DEER MANDIBLE TOOLS: AN EXAMINATION OF ONEOTA MODIFIED MANDIBLES FROM LA CROSSE COUNTY, WISCONSIN

By

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ABSTRACT

This study focuses on the modified deer mandibles that have been recovered at late prehistoric Oneota sites over the last few decades by the M.V.A.C. in La Crosse County, Wisconsin. The purpose of this study is to clarify through experimentation the function of Oneota tools made from deer mandibles.

Of the numerous deer mandibles and deer mandible fragments that have been recovered from Oneota context in the La Crosse locality there are a set of five deer mandibles, which show signs of heavy wear along the fracture of the bone marrow cavity where they were broken, presumably to obtain the marrow. These artifacts were found at the Pammel Creek site (47Lc61), the Valley View site (47Lc34), and the Gundersen Lutheran site (47Lc394), and the Sand Lake site (47Lc44). Experimental use demonstrated that the Oneota mandibles were identified as hide scrapers, which were used to soften leather for hide working.

ACKNOWLEDGEMENTS

I would like to thank the faculty members at the Mississippi Valley Archaeology Center (MVAC) for their invaluable assistance in working on my project. Special thanks go to Dr. Constance Arzigian for giving me the idea in the spring of 2009 to work on the deer mandibles collection at MVAC and for her invaluable assistance at many points during the course of this project. I would like to thank Dr. James Theler for helping me by sharing his encyclopedic knowledge of faunal remains. I would also like to thank the many people that gifted modern deer mandibles for my experiments, especially Dr. James Theler and Kassie Praska. Lastly I would like to thank Mike Bednarzhuk and Christopher Driver for helping me overcome the many hurtles during the course of this project.

INTRODUCTION

Of the many deer mandibles and deer mandible fragments recovered from late prehistoric Oneota archaeological sites within the locality of La Crosse, Wisconsin there are several relatively well preserved deer mandibles, which exhibit significant wear along the broken portion of the horizontal ramus and the diastema. These deer mandibles were likely broken to obtain the fat rich bone marrow (See Figure 1).

The deer mandible tools included in this study were recovered at the Pammel Creek site (47Lc61), the Valley View site (47Lc34), the Gundersen Lutheran site (47Lc394), and Sand Lake site (47Lc44).

Figure 1. Collection of deer mandible tools analyzed for this thesis. Top Row: 47Lc394 and Lc34 Middle Row: 47Lc61 and 47Lc44 Bottom Row: 47Lc394.

The first site the deer mandibles were recovered at was the Pammel Creek site (See Figure 2), which dates between A.D. 1430 and A.D. 1520 ± 70 (Gallagher 1985). It is centered on the southern end of a Pleistocene terrace, which is located at the southern end of the Mississippi trench, which is where the Black and La Crosse rivers converge (See Figure 5). Pammel Creek was an agricultural site and appears to have been occupied seasonally from Spring through Fall (Arzigian et Al. 1989).

The second site the deer mandible tools were recovered at was the Valley View site (See Figure 2), which was an Oneota village. It was a compact palisaded site located on the La Crosse river valley and is a late occupation site, which dates between A. D. 1550 ±40 and A. D. 1600 ±70. It is thought that the presence of a palisade may reflect a stressor, which may have been related to the abandonment of the La Crosse locality by the Oneota (Stevenson 1994).

The third site the modified deer mandibles were recovered at was the Gundersen Lutheran site (See Figure 2) was an Oneota village, which was located on three physiographic zones. The Gundersen Lutheran site was located on three physiographic zones firstly dissected uplands, secondly Pleistocene terraces, and lastly lowland floodplains. The village had a mixed economy, which included agriculture and wild plants and animals and is similar to other sites in the La Crosse locality (Arzigian et al. 1994).

The Sand Lake site is the final site (See Figure 2), which had modified deer mandible tools. It is located at the mouth of Sand Lake coulee and is part of a several hundred acre floodplain. It is located on the far northwestern most area of the city of Onalaska. The Oneota portions of the site date beginning around A.D. 1400. The subsistence methods for the Oneota of this site are largely the same to the other three sites the deer mandibles were recovered from (Boszhardt and Holtz-Leith 2008).

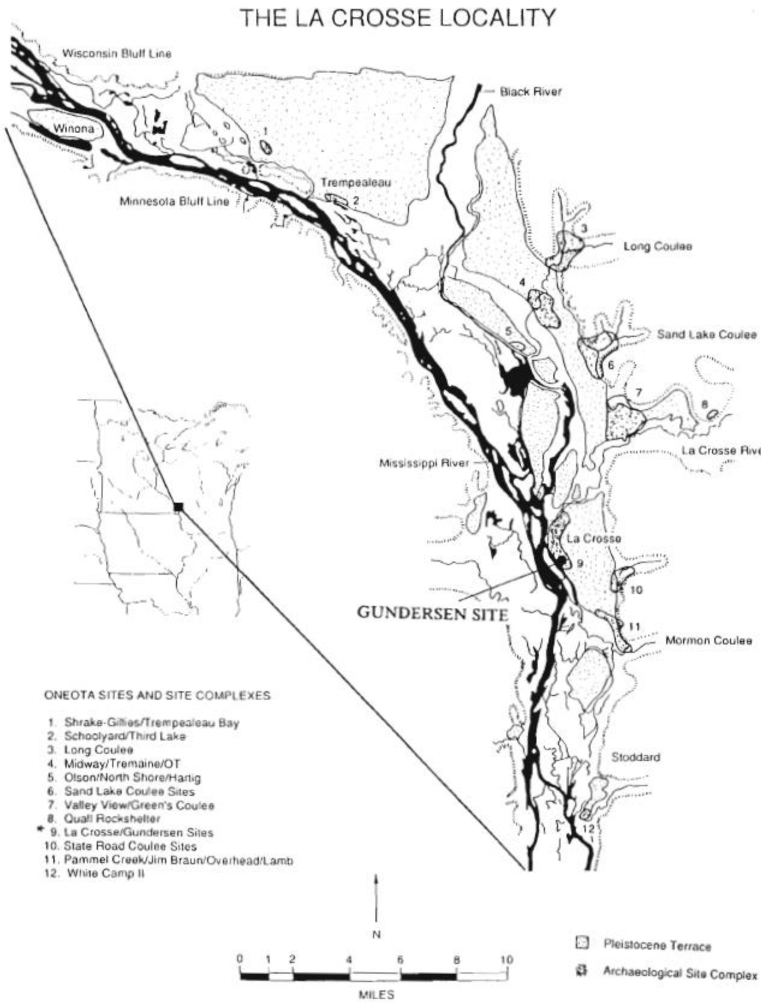

Figure 2. La Crosse Locality with Oneota sites shown (Arzigian et al. 1994).

The final pre-European Tradition in the locality of La Crosse, Wisconsin was the Oneota Tradition, which began with the Brice Prairie Phase, which dates between A. D. 1300 and 1400 The Oneota sites from this period are riverine sites and are characterized by exotic lithic preference. The ceramic typology for this ”shell tempered globular vessels with interior lip treatment and complex zones of tool trails and punctuates that border distinctive motifs such as nested chevrons …” (Boszhardt and Holtz-Leith 2008).

The next phase was the Pammel Creek phase, which dated between A. D. 1400 and 1500 and is characterized by a preference for local lithics such as prairie du chien chert. Ceramic technology for the time was "characterized by a shift from interior lip impressions to bold lip top impressions. Decorations and shoulder motifs include punctuate borders, but shifted to punctuate-filled zones." (Boszhardt and Holtz-Leith 2008).

