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The Lamona Rockshelter: cordage from the Columbia Plateau

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THE LAMONA ROCKSHELTER: CORDAGE FROM THE COLUMBIA PLATEAU

A Thesis

Presented To

Eastern Washington University

Cheney, Washington

In Partial Fulfillment of the Requirements

for the Degree

Master of Arts

By

Melodie Peterson-Bailey

Spring 2013

THESIS OF Melodie Peterson-Bailey APPROVED BY

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MASTER'S THESIS

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Chapter 1: Introduction

The Lamona Rockshelter is a natural formation located in central Washington, near the town of Odessa. It was discovered in 1969. A few years after the discovery of the rockshelter there were a series of excavations that ended in 1980.¹ During all but one of the excavations cultural objects were found. The majority of the cultural objects found were cordage items. Cordage items include strings, ropes, bow string, and netting. “Cordage is a class of elongate fiber constructions that are generally subsumed under the English term strings and rope. The manufacture of cordage is the oldest fiber-based technology in the New World archaeological record. Cordage manufacture was very likely part and parcel of the technological repertoire of the earliest migrants to this hemisphere.”² Additionally, some wooden cultural objects and a few lithic cultural objects were found. These cordage items are helpful in understanding the traditions were used in cord making, along with understanding what people were doing at this location. It can also be used to show how the culture from the Lamona Rockshelter fits into what is already known about culture in the area and to show cordage traditions change over time.

The Lamona Rockshelter is located in the Columbia Plateau, a cultural region that includes Eastern Washington, Northern Idaho, and parts of Canada, Montana, and Oregon. Eastern Washington is more specifically referred to as the Columbia Basin. There has not been much analysis of the cordage done in the Columbia Basin. The data

¹ J.R. Galm and S.A.C. Keller, “Archaeological Investigations at Lamona Rockshelter, Lincoln County, Washington.” (Presented at the 46th annual Northwest Anthropological Conference, 1993), 1.

² R.L. Andrews, J.M. Adovasio, and R.C. Carlisle. *Perishable Industries from Dirty Shame Rockshelter, Malheur County, Oregon: A Series of Chapters*. Pittsburgh, PA: Dept. of Anthropology, University of Pittsburgh, 1986, 51.

published from the Columbia Basin is limited to descriptions of just a small number of cordage items. Most publications only mention that cordage has been found, but offer little analysis of that or discussion of what cordage can tell us about culture.

Until now, the Lamona Rockshelter was no exception to the lack of work done with the cordage. Cordage was mentioned in a paper that was presented at the 46th annual Northwest Anthropological Conference.³ However, the paper is limited to just mentioning that some of the cordage was found below the depth of 2 meters, some cordage was scorched from wild fires, and the cordage was probably stored at the Lamona Rockshelter. Unpublished analysis of the Lamona cordage includes the identification of materials used.⁴ However, there has been no publication of this information or discussion of what the cordage can tell us about culture.

One of the reasons why the Lamona cordage has not been published is because the cordage and wooden cultural objects found at Lamona were lost. Records say that these cultural objects should be located in the Archeological and Historical Services located at Eastern Washington University. While the faunal remains have been located, the other cultural objects are missing. The cultural objects were lost sometime after the botanical analysis done in 1994.

Undertaking analysis of data without having access to the cultural objects is not an easy task. However, it is important to make the analysis of the cordage from the Lamona Rockshelter available, so that we can better understand the traditions of this culture and what life was like for people in this area. Fortunately, much of the standard

³ Galm and Keller, "Archaeological Investigations at Lamona Rockshelter." 1.

⁴ N.A. Stenholm, "Botanical Analysis of Lamona Rockshelter," (Eastern Washington University, Lamona file cabinet, 1994 photocopy), 2.

descriptive information about the cordage items was recorded. Recorded information includes twist, spin, numbers of plies, length, diameter, angle of twist, twist per centimeter, numbers of splices, end treatment, knots, and materials used to make cordage. Additionally, radiocarbon dates were acquired.

This information was scattered throughout several different documents most of which were hand written. In order to come up with full descriptions of the cordage items, I spent a lot of time comparing data from these pages of recorded data to come up with complete descriptions of the most of the cordage items.

Methods and theory

The goals of this study are to analyze the cordage found at the Lamona Rockshelter and use the information I find to tell what this cordage can show us about culture. At Lamona the cordage cultural objects that have been found dominate while very few other cultural objects were found. This makes interpreting culture a challenge. Still, I can use these cordage items to interpret some of the cultural aspects of life of the people who made and used the cordage.

Making cordage is not something that is done by random chance; it requires intentional choices. These choices involve which plant fibers to use, how to process the plant fibers, how to spin the fibers, which direction to twist, how thick to make the strands, and how many plies to combine. I am looking at these choices as a result of a cultural tradition. This is backed up by studies that show that choices are based on how

the spinner was taught.⁵ Knowing that cordage techniques reflect a cultural tradition, I can use it to show what the cultural ideas of making cordage were for the people who used the Lamona Rockshelter. It can show what people were doing at this location, it can be used to add to what we already know about what life was like in this area, during the time the rockshelter was used, and allow us to can compare these traditions across different locations and times to see how cordage traditions change.

This paper will examine four different sites from the Columbia Basin to show what has already been done with cordage and to compare the traditions that were used in cordage making. These locations include a rockshelter near Beverly, Washington, Upper Coulee Rockshelter, Trinidad Cave, and Cox Cave. These sites were selected because cordage analysis was done for these sites.⁶

The cordage from the Lamona Rockshelter will also be compared to some of the cordage found at well-known sites from the Great Basin including Dirty Shame Rockshelter, Danger Cave, and Hogup Cave are also included.⁷ Unlike the Columbia Plateau, the Great Basin has had a large number of sites that contained cordage items. The intent of this study is not to compare the Lamona cordage to all the cordage from the Great Basin; therefore only four sites will be selected. These four sites were selected because they all have a large amount of cordage that has been analyzed and all have cordage made from *Apocynum*. *Apocynum*, also known as Indian hemp, is important for

⁵ J.C. Minar and P.L. Crown. "Learning and craft production: An introduction." *Journal of Anthropological Research* 57, no. 4 (2001) 369-380, and M. McBrinn and C. Peterson Smith. "A New Spin on Cordage: The Effects of Material and Culture." *Kiva* 71, no. 3 (2006): 265-273.

⁶ J. Mills and C. Osborne. "Material Culture of an Upper Coulee Rockshelter." *Society for American Archaeology* 17, no. 4 (1952): 352- 359, and E.H. Swanson, "An Archaeological Survey of Caves in Washington." *American Antiquity* 24, no. 4 (1954) 387-389.

⁷ Andrews, Adovasio, and Carlisle. "Perishable Industries from Dirty Shame Rockshelter, Malheur County, Oregon," and Aikens, C. Melvin. *Hogup Cave*. Salt Lake City: University of Utah Press, 1970.

this study because *Apocynum* was used in the largest numbers at the Lamona Rockshelter. Also the Columbia Plateau and the Great Basin have many of the same plants that are found in local environments that could have been used in cordage construction; this relates back to the idea materials used are a cultural choice. This will also show that these two areas have their own traditions in cordage making further proving that cordage is a cultural choice.

Chapter 2: Why it is important to study cordage

Cordage items have been used by people for a very long time. “Anthropologists maintain that the caveman probably used thread, thong, and rope of all kind, long before they learned to control fire or use the principle of the wheel.”⁸ Throughout time as a group of people became more adapted to their environments and settled into different cultural groups the style, design, and function of their cordage items would change to best fit the needs of the people both functionally and culturally.

Cordage is important to study because it is a reflection of the choices that are made when a cordage item is spun. Studies with modern spinners and cordage in the archaeological record, found that there is no technical reason to spin a fiber one direction over the other; the reason why people spin cordage the way they do is because that is how they learned to do it.⁹ These studies challenged that the tools used, the handedness of the spinner, and the technical characteristics of the fiber determine how cordage was made.

Modern spinners were observed with the techniques that can be used in spinning cordage.¹⁰ The techniques that can be used to make cordage are by hand or with the use of a spindle. Cordage can be made by placing the fibers between the hands or on the thigh of the weaver and pushing the fibers in a rolling motion in one direction. The use of a spindle would involve a hand-twirled spindle with a large hardwood or bone whorl to

⁸ J. Duboc, “Cordage of the Early Northwest Indians.” *The Montana Magazine of History* 3, no. 2 (1953): 42.

⁹ Minar, “Learning Craft Production: An Introduction.” 389. and McBrinn and Peterson Smith. “A New Spin on Cordage: The Effects of Material and Culture.” 265-273.

¹⁰ Minar, “Learning Craft Production: An Introduction.” 369-380.

maintain an even tension.¹¹ These two techniques were tested to see if there is a visible difference in the end product and if twisting was easier or harder if done in the S or the Z direction using either method. No differences were seen between cords made by hand or spindle.

The theory that the handedness of the spinner has an effect on what direction the cord was spun was looked for in cordage that was archaeologically found. Handedness proved not to be a factor because the norm is anywhere from ten to twenty percent of any population would be left handed which would result in seeing a ten to twenty percent difference in twist direction. The actual twist variation shows to be anywhere from 100 percent S or Z, 50 percent S and Z, or any percent between these two.¹² These actual numbers do not fit as being a result of handedness.

The qualities of the fiber itself also proved not to be a determining factor for what the final twist would be. Modern spinners, in this study, were given fibers such as cotton, flax, and wool. All of the fibers were spun just as easily with an S or a Z-twist. This suggests that there are no innate qualities of the fibers that would make one twist direction better than the other.

After ruling out technical reasons why cordage was spun in a certain direction, the spinners in this study were asked why they spun in a certain direction. Their response was that “the way they learned to spin and the traditions about the fiber were much more

¹¹ N. Kidder. “Making Cordage By Hand.” Primitive Technology, Traditional Skills and Hand-Made Tools. <http://www.primitiveways.com/cordage.html> (accessed May 8, 2011), and N.J. Turner, *Plants in British Columbia Indian Technology*. Victoria, B.C., Canada: Royal British Columbia Museum, 1979.

¹² Minar, “Learning Craft Production: An Introduction.” 389.

important in choosing the direction to spin.”¹³ This means that the spinners make cordage items in the way that they were taught. If the spinner was taught to make a cordage item with a specific fiber, they will make it with the twist direction that they were taught. For example, at the Lamona Rockshelter, where all the netting was made from Type 2 *Apocynum*, two-ply S-twist with singles Z-spun.

In a different study handedness and fibers also were tested to see if either is a determining factor in choosing a twist direction.¹⁴ In these studies modern spinners twisted cordage in both an S and a Z twist to see if the handedness of the spinner made a difference in how well made that each direction of twist would be. This would assume using the dominant hand there is a dominant way to spin, and spinning in the opposite way would result in a cord that is not as well made. When the modern spinners in this study spun cordage in both directions, there was no difference between the qualities of the cordage made with an S or Z twist.¹⁵

In the same study there were also tests to see if the natural qualities of the fibers used had any factors that determined the twist direction. In this study it was found that certain fibers such as yucca were easier to spin with a Z-twist because there is an inherent Z-twist to the fiber itself. However, the Durango Site used in this study, had many examples of yucca cordage that was spun primarily in an S-twist.¹⁶ This means that even though it is easier to spin yucca with a Z-twist people in at least one location chose to

¹³ Minar, “Learning Craft Production: An Introduction.” 389.

¹⁴McBrinn and Peterson Smith, “A New Spin on Cordage: The Effects of Material and Culture.” 265-273.

¹⁵ McBrinn and Peterson Smith, “A New Spin on Cordage: The Effects of Material and Culture.” 265-273.

¹⁶ McBrinn and Peterson Smith, “A New Spin on Cordage: The Effects of Material and Culture.” 265-273.

spin with an S-twist. This shows that the ease of spinning in one direction is not as important as the cultural reason why the twist direction is chosen.

Both of these studies show that technical aspects including tools used, handedness of the weaver, and fibers used are not what determine the twist direction of the cordage. Instead, choices made in cordage construction are choices, made by the people who make cordage within a society.

There has not been very much work on how cordage can be used to show relations between different areas, but this type of work has been done with basketry. Cordage and basketry are both part of the woven industry, and so the tools used to analyze one may help with the other. Adovasio argued that a trend in basketry techniques can be seen as originating in one area, and the spread of the trend can be used to show contact or influence to the surrounding areas.¹⁷ This idea can also be used to study cordage.

Adovasio showed how basketry styles may show origins of style and connection to other areas by using the basketry from the Great Basin. In this study he defined three different complexes from the Great Basin and drew the conclusion that based on similarities and differences seen in basketry, the trends and the techniques spread out from one complex to others. The three complexes that Adovasio defines within the Great Basin are the Oregon complex, the Western Nevada complex, and the Eastern Basin complex.

The Oregon complex consists of Central Oregon and portions of Northern California and northwest Nevada. The Oregon complex did not have many dates

¹⁷ J.M. Adovasio. *The Origin, Development and Distribution of Western Archaic Textiles*. Thesis (Ph. D.), University of Utah, 1970.

associated with basketry. However, Adovasio argued that close simple twining with stitch slant down to the right represents the most basic technique. He also found that there was a preference for split stitch and for work direction from left to right with a high quality of workmanship.¹⁸

The western Nevada complex is just the western portion of Nevada. This complex is largely represented by the plaiting in the form of Lovelock wickerware, about 68 percent of the basketry, followed by coiling about 21 percent of the basketry. This complex does have many dated samples that help show the developmental stages of the complex. In stage I, 8000-4500 B.C., twining is dominant and there is no coiling or Lovelock wickerware. In stage II, 4500-2000 B.C., coiling appears and gradually becomes more popular while twining types decline. In stage III 2000-1000 B.C., coiling continues to increase in frequency with twining further decreasing; the first appearances of Lovelock wickerware are seen at this time. In stage IV, 1000 B.C- A.D. 1000, twining is insignificant, while coiling and Lovelock wickerware are common.¹⁹

The eastern Basin complex consists of Utah, north of the Colorado River and portions of western Wyoming, southern Idaho and northwest Colorado; it also includes sites such as Danger Cave and Hogup Cave. This complex has a predominance of coiling over twining, about 78 percent coiling and about 21 percent twining.²⁰

Adovasio was able to define regions with variations in the techniques used. However, he was also able to use this data to look at how these areas may have influenced each other and other areas. All three complexes started with a simple two

¹⁸ Adovasio, *The Origin, Development and Distribution of Western Archaic Textiles*, 26.

¹⁹ Adovasio, *The Origin, Development and Distribution of Western Archaic Textiles*, 37.

²⁰ Adovasio, *The Origin, Development and Distribution of Western Archaic Textiles*, 42.

element twining. Coiling originates in the eastern Basin, but later in time spreads to the other two areas. The Western Nevada Complex shares some of the attributes of the other two areas because it is geographically between them.

These ideas that cordage is made as a result of a cultural choice, not technical influences, and Adovasio's idea that by looking at basketry regional differences, are important because I can use the Lamona cordage to interpret culture, and although not on the same scale as Adovasio's work with baskets in the Great Basin, I can use cordage to show cordage traditions for the Columbia Basin.

Introduction to cordage and basketry techniques

Before the cordage from the Lamona Rockshelter can be looked at, it is important to understand the technical choices that can be made in the production of cordage and other items such as baskets and mats. When technical options are uniformly chosen throughout a culture it is probably a reflection of a learned cultural tradition rather than a limitation of the environment and materials.

Cordage can be as simple as a single strand, or ply, but it can also have multiple plies. The technology of making cordage by hand is largely the same now as it was in pre-contact time. Thus, we can look at the techniques that modern spinners use to make cords to gain a better understanding of how cordage was made.

