PLAINS ANTHROPOLOGIST, Vol. 59 No. 231, August, 2014, 207–240

ARTICLE

The Fincastle site: A Late Middle Prehistoric bison kill on the Northwestern Plains

SHAWN BUBEL
Department of Geography, University of Lethbridge, Alberta, Canada

Excavations at the Fincastle site located in southern Alberta began in 2004. Objects recovered include bison bone fragments, debitage, lithic cores, projectile points, expedient and formed tools, and fire-broken rocks. Our analysis shows that Fincastle has kill spots as well as primary (carcass disarticulation) and secondary (tongue removal, marrow extraction, and grease rendering) butchering activities. Fincastle is a single event site with a number of ceremonial bone upright features. The features and the predominance of Knife River Flint signify a strong cultural connection between the Fincastle hunters and groups living in the Middle Missouri area during the Late Middle Prehistoric Period. These findings and its early date of 2500 B.P. add to the debate surrounding the classification and interpretation of the Outlook Complex, Besant Phase, and Sonota Complex on the Northwestern Plains.

KEYWORDS Fincastle, Northwestern Plains, Besant, Outlook, bison kill site, bone upright features

The Fincastle site (DlOx-5) is located in southern Alberta, approximately 100 km east of the city of Lethbridge (Figure 1). Although the site has been known locally for decades, professional survey and excavation only took place recently. The primary objective of the Fincastle project was to gain an understanding of the site before it was lost due to looting and erosion. Shovel testing in 2003 revealed intact cultural material below the disturbed surface layers. The results of the 2004, 2006, and 2007 excavation seasons are summarized herein.

Excavation overview

The site is situated on Crown land within the Fincastle Grazing Reserve, which is predominately used for animal grazing (it has never been plowed). The Fincastle

DOI 10.1179/2052546X14Y.0000000009

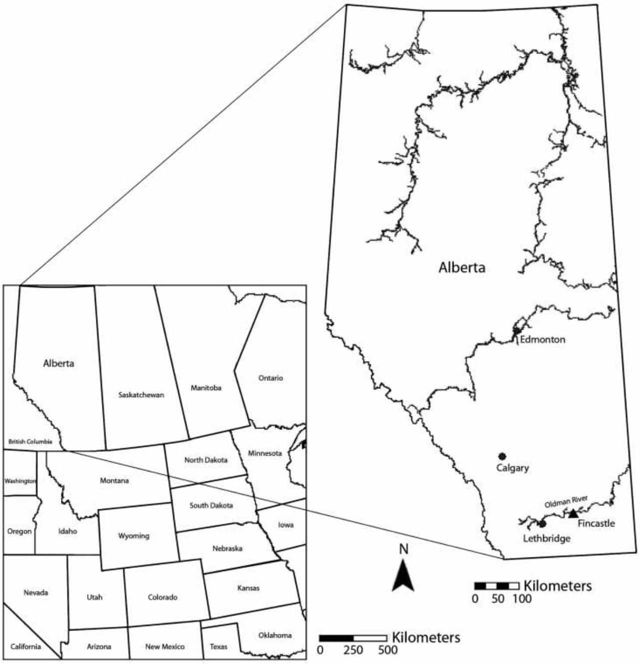

FIGURE 1 Location of the Fincastle site.

site is essentially divided in half by a north–south running barbed wire fence that marks the boundary between two land sections leased to different ranchers. Archaeological remains have been found in both sections, though the bulk of the collected material came from the eastern half, which is nestled in the inner area of a parabolic dune, and from blowouts along the arms of the dune.

Since most of the looting, aeolian erosion, and surveyed surface material was concentrated to the east of the barbed wire fence, excavation units were positioned in this section. A total of 107 m^2 was excavated in three field seasons: 101 1 × 1 m units and 24 50 × 50 cm test pits, some of which were expanded into full meter units. Location and surface elevation of the excavation units were tied to a site datum. Both the test pits and full units were excavated in 5 cm levels using trowels and small hand tools until the bone bed was reached at which time bamboo skewers, spoons, and paintbrushes were used to limit the damage to the faunal remains. The *in situ* provenience of all lithic artifacts (debitage, tools, and cores), identifiable faunal remains, unidentifiable bone fragments larger than 5 cm, and pieces of fire-broken rock larger than 2 cm were drawn on millimeter graph paper at a scale of 1:5. All excavated sediment was sieved through a 1/8″ dry mesh screen to retrieve tiny pieces of debitage, burnt and calcined bone fragments, and other small items.

The first 13 excavation units were positioned in the western portion of the site, identified as the West Area (Figure 2). These units were spread over 462 m^2 (Figure 3) and were either in or next to looted spots. The discovery of an intact bone bed and projectile points in several of the units, as well as an upright bone

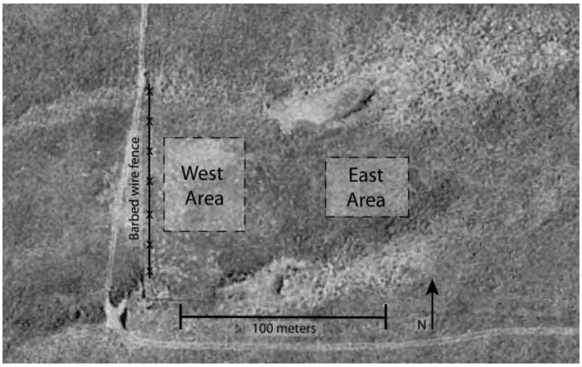

FIGURE 2 Areal photograph of the current parabolic dune surounding the Fincastle site. The two main excavation areas are indicated as well as a section of the barbed wire fence.

feature (Feature 1) warranted the expansion of excavation into neighboring units. In total, 20 units were excavated in the West Area, most of which yielded poorly preserved faunal remains because the cultural layer was close to the surface where surface and soil processes heavily affected preservation. Relatively few lithic artifacts were recovered from these units.

While most of the 2004 field crew concentrated on the units in the West Area, six 50 × 50 cm test pits were excavated to the east, along the edge of the dune's backslope, approximately 100 m east of the north–south barbed wire fence. At the time of the excavation we assumed that the dune was in its current location when the site was used and that it had served an important function for the kill, such as a natural barrier from which the hunters ambushed the bison or as part of a coral-like structure. Though these hypotheses turned out to be unsupported, the test pits revealed a dense, intact bone bed in the dune area.

The first of the East Area units next to the backslope of the dune were excavated following a checkerboard pattern (Figure 4) in order to record the stratigraphy detectable in each of the profile walls. Eventually, 81 units were completed over the three field seasons (see Figure 3). The faunal remains were better preserved than those from the West Area because they were buried much deeper below the surface. The stratigraphic context was also clearer: the single cultural layer was located just above a clay-rich deposit and was covered by a sandy matrix that was deposited over the occupation surface. This sandy matrix is the sediment of the parabolic dune.

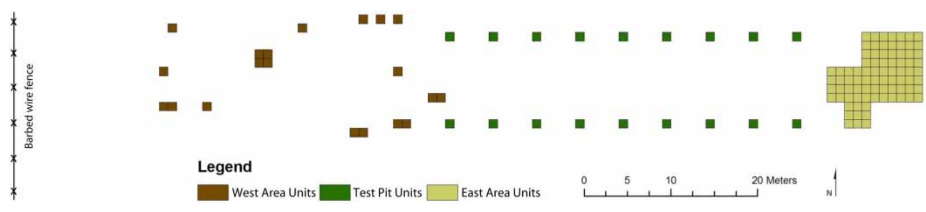

FIGURE 3 Excavation units across the Fincastle site. 107 m^2 were excavated in the 2004, 2006, and 2007 field seasons.

FIGURE 4 Checkerboard excavation method used for the East Area.

A series of 18 50 × 50 cm test pits were dug between the east and west areas to confirm that the cultural remains were from a single occupation event spread across both sections of the site. The test pits were positioned every 5 m along two east-west running transects set 10 m apart (Figure 3). Two test pits were expanded into full 1 × 1 m units because of significant cultural finds, including ash and burnt or calcined bone in one and an upright bone feature (Feature 2) in another.

In summary, over 215,000 bone fragments (mostly bison), 3,402 pieces of debitage, five cores, and 207 tools (64 expedient, 25 formed, and 118 projectile points), 1,152 fire-broken rocks, two manuports, and one piece of red ochre were collected from the excavation areas and the surface (Table 1). The faunal remains were divided into identified (ID) elements and unidentifiable (UID) fragments. Table 1 shows the artifact quantities per m^2 in brackets for density comparisons. Data obtained from the analysis of these remains were examined for spatial patterning using GIS software (Lieff 2006; Mills 2009). The *in situ* remains recovered from

TABLE 1

CULTURAL MATERIAL RECOVERED FROM THE THREE EXCAVATION AREAS

Type of Remain	West Area (20 m^2)	Test Pits (6 m^2)	East Area (81 m^2)	Total (107 m^2)
Fauna				
ID elements	1,208 (60)	296 (49)	11,954 (148)	13,458 (126)
UID fragments	46,616 (2,331)	11,833 (1,972)	145,122 (1,792)	203,571 (1,903)
Debitage	432 (21.6)	290 (48.3)	2,680 (33.1)	3,402 (31.8)
Cores	1 (0.05)	1 (0.2)	3 (0.04)	5 (0.05)
Expedient tools	3 (0.15)	11 (1.8)	50 (0.6)	64 (0.6)
Formed tools	2 (0.1)	1 (0.2)	22 (0.3)	25 (0.2)
Projectile points	23 (1.15)	5 (0.8)	90 (1.1)	118 (1.1)
Fire-broken rock	101 (5.05)	170 (28.3)	881 (10.9)	1,152 (10.8)

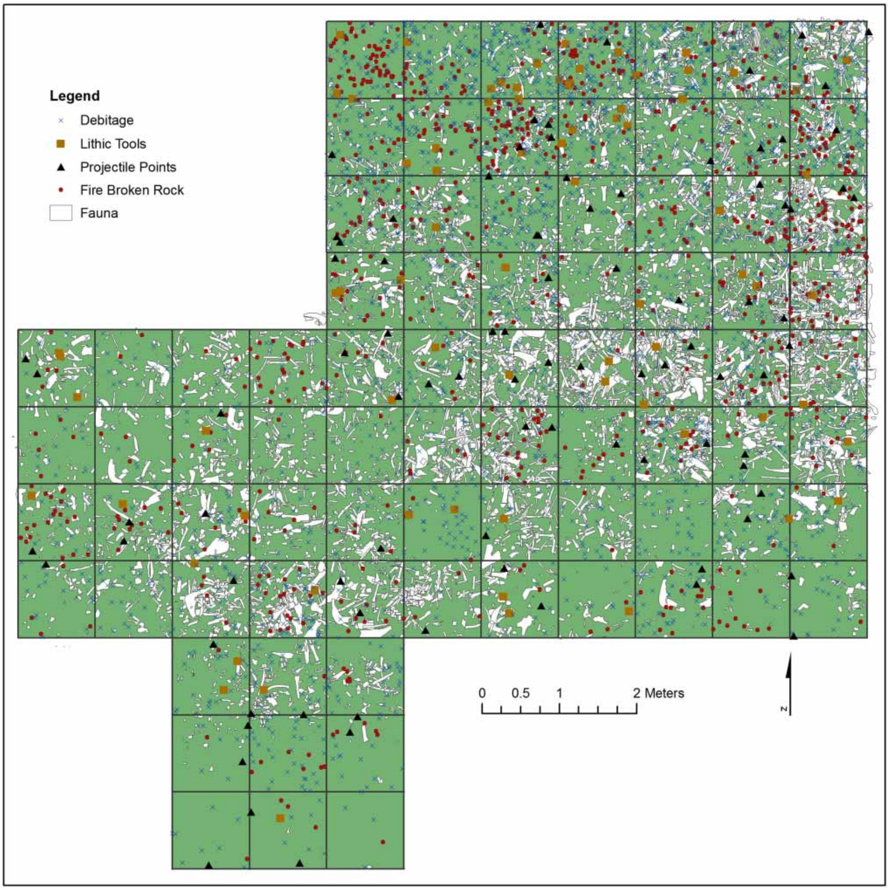

FIGURE 5 Plan of the *in situ* cultural remains recovered from the East Area excavations.

the East Area show variation in artifact classes and densities across the excavated area (Figure 5).