The Final Oneota phase was the Valley View Phase dates between A. D. 1500 and 1650. Valley View is characterized by their locality on bluff bases or simply further back from the rivers in defensive positions. The Valley View Phase Oneota relied upon local chert and silicified sandstone. In this phase vessels appear to be larger with increased rim height, with progressively finer lip top impressions. The La Crosse locality was abandoned following A. D. 1650 for reasons unclear, which will be discussed below (Boszhardt and Holtz-Leith 2008).

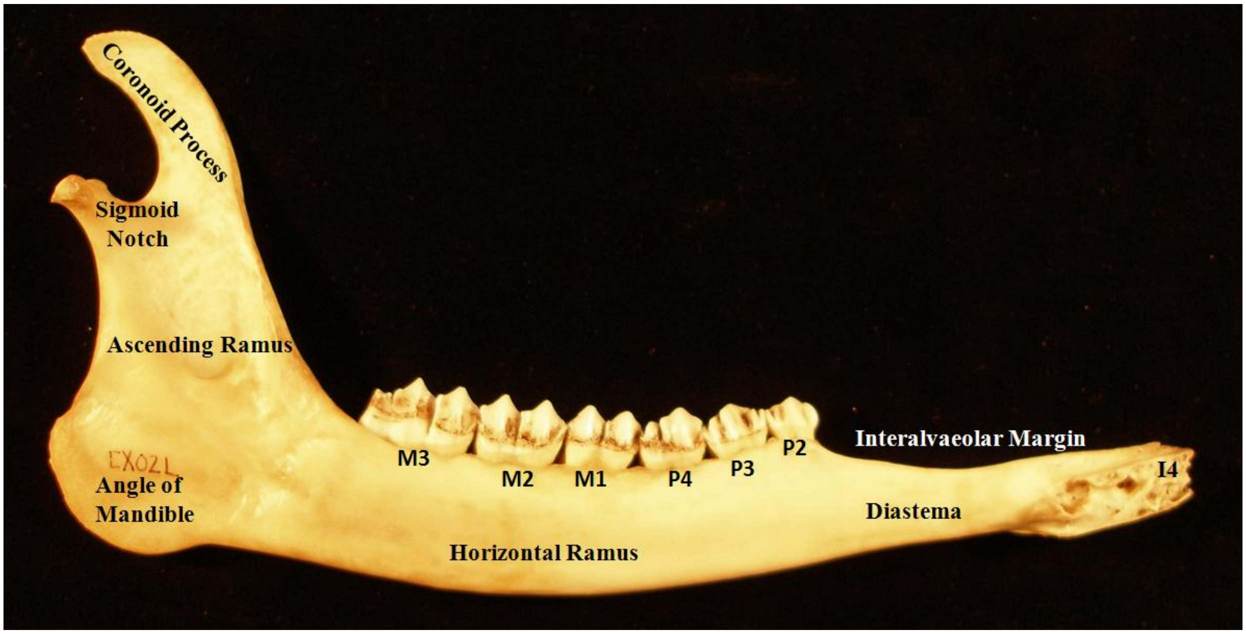

Figure 3. Deer mandible with anatomical labels.

Deer were a staple of the Oneota diet, which provided leather, protein, and fat. The Oneota used raised field systems, which can be best visualized by imagining a field with a surface akin to a washboard. The corn and other crops would have been planted on the crest of each ridge (Gallagher et al. 1985).

The Oneota were agriculturalists, they grew maize, beans, and squash. They also harvested a host of locally available wild foods, which included the hunting of deer for meat, bone, skins, and fat (Stevenson 1985). There has been little research done on how utilized the deer mandibles recovered from Oneota sites in the locality of La Crosse were modified and used. The purpose of this study is to clarify how the deer mandibles were modified into tools, used, and finally discarded. If the function of the mandible tools can be determined, then we may better understand Oneota life ways and more importantly have an analogue, which could potentially be applied to other Native American deer mandible tools.

A minority of Oneota mandibles exhibit strong signs of wear (Figures 1 & 4). The diastema of the mandibles have been broken off and the horizontal ramus shattered open. The fracture and the body of the mandibles exhibit strong wear patterns and polish. There are numerous striations at many angles from the fracture. See Figure 3 for anatomical labels for a standard deer mandible with terminology, which will be used in this study. It is my belief that the deer mandibles may have been used as dry hide scrapers to soften leather prior to tooling.

STATEMENT OF THE PROBLEM

The modified Oneota deer mandibles that have been recovered at Oneota sites in the region of La Crosse have been loosely identified as sickles, but to date there have yet to be a detailed study of their modification, wear, or function beyond identification as sickles. This illuminates a need for additional research on deer mandibles' function and role in Oneota culture. The purpose of this study is to identify how deer mandibles were modified, treated, and used to give a clearer picture of Oneota life ways.

BACKGROUND

La Crosse Region Geography

The Driftless Area is region of Wisconsin that was not glaciated during the last Ice Age, which is rather remarkable as it was completely surrounded by glaciers. The unglaciated area is contained within southwestern Wisconsin, southeastern Minnesota, northeastern Iowa, and northwestern Illinois. See Figure 5 for detailed map of the region (Martin, 1965).

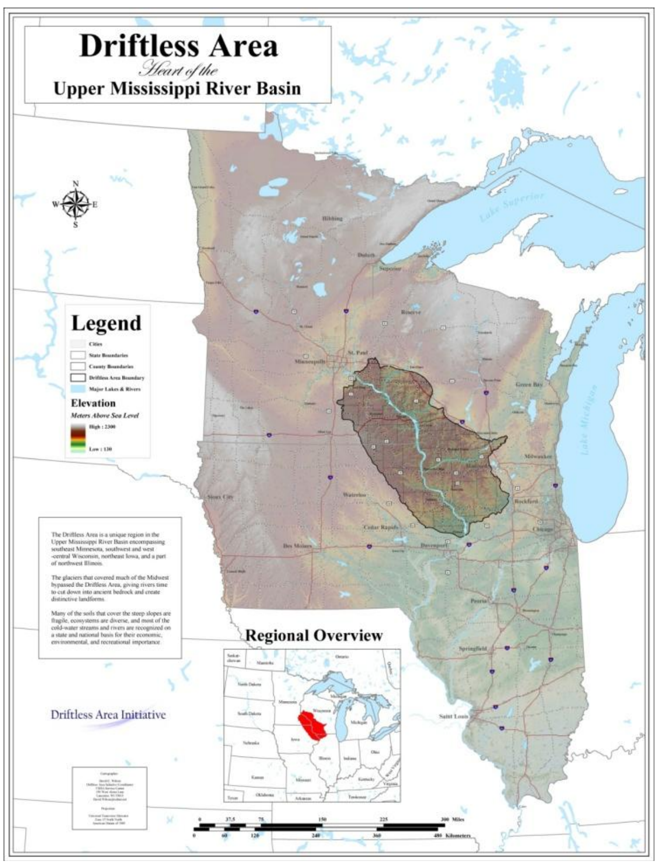

Figure 4. The Driftless Region (Driftless Area Initiative).

From Trempealeau to La Crosse there is the largest terrace system in the Upper Mississippi River Valley. There are numerous Pleistocene terraces blanketing this region as well along the Mississippi and the tributaries leading to it (Theler and Boszhardt 2003). See Figure 5 for a map of the terraces of La Crosse and of the Oneota sites in the area around La Crosse.

