

RESEARCH REPORT

Great Lakes *Rangifer* and Paleoindians: Archaeological and Paleontological Caribou Remains from Michigan

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It is often argued that Paleoindians in the Great Lakes were targeting caribou as a primary economic resource, but this assertion has been difficult to test since zooarchaeological remains in the region are extremely scarce due to degradation in highly acidic soils. This paper presents new faunal evidence from Michigan including archaeological and paleontological *Rangifer* specimens ($n = 27$), and one cervid tooth fragment recovered from a submerged caribou hunting site in Lake Huron. Despite preservation issues, these remains demonstrate that caribou were abundant on the landscape in prehistoric Michigan. Additionally, the distribution of absolute dates on *Rangifer* remains in the Great Lakes basin reveals that the archaeological and paleontological records in this region are closely tied to dynamic water levels at the end of the Pleistocene. These changing shorelines left critical evidence for understanding this period of dynamic environmental and cultural change submerged beneath the Great Lakes.

Keywords caribou, Paleoindian, Great Lakes, underwater archaeology

1. Introduction

There is substantial debate concerning the importance of caribou for Paleoindian peoples in the Great Lakes region of North America. While caribou are often portrayed as a critical resource for Paleoindian hunter-gatherers (e.g., Cannon and Meltzer 2004; Gramly 1982; Johnson 1996; Simons 1997), others suggest that additional resources played equally important roles (e.g., Custer and Stewart 1990; Kuehn 1998). The assertion that there was great reliance on caribou during the Paleoindian period has been difficult to test because zooarchaeological remains of any kind in the region are very scarce due to degradation in highly acidic soils (Bergerud et al. 2008, 64; Carr 2012; Storck 2004). Caribou bones have only been recovered from one Paleoindian archaeological site in the Great Lakes and from only four sites total—Holcombe in Michigan, Whipple in New Hampshire, Bull Brook in Massachusetts, and Udora in Ontario—resulting in a total of eight identified specimens (Cleland 1965; Robinson et al. 2009; Spiess et al. 1985, 1998; Storck and Spiess 1994).

This overall poor preservation often results in a lack of diagnostic elements even when faunal remains are recovered, further obscuring the relative abundance and economic importance of different cervid species

in this time period. In addition, water level changes following the retreat of glaciers in the Great Lakes area have obscured or drowned much of the archaeological and paleontological record from the late Pleistocene and early Holocene, further complicating the investigation of Paleoindian lifeways (Ellis et al. 1990; Karrow 2004; Karrow and Warner 1990; Lewis et al. 2005, 2007; Shott 1999).

To address these issues, this paper catalogs *Rangifer* remains from the state of Michigan to suggest that caribou were abundant in the Great Lakes region during and after the Pleistocene–Holocene transition. In addition, a cervid tooth fragment from a submerged caribou hunting site in Lake Huron draws attention to the potential of underwater archaeological investigations for addressing these questions.

2. Materials and results

Caribou are an ice age remnant species that ranged as far south as Alabama in the Pleistocene (Churcher et al. 1989). They were occasionally reported in Michigan historically, and local extirpation in the state happened toward the turn of the twentieth century (Burt 1942). Caribou remains are associated with several late prehistoric sites dating to the Middle and Late Woodland periods (200 BC–700 AD), suggesting a long history of caribou exploitation in the area (Cleland 1966, 1968; Martin 1995; Martin

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Table 1
***Rangifer* remains from Michigan**

