



“Nobody Knows the way of the Caribou”: *Rangifer* hunting at 45° North Latitude

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ABSTRACT

While caribou hunting structures are well known in the circumpolar region, equivalent features are difficult to investigate further south due to significant changes in sea level and subsequent human activity. The discovery of hunting structures on submerged landforms beneath modern Lake Huron provides a new window into caribou hunting in the mid-latitudes. This paper summarizes current findings and considers both the strategies for hunting caribou and the necessary organizational implications for such activities on the Alpena-Amberley Ridge. It is shown that many of the features known in the circumpolar region are also present in the mid-latitudes, but that significant differences are also observed. Many of these differences seem attributable to the seasonal migration of vast caribou herds across the causeway-like setting of the Alpena-Amberley Ridge.

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Nobody knows the way of the wind and the caribou.
Chipewyan proverb (Heard, 1997: 29)

1. Introduction

Caribou were a critically important resource for many prehistoric and historic communities in the northern hemisphere and as such there is an amazing amount of diversity and complexity in caribou exploitation strategies. Ethnographically across the Old and New Worlds, caribou were hunted using both passive and active technologies and occasionally with other animals serving as hunting aids, by individual hunters and large groups of men, women, and children. Passive technologies included traps such as deadfalls and snares as well as trap lines. More active strategies practiced by individual hunters include stalking, simply running down the animal, and the use of structures such as hunting blinds or other shields. Both dogs and domesticated caribou were utilized in hunting wild caribou. Dogs were used primarily to round up caribou, and domesticated individuals were used as decoys to attract wild caribou to be dispatched by waiting hunters. Despite this variability, complex and elaborate drive structures are the most widespread strategy for hunting caribou throughout the northern

hemisphere. These drives generally involved a large number of hunters and their families constructing stone, brush, and dirt structures with the goal of driving large numbers of caribou into the water, into narrow lanes or valleys, nets, or corrals (Spiess, 1979; Riches, 1982: 33–39; Gordon, 1990). While the diversity in these ethnographic examples is great, we can only assume that the variability of caribou hunting strategies represented in the archaeological record will be even greater.

While our understanding of caribou exploitation in the Arctic is greatly supplemented by a vast ethnographic record and detailed knowledge of the animals’ biology and behavior, examinations of prehistoric caribou hunting in the middle latitudes can be problematic for several reasons. First, there is a lack of models of caribou behavior in this geographic zone, since the majority of ethological studies come from arctic environs. Secondly, there are marked differences in barren ground caribou behavior compared to woodland caribou, although both subspecies have been known to migrate great distances (e.g. Kelsall, 1968: 106; Bergerud et al., 1990). Additionally, middle latitude hunting structures, such as drive lanes, hunting blinds, and meat caches, are highly vulnerable to destruction from subsequent development resulting in a picture of reindeer hunting known only from campsites (Benedict, 1996: 2–4). Finally, there is no ethnographic analogy for glacial or post-glacial caribou hunting adaptations at this latitude (Enloe and David, 1997).

Caribou are thought to be one of the primary prey species hunted by Paleoindian and Early Archaic hunters in the Great Lakes

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and Northeast (Simons, 1997). Although caribou remains, as all faunal remains in this region of acid soils, are found only rarely (at the Holcombe Beach site in Michigan (Cleland, 1965), and perhaps from Bull Brook in Massachusetts, Whipple in New Hampshire, and Sandy Ridge in Ontario (Jackson, 1990; Spiess et al., 1998), other lines of evidence including site locations (Roosa, 1977; Gramly, 1982, 1988; Jackson, 1990, 1997; Simons, 1997; Robinson et al., 2009), distributions of lithic material (Ellis, 2011), and technological variation (Johnson, 1996; Newby et al., 2005) have been used to support caribou exploitation. We believe that the hunting structures beneath Lake Huron offer further evidence for prehistoric caribou hunting in subarctic North America.

2. Background to the Alpena-Amberley Ridge and its hunting structures

The Early Holocene in the Great Lakes region is represented by a series of striking fluctuations in the level of the newly formed Great Lakes, driven by the interactions of glacial melt water and isostatic rebound of the land surface. Much of the Paleoindian occupation of the region is associated with the Lake Algonquin high stand (cf. Storck, 1982; Deller and Ellis, 1984, 2011) which lasts until about 10,000 BP (Drzyzga et al., 2012). In the modern Lake Huron basin, Lake Algonquin is followed by the Lake Stanley low stand, roughly 9900 to 7500 BP (Lewis et al., 2007; Lewis and Anderson, 2012) which saw lake levels drop by as much as 100 m. During this low water phase, a huge area of former lake bottom was exposed for human and animal occupation. The basin was divided into two distinct lakes by a rocky outcrop termed the Alpena-Amberley Ridge (AAR) (Fig. 1). This ridge is composed of limestones and dolomites of the Traverse Group (Hough, 1958; Thomas et al., 1973) and would have presented a dry land corridor running diagonally across the Huron basin from Presque Isle in Michigan to Point Clark in southern Ontario.