Stratigraphic analysis and chronology

The Fincastle site is in an area of stabilized sand hills and active blowouts known as the Purple Springs Sand Dunes (Alberta Environmental Protection 1997:125). The topography of the region is flat to gently rolling terrain. Elevation change is associated with the dune features, blowouts, and watering holes. Purple Springs Sand Dunes formed at the end of the Wisconsin glaciation, when the Laurentide ice sheet retreated to the northeast (Shetsen 1987). Glaciolacustrine deposits ranging between 5 and 25 m thick remained (Eyles et al. 1998; Harris 1985) and dune fields formed on the distal peripheries of these deposits downwind of the exposed sediment (Campbell 1997; Wolfe et al. 2002:2). Subsequent aeolian erosion and deposition has resulted in the undulating topography of the Purple Springs Sand Dunes. The dunes consist of fine to medium-grained sands, up to seven meters high (Shetsen 1987), and are longitudinally oriented in the direction of the prevailing chinook winds (Beaty 1975:71). The dunes overlay a thick bed of glacially deposited clay associated with residual glaciolacustrine sediments. The establishment of a postglacial grass cover across most of the region has stabilized the dunes (Beaty 1975:72). However, periods of drought and surface disturbances, such as fire, grazing, and human occupation, have reinitiated their movement.

The depositional sequence described above is present at the Fincastle site. The archaeologically sterile glaciolacustrine clay, silt, and gravel layer is covered by varying depths of medium-grained to fine-grained aeolian sands. Periods of stability are marked by soil development. Although the depth of the A-horizon varies, the soils are Regosols, defined as poorly developed soils with no B-horizons on unconsolidated sediment (Soil Classification Working Group 1998:119). The soils are slightly more developed in the northeast section of the site, where the backslope leads to the crest of the parabolic dune. The cultural material was concentrated in a single layer between the glaciolacustrine deposit and the aeolian sands. Aeolian activity postdating the kill event exposed the glaciolacustrine deposit in parts of the site, while in other parts it deposited more sediment over the archaeological material.

Based on the well-preserved state of the faunal remains in the East Area, where the main bone bed was located, I hypothesized that aeolian deposition took place relatively quickly after the bison were processed. This hypothesis was confirmed by the optically stimulated luminescence (OSL) dates. Six of the eight OSL samples extracted from the northeast area of the site can be used to date the kill event: two from just below the bone bed, two from within the bone bed, one 10 cm above the bone bed, and one 40 cm above the bone bed. The other two came from the glaciolacustrine deposit and the upper edge of the large blowout. The samples were extracted and prepared by Dr. Ron Goble at the University of Nebraska. Goble determined all De values using the Central Age Model or Minimum Age Model (Galbraith et al. 1999) as required and calculated the optical ages (Table 2) using a minimum of 43 suitable aliquots.

TABLE 2

OPTICALLY STIMULATED LUMINESCENCE DATES

Profile Location	OSL Sample Number	Burial Depth (m)	Stratigraphic Context	OSL Age
East profile of East Area unit 559N 604E	UNL2543	0.7	Glaciolacustrine deposit 30 cm below the bone bed	5170 ± 0.32 B.P.
	UNL2544	0.6	Sandy deposit 10 cm below the bone bed	4640 ± 0.25 B.P.
	UNL2545	0.4	Sands from within the bone bed	3140 ± 0.17 B.P.
North profile of East Area unit 566N 604E	UNL2546	0.75	Thin deposit of sand directly below the bone bed	2900 ± 0.15 B.P.
	UNL2547	0.7	Sands from within the bone bed	2050 ± 0.13 B.P.
	UNL2548	0.6	Sands 10 cm above the bone bed	1780 ± 0.13 B.P.
	UNL2549	0.3	Sands 40 cm above the bone bed	1270 ± 0.06 B.P.
North profile of the blowout	UNL2550	1.3	Sands 130 cm below the surface in the blowout	170 ± 0.02 B.P.

The OSL dates show that the sands between the bone bed and the glaciolacustrine deposit accumulated prior to the kill event. Dates for the two samples taken from within the bone bed range from 3140 ± 0.17 B.P. to 2050 ± 0.13 B.P. indicating a period of aeolian deposition around the time of the kill that continued for another thousand years or so. The upper sands in the blowout match with recent translocation events.

The radiocarbon dates support this chronological sequence. Since no charcoal was recovered from the Fincastle excavations, seven bison bone samples were sent to Beta Analytic Inc. for radiocarbon (AMS) dating (Table 3). The bone collagen from all samples was extracted with alkali and analyzed using the standard radiometric technique (i.e. synthesizing the sample carbon to benzene (92 percent) and measuring the ^{14}C content in a scintillation spectrometer). The conventional radiocarbon ages, calculated using the $^{13}C/^{12}C$ corrections, are reported here as they are the most appropriate for assessing the age of the site.

The primary contexts of two samples submitted in 2004 (a lumbar vertebra articulated with two other vertebrae and a metacarpal from Feature 4 (upright bone feature) were within the bone bed. The dates received are extremely close in age: 2540 ± 50 B.P. (Beta-201909; bone; $\delta^{13}C = -18.7‰$) and 2490 ± 60 B.P. (Beta-201910; bone; $\delta^{13}C = -19.5‰$), respectively, and have low standard deviations, thereby dating the Fincastle occupation to around 2500 B.P.

Five additional radiocarbon samples submitted in 2007 were taken from a number of contexts to confirm the connection between the different excavation areas and assess the chronological sequence of the stratigraphic layers. Since the two initial samples came from the East Area, samples from primary contexts well below the surface and away from disturbed areas in the West Area were needed. The dates received, 2490 ± 40 B.P. (Beta-241254; bone; $\delta^{13}C = -19.4‰$) and 2610 ± 40 B.P. (Beta-241255; bone; $\delta^{13}C = -19.1‰$), as well as the similar $\delta^{13}C$ values around −19‰, substantiated the temporal link between the two areas.

TABLE 3

RADIOCARBON DATES

Sample Number	Date Processed	Site Context	Bone Element	$\delta^{13}C$	Conventional Radiocarbon Age
Beta-201909	3/15/2005	East Area, bone bed	Lumbar vertebra	–18.7‰	2540 ± 50 B.P.
Beta-201910	3/15/2005	East Area, bone upright Feature 4	Metacarpal	–19.5‰	2490 ± 60 B.P.
Beta-241254	3/20/2008	West Area, bone bed	First phalanx	–19.4‰	2490 ± 40 B.P.
Beta-241255	3/20/2008	West Area, bone bed	First phalanx	–19.1‰	2610 ± 40 B.P.
Beta-241256	3/20/2008	East Block, above bone bed	Second phalanx	–17.5‰	1310 ± 40 B.P.
Beta-241257	3/20/2008	East Block, above bone bed	Lone bone fragment	–18.4‰	3100 ± 40 B.P.
Beta-241258	3/20/2008	East Block, bone upright Feature 8	Metacarpal	–19.0‰	2680 ± 40 B.P.

Since the bone upright features were all positioned below the bone bed, a second sample was submitted to verify that these features were created at the time of the kill. The conventional radiocarbon age of 2680 ± 40 B.P. (Beta-241258; bone; $\delta^{13}C = -19.0‰$) from the complete metacarpal located in Feature 8 corresponds to the other dates, temporally linking the buried upright features with the kill and processing activities that took place.

Two samples were also taken from deposits stratigraphically higher than the bone bed to determine if the material above the intact cultural layer originated from the occupation debris or from another site or occupation event. Both bone samples came from the East Area as a depositional sequence thicker than 20 cm was only present in that part of the site. The more recent date of 1310 ± 40 B.P. (Beta-241256; bone; $\delta^{13}C = -17.5‰$) from a second phalanx 29 cm above the bone bed may indicate that there was a later occupation of the area, though no other evidence has been found to substantiate this interpretation. In contrast, the long bone fragment dated to 3100 ± 40 B.P. (Beta-241257; bone; $\delta^{13}C = -18.4‰$) was also located 25 cm above the bone bed. These two dates are inconsistent with the five dates obtained from primary contexts, which was not surprising considering that both bones were found stratigraphically above the cultural layer, in aeolian deposits of reworked sands. The significant difference in age seems to suggest an earlier and later use of the area to the west although the nature of these occupations is unknown. This certainly seems to be the case for sample Beta-241256 based on its much later date and higher $\delta^{13}C$ value.

Faunal remains

The majority of the 217,029 faunal remains recovered from the site were small unidentifiable fragments; 13,458 elements were identified. The comprehensive analysis of these remains, which included species identification, element portion classification, siding, aging, and the notation of fracture types and cutmarks if present, allowed for a detailed assessment of the processing activities that took place at the site. Table 4 lists the number of identified specimens, the minimum number of individuals calculated using side and age data where applicable, the minimum number of elements including the identified bone portions, the minimum animal units (MAU), and the MAUs relative to the percent MAU. Based on the number of fused central and fourth tarsals (TRC) and fused second and third carpals (CPS) recovered, a minimum of 62 bison were killed and butchered, though this number will undoubtedly increase when the remains from the 2012 excavation season are examined. These data along with Watts' (2008) preliminary findings revealed direct (element portions, butchering fractures, and cutmarks on the bone) and indirect evidence (spatial relationships between the bones as well as other artifacts) of joint dismemberment, meat removal, marrow extraction, and grease rendering. Both primary and secondary butchering operations were carried out.