Specimen no.	Site	Element	Age	Ecotype	Reference
MSU MR.8713*	Ovid Township, Clinton Co.	Antler			Baker (1983)
MSU MR.7590*	Harold Reamer Farm, Lapeer Co.	Antler	Late Pleistocene	Woodland	Mikula (1964)
MSU VP.635*	Flanders Site, Oakland Co.	Antler	Late Pleistocene		Baker (1983, 614), Holman et al. (1986)
N/A	Kuzma Antler Site, Oakland Co.	Antler	12,888–13,100 cal yr BP		This paper
N/A	Manistee, Manistee Co.	Antler	Late Pleistocene		This paper
N/A	Satago Lake, Mackinac Co.	Antlers ($n = 2$)			This paper
N/A	I-96 Site, Eaton Co.	Proximal humerus	Late Pleistocene		Holman et al. (1986)
UMMAA 58030**	Holcombe Beach, Macomb Co.	Phalanx	11,000 cal yr BP	Barren-ground†	Cleland (1965), Fitting et al. (1966)
UMMAA 87-52-22**	Paldi, Sanilac Co.	Antler	12,925–13,080 cal yr BP		This paper
UMMP 26589***	Fowlerville, Livingston Co.	Antler	Late Pleistocene	Barren-ground	Hibbard (1951)
UMMP 44043***	Davison, Genesee Co.	Antler	6705 cal yr BP	Woodland	Crane (1956), Door and Eschman (1970, 414)
UMMP 44435***	Genesee Co.	Antler	Late Pleistocene		Wilson (1967)
UMMP 44436***	Genesee Co.	Antlers ($n = 3$)			This paper
UMMP 44440***	Genesee Co.	Antler	Late Pleistocene		Wilson (1967)
UMMP 50994***	Genesee Co.	Antler	Late Pleistocene		Wilson (1967)
UMMP 52811***	Fenton, Genesee Co.	Antler	Late Pleistocene		This paper
UMMZ 102458†	Burt Lake, Cheboygan Co.	Antler, Radius, Ulna, Humerus	Late Pleistocene		Wilson (1967)
UMMZ 46434†	Chippewa Co.	Antler			This paper
UMMZ 46435†	Chippewa Co.	Antler			This paper
UMMZ 64047†	Isle Royale, Keweenaw Co.	Antler			This paper
UMMZ 84108†	Minden City, Sanilac Co.	Antler	Late Pleistocene	Barren-ground	Burt (1942), Hibbard (1951)

*MSU = Michigan State University Museum, Lansing.

**UMMAA = University of Michigan Museum of Anthropological Archaeology, Ann Arbor.

***UMMP = University of Michigan Museum of Paleontology, Ann Arbor.

†UMMZ = University of Michigan Museum of Zoology, Ann Arbor.

‡The barren-ground affiliation of this specimen has been refuted (Spiess et al. 1985, 155).

and Perri 2011; Meghan Howey, personal communication 2014).

In addition to these later Woodland remains, 27 *Rangifer* specimens are known from Michigan dating to the late Pleistocene/early Holocene, nine of which are presented here for the first time (Table 1; Figure 1). These specimens include one bone (a phalanx) from the Holcombe archaeological site, and the rest are paleontological. The paleontological remains include 22 antlers, 3 limb bones recovered near an antler (a radius, ulna, and humerus from the same individual), and 1 isolated limb bone (a proximal humerus).

These specimens highlight the preservation and identification issues which plague faunal records in the Great Lakes region. All of the paleontological specimens were excavated from anaerobic contexts such as lake shores, peat bogs, or thick marl deposits,



Figure 1 Geographic distribution of *Rangifer* remains by county in Michigan. (counties with *Rangifer* remains shown in black).

Table 2
Dated *Rangifer* remains from the Great Lakes Basin

Site	Age*	Reference
20CN61, Michigan	1247 cal yr BP	This paper
Paynter Marsh, Ontario	2591 cal yr BP*	Jackson (2000)
Paynter South, Ontario	3674 cal yr BP*	Jackson (2000)
Auger, Ontario	5697 cal yr BP*	Savage et al. (1981)
Webb Bay, Ontario	5699 cal yr BP*	Jackson (2000)
Davison, Michigan	6705 cal yr BP	Crane (1956), Door and Eschman (1970, 414)
Steep Rock Lake, Ontario	11,457 cal yr BP*	Jackson (1989)
Holcombe Beach, Michigan	11,000 cal yr BP	Cleland (1965), Fitting et al. (1966)
Sheriden Pit Cave, Ohio	11,700 cal yr BP	Hansen (1992), McDonald (1994)
Kuzma Antler Site, Michigan	12,905 cal yr BP**	This paper
Paldi, Michigan	12,942 cal yr BP**	This paper

*All radiocarbon dates were calibrated using Calib, and the median ages are given.

