An Analysis of Fish Remains from the Krause Site (47Lc41) in La Crosse County, WI

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ABSTRACT

During the 2000 excavations at the Krause site (47Lc41) in Onalaska, WI, archaeologists from the University of Wisconsin-La Crosse and the Mississippi Valley Archaeology Center (MVAC) uncovered an earth oven feature. Oneota features are common regionally, but this feature (number 275) is different from other Oneota features. Most Oneota features in the La Crosse area are garbage or storage pits and can only offer a secondary context. Feature 275 is a stone-lined earth oven where the contents are believed to be in their primary context. Feature 275 is also unusual because of twenty different zones that appear to be separate areas of activity and use. The analysis of fish remains in this feature offers unique insights into the diet and subsistence of the Oneota people who were a pre-European agricultural society.

INTRODUCTION

In western Wisconsin, extensive archaeological research has documented a long history of occupation. The Oneota Tradition represents the last pre-European occupation of the area. Much of what has been learned about the Oneota comes from analysis of artifacts as well as the organic components represented by floral and faunal remains. Through the analysis of faunal remains, archaeologists can learn a lot about subsistence patterns of the past. This paper looks at the recovery of fish remains from archaeological sites, the steps to identifying osteological fish remains, seasonality of different species and what that can tell us, and possible environmental conditions. More specifically, this paper will look at fish remains recovered from an earth oven feature (number 275) from the Krause site in La Crosse County, Wisconsin.

BACKGROUND

Archaeology of Native People in La Crosse Area

The La Crosse region has a rich archaeological history that spans from the Paleoindian peoples to the Oneota and the consequent historic groups that arose from them. The Paleoindian people occupied the La Crosse area from about 12,000 B.P. to about 9,000 B.P. They were big game hunters who followed large mammoths and mastodons in order to survive. There are several Paleoindian sites in the La Crosse locality including the Morrow-Hensel, Rudd Bison, and Silver Mound sites (Theler and Boszhardt 2003: 53-68).

The Archaic tradition follows the Paleoindian tradition in the La Crosse area. The Archaic people occupied the La Crosse area from about 9,000 B.P. to 2,500 B.P. The Archaic period is further split into the Early, Middle, and Late Archaic. The Archaic people were also hunters and gatherers; however, they began to exploit different plants and animals. Archaic sites in the La Crosse area include the Lawrence Rockshelter, Price site III, Koster and the Raddatz Rockshelter (Theler and Boszhardt 2003: 69-84).

The Woodland people follow the Archaic people in the La Crosse area sequence. The Woodland Tradition has been divided into the Early, Middle, and Late Woodland based on technology and burial customs. In general, the Woodland people occupied the La Crosse region from 2,500 B.P. to 850 B.P. It is during this time period that pottery first begins to show up in the archaeology record. Another Woodland characteristic is the building of many burial mounds. Early/Middle Woodland sites in the area include, Nicholls Mound, Overhead, Rehbein, and Mill Pond. Late Woodland sites include, Gottschall Rockshelter, Brogley Rockshelter and Tainter Cave. (Theler and Boszhardt 2003: 97-121)

The Oneota people are the next group of people to inhabit the La Crosse area. The Oneota, however, are discussed in greater detail below because of their significance at the Krause site.

Oneota Culture

The Krause site (47Lc41) is one of the many Oneota sites in western Wisconsin. Archaeological investigations into the native people of the La Crosse region began in 1850 (Arzigian and Boszhardt 1993: 9-10). These first investigations, however, occurred before archaeologists defined Oneota culture. Ellison Orr, Charles Keyes, and William McKern first described Oneota culture through the identification of diagnostic artifact traits (Theler and Boszhardt 2003: 157-172). The Oneota people inhabited a broad area of the Midwest from the Missouri River to Lake Michigan. Archaeologists believe that the Oneota culture was formed when the previous inhabitants of the area, the Late Woodland people, began to be influenced by the Middle Mississippian culture to the south. This transition occurred around 1050 A.D. in the La Crosse region. Because of shifts in ceramic decoration, archaeologists have subdivided the Oneota culture into horizons. The first is the Emergent Oneota, followed by the Developmental Horizon and lastly, the Classic Horizon (Theler and Boszhardt 2003: 157-172). In the La Crosse region, the Oneota is further divided into Brice Prairie (A.D. 1300 – 1400), Pammel Creek (A.D. 1400 – 1500) and Valley View (A.D. 1500 – 1625) phases (Boszhardt 1985). Types of pottery found during the time period defined each of these phases. Pottery types in the Brice Prairie phase include Brice Prairie Trailed and Perrot Punctate. The Pammel Creek phase includes the Pammel Creek Trailed, Midway Incised v. bold, Perrot Punctate v. bold, Allamakee Trailed, and Koshkonong Bold v. bold. Pottery types in the Valley View phase include Valley View Trailed, Midway Incised v. fine lip, Allamakee Trailed with a fine lip, and Koshkonong Bold with a fine lip.

The Oneota people were agriculturalists whose main crops were corn, beans and squash; their subsistence also included wetland resources and some hunting (Theler and Boszhardt 2003: 157-172). The Oneota people practiced a seasonal round. This means that they utilized different resources and locations during different seasons throughout the year (Arzigian et al. 1993: 273-279). In the winter seasons, people would disperse into smaller groups exploiting large game resources and using stored plant foods. In the spring and summer people would gather in larger groups along the river. In the spring, corn and other agricultural products would be planted and many small game animals would be harvested (Arzigian et al. 1993: 273-279).

The La Crosse area was one of the most populated Oneota centers throughout the Midwest. Through time, the Oneota culture went through many changes; these changes are easily seen in the La Crosse area because of their continuous occupation of the area. One of these major changes was the movement away from the Mississippi River edge to the bluff terraces and floodplains (Theler and Boszhardt 2003: 157-172). This transition took place in the late 15th century and continued until the Oneota people left the La Crosse area in the early 16th century. This shift to the terraces has been seen as a defensive mechanism as well as an agricultural opportunity (Theler and Boszhardt 2003: 157-172). The Sand Lake site has evidence of ridged field agriculture that would have supplied great yields. The Valley View site, also situated away from the river, has evidence for a palisade that indicates a defensive tactic. The reason why the Oneota abandoned the La Crosse area is not known for certain; however most believe that it corresponded with the movement of the Europeans into the area (Theler and Boszhardt 2003: 157-172). The Oneota are believed to be the ancestors of the Ioway and Hochunk tribes that emerged during the proto-historic and historic periods.