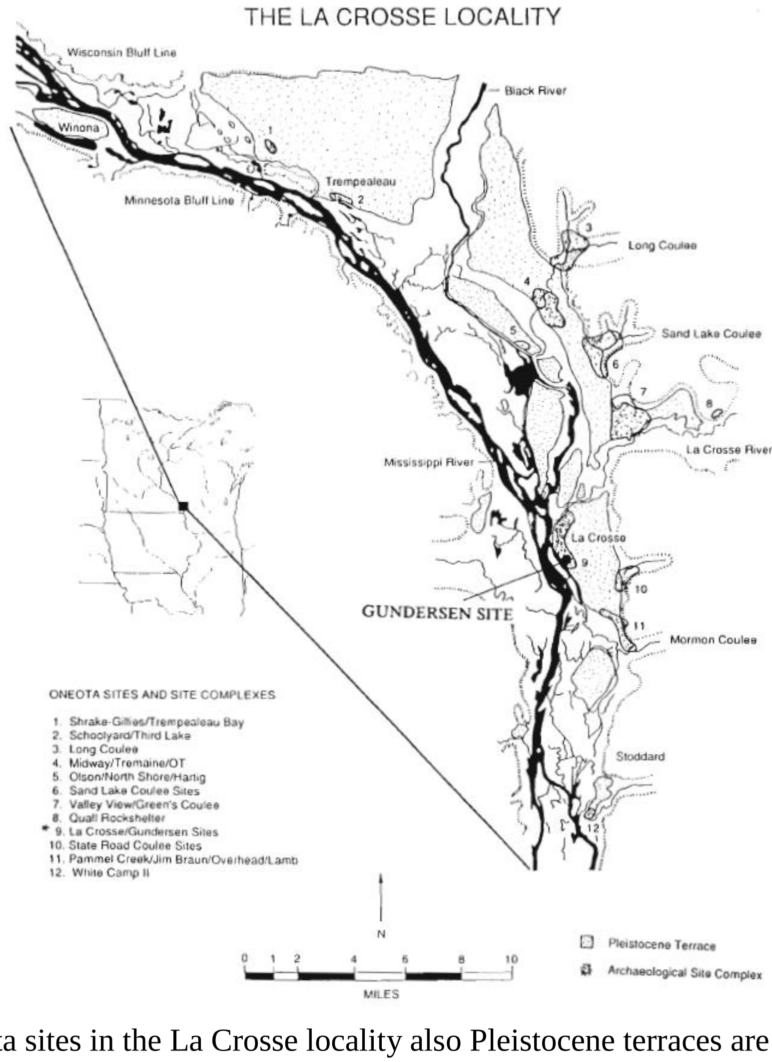

Figure 5. Oneota sites in the La Crosse locality also Pleistocene terraces are indicated (Arzigian et Al. 1994).

Oneota Characteristics

The emergent Oneota was one of two final traditions prior to European contact. The other was the Fort Ancient tradition, which shares many common characteristics with the Oneota tradition. Both traditions relied upon agriculture, hunting, fishing, and gathering. They had semi-permanent villages and seasonal camps as well. Diagnostically Oneota artifact types include globular shell tempered ceramics, numerous end scrapers, bison scapula hoes, and catlinite artifacts (Boszhardt and Holtz-Leith 2008).

Oneota come from a union between Late Woodland peoples and Middle Mississippian cultural traits, which were selectively adopted into the culture. A main difference between the Middle Mississippian and the Oneota was that they did not continue the tradition of constructing the typically elaborate mounds found at larger Mississippian sites such as Cahokia (Theler and Boszhardt, 2003).

Group interactions between regions appear to have been relatively common for the Oneota and likely utilized the river systems for trade. Trade with western groups that relied more on Great Plains resources is exemplified by buffalo scapulas hoe, engraved buffalo artwork, and red pipestone, which likely was quarried in southwestern Minnesota. Marine shell beads have also been located at Oneota sites, which link trade to groups living in the Lower Mississippi River Valley (Theler and Boszhardt 2003).

The final pre-European Tradition in the locality of La Crosse, Wisconsin was the Oneota Tradition, which began with the Brice Prairie Phase. Brice Prairie dates between A. D. 1300 and 1400. This was derived via radiocarbon dates, lithic style, and ceramic style change. The Oneota sites from this and future periods are sites, which rely on riverine resources to varying degrees. This phase is characterized by exotic lithic preference. Specifically hixton silicified sandstone and Grand Meadow chert have been recovered at all Oneota sites from this phase. The ceramic typology for this ”shell tempered globular vessels with interior lip treatment and complex zones of tool trails and punctuates that border distinctive motifs such as nested chevrons …” (Boszhardt and Holtz-Leith 2008).

The next phase was the Pammel Creek phase, which dated between A. D. 1400 and 1500 in the locality of La Crosse. This phase is characterized by a preference for local lithics such as prairie du chien chert, which could be easily obtained. In this phase occupations were moved further back from the rivers, but were still dependent on riverine resources. Ceramic technology for the time was “characterized by a shift from interior lip impressions to bold lip top impressions. Decorations and shoulder motifs include punctuate borders, but shifted to punctuate-filled zones.” (Boszhardt and Holtz-Leith 2008).

The Final Oneota phase was Valley View, which dates between A. D. 1500 and 1650. Valley View is characterized by their locality on a bluff base or simply even further back from the rivers in defensive positions. Their sites are also commonly pallisaded for defense. The lithic preference for this phase continued from the Pammel Creek phase, which relied upon local chert and silicified sandstone. In this phase vessels appear to be larger with increased rim height, with progressively finer lip top impressions (Boszhardt and Holtz-Leith 2008).

The La Crosse locality was abandoned by the Oneota around A. D. 1650 for largely unknown reasons. The Little Ice Age of A. D. 1550 through 1850 may have resulted in a cooling, which could have disrupted the maize agricultural system that the Oneota relied upon or european diseases may also have played a role in the abandonment of the La Crosse locality (Boszhardt and Holtz-Leith 2008). The abandonment of the La Crosse locality is a question, which still requires a great deal of study to resolve.

The Oneota were likely a relatively egalitarian tribal level society. They lived in very large settlements for the time, which were seasonally reoccupied for many years (Stevenson 1985). In the locality of La Crosse the sites were "strategically located to take advantage of resources from both the river and prairie environmental zones through travel or interaction" (Theler and Boszhardt 2003:158). They could also take advantage of the Mississippi as a means of transportation and trade.

Raised Field systems have been discovered in the county of La Crosse by MVAC on the Sand Lake site. Corn, beans, and squash have been recovered from the vicinity so the function of the fields is evident. The raised fields were apparently highly productive as well (Gallagher et al. 1985). The Oneota also utilized various native plants including hickory nuts, various wild berries, various weedy plants, and wild rice. The Oneota exploited much of the faunal species in the area as well (Stevenson 1985).

> *Wetland fauna … fish, waterfowl, naiads, and mammals (especially beaver and muskrat). Terrace and upland species include large mammals (elk, deer, bear), and some small mammals and birds. Bison are usually represented only by scapulae, which may have been traded or brought from other regions. Dog remains are also common, and often show signs of butchering [Stevenson 1985:61].*

Oneota Deer Mandible Characteristics

The deer mandible is a very common faunal remain on Oneota sites in the locality of La Crosse. There are numerous highly degraded deer mandible fragments housed in MVAC's collection. There are currently ten deer mandibles and roughly forty deer mandible fragments currently housed at the MVAC collection. Some of these artifacts were extracted in situ and may have been utilized, but for the purposes of this study I did not view it necessary to unearth them because they were so badly degraded and they would likely not survive the process. There were also many deer mandible fragments, which were so badly degraded that they had no value to this study and they were also not included. Lastly there were also several unutilized deer mandibles, which were not included in the study because they had no wear.