**Direct dates on *Rangifer* bone.

and the archaeological specimen was burned in a hearth (Baker 1983, 614; Burt 1942; Cleland 1965; Mikula 1964; Wilson 1967). The large number of specimens recovered in these unique environments is

quite impressive, particularly since antlers are often gnawed or eaten (Bergerud et al. 2008, 232–234; Hutson et al. 2013). In terms of identification, absent antlers or phalanges, which are very diagnostic elements of caribou, shaft fragments are difficult to distinguish between caribou, deer, and elk, leaving faunal remains from several archaeological sites indistinguishable between these taxa (e.g., Bull Brook, Whipple (Spiess et al. 1985), Cummins (Jackson 1989; Julig 1985), Sandy Ridge (Jackson 1994), and Udora (Storck and Spiess 1994)). The specimens from Michigan demonstrate that unique depositional environments were responsible for their preservation, and the presence of highly diagnostic elements (usually antlers) led to their discovery and identification.

There are 11 absolute dates for *Rangifer* remains in the Great Lakes basin, including five from Michigan (Table 2; Figure 2). Two new assays run on bone collagen preserved in antlers are $11,080 \pm 60$ ^{14}C yr BP (12,888–13,100 cal yr BP) (Beta-250341) (Don Simons, personal communication 2014) and $11,040 \pm 40$ ^{14}C yr BP (12,925–13,080 cal yr BP) (Beta-380035). Three additional specimens have associated dates: the Holcombe site has been dated to just prior to 11,000 cal yr BP based on ancient beach ridges and geological context (Cleland 1965; Fitting et al. 1966); an absolute date on American