Earth Oven and Storage/Garbage Pit Characteristics

The contents of Feature 275 are arranged in many different zones with fire-cracked rock in many of these zones. Much of the faunal remains recovered from this feature are believed to be in a primary context leading to the assumption that this feature may be an earth oven. Thoms (2008) gives several examples of pit features that he considers to be earth ovens in the Northwest Coastal region. His first example is a steam-roasting pit, which is a shallow, closed pit with rocks heated within. Firewood and another layer of rock is added. The wood is burned and heated rocks are spread across the bottom of the pit. Lastly, greens were placed over the hot rocks and coals and the greens were then covered with earth (Thoms 2008). A roasting pit is a shallow pit into which rocks that are preheated are added and covered with greens. The food is placed on top of the greens and allowed to cook.

A steaming pit is a shallow pit where rocks are preheated and covered with greens. The food is put on top of the greens and then covered with grass. A stick is placed in the pit and covered with earth. The stick is then removed and water is poured through the hole it created. The hole is then re-covered. A stone-boiling pit is a bucket-shaped pit with vertical walls lined with bark. The pit is filled with water half way, food is then added and hot rocks are carried to the pit and placed in as needed (Thoms 2008).

Thoms (2008) states that earth ovens, steaming pits, and pit boiling areas are likely to contain numerous rock filled basins and occasional fire cracked rock concentrations where cook stones were heated separately. Overall, the earth oven features contain scattered FCR and may contain remains of food that was cooked within the oven offering a primary context. Feature 275 contains the ring of FCR as well as the remains of several fish that appear to be in a primary context.

Storage pits are different from earth ovens because they do not represent foods that are being cooked. They may contain food that was placed in them to store over the winter, but most often, storage pits are used as refuse pits after they have served their purpose as storage pits. Much of what is known about the use and creation of storage pits comes from an ethnographic account from Buffalo Bird Woman in 1916. Buffalo Bird Woman was born in 1839, the daughter of Small Ankle, a leader of the Hidatsa at the time. She recounts the ways of her ancestors in a compilation called *Buffalo Bird Woman's Garden: As Recounted by, Maxi'diwiac (Buffalo Bird Woman) (ca.1839-1932) of the Hidatsa Indian Tribe* – originally published as *Agriculture of the Hidatsa Indians: An Indian Interpretation* by Gilbert Livingstone Wilson, Ph.D. (1868-1930). Buffalo Bird Woman spends a chapter discussing storage during the winter months. It is in this chapter where she describes how to build and what to store in a cache pit.

Buffalo Bird Woman states that corn; beans, sunflower seeds and dried squash were stored in these pits over the winter. The pit is shaped like a jug, wider on the bottom with a narrow neck near the top. The mouth (or entrance) of the pits was usually about two feet long. Buffalo Bird Woman says that her father's family built the cache pits to be the size of a bull boat at the bottom. She also gives other measurements. Overall, the depth of the pit is about four or five feet deep. She explains that the mouth is about one foot eight inches from the ground surface and from the mouth to the bottom of the pit is about two and a half feet.

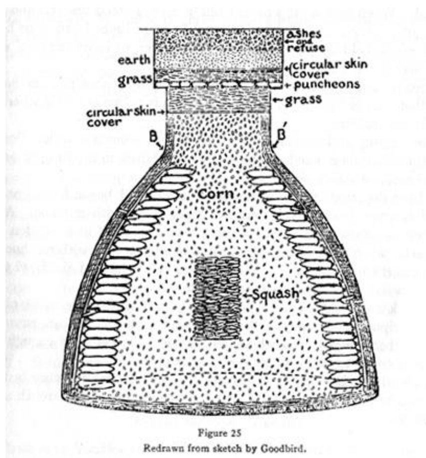

Figure 1. Buffalo Bird Woman's depiction of how a storage pit would be filled and covered. (Wilson 1917)

When the cache pit was dug, it was lined with grass. The grass was used to close the top of the mouth off and to line the side of the pit. The grass lining was about four inches thick, held in place by willow branches. The floor was composed of dried or dead willow sticks laid evenly and snugly across the bottom of the pit. (Wilson 1917)

The pit was then filled, first with braided corn. The braided corn was laid down around the outer edge of the pit, usually two ears wide, while loose corn was laid in the middle of the pit. A squash ring was added to the pit on top of the loose corn. Lastly, loose corn was filled in around the squash ring.

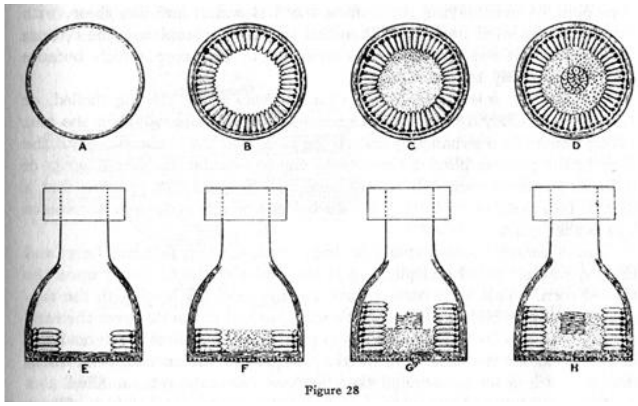

Figure 2. A depiction in cross section and vertical view to show the many steps that went into filling a storage pit. (Wilson 1917)

When the pit was filled, it was fitted with a cover made from the flank of a buffalo bull. On top of this hide covering, the same grass that lined the inside of the pit was laid down. Puncheons, split from logs, were put down on top of this grass layer. The puncheons were laid down in trenches so they didn't rock. These puncheons were then covered with more grass as well as another hide covering. Lastly, earth was heaped over the top of the pit until it reached the surface level. Garbage pits differ from storage pits and earth ovens because they contain refuse. A garbage pit may have been a storage pit at point in its use cycle. (Wilson 1917)