It is hypothesized that during Lake Stanley times, this ridge would have provided a natural route for the semi-annual migration of caribou herds and that this, in turn, would have attracted human predation. Running northwest to southeast, the AAR would have provided a natural migration route for herds of caribou moving in the autumn to more southerly rutting grounds and then returning north in the spring to calve. Recent research directed at

reconstructing the environment of the ridge during its period of exposure (Sonnenburg, 2012) indicates that the AAR presented a subarctic tundra/taiga type environment with grasses, intermittent marshes, and a thin scatter of coniferous trees. Consistent with this environmental reconstruction, a 1.5 m-long spruce pole and a toppled spruce tree trunk were recovered which yielded radiocarbon dates of 8900 ± 46 and 8829 ± 55 cal BP.

These findings suggest that rather than being one alternative migration route, the ridge may have been a preferred route and destination for migrating caribou, as the cold surrounding waters maintained a tundra-taiga type vegetation much longer than on the mainland, and successional reforestation of the ridge appears to have proceeded at a much slower rate than on mainland Ontario or Michigan. Likewise, the confined nature of the ridge would have provided a substantial element of predictability to herd movement that would have been of great value to ancient hunters.

Archaeological research on the AAR has focused on identifying and mapping stone hunting structures and associated features of the kind known historically and archaeologically from the North American Arctic (O'Shea and Meadows, 2009). The AAR preserves a subarctic landscape that has been untouched by modern development and, due to its mid-lake location, also lacks the deep sediment cover that overlays coastal sites associated with low water stands (cf. Lovis, 1989; Lovis et al., 2005). The ridge also preserves a unique record of caribou hunting associated with the Late Paleoindian and Early Archaic periods in the upper Great Lakes which is very poorly represented on land. The terrestrial investigation of these time periods is hindered not only by modern development, but also by the acidity of the forest soils which rapidly dissolves most faunal remains (see Simons, 1997). Beyond these factors, much of the land surface that represented the prime area for ancient hunter-gatherer exploitation during this time period is now located off shore beneath the Great Lakes.

The sites of the AAR provide a close parallel to more recent caribou hunting sites of the subarctic. They existed within a similar post-glacial landscape with low contours, numerous swamps, marshes and water ways, and abundant stone exposures for the construction of hunting features. These sites at 45°N may provide an even better parallel for Upper Paleolithic reindeer hunters in Central and Western Europe, given their similar latitude, and the potential to exploit the larger and denser herds present in deep prehistory.

3. Hunting sites and structures on the Alpena-Amberley Ridge

The search for caribou hunting features on the Alpena-Amberley Ridge has followed a layered strategy. It began by modeling the ancient land surface and its environment, followed by acoustic survey to locate potential hunting features. Promising acoustic targets were further investigated using a remote operated vehicle (ROV) and by direct examination via SCUBA trained archaeologists. In addition to mapping stone structures and searching for material culture debris, wood and sediment samples were collected in a number of locations. These samples not only provided important environmental data in the form of pollen and testate amoebae, those collected within and around the hunting structures have also yielded water rolled flakes, chert and quartzite micro-debitage, charcoal, bone fragments, and preserved wood. While this search strategy works well for discovering stone arrangements, the pervasive coverage of the bottom with invasive mussel species has made the recovery of less pronounced features or small artifacts much more challenging.

Several types of structures have been identified which can confidently be linked to human hunting activities on the AAR.

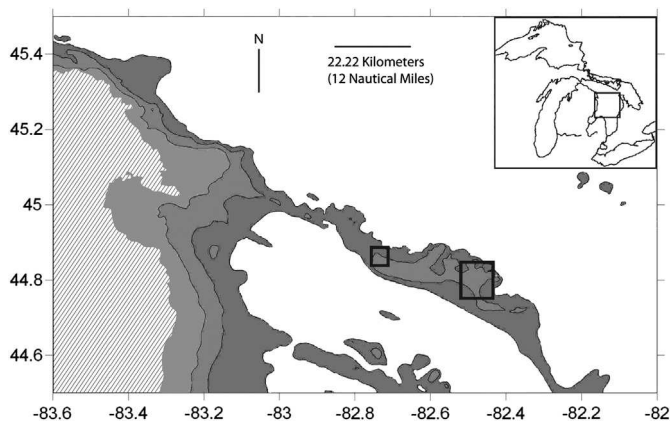


Fig. 1. The Alpena-Amberley Ridge was a dry land corridor with a Lake Stanley elevation of 140 m above mean sea level (modern lake datum is 176 m). The modern land surface is hatched and Lake Stanley stage water is shown in white. The contour interval represented by shading is 10 m. Figure coordinates are represented as degrees North Latitude and West Longitude. The map presents the western (American) half of the ridge and the black rectangles indicate the primary locations where research has been conducted. The larger of the two black squares, Area 1, is 8 km per side, while the smaller square, Area 3, is 4.5 km per side.

These include stone drive lanes, a funnel shaped drive, closed hunting blinds, and open 'V' shaped blinds. A description of the size and form of each hunting structure type is provided. Many of these structures are directionally dependent, in that they will only work if the animals are moving in a particular direction. This physical property of the feature makes it possible to determine whether it was employed during the semi-annual caribou migrations and, if so, to infer the structure's season of use. Although not the immediate focus of the present paper, other constructions have also been identified, including rectangular shaped structures, possibly representing frozen meat caches, and upright standing stones which may have functioned as *inuksuit* (stones used to both attract and channel the movement of caribou).