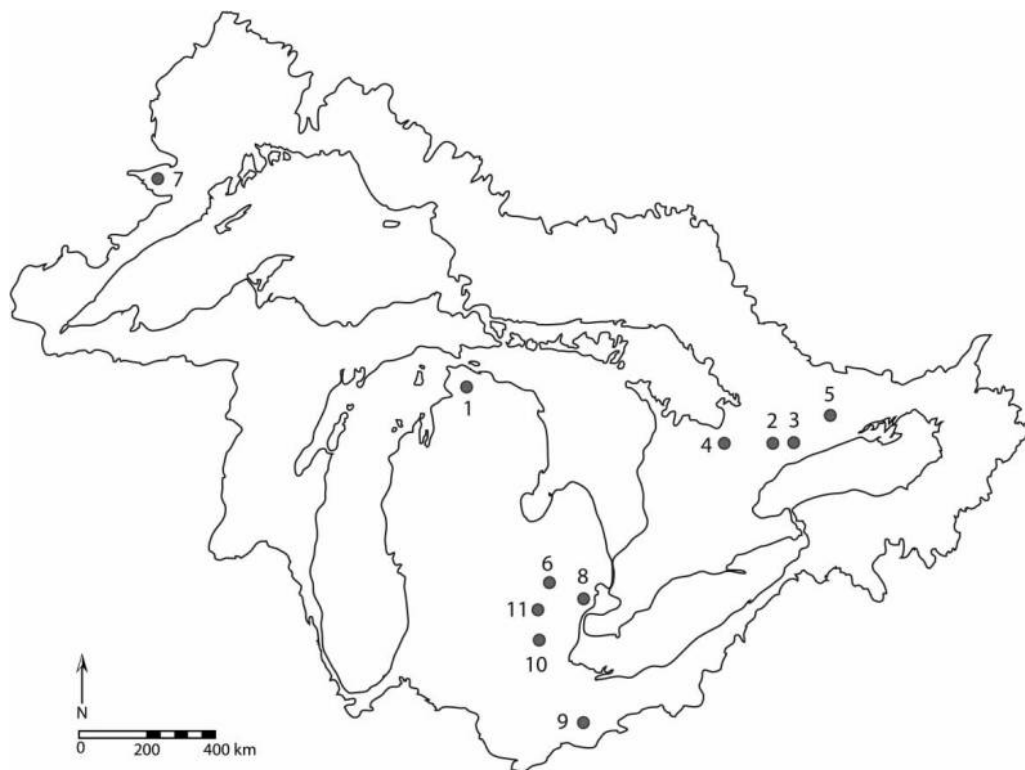


Figure 2 Geographic distribution of dated *Rangifer* remains from the Great Lakes Basin: (1) 20CN61, Michigan, 1247 cal yr BP; (2) Paynter Marsh, Ontario, 2591 cal yr BP; (3) Paynter South, Ontario, 3674 cal yr BP; (4) Auger, Ontario, 5697 cal yr BP; (5) Webb Bay, Ontario, 5699 cal yr BP; (6) Davison, Michigan, 6705 cal yr BP; (7) Steep Rock Lake, Ontario, 11,457 cal yr BP; (8) Holcombe Beach, Michigan, 11,000 cal yr BP; (9) Sheriden Pit Cave, Ohio, 11,700 cal yr BP; (10) Kuzma Antler Site, Michigan, 12,905 cal yr BP; (11) Paldi, Michigan, 12,942 cal yr BP.

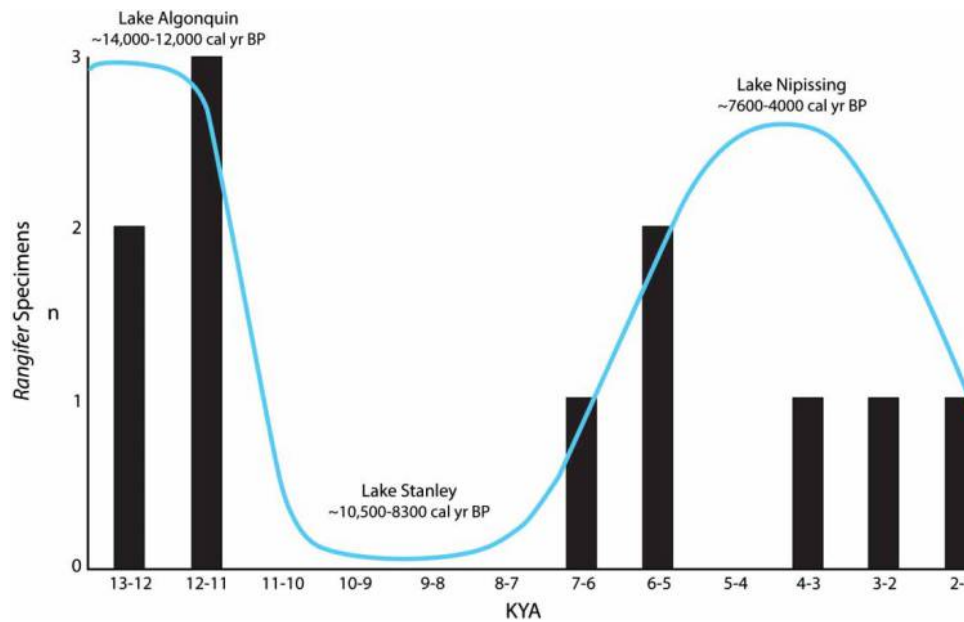


Figure 3 Dated *Rangifer* remains from the Great Lakes Basin and ancient water levels. Curved line represents generalized high water and low water stands across the entire basin.

elm associated with an antler is 5870 ± 200 ^{14}C yr BP (6288–7174 cal yr BP) (M-294) (Crane 1956); and a Late Woodland context with caribou remains is 1310 ± 40 ^{14}C yr BP (1179–1299 cal yr BP) (Beta-209909) (Meghan Howey, personal communication 2014).

Figure 3 shows the distribution of these dates and reveals a gap in dated caribou remains between about 11,000 and 7000 cal yr BP. The absence of specimens dating to this time period and the peaks on either side correspond remarkably well to fluctuating Great Lakes water stands. While the nature and timing of local water level events are extremely complex (e.g., McCarthy et al. 2015), general high water stands recorded for the Great Lakes include the Lake Algonquin (~14,000–12,000 cal yr BP) and Lake Nipissing (~7600–4000 cal yr BP) stages. A low water stand occurs between these two stages, Lake Stanley (10,500–8300 cal yr BP), where water levels were as much as 100 m lower in some areas—exposing large areas of land (Lewis and Anderson 2012; Lewis et al. 2007). This Lake Stanley phase occurs during the hiatus in dated *Rangifer* specimens and is the time period when Paleoindians appear to have been systematically targeting caribou on the Alpena-Amberley Ridge in Lake Huron (Lemke and O'Shea 2015; O'Shea et al. 2013, 2014; Sonnenburg et al. 2015). While additional radiocarbon dates are needed, the absence of dated caribou remains from this time period may be attributed to an influx of caribou into recently deglaciated landscapes that are now submerged beneath the Great Lakes (see also Pelletier and Robinson 2005).

