is considered to represent a ceremonial structure and is similar to a feature found at a bison kill site in Wyoming (Adams 1977:74). Some of the post holes associated with the pound structure contained vertically oriented bones.

The features from the Estuary site compare most favourably with those from the Tschetter site although no prepared hearths were found at the latter. The charcoal features in particular are very like the carbon stains described at the Estuary site. The post holes are like those at the Estuary site in terms of size and contents, and many of them were in close proximity as was the case at the Tschetter site. It is difficult to make a detailed comparison of the refuse pits at the Bakken-Wright site and that of the Tschetter site since the former was not completely excavated. It must suffice to state that refuse pits have been found at other Prairie Side-Notched sites.

The most difficult thing about comparing tool kits among sites is that individual researchers describe and classify the tools in different ways. However, some general comparisons can be made concerning the types of tools found and their method of manufacture.

Projectile points are the most distinctive class of tools which can be compared among the sites. Projectile points were described and compared with the type variety in chapter four. In metric and non-metric attributes the Tschetter site sample was seen to be very similar to the Gull Lake sample. The Bakken-Wright and Estuary projectile points were classified on the basis of the Gull Lake sample and were also considered to be very similar (Adams 1975, 1977).

Two classes of endscrapers were recognized at the Tschetter site, marginally retouched and modified dorsal surface. These classes are both recognized at the Gull Lake site as initial cortex flake and secondary cortex flake endscrapers. In width, length and thickness, the Gull Lake endscrapers are very like the Tschetter sample although they are not quite as thick as the former. The formed endscrapers of the Bakken-Wright site are similar to the modified dorsal surface class of the Tschetter site. They include keeled, plano-convex and tabular types identical to those described from the Tschetter site. The metric attributes of the Bakken-Wright endscrapers have not been included in the publication. The endscrapers from the Estuary site are similar to the marginally retouched, plano-convex endscrapers of the Tschetter site and like them, are most usually made of split pebbles. They are similar in length but the Estuary endscrapers are wider and thicker.

The bifaces at the Gull Lake site conform to the classes at the Tschetter site which are based on edge configuartion shapes. The Gull Lake site includes oval, ovoid, triangular and crescentic (scalpel-shaped) bifaces. One class of bifaces is called irregular petrified wood knife and is identical to the backed knife class of the Tschetter site. The fusiform knives of the Gull Lake site compare favourably with the elliptical bifaces of the Tschetter site. In length, width and thickness, the Gull Lake bifaces are within the range of variation of the Tschetter sample. Two exceptions are the triangular bifaces which are smaller at the Gull Lake site and the fusiform knives which are longer than the elliptical bifaces of the Tschetter site. The Bakken-Wright bifaces are similar to those of the Tschetter site although there are no notched bifaces at the Tschetter site. The bifaces from the Estuary site are oval, lanceolate, crescentic, triangular and like the Gull Lake site, there are backed knives. The Estuary site also contained notched bifaces unlike the Tschetter site. Most of the bifaces at the Estuary site are within the range of variation of the length, width and thickness of the Tschetter bifaces.

Unifaces are a little more difficult to compare as they are usually not described in great detail. In shapes, cross and longitudinal sections and number of edges retouched, the Tschetter sample has similarities with all of the other sites. There does appear, however, to be more formed unifaces at the Tschetter site than at the other sites. Unifacially retouched flakes are more common at the other sites than are formed unifaces. The unifacial knife category of the Tschetter site is found at the Gull Lake site with the exception that at all the Gull Lake sites they have bifacial retouch. The distinctive feature of the latter is that they are made on oval or sub-rectangular flakes (Kehoe 1973:105). No such stylized form is present at the Tschetter site. These 'rectangular flake knives' are also found at the Bakken-Wright and Estuary sites. None of the bifacially retouched flakes at the Tschetter site are comparable to the regular flake knives of the other sites.

Drills, perforators and spokeshaves are present at the Gull Lake and Tschetter sites but not at the Estuary and Bakken-Wright sites. Hammerstones are present at all of the sites but only at the Tschetter site is there a partially grooved maul.

Lithic detritus is treated in a cursory way at the sites being compared here. The Gull Lake site detritus is most commonly quartzite and thus unlike the Tschetter site. The Estuary site, however, does contain the enigmatic pièces esquillés which are so prevalent at the Tschetter site. At all of these sites, including the Tschetter site, local raw, lithic materials are consistently predominant in all tool and detritus classes. Like the Tschetter site, imported materials like obsidian and Knife River Flint do occur but in small amounts.

The ceramic assemblage from the Tschetter site was described in chapter four as conforming to the Saskatchewan River Basin Complex - Early Variant. In the Prairie levels of the Gull Lake site, two types of pottery were recovered. These are described as Gull Lake Cord-Impressed Pottery and Gull Lake Plain Pottery (Kehoe 1973:122-123). The former does not compare with the Tschetter sample. The latter is similar to the Tschetter sample in that it is fabric-impressed and smoothed on the exterior. The ceramic assemblage from the Estuary site was small but the author considered that it belongs to the Saskatchewan River Basin Complex (Adams 1977:84). An Early or Late Variant designation could not be made. The ceramics from the Bakken-Wright site all have cord-wrapped paddle impressions on the exterior surface and are thus not comparable to the Tschetter sample.