Primary butchering is defined as the separation and removal of carcass sections for further processing (Watts 2008:12). In primary butchering contexts, such as the Horner site (Frison and Todd 1987) and EgPn-111 (Head et al. 2002), axial

TABLE 4

QUANTIFICATION OF THE BISON FAUNAL ASSEMBLAGE

Element	NISP	MNI	MNE	MAU	MAU%
Cranium	402	3	3	3.0	5
Mandible	454	45	87	43.5	74
Hyoid	108	28	55	27.5	47
Sternum	2	1	2	0.3	1
Atlas	22	11	11	11.0	19
Axis	19	10	10	10.0	17
Cervical vertebra	342	–	94	18.8	32
Thoracic vertebra	591	–	173	12.4	21
Lumbar vertebra	142	–	28	5.6	10
Sacrum	19	8	8	8.0	14
Caudal vertebra	159	–	130	26.0	44
Rib	3948	18	502	17.9	31
Scapula	455	31	59	29.5	50
Humerus	124	14	21	10.5	18
Radius	150	32	50	25.0	43
Ulna	111	23	42	21.0	36
Accessory carpal	50	28	50	25.0	43
Fourth carpal	88	52	86	43.0	74
Intermediate carpal	91	45	87	43.5	74
Radial carpal	92	46	91	45.5	78
Fused second and third carpal	106	62	106	53.0	91
Ulnar carpal	85	46	83	41.5	71
Metacarpal	113	36	61	30.5	52
Fifth metacarpal	53	27	53	26.5	45
Os coxae	69	15	25	12.5	21
Femur	103	13	26	13.0	22
Patella	16	11	16	8.0	14
Tibia	172	27	49	24.5	42
Lateral malleolus	43	23	43	21.5	37
Talus	132	57	112	56.0	96
Calcaneus	143	55	107	53.5	91
Fused central and fourth tarsal	125	62	117	58.5	100
First tarsal	51	27	51	25.5	44
Fused second and third tarsal	99	53	99	49.5	85
Metatarsal	135	30	57	28.5	49
Second metatarsal	29	16	29	14.5	25

Continued

TABLE 4

CONTINUED

Element	NISP	MNI	MNE	MAU	MAU%
First phalanx	457	55	408	51.0	87
Second phalanx	420	53	388	48.5	83
Third phalanx	333	42	315	39.4	67
Proximal sesamoid	437	–	437	27.3	47
Distal sesamoid	209	–	209	26.1	45

MNE, minimum number of elements; MNI, minimum number of individuals; NISP, number of identified specimens.

sections of the animal are found in higher quantities relative to the more transportable appendicular portions. Elements may still be articulated, possibly at the spot where the animal fell. Extensive primary butchering seems to have been carried out at the Fincastle site. Though a number of axial articulations were exposed, most had less than five elements. Articulated thoracic vertebrae missing the spinous processes were the most prevalent. Only one relatively intact axial section was unearthed (Figure 6). Proximal rib portions with distal spiral fractures were also found articulated to vertebrae elements. Sections of rib cage were likely separated from the vertebral column by breaking the ribs near their proximal ends. Distal rib shafts were rarely found in association with these sections, eliminating the possibility of taphonomic breakage.

Joints were dismembered on both the axial and appendicular portions of the carcass. According to Frison (1973) dismemberment of the forelimbs was often done at the scapula–humerus joint. Unfortunately, few scapula elements are present in the Fincastle faunal assemblage and only two have butchering marks. Alternatively, the forelimbs may have been disarticulated from the animal between the humerus and radius-ulna. Butchering marks were more often seen on the proximal ends of the radius and ulna than their distal aspects, and there were several

FIGURE 6 Articulated thoracic vertebrae in an East Area unit. Proximal portions of several ribs were also articulated with this section of the vertebral column.

cases where the distal radius remained articulated with the carpals and metacarpal. The separation of the upper hindlimb from the lower leg portion seems to have been done at the distal end of the tibia. Most of distal tibia fragments have little of the bone shaft present and butchering marks were more often detected on the distal portions than the proximal ones. Furthermore, the few tibia articulations unearthed did not include the femur or patella.

Numerous lower limb articulations were documented, many of which included a complete metapodial or its distal end, and phalanges, as well as sesamoid bones in several cases (Figure 7). Articulations of the tarsals, including the calcaneus, talus, fused central and fourth tarsal, and fused second and third tarsal, were also present, but calcanei were often broken or missing from the group likely because joint dismemberment occurred at that spot. Having said that, the variable nature of the lower limb articulations at the site suggests that the butchers had no particular point on the animal they favored for lower limb removal. In any case, these low meat yielding portions were discarded as articulated units.

The abundance of disarticulated and heavily fragmented appendicular elements is an indication of secondary butchering activities. Many of the long bones and long bone fragments recovered from Fincastle showcase spiral fractures and impact marks, features of bone breaking for marrow extraction. Significantly fewer proximal sections of the humerus were found, the bone portion with the highest percent of fatty acids in a bison (Brink and Dawe 1989:91), compared to distal portions (1:10). Similar ratios were seen at EgPn-111 (Head et al. 2002:64) and Head-Smashed-In Buffalo Jump (Brink and Dawe 1989:88). Alternative taphonomic explanations for their differential presence, such as trampling,

FIGURE 7 Lower limb articulation in an East Area unit.

carnivore gnawing (which was only detected on one rib bone), and bone density attrition, seem unlikely based on the well-preserved state of the bone bed, although these factors may have played a minor role at the site. Most of the distal humerii portions have short spiral fractures close to the distal end likely created to extract marrow.

The radius was also fragmented for marrow extraction, as was the tibia. Very few femur fragments were found making it difficult to draw any conclusions regarding its role in the secondary butchering process. In fact, no complete bison femura, tibiae, or humeri were found at the site. This absence, together with the abundance of unidentifiable long bone fragments, many of which were directly associated with fire-broken rocks, other small bone fragments, and burned bone, suggests a combination of marrow extraction and grease rendering activities.

Tongue removal seems to have taken place at Fincastle, predominantly in the East Area. Mandibles were often found clustered together (Figure 8) and the majority of the 108 hyoid fragments, which are rarely preserved (Meltzer et al. 2002), were spatially associated with them. A few of the mandibles have cutmarks on the medial aspect of the ventral margin or cheek teeth sections. The coronoid process of several mandibles was smashed, likely to detach them from the cranium. The breakage patterns on the ventral margin may relate to marrow extraction or tongue removal, though the two activities were not necessarily mutually exclusive. Regardless, the mandibles were purposely removed from the cranium to be further processed at a secondary location on site.

As noted above, the spinous processes of the thoracic vertebrae were removed from the animals as part of the primary butchering stage but the number of disarticulated yet well-preserved fragments (most of which measure 10 cm in

FIGURE 8 Cluster of mandibles in an East Area unit.

length or more) confirms that a secondary, more detailed stage of meat removal also took place on site. Similar conclusions can be made based on the long shaft portions of the ribs found, though small fragments of this element were also documented across the site. Cutmarks were detected on a few of the spine and acromion scapula fragments, which seem to evidence the stripping of muscles from this part of the bison, but this interpretation remains speculative.

In summary, the Fincastle hunters likely followed the primary butchering procedure outlined by Frison (1973). They began with the removal of the hide and continued with the disarticulation of the forelimbs, between the radius-ulna and humerus, and the lower hindlimbs at the distal tibia or calcaneus. The meat from the upper hindlimbs would have been stripped, and the side, hump, and neck meat removed. Secondary butchering, including meat removal from the thoracic spinous processes and ribs, tongue removal, as well as marrow extraction and grease rendering, was also a priority at the site. Articulated carcass sections and complete elements or substantial portions that could have been processed further indicate that selection took place.

The cranium, atlas, and axis must have been separated from each of the animals as these elements were poorly represented at the site. The discovery of hyoids in the well-preserved bone bed eliminates differential preservation as a possible explanation for their limited numbers. The skulls may have been transported to another part of the site to be further processed for brain removal or served an ideological function on site or at a secondary location, but these hypotheses remain unsupported at this time.

The presence of caudal vertebrae in greater numbers than the cervical or lumbar vertebrae, several of which were in articulated sections, is also noteworthy. Their presence indicates that the tails were left on site, discarded during the primary butchering process, rather than taken off site with the hide or as cultural artifacts. It is likely that hide removal and some hide working occurred on site; an interpretation reinforced by the concentration of endscrapers in the northeast section (see below). The discovery of a few pieces of cartilage, a rare find at any kill site, is also an interesting anomaly.

Though most of the faunal remains are bison, four bone fragments were identified as *Antilocapra americana* (pronghorn) and 34 as large and medium-sized canids. The moderately preserved cranium in Feature 1 (see below) was classified as *Canis lupus* (wolf), as were most of the canid remains. A few *Canis latrans* (coyote) bones are also present in the collection. It is possible that canids were used in the kill or to transport hides and meat to the campsite. Several canid bones have processing marks on them and were disarticulated, implying they too were butchered, perhaps reflecting the killing of scavengers. Similar marks and quantities of a few individual canid animals were documented at the Happy Valley (Shortt 1993) and EgPn-111 (Head et al. 2002) kill sites as well as the Kenny (Reeves 1983b), EdOh-23 (Johnson 1983), Sjovold (Dyck and Morlan 1995), and Naze (Gregg 1987) campsites. The fact that the canid remains recovered from Fincastle were butchered does not eliminate the possibility that these animals also served a functional role for the hunters.

Site seasonality

Dentition changes in the bison mandible occur on a predictable schedule in the first four years of the animal's life making it possible to determine the season in which the animals were killed. Nine preliminary age groups were defined for this project based on the tooth eruption schedules outlined by Frison and Reher (1970), Reher and Frison (1980), and Todd et al. (1996), the incisor development rates determined by Fuller (1959), and the crown and root development of teeth and their subsequent eruption rates evident through the radiographs taken by Niven et al. (2004) (Table 5). Since molars and premolars are in place when the bison reaches approximately four years of age, only mandibles from immature animals were examined. Once mature, the degree of tooth wear, along with crown height measurements can be used to age these remains (Todd et al. 1996), though these data have not yet been collected for the Fincastle specimens.

Of the mandibles with complete or partial tooth rows, 24 immature specimens were classified into an age group; 71 mandibles have a fully erupted dentition so were from animals older than 48 months of age when they were killed. Twelve mandibles fell between 12 and 18 months, and 10 were between 24 and 30 months, while two specimens were 36 to 42 months of age. Based on these results, the mandibles in the Fincastle assemblage fit into three age groups: 1 to 1.5 years, 2 to 2.5 years, and 3 to 3.5 years, all of which fall between the early summer and late fall, assuming a late April to early June birthing season. The lack of fetal remains in the faunal collection strengthens this preliminary assessment.