3.1. Simple closed blinds

A closed blind is one in which the hunter is concealed from all directions by encircling stones. This is achieved by positioning three or more large boulders together, leaving an open space in the center for concealment and openings for egress. This type of blind is well represented by the Dragon Blind, which is composed of a series of three large boulders, with a series of smaller boulders or stones being used to supplement the area of the blind (Fig. 2a). All three main boulders have smaller stones wedged beneath their interior edges, which had the effect of tilting them outward and increasing the interior size of the blind. The main boulders of this blind ranged from 1 to 1.4 m in length, and each stood about 90 cm high. The Dragon Blind was located in a small pocket in a 365 m-long line of stones (Fig. 2b). The blind is located 9 m north of the rock line. The structure is located near the edge of a marsh and, given the alignment of the drive line, would have been useful

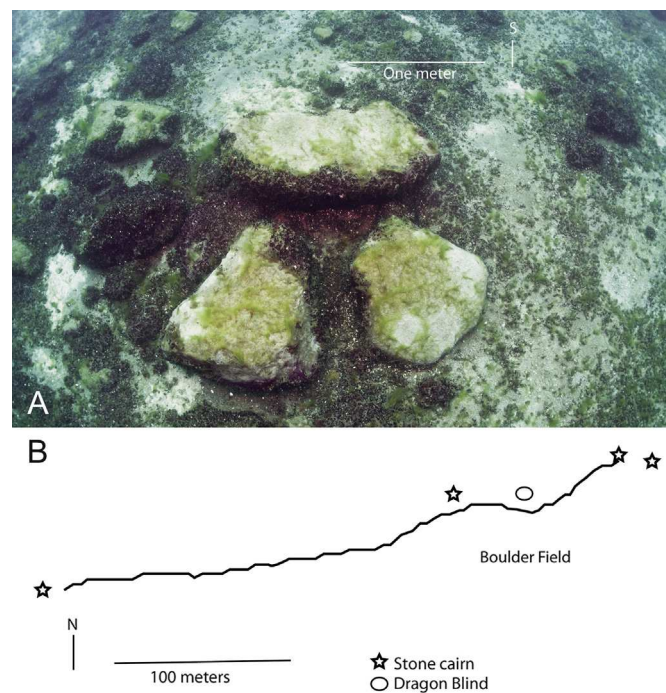


Fig. 2. The Dragon Blind and drive line in Area 1. Fig. 2A is a photograph of the Dragon Blind taken in June of 2011. South is to the top of the photograph and the blind sits in 31 m of water. The photo is used courtesy of Tane Casserley of the Thunder Bay National Marine Sanctuary. Fig. 2B is a plan of the full drive line. The line consists of small rocks and boulders forming a line of 365 m in length which follows the general contour of the landform. Large stones were placed at either end of the drive line and the Dragon Blind occupies a noticeable bulge in the line.

during the autumn migration. While the Dragon Blind was associated with a drive line, similar examples of three or four boulder blinds have been identified that are not associated with constructed drive lines.

3.2. 'V' shaped blinds

'V'-shaped blinds are composed of five or more boulders, typically with a large boulder forming the apex of the 'V', with smaller boulders or rocks forming the out-flaring arms (Fig. 3). The core 'V' on these blinds is sometimes supplemented by further extensions of stone lines, usually with a short break from the main 'V' and often turning outward at a sharper angle than the core 'V'. The stones and boulders used in the construction of the 'V'-blinds are variable, but the apex stones fall in the range of 60–110 cm in height, and the total width of the core blind falls in the range of three to 4 m.

The 'V'-shaped blinds are inherently direction dependent. Of the dozen or so blinds identified to date, the 'V' blinds are not directly associated with constructed drive lines but instead are located at natural constriction points within the landscape. Within such narrowed zones there may be multiple 'V' blinds scattered in depth within the constriction (i.e., not forming a line themselves) and in