Site and Feature Background

The La Crosse Locality is located in an area known as the Driftless Area. This means that the area was not glaciated during the last glacial maximum. The general topography of the La Crosse area consists of both high ridges, or bluff tops, and low valleys (Stevenson 1985). There are many rivers and small creeks throughout the area that the native people could have taken advantage of including the Upper Mississippi River, the Black River, the Bad Axe River, La Crosse and Trempealeau River. Some of the smaller creeks include Coon Creek, Halfway Creek, and Pammel Creek (Boszhardt 1994). This hydrologic system would have generated several different types of water currents and substrates. The hydrology of the La Crosse region changed significantly in the 1930s with the construction of a lock and dam system on the Mississippi River. This led to many lakes, sloughs, wetlands, and islands to become submerged. Vegetation in the past would have consisted mostly of prairie grasses with intermittent oak and hickory trees. The floodplains would have supplied the Oneota with rich wetland resources (Stevenson 1985).

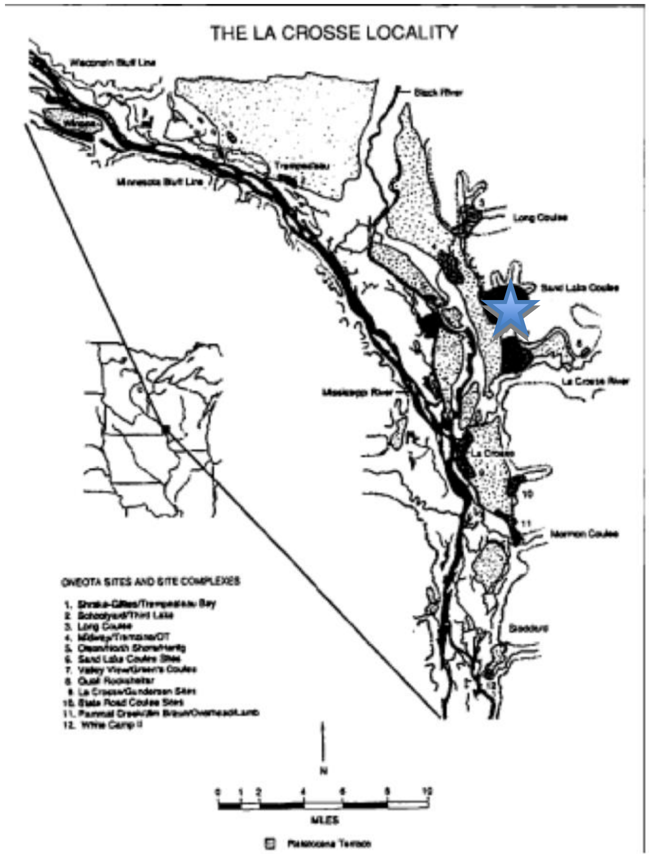

Figure 3. The La Crosse Locality – the blue star indicates the general location of the Krause site. (Adapted from Arzigian and Boszhardt 1993)

Excavations at the Krause site began in 1979 when the first survey was conducted. In 1982, the Krause site was more thoroughly surveyed, collecting over 2,000 artifacts. The Krause site was placed on the National Register of Historic Places in 1984 (Boszhardt 1985). In 1986, the Mississippi Valley Archaeology Center (MVAC) conducted the first excavations at the Krause site. At this time, approximately one acre of land was excavated revealing 40 Oneota pit features. University of Wisconsin-La Crosse Field School and MVAC conducted final excavations in 2000. Fieldwork began by removing the plow zone with heavy equipment to reveal over 500 pit feature stains. All of the features were numbered and mapped. The features were then bisected to reveal the profile. All soil from the features was taken back to the archaeology laboratory for further analysis. After examining the pottery found in the feature, it was found that Feature 275 represents the later Oneota phase of Valley View dating from A.D. 1500-1625. However, artifacts from all three of the La Crosse Locality phases were recovered from the Krause site. Artifacts representing the Archaic Period (8,000 B.C. – 500B.C.), the Woodland Period (500 B.C. – A.D. 1200), and the Mississippian Period (A.D. 800 – A.D. 1350) have all been recovered at the Krause site. Artifacts were also uncovered from all three of the local Oneota phases: Brice Prairie (A.D. 1300 – 1400), Pammel Creek (A.D. 1400 – 1500) and Valley View (A.D. 1500 – 1625) (Boszhardt 1985).

Feature 275 was excavated in two halves. The west half was skim-shoveled and screened until artifact concentrations were discovered. From that point, the rest of the west half was removed in arbitrary 10-centimeter levels and all the soil was saved as matrix samples for flotation. An ash lens was removed separately and matrixed. There was an outer rim of fire-cracked rock (FCR) that was left in place. The artifacts were removed. When the west half was removed, the many zones of the east half were able to viewed in profile. All soil from the east half was bagged and matrixed. Level 1 (0-10cmbss) was removed as a level. The rest of the east half was excavated by zones. Each zone was removed to the natural level, all soil was matrixed and larger artifacts were mapped and photographed. The datum was set up at the south profile line at the scraped surface at the base of the plow zone.