There are many commonalities to the utilized Oneota deer mandibles that have been recovered in the locality of La Crosse, Wisconsin. The most predominant feature to the Oneota deer mandibles is the modification of the horizontal ramus presumably to obtain bone marrow. Following that there is generally heavy wear and varying levels of polish and striations, which are generally perpendicular or at a forty five degree angles in a crisscrossing pattern on the fractured horizontal ramus. The crisscrossing pattern generally begins from below the third molar towards the premolars and extends to what is left of the diastema. See appendix A for detailed analysis of each mandible specimen.

Other Mandible Research

There has been very little research conducted on the subject of Oneota and Mississippian deer mandible tools and a comprehensive study should be conducted to determine if the sickle-type or if the dibble artifact types were a localized phenomena or if they were more widespread artifact type.

There have been two papers released on the subject of deer mandible tools used by Native Americans. Both papers came from work done in Illinois. The first was a site report on the Kingston Village site, which was fifteen miles southwest of Peoria, Illinois. In this site report A. M. Simpson stated that there were “deer jaw hoes” or deer jaw dibbles. It was stated that they were common on the site and that they appeared to have been hafted (Simpson 1952). There was no information given about the mandibles other than they were dibbles so the usefulness of this research is quite limited.

The second paper on deer mandible tools focused on deer mandibles from a variety of sites including in the Mississippi River Valley, which included Cahokia, Weaver-Betts, Walker-Hooper, Gentleman Farm, and several other sites, which produced only one mandible each for a total of 26 mandibles. Brown modified several experimental deer mandible sickles to confirm that their assertion that the mandibles were used as sickles was correct. Brown's objective was to simply address the interpretation for a select few mandibles, which displayed likely wear patterns. The broader issue that they were addressing by looking at the mandible types was to add some clarity to what had seemed to be a rather murky subject. The mandible tools until this point had for the most part been identified in an unscientific manner or linked by ethnohistorical accounts such as the corn sheller, which was an Iroquois tool for removing corn kernels from the cob (Brown 1964). The sample size for this paper was somewhat small, but understandably so given the rarity of well preserved modified Oneota deer mandibles.

Brown's methodology for ruling out the various competing theories was to create a hafted experimental deer mandible and to use it to cut grasses. They would then compare the striations found on their experimental mandible to the collection of deer mandible artifacts. Brown stated in his paper that there were a series of "constellations" of wear and used the pattern to rule out the competing theories. This method does hold a certain appeal since it is rather clear cut, but it forces the reader to rely entirely upon the author's expertise. Other than that the information was presented quite well and in a well thought out manner and was quite easily understood (Brown 1964).

METHODOLOGY

I addressed the question of what the deer mandibles found on archaeological sites in La Crosse, Wisconsin have been used for via experimental archaeology. There were numerous theories surrounding what the mandibles had been used for.

The experiments I conducted were an attempt to recreate the modification that all of the archaeological deer specimens exhibited. The common modification for mandibles in La Crosse County was that the diastema and the horizontal ramus had been broken open. Along the edge of the fracture, the remains of the horizontal ramus, and on the remains of the diastema was extensive wear. There were also perpendicular striations leading from the diastema of the mandible to the end of the fracture, which was below the molars (Figure 4).

Figure 6. Worn deer mandible from Valley View site

I designed experiments using modern deer mandibles and a simple hammerstone, which would have been readily available to the Oneota living in La Crosse. There were two theories on how deer mandibles were modified. The first was that the deer mandibles were split along the grain of the bone (Dr. Constance Arzigian, personal communication 2009). To test for that I took a deer mandible from a freshly killed deer, broke the diastema and then used a stone wedge to split the bottom of the mandible off. The second theory stated simply that when struck by a hammerstone the diastema and the horizontal ramus will shatter, creating the new tool for usage (Dr. James Theler, personal communication 2009). To test this theory I used a hammerstone, placed the mandible on the ground, and struck the horizontal ramus and diastema until the mandible resembled the archaeological specimens.

Once the modification of the mandibles was completed the uses of the mandible was explored. The most common theory surrounding the usage of the mandibles is that they were sickles through experimentation, which were used for the cutting of grasses (thatch) for the construction of dwellings (Brown 1964). To test this I modified a deer mandible and attempted to cut long grass and cattails with it. If the mandible exhibited the wear patterns, was more efficient than the stone counterparts, and survived the experiment then it would be likely that the tool could have been a sickle.

James Theler suggested that the deer mandibles were being used as hide scrapers (James Theler, personal communication 2010). To test that theory I drew a deer mandible across the raw hide in order to soften it for usage. If the test were to produce an identical wear pattern, survived the process, and was an efficient tool for the job then it would be a possible use for the Oneota mandibles.

It is believed that the Iroquois used deer mandibles as corn shellers (Brown 1964) and to test that I rotated corn cobs against the molars of a deer mandible mandible. The litmus test for this was if the deer mandible worked well they could have doubled as shellers since they would not produce wear on the underside of the mandible if the teeth of the mandible were used.

The next theory for the deer mandibles is that they were agricultural tools known as dibbles. A dibble is used to poke small holes in the ground for planting seeds. To test this theory I utilized MVAC's raised bed garden and used the entire bed to create as many holes as possible. This simulated planting a field many times the actual size of the field. If the mandibles survived the process, exhibited identical wear patterns, and worked efficiently at the task then would likely be dibbles.

EXPERIMENTATION

Modification: Splitting

It had been suggested that it could be possible for the diastema of the mandible to be broken off and then to split the mandible along the grain of the mandible with a sharp stone or blank. This technique would be akin to splitting wood (Dr. Constance Arzigian, Personal Communication).

I braced the experimental mandible (EX-01L) on a cinder block and struck the diastema with a hammerstone to create an edge, which exposed the grain for splitting (Figure 7). I set aside the portion of the mandible, which I had broken off. My first attempt was to strike the mandible against a very large edged stone, but it simply mashed the bone and did not split it. The second attempt was to strike the mandible with large wedge shaped piece of quartz. I was able to shear a few pieces of bone, but was unable to make any real headway. My final attempt was to strike the mandible against a much sharper stone, which was braced between two cinder blocks, but that also provided similar results (Figure 8). A few pieces broke off, but this technique seems to be quite inefficient. In my opinion deer mandibles were not modified in this fashion due to the inefficiency of the method and the high risk of smashing one's hand with a sharp stone tool.

Figure 7. Deer mandible with front snapped off.

Figure 8. Mandible following splitting attempt.

Modification: Side Percussion

The side percussion hypothesis was inspired from the recovered deer mandible from 47Lc061, which had an impact fracture along the horizontal ramus (Figure 9), which exposed the inside of the horizontal ramus. I hypothesized that the Oneota mandible tools were made via a hammerstone striking the horizontal ramus, which split the open providing the blade for the tool.

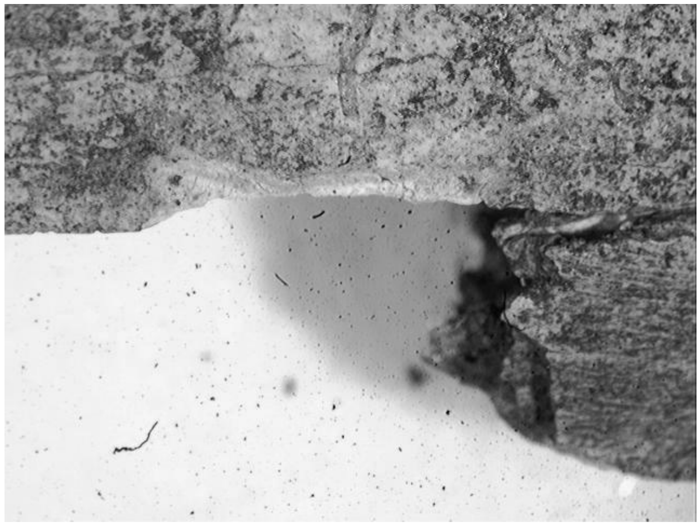

Figure 9. 47Lc061 impact fracture 10X Magnification.