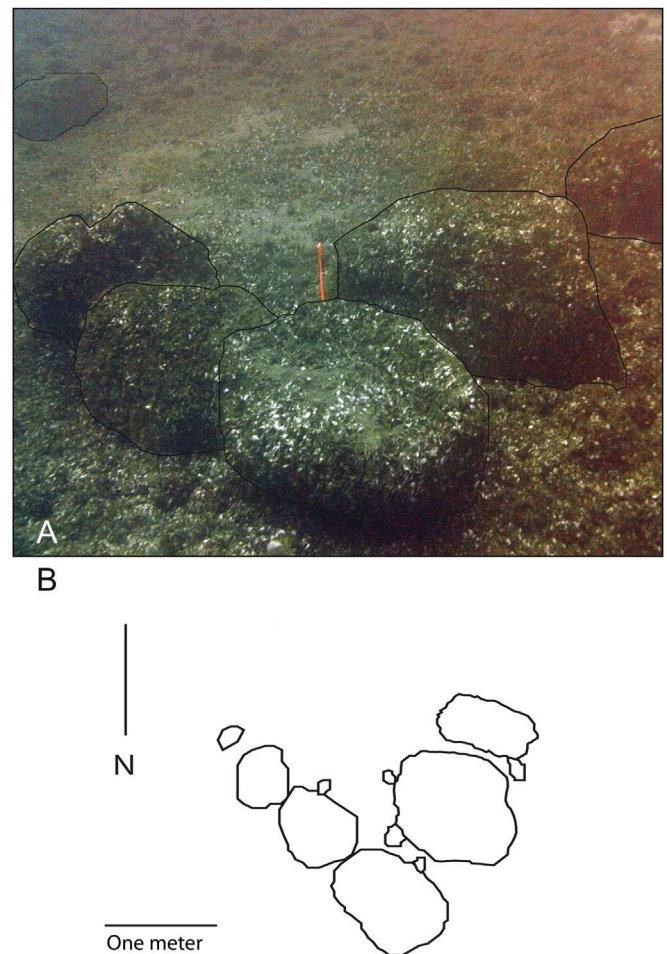


Fig. 3. 'V'-shaped blind. Fig. 3A is a photograph of a blind looking to the south in Area 3. This blind is located in 34 m of water. The outline of the component stones has been highlighted. The floating flagging tape in the center of the blind marks the location of a sediment sample collected from the interior of the blind. Photo is used courtesy of Michael Courvoisier. Fig. 3B is a plan of the same structure with the same orientation.

some areas there may be blinds oriented for both the spring and autumn migrations.

Fig. 4 provides overviews of two such settings. Fig. 4a presents a natural narrowing formed by pairs of low parallel esker or moraine features. These parallel features provide a natural narrowing, and 'V' structures of both a northerly and southerly orientation are located within the narrowed zone. Fig. 4b presents a contrastive setting in which the landform itself narrows sharply with steep banks, such that the animals necessarily had to travel up and over the height. The 'V' structures here take advantage of this narrowing and of local rock outcrops to form a rough line of structures facing the oncoming animals. Acoustic imaging suggests the presence of two converging lines of smaller rocks leading uphill toward the blinds: one 900 m in length, the other 670 m. The opening produced by these converging lines is on the order of 400 m and is unlikely to have created a kill zone, but rather served simply to accentuate the natural topography leading to the hunting sites. It was in this same area that a rectangular structure, interpreted as a cold weather cache, was also located.

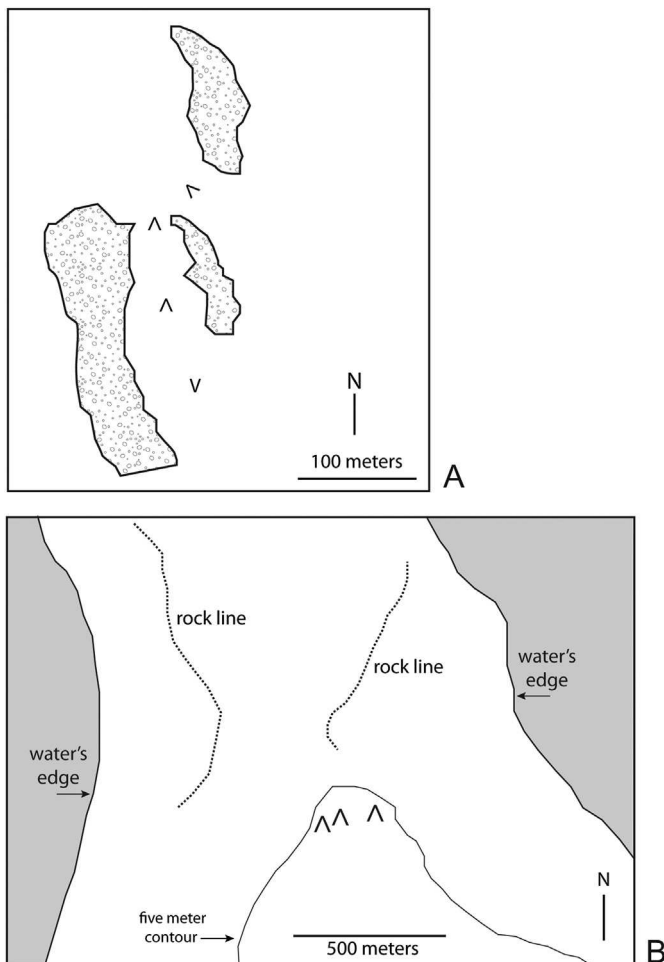


Fig. 4. Two examples of areas containing 'V'-shaped blinds within Area 3. Fig. 4a shows a gap produced by a series of parallel glacial eskers or moraines (hatching). These naturally occurring linear piles of cobbles are from 3 to 5 m high and create narrow channels through which the animals would move. Note the blind near the south end of the channel is oriented to the south. Fig. 4b shows a narrow overlook site where the animals are constrained by steep slopes. Acoustic survey shows two long lines of smaller rocks downhill from the hunting blinds which probably served to help direct the animals towards the hunting blinds. Both drawings are based on a mosaic of acoustic images.

3.3. Funnel-shaped hunting structures

By far the most complex hunting feature identified on the Alpena-Amberley Ridge to date is the Funnel Blind (Fig. 5). This feature is composed of multiple elements. The core funnel is formed by a tightly set line of six boulders on one side (8 m), and an equally solid, but more complex line opposite (9 m), which appears to have functioned as both a blockade and hunting blind. The two converging lines end in a gap of 5 m, although a large stone placed in the middle of this gap, results in two openings of 2.5 m. The complex also incorporates two 'three boulder' blinds similar to the closed blind type already described: one at the far end of the core blind and the other in front of the converging lines. Immediately behind this latter blind is a large stone that may once have stood upright. Beyond the core funnel, lines of spaced boulders extend outward, with one arm anchored on a meter drop off (15 m), and the other (18 m) on an upwardly sloping boulder field at the base of a high ridge.