Figure 4. Feature 275 during excavation. Photo from Connie Arzigian

Table 1. Soil descriptions of some of the different zones in Feature 275

	Zone Description
Zone 1	Located near the surface, contained silty dark brown soil (10yr 3/3)
Zone 2	Ash lens located near surface, burnt orange and yellowish brown soil with charcoal (10yr 5/4)
Zone 3	silty charcoal zone located under zones 1 and 2, dark brown silty soil (10yr 3/3)
Zone 4	silty dark brown soil (7.5yr 3/3) with nodules of burnt earth (2.5yr 3/4)
Zone 5	mottled zone, ash with some flecks of burnt earth (10yr 3/3 dark brown and 3/4 dark yellowish brown
Zone 6	Ash lens with tiny nodules of burnt earth and charcoal flecks, located near the surface
Zone 7	charcoal zone with nodules of ash intermingled with ash lens in zone 6
Zone 8	charcoal zone 10yr 2/1 black
Zone 9	Ash lens, contains charcoal with nodules of burnt earth (7yr 5/8 strong brown)
Zone 10	black soil with a lot of charcoal, greasy, becomes more light in color
Zone 11	Ash lens with dark yellowish brown soil (10yr 4/4) charcoal and shell flecks with burnt bone
Zone 12	charcoal zone, 10yr 4/4 dark yellowish brown with streaks of 7.5yr 4/6 strong brown
Zone 14	located under an ash lens, flat copper piece found within zone
Zone 15	Located on the south side between FCR and sterile soil.
Zone 16	blends into Zone 6 which is located near the surface of the feature
Zone 17	very thin, located under FCR and fish scales
Zone 18	located between zones 2 and 11 between 15-20 cmbss
Zone 19	located under FCR, contains a small ash lens
Zone 20	located under zone 1 and adjacent to zone 3
Zone 21	located under zone 5

Details about each zone were recorded including soil descriptions and in some zones, physical characteristics of the zone. There were three zones that were described as ash lenses. These zones are: Zones 6, 11, and 12.

The floral remains from Feature 275 have been recorded and analyzed by Quinlan Stefaniak in 2004. She reports that almost every major plant type used by the Oneota was found in this feature. The plant remains from the feature indicate use throughout the spring, summer and fall. Also, the assortment of the remains is found in both the zones at the top of the feature as well as those on the bottom. In particular, wild rice and acorn were more abundant in this feature than others at the Krause site. Wild rice, acorns, and beans are the only species that have their highest densities in this feature. (Stefaniak 2004). Feature 275 also had the highest concentration of tobacco seeds. Stefaniak states that this can be attributed to smoking around the hearth and emptying their ashes into it. Overall, Feature 275 contained the highest amount of plant remains at the Krause site.

Table 2. Plant remains found within Feature 275. (Stefaniak 2004: 13)

Feature	275
Soil Volume (L)	345.55
Total Corn (Zea mays) (g)	20.379
Corn Kernels (Zea mays) #	4237
Corn Kernels (Zea mays) (g)	11.014
Corn Cupules (Zea mays) #	3593
Corn Cupules (Zea mays) (g)	9.365
Beans (Phaselous vulgaris) #	156
Beans (Phaselous vulgaris) (g)	0.951
Squash Rind (Cucurbita sp.) #	28
Squash Rind (Cucurbita sp.) (g)	0.028
Starchy Material (g)	6.035
Hickory Nutshell (Carya sp.) #	1674
Hickory Nutshell (Carya sp.) (g)	7.464
Hickory Nutmeat (Carya sp.) #	5
Hickory Nutmeat (Carya sp.) (g)	0.149
Acorn Nutshell (Quercus sp.) #	17527
Acorn Nutshell (Quercus sp.) (g)	23.689
Acorn Nutmeat (Quercus sp.) #	29
Acorn Nutmeat (Quercus sp.) (g)	2
Unidentified Nutmeat #	64
Unidentified Nutmeat (g)	0.24
Hawthorne (Crataegus sp.) #	2
Hawthorne (Crataegus sp.) (g)	0.015
Unidentified Nutlet #	11
Unidentified Nutlet (g)	0.092
Sunflower (Helianthus annus) #	5
Sumpweed (Iva annua) #	
Goosefoot (Chenopodium sp.) #	1437
Pigweed (Amaranthus sp.) #	
Tobacco (Nicotiana rustica) #	813
Nightshade (Solanum americanum #	18
Cranberry/Blueberry (Vaccinium sp.) #	
Wild Rice (Zizania aquatica) #	33285
cf Wild Rice (Zizania aquatica) #	
Knotweed (Polygonum sp.) #	82
Bayberry (Myrica sp.) #	4
Naiad (Najas sp.) #	507
Stargrass (Hypoxis sp.)#	1
cf Boneset (Eupatorium sp.) #	
Catchfly (Silene sp.) #	
Grass Seeds (Poaceae) #	1423
Grass Awns (Poaceae) #	294
Embryos #	36
Fungus #	243
Unidentified Seeds #	82

Fish Background

The history of collecting faunal remains from archaeological sites has varied since it's beginning. In the past, archaeologists collected animal bones in a haphazard manner. Early excavators may have collected bones only when nothing else was available, and even then, they were only dealing with fairly large bones (Wheeler and Jones 1989). More recent excavations at archaeological sites have demonstrated the need for sieving techniques in order to achieve a representative sample of animal remains. Wheeler and Jones (1989) state that hand collection and sieving must be carried out in a complementary manner to get the most information that is possible. Articles by Colburn (1991), Kelly (1991), and Snider (1991), Manzano and Dickinson (1991), and Morey, Klippel, and Manzano (1991) all discuss the importance of using the appropriate techniques to obtain a representative sample of fish of all sizes. The ¼-inch screen size that is used most frequently at archaeological sites to filter artifacts will not always recover a representative sample of the fish that may be present at the site. The above authors recommend using at least 1/8-inch screen size in order to recover the remains of smaller fish. Fish remains can also be recovered in the flotation process, which uses a 40-mesh screen, which is small enough to trap plant remains. In sites where only a quarter inch screen is used, the sample is biased in favor of the larger species of fish.

Fish Description

Before we go can too much further into this paper, an explanation of fish and how they can be used archaeologically is necessary. Fish can tell us about the possible seasonality of a site by looking at when they were most likely harvested. Seasonality of harvest can tell us a lot about when an archaeological site was occupied. Each species of fish is unique in where and when they spawn. Spawning time is important because this is *usually* when the fish are most vulnerable to capture. Wheeler and Jones (1989) indicate that fish that make local spawning migrations in river systems do so at a certain time during the year and their presence in archaeological sites can demonstrate seasonality of capture. In *Fishes of Missouri* (Pflieger 1975) gives accounts when each species of fish spawns.