There are three different types of plant materials that have been used for the manufacture of cordage: hard fibers, soft fibers, and seed fibers. Hard fibers are comparatively stiff strands from leaves and stems. An example of hard fibers is pineapple leaves. Soft fibers are more flexible than hard fibers and are made from flexible

elongated strands from the inner bark of plants such as *Apocynum*. Seed fibers include cotton.²¹ Animal skin can be also used to make cordage when it is cut into strips and twisted.

Plant fibers first need to be processed so that the fibers can be made into cords. Processing fibers can be used to separate the fibers completely or the fibers can have less separation; when less separated the fibers will be thicker and stiffer. After the fibers were processed they were made into threads by twisting with the hands, or with the use of a spindle. Twisting the fibers give the cordage more strength and structure than it would have if it were unspun. Lengths of fibers were then spliced together to make a long continuous strand.

Spin and twist

Depending on whether the fibers are spun clockwise or counterclockwise, a Z-twist or an S-twist is created. Fibers that are spun clockwise create a Z-twist, while those spun counterclockwise create an S-twist. The identification of a Z-twist and an S-twist is easy because the slant of the fibers follows the slant of the letter Z or S. If the fibers slant to the right from top to bottom, it is an S-twist. If they slant to the left, it is a Z-twist.

Cordage when it has more than one ply has both a spin and a twist. Whether the initial manipulation of the fiber is S or Z is referred to as the spin. The final direction in which the plies are joined is called the twist and this can also be either S or Z. Sometimes S and Z are referred to as R and L, standing for right or left, the direction that the fiber was turned. I will only use S or Z to refer the directions. There are also different ways of

²¹ W.M. Hurley. *Prehistoric Cordage: Identification of Impressions on Pottery*. Washington, DC: Taraxacum, 1979, 3-4.

writing descriptions of cordage. It can be written as two ply S spun Z twisted, or two-ply Z-twist with singles S-spun. Both ways of writing this example are saying the same thing and each way will be seen in cordage descriptions depending on the author. I will use the latter verbiage because I feel it is the easiest to understand.

Construction of plied cordage

Single ply cordage is made with a small bunch of fibers that have been twisted with either an S-twist or a Z-twist. All cordage construction starts with the single ply and other plies can be twisted against the cord to make cordage with more plies.

Two-ply cordage can be made in two ways. Two pieces of single ply cordage can be twisted together. In this technique each ply does not need to alternate twist. In the second technique cordage can produce either a two-ply S-twist with singles Z-spun or a two-ply Z-twist with singles S-spun. To make a two-ply piece of cordage with alternating twist and spin, the spinner continues to twist a Z-spun piece of cordage clockwise. This causes a kink to be formed in the center, which makes the cord fold over on itself in a counterclockwise twist. The kink makes a newly formed two-ply twist, which is referred to as a two-ply S-twist with singles Z-spun. The same technique can be used on a single-ply S-spun length of cordage when the spinner continues to twist the cord counterclockwise causing a kink to be formed in the center. The kink creates a clockwise twist which will create a two-ply-Z-twist with singles S-spun.

Cordage can also be more than two-ply. When another piece of single ply cordage is twisted with a two-ply piece of cordage, it will make a three-ply cord. Four-ply cordage can be made by twisting together two pieces of two-ply cordage or by continuing to twist

a two-ply cord until a second kink forms, causing the cord to fold over on itself a second time.

Instead of twisting cordage can be made by braiding more than two pieces of single-ply. With this technique the cordage will appear to have a similar look to braided hair. There are no pieces of braided cordage from the Lamona site, making further discussion of this technique unnecessary.

Cordage can also be wrapped. “Wrapped cordage is a special functional subclass of cordage in which an inner core consisting of a strand or bunch of untwisted fibers or a length of some type of cordage is sequentially encircled or wrapped with an outer covering”²² Cordage would be wrapped so that the cord would be stronger and protected against wear.

Other Technical Features

Besides the numbers of plies that cordage is made with, there are other features that represent a choice in cordage construction. These features include diameter of the cord, the number of twists per cm, the angle of twist, and other alterations like knots. In this data, diameter is the only feature that will be analyzed. The other features are useful in describing the cordage cultural objects but variability in these traits is not consistent enough to see the cultural ideas they reflect.

Diameter of cordage is important because thick and thin cords are used for different purposes. The diameter of the cordage is determined by the amount of material spun

²² Adovasio, Andrews, and Carlisle, “Perishable Industries from Dirty Shame Rockshelter, Malheur County, Oregon,” 57.

and/or how fine the fibers are. Using more fibers will make a thicker cord. When the plant fibers are processed the fibers can be more or less processed. A more processed fiber will be well separated and fine, while a less processed fiber will be thicker and the fibers could have remains of bark.

These different techniques show that there is more than one way to make cordage. When a specific way of making cordage is used it is because of a cultural choice. Single-ply, two-ply, three-ply, and four-ply cordage, along with the other traits, all will be used to make different types of cordage items based on the cultural idea of what is appropriate. For the cordage from the Lamona collection, diameter will also be helpful showing cultural choices. Most often diameter is directly related to material as some materials create thicker or thinner fibers. The link between diameter and materials will be seen later when I examine the two different processing techniques used for *Apocynum*.

Classification of basketry

Basketry will not be looked at with the same intensity as cordage in this project because there are very few examples of basketry found at the Lamona Rockshelter. However, because there was some basketry, it is useful to understand the choices that could have been made in producing baskets.

J. M. Adovasio is one of the leading experts on basketry and how basketry is constructed. Adovasio has analyzed over 50,000 samples of baskets and has published a

very detailed and comprehensive guide on the analysis and identification of basketry the following discussion is based on his work.²³

The term basketry includes other items such as matting, bags, netting, hats, and cradles.²⁴ All of these items are grouped together because they use the same tools and techniques for construction.

There are three types of weaving from which basketry can be constructed: twining, coiling, and plaiting. Twining is constructed by moving flexible elements called wefts around stationary elements called warps. The warps are constructed with a hard fiber like a whole stick, a split stick, or twig. The wefts are made of soft plant fibers that can be spun or unspun cordage. In the process of twining, the warps are vertical and the wefts are moved around the warps horizontally. The warps are considered vertical because during the construction process the weaver holds them along the length of her body while she would weaves the wefts horizontally.²⁵

Weft rows can be woven in either an S or a Z. When viewed straight on in the normal vertical position, the stitch will either slant to the left or the right. When the stitch slants down to the left, it is called an S because the space where the wefts are paired together creates the slant of an S, and when it slants down to the right it creates a Z slant.²⁶

²³ J.M. Adovasio, *Basketry Technology: A Guide to Identification and Analysis*. Chicago: Aldine Pub. Co., 1977.

²⁴ Adovasio, *Basketry Technology: A Guide to Identification and Analysis*, 25.

²⁵ Adovasio, *Basketry Technology: A Guide to Identification and Analysis*, 25.

²⁶ Adovasio, *Basketry Technology: A Guide to Identification and Analysis*, 25.

Coiled basketry is different from twined basketry because instead of having a series of stationary supports or wefts, it has one stationary horizontal unit called the foundation and moving vertical elements called stitches. It is called coiling because the foundation element is a coil that starts at the center of the basket and continues to the rim.

The coils of the foundation element have to be stabilized with a sewn stitch, which can use different types of stitching. Stitch types used in coiling include; simple stitch, intricate stitch, and wrapping stitch. Simple stitch is a one revolution wrap of the stitch around the foundation element that holds two coils closer together, while the other stitches are more complex variants of this.

Plaited basketry is different from both twined and coiled basketry because all the elements are moving elements. The elements in plaiting are called strips, which are woven one over the other without any sewing involved. As there are no examples of coiled baskets or plaited basketry at the Lamona Rockshelter, further discussion of these techniques is beyond the scope of this paper.

All of these techniques are important to understand because they are all choices that can be made with how to make cordage and basketry. Cordage is found in the largest number of all cultural objects found at the Lamona Rockshelter. The Lamona cordage is made up of mostly two-ply cordage, and there are also some basketry items that were twined. These include a twined sandal and five twined mats. With all of the technical choices that can be made in both cordage and basketry the limited varieties that were found at the Lamona Rockshelter were because of a cultural choice. The cordage and basketry were not made in these styles because they are the only way to make these

items. As shown above, there are many different ways to make these items. This will be discussed in more detail in Chapter 5.

Chapter 3: Work that has already been done with cordage

Before presenting the cordage items from the Lamona Rockshelter work that has already been done in the Columbia Basin and some sites in the Great Basin will be examined. These sites are important to look at because they will show cordage traditions we already know as well as what type of analysis has already been done with cordage.

The Columbia basin is from the same cultural tradition as the Lamona Rockshelter. Adding the Lamona cordage to what is already known in this area will allow for a more complete understanding of cordage traditions for the area. The Great Basin is culturally and technically similar in cultural object construction to the Columbia Plateau and there has been a more complete analysis of cordage. By examining and comparing what was going in with cordage making traditions in the Great Basin we can gain a better understanding of cordage in the Columbia Plateau.

Cordage from the Columbia Plateau

Several caves and rockshelters that have been excavated in central Washington contained examples of cordage items along with smaller examples of basketry. These sites include an unnamed rockshelter near Beverly, Upper Coulee Rockshelter, Trinidad Cave, and Cox Cave. By using the analysis of cordage found at each of these sites I can begin to develop a model for cultural traits that can be seen in cordage and basketry for this area of the Columbia Plateau. In a later in Chapter 6 I will also add the Lamona cordage to this model.

Rockshelter near Beverly Washington

Cultural objects were recovered in 1953 from an unnamed rockshelter located near Beverly, Washington.²⁷ The analysis concluded that there were two different occupations. The first occupation did not have any cordage or basketry. The second occupation has eight pieces of cordage and one twined cedar mat. All the cordage is two-ply; only the final twist was recorded. There are three pieces of cordage made from *Apocynum* with S-twist. Two of these cords are made from finely shredded *Apocynum*; the diameters are 1/32 inch and 1/64 inch. The third *Apocynum* cord has no further description of the material; the diameter is thicker at 1/16 in. There are two pieces of cordage made from grass. One is S-twist and the other is Z-twist. Two pieces are made of cedar, one is made of cedar strips and is S-twisted, and the other is Z-twisted. The last piece is made of cattail and is Z-twisted.

No cordage was radiocarbon-dated, but according to Swanson the first occupation is at the same time as the Upper Coulee Rockshelter, which is equated with the Cayuse II phase at Vantage and the second occupation is equivalent in age to Cayuse III. The Cayuse III phase is late pre-contact to early historic which is far later than the cordage at the Lamona Rockshelter.²⁸

While this rockshelter did not contain a large amount of cordage, it is still an important site as it represents cordage used in the late pre-contact to early contact times.

²⁷ E.H. Swanson. "A Small Rockshelter in Eastern Washington." *American Antiquity* 24, no. 4 (1959): 430-431.

²⁸ Swanson, "A Small Rockshelter in Eastern Washington," 431.

At this time period four materials were used at this location: *Apocynum*, cedar, cattail, and grass.

Upper Coulee Rockshelter

Upper Coulee Rockshelter is located six miles southwest of the town of Grand Coulee, Washington. Upper Coulee Rockshelter was the first dry rockshelter excavated in the Columbia Plateau. The excavation took place in the summer of 1950 and was done by a Smithsonian Institution River Basin Surveys crew. The analysis of cordage was done by Mills and Osborne.²⁹ This excavation recovered a large amount of cordage made from a diverse collection of plant materials.

Most of the cordage from Upper Coulee Rockshelter was made of *Apocynum*, a total of 37 pieces. Of the *Apocynum* cordage, there are four pieces in which the fibers were not separated from the other tissue, three pieces whose fibers were completely removed from the other tissue, and 30 pieces that did not have any description for fiber separation but probably fall somewhere between the two extremes. Mills and Osborne concluded that this is likely due to different processing techniques.

Of the four pieces of *Apocynum* with unseparated fibers one was two-ply Z-twist with singles S-spun, two were two-ply S-twist with singles Z-spun, and one was S-twist with singles S-spun. The three pieces of *Apocynum* cordage with separated fibers did not have spin or twist recorded. The other 30 pieces of *Apocynum* cordage includes 27 pieces of two-ply S-twist with singles Z-spun, one two-ply S-twist with singles S-spun, two

²⁹ Mills and Osborne, "Material Culture of an Upper Coulee Rockshelter," 352.

pieces of two-ply Z-twist with singles S-spun, and one piece of four-ply S-Twist with singles Z-twist.

Sixteen pieces were made of tule, the second most common material used. Fourteen pieces are two-ply Z-twist with singles S-spun. One of the other two pieces of tule is a cord that was used to twine a rye grass mat; no detail about the spin and twist were included. The other one is a rope that is two-ply Z-twist with singles S-spun with each single being made of three tule stems twisted together.

Eleven pieces of cordage were made out of sage bark. Nine were single-ply; eight are Z-twist, and one is S-twist. Two pieces were two-ply, one of which is S-twist with singles Z-spun and the other a Z-twist with singles S-spun. In all of this cordage, the sage bark is described as being just strips of sage with loosely separated fibers.

There are five pieces of cedar cordage and four pieces of cordage made of alder bark. The cedar cordage is two pieces of single-ply Z-twist, two pieces of two-ply Z-twist with singles S-spun, and one bunch of fibers that has not been twisted. The alder cordage is three pieces of two-ply S-twist with singles S-spun and one piece of single-ply S-twist; in all pieces no attempt was made to separate the fibers of the alder bark from the other tissue.

Upper Coulee Rockshelter also contained several examples of basketry that were very fragmented. However, these fragments were still identified and analyzed. One specimen is the remains of the selvage from a mat. Selvage is the border that was sewed around the rim of an item so that it does not come undone. This item was made of

individual stalks of tule that make up the warps and it is twined with two-ply wefts made of *Apocynum*.

Other basketry from Upper Coulee Rockshelter includes three pieces of twined ryegrass matting. In each piece of matting all the warps were made of untwisted bundles of ryegrass that are one-fourth to three-fourths inch in diameter. While all the warps were the same, each piece of matting has a different weft construction. In the first mat the weft is an untwisted bundle of ryegrass, the second has slightly S-twisted bundles of ryegrass, and the third used single-ply cordage.

Mills and Osborne stated that the analysis of cordage at Upper Coulee Rockshelter shows that there was a use of a variety of materials and production techniques, ranging from the use of cedar bark and tule cord with almost always a Z-twist to the use of *Apocynum* and alder with almost all pieces having an S-twist.

I believe that the choices that were made are a reflection of a cultural choice; I also believe that the importance of the materials chosen can be seen. The large number of *Apocynum* cords presumably means that *Apocynum* is the most important material used. *Apocynum* is flexible as there was more than one way to process the fibers. In one of these processing techniques the fibers were completely separated from the tissue and in the other the fibers were not separated. Other fibers, including sage bark and alder, do not seem to have been as important as *Apocynum* because they made no attempt to separate the fibers. However, these two fibers were still found in relatively large numbers which suggest some level of importance. Tule cordage by far shows the least amount of importance in the production of cordage. The tule cordage is described as having no

attempt to splice the fibers in a continuous form; the cordage is just made of lengths of tule stalks that were twisted.

Trinidad Cave

Trinidad Cave is located near Trinidad, Washington, and was excavated as a part of a series of excavations across the Columbia Plateau, that were a part of a survey of cave and rockshelters done in 1952.³⁰

All of the 56 pieces of cordage found at Trinidad Cave are made of cedar bark. The cedar bark was processed in two different ways, which produced cordage with fibers completely unseparated and cordage with fibers well separated. About 75 percent is made of cedar bark with unseparated fibers. The other 25 percent of the cordage was made of well-separated fibers.

