

HEAD-SMASHED-IN BUFFALO JUMP, SEASONALITY AND SETTLEMENT STRATEGIES ON THE CANADIAN PLAINS

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Abstract. Head-Smashed-In Buffalo Jump is a major Bison communal kill site on the western Canadian Plains that has been used for over 5000 years. The paper examines seasonal patterns of use at Head-Smashed-In and surrounding archaeological sites to assess whether or not bison on the Canadian Plains moved from a summer range on the open grasslands to a winter range in wooded areas, particularly the foothills on the western margin of the Plains. Through multiple lines of evidence including First Nations oral traditions, European records, bison butchering patterns, tooth wear, dental cementum increment analysis, stable carbon isotope analysis, and phytoliths, it is shown that Plains people did employ a seasonally shifting exploitation pattern in this area and that bison seasonal movement was a significant factor in this seasonality.

Résumé. Head-Smashed-In Buffalo Jump est un site d'abattage communautaire majeur, localisé dans les plaines de l'Ouest canadien, qui a été utilisé pendant plus de 5000 ans. L'article examine les schémas saisonniers d'exploitation à Head-Smashed-In et dans les sites archéologiques avoisinants, pour évaluer si les bisons dans les plaines canadiennes ont migré ou non, depuis un habitat estival de prairies vers un habitat hivernal boisé, plus particulièrement, les contreforts de la limite occidentale de la plaine. A travers un ensemble d'approches, incluant les traditions orales des Premières Nations, les documents européens, les modalités de boucherie du bison, l'usure des dents, la cémento-chronologie, l'analyse isotopique du carbone et les phytolithes, il est montré que les autochtones ont employé un mode d'exploitation itinérant saisonnier dans cette région et que les déplacements saisonniers du bison étaient un facteur significatif dans cette saisonnalité.

Bison hunting on the North American Plains has served as a model for many of our archaeological notions about big game hunting strategies and organization in the past. Earlier European romantic notions of life in the New World resulted in many accounts of bison hunting in explorer and adventurer journals (e.g. Dodge 1959), but the horse preceded these Europeans onto the Plains and so what these recorders saw was not quite the same as what had been ongoing for millennia before their arrival. The controversy about what bison behaviour was and how First Nations responded in their settlement and hunting strategies began then and has continued to the present (e.g. Roe 1970). Early researchers of bison behaviour, historians and zoologists, even debated whether bison moved across the entire expanse of the Plains from north to south annually, a notion ultimately rejected (Roe 1970:539-542, 594-595).

Work on the Canadian Plains since the 1970's (Arthur 1975, 1978; Morgan 1979, 1980) has suggested that Northern Plains people such as the Blackfoot followed a seasonal round from open grassland camps in the summer to more sedentary camps that were considered their "home" camps in the well treed valleys and prairie margins - foothills and parkland - in the winter. The human pattern was seen as largely a response to seasonal movements of bison, the main component in the subsistence. Winter camps were used from

late October or early November, when the bison moved into their winter range in the sheltered areas, through to about March when the bison moved out onto their summer range. Winter camps were selected for good water, good supplies of wood (for fires and to build pounds), and good grass for the horses. From March through to June hunting was as scattered groups on the open prairie. After the summer ceremonies ("Sun Dance") communal hunts were organized. The bison bulls were in their prime in early summer and large herds were gathering for the rutting season in mid to late summer. Finally, the most important hunting season was in the fall when female bison were in their prime (Ewers 1958:88-91; Verbicky-Todd 1984:4-6; Wissler 1986b:20-21). Research on the Southern Plains (Bamforth 1988) has also documented a seasonal movement of bison, although the factors involved in the shifting range are different.

More recently it has been suggested that this small scale movement on the Canadian Plains, over a few tens or hundreds of kilometers annually between a summer range and a winter range, is also incorrect (Malainey & Sheriff 1996). This notion has in turn not been without opposition (Peck 2004; Vickers & Peck 2004). All of these interpretations of past bison movement and human behaviour, while employing various types of data as the basis for inferences, rely heavily on historic records and often utilize the same observers and events

to support opposing positions on the matter (e.g. Malainey & Sherriff 1996:333-346; Peck 2004:92-97). This situation draws attention to the fact that, as Peck appropriately notes (2004:92), careful reading of the historic records is necessary. It also illustrates why alternative sources of information are needed to assist in understanding these issues.