3. Discussion

The *Rangifer* remains from Michigan presented here suggest that caribou were more abundant on the pre-historic landscape than traditionally assumed. Given that these specimens were *only* preserved due to unique circumstances or depositional environments (e.g., anaerobic contexts or burning), caribou were likely more common on the landscape. Additionally, the majority of these specimens are highly diagnostic elements, and as shaft fragments are difficult to distinguish between species (such as at Bull Brook, Whipple (Spiess et al. 1985), Cummins (Jackson 1989; Julig 1985), Sandy Ridge (Jackson 1994), and Udora (Storck and Spiess 1994)), many more caribou bones probably exist in zooarchaeological assemblages from this time period. Furthermore, these *Rangifer* remains suggest that a portion of paleontological and archaeological records across the Pleistocene–Holocene transition is most likely submerged given the distribution of absolute dates and their correspondence with ancient lake levels. But what were these caribou like? And do we have any evidence of caribou occupying landscapes which are now underwater?

Archaeologists have used subspecies of caribou to understand prehistoric herds and Paleoindian adaptations. While there are nine extant subspecies of *Rangifer* (Banfield 1961, but see Flerov 1952; Geist 1998; Heptner et al. 1961 for other taxonomies), two of these found in North America have had the most influence on archaeological interpretations, barren-ground (*Rangifer tarandus groenlandicus*) and woodland (*Rangifer tarandus caribou*). Subspecies

identification has been important since behaviors, specifically group size and migration patterns, are often thought to differ a great deal between modern woodland and barren-ground caribou subspecies (Bergerud et al. 2008). Therefore, identification of either subspecies has been used to make inferences concerning Paleoindian subsistence strategies and mobility regimes, i.e. highly mobile Paleoindian groups targeting large barren-ground herds of migrating caribou or Paleoindian hunting of smaller groups of woodland caribou in more restricted geographic areas (e.g., Carr 2012; Deller 1976, 1979; Peers 1985; Storck 1982). Likewise, subspecies have been used to infer paleoenvironments since modern subspecies seemed to have different environmental preferences, giving rise to “barren-ground” or tundra caribou vs. “woodland” or forest classifications (e.g., Cleland 1965, 351). However, *Rangifer* as a species is extremely variable, and skeletal morphology and behaviors differ a great deal both between and *within* subspecies.

For example, skeletal fragments are difficult to assign to one subspecies or the other with a high degree of confidence. While antlers are often used to identify subspecies due to some broad morphological differences between woodland and barren-ground forms (Figure 4), extensive overlap in size and shape makes identifications of fragments tentative at best (e.g., Banfield 1961, 24; Bubenik 1975; Goss 1980; Spiess 1979, 35). In addition to the difficulty of determining subspecies from faunal remains, behavior is highly variable across *Rangifer*. For example, while woodland caribou tend to be more sedentary than

long-distance migrating barren-ground varieties, some caribou that are *morphologically* assigned to the woodland variety are known to migrate great distances (e.g., from the forest to tundra about 320 km each way (Spiess 1979:31)). Likewise, some barren-ground caribou splinter off from large migratory herds and become sedentary (Geist 1998, 333; Spiess 1979). These are only a few examples of variability that exists in *Rangifer* which makes strict correlations between subspecies and certain traits problematic if not impossible (e.g., Bergerud et al. 2008; Klein 1970; Reimers 1972; Spiess et al. 1985). Importantly, rather than being genetically determined, these behavioral and morphological differences arise due to local environments (Flagstad and Røed 2003; Geist 1998, 317, 323, figure 12-1), although additional genetic studies such as those by Røed (2005) are potentially fruitful areas for future research.