I had obtained a deer mandible (EX-01R) from Dr. Theler for this experiment, which had been killed several years prior to the experiment. I sandwiched the mandible between a large stone and a 150 gram hammerstone. On the second strike to the bone the bone fractured nicely along the horizontal ramus. Following the third and forth strikes the new mandible tool looks like the Oneota artifacts (Figure 10).

Figure 10. Results of side percussion experiment #1.

The particular mandible that was used for this experiment was an older mandible with no bone marrow present. As a result of the age the bone was rather brittle and broke during the course of the reed cutting experiment, which will be discussed below.

As a result of the first attempt I began to experiment with a second experimental deer mandible (EX-02R), which Dr. Theler had also given to me. I processed the second mandible exactly as the first, but this mandible was fresh enough to still have bone marrow in it. This mandible was set aside for later photography (Figure 11).

Figure 11. EX-02R Following side percussion; with bone marrow present.

Mandible Use: Sickle: Cutting Reeds

Following the creation of a successful deer mandible specimen I attempted to use it to cut cat-tails in the Mount Prairie State Wildlife Management Area, which is approximately 10 miles southwest of La Crescent, MN. The first cutting Edge that I used was a straight edged stone wedge made from Prairie du Chien chert, which was approximately 11CM long and cut with relative ease. I was able to apply sufficient force with little effort and cut the reeds easily. The second tool that I used was a serrated blade made from Arkansas novaculite, which was about 11 cm long (a large flake, which I had pressure flaked to add teeth). The performance from the serrated blade could best be best characterized as like cutting butter. This tool was almost effortless and could easily have been the ideal tool for this application.

Using the fracture made via side percussion the mandible was a great deal more difficult to use for cutting reeds than the stone tools. It didn't cut the reeds it pulverized them. It was difficult to apply the required force to the mandible without hurting my hands on the deer teeth. The cutting edge of the mandible was much duller than either of the stone tools, which played into the efficiency of the tool.

The last tool type that I used was the teeth of EX-01R; the first deer mandible that I modified. The tool worked reasonably well until it broke. It seems that without the underside of the mandible for support the tool cannot withstand the force of cutting with the teeth.

During the course of this experiment I recorded the number of cuts per centimeter of thickness of cattail. According to my results (See Figure 12) attempting to cut by using the fracture is twelve times less effective than the serrated blade and seventeen times less effective than the straight edged blade.

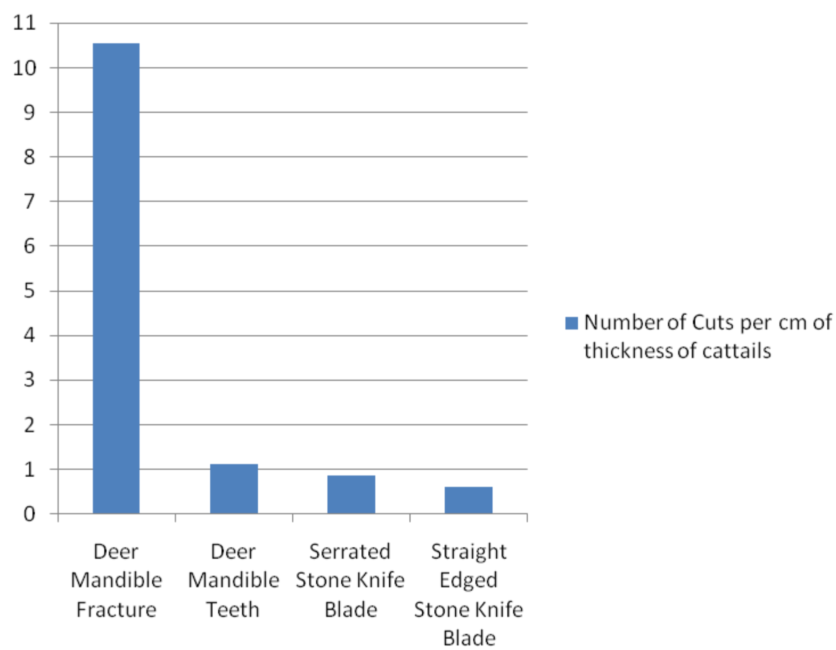

Figure 12. Deer mandible sickle experiment results.

After observing where the deer mandibles are rubbing against the reeds it is inconsistent with the wear patterns found on the original mandible sickles. The wear on the deer mandibles when they are being used to cut the reeds are only along the cutting blade, but the original artifacts showed deep striations along both sides of the artifacts in areas that had no contact with the reeds. That combined with the difficulty of the use of the mandible precludes the usage of this as a sickle for the cutting of reeds.

Mandible Use: Sickle- Cutting Grass

Following the reed cutting experiment I conducted a simple test to compare the usefulness of the deer mandible teeth, underside fracture, serrated stone tool, and straight edged stone tool. The mandible that I used for this experiment was EX-03R, which was one of the mandibles that had been provided to me by Kassie Praska. It had been processed by the side percussion method previously discussed.

Both the straight edged and serrated edged stone tools were somewhat effective for this task, but they had convex blades, which limited their effectiveness because the grasses would slip across the blade without being cut. The same was true for the underside of the deer mandible. The only tool that excelled at l for cutting grasses was using the teeth of the deer mandible. The concave tooth line of the mandible along with the relatively sharp teeth cut the grass with relative ease.

Mandible Use: Corn Sheller

The potential for deer mandibles to be used as corn shellers came from Brown’s 1964 article in which he referenced ethnohistorical accounts that stated that the Iroquois used them as shellers.

At the suggestion of Dr. Anderson I conducted an experiment to determine the viability of using deer mandibles to remove kernels of corn from the cob.

I used an unmodified deer mandible because I wasn't testing for any wear on the fracture. The goal for this experiment was simply to determine if the mandibles could have doubled as shellers. By rotating the corn cob against the deer mandible molars the kernels popped off. I recorded the time for each cob. The second technique that I tried for corn shelling was simply rubbing two corn cobs together to pop the kernels off. I also recorded the time for each cob to finish.

The cob on cob method of shelling corn turned out to be more efficient than by using the deer mandibles. On average the cob on cob method took 45 seconds a cob while using the deer mandible an average of 57 seconds per cob was the result (see Figure 13). The only other note is the wear and tear on my thumb from the rotation of the corn cob. After a short while I was forced to stop the experiment due to a large blister.

Using a deer mandible was a rather awkward tool for shelling corn. It was less efficient than rubbing corn on corn, hard on the fingers, and required more force than simply rubbing two cobs together. Assuming the Natives would have used the mandible in the same manner I don't believe that anyone would have utilized a deer mandible for shelling corn.