Ethnographic studies of Plains people provide a somewhat different perspective of traditional life since they rely much more on First Nations testimony. Generalized lifeways recorded in ethnographies support the notion of Northern Plains summer camps being on the open plains and winter camps usually being located in wooded river valley areas where water, horse pasture, and bison were also usually located (e.g. Ewers 1958:88-94; Verbicky-Todd 1984:5-7; Wissler 1986a:114-115). Contact period photographs and paintings also bring a different perspective to this documentation, since the artists who produced these records often had quite different interests and experiences compared with the fur traders, military men, and missionaries who created most of the documentary record. Karl Bodmer's paintings of a Sioux summer camp (Taylor 1991:94) and an Assiniboine summer camp (Thomas & Ronnefeldt 1976:70-71) in 1833 illustrate the summer pattern well, although the Assiniboine camp location may have also been influenced by the nearby location of a fort rather than strictly traditional considerations. The 1874 photograph taken by the International Boundary Commission in southern Alberta (fig. 1) shows a Blackfoot summer camp in the grasslands as does a 1904 Edward Curtis photograph of an Atsina (Gros Ventre) family (Taylor 1991:66). Taylor (1991:89) also shows a ca. 1910 Crow camp in Montana that is on a flowing Little Big Horn River but with no leaves on the trees, signifying a fall or spring encampment in a sheltered riverine area as expected based on this model. Bodmer painted a snow-covered Hidatsa village in the trees (Glenbow Archives NA-2021-13) and Curtis photographed a mounted Crow warrior in the snow and trees (Glenbow Archives NA-1700-8) as well as a Crow woman surrounded by snow holding a stack of firewood while standing beside her tipi (Glenbow Archives NA-1700-7), these three images showing the location of winter camps in riverine wooded areas. An 1875 drawing by Richard Nevitt of the North West Mounted Police near Calgary in southern Alberta (fig. 2) similarly shows a winter camp in a wooded area. Summer camps might also be present on rivers, not surprisingly, as exemplified

by Edward Curtis photographs (e.g. Bryan 1967:289) as well as an illustration in McClintock (1968:407).

Historic records are filtered through European perspectives, are generally written for a European audience, and are often based on only a very short time in the region, the latter particularly significant (e.g. Roe 1970:531-533). An obvious balance can be found in more direct First Nations accounts, observations from the people involved in the phenomenon, and involved over many generations.

Winter counts, hides or other documents that enumerated the years by significant events each year, are examples of First Nation documentary records. In recording these events reference is sometimes made to where and when important events occurred. Looking only at Blackfoot accounts, any references I could find specifically linked to winter camps and a location indicated their presence in river valleys or other woodland sheltered areas. Summer camps might also be there, but some were also out on the open plains. Wissler (1986b:45-50) recorded two Montana Blackfoot winter counts prior to 1911, one by Elk-horn that begins in 1845 and is 56 years long and another by Big-brave that is 61 years long.

In 1847 Elk-horn "...spent most of the winter on the Marias [River]...", in 1849 he "Wintered on the Teton [River]...", then in 1854 "...spent spring on the Marias [River]...", and in 1857 had a "...summer camp on the northeast side of Sweet Grass Hills (Canada)" (1986b:45-47). The two examples that are winter camps with known locations were on rivers where the supply of wood, water, and grass would have been good and so they follow the commonly accepted pattern. The spring camp also represents the traditional pattern. The one identified summer camp may have had similar resources to the winter camps, but the grasslands also meet the hills here. However, it was not uncommon to have summer camps in similar local environments to typical winter camps if bison were present since water, in particular, was still a necessary resource. These camps illustrate that summer camps might be placed in more favourable locations as well, but winter camps had particularly stringent requirements.

Similarly, two of the three camps that can be identified in Big-brave's account are winter camps. In one the "...Peigan



Figure 1. International Boundary Commission photograph of Blackfoot summer camp in southern Alberta, 1874 (Glenbow Archives NA-249-78).



Figure 2. Richard Nevitt (North West Mounted Police) 1875 drawing of a Blackfoot winter camp near Calgary, Alberta (Glenbow Archives NA-1434-28).

wintered on the Marias River..." and for the other "That winter, Mountain-chief spent on Belly River". Big-brave's account also includes a year when "In the summer, the Blood camped at Yellow Mountains..." (1986b:48-50), again showing perhaps that the summer pattern is more subject to variation. The later portion of Big-brave's account is on the Reservation and he notes he and many other Blackfoot spent 7 winters and summers on Birch Creek, then he moved to Blacktail Creek and wintered there, then he lived 2 winters and summers on White Tail Creek, and then he moved back to Blacktail Creek where he spent 19 winters and summers. Clearly the Reservation period alters the pattern somewhat, since the Blackfoot were obliged to stay on the Reservation, but it is significant that they chose their "home camp" location on the river, where all resources needed for all seasons were available.