The variability in *Rangifer* seems to have evolved as adaptive responses to postglacial climate change (Flagstad and Røed 2003), and behavioral differences are so clearly mediated by local environments that barren-ground and woodland varieties are better referred to as ecotypes (Bergerud et al. 2008, 34; Spiess et al. 1985). Therefore, paleoenvironment is an important component for understanding changes in caribou populations over time, and the Michigan remains may be examples of a Pleistocene form of caribou with a unique historical development as populations adapted to local climatic changes during this time period. An example of the late Pleistocene variability in *Rangifer* is a specimen from Toronto which was originally interpreted to be



Figure 4 Barren-ground (left) and woodland (right) caribou antlers to scale (zoological specimens 63243 and 124573 from University of Michigan, Museum of Zoology, Ann Arbor).

a new species of deer (Churcher and Peterson 1982). Since the initial report, many now believe the specimen to actually fit within the range of *Rangifer* (e.g., Jackson 2000). This specimen was directly dated to $11,315 \pm 325$ ^{14}C yr BP (12,571–13,831 cal yr BP), and if included in the distribution of chronometric dates from the Great Lakes Basin, would fit into the Lake Algonquin high stand.

Dynamic environmental changes in this period caused by retreating glaciers, isostatic rebound, and cold meltwaters (e.g., McCarthy et al. 2015; Sonnenburg 2015; Shane 1994, 12–13; Shuman et al. 2002; Williams et al. 2004) saw some caribou populations follow the ice fronts north (e.g., Bergerud et al. 2008) and perhaps others moved into refugia which are now submerged, as indicated by Figure 3. These recently deglaciated landscapes, such as the Alpena-Amberley Ridge (AAR) in Lake Huron, would have been ideal for caribou, with forage, fresh water, and probably fewer insects than the mainland due to significant winds coming off the water on either side of the ridge (McCarthy et al. 2015; O'Shea et al. 2014: tables S1–S2; Sonnenburg 2015). Rapid colonization of this feature following deglaciation was possible due to *Rangifer*'s unique ability to move into newly available territories (Kuhn et al. 2010, 1321). The availability of this new land fits well with the distribution of radiocarbon dates on *Rangifer* remains, which suggests that the archaeological and paleontological records of the Great Lakes are closely tied to changing lake levels.

The ideal habitat for caribou provided by the AAR is supported by the underwater archaeological record on this feature. Caribou hunting structures and lithic artifacts have been discovered on this submerged landform, which was dry land between ~9000–8300 cal yr BP (Lemke 2015; O'Shea et al. 2013, 2014, table S2; Sonnenburg et al. 2015; see also Lewis et al. 2007; MacCarthy et al. 2015). In addition, one tooth fragment identified to the cervid family was recovered

from a bulk sediment sample collected inside one of the hunting blinds (Figure 5; see also O'Shea et al. 2013, figure 2). While too small to be identified to species, the tooth fragment preserved diagnostic surface textures indicative of the cervid family, which includes caribou. Given its context inside an anthropogenically constructed stone hunting blind next to a drive lane which matches ethnographic and historic descriptions of caribou hunting tactics (O'Shea and Meadows 2009; O'Shea et al. 2013), this tooth may belong to *Rangifer*. The hunting structures preserved on the AAR are some of the oldest in North America (Zedeño et al. 2014) and provide direct evidence of Paleoindian caribou hunting (Lemke and O'Shea 2015; O'Shea et al. 2013, 2014).

4. Conclusion

The late Pleistocene and early Holocene period represents a time of dynamic environmental and cultural changes in the Great Lakes. The 27 *Rangifer* remains presented here reveal that caribou were undoubtedly more common on the landscape than formerly presumed. While only one of these specimens comes from an archaeological site, the paleontological record cannot be ignored by archaeologists interested in the Pleistocene–Holocene time period because it provides critical background information about the landscape in which Paleoindians were living and hunting. Lastly, the distribution of dated *Rangifer* remains from the Great Lakes suggests that portions of the archaeological and paleontological records in this region are submerged. The unique preservation of hunting structures, artifacts, and the cervid tooth fragment offered on the Alpena-Amberley Ridge demonstrates that underwater archaeology is a promising avenue for future research in the Great Lakes region.

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Figure 5 Cervid tooth fragment recovered from inside the Dragon hunting blind, Alpena-Amberley Ridge, Lake Huron (see O'Shea et al. (2013, figure 2) for images of the hunting blind).

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