The orientation of this complex does not neatly fit with an obvious seasonal migration. It is, however, located between a high ridge and a low wetland marsh. The orientation of the feature suggests that the animals may actively have been driven from browsing areas near the wetland towards the high ridge, as caribou are prone to run uphill when frightened (cf. Spiess, 1979: 109) and that as the animals neared this ridge they would have been turned into the funnel structure. Such an operation would imply the involvement of greater numbers of people to move the herd. The number of blinds associated with this structure, and the size of the central blind, similarly suggest the potential involvement of a greater number of hunters.

4. Seasonal associations of the Alpena-Amberley hunting structures

Seasonality is a critical variable for understanding caribou exploitation (Enloe and David, 1997: 53) since it determines the availability, predictability, and quality of the animals (Bouchud, 1953, 1966; Burch, 1972; Spiess, 1979; Gordon, 1988). In terrestrial archaeological sites, even when faunal material is completely lacking, season of use of hunting structures can often be determined with great accuracy (Morrison, 1981: 182). Likewise, in considering the hunting structures identified so far on the AAR, an overwhelming number exhibit an orientation consistent with an autumn migration. This includes both instances of documented drive lines, and the majority of both closed and 'V'-shaped hunting blinds.

An emphasis on autumn hunting is hardly unexpected given ethnographic descriptions of more recent caribou hunters. Autumn is the time when the animals are in their prime, with maximum body weight and fat, and with their skins and sinews at their most desirable (Stefansson, 1951: 337; Reimers and Ringberg, 1983; Blehr, 1990: 320; Enloe, 2003: 24). Autumn migration routes also typically lead to relatively predictable winter ranges (Calef, 1981: 129). For all of these reasons, communal hunting in autumn for furs and surplus meat for winter is a commonly documented activity among northern hunters (Brink, 2005: 16).

The seasonal pattern of structure orientation can also be compared to the predicted movement routes produced by agent-based simulations of caribou movement over the dry land environment of the AAR (Reynolds et al., 2011; Jin, 2012). Creating rules for the individually simulated caribou requires extracting the minimum decision rules needed to realistically represent individual caribou behavior and movement. Once this is accomplished, the caribou are allowed to 'learn' the environment via multiple simulated iterations through the AAR corridor. Over a large number of trials,

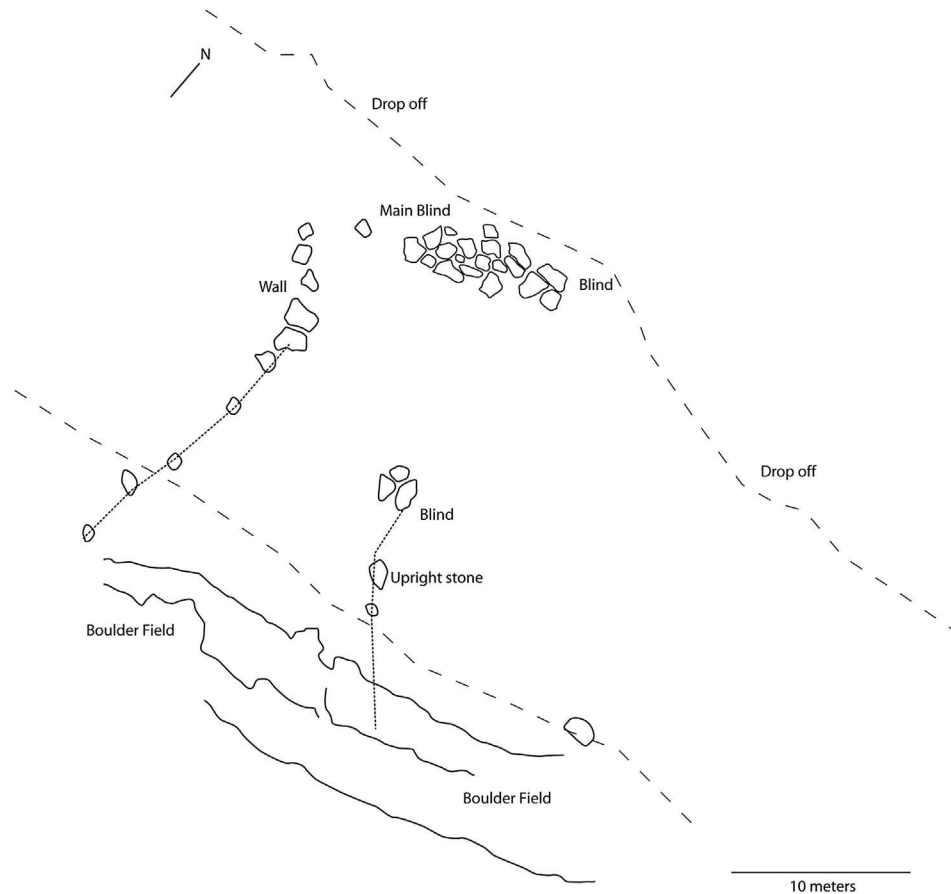


Fig. 5. The Funnel Drive structure. The Funnel Drive is located roughly 600 m southwest of the Dragon Blind in Area 1. The opening of the two converging arms is at the upper left of the image. The feature is bounded by boulder field at the bottom of the drawing that slopes upward to the south, and by a drop off behind and parallel to the main blind complex. The contour lines represented in both areas are approximately 1 m. The specific elements of the structure mentioned in the text are labeled on the figure.