Sturgeon (Acipenseridae) is a primitive fish that consist of about 25 species. Two of these are common in Wisconsin archaeological sites. The first is Lake Sturgeon (*Acipenser fulvescens*); spawning occurs in the late spring when the fish enters small streams. During spawning, they frequently break the surface or even leap right out of the water, which makes a loud splashing sound that can be heard a significant distance away (Pflieger 1975:59-62). This makes them extremely vulnerable to capture. The second is the shovelnose sturgeon (*Scaphirhynchus platorynchus*). There is not as much information on the spawning habits of this species. It is known to occur in the open channels of rivers and the height of spawning in the Mississippi River is known to be in early May (Pflieger 1975:59-62).

Figure 5. *Acipenser fulvescens* (Lake Sturgeon) Photo from James Theler

Another common fish is the bowfin (Amiidae). The family Amiidae only has one living species: *Amia calva*. This species also happens to appear commonly in archaeological sites in Wisconsin. The Bowfin normally spawns from late April to early May in Wisconsin (Becker 1983).

Figure 6. *Amia calva* (Bowfin) http://www.seagrant.wisc.edu/greatlakesfish/fbowfin.html

Similar to the bowfin, the freshwater drum fish is the only fish in its family (that lives in freshwater). The drum fish is known to spawn from the first of May to the end of June in Wisconsin. (Becker 1983). Researchers have found that the drumming noise that this species makes only occurs from May to August with a peak in June. They believe that this noise may be linked to their spawning (Pflieger 1975). If so, this would make them more visible to human predators.

Figure 7. *Aplodinotus grunniens* (Freshwater drumfish) Photo from James Theler

Another common fish family found in the archaeological record is the pike family (Esocidae). Both species, Northern Pike and Muskellunge are found in Wisconsin. Northern Pikes (*Esox lucius*) spawn in the early spring just after the ice melts. (Becker 1983) They move into marshes or other shallow, marginal waters. Because these fish are very large, averaging about17 inches by the time they are 8 months old, they may become more vulnerable in shallower waters (Pflieger 1975). The Muskellunge is slightly different from the Northern Pike in that it is a solitary fish and is more evasive. It spawns slightly earlier than the Northern Pike, but still ventures into shallower water (Pflieger 1975).

Figure 8. *Esox lucius* (Northern Pike) http://www.rudybenner.com

Suckers are a very common family of fish in the archaeological sites of Wisconsin. There are many different species that are represented, these include; the bigmouth and smallmouth buffalo, black buffalo, quillback, white sucker, northern hog sucker, spotted sucker, and the black, golden, silver, and shortnose redhorses. In general, these suckers are all spring spawners, usually beginning in April. Most of them tend to gather in larger groups in shallow waters, again, making themselves more visible to human predators (Pflieger 1975).

Figure 9. *Ictiobus cyprinellus* (Bigmouth buffalofish)
http://www.epa.gov/bioindicators/images/fish/suckers/buffalofish

Figure 10. *Moxostoma anisurum* (Silver Redhorse) Photo from James Theler

Catfish are another popular group of fish that occur on sites in Wisconsin. There are 37 species that belong to the Ictaluridae family. Common species in this area include: the black, brown, and yellow bullhead, the channel catfish, flathead, and stonecat. Most species of catfish spawn in the late spring or summer. Catfish create nests beneath logs and one of the parent fish guards it continuously. When the young leave the nest, they travel in a compact school accompanied by one or both adults. The channel catfish prefers a swifter current like those in river channels while the bullheads prefer the slow backwaters of ponds and rivers. (Becker 1983)

Figure 11. *Ictalurus punctatus* (Channel Catfish) Photo from James Theler

The perch family (Percidae) also occurs with some frequency. Common species include: the walleye, sauger, and yellow perch. This family tends to spawn somewhat earlier. It can begin as early as late February and extends into early April. The peak however tends to be in March (Pflieger 1975).

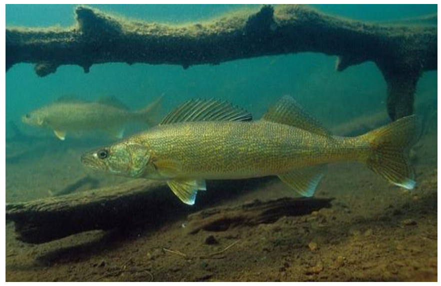

Figure 12. *Stizostedion vitreum* (Walleye) http://www.saco.ca/images/walleye

Fish can also tell us about the water systems that were present in prehistoric times. Fish are able to tell us this because each type of fish prefers a specific water speed, substrate, and temperature. *Fishes of Missouri* (Pflieger 1975) also discusses habitat preferences for each of the species of fish mentioned previously. For example, the sturgeon, both the shovelnose and the lake sturgeon, tend to inhabit large and open rivers. The lake sturgeon inhabits moderately clear rivers and lakes. It's often found over firm sandy, gravelly, or rocky bottoms (Pflieger 1975:59-62). The shovelnose sturgeon is found in channels of large rivers in areas of fast current. It prefers a gravel bottom and is very tolerant of high turbidity (Pflieger 1975:59-62). If the sturgeon is found at an archaeological site, it is likely that a large, open river with a rocky bottom was probably somewhere nearby. This can be useful information because a river's path may have been significantly different prehistorically.

The details concerning how fish are recovered from archaeological sites and calculations that can be done with the bones once they are sorted are discussed in detail in the methodology section of this paper. Overall, this information is meant to give a brief background of what can be inferred from fish at archaeological sites that will not be discussed later.

METHODOLOGY

The methodology for this paper is specialized. This is because it required the intensive study of fish osteology before any other work could be done towards the project. Obtaining the required knowledge for this project is an ongoing process. The Mississippi Valley Archaeology Center houses a comparative collection of modern fish skeletons, which was used to help identify the archaeological specimens. This collection, along with several texts was used to gain the basic knowledge needed to begin the identification of archaeological samples. The reference books that are most helpful are *Fish, Amphibian and Reptile Remains from Archaeological Sites* (Olsen 1969) and *An Illustrated Osteology of the Channel Catfish* (Mundell 1975). Overall, there has not been a great amount of work done of the identification of fish in comparison to other types of faunal analysis. Wheeler and Jones (1989) and Casteel (1976) both offer a fairly comprehensive study of how fish can be utilized from archaeological remains. They both go into depth about recovery from archaeological sites, ways to identify species, including comparative collections and illustrated texts, calculations of size and minimum number of individuals (MNI), as well as possible seasonal trends and aspects of harvest.