Vickers (1986:8) noted that site location is strongly, and usually implicitly, linked with the site's seasonality. The location of the Fincastle bison kill site, in an open plains setting but still close to the abundant berry patches and wood supply of the Oldman River, could be linked with opportunistic bison hunting in the early summer. However, it is more likely connected to the killing of an aggregated bison

TABLE 5

IMMATURE BISON AGE GROUPS BASED ON TOOTH ERUPTION RATES IN THE MANDIBLE

Birth to 3 Months	Deciduous teeth are present (dP_4, dP_3, dP_2). M_1 remains below the alveolus.
3 to 6 Months	M_1 starts to ascend. Anterior cusp erupts first followed by the posterior cusp.
6 to 12 Months	M_1 is fully erupted between 9 and 12 months. P_2, P_3, and M_3 crowns form.
12 to 18 Months	P_2 and P3 begin to ascend. P_4 remains below the alveolus. M_2 begins to ascend and erupt, reaching 3/4 the height of the M_1 by 18 months. M_3 anterior cusp may erupt a few mm.
18 to 24 Months	Anterior cusp of the M_3 erupts. M_2 is fully erupted by 24 months.
24 to 30 Months	Medial cusp of the M_3 erupts. The dP_2 and dP_3 are shed. P_2 and P_3 ascend and significantly erupt by 30 months.
30 to 36 Months	P_4 starts to ascend and erupts between 33 to 34 months. By 36 months, the posterior cusp of the M_3 starts to erupt.
36 to 42 Months	All adult premolar roots are fully formed. By 42 months, the P_4 fully erupts, as does the posterior cusp of the M_3. Height of the M_3 reaches between 1/2 and 3/4 the height of the M_2.
42 to 48 Months	M_3 reaches the height of the M_2. The bison has a mature dental morphology at 48 months.

herd in the late summer or early fall based on the number of animals killed in the single event. Moreover, the inconsistency of the articulated limb elements (some were in articulation while others were disarticulated and further processed for marrow and grease) may relate to differences in animal fat contents (Brink and Dawe 1989). Males use up their fat stores during the rut becoming quite lean at this time, and the females weaning their calves are much thinner than the ovulating cows with the high fat stores they need to support pregnancy (Brink 2008:52). It is conceivable that the hunters selected the higher yielding cow carcasses for secondary processing and avoided the musky meat of the leaner bulls.

Bone upright features

In addition to the rather typical bone midden, eight bone upright features were discovered below the bone bed, pressed into the otherwise sterile glaciolacustrine deposit. The upright bone features were in no perceivable pattern, though six were in the East Area (Figure 9). Feature 5 is a single, vertically positioned maxilla, while Feature 2 includes an upright metatarsal and fractured radius. Feature 4 has two vertical metacarpals and three vertical scapulae pressed into a triangle constitute Feature 3. Four other bone upright features include mandibles oriented with the distal end down. Feature 7 is the most impressive with an upright tibia and four mandibles positioned so the teeth fanned outward (Figure 10). At the bottom of Feature 1 was a canid cranium facing downward with an upright mandible and scapula above it. The upright bones of Feature 6 include a scapula, two mandibles, and a metatarsal. Feature 8 had the highest number of upright bones starting with an axis at the top, followed by a vertical metacarpal, calcaneus, first phalanx, third phalanx, and a mandible oriented so the proximal end was pressed deep into the clay. At the bottom were four carpals, a sesamoid, and the distal epiphysis of a radius (Figure 11).

No pit outlines were detected, nor was sandy sediment incorporated into the features (filling up pit depressions). The high bulk density of the glaciolacustrine deposit would preclude pushing the bones into the sediment unless it was water saturated. The gleyed coloring of the sediments indicates anaerobic conditions in the past so standing water may have existed at the time of the kill. A pond may have been what attracted the bison to the site. The hunters capitalized on the watering animals.

How the bone uprights were constructed is discernable but their function is unclear. The position of the Fincastle uprights well within the sterile clay, below the bone bed, would not have allowed them to function as anvils for lithic reduction or bone splitting as Neuman (1975:35) suggested for those at the Stelzer site. Furthermore, the pristine condition of the bones indicates that they were never used as part of the butchering procedure or another utilitarian function that would have left impact marks. Nor are they similar to the bone features at Head-Smashed-In that Brink and Dawe (1989:38) conjectured to be tipi tie-downs or anchors for drying racks. Such bone features were typically made using rib or long bone fragments placed into the ground at an angle. Several upright bone elements were within post-mold features at Fitzgerald (Hjermstad 1996:70),

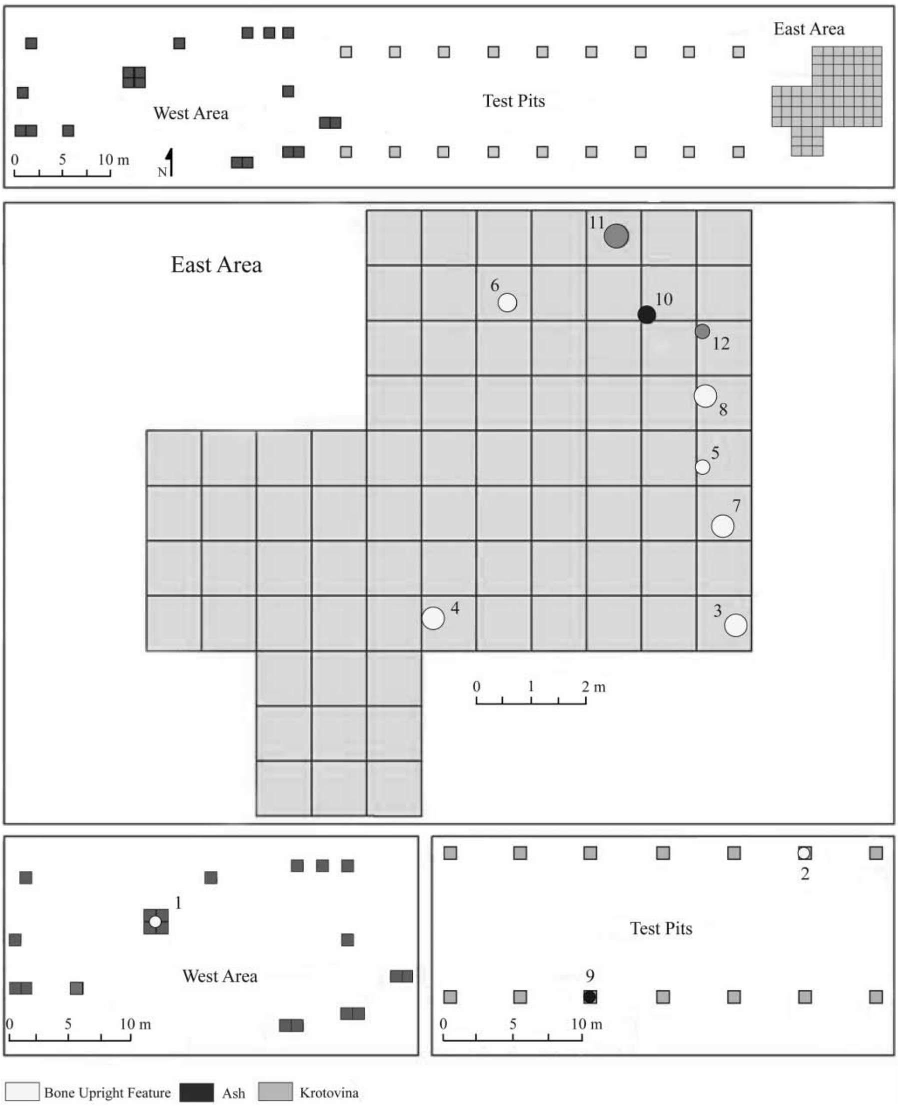

FIGURE 9 Location of the eight bone uprights features.

Mortlach (Wettlaufer (1955:41), Antonsen (Davis and Zeier 1978:26), and Ruby (Frison 1971:80), but no pit or post mold features could be seen around the Fincastle bone uprights. They were also not bone caches like the feature at the Kenny site (Reeves 1983b:32). The mandibles and long bone jammed together into the ground at the Melhagen site (Ramsey 1991:215) are comparable to Feature 7 at Fincastle but unfortunately details about the Melhagen feature are unavailable for review. The most similar features are the bone uprights excavated at the Muhlbach site. Though Gruhn (1969:139) was unable to determine their function, she noted that they were below the bone bed and were not used to wedge posts. It is

FIGURE 10 Bone upright Feature 7. Four mandibles and one tibia vertically positioned, pressed into the glaciolacustrine clay deposit below the cultural surface.

conceivable that the uprights served an ideological purpose that cannot be fully understood at this time.

Lithic artifacts

The lithic assemblage consists of 3,616 items: 3,402 pieces of debitage, five cores, 207 tools, and two manuports. The two manuports (one petrified wood and one limestone) are included with the expedient tools in Table 6. As is the case for most kill sites, projectile points (118) dominate the assemblage. A significant number of other tool types were also found, including 64 expedient and 25 formed tools.

Raw material

The raw material of each artifact was assessed on the basis of its texture (the size, shape, and organization of the rock's particles), the presence of inclusions, luster, color, and translucency. All pieces were macroscopically examined using a 10× hand lens. Types requiring microscopic classification were viewed with an Olympus CH2 optical microscope at a magnification of 40×. The extensive reference collection at the Royal Alberta Museum was used to help identify sources of chert, including Knife River Flint, Swan River, and Montana. The origins of the obsidian pieces were chemically determined through X-ray diffraction (Skinner and Thatcher 2009).

Knife River Flint formed when silica gradually replaced the organic matter and filled the pores of a peat deposit in North Dakota between about 60 and 30

FIGURE 11 Bone upright Feature 8. Twelve vertically positioned bison bones found in the glaciolacustrine clay deposit below the cultural surface.

million years ago (Bluemle 1993). It was surface collected and mined from secondary alluvial deposits in the Dunn and Mercer counties. Knife River Flint made its way into assemblages found hundreds of kilometers away and became one of the most widely used raw materials on the Northern Plains (Clayton et al. 1970; Gregg 1987). Many researchers macroscopically identify it by its deep brown to amber color, though the color can be homogenous or mottled. Knife River Flint is generally vitreous and slightly translucent but the dark brown patches may be opaque and the colorless areas completely translucent. This coloring is due to the extremely fine-grained organic particles dispersed through the stone (Bluemle 1993). Fossilized organic fragments can be occasional seen microscopically, which is one of its defining characteristics (Miller 2010:591–592). Unfortunately, as Kirchmeir (2011) pointed out, pieces not made of Knife River Flint have been labeled as such based on color alone. This is a significant problem because a number of sources of these non-Knife River Flint rock types are present in the northern Plains, such as Hand Hills chert from Alberta. Ultraviolet light can be used to differentiate Knife River Flint from other brown cherts and chalcedonies as it fluoresces faint orange when subjected to UV shortwaves (Akridge and Benoit 2001). A UV light was used to confirm Knife River Flint presence in the Fincastle collection.

TABLE 6

LITHIC ARTIFACTS PER RAW MATERIAL

Raw Material Type	Debitage	Cores	Expedient Tools	Formed Tools	Projectiles	Total
Knife River flint	2,560		31	9	97	2,697
Swan River chert	285		3	12	1	301
Miscellaneous chert	140		5		6	151
Silicified siltstone	109		1		6	116
Medium-fine quartzite	82	5	14	1	1	103
Massive quartz	57		1			58
Montana chert	45		3		1	49
Yellow/red chalcedony	31				1	32
Obsidian	25		2		2	29
Kootenay argillite	28					28
Black chert	18				1	19
Petrified wood	10		2	1	1	14
Argillite	7		1	1		9
Porcellanite	3			1	1	5
Course quartzite	2					2
Sandstone			1			1
Limestone			1			1
Granite			1			1
Total	3,402	5	66	25	118	3,616

Swan River chert outcrops in the Swan River Valley in southwest Manitoba, but can also be found in limited quantities in Laurentide gravel deposits as far west as southeastern Alberta (Grasby et al. 2002). The mottled color and texture of Swan River chert are highly variable but the curdled-milk appearance is a signature characteristic along with the presence of numerous small vugs (cavities within the rock) or microfossil inclusions. Chert originating from Madison Limestone in Montana is also variable in color and can range from opaque to highly translucent. The very fine-grained opaque varieties (yellow, red, green, white, and gray) are the most commonly recognized of the Montana cherts. Though they are more translucent and lighter in color than the opaque specimens, the pieces in the Fincastle collection identified as yellow and red chalcedony likely originated in Montana. Chert artifacts not sourced to a specific chert type were classified as miscellaneous chert.