preferred routes and strategies began to emerge which are tracked by the program. As the caribou came to learn the environment it was noted that the herds typically did not follow the same routes during the autumn and spring migrations across the ridge. The southerly, autumn migration followed a longer path that made more use of browse areas en route, while the northerly spring migration to the calving areas tended to follow a more direct route across the ridge, with much less emphasis on browsing en route. These patterns, which are consistent with known movement patterns of migrating caribou (e.g. Calef, 1981), were not built into the simulation, but rather emerged and were learned by the simulated caribou.

The distinctive seasonal routes fit well with the predicted line of movement reflected in the directionally dependent hunting structures. Areas linked to greater access to browse, such as the Dragon Blind, exhibit a seasonal association with autumn hunting. Hunting structures in locations that would have been crossed in both the spring and the autumn, as in the moraine field illustrated in Fig. 4a, exhibit structures with both autumn and spring orientations, although autumn orientations are more numerous. In other instances it is the terrain, itself, which imposes the season of use, as in the overlook hunting structure in Fig. 4b. Even though this same narrow zone would necessarily be crossed in both the spring and autumn, the location would only have been effective as a hunting site when the herd was moving uphill from the northwest. All of this fits well with what is known about caribou hunters, that they utilized both a detailed knowledge of caribou behavior and the local topography to situate themselves in the best possible location to intercept and successfully hunt the animals.

The Funnel Drive is both the most complex structure, and the only one identified to date with an orientation that is not linked to seasonal migration in any obvious way. The construction is located within 600 m of the Dragon Blind and shares the same setting; with nearby wetlands and an adjacent east-west running high ridge. As this area is associated with the postulated autumn migration route, it is possible that hunters here attempted to divert a segment of the herds as they moved south. On face value, however, the construction seems most consistent with models of a true drive, where a grazing herd is driven or stampeded towards a kill zone.

5. Alpena-Amberley Ridge hunting patterns in comparative perspective

Stone drive lines, hunting blinds, and *inuksuit* of the kind documented for the AAR have been reported in a number of Arctic and Sub-Arctic settings (cf. Brink, 2005). Max Friesen (2013) has proposed a classification for caribou hunting structures on Victoria Island in the central Canadian Arctic. In his model, Friesen focuses on the characteristics of the hunting weapons used, and examines how this predetermines the form of the hunting structures, the size of constructions, and the widths of openings created. In turn, these features are causally linked to caribou behavior, and particularly to the level of panic that must be induced in the herds to force the animals into the kill areas. The key characteristics of his two modal patterns are presented in Table 1. In essence, he posits that hunting with lances requires the hunters to get quite close to the animals, which implies that the hunting features must have narrow opening and large enough blinds to adequately conceal the hunters. He also

posits that the animals must be in a state of panic to be forced into the narrow structures. These are the conditions giving rise to his Type 2 structures. By contrast, hunting with bow and arrow (or high powered rifle) does not require such closeness, and allows the opening to be much wider, shallower hunting pits, and discontinuous lines since the animals need not be panicked in order to traverse the structure.

Table 1
Characteristics of Type 1 and 2 hunting constructions following Friesen 2013.

Pattern	Lines	Gap	Blind	Animal state	Weapon
Type 1	Diffuse, discontinuous	Wide avg. 30 m	Shallow, in or behind gap	Bothered, not panicked	Bow and arrow
Type 2	Robust, continuous	Narrow avg. 4.5 m	Substantial, continuous with wall	Panicked	Lance

Friesen's model provides a good starting point for an assessment of the AAR hunting structures. One factor that is controlled in this sample is that on purely chronological grounds none of the hunting structures can be associated with bow hunting, since the bow and arrow was introduced much later in the Great Lakes Region (Blitz, 1988). Therefore, and other things being equal, all of the hunting structures beneath Lake Huron should resemble the Type 2 drives. The structures should also all predate the Dorset Palaeoeskimo occupation thought responsible for the construction of the Victoria Island structures.

The average values for Friesen's model variables as observed in the three varieties of hunting structures documented on the AAR are summarized in Table 2. The actual state of the animals cannot be known for certain but is suggested based on Friesen's expectations for the character of the drive lines.

Of the three varieties of hunting structures identified on the AAR, only the Funnel Drive provides an unequivocal match to one of Friesen's expected types. The Funnel Drive combines all of the features expected for a Type 2 hunting structure.

Table 2
Characteristics of Alpena-Amberley ridge hunting constructions.