Once the basic knowledge of fish osteology is obtained, it is possible to move on to the identification of the archaeological samples. Physically doing the sorting and identification is the key to really learning the osteology. The identification process is done mainly through a comparative collection (Casteel 1976:7-8). The bones found archaeologically are compared to those from modern species of known weights.

Once a bone has been identified to genus or species, if possible, the next step is to estimate the live weight of the individual fish. Size can be estimated using a comparative collection of modern species of known weights. The size is simply estimated by noting whether the archaeological specimen is smaller or larger than the modern specimen of a specific weight (Casteel 1976:93-122).

Once the live weight of the fish has been estimated, it possible to obtain a reasonable estimate of the amount of edible meat that each individual could have provided. Edible meat estimates are important because it helps to regulate or even out the amount of meat that could have been used by native peoples. For example, if an assemblage contains two twenty-five pound sturgeon and twenty-five two pound golden red-horses, the edible meat count will account for the differences. Instead of simply looking at the numbers of fish of each species, it takes into account the meat that is available. In the example above the meat of the two sturgeons is equal to that of the twenty-five golden red-horses. This edible meat content can be found by taking seventy percent of the calculated live weight of the fish (Theler personal communication).

All of the information that has been obtained so far should be entered into a database for smoother analysis. Entering information into a database, although time consuming, can be very helpful in making calculations and finding patterns. A database can be used to calculate the MNI (minimum number of individuals) and NISP (number of identifiable specimens). The NISP is simply a count of the number bones, be it fish, mammal or amphibian that are found at an archaeological site. MNI is the minimum number of individuals that are represented. It is calculated by looking at a certain skeletal element and determining how many are from the right side and how many are from the left side (Breitburg 1991:153-162). There has been debate about which of these methods is most representative. It is thought that NISP may overestimate the number of individuals present in the assemblage. It does not take into account that there may be multiple elements from one individual present. The MNI value however, may be thought to under-represent the number of individuals present. (Marshall and Pilgrim 1993:262) Therefore it is advantageous to use both values when examining a faunal assemblage.

University of Wisconsin-La Crosse professor Dr. James Theler guided the process. After the specimens in each zone were identified to the appropriate species or genus, Dr. Theler checked all of the identifications to make sure they were all correct. Due to time constraints, Dr. Theler also identified the mammal bones in this feature.

RESULTS

Feature 275 contained 4595 fish bones that were, if possible, identified to the family, genus, or species level. The fish remains were present in every level or zone except for Zones 7, 14, 16, and 21. These zones however, did contain other animal remains. Levels 1 and 3 and the West Wall contained the highest number of fish remains. The feature contained seven families, eleven genera, and sixteen species. The MNI (minimum number of individuals) indicated that at there were at least 43 individuals present within the feature. The NISP (number of identified specimens) was 121. There were also many mammal bones recovered from the feature and identified by Dr. Theler. Most of the mammal remains were found in the west half of the feature in level 3.

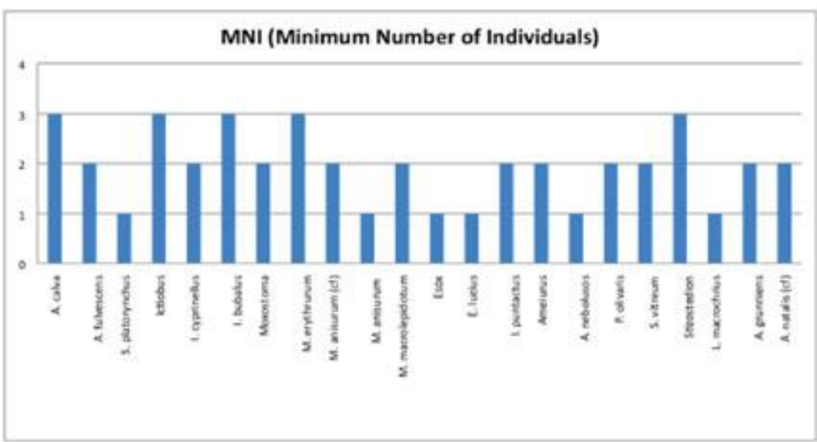

Figure 13. The MNI (minimum number of individuals) shows the distribution of fish species present within the feature.

The most common families as determined from the MNI were Catostomidae (Sucker family), followed by Ictaluridae (Catfish family) and Percidae (Perch Family). The three most common species in the feature were *Amia calva* (bowfin), *Ictiobus bubalus* (smallmouth buffalofish), and *Moxostoma erythrurum* (golden redhorse). The MNI also indicates that the feature contained a wide and even distribution of species. There was no single species that is represented more frequently than any of the other species.

The NISP however, indicates that *Amia calva*, *Ictalurus punctatus*, and *Aplodinotus grunniens* were the most common species represented. According to the NISP, the *Aplodinotus grunniens* (freshwater drumfish) is the most common species representing over forty percent of the fish remains recovered from the feature. The NISP also indicated that *Ictalurus punctatus* (channel catfish) represented over twenty percent of the fish from the feature. Neither of these species was indicated by the MNI as being this common. *Amia calva* (bowfin) however, was also indicated by the MNI as being one of the more common fish. The MNI however indicates that the bowfin makes us seven percent of the sample while the NISP indicates that it makes up over fifteen percent.