Cobbles of quartzite, granite, limestone, and sandstone would have been available in the site vicinity at the time of the kill. Massive quartz, silicified siltstone, petrified wood, porcellanite, argillite, and pebble chert could have been acquired from nearby secondary deposits, as could have Swan River chert. Non-local Kootenay argillite, Montana chert, obsidian (sourced by Skinner and Thatcher [2009] to Obsidian Cliff in Wyoming and Bear Gulch in Idaho), and Knife River Flint would have necessitated long distance travel or trade networks. More importantly, the Fincastle hunters seem to have had well-established connections to the Middle Missouri region as 75 percent of the lithic assemblage is Knife River Flint (Table 6). Whether the hunters procured this material in North Dakota themselves or traded for it is difficult to determine. In either case, the variety of local materials suggests an unsystematic collection of stones found at or near the site that were used to supplement their Knife River Flint tools.

Lithic production

Debitage was found in all areas of the site (see Table 1). Excluding surface finds, the units with the highest concentrations of debitage were generally located in the northern reaches of the East Area, though 78 pieces were found in one of the northern test pits, which equated to 312 pieces per m^2, almost three times the density of the next highest unit. Densities varied across the site, dropping to less than 10 pieces in some excavated units, with no debitage in three of the test pits. Most of the debitage was discovered while screening (75 percent), several pieces were found on the surface (5.5 percent), while disturbed areas yielded fewest specimens (3 percent). The remaining 564 flakes (16.5 percent) were recovered *in situ*. The low *in situ* recovery was due to their extremely small size. Most debitage items weigh 0.1 g or less (85 percent), or have a maximum dimension of less than 10 mm (72 percent).

Nodule testing and core preparation (very early stages of lithic manufacture) were not carried out at the site based on the low quantity of primary flakes (15 flakes; 0.4 percent of the assemblage) and raw material variability. Though higher than the primary flakes, the quantity of secondary flakes (4 percent) is also minor with regard to the complete debitage assemblage. Expedient tools, specifically the choppers, may have been manufactured on site using locally collected stone, but these tools are the exception rather than the norm.

Almost all of the 2,474 complete flakes are tertiary (94 percent). When the flake fragments and shatter with no cortex (99 percent of this group of artifacts) were included with the complete tertiary flakes, they represented 95 percent of the assemblage. Based on their metric attributes, the assemblage is dominated by small, tertiary flakes and flake fragments. Furthermore, 79 percent of the tertiary debitage is made of non-local materials. Thus, the debitage reflects an emphasis on finishing and resharpening tools brought to the site.

The few cores recovered from the bone bed were spread across the site (see Table 1) and revealed no manufacturing center or concentration of such activity. Rather, their locations seem to indicate flake blank production at the spot of use during the butchering process. Overall, the five multidirectional cores in the Fincastle assemblage reflect an *ad hoc* approach to flake production using locally available nodules of medium-to-fine-grain quartzite. Debitage and tools made of the same material were also recovered. Other cores must have been knapped on site as primary and secondary waste flakes of different material types (including Knife River Flint, Swan River chert, and miscellaneous cherts) were also found. The cores used to create at least some of the tools recovered from the site were either discarded elsewhere (i.e. not in the excavated areas), or were taken away when the occupants left. Alternatively, a number of the tools could have been made at a camp or manufacturing site before their use at Fincastle. The projectile points were undoubtedly made prior to the hunting event.

Lithic tools

Most non-projectile point tools were recovered from the East Area (80 percent), in the northern most units in particular. These units were also debitage rich (Figure 5). The average density for this excavation area was 0.9 tools per m^2 (Table 1), with an increase to 2.9 per m^2 in the 14 northern units. Expedient tools, most of which are complete, make up the bulk of the assemblage (71 percent). They include 26 utilized flakes, 22 retouched flakes, a borer, three choppers, 11 hammerstones, and an anvil. The majority were found within the bone bed, evidencing their use in butchering activities at those locations.

Though the hunters may have brought some cores with them, they likely took advantage of the locally available raw materials. A number of expedient tools and debitage flakes are made of quartzite (129), siltstone (112), quartz (58), chalcedony (31), pebble chert (19), petrified wood (11), argillite (9), porcellanite (2), and sandstone (1), nodules of which are present in secondary surface deposits at the site, as are some miscellaneous chert stones (149). Due to the variable shapes and sizes of the nodules, the expedient tools, especially the modified flakes, range in size and shape. One of the retouched tools was crafted from a blade fragment of a broken projectile point. There is slight, but clear, unifacial retouch on the distal snapped margin. Its presence attests to the capitalization of available flakes and fragments to create the expedient tools used to process the bison.

The hammerstones were locally available cobbles collected and used at the time of the kill. Some may have been used to retouch the lithic tools being used to process the bison, and others as butchering tools themselves. Based on the amount of debitage collected, tool finishing and resharpening took place, and hammerstones would have been needed to fracture the bison bones for secondary processing. Unfortunately, directly connecting specific artifacts with these activities was not possible, though their context implies their use in both. The large pink granite anvil, which weighs 42.8 kg, was clearly culturally positioned and likely used as a solid surface on which to break bone. No impact marks were detected but the East Area unit that it was found in contained the highest number of unidentified faunal remains (4,833) recovered from the site.

In addition to the projectile points (discussed in the following section), 25 formed tools were recovered from the Fincastle site, including a uniface, five bifaces, a knife, 15 endscrapers, two drills, and a wedge. Like the expedient tools, most are complete, the exceptions being four of the five bifaces, five of the endscrapers, and what was likely a hafted knife (DlOx-5: 9450 in Figure 12), were found within the bone bed, and came from the East Area. Knife River Flint and Swan River chert were used exclusively to produce the bifaces. The green argillite uniface may have been made from a cobble found on site but no matching debitage was found in the excavated units.

Eight of the complete endscrapers are characteristic thumbnail scrapers and all the fragmented scrapers are similar in form, bringing the total number to 13 (87 percent). The two other endscrapers were made on a large flake and a medium-fine quartzite pebble, respectively. The endscrapers are made of Swan River chert (nine), Knife River Flint (four), medium-fine quartzite (one), and porcellanite (one). Since no cores of the former two material types were found, it is possible that these tools were made at another location in anticipation of the kill. The majority of the endscrapers (80 percent) were found in the northern extension of the East Area so scraping related activity may have been concentrated in this area of the site. The drills and the borer were also found in that vicinity, which strengthens the hypothesis that secondary activities, conceivably hide working, as well as marrow extraction and grease rending, took place.

The cores and tools recovered at the Fincastle site can be directly linked to the hunting and butchering of bison. The assemblage includes tools used to disarticulate the animals, remove the hide, cut meat from the bones, break open the long bones to extract marrow, and smash the bones for grease rendering. The context of these tools, in direct association with the bone bed, confirms their butchering functions. Furthermore, most tools were recovered from the East Area, where the densest concentration of bison bone and resharpening debitage flakes were located.

Projectile points

Besides a concentration of three points in one of the northern test pit units, the 118 projectile points and point fragments were spread across the excavation areas (see Table 1). Thirty-six (31 percent) are complete, meaning all portions of the point are present. The body and base specimens missing only the tip ($n = 16$) and projectile missing its left proximal margin ($n = 1$) were considered almost complete. Together, they make up roughly half of the collection (45 percent), and provided a large, inclusive dataset to study. The remaining fragments include 19 tips, seven tip and body portions, 11 body fragments, one shoulder piece, 12 body and base portions, two base fragments that include the notch, and 13 bases. On the basis of the hafting portion (the base), the assemblage contains a minimum of 81 projectiles.

Measurements of the projectile point attributes were recorded to one-tenth of a millimeter (Figure 12). The complete projectile points in the collection range in length from 17.7 to 57.5 mm, with a mean of 36.1 mm and a standard deviation of 9.3. Many of the smaller points retain characteristics of the flake they were made on and were only minimally to moderately shaped. The widths of the projectile points are much closer in size: the mean is 20.0 mm with a standard deviation of 2.9 mm (less than 15 percent of the mean). The same can be said about the shoulder, neck, and base widths, with means of 20.1, 14.1, and 17.6 mm, respectively. The shoulder is the widest point of the projectile in all but seven cases. Three of these points are slightly wider in the body, just above the shoulders (0.5, 0.8, and 1.5 mm wider), and four have a wider base than shoulder width (0.4, 0.5, 1.1, and 1.4 mm wider). The base width is an average 88 percent of the shoulder width, ranging from 70 to 108 percent with a standard deviation of 8.5 percent. Though the base was specifically modified to be less than the shoulder width, it was not significantly reduced.

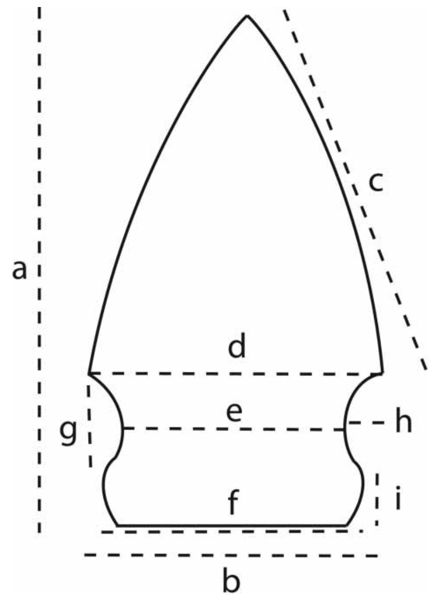

FIGURE 12 Projectile point attribute measurement locations for the (a) maximum length, (b) maximum width, (c) blade length, (d) shoulder width, (e) neck width, (f) base width (g), notch height, (h) notch depth, and (i) proximal margin height. Thickness, measured at the thickest part of the point, and weight, measured to a tenth of a gram, are not shown.

The neck is present on 72 projectile points. This attribute ranges from 7.2 to 18.7 mm wide, averaging 14.1 mm with a standard deviation of 2.2 mm. The neck width of each point was compared with its shoulder and base dimensions in order to evaluate shaping consistencies between these attributes within the assemblage. Neck width is 72 percent of the shoulder width on average (neck width/shoulder width), with a standard deviation of 6.6 percent. Equally as consistent, neck width averages 82 percent of the base width (neck width/base width), with a standard deviation of 6.8 percent. The difference between the shoulder and neck widths is greater than between the neck and base widths simply because the base width is generally smaller than the shoulder width. That the standard deviations of 8.5 percent (base/shoulder), 6.6 percent (neck shoulder), and 6.8 percent (neck/base) are low and similar means that the shoulders, neck, and basal portions of the projectile point were created with a specific form in mind, and were of equal consequence.