All but four pieces of cordage are two-ply; the others are two pieces of four-ply and two pieces of single-ply cordage. Forty-six pieces of cordage are two-ply-S-twist with single Z-spun. Six pieces of cordage are two-ply-Z-twist with singles S-spun. One piece is four-ply-Z-twist that has 2-S-twist with singles Z-spun. One piece is four-ply S-twist, 2-S-twist with singles Z-spun. Finally, there is one piece of single-ply S-twist and one piece of a single-ply Z-twist.³¹

Trinidad Cave also contained some basketry. This includes three pieces of twined matting that was made of split cattails and sewed with a four-ply S-twist, two-S, single-Z

³⁰ E. Swanson, "An Archaeological Survey of Caves in Washington." *American Antiquity* 19, no. 4 (1954): 387-389.

³¹ Swanson, "An Archaeological Survey of Caves in Washington," 387-389.

twist thread, one piece of open twined matting made of tule, two pieces of open work twined matting made of grass, and five pieces of coiled basketry.³²

Unlike cordage from other rockshelter and caves located in Washington State, cedar is the only fiber used in cordage construction. At Trinidad Cave there are several samples where the cedar fibers have been separated as well as some pieces where the fibers are not separated. Cedar must have been more important for the traditions of making cordage than any other materials because it is the only material used and it has two different processing techniques. No dates were acquired for the cordage.

Cox Cave

Cox Cave, near Vantage Washington, was part of the same survey of cave and rockshelters as Trinidad Cave was excavated.³³ At Cox Cave about half of the cordage is two-ply Z-twist with singles S-spun made from *Apocynum*. Cedar was also used and like Trinidad Cave it was used in two-ply S-twist with singles Z-spun³⁴. The cordage analysis only mentioned that *Apocynum* cordage was in two-ply Z-twist with singles S-spun and cedar was used in two-ply s-twist with singles Z-spun, but it did not mentioned what material went with each specific piece that was analyzed for twist and spin. The analysis is as follows: five pieces of two-ply-S-twist with singles Z-spun, eight pieces of two-ply-Z-twist single S-spun, one piece of two-ply-S-with a third single-Z added at end, and

³² Swanson, "An Archaeological Survey of Caves in Washington," 387-389.

³³ Swanson, "An Archaeological Survey of Caves in Washington," 387-389.

³⁴ Swanson. "An Archaeological Survey of Caves in Washington," 387-389.

three pieces of one-ply-Z-twist (perhaps separated from two-ply-S-twist pieces). Eight of the pieces are cedar and nine are *Apocynum*.³⁵

Summary

Apocynum used to make cordage at all sites except for Trinidad Cave, while the use of sage, tule, grass, and cedar were also not uncommon in these sites. Based on this I can see that the use of *Apocynum* is an identifier of shared cultural traits. This means that all the sites that contained *Apocynum* are more closely culturally related than sites that do not have *Apocynum*. In later chapters I will look at the Lamona cordage and add it to what it is already known about this area and begging to identify what the oldest cordage making traditions are and conclude that there was an increase of other materials as time went on.

Cordage from the Great Basin

Dirty Shame Rockshelter

Dirty Shame Rockshelter is located in Oregon near the borders of Idaho and Nevada. It lies between the Great Salt Lake and Snake River Plain regions of Utah and Idaho to the east and the Fort Rock, Warner, and Surprise valleys of south-central Oregon and California to the west. A large variety of cultural objects and basketry were found during the excavation, including 814 fragments of cordage.³⁶

³⁵ Swanson, "An Archaeological Survey of Caves in Washington," 387-389.

³⁶ Adovasio, Andrews, and Carlisle, "Perishable Industries from Dirty Shame Rockshelter," 56.

All of the cordage was analyzed for splices, knots, angle of twist, and other cordage manipulations such as wrapping. Based on the analysis, the cordage was classified into 12 different structural types:

- Type I: single-ply Z-twist,
- Type II: single-ply S-twist,
- Type III: two-ply-Z-twist with singles S-spun,
- Type IV: two-ply-S- twist with singles Z-spun,
- Type V: two-ply-Z-twist with singles Z-spun,
- Type VI: three-ply-Z-twist singles S-spun,
- Type VII: three-ply-S-twist with singles-Z-spun,
- Type VIII, IX, X, XI, and XII are all compound two-ply.³⁷

There was also 23 pieces of wrapped cordage. Eleven pieces have untwisted single ply inner cords. The remaining pieces have inner fibers of types II, III, and IV. The outer fibers that the cords are wrapped in also include untwisted fibers, and cordage types I, II, III, and IV.

Analysis of these cordage pieces showed correlations between form and function. Smaller diameter tightly twisted cordage was used for nets, hafting, snares, trap manufacture, and warps and wefts in twined basketry. Larger-diameter cordage with a looser twist was used for other basketry such as sandals. Both types were used for tying, binding, and lashing.³⁸

³⁷ Adovasio, Andrews, and Carlisle, "Perishable Industries from Dirty Shame Rockshelter," 56.

³⁸ Adovasio, Andrews, and Carlisle, "Perishable Industries from Dirty Shame Rockshelter," 62.

Sage and *Apocynum* were the plant materials most used to make cordage. Sage was the most frequently used fiber; it was manufactured into large diameter cordage. *Apocynum* was made into the smaller diameter cords such as types III and IV.

These two different plant materials are processed differently. Sage was processed by removing and discarding the outer bark; then the inner bark was soaked, shredded, and then spun. *Apocynum* on the other hand was made from the outer bark then soaked, shredded, and then spun.³⁹

This location has had a lot of different of cordage types and materials, suggesting that there was a more complex tradition of making cordage than on the Columbia Plateau. This complex tradition of cordage might be the result of a culture that has been in the area for a longer time than on the Columbia Plateau.

Danger Cave

Danger Cave is located in western Utah; it was a major part of a series of excavations that also included Juke Box and Raven Caves. Danger Cave had the largest sample of cordage of the three caves excavated. From this study, 711 pieces of cordage were analyzed.⁴⁰

Danger Cave had 637 pieces of the cordage. Random samples of 330 pieces were analyzed for raw materials. This analysis of cordage shows that there were differences in raw material at the different levels of excavation. In level D III, *Apocynum* was preferred, with cedar second, followed by flax. In Level D IV, common sage brush was almost

³⁹ Adovasio, Andrews, and Carlisle, "Perishable Industries from Dirty Shame Rockshelter," 62.

⁴⁰ J.D. Jennings. *Danger Cave*, Salt Lake City: University of Utah Press, 1957, 227.

exclusively used. In level D V, sage remained popular but milkweed and bulrush were also heavily used.⁴¹ *Apocynum* was not used after level III, and sage did not appear before level D IV.

There was no ecological evidence to justify these changes in plant material, because there was no change in the available floral resources during the entire occupation of the cave. According to Professor Cottam, who made all the identifications of plant materials, all the plants used along with about 70 more plants that could have been used were found within ten miles of the cave from the earliest period of occupation to the present.⁴² This means that the plants chosen were because of a cultural choice rather than random selection of available plants.

With all the plants to choose from, one must conclude that the plants were deliberately chosen for either practical or cultural reasons.⁴³ The use of two different types of plant materials, bark fibers, suggests sophisticated knowledge for securing and processing the different fibers. Both types of plant materials are capable of being made into a variety of different thicknesses, but this study showed that in general the thicker diameter cord was made of bark fibers.⁴⁴

This location was used many different times or for a long period of time. Over time there was a change in materials used, which suggest that the ideas about making cordage changed over time. *Apocynum* in found at the lowest levels which means that it

⁴¹ Jennings, *Danger Cave*, 227-228.

⁴² Jennings, *Danger Cave*, 228.

⁴³ Jennings, *Danger Cave*, 228.

⁴⁴ Jennings, *Danger Cave*, 228.

can be seen as the oldest fiber used at this location, but it appears that it lost some importance as time went on.

Hogup Cave

Hogup Cave is located in Great Salt Lake region of Utah. Excavations were done at Hogup Cave to investigate the changing patterns of cultural ecology over time. The excavation produced 1,242 pieces of cordage.

There was a large variety of cordage found. Most of the cordage collection is two-ply, but 14 one-ply and 21 three-ply pieces were found. The complete net was made of two-ply S-twist cordage made from shredded sagebrush bark. The net fragments were typically made from a light two-ply cordage ranging between 4.0 and 5.0 cm. squares.⁴⁵ There seems to be no strong preference in twist direction with 575 pieces S-twisted and 667 Z-twisted.

Cordage materials were identified for 1,162 pieces. The plant material most used is milkweed with 582 pieces. The second most used was *Apocynum* with 338 pieces, followed by sage with 188, juniper with 36, and *Cowania* with 18 pieces. The cords made from the fibrous stalks milkweed and *Apocynum* were used to make the finest cords and are found in all levels of the excavation, while the woody plants such as sage and juniper were made into cordage with greater diameter.⁴⁶

Based on similarities in cultural objects and time periods of occupation, different units were identified. Unit I is made of excavation levels 1 through 8 and dates from

⁴⁵ Aikens, *Hogup Cave*, 127.

⁴⁶ Aikens, *Hogup Cave*, 127.

6400-1250 B. C. This cordage from this unit shows a predominance of Z-twist over S-twist with large numbers of net fragments. Unit II is made up of levels 9 through 11 and, dates from 1250 B.C. – A.D. 400. Unit III dates from A.D. 400-1350, levels 12 through 14 S-twist is predominated over Z-twist. There were not many cordage fragments from this level as this was likely used as a hunting camp. Unit IV has no cordage identified.⁴⁷

These sites from the Great Basin are helpful for this project because they show what type of materials and cordage making techniques were used in a nearby area. In Chapter 6 I will provide comparisons of this cordage from the Great Basin to the Lamona Rockshelter to show that although many of the same plant materials are found in both areas there are many differences in cordage making traditions.

⁴⁷ Aikens, *Hogup Cave*, 188-194.

Chapter 4: The Lamona Rockshelter

The Lamona Rockshelter had four seasons of field school work done ending in 1980.⁴⁸ As a result of these excavations large amounts of rock, animal bones, and cultural objects were recovered. These excavations were able to show information on how the rockshelter was created and its use by humans.

Environmental Construction of the Rockshelter

The Lamona Rockshelter is a natural feature located east of the town of Odessa in Lincoln County, Washington. The Lamona Rockshelter is located on top of a bluff, on the south side of Crab Creek. It lies behind a major rock face known as Jump off Joe. The Lamona rockshelter is about 1.2 miles upstream from where Crab Creek enters Sylvan Lake. Due to this remote location the Lamona Rockshelter was not identified until 1969 during an aerial study.⁴⁹

The Lamona Rockshelter was carved out of the basalt bedrock as a result of the Missoula floods. J. Harlen Bretz found that there were four major tracts for the Missoula flood waters to follow. This was part of the second: “The next spillway group to the west, the Telford-Crab Creek tract, heads in the vicinity of Telford station, about 40 miles from Cheney.”⁵⁰ It is by following these flood tracts that water was able to carve out the Lamona Rockshelter.

⁴⁸ Galm and Keller, “Archaeological Investigations at Lamona Rockshelter,” 2.

⁴⁹ Galm and Keller, “Archaeological Investigations,” 2.

⁵⁰ J.H. Bretz. *The Channeled Scablands of Eastern Washington*. New York: American Geographical Society, 1928, 450.

The Missoula flood waters crossed over the land causing the topsoil to be stripped all the way down to the basalt bedrock. The water flow ripped large pieces of the basalt bedrock out of the land. The removal of large pieces of basalt left a cave-like structure.⁵¹ This is known as the Lamona Rockshelter.

The Excavations

The site includes the south-facing rockshelter and a depression in the basalt, which lies in front of the opening of the rockshelter. The depression once contained a pond but is now dry. The first excavation was done in the dry pond while later excavations were done inside the rockshelter.

The first excavation at the Lamona Rockshelter was done by geographers. This excavation was a 4 m by 4 m test pit dug into the center of pond sediments outside of the rockshelter. The test pit was taken down to the bedrock, 5.3 meters deep. All the sediment from this test pit was screened for cultural materials. No cultural materials were found, but at least eight layers of ash were found. Two layers of ash were analyzed one from 302cm to 306cm and one from 396cm to 404cm. The first ash was identified as Manama and the second was identified as Glacier Peak ash.⁵²

More excavations were done in 1979 and 1980, in the rockshelter, as a part of summer field schools under the direction of Dr. Sarah Keller. Two trenches were excavated; they were two meters wide by seven meters long and up to three meters deep. The excavations were described as being very difficult: “The deposits in the shelter were slow and difficult to excavate. They consist of unconsolidated rock, some of which is

⁵¹ Galm and Keller, “Archaeological Investigations,” 2.

⁵² Galm and Keller, “Archaeological Investigations,” 3.

massive columnar basalt fragments from the overlying basalt roof which forms the cliff face of the shelter. These vary from 20cm to 1m in diameter. Equally common are large chunks of vesicular basalt which appears to be coming from the back of the shelter, below the entablature contact. This lithic component makes up at least half of the entire deposit.”⁵³ Because of the large amount of rock fall, it was not possible to make the trenches any deeper without going wider. Due to the rocky makeup of the rockshelter floor, it was not easy to see different layers in the stratigraphy.

Stratigraphy and Dates

The only information recorded on stratigraphy is a list of soil types and volcanic ash that was seen in the pond trench and the main trench.⁵⁴ The pond trench stratigraphy was done from photos; it was not stated how the main trench stratigraphy was obtained. No visible layers of occupation can be seen in either trench. The ground is rocky and full of rodent holes. About half of the cordage was found in rodent holes at various depths most of which were recovered below 1.5m with few samples of cordage found below 2 m. “Recovery at these depths cannot be attributed solely to disturbance by burrowing animals and insects and suggests the presence of stable surfaces in this massive deposit.”⁵⁵ This means that even though no visible cultural layers can be seen and rodents disturbed the location of some cultural objects it is believed that there must be a cultural level below 2 m.

⁵³ Galm and Keller, “Archaeological Investigations,” 3.

⁵⁴ Anonymous, “Stratigraphy of Lamona Rockshelter” (Eastern Washington University, Lamona file cabinet, photo copy, unknown date), 1-2.

⁵⁵ Galm, and Keller, “Archaeological Investigations,” 6.

Radio carbon dates were acquired on several samples. Two of the tests were done on lake mud:

- Sample 1: radiocarbon age BP 6560 +/- 120; call BC 5445; call BP 739
- Sample 2: radiocarbon age BP 8810 +/- 140; call BC 7913; call BP 9862.

More dates were acquired from some wood pieces and cordage:

- Wood sample 1: elderberry stake radiocarbon age BP 5740 +/- 60; call BC 4557; BP 6506.
- Wood sample 2: non-modified red-osier dogwood branch radiocarbon age BP 101 +/- 1; call AD 1889, 1908, 1954; call BP 61, 41, 0.
- Wood sample 3: possible mockorange arrow shaft was dated; radiocarbon age 6780 +/- 60, call BC 5621; call BP 7570.
- Cordage sample: 4-ply cordage radiocarbon age BP 5950 +/- 70; call BC 4832; call BP 6781.

These dates show some variations in time. The oldest is the modified mockorange shaft which is about 1000 years older than the cordage and wooden stake. The cordage and wooden stake do not have the same date but the dates are close enough to suggest that they were used at or close to the same time. The wooden stakes are likely part of a scaffolding set that has been in place for a long period of time. This means that the scaffolding could have been set in place for the purpose the rockshelter being used as storage years before the cordage. The rockshelter was probably used for storage over a long period of time. The modern wood must have been deposited recently and has nothing to do with pre-contact use of the rockshelter.