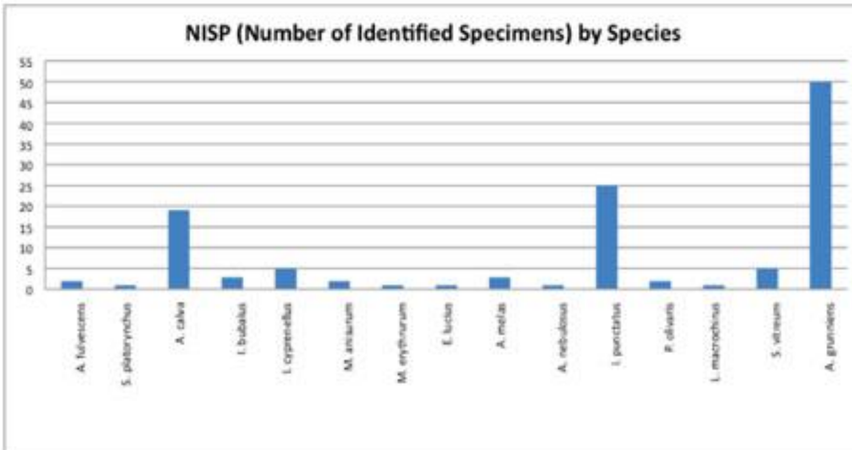

Figure 14. The NISP (number of identified specimens) does not show the even distribution of species that the MNI value does.

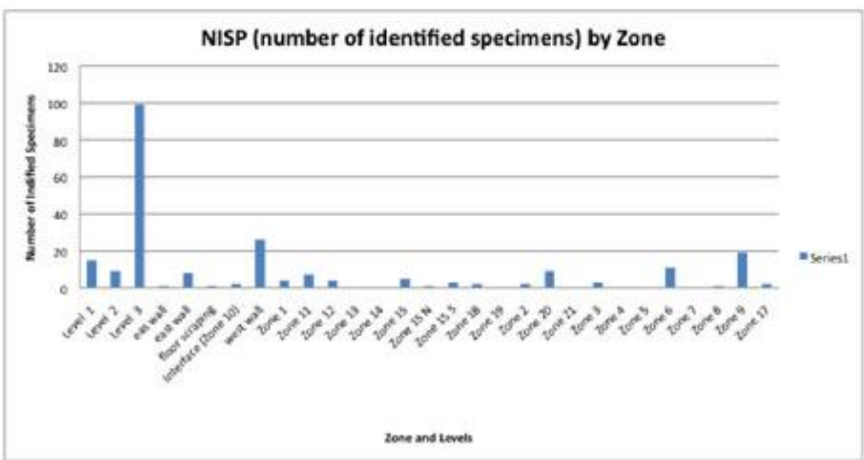

Figure 15. The NISP per zone indicates that Level 3 contains the most fish remains while there are several zones that do not contain identified fish remains.

Edible meat calculations indicate that the Catostomidae family represented the most edible meat in the feature with a total of 78.75 pounds. Two other families that represented significant amounts of edible meat were the Ictaluridae family and the Acipenseridae family. The Ictaluridae family represented 21.35 pounds of edible meat while the Acipenseridae family represented 10.5 pounds of meat. Edible meat was also calculated for the species level. *Ictiobus cyprinellus* was the species that represented the most edible meat with a total of 17.5 pounds of meat. Two other species that contained significant amounts of edible meat were Ictiobus bubalus and *Pylodictus olivaris*. *Ictiobus bubablus* represented 16.1 pounds of meat while *Pylodictus olivaris* represented 11.9 pounds.

Table 3. The edible meat distribution among the families in both pounds and percentage values.

Species	Weight (lbs)	Percentage

Catostomidae	78.75	60.94%
Percidae	4.41	3.41%
Amiidae	8.4	6.50%
Acipenserdae	10.5	8.13%
Esocidae	2.31	1.79%
Ictaluridae	21.35	16.52%
Sciaenidae	3.5	2.71%

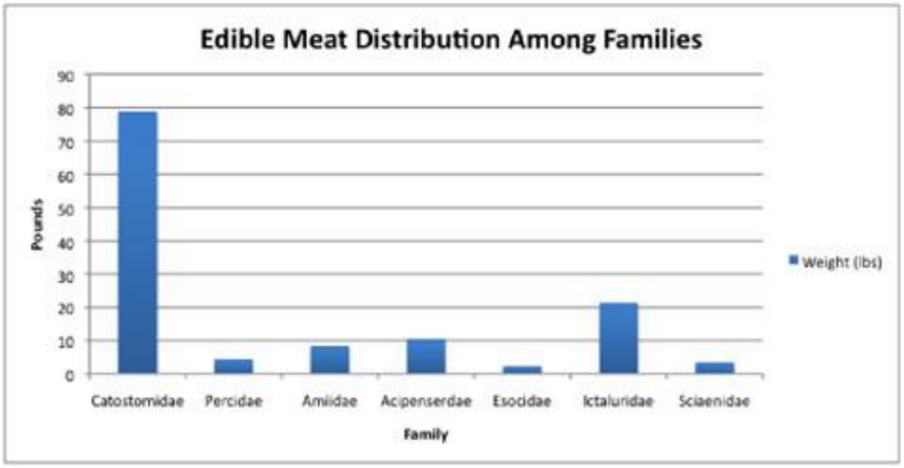

Figure 16. The Catostomidae family represents the most edible meat of the 7 families that occur in the feature.

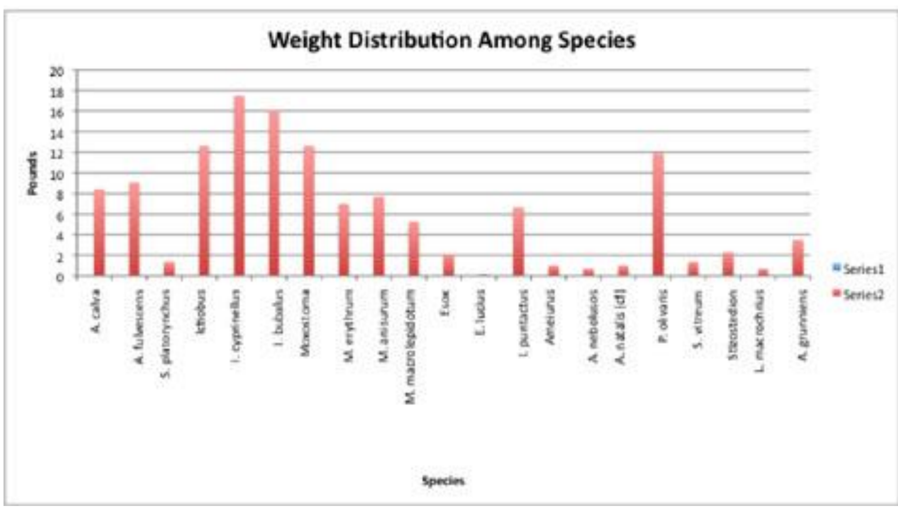

Figure 17. The edible meat distribution among the species found in the feature. *Ictiobus cyprinellus* represents the most edible meat of the species.