The length of the projectile was of less importance to the knappers than the other point attributes. The mean blade length based on the left (n = 59) and right blade (n = 56) measurements, including those extrapolated, is 29.8 mm with a standard deviation of 10.0 mm. This standard deviation of about 34 percent of the mean is significantly higher than any of the other features, including the total length (SD 26 percent). This range in body and total lengths matches Thomas's (1978) comparative study in which he determined that length was the least significant typologically discriminating attribute.

The general uniformity of the Fincastle assemblage was further accentuated by the non-metric aspects of the projectile points. Eighty-two percent of the specimens are made of Knife River Flint (Table 6) suggesting selection of this stone for projectile point manufacture. Most of the remaining 21 specimens (18 percent) are made of a variety of locally available materials: six are made of siltstone, six of miscellaneous cherts, and one of each of petrified wood, yellow chalcedony, black chert, medium-fine quartzite, porcellanite, and Swan River chert. The other three are made of obsidian (two) and Montana chert. The Knife River Flint specimens are longer on average than those made of other materials. The complete Knife River Flint points (32) have a mean length of 37.6 mm while those made of siltstone (2), obsidian (1), and quartzite (1) average 23.9 mm long. The Knife River Flint points are also wider, and thicker, and have larger shoulder, neck, and base widths (Table 7). Despite these differences, the relationships between neck width and shoulder width, and neck width and base width remain similar for all material types. Few differences were noted between notch types, orientations, and shapes, shoulder shapes, and basal edge shapes. It is also important to note that all five of the complete projectile points not made of Knife River Flint were only minimally to moderately shaped. Some of these points may have been created quickly using locally available material just before or even during the kill event.

Tip shape (pointed, sharp, blunted, or round) did not seem to relate to any of the other projectile features, including raw material and body shape. Specimens that were noted as being reshaped have three different tip shapes (pointed, sharp, and blunted). Based on these findings, I assumed that the knappers did not intend to create a specific tip shape beyond one that was relatively pointed rather than rounded.

A clear intention to create a convex blade shape form was noted. When the left and right blades were examined as pairs, 81 percent have at least one convex blade edge, 50 percent of which are bi-convex. The remaining specimens have a combination of convex, straight, convex/concave, and recurved edges, possibly the result of reconditioning them into cutting tools. There are a few specimens with isolated retouch along one edge that confirm this hypothesis. The possibility of resharpening is discussed below.

TABLE 7

COUNTS, MEANS (MM), AND STANDARD DEVIATIONS (SD) FOR THE KNIFE RIVER FLINT AND NON-KNIFE RIVER FLINT PROJECTILE POINTS WITH THESE ATTRIBUTES PRESENT

Attribute	Knife River Flint Points			Non-Knife River Flint Points		
	Count	Mean	SD	Count	Mean	SD
Length	32	37.6	8.5	4	23.8	5.4
Width	56	20.5	2.7	9	17.0	1.9
Thickness	71	5.7	1.2	12	5.1	1.5
Shoulder width	58	20.4	2.7	8	17.4	1.8
Neck width	60	14.5	1.9	12	12.1	2.4
Base width	58	18.0	2.3	10	15.2	1.6

The notches on the Fincastle points have elements of both side- and corner-notched types. The notches were created by pressure flaking the lower lateral margins of the tool, typical of side notching, and the sides of the base were also significantly altered in this process. As noted above, the base of almost all points is measurably less wide than the shoulder. Most notches (70 percent) are oriented toward the distal end of the point, which is generally a trait of corner notching. To discriminate this notch form a new corner/side-notch type was defined based on the combination of these characteristics. To clarify, the following features were used to identify the three notch types: side notching involves pressure flaking along the lower lateral margin which results in a notch that extends toward the middle of the point, more or less parallel to the bottom of the base although it can be skewed toward the proximal or distal end. Side-notching does not normally affect the basal margin, and the left and right sides of the base, the proximal margins, are present. Alternatively, corner notching is done from the edge of the base toward the distal end of the projectile. Such notching affects both the base and the lower lateral margins of the point. True corner notching removes parts of the base so neither side of the basal margin is present. Corner/side notching as seen in the Fincastle assemblage involves pressure flaking the lower lateral margins (side notching) as well as the proximal edge margin (corner notching); however, the margin is still present, though it is typically less than 2 mm high. The presence of measurable proximal edge margins is likely the product of modification to the base after notching. The notches are often distally skewed but symmetrical notch shapes also occur. The shoulders are typically wider than the base inferring the removal of portions of the basal and lateral edges.

Using these notching definitions, the majority (70 percent) of the notches identified in the collection were classified as corner/side-notched. Of the 60 projectile points that have both their left and right notches present, 57 percent have paired corner/side-notches and another 26 percent have one notch of this type. Only six specimens have notches that are both side-notched and two have notches that are both corner-notched. Also telling is the presence of two projectile points that have both a side and a corner-notch. The Fincastle assemblage exhibits a knapping template aimed at creating corner/side-notched projectile points.

No relationship was identified between the notch type and its shape, height, depth, or orientation. The knappers likely shaped (rounded) the notches as part of the manufacturing and hafting process. Having said that, the notches are predominantly shallow and are of some height. Notch depths range from 0.8 to 4.3 mm, with a mean of 2.4 mm and standard deviation of 0.7 mm. The notches are about three and a half times as high as they are deep, ranging between 3.7 and 12.5 mm in height and averaging 8.2 mm, with a standard deviation of 1.6 mm. There was a clear tendency to pressure flake a significant section of the lower lateral margin of the projectile point, probably to create a larger hafting area. There was no apparent connection between the depth or height of the notch and the notch type or orientation. The primary intention was to create a rounded, shallow, high notch, low on the proximal margin. A combined corner/side-notched approach was used to achieve this.

Finally, the base type was identifiable on 75 specimens. The most common base type is straight (60 percent), followed by concave (20 percent), convex (12 percent), and concave–convex (8 percent). There is no direct relationship between the base type and the general projectile metrics or raw material. Therefore, the type of base is not indicative of intentional shape manufacture. The majority of the specimens have a straight base, so this form was likely the objective. If present, the degree of concavity and convexity is minimal. The creation of a concave or convex base may have been the result of manufacture error during the basal thinning process. Almost all of the bases were basely thinned (91 percent) and ground (93 percent), thereby reflecting the manufactured projectile point template.

Point resharpening

A recognizable degree of variability is present within the Fincastle point assemblage (Figure 13). Assessing whether the variability within or between assemblages is a result of the production and refurbishing, raw material, site function, or reflects a different cultural group can be difficult. Invasive retouch along the blade edge, a characteristic of resharpening, was noted for 51 (43 percent) of the projectile point specimens. The metric and non-metric attributes of these resharpened points were compared to the general assemblage to detect morphological differences resulting from this activity. Since all but one of the complete resharpened points are made of Knife River Flint, the other is obsidian, the resharpened Knife River Flint point measurements were compared to the metric values calculated for the complete Knife River Flint subassemblage, thereby eliminating material type as a variable. The resharpened projectile points are shorter and lighter in general, but neither the average length nor weight of the resharpened Knife River Flint pieces fell below the average dimensions calculated for the complete collection, which included the non-Knife River Flint artifacts (Table 8). Alternatively, the average width, shoulder, neck, and base widths were all slightly larger for the resharpened tools.

The resharpening process is portrayed in Figure 14. The projectile point on the far left (DlOx-5: 9468) has not been resharpened. It is one of the longest specimens in the collection. The resharpened projectile points have been arranged according to

TABLE 8

COUNTS, MEANS (MM), AND STANDARD DEVIATIONS (SD) FOR ALL PROJECTILE POINTS, THE KNIFE RIVER FLINT POINTS, AND THE RESHARPENED KNIFE RIVER FLINT POINTS WITH THESE ATTRIBUTES PRESENT

Attribute	All Projectile Points			Knife River Flint Projectile Points			Resharpened Knife River Flint Points		
	Count	Mean	SD	Count	Mean	SD	Count	Mean	SD
Length	36	36.1	9.3	32	37.6	8.5	19	36.5	6.0
Width	65	20.0	2.9	56	20.5	2.7	35	20.9	2.6
Thickness	83	5.6	1.3	71	5.7	1.2	45	5.7	1.2
Shoulder width	66	20.1	2.6	58	20.4	2.7	36	20.9	2.5
Neck width	72	14.1	2.2	60	14.5	1.9	37	14.9	1.6
Base width	68	17.6	2.4	58	18.0	2.3	34	18.2	1.9

FIGURE 13 Representative sample of the projectile points (a) DlOx-5: 705; (b) DlOx-5: 848; (c) DlOx-5: 852; (d) DlOx-5: 855; (e) DlOx-5: 857; (f) DlOx-5: 858; (g) DlOx-5: 860 (h) DlOx-5: 861; (i) DlOx-5: 864; (j) DlOx-5: 865; (k) DlOx-5: 866; (l) DlOx-5: 869; (m) DlOx-5: 870; (n) DlOx-5: 879; (o) DlOx-5: 881; (p) DlOx-5: 882; (q) DlOx-5: 883; (r) DlOx-5: 884; (s) DlOx-5: 8376; (t) DlOx-5: 8386; (u) DlOx-5: 9002; (v) DlOx-5: 9464; (w) DlOx-5: 9468; (x) DlOx-5: 13971; (y) DlOx-5: 13975; (z) DlOx-5: 13985 and a bifacial knife (DlOx-5: 9450) from the Fincastle site.

FIGURE 14 Selected projectile points illustrating the resharpening activities of the Fincastle hunters. DlOx-5: 9468 (a) has not been resharpened, while the other eight specimens, arranged from longest (left) to shortest (right) have been (b) DlOx-5: 876; (c) DlOx-5: 13974; (d) DlOx-5: 9002; (e) DlOx-5:13973; (f) DlOx-5:13972; (g) DlOx-5:882; and (h) DlOx-5:883. DlOx-5: 890 (i) was reworked into a drill. Note that the shoulder, blade, and neck widths remain similar in size.

decreasing lengths based on their (extrapolated) blade lengths. Shoulder, neck, and base widths are similar. Blade edge modification, likely while the point was still hafted, was the main method of resharpening. The location of the tip break would have dictated the resharpened blade length.

Culturally defining the Fincastle site

Several archaeological phases or complexes have been identified on the Northwestern Plains during the Late Middle Prehistoric Period (about 2500–1350 B.P.), including Outlook, Sandy Creek, Besant, and Sonota. How these taxonomic entities relate to each other has been debated for decades (Cloutier 2004; Duke 1991; Dyck 1983; Hjermstad 1996; Joyes 1984; Peck 2011; Ramsey 1991; Reeves 1983a; Shortt 1993; Syms 1977). Co-occurring temporally with the important cultural changes that took place during the Pelican Lake-Bracken Phase, but of uncertain relation to them, were occupation events at Head-Smashed-In Buffalo Jump (Reeves 1978), the Sjovold site in southern Saskatchewan (Dyck 1983), and Fincastle. Assemblages featuring an almost exclusive use of Knife River Flint at these sites were dated to around 2500 B.P. (Dyck 1983:107–108; Peck 2011:241–242; Reeves 1978:172; Varsakis 2006:110–111). Sometimes interpreted as antecedents to the Besant Phase (Dyck and Morlan 1995; Reeves 1983a; Shortt 1993), these occupation levels were instead considered by Varsakis (2006:363) as an early manifestation of the Sonota Complex on the Northwestern Plains. As Peck (2011:242) has indicated, however, there is a precedent in the archaeological literature for use of the term 'Outlook Complex' to describe these materials. The distinctive projectile points from the 'Un-named Complex' at the Sjovold site (Dyck 1983:107–108) were subsequently named Outlook side-notched points by Dyck and Morlan (1995:425).