Fauna

About fifty percent excavated objects were natural rock from roof fall and other natural accumulation. The other fifty percent includes faunal remains, botanical remains, and cultural objects. The collection of faunal remains is very large, but there is no evidence that any of it was due to human introduction. Lee Lyman analyzed about 30,000 faunal remains, of which about 6900 were identified by species.⁵⁶

Lyman found 27 specimens of the western painted turtle. The western painted turtle is not a species that would normally be found in a rockshelter without being brought there by humans or predators. None of the 27 specimens showed any signs of butchery. These specimens seemed to have been eaten by carnivores, because there are puncture marks on the bones, which have a corroded appearance as if they were passed through a digestive system.⁵⁷

There were a large number of small rodents such as voles, shrews, bats, gophers, squirrels, and mice. These rodents are representing the normal rodent population in this area. The excavations further show there was a large population of rodents because a large number of cultural objects were found in rodent burrows. Thus, they are also not evidence of human activity.

One of the largest numbers of identified species consists of a variety of rabbits and hares, with a little over 2800 specimens. None of the specimens shows any signs of

⁵⁶ R.L. Lyman. "Paleobiology and Taphonomy of Mammalian and Turtle Remains from Lamona Rockshelter (45LI150)" (Eastern Washington University, Lamona file cabinet, 1992), 4.

⁵⁷ Lyman, "Paleobiology and Taphonomy," 4.

human modification such as burn marks or butcher marks. These specimens instead show signs of digestion and puncture marks from the bites of predators.⁵⁸

There are also some animals that could be associated with human activity. These species include deer, bison, elk, sheep, and antelope. Most of these species are represented by a very small number of samples. At least one sample came from a domestic sheep, and the single sample identified as bison could be from a domestic cow. None of these specimens shows any signs of human use; they instead show signs of being digested or gnawed on. All these factors allowed Lyman to conclude that the faunal remains are the result of a natural collection and not due to human activity at the rockshelter.

Botanical Summary

Nancy Stenholm analyzed the botanical remains that were recovered at the Lamona Rockshelter; the analysis included 195 samples of charcoal, wood, woody tissue, disintegrating stem tissues, and cordage.⁵⁹ This analysis shows that some of the botanical materials were human introduced while others were naturally introduced. A little less than half of the materials analyzed were natural introduced, including all of the charred wood and charcoal, all but nine pieces of wood, and many plant fibers such as grasses and sage fibers. These fibers were likely introduced by animals for nesting and some were likely deposited by the wind. The materials that are likely human introduced include nine pieces of wood that show signs of modification and all cordage and basketry.

⁵⁸ Lyman, "Paleobiology and Taphonomy," 7-8.

⁵⁹ Stenholm, "Botanical Analysis," 1.

All the charred materials are woods that can be found in the local environment. These charred samples range from slightly charred at one end to charcoal. Most of the samples of charcoal are aspen (18 samples), followed by sage (12 samples), bitterbrush (4 samples), willow (2 samples), and wood from the rose family (2 samples). Charred pieces of wood include two pieces of mockorange that are charred at one end, one piece of sage wood charred at one end, one sage wood branch, and one piece of charred aspen. None of these charred items show any signs of being modified by humans or being burnt by humans. The charred items were not found in association with a hearth and some were only slightly charred. Instead, the burning seems to have been caused by wild fires. The rockshelter opens in the direction of the prevailing winds which allowed embers to enter the rockshelter and cause a small amount of damage to the wood and plant fibers that were located there.⁶⁰

Non-charred woods are the same woods as the charred materials. These include, 12 pieces of sage, eight pieces of mockorange, eight pieces of elderberry, three pieces of unidentified wood, one piece of willow, one piece of cedar, and one piece of red-osier dogwood. Some of these pieces of woods are the result of human introduction and some are naturally introduced. Nothing suggests that the sage, willow, unidentified wood, and the red-osier are human introduced. The red-osier was dated to modern times, showing that this piece of wood is not associated with the cultural objects.

Wood that is probably due to human introduction includes one piece of sage, six pieces of elderberry, two pieces of mockorange, and one piece of cedar. The sage was a possible stake, which could have been a part of scaffolding for holding nets and cords.

⁶⁰ Galm and Keller, "Archaeological Investigations," 4.

The six pieces of elderberry were also stakes that would have been used as supports in the scaffolding. The other piece of elderberry is split but shows no other signs of modification. One piece of mockorange was smoothed on one end; the other is in very fragile condition but is smoothed as if it were a shaft. The cedar is just a slat with a stress fracture, but cedar is not found in the local environment. Cedar is found in wetter or mountainous areas, not the dry area where the Lamona Rockshelter is located. The only way for this piece of wood to have gotten there is to have been transported by humans.

The largest numbers of botanical samples are plant fibers are fibers are introduced by humans. *Apocynum*, Indian hemp, is most common with a total of 94 pieces. The pieces of *Apocynum* range from unmodified plant fibers to fragments of cordage and netting. There are 20 samples of sage. The sage fibers also range from plant fibers to cordage. However, there is only one piece of sage cordage. The other sage fibers are unprocessed and may not have been introduced by humans. Another plant that ranges from just fibers to being constructed into mats and cordage items is bulrush, with a total of eight pieces. There is also one piece of aspen that was made into cordage.

Other plant materials were probably the result of natural accumulation. A total of 19 samples were described as disintegrating grass stem, making species identification impossible. Twenty-one samples are listed as woody plant stems, mostly without epidermis or pith; this is a sign of transportation and use by animals for nests. These samples are likely introduced by rodents, birds, and wind.⁶¹

⁶¹ Stenholm, "Botanical Analysis of Lamona Rockshelter," 2.

There is no evidence of food associated with humans. The only edible plant that was found is 25 chokecherry pits. These chokecherry pits seem to be deposited by rodents; the pits have signs that show they were eaten by rodents and were found in or around rodent holes.

Cultural Objects

The cultural object type that was found in the largest numbers is cordage and basketry with a total of 100 pieces. The collection of cordage is largely made up of two different types of cordage from *Apocynum*.

Type 1 *Apocynum* cordage tends to be thicker and better-made than Type 2 *Apocynum* cordage. It is up to 5.22 mm in diameter, and it is often made into two- to four-ply cordage. Stenholm was able to look at the samples under magnification; she describes Type 1 *Apocynum* as having as a thin epithelial tissue and resinous quality. The epithelial tissue does not seem to add strength but it may provide color adhesion and the resinous quality seems to hold the fibers and tissues together in a stiffer form.⁶²

Type 2 *Apocynum* cordage is made from a much lighter color than the Type 1 *Apocynum* cordage; it is a light brown to whitish in color. Also it is much finer in diameter than Type 1 *Apocynum*, as fine as .4 mm in diameter. Type 2 *Apocynum* cordage was used largely in the construction of netting. It is also seen in the twining of mats and basketry samples. Type 2 *Apocynum* cordage looked at under the magnification the fibers

⁶² Stenholm, "Botanical Analysis of Lamona Rockshelter," 2.

did not have the resinous coating as Type 1 *Apocynum* which makes the fibers less stiff and easier to pull apart.⁶³

Other types of cordage are found in smaller numbers, including cordage made from sage and one from mammal skin, two pieces of two-ply bulrush cordage and one piece of three-ply cordage made from aspen.

Baskets and mats were found in very small numbers: five mats, one possible sandal, and one a piece of basket or mat. All five mats are made of bulrush, sewn with 2-ply cordage. One sample was sewn with Type 1 *Apocynum* cordage; the others were sewn with tule cordage. The possible sandal is also made of bulrush sewn with Type 2 *Apocynum* cordage. The item that is either a mat or basket is in fragile condition that makes further identification impossible.

The wooden cultural objects included seven wooden stakes made from elderberry, sage, and mockorange. Five of the seven wooden stakes are made from elderberry; the longest of these samples is 30.4 cm and the shortest is 8.5 cm in length. All of the elderberry stakes are in fragile condition and not a lot of information was provided in the description. However, one sample had more information, including radio-carbon dates. This piece is described as being split in half and bi-pointed, with a length of 30.4 cm and 2.9 cm in width at the widest point. The other two wood stakes are a sage stake that has been broken into three different pieces totaling 8.7 cm long and 9.8 mm wide and a fragile piece of mockorange wood 6 cm long and 4.8 cm wide.

⁶³ Stenholm, "Botanical Analysis of Lamona Rockshelter," 2.

The other wooden cultural objects are four pieces of worked wood; these include one cedar slat, possible mockorange arrow shaft, a piece of modified mockorange, and elderberry stem. This cedar slat has a stress fracture and a stress line from bending. The slat is six cm long and three cm wide and the wood is in great condition. The possible mockorange arrow shaft has been broken into several pieces and is in fragile condition. The wood is very delicate making identification difficult. However, it shows signs of being smoothed. The other mockorange cultural object is smoothed on one edge and shows wear on another edge, suggesting human manipulation. The elderberry stem shows signs of being split, but no other modifications are described.

Few lithic cultural objects were recovered. Only eleven lithic cultural objects were recovered. All of the lithic cultural objects are made of cryptocrystalline silicates or CCS. The CCS is likely from a source located along Crab Creek.⁶⁴ The entire collection consists of eight flakes, one uniface, one projectile point tip, and one projectile point. The projectile point tip has straight edges that come to a sharp point. There was enough of this point to see that the cross section was probably biplano. The projectile point is a small side notched point with a broken tip that appears to have been reworked.⁶⁵

There is only one cultural object made out of shell, a bead that has a single-ply Type 2 *Apocynum* cord threaded through it. The shell is *Olivella* sp. The shell must have been transported to this location by human trade because it is a shell that is only found on the ocean coast.⁶⁶

⁶⁴ Galm and Keller, "Archaeological Investigations," 6.

⁶⁵ Anonymous, "Descriptions of lithic cultural objects" (Eastern Washington University, Lamona file cabinet, photocopy), Unknown date, 1-2.

⁶⁶ Stenholm, "Botanical Analysis of Lamona Rockshelter," 1.

Chapter 5: Analysis of Cordage and Other Perishable Cultural Objects from the Lamona Rockshelter

When looking at the total collection of the cordage items from the Lamona Rockshelter, I found that certain technical aspects of the cordage stand out in both material and techniques. *Apocynum* is by far the most-used material. Out of 100 cordage cultural objects, 83 were recorded as *Apocynum*; not all had material recorded, so the actual number may be higher. The *Apocynum* cordage uses two different processing techniques that give the cordage two different looks and qualities. The two different processing techniques produce Type 1 *Apocynum* and Type 2 *Apocynum*. The two different processing techniques allowed for cordage items with both finer and thicker diameter. These different materials represent cultural choices made for how to construct cordage items.

Three things stand out in the techniques used in cordage construction. All the cordage with multiple plies is made by alternating between twist directions. Having the plies alternate will allow for the cordage to have more strength.⁶⁷ It also suggests that the method for making multiple plies is twisting a ply until it turns back on itself. Overall the collection of cordage shows a preference for the final twist being Z with singles S-spun; 52 pieces Z-twisted with singles S-spun while 31 are S-twisted with singles Z-spun. Eighteen out of 26 of Type 1 *Apocynum* two-ply cordage is Z-twist with singles S-spun. Type 2 *Apocynum* cordage shows there is only a slight preference for cordage with S-twist with singles Z-spun; 17 total, and 15 total Z-twist with singles S-spun. Specific techniques and cordage types were used to make specific items. Single ply is all Z-twist

⁶⁷ Kidder, "Making Cordage By Hand."

and mostly made from *Apocynum*. The netting was all made from Type 2 *Apocynum* two-ply S-twist with singles Z-spun. Four-ply cordage was made from *Apocynum*; seven pieces have a final twist of S, while the other eight did not have twist or spin recorded. Other kinds of cordage exist only in small numbers and are varied.

Cordage with different numbers of strands was used differently. Much of the two-ply cordage was made into netting. Two-ply cordage was used in twining. Single-ply cordage was used to thread beads. Much of the other cordage was too fragmented to identify what it was used for.

Single-ply cordage

There are four pieces of single-ply cordage. Three of them are made of *Apocynum*; the other piece did not have material listed. Two of the single ply cordage pieces are made of Type 1 *Apocynum*. Both pieces are fragile, have a Z-twist, and have knots in them.

All of the single ply cordage is Z-twisted and all of the identified material is *Apocynum*. Unfortunately information is missing, so that each piece could not be compared in the same way. These single ply pieces of cordage are very small and in fragile condition, which makes knowing what they were used for quite difficult. There are only two single-ply cords whose use can be identified one is the Type 2 *Apocynum* cord and the other did not have material recorded. The cord made from Type 2 *Apocynum* has a single shell bead strung on it, and was probably use as an embellishment sewn on another item. The other cord was used in the twining of a mat.

Two-ply cordage

Most of the collection of cordage is two-ply cordage most of which is made of Type 1 *Apocynum* or Type 2 *Apocynum*. Some cordage is made from *Apocynum* but the fragile condition of the cords makes knowing the processing type of *Apocynum* impossible. A small amount of cordage made is from other plant fibers; one is even made of animal skin. Some of the two-ply cordage has knots, some is identified as netting, and some has other defining characteristics (see descriptions for more details).

There are 20 pieces of two-ply cordage made of Type 2 *Apocynum*. One piece does not have the twist or spin recorded. Four pieces are S-twisted with singles Z-spun. The other 15 pieces are Z-twist with singles S-spun. There are 32 pieces of Type 2 *Apocynum* cordage. Unlike the Type 1 *Apocynum* cordage where most pieces have a final twist of Z, Type 2 *Apocynum* two-ply cordage has more of an equal distribution between S and Z-twist. There are 15 that are S-twisted with singles Z-spun and 17 that are Z-twisted with singles S-spun.

Most of the two-ply cordage made from *Apocynum* is just fragments of cording. However, there are several examples that are identified as netting or have other unique features that set these samples apart. Seven samples of two-ply cordage are identified as netting. One of these net fragments is identified as *Apocynum* but whether it is Type 1 *Apocynum* or Type 2 *Apocynum* was not recorded. All the other pieces identified as netting are made from Type 2 *Apocynum*. All but one piece of the netting is S-twist with singles Z-spun; the remaining one is Z-twist with singles S-spun. The lengths vary from 3

cm to 22 cm. Diameter ranges from 0.75 mm to 1.6 mm, while twist per cm ranges from 4 to 8.

All the fragments of the Type 2 *Apocynum* netting have knots. Not all of the knots are identifiable due to the fragile condition of the cordage. However, four of the six net fragments have identifiable knots. One has a total of six square knots, one has one square knot, one has weaver knots, and the last has one overhand knot. None of these netting fragments have the same measurements or knots which leads me to believe that they are not all fragments of the same net.

Several other pieces of two-ply cordage have knots and similar measurements to that of the fragments that are identified as netting, which leads me to believe that is more netting fragments than were originally identified. Six other pieces of cordage fragments have knots; I believe that at least three of them are netting fragments.

All three of the additional cordage pieces that I believe to be netting are made of Type 2 *Apocynum* S-twist with singles Z-spun. The lengths range from 10.3 cm to 22 cm, diameter 1.2 mm to 2.64 mm, and one does not have twist per centimeter recorded but the other two both have 7 twist per cm. One of these fragments might even have been originally part of the same net as one of the other net fragments. These two fragments both have the same spin and twist (S-twist with singles Z-spun), the same diameter (1.2mm), the same angle of twist (49°), and the same number of twists per centimeter (7).