Pattern	Lines	Gap	Blind	Animal state	Weapon
Closed blind	Diffuse, continuous	Narrow (?) 9 m	Substantial, in gap	Not panicked?	Lance
V-Blind	Diffuse, emphasis on existing topography	Wide, avg. 25 m	Substantial, in or behind gap	Not panicked?	Lance
Funnel drive	Robust, continuous	Narrow, 5 m/2.5 m	Substantial, continuous with wall	Panicked?	Lance

The Closed Blinds and 'V'-shaped Blinds present a mix of Type 1 and Type 2 features. Drive lines, if they exist at all, are diffuse, relatively low, and often seem designed primarily to accentuate the existing flow of the landscape. The gaps through which the animals must pass, whether constructed or a result of natural terrain, are wider than expected for Type 2 structures, and in the case of the 'V' Blinds approach the widths associated with Type 1 structures. The blinds, themselves, resemble the more substantial Type 2 constructions, but they are located in a fashion more consistent with Type 1 structures. These results suggest that factors beyond the hunting weapon must be invoked to account for the character of the AAR hunting structures.

6. Discussion

As it seems clear that hunters employing lances must get relatively close to the animals in order to kill them, there must be some other mechanism or condition that enabled the lance-armed hunters to do so from the AAR hunting structures. The size of the hunting blinds would provide sufficient concealment to allow the hunters proximity to the animals without raising undue alarm. The key difference appears to be that hunters were reliably able to

predict where dense herds of animals would pass and could conceal themselves in substantial blinds that would be potentially surrounded by migrating animals. In other words, the inconsistencies between the Victoria Island structures and the majority of those on the AAR may be a function of the predictable seasonal migration of very large herds of caribou across a tightly constricted landform.

Such a circumstance would account for the apparent non-panicked state of the animals and still allow lance armed hunters the ability to strike their prey. This is consistent with Burch's observation (1972: 361) that large groupings of caribou ignore all but the most imminent danger during migration. This use of the AAR hunting blinds may have a number of additional implications for the size and organization of the Late Paleoindian and Early Archaic societies. In the Friesen model, the operation of caribou drives was seen as a relatively effort intensive activity, requiring personnel to frighten and drive the animals into kill zones where numerous hunters waited, but the more passive strategy implied by the AAR structures, as well as their modest sizes, suggest that they may have been operated by a smaller number of individuals. More passive hunting strategies have been documented ethnographically across the Northern Hemisphere, including the use of snares and trap lines to hunt caribou as well as individual stalking or hunting in small groups using hunting blinds. What is unique in the AAR case is small groups of hunters targeting large groups of animals during migrations. This is in contrast to ethnographic cases were

individual hunters or passive technologies are used to hunt smaller groups of non-migrating caribou.

The question of hunting group size also leads to the question of how, and how intensively, would the AAR have been occupied during Lake Stanley times. The very factors that maintained the ridge as a tundra-taiga environment (very cold waters, narrow landmass, cold temperatures, and high winds) would probably have made the AAR a relatively exposed and unpleasant place for year-round habitation. Given the geographical position of the AAR and the predictability of herd migrations (Kelsall, 1968: 106), it would have been completely viable for hunters to travel to the ridge to intercept the migrating herds and then to depart. During winter months one or both of the lakes in the Huron basin would be ice covered, and could be reached via sled to collect frozen caches of meat left on the ridge. This pattern is not unlike that recorded for some historic Eskimo groups that follow a bi-annual subsistence regime, e.g. caribou in the autumn, frozen caribou in the winter, and coastal resources in the spring and summer (e.g. Spiess, 1979: 138; Burch, 1991).

All of these features are consistent with an occupation by a series of small bands of hunter-gatherers, and a relatively low overall density of population. While there would seem to have been

a sufficiency of caribou to support larger population concentrations, the size and organization of hunting structures suggest this was not the case. The possible exception is the Funnel Drive structure which could accommodate a larger number of hunters at the kill site and require others to frighten and drive the herd.

There is no obvious reason why the Funnel Drive should be so different from the other hunting structures identified on the AAR, both in its construction and in the implied size of the group involved in its operation. Since the structure is at a relatively high elevation on the AAR and would have remained dry land after lower portions of the ridge were inundated, it is possible that this construction was built later than the others and was designed to capture the smaller numbers of animals that may have remained more or less permanently in this ecological refugium during later Lake Stanley times. Spiess (1979: 118) suggests a similar conclusion when he notes that bigger and more complex drives are needed when caribou are few or dispersed. As lake levels rose during this later portion of the Lake Stanley low stand, the AAR gradually became broken up into a series of isolated islands, which would have ended the ridge's potential use as a migration route, although successional changes in the vegetation cover may have already diminished this role.