Bone tools were common at all of the sites and included most of the same categories as those described from the Tschetter site. Kehoe (1973:140) notes that in all the layers at the Gull Lake site, the Prairie levels contained the most bone tools and the greatest varieties of bone tools even though a corresponding amount of other bone was not always present in those levels.

6.3 Conclusions

The bison drive is probably one of the most spectacular archaeological sites on the Northern Plains. A mass of bison bone laid bare by the erosive action or a river or exposed in a road cut is identified readily as a bison kill by most Plains dwellers. On the Northern Plains where the habitation sites of prehistoric people are often ephemeral the bison kill represents a situation of great archaeological potential. From the study of the bone beds of these sites, archaeologists have been able to postulate the way of life of prehistoric hunters. The settlement pattern, social organization, butchering techniques and bison behavioural patterns are some of the information which archaeologists glean from bone beds and their associated artifacts and features.

Although bison driving is by no means confined to the Late Prehistoric Period, it is generally agreed that communal, ritualized bison driving flourished during this time (Wilson and Davis 1978, Kehoe 1973). Furthermore, the evolution of the bison drive is envisaged in terms of cultural continuity. It has been suggested that the continuity extends from the Paleo-Indian Period and became progressively complex, culminating in the formal, communal drive of the Late Prehistoric (Wilson and Davis 1978:314-317).

In any discussion of Late Prehistoric drives, certain adjectives consistently appear in the literature. 'Communal', 'co-operative', 'planned', 'ritualized', 'complex' and 'patterned' are some of the adjectives used. They imply a number of aspects of social organization;

a mechanism of authority; division of labour; population size and specific subsistence economy. The fact also that these are applied almost exclusively to Late Prehistoric drives implies an evolutionary perspective.

Late Prehistoric drives utilized a variety of natural features. A predominance of topographical features associated with drainage basins is noted. Forbis (1962:67) has said that in his experience, drives face either east or north, very seldom west and hardly ever south. He considers that the direction of the kill is a function of the olfactory sense of the bison and prevailing wind direction, but perhaps also a function of the protection the cliff afforded against the sun which prevented meat from spoiling. Arthur (1962:44) agrees that in his surveys, buffalo jumps generally faced north.

Natural, wooden and stone corrals are all mentioned in the literature. The natural corrals are associated with drop-offs and Kehoe (1973:191) notes that a hummocky terrain is desirable for keeping the herd within the drive lane. The absence of these topographical features determined the use of constructed pounds on the level prairie.

In most instances the components of the drive are described in relation to present day topography. Albanase (1978:53-58) discusses the reconstructed topography of some Paleo-Indian sites. His study is useful in that he stresses the fact that topography changes over time. The migration of rivers, changes in the sinuousity of stream channels, cycles of cutting and filling-in of coulees and any number of mass-wasting processes are all pertinent factors related to changes in topography over time from the Late Prehistoric to the present day (Davis and Wilson 1978:319). Such geomorphic processes may also bias the sampling distribution of sites. It is possible that what has been recorded in terms of bison drive locations may only be one part of the total number of possibilities.

The tool kit of the Prairie Side-Notched bison hunter contained, first and foremost, projectile points which are always the greatest number of any tool type at a kill site. Small, asymmetrical, formed bifaces also characterize the Prairie Side-Notched tool kit (Adams 1977:143). In addition, unifaces, endscrapers, drills, perforators, hammerstones, retouched flakes and mauls are also present as well as a great number and variety of bone tools and ceramic sherds. A preference for locally available raw materials has been noted at Prairie Side-Notched sites as well as the products of the bi-polar reduction of pebbles. Retouched flakes are always more numerous than other flakes and cores are relatively few in number. Features include flat and basin shaped hearths, refuse pits and post holes.

The Tschetter site provides an example of a Prairie Side-Notched site which was occupied during the winter and is located in the Aspen Parkland. The site conforms in some aspects to the known pattern of Late Prehistoric bison driving on the Northern Plains, but there are some basic differences. These differences are related to the season of occupation and utilization of a different ecological zone. The archaeological evidence of winter bison procurement in the Aspen Parkland is not well known. The Tschetter site provides some clues to a description of the winter economy of Late Prehistoric people. Essential to this description is the fact that people followed the bison in the winter to the Aspen Parkland. Since mass driving episodes were not possible here due to the nature of the topography, the bison were impounded. In this context, natural depressions and stands of aspen were conducive to pound construction. Several episodes of driving bison into the pound throughout the winter may have been necessary and to that end, the pounds were repaired for subsequent use. Several surface fires provided centres of warmth and food preparation as the work progressed. The tool kit was geared almost exclusively to killing and butchering. The use-wear analysis was particularly useful in this respect, as the majority of scraping tools are suggested to have been used to manufacture bone tools as opposed to dressing hides. The latter activity is not considered to have been prevalent at the Tschetter site, nor would it have been a comfortable activity to perform in the cold and snow.

The potential for the discovery of sites like the Tschetter site is strongly suggested by the ethnohistoric record which provides accounts of winter bison pounding from Fort Carlton to Edmonton. The Tschetter site is one example of the relationship between bison pounding, the Aspen Parkland and a winter economy. The discovery and excavation of like sites is needed in order to provide a complete picture of the year-round economy of the Northern Plains bison hunter.

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