Thirty-two percent of the fish remains were burned. There were six zones which the percent of burned bone exceeded fifty percent. These zones were Zones 4, 5, 12, 17, 19, and the Interface. Zone 4 is located just above Zone 5 and both of these zones abut Zone 12. Both Zones 17 and 19 were located beneath FCR (fire cracked rock). Zone 12 contained a piece of FCR that was very burnt on the bottom.

Table 4. The percent of burned bone that occurs in each level or zone.

Percent Burned Bone Per Level or Zone				
	Non-burned	Percentage	Burned	Percentage
Level 1	358	87.75%	50	12.25%
Level 2	151	84.36%	28	15.64%
Level 3	795	65.27%	423	34.73%
West Wall	86	67.72%	41	32.28%
East Wall	67	73.63%	24	26.37%
Floor Scraping	3	75.00%	1	25.00%
Zone 1	54	96.43%	2	3.57%
Zone 2	25	89.29%	3	10.71%
Zone 3	89	73.55%	32	26.45%
Zone 4	0	0.00%	1	100.00%
Zone 5	3	42.86%	4	57.14%
Zone 6	507	73.48%	183	26.52%
Zone 8	17	80.95%	4	19.05%
Zone 9	301	50.50%	295	49.50%
Zone 11	193	63.70%	110	36.30%
Zone 12	7	17.50%	33	82.50%
Zone 13	7	100.00%	0	0.00%
Interface	6	18.75%	26	81.25%
Zone 15	97	70.80%	40	29.20%
Zone 15N	214	67.94%	101	32.06%
Zone 15S	67	89.33%	8	10.67%
Zone 17	7	50.00%	7	50.00%
Zone 18	1	100.00%	0	0.00%
Zone 19	8	42.11%	11	57.89%
Zone 20	89	84.76%	16	15.24%

CONCLUSIONS

Feature 275 displays a wide and fairly even distribution of fish. The three most common fish by MNI (minimum number of individuals): the smallmouth buffalo, the bowfin and the golden redhorse represent different water systems that may have exploited. The smallmouth buffalofish prefers a swifter current while the bowfin prefers the calmer waters of lakes and large slow moving rivers. The golden redhorse however, has a bigger range of water systems that it can be found in. What this means is that the Oneota were exploiting a variety of water systems. Also, the presence of these big river fish indicates that the Oneota were traveling the distance to the Mississippi River to catch the larger fish like the channel catfish and the flathead catfish, which are both present in significant amounts of the edible meat.

The Catostomidae (Sucker) family was by far the most popular. Although the Catostomidae family is large, many of its members spawn in the spring. Spawning in this family is when most of the fish are most vulnerable to capture. The most common fish from the Catostomidae family found in Feature 275 was *Moxostoma erythrurum* (Golden Redhorse), which spawns in May. During spawning, it rolls and jumps making it more vulnerable to capture (Becker 1983). *Ictiobus bubalus* (smallmouth buffalofish), one of the most common fish in the feature, also belongs to the Catostomidae family. The smallmouth buffalofish has been known to spawn from early April to June. *Amia calva* (the Bowfin), from the Amiidae family, was another common fish in the feature. The bowfin typically spawns from late April to early May. The presence of the Esocidae (Pike) family, although not as common as these three other families, is still significant in indicating an early spring occupation.

The edible meat distribution shows a similar pattern. The Catostomidae family makes up 78.75 pounds of a total 129.2 pounds, or sixty percent of the edible meat calculated for the feature. The Ictaluridae family (catfish) makes up about sixteen percent of the edible meat. Members of the Ictaluridae family are generally harvested in a later season than the Catostomidae and Amiidae families. Spawning in this family occurs from late May to July. Both the channel catfish and the flathead catfish are nesters. These large fish are usually captured while guarding their nests after spawning as already occurred.

Presence of both the Ictaluridae and Catostomidae families in such great amounts indicates that the feature was used in the early spring to at least the early summer. The Catostomidae remains indicate that the feature was used in the spring when individuals are usually harvested. The Ictaluridae remains indicate that the feature was used in during the summer. The Catostomidae remains are in their highest concentrations in Level 3 and the West wall of the feature. The remains from the Ictaluridae family are concentrated in Zones 6 and 9. This, along with the fact that there are several zones with high degrees of burning and others with none at all, indicates that the feature was used more than just once. The feature has several zones that indicate a fifty percent or more degree of burning. These zones were, Zones 4, 5, 12, 17, 19, and the Interface. Zones 4 and 5 are adjacent to each other in the feature, and both of these zones lie next to Zone 12. This is a general area that shows a great amount of burning. The rest of the zones however, contained a majority of non-burned bones.

So far, it can be determined that Feature 275 was used in both early spring as well as the summer season. The presence of both Catostomidae and Ictaluridae in many of the same zones may mean that the some of these fish may have been taken at the same time. It is possible that both of these families of fish can be harvested at the same time. Whether this was the case or not, it cannot be known for sure. The mammal bones present in the sample also indicate a spring use of the feature with the presence of whitetail deer. White tail deer are most commonly hunted in the fall, but in the case of this feature, they may represent a late winter, early spring use because of its presence with the early spring spawning fish like the northern pike and the sucker family. The skeletal elements of the deer also indicate a late winter/early spring subsistence stress. The burning that has occurred in the feature occurred in a generalized area. Three zones that make up a significant area of the feature, all contained bones that were burned in excess of fifty percent. Because of the different areas of burning and different seasonal fish, it can be determined that Feature 275 was used in more than one instance.

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