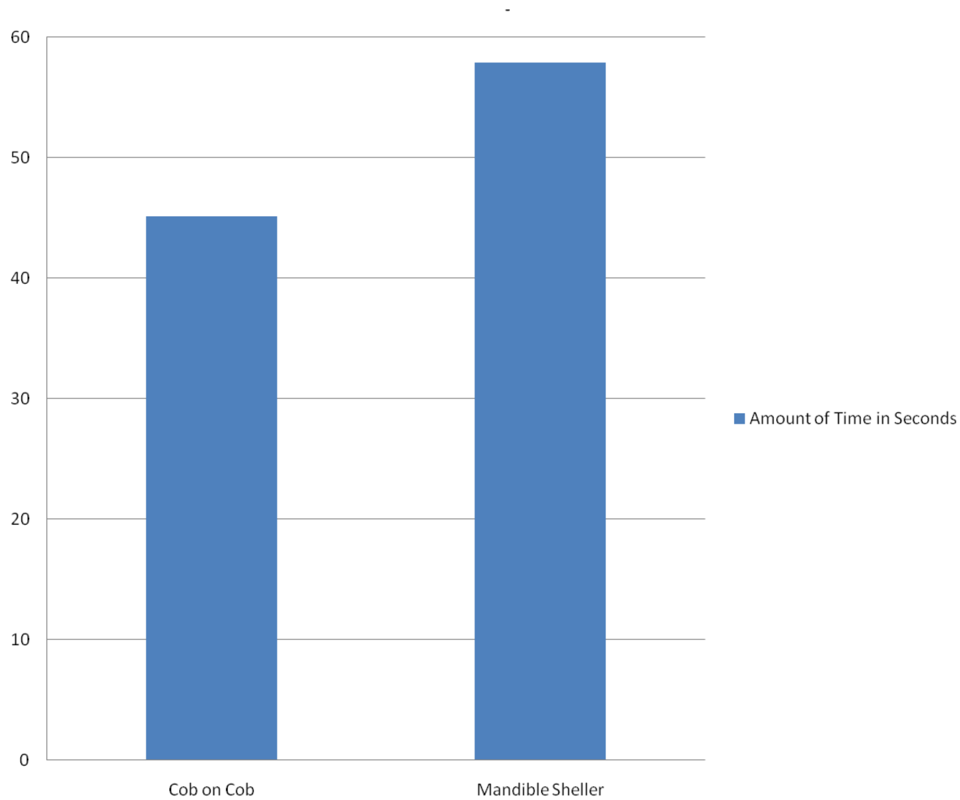

Figure 13. Mandible sheller experiment results.

Mandible Use: Dibble

I first read about deer mandible dibbles in James A. Brown's article "The Identification of a Prehistoric Bone Tool from the Midwest: The Deer-Jaw Sickle" (Brown 1964). A dibble is a tool for the planting of seeds by making holes in soil (Houghton Mifflin Company 2001). It was one of several other unfavorable interpretations in his paper. After a reexamination of the Oneota specimens it seemed to be an option.

There were a series of perpendicular striations on the archaeological specimens in areas, which received no wear from using the blades as a sickle, which made me curious. I hypothesized that the patterns could have been made by inserting the broken diastema of the mandible into the soil and twisting the mandible by ninety degrees, which would produce a hole for the planting of seeds.

In this experiment I used another of the mandibles, which had been provided by Kassie Praska (EX-03L). I modified this deer mandible using the side percussion method. I chose the raised field garden at MVAC for my experiment. The procedure was rather simple. I would simply push the tip of the mandible into the raised bed and rotate it by ninety degrees. I covered every square inch of five raised beds (1.5 ft Wide X 8 Ft Long X 5 beds = 8640 Sq inches ~ 8640 insertions).

The results of this experiment were startling to say the least. Following the experiment there were a series of matching wear patterns that it seemed likely that I have found the probable use of the deer mandibles. The first matching piece of the puzzle was the wear on the experimental specimen (Figure 14). Both the archaeological specimens and the experimental specimens showed a great deal of polish and wear (Figures 14 and 15). The sharp edges from the fractures had all but disappeared. At a glance the mandible visually matched the archaeological specimens (Figure 16).

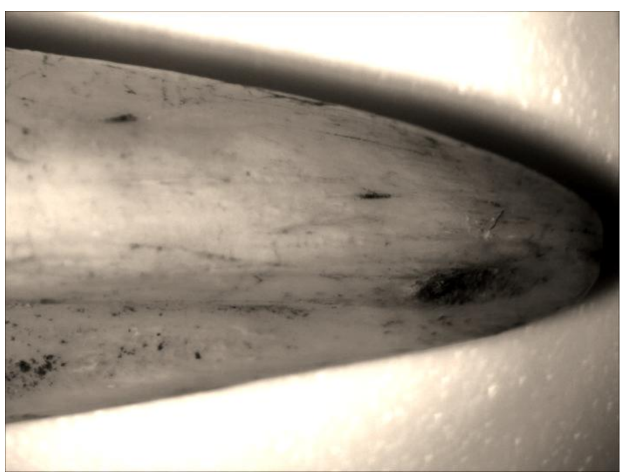

Figure 14. The experimental mandible dibble showing extreme signs of wear and striations (EX-03L).

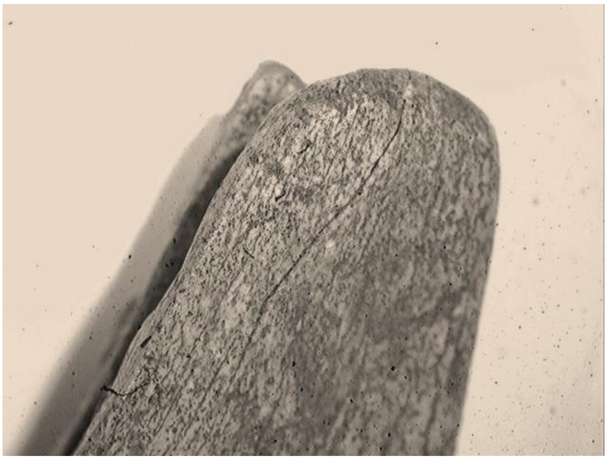

Figure 15. Deer mandible artifact exhibiting strong wear and numerous striations approximately 10X magnification.

Figure 16. Experimental mandible dibble exhibiting strong wear along the fracture.

Examination of the bone marrow cavity of both specimens indicated a lack of wear (Figures 17 and 18). This lack of wear is because after three or four insertions the cavity became filled with a plug of soil, which remained there during use. This precluded the possibility of any wear because there was only non-moving tightly packed soil pushed tightly against the bone marrow cavity (Figure 18).

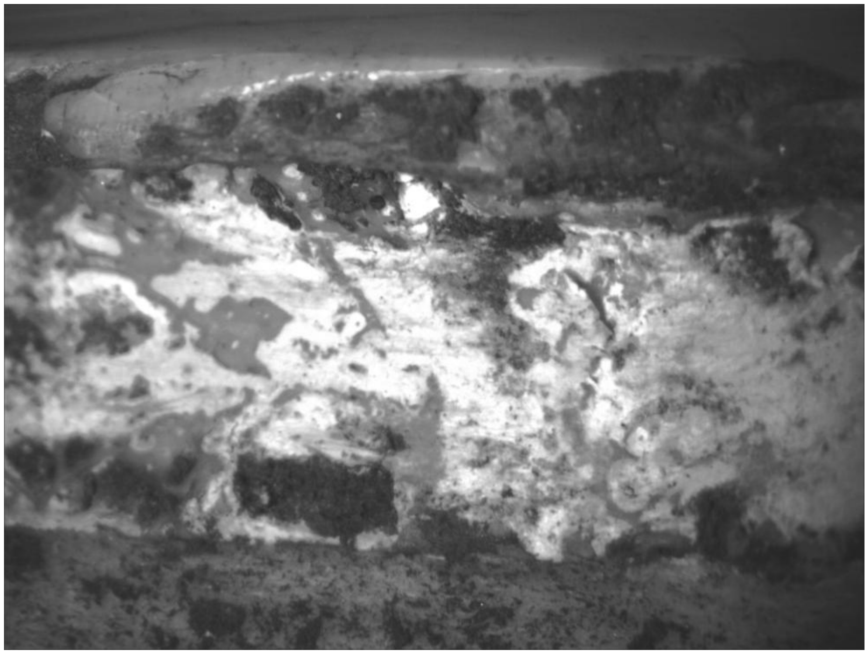

Figure 17. Experimental deer mandible bone marrow cavity lacking any substantial wear.