Three of the unusual cordage fragments are made of Type 1 *Apocynum*. All these three pieces look as if they are in the first stages of cordage manufacture. Two of these pieces are S-twist with singles Z-spun and are described as being hastily manufactured.

Both have knots but one piece has a knot only in one of the plies. The third piece is Z-twist with singles S-spun; it has fibers that are very loosely twisted. The hasty manufacture and the loose twist lead me to believe that these pieces were not completely finished. Someone may have started making the cord but either never finished making it as high quality as the rest or didn't bother to finish it as the cord was just intended for a quick temporary use.

The most unusual piece of cordage is the one that is a combination of both Type 1 *Apocynum* and Type 2 *Apocynum*. This cord is Z-twist with singles S-spun. It is very loosely twisted with a diameter of 5.15 mm and only two twists per cm. No other examples were found that combined both types of *Apocynum*. Because it is very loosely spun, it is possible that this could be a cord made out of scrap materials and intended for temporary use.

There are at least eight pieces of the two-ply cordage are not made of *Apocynum*. Two of these eight are made of bulrush. Not a lot of information was recorded about these fragments of bulrush cordage because of the fragile condition. Both of the pieces of bulrush cordage has a Z-twist but spin was not recorded. One of these pieces of the Z-twist cordage is made from flattened stems with loose bulrush tissue fragments. Three pieces of cordage were made out of tule. These tule cordage pieces did not have spin or twist recorded. They were used in the twining of mats.

The other two pieces of cordage are made of mammal skin and sage respectively. The first possibly made from rabbit skin; it is, a brown pigmented fur and the skin is light

tan. The cord is two-ply S-twist with no spin recorded. The sage cordage is S-twist with singles Z-spun.

Three and Four-ply Cordage

There is only one piece of three-ply cordage and this is the only sample made of aspen. This cord has a final twist of Z and is made from a two-ply cord with a single ply cord added.

There are 16 pieces of four-ply cordage. There are nine pieces of Type 1 *Apocynum* cordage, five pieces of Type 2 *Apocynum* cordage, and two pieces whose material was not recorded. All of the four-ply pieces that have the twist and spin recorded have a final S-twist and are made of two two-ply Z-twist with singles S-spun that have been re-plied.

Basketry

The basketry includes five twined mats, one sandal, and one piece that could either be a mat or a basket. Four of the mats made from tule and are sewn with bulrush cordage. The other one is sewn with Type 2 *Apocynum* cordage. The information recorded on these mats is missing a lot of detail; all that I could gather was the material type and cordage. The sandal fragment is made of three bulrush stems that have probably been twined with Type 2 *Apocynum* cordage. The last piece of basketry is in fragile condition, which makes it hard to say whether it is a basket or a mat. This fragment is made from small stems of hard rush.

What the Cordage was used for

Two-ply cordage can be used for the construction of a variety of items because it is strong due to the second ply and it can be made in different diameters, allowing the spinner to make a thin or a thicker cord is needed. For a large number of the two-ply cordage from Lamona, we do not know what the intended use was. The cords are very fragmented making their purpose very hard to determine. We can show what some pieces were used for.

The purpose of cordage made out of Type 1 *Apocynum* is usually hard to determine. These cord fragments are made with a thicker diameter than the cordage made out of Type 2 *Apocynum*. There is only two pieces of Type 1 *Apocynum* cordage whose use can be identified; one was used for threading a shell bead and the other was used in twining of a mat.

Most of the two-ply cordage made out of Type 2 *Apocynum* is very fragmented, but there are at least eight pieces that were identified as netting. There are likely more netting fragments but when the fragments are very small it is not possible to see features such as knots that would suggest netting. All but one piece of the netting was made out of cordage with S-twist with singles Z-spun Type 2 *Apocynum*. The other one is also made of Type 2 *Apocynum* but it is S-twist with singles Z-spun. There are 14 other pieces of cordage fragments made of Type 2 *Apocynum* S-twist with singles Z-spun that also could have been fragments of nets. However, these pieces are very small and do not have any knots, making it hard to be definitive.

Two-ply cordage also was used in twining. There is a total of seven twined items, five of which are mats, one a sandal, and the other too fragile to be able to identify. All but two of these items are twined with two-ply cordage; one is twined with a single-ply cord and the other did not have the number of plies recorded. The matting is twined with two-ply cordage made from Type 1 *Apocynum* in one sample and three samples are twined with two-ply tule cordage. The fifth piece of matting is twined with two-ply cordage made from *Apocynum* but *Apocynum* type was not recorded. The sandal is twined with a two-ply Type 2 *Apocynum* cord.

One fragment of the four-ply cordage is 141.8 cm long and has several knots, which could suggest that it was used as a snare or some other type of rope. However, the four-ply cordage was too fragmented and found in numbers too small to be able to definitively know its uses.

Single ply cordage was found in very small numbers. However, at least two pieces show what it was used for. One piece was threaded through a shell bead, probably to keep it attached to some other type of item as decoration. It is likely that there may have been more shell beads that were held by the other pieces of the single-ply cordage. The other piece of single-ply cordage was used to twine a mat. Based on the small amount of single-ply that was found and that it was only used in one piece of matting, single-ply cordage probably was not used very much in twined items. It is likely that single ply-cordage was not used for many reasons due to its not being as strong as multiply-plied cordage.

Thee-ply cordage was only found in one sample. The three-ply cordage was also the only cord made of aspen. Unfortunately this is just not enough information to know what it was used for and why it was made of aspen instead of *Apocynum* like the majority of the other cordage items.

Even though the use of every cordage item cannot be seen there still is enough information from the cordage analysis to gain a better understanding of cordage-making traditions. This information tells that two-ply cordage was the most important cordage used because it is found in the largest numbers and it is used and made for more than one use. Two-ply cordage was used to make nets and was used for twining. Two-ply cordage would have been selected for these purposes because it was strong enough to hold but the diameter of the cord is thin enough to be made into nets and used as thread in twining.

Cordage found in single-ply, three-ply, and four-ply all seems to be used for secondary purposes, but the traditions for making these items can still be seen. Looking at the entire collection of cordage items shows that *Apocynum* is the material of choice.

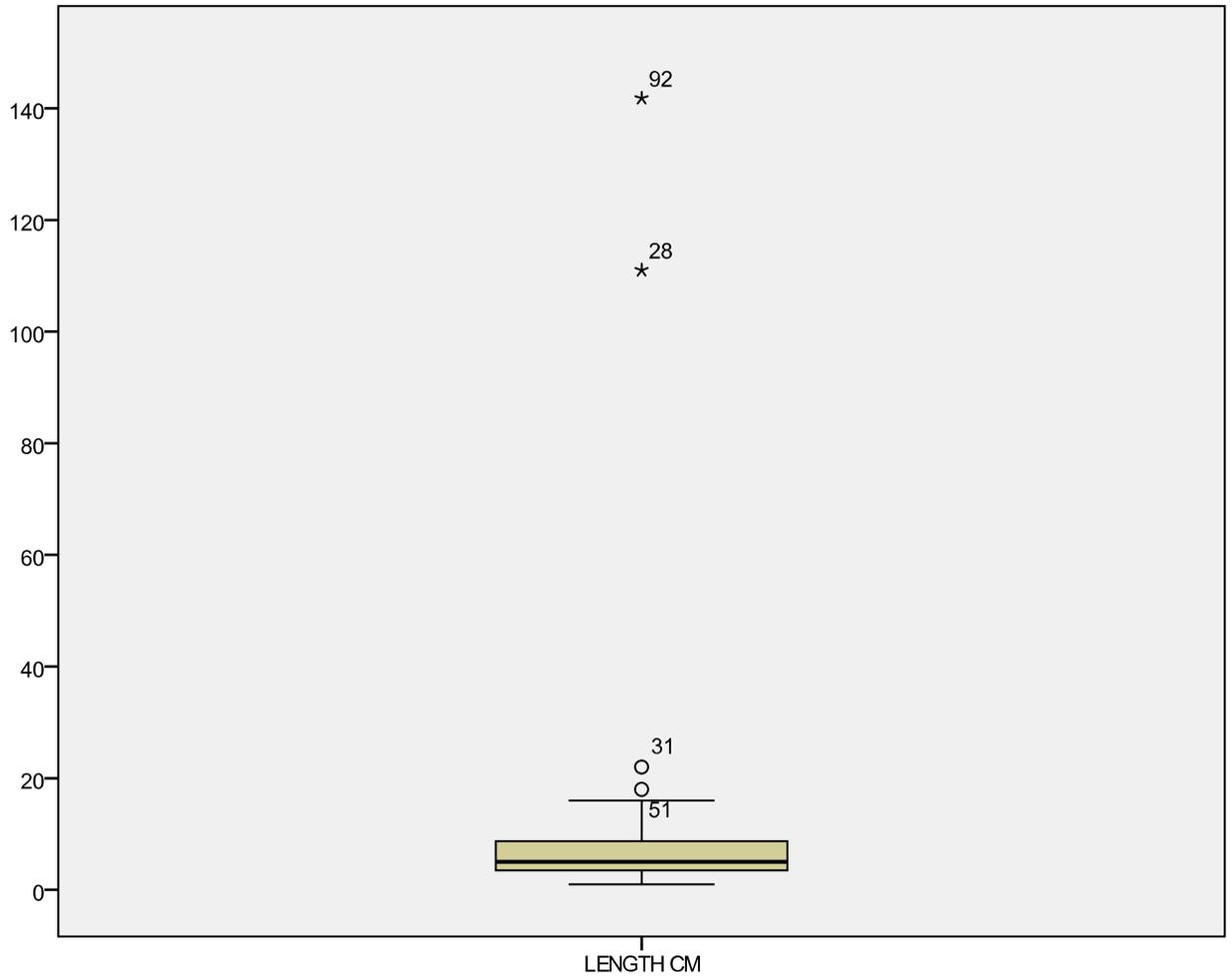


Table 1: Box Chart: Length in Centimeters. The lengths of the cordage items are mostly less than 20 cm; the shortest is only 1cm and the longest is 141 cm. These lengths do not represent how long the cords were when they were made. The lengths seen are a result of preservation.

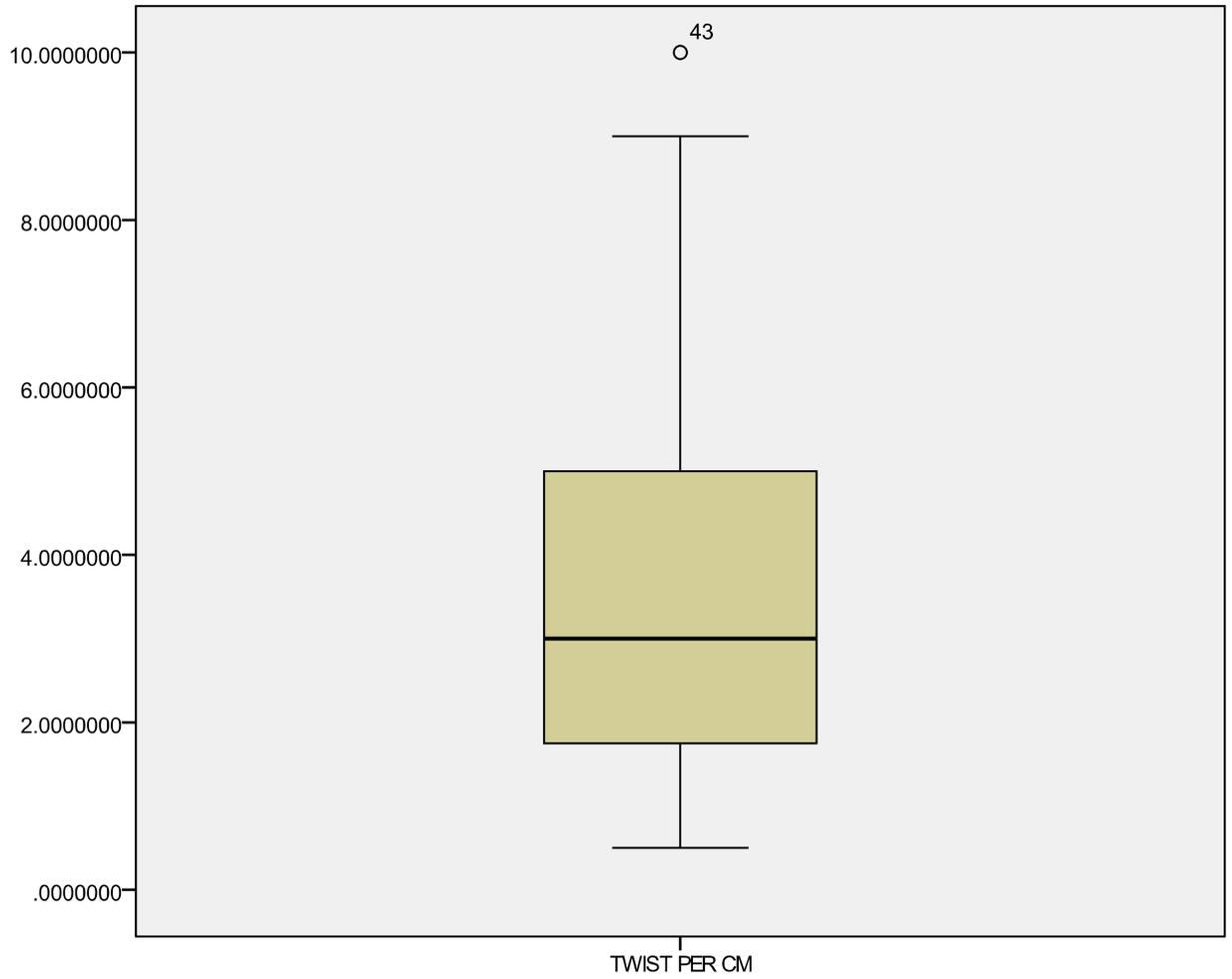


Table 2: Box Chart: Twist per Centimeter. This chart shows that the average twist per centimeter is between two and five. This is a reflection of the cultural norm of how many twists per cm were twisted in a cord. One cord was recorded to have 43 twists per cm; however, this is likely to be due an error of data entry.