Outlook points can be highly variable in form, but feature elongate blades, wide necks, straight or concave bases, and shallow notches low on the side margins (Reeves 1983a:31–33; Shortt 1993: 48–49). Peck (2011:247) stressed that although Knife River Flint is "not always the dominant raw material, it occurs in unusually high amounts relative to other time periods in Alberta's past." Given the great similarity of Outlook to later Sonota assemblages, this naming convention may prove redundant as further data accumulate. Because there is a 1,000-year gap between Outlook and Sonota occurrences on the Northwestern Plains and their relationship remains unclear, use of the term Outlook seems reasonable for the time being.

The Sandy Creek Complex (about 2500 B.P.) was applied to the short, thick, and shallow side-notched points with slightly indented bases and "lugs" or "ears" first recovered from the Mortlach site (Wettlaufer 1955:49–53). Reeves (1983a), Dyck and Morlan (1995), and Brumley and Rennie (2005) all recognized that the Sandy Creek points are similar in morphology to the Besant form, and therefore defined this complex as a prelude to the Besant Phase or included these materials within it. Though Sandy Creek sites are contemporary with Fincastle, in morphological terms the projectile points are the least similar to each other. Sandy Creek points tend to be short, stout points that are widest at the base while the Fincastle points are much longer and are widest at the shoulders.

The term Besant originates from Wettlaufer's (1955) work at the Mortlach Site in south-central Saskatchewan. The diagnostic projectile point of this phase was described as "short and broad with shallow side notches and a slightly concave base" (Wettlaufer 1955:44). Dyck (1983:115) added that the notches are twice as high as they are deep and Reeves (1983a:55) found that they were often located very near the base of the point. He also noted that many of the points were basally thinned or ground and ranged from crude to well-formed types (Reeves 1983a:54–57). Besant points have proved ubiquitous across the northern Plains, extending from Alberta to Manitoba, with similar point forms and lifestyles occurring in Montana, Wyoming, and the Dakotas, giving rise to what Reeves (1969; 1983a) termed the Besant Phase (see Peck [2011] for an overview of Besant Phase sites). Reeves (1983a:93–94) assigned Besant Phase materials in the Saskatchewan River Basin a date range of 1800 B.P. to 1200 B.P. The time frame was subsequently revised by other researchers to a succession of earlier dates: 2000 B.P. to 1150 B.P. (Dyck 1983:113); 2350–2150 B.P. to 1250 B.P. (Morlan 1988:305); about 2100 to 1200 B.P. (Vickers 1986:81–87); and 2150 to 1250 B.P. (Walde et al. 1995). Reeves did, however, identify Besant side-notched points within bone layers associated with earlier corner-notched projectile point styles at Head-Smashed-In Buffalo Jump dating to about 2500 B.P. (Reeves 1978:164). These points, interpreted by Peck (2011:246) as Outlook, were notched low on the lateral margins, had straight or slightly indented bases, and were all made of Knife River Flint.

Revised several times following the original draft in 1969, Reeves' (1983a:96, 140–141) definition of the Besant Phase came to include a particular cultural assemblage: the common utilization of Knife River Flint, discrete drill types, a high frequency of asymmetric ovate bifaces, few bifacial choppers, and an absence of pointed unifacial flakes, domed sidescrapers, and pointed unifaces. He also noted the occurrence of rare and localized cord-marked bossed and punctuated conchoidal pottery, excavated earth-filled hearths, surface hearths, cache pits, bone uprights, and secondary burials usually accompanied with many grave goods. Neuman (1975:82) and Syms (1977:88–90) have argued there is a clear difference between the site assemblages from northern Plains and those from the Middle Missouri region, and defined them as Besant and Sonota, respectively. Indeed, the burial mounds that contained secondary burials and grave offerings were largely restricted to the Middle Missouri area. Yet bone upright features, typically associated with the Sonota Complex, have also been found at sites in the northern Plains, including Muhlbach (Gruhn 1969) and Fincastle.

Sonota projectile points were described by Neuman (1975:17–18) as broad, triangular, convex-sided points with low broad side notches, and a slightly convex, straight, or slightly concave base. Some of the forms were long and slender. Syms (1977:89) added that the points possessed "a distinctive side- or corner-notched base, widths between about 18 to 26 mm, and lengths from 16 mm to more than 67 mm" and noted that Knife River Flint comprises more than 80 percent of the lithic assemblages at Sonota sites. Given that the high proportion of Knife River Flint does not diminish with distance from the quarries, Syms (1977:90) argued against the possibility of this material arriving at outlying Sonota sites through trade.

Neuman (1975:88) suggested that the Sonota Complex was a regional variation of a cultural tradition that effectively exploited the plains-riverine environment of the Middle Missouri between 1950 and 1350 B.P. However, both Neuman (1975) and Syms (1977) added that the Sonota Complex reached into Alberta and Saskatchewan. Indeed, Peck (2011) documented a number of such sites. The cultural remains unearthed at Fincastle match exceptionally well with the Sonota Complex elements. The projectile point forms are decidedly similar, there was a preferred use of Knife River Flint, and bone uprights were present. Still, the early date and lack of burial features at sites in Alberta makes it a problematic fit.

In her review of 23 sites across the Northwestern Plains dated to the Late Middle Prehistoric Period, Foreman (2010) identified a number of cultural connections as well as regional differences based on the forms of the projectile points, the raw materials that were utilized, cultural features (including hearths, bone uprights, and burials), butchering patterns, and the presence of particular animal species, such as *Canis* and pronghorn. On an individual level, the Fincastle points can be connected with each of the four projectile types. The elongated point forms are reminiscent of Outlook and Sonota, but there are shorter forms that match better with the traditional Besant points. Broader comparisons of the point styles and raw materials, as well as the presence of bone uprights, link Fincastle most closely with sites in the Dakotas. However, Fincastle shares similar faunal assemblage attributes with other kill and camp sites in southern Alberta and Saskatchewan, possibly reflecting the local environment and available game.

The difficultly in typologically and, by extension, culturally classifying the Fincastle assemblage speaks to the importance of Peck's (2011) re-evaluation the classification schemes being used for this period in the Northwestern Plains. Though there is clearly regional variability, as well as site activity related differences, the Fincastle assemblage matches best with other Outlook sites.

Conclusion

Around 2500 B.P., a group of sufficient size made a substantial kill by ambushing a herd of bison watering in a marshy, interdune area in southern Alberta in the late summer or early fall. They carried out primary (carcass disarticulation) and secondary butchering operations (meat stripping, tongue removal, marrow extraction, and grease rendering), as well as preliminary hide working. This particular group had access to Knife River Flint from distant sources in North Dakota. Whether they originated in that region or acquired raw materials through trade, travel, or some other form of social interaction, Knife River Flint was used to prepare most of their tools before the kill. Locally available toolstones were utilized for only a few of the expedient tools. Both the prevalence of Knife River Flint and bone uprights suggest some type of cultural connection with the Middle Missouri region.

Acknowledgements

The Fincastle project is a team effort. More than 100 undergraduate students and volunteers participated in the excavation seasons and many of them assisted with the processing and analysis of the cultural remains. Six graduate students have written theses on the site, which have significantly contributed our understanding of these ancient hunters. Jack Brink and Bob Dawe (at the Royal Alberta Museum) provided continuous support and guidance, as have Jack Ives (now at the University of Alberta), Trevor Peck, Wendy Unfreed, Brian Ronaghan, and David Link at the Archaeological Survey of Alberta. John Fisher, Jack Ives, Marcel Kornfeld, Elizabeth Lynch, and Allison Grunwald provided many helpful comments on earlier drafts of this paper. Funding was received from the Social Sciences and Humanities Research Council of Canada (SSHRC: 833-2003-1030), Alberta Community Development, the University of Lethbridge, and the Archaeological Society of Alberta.

References cited

Akridge, Glen D., and Paul H. Benoit (2001) Luminescent Properties of Chert and Some Archaeological Applications. *Journal of Archaeological Science* 28:143–151.

Alberta Environmental Protection (1997) The Grassland Natural Region of Alberta. Alberta Environmental Protection, Natural Resources Service, Recreation and Protected Areas Division, Natural Heritage Protection and Education Branch. Edmonton, Alberta. Electronic document, http://tpr.alberta.ca/parks/heritageinfocentre/docs/Grassland_Natural_Region_of_Alberta_Report.pdf, accessed October 25, 2012.

Beaty, Chester B. (1975) *The Landscapes of Southern Alberta: A Regional Geomorphology*. University of Lethbridge Production Services, Lethbridge, Alberta.

Bluemle, John P. (1993) State Rocks, Minerals and Fossils: A State Rock for North Dakota? *North Dakota Geological Survey Newsletter* 20:4–6.

Brink, Jack W. (2008) *Imagining Head-Smashed-In: Aboriginal Buffalo Hunting on the Northern Plains*. Athabasca University Press, Edmonton, Alberta.

Brink, Jack W., and Robert J. Dawe (1989) *Final Report of the 1985 and 1986 Season at Head-Smashed-In Buffalo Jump, Alberta*. Archaeological Survey of Alberta Manuscript Series No. 16, Alberta Culture and Multiculturalism, Historical Resources Division, Edmonton, Alberta.

Brumley, John H., and Patrick J. Rennie (2005) *Chasing Ancient Shadows: A Culture History Model for the Northwestern Plains*. Manuscript prepared by Ethos Consulting, Havre, Montana.

Campbell, Celine (1997) Postglacial Geomorphic Response and Environmental Change in Southeastern Alberta, Canada. Unpublished Ph.D. dissertation, Department of Earth and Atmospheric Sciences, University of Alberta, Edmonton, Alberta.

Clayton, Lee, W. B. Bickley, Jr., and W. J. Stone (1970) Knife River Flint. *Plains Anthropologist* 15:282–290.

Cloutier, Riel (2004) Testing Contemporaneity: The Avonlea and Besant Complexes on the Northern Plains. Unpublished Master's thesis, Department of Archaeology, University of Saskatchewan, Saskatoon, Saskatchewan.

Davis, Leslie B., and Charles D. Zeier (1978) Multi-Phase Late Period Bison Procurement at the Antonsen Site, Southwestern Montana. In *Bison Procurement and Utilization: A Symposium*, edited by Leslie B. Davis, and Michael Wilson, pp. 222–235. Memoir 14. Plains Anthropologist 23 Part 2. Lincoln, Nebraska.

Duke, Philip G. (1991) *Points in Time: Structure and Event in a Late Northern Plains Hunting Society.* University Press of Colorado, Niwot, Colorado.

Dyck, Ian G. (1983) The Prehistory of Southern Saskatchewan. In *Tracking Ancient Hunters: Prehistoric Archaeology in Saskatchewan*, edited by Henry T. Epp, and Ian G. Dyck, pp. 63–139. Saskatchewan Archaeological Society, Saskatoon, Saskatchewan.