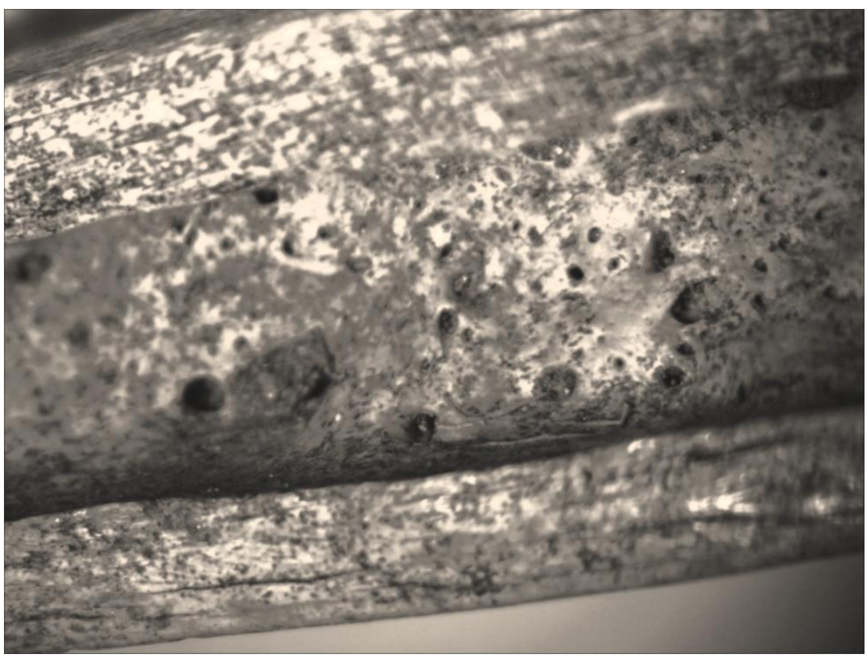

Figure 18. Archaeological deer mandible, which shows no wear on the bone marrow cavity.

Figure 19. Experimental Mandible, with the plug of soil and barely visible striations.

Under ten times magnification the striations on the experimental deer mandible dibble there were many more striations leading from the tip of the mandible than there were striations leading from the mandible fracture (Figure 20 and 21). This precludes this use for the mandibles in the MVAC collection being used as deer mandible dibbles, but given the ease of use it is a possibility that deer mandibles in general could have been used as dibbles.

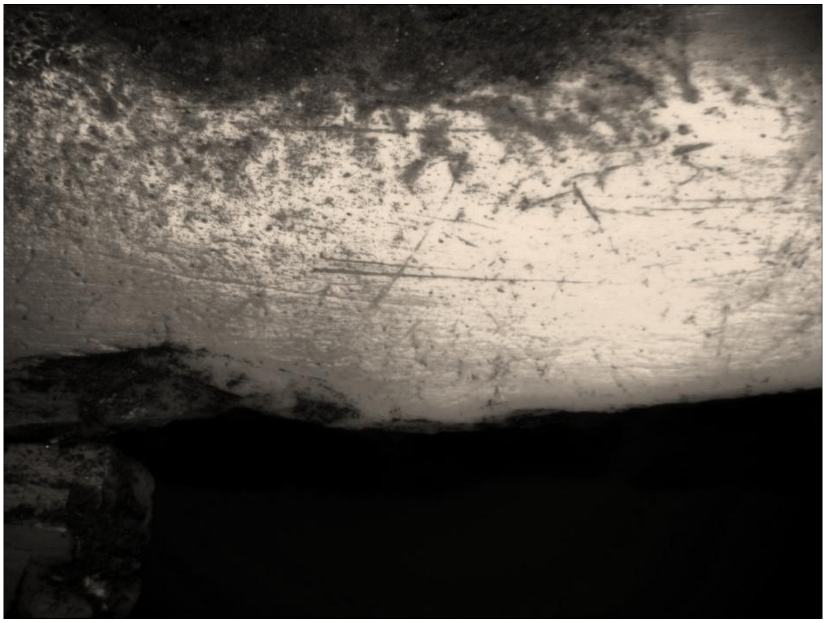

Figure 20. Striations on the experimental deer mandible showing mostly linear striations approximately 10X magnification.

Figure 21. Numerous perpendicular striations on deer mandible artifact from 47Lc34 with many more perpendicular striations than experimental model approximately 10X magnification.

Mandible Use: Hide Scraper

Following the dibble experiment I spoke with Dr. James Theler about other potential uses for deer mandibles. He suggested that the deer mandibles were likely used as hide scrapers because they had more perpendicular striations than striations parallel to the fracture (see Figure. 22).

After an examination of the deer hides at MVAC I came to the conclusion that they were far too tough to be used for clothing so I decided to dry scrape them with the deer mandible fracture. I used the side percussion method to modify the deer mandible for this experiment.

To test the hypothesis I scraped the two dried deer stiff hide portions, which were roughly a total of four square feet. The procedure for this experiment was rather simple. I repeatedly scraped the mandible fracture across the rawhide until the leather produced a soft velvety texture in each section. I alternated handedness as needed when I would begin to tire. The medial side of the mandible was used when I used it in my right hand and the lateral for the left. Since I am right handed there was considerably more wear on the medial side than on the lateral.

Shortly into the experiment the deer mandible began to exhibit many of the traits associated with the Oneota modified deer mandibles (Figure 23). Firstly the fracture began to wear down within the first twenty minutes. Secondly from the odd assortment of grit and sand on the hide striations and the general abrasiveness of the rawhide a series of striations began to appear, which matched the Oneota modified deer mandibles that I had previously examined. Lastly the polish that I had noted on the mandibles matched the experimental model as well.

Figure 22. Experimental Deer Mandible Scraper Showing High Polish.

Figure 23. Experimental deer mandible hide scraper exhibiting similar striations to archaeological deer mandibles.

CONCLUSIONS

While I lack the certainty required to state that the modified deer mandible tools found at Oneota sites across the locality of La Crosse, Wisconsin are definitively hide scrapers I do believe that there is a strong likelihood that these tools were utilized for that function. This is evidenced from the similar wear patterns, which includes similar polish, no wear in the marrow cavity, and the similar striations along the horizontal ramus. Further research is clearly called for, but this study makes for an interesting beginning to this archaeological question.

MORE RESEARCH

Further research in the subject of deer mandible tools is needed. Specifically experimentation to recreate Brown's 1964 deer mandible sickle experiments to create a detailed template for mandible sickles would make for a wonderful thesis idea. Examination of the collections at various museums to determine if the hide scraper mandible artifact type is limited to the La Crosse locality would also be an excellent furtherance in the subject.