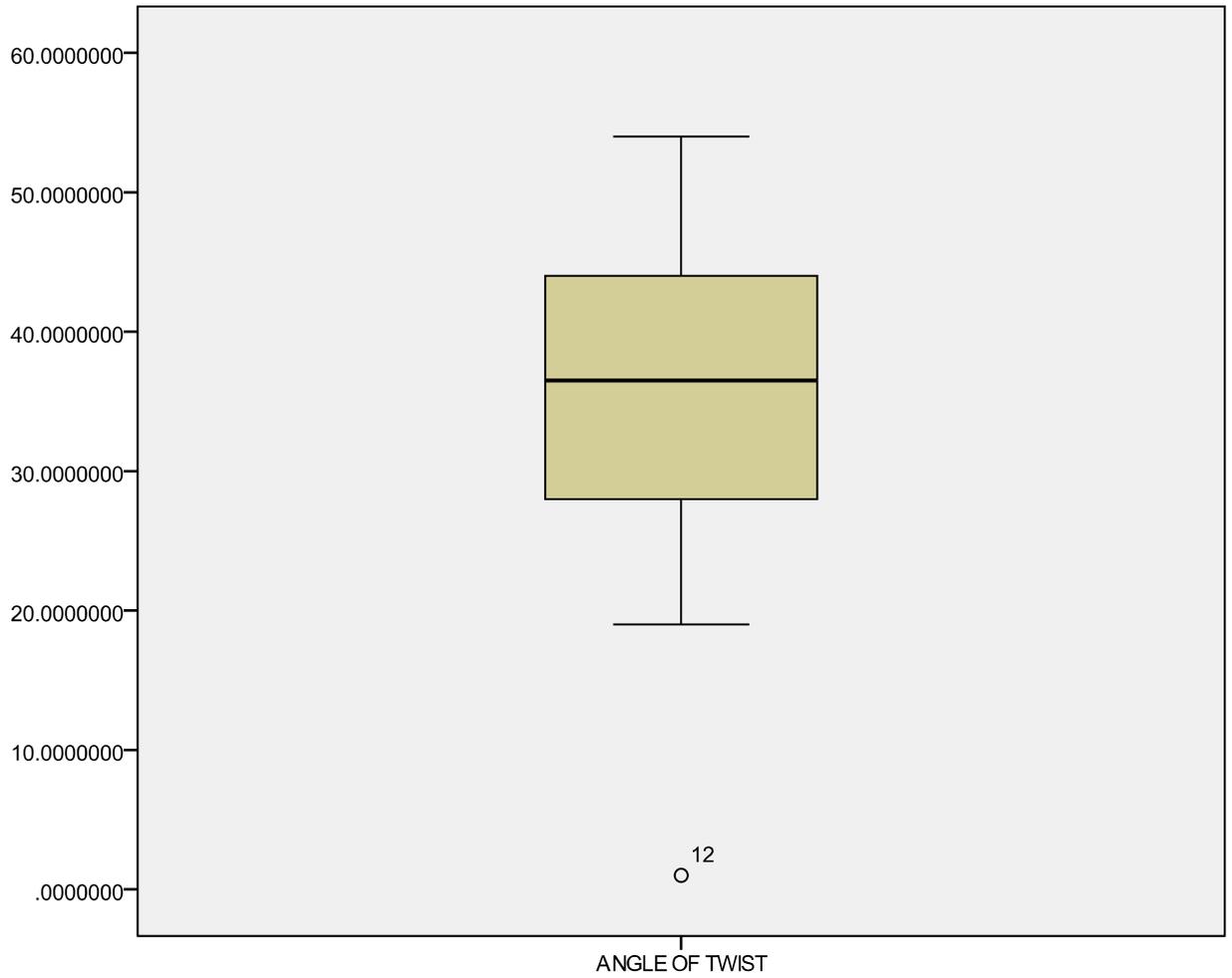


Table 3: Box Chart: Angle of Twist. This chart shows the angle of twist just like other features of the cordage is constantly chosen with most pieces of cordage falling between about 27 and 44 degrees.

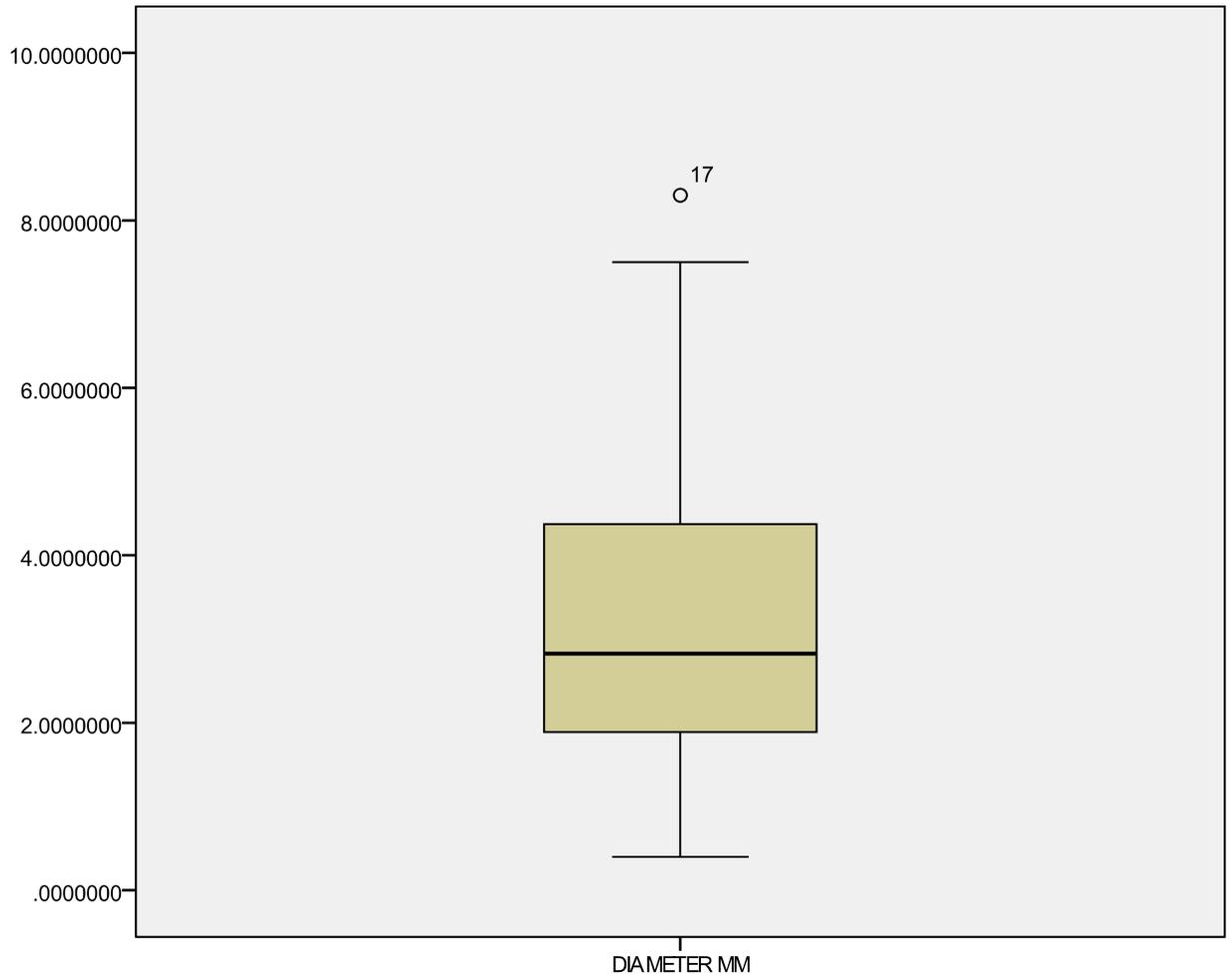


Table 4: Box Chart: Diameter in millimeters. The diameter of the cordage is how thick the cordage is. The thicker cordage is largely represented by the cords made out of the Type 1 *Apocynum* and the four-ply cordage. The thinner diameter cordage is seen in the single-ply and cordage made out of Type 2 *Apocynum*.

Chapter 6: Internal and External Correlations

The majority of evidence that the Lamona Rockshelter was used by humans is the cordage that was found. Cordage seems like it is limited in what it can show about culture; however, it can be used to tell us aspects of culture for the people who made the cordage and what it can tell us about culture in the surrounding area.

Internal Correlations

What the Lamona Rockshelter was used for

Based on radio carbon testing and lithic cultural objects the Lamona Rockshelter was used by humans at least three different times. From the earliest use of the rockshelter, the only cultural object that was recovered from this time is cultural object is a piece of mockorange wood that was modified.

The latest use of this rockshelter by humans is also represented by a very small sample of cultural objects and this use can be seen with the lithic cultural objects that were left behind. There are only a total of eleven lithic cultural objects. These cultural objects include eight flakes, one uniface, one projectile point tip, and one side-notched projectile point. When the side-notched projectile point was compared to other side-notched points from the Columbia Plateau, it appears to be from around 2500 BP. This date is much later than the dates for the majority of the cultural objects that were found. This small number of lithic cultural objects could likely be the remains of a hunting trip.

The time period from which the cordage was left behind is from a time that falls in between the times when the modified mockorange and when the lithic cultural objects,

although it is much closer in time to when the mockorange was left behind. The dates acquired for this use of the rockshelter come from a piece of four-ply cordage and an elderberry wooden stake that was both radiocarbon tested. The date for the wooden stake is 5740 +/- 60; call BC 4557; cal 6506 and the cordage was dated 5950 +/- 70; call BC 4832; cal BP 6781. These dates are not exactly the same date, but when the standard deviations are used they are close enough to have been used at or near the same time with the same propose of this rockshelter being used as a storage shelter for the cordage items that would have been made at this location.

Only one of the wooden stakes was sent for radiocarbon dating. However, there is a total of seven wooden stakes that were found in two parallel rows spaced about 60 cm apart. These wooded stakes are most likely the remains of scaffoldings. These scaffoldings would have functioned as different levels then the cordage and nets would be stored on, which helps in these items to be protected from rodents and other pests. Having scaffolding also would allow for better organization and larger number of items to be placed in this location. The use of scaffolding and racks for storage is something that is known to have been done because scaffoldings were found at other sites across the Columbia Plateau and are also known to have been recorded in the ethnographic record.⁶⁸ The scaffolding and the large amount of cordage, net fragments, and mats suggest that the Lamona rockshelter was used for storage.

The netting fragments could have been used to hold other items that were being stored or the nets could have been larger nets that were used for trapping animals. Either type of net could be placed on the scaffolding for storage. Most likely the nets were used

⁶⁸ Galm and Keller, "Archaeological Investigations," 7.

to trapping animals. Mats could have been placed in this rockshelter for two possible reasons. One reason is that they could have been stored until they were needed. The other reason is that the mats could have been used to line the floors to keep dirt and pests away from cordage and nets that were being stored.

Besides storage, the Lamona Rockshelter was also used as a place to process *Apocynum* and to make cordage items. Processing of *Apocynum* can be seen because there are both finished items made of *Apocynum* and fibers that might be the results of early production of cordage items. The number of pieces of *Apocynum* cordage found in their completed form is much larger than the samples that are found in the fibrous form. This large amount of completed cordage items represents some of the items that could have been made at the Lamona Rockshelter and the fibers are the fibers that would be used to make cordage items at a later time.

There are two different types of cordage made from *Apocynum* found at the Lamona Rockshelter which show that the processing took place at this location. These two processing techniques are what were used to make the Type 1 *Apocynum* and Type 2 *Apocynum*. Stenholm mentions the two different types of cordage made from *Apocynum* are the results of a process for quicker use and a more traditional processing. "For cordage on demand, the stems containing bark, cortical tissue, and best fibers could be stripped and twined in the field. The underlying cells may contain mucilage or other substances giving the cordage color and adhesion."⁶⁹ This process is what would have been used to make Type 1 *Apocynum*. Also this processing technique was probably used before the *Apocynum* was brought back to the rockshelter.

⁶⁹ Stenholm, "Botanical Analysis of Lamona Rockshelter," 2.

The second more traditional technique was used to make Type 2 *Apocynum*. “The traditional retting process involves soaking in water to loosen and rot the ground tissue. Beating the retted mass results in light-colored fiber which can be stored and used at will. Retting takes longer but the results are a finer fiber body without other plant tissues.”⁷⁰ This type of processing *Apocynum* would not have been done in the field. The fibers would have been taken back to the rockshelter processed then made into cordage items as needed. This processing technique would explain why there were *Apocynum* fibers found in the early stages of production.

There are all stages of production for the making of cordage in *Apocynum* that were found at the Lamona Rockshelter. The *Apocynum* fibers may represent different stages of production in a total number of 12 samples. These samples are made up of stem fragments, with and without bark or epithelium fibers. At least two samples are described as being a fibrous mass, one of which is decried as being very fine fibers. These fine fibers would likely represent some of the fibers that were the result of making Type 2 *Apocynum* cordage. Some of the bark fragments are likely left over after the bark was stripped and could be a result of the quicker process that is used for making Type 1 *Apocynum*. These types of fragments are finer than the finished cordage items which means that the numbers of these remains would not be as likely to be preserved as the cordage items that are finished which would explain why there are fewer than there are finished cordage items.

⁷⁰ Stenholm, “Botanical Analysis of Lamona Rockshelter,” 2.

The Importance of Materials used at the Lamona Rockshelter

With 100 cordage cultural objects made out of plant materials it is easy to see what materials were used and what importance the material had. *Apocynum* is by far the most important material. It is the most important material because it is what most of the collection is made from. There are 82 pieces of cordage that were recorded as being made from *Apocynum* and also at least one mat, and one sandal that are sewn together with *Apocynum* cordage. There is a possibility that there is even more cordage made from *Apocynum* than was recorded. There are several pieces of cordage that did not have material type recorded, likely due to the fragile condition of the cordage.

The number of *Apocynum* fibers compared to the other fibers used in the construction of cordage items is a very large difference. *Apocynum* must have been an important fiber in the tradition of cord-making for these people. I do believe that the materials that are chosen are a reflection of a cultural tradition. Tradition is defined as; “1. *a*: an inherited, established, or customary pattern of thought, action, or behavior (as a religious practice or a social custom) *b*: a belief or story or a body of beliefs or stories relating to the past that are commonly accepted as historical though not verifiable 2: the handing down of information, beliefs, and customs by word of mouth or by example from one generation to another without written instruction 3: cultural continuity in social attitudes, customs, and institutions”⁷¹

⁷¹ Merriam Webster Dictionary, “Tradition.” *Dictionary and Thesaurus - Merriam-Webster Online*. <http://www.merriam-webster.com/dictionary/tradition> (accessed June 12, 2012).

When I say a cultural tradition I mean that people do things a certain way because that is how they were thought to make an item. It will be a tradition when everyone is taught to make an item in the same way and no one just makes cordage however they want or because of limitations from environmental or technical reasons.

Apocynum appears to be important in the traditions of making cordage because it is found in the largest number and processed in two different ways that allow for the same material to be used for cordage with a thicker and a finer diameter. Type 1 *Apocynum* is thicker in diameter and Type 2 *Apocynum* has a thinner diameter. This is important because it shows that technical limitations such as the thickness of the fibers were not a determining factor in why the fiber was selected. When cordage was needed with a fine diameter to make netting, for example, the *Apocynum* would have been processed into Type 2 *Apocynum*. When a thicker diameter cord that would be needed it would be processed into Type 1 *Apocynum*. There was a cultural reason to use the just one material to make both thicker and thinner diameter cordage. Otherwise there would have been the use of materials that have a natural thickness to the fibers.

The two different types of cordage made from *Apocynum* show that *Apocynum* is a more important material than other materials that could have been used. Having two different types made from one material shows that there was a good understanding of the plant. However, *Apocynum* is not the only plant than could have been made into cordage items. There are other pieces of cordage found at this site that were made of other fibers such as, sage, tule, aspen, and rabbit skin. All of these other materials can be found in the local natural environment but there is a very small sample of cordage made from these

materials. This shows that there was also a knowledge and understanding of how to make cordage with other materials.

By having sage, tule, and aspen all available to use in cordage construction but not used in large numbers shows that these materials are not as important. This ready availability shows that material used in cordage construction was not just selected because the fibers grew there. *Apocynum* was found in the large number quantities because it was the most important fiber for cultural reasons, not just practical reasons.

The importance of material also is seen in combination with the function of the cordage item and twist directions. Traditions of material choice and preferred construction techniques can be seen in the items that were made. All the single ply cordage with material that could be identified was made from *Apocynum* and made with a Z-twist. All but one of the fragments that have been identified as netting and the possible net fragments are made from Type 2 *Apocynum* two-ply S-twist with singles Z-spun. The majority of the other two-ply cordage fragments were made from *Apocynum*. With the Type 1 *Apocynum* it appears that there was a preference to make the cordage with Z-twist and singles S-spun, with 75 percent as Z-twist and singles S-spun. The Type 2 *Apocynum* looks like there was no preference for the spin and twist with close to a 50 percent split between Z-twist and singles S-spun and S-twist with singles S-spun. Four-ply cordage was all made of *Apocynum* of both Type 1 and Type 2 and both S and Z-twist was used for the final twist, it appears that there was no preference to *Apocynum* Type 1 or *Apocynum* Type 2, or spin and twist. The preferred material for mats is tule or bulrush that is sewn with *Apocynum* or bulrush cordage.