War exploits were also recorded by Plains men, sometimes on bison robes, sometimes on tipi covers, and particularly as oral accounts recited at various events such as in coup counting. Again, Wissler (1986b:33-36) recorded two of these that each made mention of a camp location and season. In Strange Wolf's account he mentions a raid on an Assiniboine camp on a river when it was very cold and snowing, clearly a winter camp (1986b:34). Similarly, Many White Horses recounts a raid on a Flathead camp on a river and that the raiding party was subsequently snowed on (1986b:35-36).

But perhaps the best sources for a direct indication, particularly in pre-horse times, are the incidental mentions of camp locations in oral traditions ("legends"). These place events in the First Nations landscape, Blackfoot for example. They are long-standing traditions, passed orally from generation to generation, that generally reach back to much earlier, pre-horse and pre-gun times. They record events and scenes in a manner that is familiar and appropriate to the First Nation peoples in question - truly their perspective - in a manner that teaches what European researchers would term historical facts. These likely represent the only true pre-contact records aside from archaeology. My examination included only Blackfoot traditions recorded by Wissler and Duvall (1995) about AD 1900. A number of these traditions had some references to events associated with camps in particular locations, sometimes with an indication of the time of year or type of event.

All the accounts specifically linked to winter events occurred in river valleys or similar areas that fit with the notion that winter camps were in wooded areas. In a tradition Wissler and Duvall (1995:71-72) call "The Bunched Stars", about the origin of the Pleiades, there was a spring Peigan camp engaged in hunting bison for hides. As a result of the request of six brothers water was taken from the people for seven days and the people responded by taking two camp dogs down to the now dry river bed to have them dig for water. This, then, is clearly a spring camp in a river valley. Another Peigan tradition Wissler and Duvall record is the origin of the buffalo calling stone, or iniskim (1995:85-87). The event occurs while the Peigan are camped on a river and when Weasel-Woman is walking among logs by the river, gathering firewood. She begins picking some white berries and then

she hears a singing. What type of berries she is collecting is not mentioned, but they would probably be snowberries or red-osier dogwood berries. Regardless, these would not be available in spring or early summer, hence this river camp must have occurred sometime between late summer and winter; late summer to fall might be most likely since there is no mention of snow or cold weather. The "Bear-knife" tradition (1995:95) records that a hunter of mixed Tsuu T'ina and Peigan heritage, hunting in the winter, becomes disoriented in a blizzard and looks for shelter "...in the brush and timber...". This is clearly a reference to winter hunting and probably a nearby camp in a wooded area. In the tradition about the origin of the medicine shields (1995:101-102), at a spring camp a man kills his wife; her body is left in the camp to later be found by buffalo who bring her back to life. At this point they use medicine shields to allow her to cross the river, showing that this spring camp is in a river valley.

In the North Peigan tradition of the origin of the Horn and Matoki societies (1995:119-120) the people are camped at a time of year that is clearly not winter and there is no mention of any river or woods. The people travel but hide as they move by covering themselves with grass. This seems to be a summer camp in grasslands, as expected.

Oral traditions confirm that winter and spring camps were in wooded riverine areas and summer camps, at least sometimes, were on the open prairie. These teach history and hence reflect the usual Blackfoot cultural pattern.

Archaeology also, of course, can contribute to this debate in a number of ways. Various lines of evidence from western Alberta, particularly that at Head-Smashed-In Buffalo Jump and in the surrounding area, provide a good assessment of this in the same area the Blackfoot have long inhabited. Head-Smashed-In is in the Porcupine Hills in the foothills of the Rocky Mountains in southwestern Alberta. It is on the edge of the grasslands and aspen parkland, and 2-3km from the Oldman River (fig. 3).

Dental cementum increment analysis (*e.g.* Burke & Castanet 1995; Lieberman 1994; Peck 2004) has been used in a number of species to define season of death and age in mammals. Peck (2004) undertook such an analysis in southern Alberta. Included in his sample were eight specimens from my excavations at Head-Smashed-In of which six gave interpretable results. Five of these identified the season as between late October and late March (*i.e.* winter) and the other gave a result between mid-June and mid-October (summer to fall, but could not be isolated within that time) (2004:133). In Peck's larger study his foothills and parkland sites were all dominated by winter kills and the only sites with summer kills were well out on the open prairie away from these zones (2004:145). This confirms the dominant pattern of wintering - bison and the hunters that pursued them - in the sheltered areas, mainly in the foothills and parkland. Peck's study also showed the wintering pattern extending into the riverine woodlands.