APPENDIX A

ONEOTA MODIFIED DEER MANDIBLE ARTIFACTS ANALYZED RAW DATA

Table 1. Deer Mandible 47Lc34 and 47Lc61

Specimen	LC34 F61 (all) 909		47Lc61 89.632 F139 L-2	
Age	Adult		3.5	
Side	Right		Left	
Bone marrow cavity wear:	Absent		Absent	
Tooth Wear: Presence/Absence	Absent		Absent	
	Medial	Lateral	Medial	Lateral
Fracture Wear	Completely rounded	Rounded	sharp small bumps rounded	Completely rounded
Body wear: (Below particular teeth				
On Ramus	No Wear	No Wear (single scratch)	No Wear	Little: fine striations
Predominant angle of striations:	n/a	n/a	N/a	23
Polish	No Polish	No Polish	Slight Polish	Slight Polish
Behind Molars	Little: fine striations	Little: fine striations	No Wear	No Wear
Polish	High Polish	High Polish	Slight Polish	Slight Polish
Predominant angle of striations:	45 Toward back	45 towards back	N/A	N/A
Third Molar wear	Little: fine striations	Little: fine striations	Little: fine striations	No Wear
Polish	High Polish	High Polish	Slight Polish	Slight Polish
Predominant angle of striations:	45 toward front	45 toward front	90	N/A
Second Molar Wear	moderate	Little: fine striations	Little: fine striations	Little: fine striations
Polish	High Polish	High Polish	Slight Polish	Slight Polish
Predominant angle of striations:	45 & 45 most back	Mixed	Mixed 45&45	45 towards front
First Molar Wear	Strong	moderate	Little: fine striations	moderate
Polish	High Polish	High Polish	Slight Polish	Slight Polish
Predominant angle of striations:	Mixed Mostly 45/45	Mixed Mostly 45/45	Mixed 45&45	45 & 90 Mixed
Forth Premolar Wear	moderate	moderate	No Wear	moderate
Polish	High Polish	High Polish	Slight Polish	Slight Polish
Predominant angle of striations:	Mixed Mostly 45/45	Mixed Mostly 45/45	N/A	45 & 90 Mixed
Third Premolar Wear	Little: fine striations	Little: fine striations	No Wear	Little: fine striations
Polish	High	High	Slight Polish	Slight Polish
Predominant angle of striations:	Mixed Mostly 45/45	Mixed Mostly 45/45	N/A	45 & 90 Mixed
Second Premolar Wear	Little: fine striations	Little: fine striations	No Wear	Little: fine striations
Polish	High	High	Slight Polish	Slight Polish
Predominant angle of striations:	Mixed Mostly 45/45	Mixed Mostly 45/45	N/A	45 & 90 Mixed
Tip Wear	Little: fine striations	Little: fine striations	Absent	Absent
Polish	High	High	Absent	Absent
Predominant angle of striations:	Mixed	Mixed	Absent	Absent

Table 2. Deer Mandible 47LC394 F550 and 47LC394 F88

Specimen	45LC394 F550 942343		47Lc394 91.1736.54.05 F. 88	
Age	Adult		Adult	
Side	Right		Left	
Bone marrow cavity wear:	Absent		Absent	
Tooth Wear: Presence/Absence	Absent		Absent	
	Medial	Lateral	Medial	Lateral
Fracture Wear	Sharp small bumps roun	sharp small bumps rounded	Worn, but still sharp	Worn, but still sharp
Body wear: (Below particular teeth				
On Ramus	No Wear	Little	No Wear	No Wear
Predominant angle of striations:	N/A	45 towards the	N/A	N/A
Polish	No Polish	No Polish	No Polish	No Polish
Behind Molars	Little: fine striations	N/A	No Wear	No Wear
Polish	No Polish	Slight Polish	Slight Polish	Slight Polish
Predominant angle of striations:	N/A	N/A	N/A	N/A
Third Molar wear	Little: fine striations	No Wear	Little: fine striations	moderate
Polish	Slight Polish	Slight Polish	Slight Polish	Slight Polish
Predominant angle of striations:	Mixed 45 & 45	N/A	Mixed 45 & 45	90
Second Molar Wear	Little: fine striations	No Wear	Little: fine striations	Little: fine striations
Polish	Slight Polish	Slight Polish	Slight Polish	Slight Polish
Predominant angle of striations:	Mixed 45 & 45	N/A	90	90
First Molar Wear	Absent	Absent	Little: fine striations	No Wear
Polish	Absent	Absent	Slight Polish	Slight Polish
Predominant angle of striations:	N/A	N/A	80 towards rear	N/A
Forth Premolar Wear	Absent	Absent	Little: fine striations	Little: fine striations
Polish	Absent	Absent	Slight Polish	Slight Polish
Predominant angle of striations:	N/A	N/A	90	90
Third Premolar Wear	Absent	Absent	Little: fine striations	Little: fine striations
Polish	Absent	Absent	Slight Polish	Slight Polish
Predominant angle of striations:	N/A	N/A	90	90
Second Premolar Wear	Absent	Absent	Little: fine striations	Little: fine striations
Polish	Absent	Absent	Slight Polish	Slight Polish
Predominant angle of striations:	N/A	N/A	90	90
Tip Wear	Absent	Absent	moderate	moderate
Polish	Absent	Absent	Slight Polish	Slight Polish
Predominant angle of striations:	N/A	N/A	90	90

Table 3. Deer Mandible 47LC44 F89

Specimen	Lc44 89.1087.04	
Age	Adult	
Side	Right	
Bone marrow cavity wear:	no	
Tooth Wear: Presence/Absence		
	Medial	Lateral
Fracture Wear	Rounded	Rounded
Body wear: (Below particular teeth		
On Ramus	Absent	Absent
Predominant angle of striations:	Absent	Absent
Polish	Absent	Absent
Behind Molars	fine striations	moderate
Polish	Strong Polish	Strong Polish
Predominant angle of striations:	45 towards the back	Mixed 90
Third Molar wear	moderate	moderate
Polish	Strong Polish	Strong Polish
Predominant angle of striations:	some 90 mostly 80 towa	80 towards the back
Second Molar Wear	Little: fine striations	Little: fine striations
Polish	Strong Polish	Strong Polish
Predominant angle of striations:	some 90 mostly 80 towa	80 towards the back
First Molar Wear	2.5 Numerous Striations	Little: fine striations
Polish	Strong Polish	Strong Polish
Predominant angle of striations:	Mixed Numerous	Mixed Numerous
Forth Premolar Wear	No Wear.5 sparce striati	Little: fine striations
Polish	Strong Polish	Strong Polish
Predominant angle of striations:	Mixed Numerous	Mixed Numerous
Third Premolar Wear	No Wear.5 sparce striati	No Wear.5
Polish	Strong Polish	Strong Polish
Predominant angle of striations:	Mixed Numerous	Mixed Numerous
Second Premolar Wear	Absent	Absent
Polish	Absent	Absent
Predominant angle of striations:	Absent	Absent
Tip Wear	Absent	Absent
Polish	Absent	Absent
Predominant angle of striations:	Absent	Absent

Appendix B

EXPERIMENTAL DEER MANDIBLE SCRAPER ANALYSIS RAW DATA

Table 4 Experimental Deer Mandible scraper data

Specimen	Experimental scraper EX-04R	
Age		
Side	Right	
Bone marrow cavity wear:	Absent	
Tooth Wear: Presence/Absence	Absent	
	Inside	Outside
Fracture Wear	Rounded	Slightly worn
Body wear: (Below particular teeth		
On Ramus	Sharp	Sharp
Predominant angle of striations:	N/A	N/A
Polish	2	2
Behind Molars	Sharp	Sharp
Polish	Slight Polish	Slight Polish
Predominant angle of striations:	N/A	N/A
Third Molar wear	Slightly Worn	Slightly Worn
Polish	Moderate Polish	Moderate Polish
Predominant angle of striations:	90	90
Second Molar Wear	Rounded	Sharp
Polish	Strong Polish	Strong Polish
Predominant angle of striations:	Mixed 45 - 45	90
First Molar Wear	Rounded	Sharp
Polish	High Polish	Strong Polish
Predominant angle of striations:	Mixed 45 - 45	90
Forth Premolar Wear	Slightly Worn	Sharp
Polish	Strong	Strong
Predominant angle of striations:	Mixed mostly 90	90
Third Premolar Wear	Sharp	Sharp
Polish	Strong Polish	Strong Polish
Predominant angle of striations:	90	90
Second Premolar Wear	Sharp	Sharp
Polish	Strong Polish	Moderate Polish
Predominant angle of striations:	90	90
Tip Wear	Sharp	Sharp
Polish	Moderate Polish	Moderate Polish
Predominant angle of striations:	Mixed	90

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