Other materials were used in construction of cordage including sage, bulrush, and mammal skin. However, due to the small numbers of these that were found, it cannot be known what the intended use was.

How the Cordage from the Lamona Rockshelter fits into what is already known about Culture on the Columbia Plateau

The Columbia Plateau covers a large area that can be divided into three areas: the Northern Plateau, the Southern Plateau, and the Eastern Plateau. All three areas show that there were trends that can be seen in cultural development among these subareas.⁷² However, for the purposes of this paper only the Southern Plateau area will be looked at in detail because this is the area in which the Lamona Rockshelter is located.

In the Southern Plateau there is a record of cultural occupation from 11,500 years ago through contact.⁷³ This time of cultural history is divided into three different periods. The earliest period, period 1 is from 11,500 years ago to 5000-4400 B.C., period 2 is from 5000-4400 to 1900 B.C., and period 3 is from 1900 B.C to 1720 A.D.

In period 1 the earliest known culture is seen in only one site which is the Richey-Roberts Clovis cache. More is known about culture in the post-Clovis times of this period. Post-Clovis there is no evidence of housing or food storage at this time. This means that life was based around a high level of mobility. Food was hunted or gathered based on what was available during each season. "Salmon were not a significant resource. Storage if used is not apparent in the archaeological record. It is assumed that

⁷² K.M. Ames, D.E. Dumond, J.R. Galm, and R. Minor. "Prehistory of the Southern Plateau." In *Handbook of the North American Indians, Volume 12*, edited by D.E. Walker, Jr. Washington, DC: Smithsonian Institution, 1998, 73.

⁷³ Ames, Dumond, Galm, and Minor. "Prehistory of the Southern Plateau," 103.

these people maintained balance with food resources by supra-annual mobility.”⁷⁴ Based on the archaeological record it is known that bison, elk, deer, and prong horn was hunted.⁷⁵

In period 2 there are many similarities to how life was in period 1, with a high level of mobility and the hunting of large game, but it differs in that there is the first appearance of housing and some decrease in mobility. The housing style that started to appear is the pit house. The appearance of housing shows that there was less mobility than there was in period 1. With the change in housing and decrease in mobility, there was change in food, and there was an increase in the gathering of roots and the harvesting of fish.⁷⁶ About 4400 B.P. pit houses started to appear near forest edges where multiple resources can be accessed nearby.⁷⁷ After 3000 B.C. there is a seasonal reoccupation of currently used sites, which is related to the seasonal gathering of salmon.⁷⁸

Period 3 is much later in time than the use of the Lamona Rockshelter, so a brief discussion of this time is all that is necessary for the scope of this paper. Settlement patterns are based on a winter village pattern. This is where a there is movement to one location to another based on time of the year. The housing used is the pit house. Pit houses are found all across the Columbia Plateau. The gathering and storage of salmon is common along with the gathering of roots.

⁷⁴ E.S. Lohse, “The Columbia Plateau-Snake River Region Cultural Sequence,” presented in the Symposium *Projectile Point Sequence in North America*, 2005.
<http://www.iri.isu.edu/AIRC%20Research%20Documents/Points%20Docs%20documents/Lohse%20web%20site/Plateau%20Sequence%20revised.htm> (accessed June 10, 2013).

⁷⁵ Ames, Dumond, Galm, and Minor. “Prehistory of the Southern Plateau,” 104.

⁷⁶ Ames, Dumond, Galm, and Minor. “Prehistory of the Southern Plateau,” 110.

⁷⁷ Lohse, “The Columbia Plateau-Snake River Region Cultural Sequence,” 18.

⁷⁸ Ames, Dumond, Galm, and Minor. “Prehistory of the Southern Plateau,” 110.

The Lamona Rockshelter fits into period 2. The cordage from the Lamona Rockshelter can be used to help add to what we know about how life was. The Lamona Rockshelter shows that there was a use of storage. However, just as expected the Lamona Rockshelter was not used to store food. This rockshelter was used to store cordage and nets. The nets also give a clue to how life was in that these nets were likely used to trap small animals or fish. Based on the information that is already known, that fish were not a primary food for this time period, the nets were probably used to trap small animals or birds.

The storage of these nets shows that the trapping of small animals for food was important and people would have returned to the same areas. This means that there was some level of continued use of this area; it was likely a seasonal reoccupation of this area. People would have returned to this area when it was ideal to hunt small animals, and to also gather and process *Apocynum* that was used to make the cordage and nets that were found. This also means that seasonal reoccupation and storage was used earlier than thought.

External Correlations: Lamona Cordage Compared to other Cordage from the Columbia Plateau

Due to the large gap in times between these other sites from the Columbia Basin and the Lamona Rockshelter, the cordage from these sites cannot be seen as having any direct connections. What can be done is the similarities that exist can be looked at and the Lamona cordage can be added which can be used to see what traditions changed or stayed the same over time. This can show that there are probable cultural changes or contact with other cultures.

When cordage found at the Lamona Rockshelter is compared to cordage found at the other sites in the Columbia Basin, some similarities and differences can be seen. As discussed in previous chapters, cordage traits are a reflection of culture. By adding the cordage from the Lamona Rockshelter to what is already known, I can show the development of cordage traditions over time for this area.

It is only natural that over long periods of time there will be changes in a tradition of making something. Changes will happen when a new group of people moves into an area. When a new group of people replaces the group of people who previously occupied the area, the differences seen in cordage items can be very large. Some traditions in cordage making might be strong enough to last long periods of time, which will result in seeing some common traits in cordage items. By looking at the other sites that contained large amounts of cordage these changes and similarities can be seen. However, due to the lack of cordage found in this area there will have to be some generalizations made. As of now the Lamona Rockshelter represents the oldest known cordage making traditions for this area which is the use of *Apocynum*. Based on the other sites Trinidad Cave, Cox Cave, the rockshelter near Beverly, and Upper Coulee Rockshelter that are from a much later time, additional materials such as cedar, sage, tule, and grass were added to cordage making traditions.

Trinidad Cave is a site that can show how different cordage making tradition can be. There are no similarities seen in cordage traditions between Trinidad Cave and the Lamona Rockshelter. All the cordage from Trinidad is made from cedar bark while the Lamona Rockshelter has no cedar cordage. The only similarities are seen between these two sites is in with a single piece of mat. This single piece of mat is made of tule and tule

mats were found at the Lamona Rockshelter. However, having one mat made out of the same material does not suggest that there are any connections culturally between these two sites. The people who made the cordage items found at Trinidad cave must have an unrelated cultural development of cordage traditions that moved into the area much later in time. Trinidad Cave and the Lamona Rockshelter have cordage that is culturally unrelated; the differences between these two sites show how much a tradition of making cordage can change over time in one area.

Cox Cave shows similarities to both Trinidad Cave and the Lamona Rockshelter. The descriptions of the Cox Cave cordage are not very detailed and there is only a total of 17 pieces of cordage. The only comparison that can be done is with materials used. There are nine pieces of cordage made of *Apocynum* and eight pieces made of cedar. The *Apocynum* as material used is the only similarity that can be seen to the Lamona Rockshelter and cedar as material used shows that there are also some similarities to Trinidad Cave. Although, the descriptive data are limited to just seeing both *Apocynum* and cedar at one location, this suggest that the people who made the cordage use both older and new cordage making tradition. *Apocynum* is the oldest known material used in cordage construction for this area, and cedar seems to be a tradition that was added later in time. This is a site that represents a culture that shares two possible cordage-making traditions.

The rockshelter near Beverly also shows some similarities to cordage found at Lamona along with showing similarities to the other sites found in this area. The similarity it shows to the Lamona Rockshelter is that there is three pieces of cordage made *Apocynum*. The other five pieces of cordage found are made of a variety of other

materials including grass, cedar, and cattail. According to Swanson who did the cordage analysis, these cordage items are from the late pre-historic to early historic times. All of this shows that the people who made this cordage have a large variety of cordage making traditions that are both older and newer.

The Upper Coulee Rockshelter has the largest varieties of cordage making traditions that can be seen from all the sites that are included. The Upper Coulee Rockshelter had both Z-twisted cordage made from cedar bark and tule, and S-twisted cordage made from *Apocynum*; this shows that there is trend in using a certain material with a specific twist.

The Upper Coulee Rockshelter shows the majority of the cordage being made from *Apocynum* and having an S-twist. By having a large amount of *Apocynum* with a final S-twist shows that this would be a representation of an older tradition that was used in the Columbia Basin. This representation of an older tradition can be seen as lasting because *Apocynum* with a final S-twist found at the Lamona Rockshelter is found in about half the entire collection.

Also there seem to be some possible similarities seen with these two sites in processing *Apocynum*. The *Apocynum* from Upper Coulee Rockshelter shows that four pieces were made without separating the fibers from the tissue, and three other pieces were made by completely removing the fibers from the tissue.⁷⁹ These two processing techniques did not have as much descriptive analysis done as the Lamona cordage did to

⁷⁹ Mills and Osborne, "Material Culture of an Upper Coulee Rockshelter," 356.

define Type 1 *Apocynum* and Type 2 *Apocynum*, but because there are two different types it shows that there were some possible connections in the tradition processing *Apocynum*.

Changes and the adding of new traditions can be seen because of the use of cedar bark and tule with a final Z-twist and the sage cordage that is Z-twisted. The Lamona Rockshelter did have a small number of tule cordage but nowhere close to the amount that was found at Upper Coulee Rockshelter; no cedar was used at all and there was only one piece of sage cordage at the Lamona Rockshelter.

What all these sites along with the Lamona cordage show us is that *Apocynum* is the most popular material chosen. The Lamona Rockshelter represents the oldest known traditions in cordage making and the large majority of the cordage is made of *Apocynum* with very small samples of cordage made from other materials. This also suggests that *Apocynum* use in cordage is the oldest known tradition in cordage making for this area.

Sage, aspen, and tule were also found at the Lamona Rockshelter but in only one sample each of sage and tule and only four pieces of tule. However, sage, aspen, and tule were used at the other locations such as Upper Coulee Rockshelter. This can mean that these materials are known to be used in cordage-making traditions at early times, but not as popular of a chose until later in time.

Based on the fact that there is no cordage made from cedar found at the Lamona Rockshelter and that it is not a material that can be found in the local environment, the tradition of using cedar to make cords came from another area. However, because cedar was found at other locations such as the unnamed rockshelter near Beverly, Washington, Upper Coulee Rockshelter, Trinidad Cave, and Cox Cave that at some point in time cedar

gained popularity as material to make cordage items. Cedar wood was found at the Lamona Rockshelter, showing that there was some level of trade or contact with areas where cedar was found. The increase in the use of cedar cordage in the Columbia Basin is likely due to either an increase in trade of materials or due to the movement and blending of cultures that used cedar in the construction of cordage into the Columbia Basin.

Chapter 7: Conclusion

My study of the Lamona Rockshelter was able to show that culture can be interpreted by looking at cordage items that were left behind. This study showed that cordage can be used to know what a location was used for, what traditions were used in cordage making, and how cultural traditions in cordage making can be tracked as lasting over time. Cordage can be used in this way because the cords made are the result of cultural choices and behaviors.

As an example of the idea of cordage as cultural behavior: in the Great Basin at Hogup Cave a complete net was found made out of sagebrush. This means that sage is a material that has all the technical qualities that allow it to be made into cordage and netting. If the cordage found at the Lamona Rockshelter were made purely based on available material that could be spun into cordage, sage netting is something that would have also been found at the Lamona Rockshelter. Sagebrush is found in very large numbers near the Lamona Rockshelter, and many fragments of sage fibers were naturally deposited in the rockshelter but sage was not usually selected to make cordage. Sage was found in one piece of cordage, which shows that there was the knowledge of using this material. However, it was not selected to make nets, presumably because a cultural tradition was developed that nets are made of *Apocynum*.

Cordage was the cultural object found in the largest numbers at the Lamona Rockshelter, while remnants of scaffolding were found in the second largest numbers. The combination of these two cultural objects and the absence of other cultural object types shows that this location was used for storage, presumably storage of nets and other

cordage. This lets us know that the storage of cordage and nets, which were likely used to trap small animals, was done at an early time.

Cultural traditions in cordage making can be seen at the Lamona Rockshelter by looking at materials they used, as well as the twist, spin, ply, and diameter of the finished cordage. *Apocynum* was the most used and presumably the most important material used. It was important enough to use for almost every cordage item found. This importance can further be seen in the two different types of *Apocynum* cordage that were made by using two different processing techniques for the raw material. These two different processing techniques allowed for cordage to be made with a thicker and a thinner diameter. Thus, *Apocynum* could be used for different types of cordage that would require a thicker or a thinner diameter. This shows that *Apocynum* is culturally important because another material could have been selected that would have natural qualities that were needed to make cordage of different diameters.

Fibers selected are not the only quality of the cordage found at the Lamona Rockshelter that reflects a cultural choice. Cultural choices can also be seen with spin of single plies and twist combining multiple plies. Specific twist directions were used for certain items that were made. For example, all single-ply is made with a Z-twist and all netting is made out of S-twist with singles Z-spun. Cordage made from Type 1 *Apocynum* was mostly two ply, with Z-twist with singles S-spun. However, most of it is sufficiently fragmentary that its use cannot be identified. Other cultural traditions in cordage spin and twist are not as clearly seen. This is likely due to the fact the most of the cordage was too fragmented to be able to identify the uses.

Not all of the cordage fragments were able to be identified by use or material. Cordage items that could be identified include nets and pieces of twine or rope. Many specific items have identifiable methods and materials. For example nets were all made of Type 2 *Apocynum* that has been spun in to two-ply cordage that is S-twist with singles Z-spun. There are no examples of nets being made of any other materials or twist. There is no reason other than culturally as to why nets were not made out of other materials such as sage, as seen in nets from the Great Basin.

Looking at cordage as a reflection of culture is also useful in showing cultural traits that can be seen at other locations and over time. Cordage is made by using techniques that are passed down from one generation to the other, resulting in a uniform set of choices in materials and twist and spin. Sites with similarities in cordage items – in materials, twist, spin, and the like – may be more closely cultural related than sites that have greater differences. I used this idea to begin to show that *Apocynum* was the oldest and most used material for this area and those cultural connections or commonalties can be seen as lasting over time when similarities in cordage are found at other locations that were used at later times than the Lamona Rockshelter was. When no similarities are seen in cordage it is presumably the result of cordage traditions that developed independently or are from another area.

Previous to this study it was known that *Apocynum* was a common material used in the Columbia Basin. This study shows that *Apocynum* is the oldest known material in the traditions of making cordage and that other materials gained importance as time went on. The Lamona Rockshelter dates to 6781 BP, much earlier than any of the other previously known cordage in the Columbia Basin. Not only is *Apocynum* the oldest

known material used, it is presumably the most important material in cordage making traditions. I came to this conclusion because *Apocynum* was used in the large majority of cordage found at the Lamona Rockshelter and it is found in large numbers at other sites in the area. All but one of the other sites from the Columbia Basin, which I included in this paper, used *Apocynum* for the majority of the cordage that was found. This means that *Apocynum* remained the most important fiber, and other fibers seem to have been added as culturally acceptable fibers to use in cordage construction sometime after the time of the Lamona Rockshelter and sometime before these other sites were used.