The more traditional approach that has been used in assessing seasonality on the North American Plains is tooth eruption



Figure 3. Looking from the cliff top, Head-Smashed-In Buffalo Jump, across pow-wow ground to the Old Man River.

and wear schedules (e.g. Frison & Reher 1970; Reher & Frison 1980; Reher 1970). Brumley (1995:66, 137-138) employed tooth eruption and wear, and fetal bison bone, to give estimates for season of use for a number of sites in the Oldman River Dam project area just west of Head-Smashed-In. His conclusion (1995:66) from this study was that there was "...a trend for essentially similar levels of cultural use of the OMRD [Old Man River Dam] Archaeological Project Area during the fall, winter, and spring, with a significant reduction in levels of use during the summer season". This area is in the foothills that the conventional model would see as the traditional late fall through early spring bison habitat and hence human settlement area. My work at Head-Smashed-In, based on tooth eruption and wear, shows a comparable pattern. Of 89 mandibles dating between 1100 and 1300 BP that could be assigned an age, only 13 indicated a summer death season whereas 22 indicated a fall death, 38 a winter death, and 16 a spring death. Both of these data sets corroborate the seasonal use pattern seen in the other data sets, of a use of the wooded areas from fall through spring and a general absence of use of these habitats in the summer when presumably people moved east onto the open plains to hunt bison as the animals moved into their summer range.

Archaeological butchering pattern analysis has some potential to illuminate season of site use. Morlan (1994:773) has noted that green bone fracture (bone broken culturally, while it is fresh) through the articular ends of long bones is probably the result of breaking frozen bone. This obviously can only occur during the winter and hence is an indication of use of a site during the winter (although this does not eliminate the possibility of the site also being used in other seasons). He noted these patterns were particularly seen in the distal tibia and in the proximal end of the radius, metacarpal, and metatarsal. I examined these 4 elements in the Head-Smashed-In assemblage and found frequencies of 1-5% of these fragments exhibited green bone fractures through these specific ends: 5% for the radius proximal end (46 of 919 total fragments), 2% for the metacarpal (14 of 744 total fragments) 1% for the tibia (9 of 992 total fragments), and 2% for the metatarsal (14 of 660 total fragments). These figures show at least some use of Head-Smashed-In during weather that was cold, and cold for long enough that bones and carcass portions froze—mainly winter, but also perhaps late fall or early spring.

Stable isotope analysis can also provide insight into season of site use, when employed in conjunction with phytolith analysis and an understanding of plant biogeography.

Plants have different photosynthetic pathways, the ways they fix carbon into sugars, the main ones being C_3 and C_4 (Christholm 1989). The amount of C_3 and C_4 plants an animal ate can be approximated by the amount of various carbon isotopes in its bone, since each photosynthetic pathway discriminates differently against the heavier carbon isotopes. The measure of this is the $\delta^{13}C$ value and if an animal like a bison ate pure C_3 plants its bone would have a value of close to -21.5% . Conversely, if this animal ate a pure C_4 plant diet it would have a value of close to -7.5% (Varney *et al.* 2001:3-4).

C_4 plants are mainly subtropical arid-adapted plants and in Alberta are rare, found only in the southern portion of the province and mainly in the southeast part of the province. The only widespread, common C_4 plant is blue grama grass (*Bouteloua gracilis*) and if Alberta bison were eating any C_4 plants this would be the only one of consequence.

Stable carbon isotope analysis (Varney *et al.* 2001) of a sample of 36 buffalo bones from Waterton Lakes National Park, just southwest of Head-Smashed-In, was recently undertaken. Two modern bison from the Park eating only C_3 plants gave values of -20.5% , indicating a baseline for a pure C_3 diet. Although 2 of the 34 pre-European age samples gave comparable values (-20.9%), 32 gave less negative values indicative of a C_4 diet contribution of between about 5% and 15% ($\delta^{13}C$ values of between -19.7% and -18.8%). Presently there are no C_4 plants in the park. This indicates that these bison must have been migrating to the east out of the Park at some time during the year, probably during a summer movement onto the open plains, if blue grama grass was not present in the current Park area during the recent past. This latter facet of palaeoenvironment was tested by phytolith analysis.