The majority of hunting structures on the AAR demonstrate marked differences when compared to those constructed by late prehistoric and historic Arctic caribou hunters in North America. While drive lanes and other caribou hunting structures are best preserved and best known from the Arctic, the Late Paleoindian-Early Archaic AAR structures may, given their early date and latitude, be more comparable to reindeer hunting sites in other glacial mid-latitude environments known from the Upper Paleolithic record in Central and Western Europe. Faunal remains from camp-sites across Europe demonstrate that reindeer exploitation was important throughout the Upper Paleolithic. Much like the behavior hypothesized for the AAR, Upper Paleolithic hunters appear to have targeted caribou during their migrations (rather than following herds across the landscape) and positioned themselves to intercept the animals from strategic positions (White, 1989; Burch, 1991). Eastern Gravettian/Pavlovian sites in Central Europe, particularly in Hungary, may represent specialized interception sites for migrating reindeer (Thacker, 1997: 92) much like those known from the AAR. Similarly, seasonality also plays an important role in reindeer hunting in the Old World. While the seasonality of some faunal remains may be ambiguous, reindeer remains in Magdalenian sites in the Paris Basin consistently represent autumn hunting (Enloe and David, 1997; Enloe, 2003), suggesting that prehistoric hunters across the globe targeted these animals in their peak condition. The hunting documented on the AAR has similarities in both seasonality and general exploitation strategies to *Rangifer* hunting during the Upper Paleolithic. Further research in the unique setting of the AAR has the potential to fill in important gaps in our knowledge of the diversity of caribou hunting adaptations in the distant past.

While we believe the hunting structures identified on the AAR provide a valuable point of comparison with extant structures in the Arctic, and for the reindeer hunters of the European Upper Paleolithic, the limitations of these data and these comparisons should be kept in mind. While the submerged landscape is largely preserved and lacks a thick covering overburden, it has nevertheless undergone substantial change as a result of its inundation and subsequent submergence. We cannot expect stacked stone structures to remain standing, although some occasionally do. We similarly cannot read too much into the scouring of the bed rock surface which in shallower areas has removed any chance for the recovery of cultural debris. But most significantly, it is premature to place too much quantitative reliance on the current sample of

structures. The lake bottom, even with modeling, is a very big place, and our view of it is greatly diminished by the invasive mussels which cover everything hard on the lake bottom. Our survey techniques have been effective at identifying large stone structures, such as the hunting blinds reported here, but we have covered only a fraction of areas likely to contain hunting structures, and we cannot at this point rule out the presence of smaller, shallower hunting pits, drive lines, or other small structures. The same limitation currently holds for the discovery of camp sites and settlements, which should be located at some distance from the hunting features (Stewart et al., 2000, 2004) and may again produce ambiguous visual and acoustic signatures. Future research will emphasize the discovery of these latter kinds of sites. Lastly, caribou behavior is diverse across the nine sub-species of *Rangifer*, and until faunal remains are recovered, it will be difficult to determine the exact types of caribou that may have traversed the AAR.

7. Conclusions

In this paper we have presented a first view of caribou hunting structures documented on the Alpena-Amberley Ridge beneath modern Lake Huron. This unique geological feature and the microenvironment it supported 9000 years ago seems to have created a predictable migration route for caribou and provided ideal hunting grounds for the Late Paleoindian-Early Archaic foragers of the region.

Oftentimes caribou are characterized as being unpredictable and difficult to intercept as illustrated by the Chipewyan proverb, "No one knows the way of the wind and the caribou". The research presented here provides a counterpoint and suggests that, given a particular mix of topography, environment, climate, and animal behavior: hunters can indeed know the way of the caribou.

We also attempted to place these structures into a broader context by evaluating their season of use. We have compared their construction, placement, and form to more recent structures documented in the Arctic and Subarctic regions of North America, and briefly to reindeer exploitation in Paleolithic Europe. As a result of these comparisons we have gained new insights into the character of the Late Paleoindian and earlier Archaic cultural adaptations in the upper Great Lakes, and hopefully have provided additional comparative data that will be useful for understanding caribou hunting in other settings.

For the Great Lakes region, these results support the assertion made by Simons (1997) and others regarding the importance of caribou in the subsistence system of early Great Lakes hunters. Our results suggest that substantial numbers of caribou were present in the region and that conditions remained suitable for the animals in the area of the AAR, even as spruce and pine forests began to close off mainland Michigan and Ontario. The results also support a model of Late Paleoindian and earlier Archaic society as made up of relatively small groups of mobile hunters which in all probability practiced seasonally distinctive subsistence activities. In the absence of documented settlement sites on the AAR, it is not possible to empirically demonstrate how the seasonal pattern of subsistence and movement was managed, but this is a goal of our ongoing research.

An interesting aspect of these results is the suggestion that there was an abundance of animals that moved quite predictably across the AAR, and yet that they were exploited by only small bands of hunters. It is not clear from present evidence whether this was the common mode of life among Late Paleoindian and Early Archaic populations, or whether it somehow reflects the unique setting of the AAR. Similarly, the suggestion of larger groups of hunters pursuing smaller numbers of animals towards the end of the Lake Stanley low stand may provide insights into the broader spectrum

economies that emerge with the Middle and Late Archaic periods. Once water levels had risen sufficiently to break the ridge into isolated islands, an emphasis on water transport and aquatic resources would have represented a viable alternative to the now diminished and dispersed herds of caribou. It may well be that the florescence of coastal fishing technologies observed during the Late Archaic period in the Upper Great Lakes (cf. Cleland, 1982) may have had its origins in the rising water levels at the end of Lake Stanley.

Looking beyond the Great Lakes, the AAR hunting structures and the hunting strategies they suggest may provide insight into earlier times in prehistory when dense herds of caribou and reindeer roamed much of the northern world. While these archaeologically-derived models can hopefully complement the accounts of living informants and historic sources, they should also remind us that the past really was a different place and that any accounting of the distant past must necessarily rely on the tools and methods of archaeology.

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