As more data and cordage analysis become available, a more complete model of cultural traits seen in cordage in the Columbia Basin can be made. This would allow for a better understanding of how different groups interacted in that area. Having more data will allow it to be seen when cordage traditions changed and where the traditions may have come from.

Suggested work will include finding more sites from this area where cordage was found and making the cordage analysis available by reexamining sites that have already been excavated. It is possible that there are other sites like the Lamona Rockshelter that contained a large amount of cordage items but the data was not made available. If more sites are found we can add more to what cordage can tell us about culture of the area. Also when excavating future sites cordage should be looked at in the same intensity as other cultural objects as a way of understanding culture. If both are done and the data can be added to what I have from the Lamona Rockshelter we can then gain a better understanding of culture in this area.

Appendix A: Descriptions of the Individual Cordage Items

These descriptions came from using notes and other descriptions of the cordage item. However, none of the original notes or descriptions contained all of the description details. To come up with the descriptions that follow, I spent time on comparing the notes and combining what was recorded so that all this information could be easily looked at and understood. In several of the descriptions of the cords information is missing due to it was not recorded in any document that I could find.

Single ply cordage

Cat No. 860

- Material Type 1 *Apocynum*
- Z-twist
- Length 5 cm
- Diameter 2.73 mm
- Angle of twist 37°
- Twist per cm not recorded
- Unidentified knots

Cat No. 920

- Material Type 1 *Apocynum*
- Z-twist
- Length 2.5 cm
- Diameter 2.73 mm
- Angle of twist 37°
- Twist per cm not recorded
- Unidentified knots

Cat No. 894-3

- Material not recorded
- Z-twist
- Length 2 cm
- Diameter .89 mm
- Angle of twist not recorded
- Twist per cm not recorded

Cat No. 884

- Material Type 1 *Apocynum*
- Z-twist
- Length 1.5 cm
- Diameter 2.23 mm
- Angle of twist not recorded
- Twist per cm not recorded

Two-ply cordage

Cat No. 70

- Material Type 1 *Apocynum*
- two-ply S-twist with singles Z-spun
- Length 16 cm
- Diameter 1.25 mm
- Angle of twist 54°
- Twist per cm 8

Cat No. 220

- Material Type 1 *Apocynum*
- two-ply Z-twist with singles S-spun
- Length 9.5 cm
- Diameter 1.91 mm
- Angle of twist 30°
- Twist per cm not recorded

Cat No. 238

- Material Type 1 *Apocynum*
- two-ply S-twist with singles Z-spun
- Length 13 cm
- Diameter 2.48 mm
- Angle of twist 52°
- Twist per cm 5

Cat No. 279

- Material Type 1 *Apocynum*
- two-ply S-twist singles Z-spun
- Length 7 cm
- Diameter 1.52 mm

- Angle of twist 43°
- Twist per cm 6

Cat No. 868-1

- Material Type 1 *Apocynum*
- two-ply Z-twist singles S-spun
- Length not recorded
- Diameter not recorded
- Angle of twist not recorded
- Twist per not recorded

Cat No. 869

- Material Type 1 *Apocynum*
- two-ply S-twist singles S-spun
- Length 4.7 cm
- Diameter 1.87 mm
- Angle of twist 40°
- Twist per cm 3

Cat No. 870

- Material Type 1 *Apocynum*
- two-ply Z-twist singles S-spun
- Length 8.7 cm
- Diameter 3.31 mm
- Angle of twist 21°
- Twist per cm 3

Cat No. 892-2

- Material Type 1 *Apocynum*
- two-ply ply Z-twist singles S-spun
- Length 4.1 cm
- Diameter 2.83 mm
- Angle of twist 42°
- Twist per cm 2

Cat No. 896-1

- Material Type 1 *Apocynum*
- two-ply Z-twist with singles S-spun

- Length 4.4 cm
- Diameter 2.16 mm
- Angle of twist 26°
- Twist per cm 1

Cat No. 896-2

- Material Type 1 *Apocynum*
- two-ply Z-twist with singles S-spun
- Length 14.6 cm
- Diameter 4.25 mm
- Angle of twist 35°
- Twist per cm 2

Cat No. 896-3

- Material Type 1 *Apocynum*
- two-ply Z-twist with singles S-spun
- Length not recorded
- Diameter not recorded
- Angle of twist not recorded
- Twist per cm not recorded

Cat No. 899

- Material Type 1 *Apocynum*
- two-ply Z-twist with singles S-spun
- Length 4.5 cm
- Diameter 3.09 mm
- Angle of twist 26°
- Twist per cm 1.5

Cat No. 905

- Material Type 1 *Apocynum*
- two-ply Z-twist with singles S-spun
- Length 2 cm
- Diameter 1.81 mm
- Angle of twist not recorded
- Twist per cm not recorded

Cat No. 906

- Material Type 1 *Apocynum*
- two-ply S-twist singles Z-spun
- Length 3.5 cm
- Diameter 2.59 mm
- Angle of twist 27°
- Twist per cm 3

Cat No. 909

- Material Type 1 *Apocynum*
- two-ply Z-twist with singles S-spun
- Length 4.7 cm
- Diameter 2 mm
- Angle of twist 19°
- Twist per cm 2

Cat No. 910

- Material Type 1 *Apocynum*
- two-ply Z-twist singles S-spun
- Length 7.8 cm
- Diameter 2.8 mm
- Angle of twist not recorded
- Twist per cm not recorded

Cat No.

- Material Type 1 *Apocynum*
- two-ply Z-twist singles S-spun
- Length cm not recorded
- Diameter 8.3 mm
- Angle of twist not recorded
- Twist per cm not recorded

Cat No. 913

- Material Type 1 *Apocynum*
- two-ply Z-twist with singles S-spun
- Length 3.6 cm
- Diameter 5.15 mm
- Angle of twist 53°
- Twist per cm 2

Cat No. 914

- Material Type 1 *Apocynum*
- two-ply Z-twist with singles S-spun,
- Length 11.3 cm
- Diameter 2.04 mm
- Angle of twist 20°,
- Twist per cm 1.5

Cat No. 80

- Material Type 2 *Apocynum*
- two-ply S-twist with singles Z-spun
- Length 10.3 cm
- Diameter 1.89 mm
- Angle of twist not recorded
- Twist per cm not recorded

Cat No. 124

- Material Type 2 *Apocynum*
- two-ply S-twist with singles Z-spun
- Length 3 cm
- Diameter 2.53 mm
- Angle of twist 40°
- Twist per cm not recorded

Cat No. 221

- Material Type 2 *Apocynum*
- two-ply S-twist with singles Z-spun
- Length 4.1 cm
- Diameter 3.1 mm
- Angle of twist 31°
- Twist per cm 3

Cat No. 229

- Material Type 2 *Apocynum*
- two-ply S-twist singles Z-spun
- Length 111 cm
- Diameter .4 mm
- Angle of twist 26°
- Twist per cm 9

Cat No. 861

- Material Type 2 *Apocynum*
- two-ply S-twist singles Z-spun
- Length not recorded
- Diameter 1.37 mm
- Angle of twist 45°
- Twist per cm 6
- Six square knots
- Net

Cat No. 862

- Material Type 2 *Apocynum*
- two-ply S-twist singles Z-spun
- Length 5 cm
- Diameter 1.2 mm
- Angle of twist 40°
- Twist per cm 7

Cat No. 863

- Material Type 2 *Apocynum*
- two-ply S-twist singles Z-spun
- Length 22 cm
- Diameter 1.2 mm
- Angle of twist 40°
- Twist per cm 7
- Knots

Cat No. 864

- Material Type 2 *Apocynum*
- two-ply S-twist singles Z-spun
- Length 3 cm
- Diameter 1.6 mm
- Angle of twist 49°
- Twist per cm 3

Cat No. 865

- Material Type 2 *Apocynum*
- two-ply S-twist singles Z-spun
- Length not recorded

- Diameter 1.06 and 1.62 mm
- Angle of twist 34°
- Twist per cm 5
- Two pieces

Cat No. 868-2

- Material Type 2 *Apocynum*
- two-ply S-twist singles Z-spun
- Length 3.5 cm
- Diameter .80 mm
- Angle of twist 37°
- Twist per cm 5

Cat No. 877

- Material Type 2 *Apocynum*
- two-ply S-twist singles Z-spun
- Length 6.2 cm
- Diameter 2.59 mm
- Angle of twist 54°
- Twist per cm 5

Cat No. 879

- Material Type 2 *Apocynum*
- two-ply Z-twist singles S-spun
- Length 5 cm
- Diameter 0.75 mm
- Angle of twist 23°
- Twist per cm 4
- weaver knots
- Net

Cat No. 880

- Material Type 2 *Apocynum*
- two-ply Z-twist singles not listed
- Length 6 cm
- Diameter 1.96 mm
- Angle of twist 41°
- Twist per cm not recorded

Cat No. 880-2

- Material Type 2 *Apocynum*
- two-ply Z-twist singles not listed
- Length 6 cm
- Diameter 2.54 mm
- Angle of twist 47°
- Twist per cm not recorded

Cat No. 885

- Material Type 2 *Apocynum*
- two-ply Z-twist singles S-spun
- Length not recorded
- Diameter 1.21 mm
- Angle of twist 28°
- Twist per cm 5

Cat No. 886

- Material Type 2 *Apocynum*
- two-ply Z-twist with singles S-spun
- Length 3.2 cm
- Diameter 3.47 mm
- Angle of twist 27°
- Twist per cm not recorded

Cat No. 890

- Material Type 2 *Apocynum*
- two-ply Z-twist with singles S-spun
- Length 9 cm
- Diameter 1.82 mm
- Angle of twist 44°
- Twist per cm 3
- One splice

Cat No. 892-1

- Material Type 2 *Apocynum*
- two-ply ply Z-twist singles S-spun
- Length 7.2 cm
- Diameter 3.22 mm
- Angle of twist 45°

- Twist per cm 3

Cat No. 893

- Material Type 2 *Apocynum*
- two-ply
- Length 4.3 cm
- Diameter 5.33 mm
- Angle of twist 24°
- Twist per cm 3.5
- Three pieces

Cat No. 895

- Material Type 2 *Apocynum*
- two-ply Z-twist with singles S-spun
- Length 9.5 cm
- Diameter 2.82 mm
- Angle of twist 35°
- Twist per cm 3

Cat No. 896-4

- Material Type 2 *Apocynum*
- two-ply Z-twist with singles S-spun
- Length not recorded
- Diameter not recorded
- Angle of twist not recorded
- Twist per cm not recorded

Cat No. 904

- Material Type 2 *Apocynum*
- two-ply S-twist with singles Z-spun
- Length 2.7 cm
- Diameter .98 mm
- Angle of twist 40°
- Twist per cm 10

Cat No. 908

- Material Type 2 *Apocynum* mixed with *Apocynum* fibers type not recorded
- two-ply Z-twist with singles S-spun
- Length 4.4 cm

- Diameter mm not recorded
- Angle of twist not recorded
- Twist per cm not recorded

Cat No. 912

- Material Type 2 *Apocynum*
- two-ply Z-twist with singles S-spun
- Length 1 cm
- Diameter 2.37 mm
- Angle of twist 52°
- Twist per cm 5

Cat No. 915

- Material Type 2 *Apocynum*
- two-ply Z-twist with singles S-spun
- Length cm not recorded
- Diameter mm not recorded
- Angle of twist not recorded
- Twist per cm not recorded

Cat No. 916

- Material Type 2 *Apocynum*
- two-ply Z-twist with singles S-spun
- Length 5.3 cm
- Diameter 3.46 mm
- Angle of twist not recorded
- Twist per cm 3

Cat No. 917

- Material Type 2 *Apocynum*
- two-ply Z-twist singles S-spun
- Length 3.5 cm
- Diameter 2.4 mm
- Angle of twist not recorded
- Twist per cm not recorded

Cat No. 918

- Material Type 2 *Apocynum*
- two-ply Z-twist with singles S-spun

- Length 6 cm
- Diameter 3.49 mm
- Angle of twist 28°
- Twist per cm 1

Cat No. 919

- Material Type 2 *Apocynum*
- two-ply
- Length cm not recorded
- Diameter 1.2 mm
- Angle of twist not recorded
- Twist per cm 8
- Net with square knots

Cat No. 212

- Material *Apocynum*
- two-ply Z-twist with singles S-spun
- Length not recorded
- Diameter not recorded
- Angle of twist 51°
- Twist per cm 7
- Net

Cat No. 887

- Material *Apocynum*
- two-ply Z-twist singles S-spun
- Length 2.2 cm
- Diameter 2.17 mm
- Angle of twist 21°
- Twist per cm 2

Cat No. 891

- Material *Apocynum*
- two-ply S-twist singles Z-spun
- Length 8.2 cm
- Diameter 3.05 mm
- Angle of twist 30°
- Twist per cm 4

Cat No. 907

- Material *Apocynum*
- two-ply Z-twist with singles S-spun
- Length 1.4 cm
- Diameter mm not recorded
- Angle of twist not recorded
- Twist per cm not recorded

Cat No. 894-3

- Material not recorded
- Z-twist
- Length 2 cm
- Diameter .89 mm
- Angle of twist not recorded
- Twist per cm not recorded

Cat No. 231-2

- Material recorded
- two-ply S-twist singles Z-spun
- Length 11 cm
- Diameter .79- 2.05 mm
- Angle of twist 37°-52°
- Twist per cm 5-6
- One splice

Cat No. 836

- Material not recorded
- two-ply S-twist singles Z-spun
- Length 1.5 cm
- Diameter 3.68 mm
- Angle of twist 38°
- Twist per cm not recorded

Cat No. 868-3

- Material not recorded
- two-ply not recorded
- Length 1 cm
- Diameter 2.29 mm
- Angle of twist 39°
- Twist per cm 3

Cat No. 875

- Material bulrush cordage
- two-ply Z-twisted spin not recorded
- Length 8.5 cm
- Diameter 5.4 mm
- Angle of twist 30°
- Twist per cm 1

Cat No. 894

- Material not recorded
- two-ply Z-twist with singles S-spun
- Length 2.5 cm
- Diameter 1.86 mm
- Angle of twist 36°
- Twist per cm not recorded

Cat No. 900

- Material rabbit skin
- two-ply S-twist spin not recorded
- Length 5.4 cm
- Diameter 3.15 mm
- Angle of twist 40°
- Twist per cm 1

Three-ply cordage

Cat No. 187

- Material aspen
- Three-ply final twist direction is Z
- Length 4 cm
- Diameter 19.5 mm
- Angle of twist not recorded
- Twist per cm not recorded

Four-ply cordage

Cat No. 876

- Material *Apocynum*
- Four-ply made of two two-ply Z-twist S-spun the final S-spun
- Length 6.5 cm

- Diameter 3.28 mm
- Angle of twist 35°
- Twist per cm 2

Cat No. 882

- Material Type 2 *Apocynum*
- Four-ply made of two two-ply S-twist singles Z-spun final S-spun
- Length 2 cm
- Diameter 4.8 mm
- Angle of twist 54°
- Twist per cm 3

Cat No. 883

- Material Type 1 *Apocynum*
- Four-ply made of two two-ply S-twist singles Z-spun final S-spun
- Length cm not recorded
- Diameter mm not recorded
- Angle of twist not recorded
- Twist per cm not recorded

Cat No. 902

- Material Type 1 *Apocynum*
- Four-ply twist not recorded
- Length not recorded
- Diameter 4.5 mm
- Angle of twist not recorded
- Twist per cm not recorded
- Five pieces

Cat No. 902

- Material Type 2 *Apocynum*
- Four-ply twist not recorded
- Length not recorded
- Diameter not recorded
- Angle of twist not recorded
- Twist per not recorded
- Three pieces

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