Phytoliths are silica deposits in plant cells, infillings in cells or encrustations on the exterior of cells, that are a mold or cast of the original cell (Pearsall 2000:356). Their composition of essentially pure SiO_2 makes them very resistant to degradation of any kind and they readily survive in most sedimentary contexts. The phytolith data add support to the notion that no C_4 plants were present in the Park in earlier times. Blue grama grass has a very distinctive saddle phytolith (fig. 4) and my work on a series of samples covering the past 2000 years (Kooyman 2000) show none of these phytoliths in sediments from 2 sites in Waterton National Park. Rather, the contemporary dominance of fescue grass and aspen poplar is seen. Further to this point, my phytolith research on sediments from Head-Smashed-In Buffalo Jump 30km east of Waterton Park showed this phytolith was present but rare (fig. 5) in comparable age sediments. This shows that for bison to consume the level of C_4 plants indicated by the isotope data, they would have had to migrate even further to the east. This supports the notion of a more substantial migration of bison from a wintering to a summering range, the latter likely in the short grass prairie of southeastern Alberta. Based on generations of observing this behaviour, it is probable that

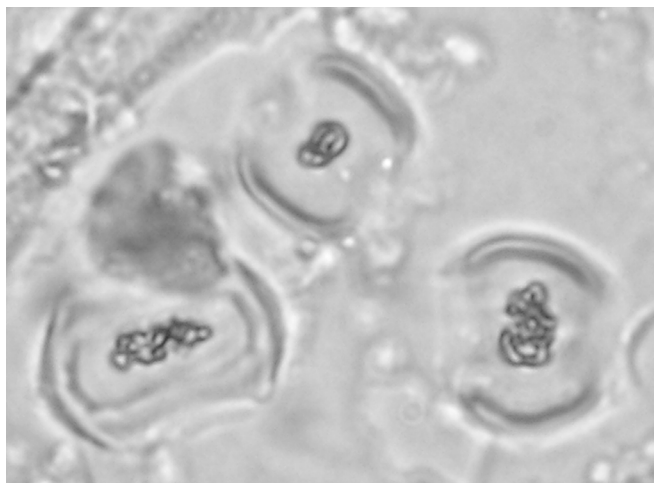


Figure 4. Modern comparative blue grama (*Bouteloua gracilis*) distinctive saddle phytolith.

the First Nations people relying substantially on bison as the basis of their subsistence would have employed a similarly seasonally shifting settlement pattern (Peck 2004:111-112; Vickers & Peck 2004:117-118).

Together these lines of evidence from Head-Smashed-In Buffalo Jump and the Canadian Plains - photographic and artistic illustrations, First Nations traditional records, dental cementum increment analysis, tooth eruption and wear data, butchering pattern analysis, stable carbon isotope and phytolith analysis - provide a clear picture of bison seasonal behaviour and how human hunters exploited and responded to this in the past. The pattern was one of bison shifting from summer ranges on the more open grasslands to winter ranges in more wooded areas in river valleys and on the peripheral areas of the Canadian Plains. This is the pattern identified in written European historic records and supported by Peck, Vickers, Morgan, Arthur, and Roe, among others. First Nations people on the Canadian Plains followed a similar seasonal settlement strategy, in part as an adaptive response to this bison behaviour,

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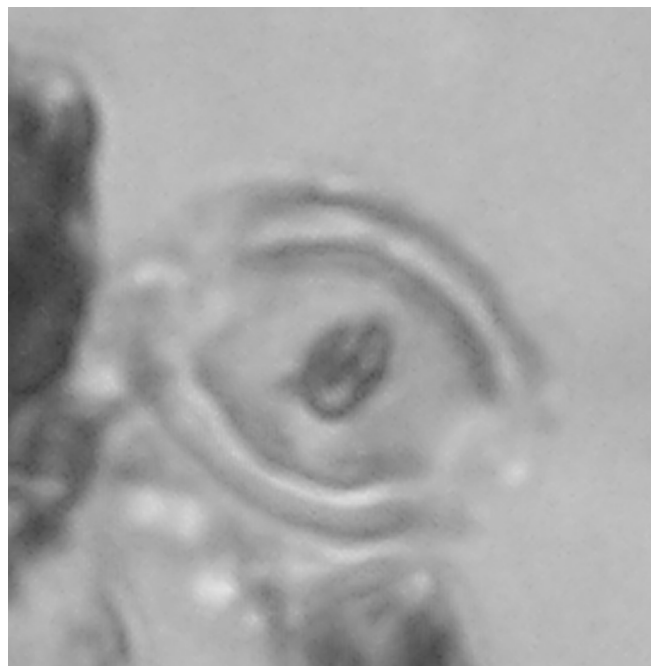


Figure 5. Blue grama (*Bouteloua gracilis*) distinctive phytolith from Head-Smashed-In Buffalo Jump sediments.

but also because it allowed them to access a number of other critical resources such as water and wood.

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