Dyck, Ian G., and Richard E. Morlan (1995) *The Sjovold Site: A River Crossing Campsite in the Northern Plains*. Mercury Series Paper No. 151, Archaeological Survey of Canada, Canadian Museum of Civilization, Hull, Quebec.

Eyles, Nick, Joe I. Boyce, and Rene W. Barendregt (1998) Hummocky Moraine: Sedimentary Record of Stagnant Laurentide Ice Sheet Lobes Resting on Soft Beds. *Sedimentary Geology* 123:163–174.

Foreman, Christine (2010) Besant Beginnings at the Fincastle Site: A Late Middle Prehistoric Comparative Study on the Northern Plains. Unpublished Master's thesis, Department of Geography, University of Lethbridge, Lethbridge, Alberta.

Frison, George C. (1971) The Buffalo Pound in North-Western Plains Prehistory: Site 48CA302, Wyoming. *American Antiquity* 36:77–91.

Frison, George C. (1973) *The Wardell Buffalo Trap (48SU301): Communal Procurement in the Upper Green River Basin, Wyoming*. Anthropology Papers No. 48, Museum of Anthropology, University of Michigan, Ann Arbor, Michigan.

Frison, George C., and Charles A. Reher (1970) Appendix I: Age Determination of Buffalo by Teeth Eruption and Wear. In *The Glenrock Buffalo Jump, 48CO304: Late Prehistoric Period Buffalo Procurement and Butchering*, edited by George C. Frison, pp. 46–50. Memoir 7. Plains Anthropologist 15 Part 2. Lincoln, Nebraska.

Frison, George C., and Lawrence C. Todd (1987) *The Horner Site: The Type Site of the Cody Cultural Complex*. Academic Press, Orlando, Florida.

Fuller, William A. (1959) The Horns and Teeth as Indicators of Age in Bison. *The Journal of Wildlife Management* 23:342–344.

Galbraith, Rex F., Richard G. Roberts, G. M. Laslett, H. Yoshida, and Jon M. Olley (1999) Optical Dating of Single and Multiple Grains of Quartz from Jinmium Rock Shelter, Northern Australia: Part I, Experimental Design and Statistical Models. *Archaeometry* 41:339–364.

Grasby, Stephen E., Eugene M. Gryba, and Ruth K. Bezys (2002) A Bedrock Source of Swan River Chert. *Plains Anthropologist* 47:275–281.

Gregg, Michael L. (1987) *Archaeological Excavation at the Naze Site (32SN246)*. National Technical Information Service, Operations Division, Springfield, Virginia.

Gruhn, Ruth (1969) *Preliminary Report on the Muhlbach Site: A Besant Bison Trap in Central Alberta*. Paper No. 4. National Museums of Canada Bulletin 232, Contributions to Anthropology VII: Archaeology, Ottawa, Ontario.

Harris, Stuart A. (1985) Evidence for the Nature of the Early Holocene Climate and Paleogeography, High Plains, Alberta, Canada. *Arctic and Alpine Research* 17:49–67.

Head, Thomas, Brent Murphy, and Thayer Smith (2002) *Historical Resources Impact Mitigation, EgPn-111*, ASA Permit No. 2000-097 (Incorporating Work from ASA Permit 1998-024). Archaeological Survey of Alberta, Edmonton, Permit No. 1998-024. Copies available from the Archaeological Survey of Alberta, Edmonton.

Hjermstad, Benjamin E. (1996) The Fitzgerald Site: A Besant Pound and Processing Area on the Northern Plains. Unpublished Master's thesis, Department of Anthropology and Archaeology, University of Saskatchewan, Saskatoon, Saskatchewan.

Johnson, Eldon A. (1983) EdOh-23: A Besant Site in the Great Sand Hills. *Saskatchewan Archaeology* 4:41–43.

Joyes, Dennis C. (1984) Review of Culture Change on the Northern Plains: 1000 B.C. – A.D. 1000. *Plains Anthropologist* 29:167–170.

Kirchmeir, Peter F. R. (2011) A Knife River Flint Identification Model and Its Application to Three Alberta Ecozone Archaeological Assemblages. Unpublished Master's thesis, Department of Anthropology, University of Alberta, Edmonton.

Lieff, Sam (2006) Applications of Geographic Information Science in the Archaeological Research of the Fincastle Kill Site (DlOx-5), Alberta, Canada, and Tel Beth-Shemesh, Israel. Unpublished Master's thesis, Department of Geography, University of Lethbridge, Lethbridge, Alberta.

Meltzer, David J., Lawrence C. Todd, and Vance T. Holliday (2002) The Folsom (Paleoindian) Type Site: Past Investigations, Current Studies. *American Antiquity* 67:5–36.

Miller, James C. (2010) Lithic Resources. In *Prehistoric Hunter-Gathers of the High Plains and Rockies*. 3rd ed. by Marcel Kornfeld, George C. Frison, and Mary Lou Larson, pp. 553–598. Left Coast Press Inc., Walnut Creek, California.

Mills, Tammi (2009) A GIS Analysis of the Fincastle Site. Unpublished Master's thesis, Department of Geography, University of Lethbridge, Lethbridge, Alberta.

Morlan, Richard E. (1988) Avonlea and Radiocarbon Dating. In *Avonlea Yesterday and Today: Archaeology and Prehistory*, edited by Leslie B. Davis, pp. 291–309. Saskatchewan Archaeological Association, Saskatoon, Saskatchewan.

Neuman, Robert W. (1975) *The Sonota Complex and Associated Sites on the Northern Great Plains*. Publications in Anthropology 6, Nebraska State Historical Society, Lincoln, Nebraska.

Niven, Laura B., Charles P. Egeland, and Lawrence C. Todd (2004) An Inter-site Comparison of Enamel Hypoplasia in Bison: Implications for Paleoecology and Modeling Late Plains Archaic Subsistence. *Journal of Archaeological Science* 31:1783–1794.

Peck, Trevor R. (2011) *Light from Ancient Campfires: Archaeological Evidence for Native Lifeways on the Northern Plains*. Athabasca University Press, Athabasca University, Edmonton, Alberta.

Ramsey, Allyson M. (1991) The Melhagen Site: A Besant Bison Kill in South Central Saskatchewan. Unpublished Master's thesis, Department of Anthropology and Archaeology, University of Saskatchewan, Saskatoon, Saskatchewan.

Reeves, Brian O. K. (1969) The Southern Alberta Paleo-Cultural - Paleo-Environmental Sequence. In *Post-Pleistocene Man and His Environment on the Northern Plains*, edited by Richard G. Forbis, Leslie B. Davis, Oscar A. Christensen, and Gloria G. Fedirchuk, pp. 6–46. University of Calgary Archaeological Association, The Students' Press, Calgary, Alberta.

Reeves, Brian O. K. (1978) Head-Smashed-In: 5500 Years of Bison Jumping in the Alberta Plains. In *Bison Procurement and Utilization: A Symposium*, edited by Leslie B. Davis, and Michael Wilson, pp. 151–174. Memoir 14. Plains Anthropologist 23 Part 2. Lincoln, Nebraska.

Reeves, Brian O. K. (1983a) *Culture Change in the Northern Plains: 1000 BC – AD 1000*. Archaeological Survey of Alberta Occasional Paper, No. 20, Archaeological Survey of Alberta, Edmonton, Alberta.

Reeves, Brian O. K. (1983b) The Kenney Site: A Stratified Campsite in Southwestern Alberta. *Archaeology in Montana* 24:1–135.

Reher, Charles A., and George C. Frison (1980) Analysis of the Bison Mandibles. In *The Vore Site 48CK302: A Stratified Buffalo Jump in the Wyoming Black Hills*, edited by Charles A. Reher, and George C. Frison, pp. 59–94. Memoir 16. Plains Anthropologist 25 Part 2. Lincoln, Nebraska.

Shetsen, Irina (1987) *Quaternary Geology, Southern Alberta*. Alberta Research Council, Edmonton, Alberta, scale 1: 500 000.

Shortt, Mack W. (1993) The Happy Valley Bison Kill. Unpublished Master's thesis, Department of Archaeology, University of Calgary, Alberta.

Skinner, Craig E., and Jennifer J. Thatcher (2009) *X-Ray Fluorescence Analysis of Artifact Obsidian from the Fincastle Bison Kill site (DlOx-5), Alberta, Canada*. Northwest Research Obsidian Studies Laboratory Report 2009-104, Corvallis, Oregon.

Soil Classification Working Group (1998) *The Canadian System of Soil Classification*, 3rd edition. Agriculture and Agri-Food Canada Publication 1646, NRC Research Press, Ottawa, Ontario.

Syms, E. Leigh (1977) Cultural Ecology and Ecological Dynamics of the Ceramic Period in Southwestern Manitoba. Memoir 12. *Plains Anthropologist*. 22(76, Part 2):1-160.

Thomas, David H. (1978) Arrowheads and Atlatl Darts: How the Stone Got the Shaft. *American Antiquity* 43:461–472.

Todd, Lawrence C., David J. Rapson, and Jack L. Hofman (1996) Dentition Studies of the Mill Iron and Other Early Paleoindian Bison Bonebed Sites. In *The Mill Iron Site*, edited by George C. Frison, pp. 145–175. University of New Mexico Press, Albuquerque.

Varsakis, Irene (2006) Besant Revisited: The Fincastle Site (DlOx-5) and Archaeological Cultures on the Northwestern Plains, 2500 B.P. – 1250 B.P. Unpublished Master's thesis, Department of Geography, University of Lethbridge, Lethbridge, Alberta.

Vickers, J. Roderick (1986) *Alberta Plains Prehistory: A Review.* Occasional Paper No. 27, Archaeological Survey of Alberta, Edmonton, Alberta.

Walde, Dale, David Meyer, and Wendy Unfreed (1995) The Late Period on the Canadian and Adjacent Plains. *Journal of American Archaeology* 9:7–66.

Watts, Angela (2008) A Comprehensive Analysis of the Butchering Activities Performed at the Fincastle Bison Kill Site (DlOx-5). Unpublished Master's thesis, Department of Geography, University of Lethbridge, Lethbridge, Alberta.

Wettlaufer, Boyd N. (1955) *The Mortlach Site in the Besant Valley of Central Saskatchewan*. Anthropological Series No. 1, Department of Natural Resources, Regina, Saskatchewan.

Wolfe, Stephen A., Jeff Ollerhead, David J. Huntley, and Celine Campbell (2002) *Late Holocene Dune Activity in the Duchess Dune Field, Alberta*. Geological Survey of Canada, Current Research 2002-B3.

Notes on contributor

Shawn Bubel completed his PhD in geoarchaeology at KU Leuven Belgium in 2002, and is currently an associate professor of archaeology in the geography department at the University of Lethbridge, Alberta. He has worked at a number of sites in western Canada, Belgium, France, Poland, Israel, Turkey, and Egypt, and has been directing the Fincastle excavation project since 2003. Correspondence to: Shawn Bubel, Department of Geography, University of Lethbridge, 4401 University Drive, Lethbridge, Alberta T1K 3M4, Canada. Email: bubest@uleth.ca